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Value creation in pharmaceutical mergers & acquisitions
An empirical study of stock price movements

Master Thesis

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Abstract

The pharmaceutical industry is a highly regulated industry with tremendous R&D costs when it comes to the development of new drugs and its applications. Mergers and acquisitions are often used to achieve cost synergies, to gain competitive advantage and to grow the business. Much research of general M&A activities has been conducted over the last years, but not many scholars have investigated value creation of M&A for the pharmaceutical industry.

When trying to identify M&A drivers and how value was created, stock returns are measured against market returns to see if there have been abnormal returns for shareholders of the bidding firm. Our research focused primarily on the stock market reaction when a deal was announced, to see if the stock returns have been different from zero for shareholders. This is carried out by applying the event study methodology which has gained much recognition in previous literature. As a next step we tried to identify potential firm-specific value drivers by applying a cross-sectional regression. For the purpose of our event study analysis we used a data set of 196 horizontal acquisitions that were announced between 2007 and 2018.

We find that shareholders of the bidding firms earn significant abnormal returns when the deal is announced, which is not in line with most previous research that suggests zero abnormal return at the day of the announcement. The same applies for shareholders of Indian and Chinese companies with showing significant returns.

We see higher significant returns when the deal is carried out domestically, which is in contrary to literature which indicates a preference for cross-border deals.

Our findings show that the preferred method of payment in pharmaceutical M&A is other payments, which means that the from other researchers suggested preference for cash-financed deals cannot be confirmed by our results. For shareholders of Indian companies, we find higher returns on average for cross-border deals but without proven significance, whereas for shareholders of Chinese companies we find that on average, cross-border deals achieve significant higher cumulative abnormal returns. Finally, we find statistical evidence that the CAAR on the event day in the year of the financial crisis is lower for shareholders than the CAAR on the event day post-crisis.

1 Introduction

The pharmaceutical industry is one of the industries with the most M&A activity in terms of number of deals and also in regard to how much is spent for an acquisition. While large deals change the competitive environment in pharma continuously, smaller deals are essential for operations of pharma companies (Kurmann Partners, 2018, p. 1). Firms see acquisitions as an investment with which they hope to enhance capacity, gaining new knowledge or capabilities, or to enter a new product or geographical area. Therefore, M&A can help achieving operational or managerial efficiencies, which are e.g. the reduction of production costs, the use of new technologies or enhanced use of information and expertise to name only a few (Pautler, 2003, p. 1-2).

In Q3 2018, the worldwide volume of total M&A deals equaled US$3.2 trillion which marked the strongest nine months in the history of M&A transactions (Reuters, 2018). Nevertheless, 2007 marked the highest deal value in overall mergers and acquisitions worldwide, followed by 2015 with the second-highest volume of US$4.8 trillion (Statista, see Appendix 1). Even though these numbers decreased after 2015, the overall trend appears increasing which is also highlighted by the strongest nine months in 2018 in M&A history mentioned above.

Looking at the worldwide deal value from 2007-2015, in 2007 the value of the M&A equaled only $12.1bn, it increased to more than $78bn in 2015 (Statista, see Appendix 2), which emphasizes the increasing trend of M&A in the pharmaceutical industry. During 2018, the deal volume M&A in the pharmaceutical industry of the first six months equaled 212 deals worth more than $200 billion which is an increase of +40% (own calculations) compared to only 151 deals in the same period one year earlier (Bansal, De Backer & Ranade, 2018).

Measuring value creation in the pharmaceutical industry is difficult for different reasons: first of all, the pharma industry is highly dynamic. This means that on an ongoing basis there are changes regarding new drug discoveries and regulations or new alliances which makes it difficult to allocate long-term changes to one specific event (Ravenscraft & Long, 2000, p. 297). Moreover, among the different industries, the pharmaceutical one has seen constant restructuring since the mid-1990s due to changes in regulations and high research and development costs. Additionally, the pharma industry is concentrated which the 10 biggest companies accounting for 48% of worldwide sales. It is in fact concentrated due to investments in M&A (Demirbag, Ng & Tatoglu, 2007, p. 41-42). Through the completion of acquisitions, the pharmaceutical companies can reach synergistic benefits and increase their market power. Achieving economies of scale and scope, escalating R&D investment costs,

patent expirations, and rising marketing costs are the main factors underlying M&A. Furthermore, the competitive environment of the pharmaceutical industry has also been a reason for firms to merge (ibid., p. 44).

Pharma is a high-tech and knowledge intensive sector which requires constant and considerable investments due to the elevated R&D costs (Gassmann, O. et al. 2018 p.23). In addition, it is also a risky sector both for the high failure rate and the very long process needed for the development of a new drug (Bain, 2004, p.9). Overall the pharmaceutical landscape is constantly changing because of the emergence of disruptive technologies and of the advancement in medicine (Van den Heuvel, Stirling, 2007, p.5).

Because of the constraints as in form of complexity and constant changes in the industry, the best measure of value creation seems to be the stock market reaction in terms of abnormal returns for shareholders (Ravenscraft & Long, 2000, p. 297), which will be further investigated in this study.

Due to the above-mentioned deal scope and volume and hence the increasing interest in M&A in that industry, notwithstanding the key role played by acquisitions in ensuring the profitability and competitiveness of the pharmaceutical companies, it is interesting to analyze the environment of mergers and acquisitions in the industry. Furthermore, there are interesting aspects like the development of the payment method, the geographical areas and the financial crisis, that can be taken into consideration when analyzing the pharma environment. This will be the main motivation for conducting this study and shall be further explained in a later chapter, which describes the core question of the thesis.

1.1 The pharmaceutical industry landscape

Pharmaceuticals is a large, high growth and globalized market that satisfies the needs of the consumers in an area vital for society (Gambardella, Orsenigo & Pammoli, 2000, p. 1). Assessing the competition of the industry is complicated because of the elevated number of actors involved which comprises not only the individual companies, but also a set of institutions as governments, regulatory authorities, healthcare systems and consumers (ibid., p. 2). In an attempt to analyze the intricate pharma environment, the Five Competitive Forces of Michael Porter will be used.

Considering that the threat of entry in an industry depends on the height of entry barriers (Porter, 2008, p. 26), the risk of potential entrants in the pharmaceutical sector is relatively low because of

the large research and development (R&D) costs (Gassmann, O. et al. 2018 p.23). The companies need in fact to invest increasingly higher percentages of their revenues in technologies and in drugs development in order to survive so, for this reason, without substantial capital, it is basically impossible to become successful in this industry. An interesting case is represented by the biotech companies, emerging firms with limited cash reserves, which are growing exponentially and became extremely appealing for big pharma during the last years. These small firms are usually acquired by the multinational pharmaceuticals companies in order to strengthen their pipelines, enhancing their franchising in a therapeutic area or acquiring their proprietary drug discovery technology platforms (Malik, 2009, p. 819). Another important entry barrier is instead constituted by the knowledge barriers since pharmaceuticals is a research-based industry and its success completely depends on the progress achieved in medicine (De Souza, 2007, p. 41). Lastly, the heavy government regulations and the requirements imposed by the institutions, aiming at ensuring the safety, efficacy and minimal side effect of the new drugs, constitute an expense and prevent the entry of potential competitors (Gassmann, O. et al. 2018 p.23).

In regard to the power of the suppliers, each stage, from research to sale, is completely controlled by the individual companies who manufacture the pharmaceuticals (Gassmann, O. et al. 2018 p.20). As a result, the suppliers in the pharmaceutical industry have very low bargaining power since they supply only the raw materials (Whiteside, 2016).

In terms of buyers' bargaining power, the structure of payments and decision making is extremely intricate in the pharmaceuticals. If we consider the consumers as the main buyers, then they have a complete lack of power regarding prices. Also, the physicians, the prescribers of drugs, do not profit from their sales. Only the medical institutions and pharmacies have a little negotiating power against drug manufacturers, but this is drastically reduced when there is only one producer for the drug (ibid.).

When a new drug is approved by the institutions, Food and Drug Administration in US, European Medicines Agency in Europe, it is also protected by a patent that lasts for 20 years. Upon the patent expiration, the production of a generic correspondent drug is allowed. According to the Food and Drug Administration, a generic drug is "a generic drug product is one that is comparable to an innovator drug product in dosage form, strength, route of administration, quality, performance

characteristics, and intended use" (FDA, 2018). Overall, the threat of substitutes becomes significantly high as more companies lose patent protection.

Finally, in the complex pharmaceutical environment, it is possible to distinguish four main strategic archetypes. The originators represent the classical pharma model and focus on financing the development and marketing of new drugs; the generic drug providers instead provide and deliver low cost drugs; the third type are the consumer health companies which use mass-consumer marketing techniques to promote drugs directly to the consumers and the fourth one are the point-of-call specialists (like Novo Nordisk A/S) (Bieri, 2018, p. 2). Despite the patent protection mentioned in the previous paragraph, the pharmaceutical companies are subject to competition from the moment they place a new drug on the market (Camejo, McGrath & Herings, 2011, p. 19). This type of competition is made through clinical superiority, which means incremental clinical efficacy, and therefore the later a drug enters the market the higher the clinical effectiveness of existing comparators (ibid). After the patent expiration, the intensity of the competition varies across countries. The markets based on free or semi-free prices and relying on competitive mechanisms (like USA) experience a significant level of competition and market shares mobility, while the markets relying on price fixing (like Italy or France) experience market share stability even after patent expiry (Gambardella, Orsenigo & Pammoli, 2000, p. 60).

Overall, the North American region represents the biggest pharmaceutical market in terms of sales and projected global pharmaceutical sales in 2022 confirms it (Statista, see Appendix 3). In 2018, the United States generated more than 460 billion U.S. dollars of revenue followed by Europe, responsible for generating around 196 billion U.S. dollars (Statista, see Appendix 4). In general, the pharmaceutical industry is rapidly growing especially in the emerging countries. In fact, the growth forecasts between 2017 and 2030 reported by Statista (see Appendix 8) shows a worldwide growth equal to 160% with the biggest growth forecast given for India with 232 percent.
Despite being a fast-growing sector, pharmaceutical companies will also experience challenging years in the near future due to the patent expiration which will put 43 billion U.S. dollars of revenues at risk in 2019 until reaching a peak of 67 billion U.S. dollars at risk in 2023 (Statista, see Appendix 5).

1.2 Research question

The following research question shall be defined and investigated with the aim of delivering relevant results in a M&A context and which has been established after investigating relevant literature of the last decades.

We want to show empirically what creates value in pharmaceutical mergers and acquisitions and our subsequent research question is established as:

How can value be created in pharmaceutical mergers and acquisitions on a global level and how exactly can we measure value creation, to demonstrate significant results?

To analysis value creation further, we will also focus on the following sub-questions:

- what are the key value drivers found in theory and literature that can be applied to real world evidence, meaning mergers and acquisitions that happened in the last twelve years?
- following up on relevant literature, has there been any preferred payment method of the bidding firms and if yes, what are the reasons for it found in previous research and our own empirical results?
- is there a trend regarding cross-border or domestic deals? How engaged are emerging countries like India or China when it comes to mergers and acquisitions?
- has the financial crisis impacted the deal volume in the pharmaceutical industry?

After investigating on the above-mentioned main research- and the sub-questions, we will test some hypotheses to get statistical evidence, which can be found in chapter 3 and the results in chapter 6.

1.3 Delimitations

There are some limitations regarding this thesis that need to be taken into consideration while researching. First of all, the time period that we will use for all our data selection will include only the years 2007 until the year-end of 2018 to narrow down our empirical research to a certain timeframe. Furthermore, we will only consider horizontal mergers or acquisitions in our research, which means we will only analyze merger from which the acquiring and target companies were in the same industry, in our case the pharmaceutical industry. As a result, we will only use literature that is relevant for our topic and research question. This means that our literature review only contains aspects that are relevant for our hypotheses and hence again our empirical research. Since there is a

lot of existing literature regarding mergers and acquisitions in general and due to limitation in pages for this thesis, we can narrow it down by this approach.

While writing this thesis, we act as outside analysts which means that we only have access to publicly available information. Furthermore, regarding the analysis regarding cross-border vs. domestic deals and the preferred method of payment, we could have had a bigger data sample if we would have had internal information from all companies, which is out of our scope since we don't have access to the internal data of all acquiring and target deals. Additionally, we will focus on financial value drivers like financial ratios or key performance indicators (KPIs) that measure the firm's financial performance and which are closely related to value creation, e.g. growth, margins and investment rations just to name a few, that will used to detect firm-specific value-driver.

As the existent literature appears to largely rely on financial KPIs as indicators for value creation, it could be of interest to see how R&D productivity as a performance measure can provide a better picture of the nature of value creation in pharma (Demirbag, Ng, Tatoglu, 2007, p. 42). Extending the value drivers to more sophisticated ones could be interesting for further research.

Since the main focus of our thesis is to measure value creation in pharmaceutical mergers and acquisitions, we choose to measure the value creation for shareholders in form of abnormal returns on stocks as an overall argument. We will further elaborate on the how and why in the literature review and the following chapters. When we measure value creation for shareholders, we consider only the created value for shareholders of the bidding companies and do not consider the role of the target company. As mentioned before regarding the how and why, we will elaborate more on that later on.

Using pre- and post-merger accounting measures to detect changes that come with the announced transaction could have been an option too, but as accounting measures can be easily manipulated and biased, we choose to use stock prices as measurement for value creation. We believe that they can be less manipulated, as the efficient market theory assume that the stock prices adjust immediately to new information. Therefore, we assume semi-efficient markets for the whole period of our event study.

Finally, while we were retrieving the data for our deal sample from Zephyr, we chose to focus only on mergers and acquisitions for our research, meaning that we did not take any other deal type like management buy-out or buy-in into consideration. After having a closer look at the final data set, we found that there are only acquisitions and no mergers. As a result, from now on when we refer to the term mergers and acquisitions as acquisitions due to the above-mentioned reason.

We choose to limit the set of target companies down to companies that are not listed, since otherwise our data sample would have only consisted of 1 deal.

Therefore, it was not possible to measure the abnormal returns for shareholders of the target companies, since we couldn't find much stock price data for those companies. Calculating the abnormal returns for only a small number of target companies (n <= 10) would in our opinion not give any meaningful results and hence we will only present the results for the event study of acquiring firms. This finding stems from our filtering of the data from Zephyr, where we've have found only one horizontal deal between a listed bidding and a listed target company. We assume that this might be due to the fact that we only consider horizontal mergers and that we have found that large listed pharmaceutical companies mainly buy other non-listed pharmaceutical companies.

1.4 Determining relevant stakeholders

Even though a merger or an acquisition can be relevant for different groups of stakeholders, finance literature often focuses on the effects of M&A for stockholders of the acquiring as well as for the target firms. This is often done by using event studies to determine the stock market's reaction to the announcement of a merger or an acquisition, which will both be further explained in the methodology chapter. When a company announces a transaction, it is interesting to investigate whether the market shows a reaction to that announcement and whether the markets expects that the buyer or seller will profit from the deal. (Pautler, 2003, p. 8). Hence, we can evaluate the shareholders' wealth by looking at the changes in stock prices and see whether there were abnormal returns surround the announcement day.

Due to the relevance for shareholders in finance literature and the possibility to measure value creation by detecting abnormal stock movements, we choose to focus on shareholders as the relevant stakeholder in this thesis. If abnormal returns can be achieved through a merger or an acquisition, shareholders are directly influenced since their wealth has increased. Therefore, we exclude any other stakeholder from our research and only focus on relevant shareholders of the acquiring firms. We exclude the target companies' shareholders as there were not many listed pharmaceutical target companies when we were collecting our data set from Zephyr.

2 Literature review

"M&A can destroy value, but it can also create substantial returns" - (Cools et al., 2007)

Value creation in mergers and acquisitions is and has always been a wide-discussed topic in the past decades, especially when it comes to the question of how exactly value can be created (Cools et al., 2007, p. 6) and when considering that M&A can be an effective tool for maximizing value for shareholders (Masset & Cravatte, 2014, p. 57). Since many companies choose M&A for growth instead of growing internally (Luypaert & Huyghebaert, 2007, p. 1) and since growth is the biggest contributor to shareholder return, companies that show substantial cash reserves tend to invest their money in growth through M&A instead of relying on a slower organic growth (Cools et al., 2007, p. 6). This is emphasized by the fact that the number of deals is growing due to the expectations that a merger or an acquisition will enhance the value of a company, meaning to improve their position in the market through efficiency, reduced costs through economies of scale and synergies (Shah & Arora, 2014, p. 170).

Danzon, Epstein and Nicholson (2004) have found that large pharmaceutical companies often merge to handle excess capacity as a result of upcoming patent expirations and gaps in the product pipeline. In addition, they recognized that merged firm grew slower in operating profit three years after merging which questions the effectiveness of the merger and which rose our interest to further investigate into that topic.

R&D investments in the pharmaceutical industry are in general undertaken to achieve profitable gains in the long run (Comanor, 1965, p. 190). Beside high costs in R&D, there are two further relevant aspects according to Gagnon & Volesky (2017) that need to be considered when looking at mergers or acquisitions in the pharmaceutical industry: the expirations of patents of drugs which could lead to one company acquiring another company's patent and lower the costs of a new drug application.

In the 1990s, pharmaceutical companies had to face the expirations of patents of so-called blockbuster drugs and not a single new drug that could reach the blockbuster status before the prominent ones expire, even though these drugs made billions of dollars. Hence, companies had a lot of cash but needed to constantly invest in R&D, so the incentive for a merger was clearly given especially if they didn't have a sufficient pipeline to replace their expiring blockbuster products: with an effective merger, the companies could consolidate their operations and cut down excess capacity (Ravenscraft & Long, 2000, p. 313). When a company's patent for a drug expired, that company can buy another

pharmaceutical company's one which still has the patents for relevant drugs that could further enhance the business of company 1 and which they can use for their own regulatory and marketing capacities (Richman & Vidal, 2017, p. 791-792).
Nevertheless there are recent papers like Richman & Vidal (2017) that claim that M&A in pharma destroys R&D synergies and economies of scale by discovering less drugs and reducing competition among the industry, especially when the company that acquires another company is a big corporation and which makes investigating M&A in this industry interesting.

According to Ravenscraft & Long (2000), value creation in the pharmaceutical industry can be difficult to measure due to its complexity and dynamics in terms of regulations. The best measure of value creation seems to be the stock market reaction in terms of abnormal returns for the shareholders. The findings regarding abnormal performance of stocks are mixed, with different studies documenting positive but also negative returns for shareholders of the acquiring firms.
Ravenscraft & Long (2000, p. 297) carried out an event study for 65 pharmaceutical deals between 1985 and 1996, finding significant positive abnormal returns of 13,31% for the target companies, but negative returns of -2,12% for the bidding companies. After they looked only at the horizontal mergers, they find significant positive abnormal returns for both bidder and target (ibid., p. 298).
Rani, Yadav & Jain (2011) mention that abnormal stock returns in general show the value that a transaction can create for the shareholders. This is also reflected in the semi-strong market efficiency theory, which assumes that stock prices reflect past prices and all other public information and that the prices will adjust to new announcements like a merger of two companies (Brealey, Myers & Allen, 2017, p. 332). This is further supported be a study of PwC (2018) which considers stock prices as a good measure of value because it represents the market's expectations of the potential future earnings of the company in comparison to financial benchmarks like EBITDA or other margins, which do not reflect the firm's earnings potential, and which can't be seen as measures of value themselves. PwC (2018) had further shown that stock prices can track accurately the intrinsic value and its changes over a certain period and that the intrinsic value of a firm reflects their efforts to create value for its shareholders shown in the strategy, operating performance and asset base of the respective company.
Looking at the findings of research regarding M&A in pharma, Bain & Company (2014) have found that when looking at the shareholder's return in the industry for the last 20 years, that ten companies have outperformed the others on a regular basis. What differentiates these companies from the rest is that they were putting effort in building leadership in their business categories and capabilities and

that they all used targeted strategies to actually build their leadership position. Building leadership has been crucial to become successful in the pharmaceutical industry: taking Roche or Novo Nordisk as an example, they both generated at least 50% of their revenues from only one area of business. In the case study of Bain & Company we could also see that 46% of all pharma deals created underperforming companies, which is in line with the general findings about M&A that say it often destroys value instead of creating it.

Rani, Yadav & Jain (2011) highlight the relevance of the pharmaceutical industry for mergers and acquisitions since the industry differs from others not only in terms of bringing a new drug to the market but also because of the lower rate of success for drugs that actually come through the pipeline. As a result, pharmaceutical companies have major incentives to use merging activities for the purpose of research. The whole industry has seen a lot of activity happening and as they conclude, it is likely to achieve abnormal returns for shareholders in the short run.

Effects on stock prices of bidding firms and targets can differ substantially which is also emphasized by Jensen & Ruback (1983) who show that bidding firms often earn zero return on a merger while targets earn a significant positive return on the announcement day, which is on contrary to what Rani, Yadav & Jain (2011) have found. Goergen & Renneboog (2004) find only small significant returns for shareholders of the bidding firm.

A study by Deloitte from Masset & Cravatte (2014) has further found that value for shareholders can be created if either the target is acquired at a lower price than the intrinsic value, the financial and operating performance of the target can be improved or if synergies can be realized.

Hitt et al. (2012) found that many mergers actually create negative value due to the challenges of implementing and completing an acquisition or because they are unable to create synergies and often paying a premium that is way too high. This is also supported by Deloitte who define an implementation program for the successful integration of two companies as crucial.

Abnormal returns are in general influenced by different factors, for example the method of payment (i.e. cash or stock) or the kind of acquisition (domestic or cross-border) (Shah & Arora, 2014, p. 171), which will be further investigated in our own research. We will also look deeper into the effects of the financial crisis on stock prices and how the deal volume was affected in 2009 compared to 2008.

Method of payment

The method of payment in mergers and acquisitions in relation to abnormal returns has been investigated a lot in literature, with cash and stock being the two most common ones (Fuller, Netter & Stegemoller, 2002, p. 1769). Several researchers have found that in general, bidders who make

cash offers tend to have higher returns when the merger is announced than those who make stock offers (e.g. Travlos (1987), Fishman (1989) and Martin (1996)). Another study by Huang & Walking (1987) for 204 US companies has shown that cash acquisitions generate higher abnormal returns than stock offers with 29.3 per cent for cash offers and only 14.4 per cent for stock offers. Moreover, Harford (1999) found that firms that are rather rich in cash tend to acquire other firms more often that companies that are low in cash. He further found that acquisitions by cash-rich firms tend to be value destroying and also tend to have abnormal declines in operating performance. Looking at the overall transactions that have been paid with cash since 2000, it is shown by BCG from Cools et al. (2007) that almost 75% of all transactions are paid with cash. This can be a signaling effect, since choosing to pay with cash could signal that the investors are more serious about creating value because money is at stake. As a result of BCG's research, cash deals tend to generate a higher probability of creating value.

Pautler's research (2003) has further found that mergers paid with stock tend to differ from those paid with cash since the stock market seems to prefer cash deals and also, that transactions that are paid for with cash lead to higher returns that the ones paid for with stock.

Hitt et al. (2012) used several variables for their research about why mergers and acquisitions often fail and one of those variables is the method of payment, meaning that companies can pay for an acquisition with either cash, stock or a combination of both. During their research they found that when acquiring firms pay with cash, the probability that they create value is higher than if they use stock for payment and furthermore stock is more often used as a payment if the firm of the acquirer is undervalued. There are only some studies that are advocates for stock as the preferred method of payment. Luypaert & Huyghebaert (2007) found that during booming stock markets bidding companies often use stock as a payment. Andrade, Mitchell & Stafford (2001) showed that between 1980 and 1990, stock was more often used than cash, with 58% accounting for stock-paid deals.

Cross-border vs. domestic

In general, the globalization of business has increased during the last companies, meaning that companies are trying to achieve a competitive advantage through economies of scale or scope by internationalizing their value chain (Kyvik, 2013, p. 1). To become more international, companies pursue cross-border M&A to achieve sustainable long-term growth (ibid., p. 2).

Previous research regarding geographical aspects in M&A activity has been of of interest for many scholars and hence it is worth considering the potential impact of cross-border vs. domestic M&A for

the empirical research of this thesis. Ravenscraft & Long (2000) find that cross-border deals achieve abnormal returns of 4.25% for shareholders of the bidding companies with statistical significance.

Looking at cross-border vs. domestic mergers, BCG's Cools et al. found already back in 2007 that between 1997 and 2006 America has been the top player when it comes to M&A, with accounting for 46.5% of all deals, followed by Europe with 29.5%. Also, Hassan et al. (2007) discovered that between 1981 and 2004, acquisitions in the US that have been made by US companies had a positive impact on shareholder returns in the pharmaceutical industry.

Nevertheless, their research back then has also shown that developing countries are catching up and becoming more active. Especially Asia Pacific seems to have significant growths in terms of M&A with an increase in the number of deals from 2091 in 2000 to 6939 deals in 2011 (Vazirani, 2012, p. 37). Several scholars (Bhagat et al. 201; Nicholson and Salaber 2013) have found that the number of cross-border acquisitions from emerging countries have increased during the last years, mainly done by Chinese or Indian bidding firms.

According to a recent Statista (see Appendix 6) analysis, since 2015, more than 2000 Chinese company takeovers per year were registered. Hassett et. al (2017) found that until 2008, India was the biggest acquiring country when considering BRIC countries in terms of number of deals before China overtook that role.

Another interesting aspect is that lately between 2001 and 2007, the Indian pharmaceutical industry has seen significant positive abnormal returns to shareholders (Rani, Yadav & Jain, 2011) which comes with no surprise considering the fact that India is an important manufacturer of generic drugs, puts a lot of emphasis on R&D and had a CAGR of 11.7% between 2005 and 2015. It is hence for our research of high interest to see how the global deal share developed or if it is still the same.

In general, the pharmaceutical industry is one with very high investments in R&D, hoping for achieve high returns in the long run. Banerjee & Nayak (2015) are one of only a few papers that has recently investigated cross-border vs. domestic mergers and acquisitions in the pharmaceutical industry. They have found, that firms with high R&D costs as a percentage of sales and with a lower number of drug approvals tend to merger with foreign firms, whereas domestic mergers happen more often between two companies with lower R&D expenditures as a percentage of sales and lower number of drug approvals. Furthermore, they have shown that domestic mergers have less long-term effects on new drug approvals than cross-border ones, indicating that cross-border mergers creating more value in the long run.

Financial crisis

The literature regarding the effect of economic downturns on mergers and acquisitions generally seems to agree on the negative impact that a crisis has on the markets and, as a consequence, on the company's takeovers. Capaldo, Cogman & Suonio (2009) from McKinsey find that the financial crisis of 2008 generated uncertainty and confusion in the markets, creating difficulties with financing especially for very large transactions). They further find that the US recession led to a steep decline in the M&A value, of approximately 50% in the first year, mainly due to a general fear about the economic outlook which forced the acquirers to put plans on hold. This is in line with the research developed by Harford (2005) who focused on the drivers of the mergers waves which demonstrating the correlation between mergers and economic, regulatory and technological shocks. Overall, the M&A volumes remained still healthy in 2008 and the emerging countries played a significant role in the global landscape. Capaldo, Cogman & Suonio (2009) from McKinsey find that even though there was an evident decrease of deals in America, the number of deals in Asia-Pacific countries remained constant and accounted for the 20% of the total deal number by target, consolidating the performance of the previous year.

Notwithstanding the general risk involved in closing a deal during a period of crisis, acquisitions during a recession can actually create greater value. According to a report developed by Ficery et al. for Accenture (2009), companies with a strong balance sheet and recent positive economic performance can benefit in terms of value creation during a downturn. Since the companies' market capitalizations during a financial crisis drop (it dropped between 40-70% in 2008 in comparison to the year before), the "entry price" for the acquired business is often much lower. Secondly, due to the lower values, companies can aim to acquire firms previously out of their price range and lastly, in general there's less competition in the acquisition environment because organizations without a solid financial position do not have the resources to undertake a deal (ibid.).

We would like to further investigate the M&A activity in the pharmaceutical industry during the years preceding and following the financial crisis in order to assess whether there has been a significant impact on the volumes of deals as claimed by the majority of the literature or if the solid economic performance of the big pharmaceutical companies preserved the stability of the M&As.

Firm size

The so called 'small-firm effect', namely, according to the Roll (1981, p. 879) definition, the tendency of "small firms [...] to have larger average returns than large firms even after adjusting for risk.", has been extensively discussed in literature.

In particular, the foundation of the relationship between size and returns is constituted by three main theories (Duy & Phuoc, 2016, p. 211). The first of them is CAPM, which proves that high risk leads to high returns and where the company size contributes partially to the risk premium as big companies are considered safer for investment. The second model including a firm effect is Fama and French which was built on the observation that small capitalization stocks and low book-to-market stocks bring higher return in comparison to other stocks in the market. The third theory relating firm size and returns is finally the efficient market theory according to which the prices of stocks will fully reflect their inherent information (ibid.).

Sweeney, Scherer et al. (1996) trace the small-firm effect back to the fact that small firms as a group are likely to have larger capital budgets relative to their total market value than do larger firms as a group. This leads smaller firms to generate returns greater than their cost of capital which bring higher abnormal returns for the shareholder.

However, Schultz (1985) finds that from the beginning of the 80's the size effect seems disappeared due to the changes in the market conditions although some studies demonstrated its existence in the form of the so-called January effect which consists in a seasonal increase of the small firms' stock prices during the first few days of January.

Due to the existence of a large literature debate in regard to the correlation between the firm size and the abnormal returns generated, we would like to verify the presence of this phenomenon in the deals closed in the pharmaceutical industry during the last twelve years. To account for firm size, we will use the market capitalization as a control variable while conducting the cross-sectional regression analysis.

There has been an extensive research on mergers and acquisitions going on for the recent merger waves, which led to mixed results. Furthermore, there has not been extensive research for M&A in the pharmaceutical industry, especially not for the last few years. We therefore assume that our research can improve knowledge surround that matter in the industry and that it can follow-up on previous research. Hence, the empirical results of our thesis will show if they are similar to the research that has been done before or if there have been significant changes. We aim to analyze and

test some hypotheses statistically to see what is creating value, focusing especially on the abnormal return for shareholders of the acquiring companies on a global level, but also analyzing the performance of two emerging countries more in detail. Furthermore, we want to investigate firm-specific drivers related to cross-border vs. domestic deals, the method of payment and the impact of the financial crisis in 2008 on M&A activity in the following years.

3 Hypotheses

After conducting intensive research about previous mergers and acquisitions in the pharmaceutical industry, we decided to set up several hypotheses that are derived from previous literature and that seem to be relevant for our thesis. It further will be the starting point for our empirical research to prove the statistical significance for our hypotheses about value creation and to see, if they can be confirmed or rejected. As already mentioned in the literature review, there exist many studies about M&A of the last decades, but there hasn't been much research about value creation in the last twelve years or especially after the financial crisis, which is why this thesis can be seen as a continuation of previous findings about M&A in the pharma industry.

1. Value creation and the effect of the announcement

Since the focus of this thesis is on value creation, which is reflected in the research question, it needs to be specified how value creation can be measured. As can be seen from the literature review, many studies have found that changes in stock prices are a good for value creation, since it is assumed to be less biased and less easy manipulated in comparison to accounting measures. We therefore expect that changes in stock prices will be an accurate benchmark and indicator of value creation for this thesis.

Based on mixed findings in previous literature, our overall hypothesis is that during the last 12 years (2007-2018), horizontal M&A in pharma did not create substantial value to its shareholders measured on abnormal return. Furthermore, as India and China has seen growth in M&A activity during the last year we want to investigate whether these transactions led to value creation for their shareholders. We assume zero abnormal returns and therefore formulate our first hypotheses as:

H1.1: Zero abnormal return for shareholders of the bidding firm when merger or acquisition is announced

H1.2: Zero abnormal return for shareholders of Indian bidding firms when merger or acquisition is announced

H1.3: Zero abnormal return for shareholders of Chinese bidding firms when merger or acquisition is announced

2. Cross-border vs. domestic M&A

As evidenced by the pharmaceutical market analysis in chapter 1.1, the drug industry represents a globalized, high risk and capital-intensive sector. The competition in the market can be elevated and especially the big multinational enterprises have to face diverse and uncertain business environments (Park & Choi, 2014, p. 104). In this context, foreign direct investments constitute an opportunity for the companies to improve their organizational efficiency and to build a competitive advantage (ibid). In fact, there are many advantages related to the international acquisitions, such as the expansion into new geographical markets, the reduction of the manufacturing costs and the acquisition of knowledge (Bösecke, 2009, p. 46).

Through the analysis of the pharmaceutical M&A environment during the period 2007-2018 and with the support of the FDI theory, our purpose is to continue to elaborate on the value creation subject from a geographical perspective and therefore to verify the following hypothesis:

H2.1: International alliances create more value for shareholders of the bidding companies than the national ones.

By examining the drug industry from a geographical point of view, it is interesting to notice the emergence of a dynamic M&A activity in the Indian market. According to the research of Tripathy and Prajapati (2015), the Indian pharmaceutical acquisitions follow the same logic of the other global alliances. Currently, from all Indian industries the pharma industry represents the one with the most overseas investors and is driven by the need to improve global competitiveness, by the desire to enhance the pipelines as well as by the willingness to consolidate the market shares (ibid., p. 188). Considering that the emerging markets show a faster increase in pharmaceutical sales between 2016 and 2018 than the European countries (Statista, see Appendix 4) and that Hassett et al. (2017) have found that cross-border M&As from emerging countries especially in India and China, have increased, we are interested in testing the following sub-hypotheses:

H2.2: International alliances create more value for shareholders of Indian bidding companies than the national ones.

H2.3: International alliances create more value for shareholders of Chinese bidding companies than the national ones.

3. Preferred method of payment

A BCG report from Cools et al., released in 2007 as well as several other studies mentioned in the literature review, reports that cash-only transactions bring more value in comparison to the deals paid with stock, a mix of cash and stock or other payments. The explanation lies in the fact that cash transactions send positive signals to the market, indicating that the acquirer has calculated it will earn returns that are higher than the cost of capital. Through our research and, we aim to verify the correctness of the following hypothesis for the timeframe 2007-2018:

H3.1: Market reacts better to cash financed acquisitions.

4. Effects of the financial crisis

As a study by Rajan & Harding from Bain & Company (2009) has found, for most of the companies, closing a deal during an economic crisis represents a risky investment. The markets are depressed and that is why the number and value of deals diminished during and immediately right after a downturn. A decrease in M&A activity is in particular due to the skepticism about the availability of funding, especially equity capital (Kostic, 2013, p. 123). However, for companies that are strong both from a strategic and financial point of view, crises can constitute an opportunity to consolidate and improve their position through the M&A activity (Bain & Company, 2009). Through an analysis of the years around 2008, we will verify whether the following hypotheses are supported by the evidence:

H4.1: The number of M&A decreased after the financial crisis

H4.2: Zero abnormal returns for the shareholders in the year after the financial crisis of 2008

4 Data

4.1 Data selection process

To carry out an empirical study, we first need to collect the relevant data for our research. This thesis is supposed to measure value creation on a global level from 2007 to the year-end of 2018. There are several databases that can be used to get relevant data about M&A deals, but due to constraint access we decided to work with Zephyr, Osiris (both Bureau van Dijk databases) and also with Thomson Reuters Eikon. We will further elaborate on the use of these databases in the methodology part, but in general it can be said that these databases enabled us to collect all relevant data related to the dea, like the announcement and closing date, the deal volume, stock prices and other relevant market information that we can incorporate into our calculations or that can be interesting for our empirical research.

To narrow down our dataset, we decided to make use of the following criteria that we apply:

1. The announcement date and the completion date have to be between the 01.01.2007 and 31.12.2018.
2. The deal has to be completed and confirmed.
3. The acquirer has to be publicly listed.
4. Only transactions classified as a merger or an acquisition are included in the data sample
5. All regions and all methods of payments are included.

In order to obtain a large data sample, we have furthermore decided to not apply restrictions in terms of the deal value. The following paragraphs will describe the reason for applying these specific criteria in detail.

The decision of focusing on the time horizon between 2007 and 2018 is mainly driven by two purposes. First, as already mentioned in the literature review and the hypotheses part of the paper, our intention is to contribute to the previous M&A research through the analysis of the M&A activity during the last twelve years since not many studies have been conducted regarding value creation in the recent past. Secondly, due to our interest in investigating the effects of the financial crisis on the M&A context, we chose to start our research from 2007, in order to make a comparison between the years before the economic downturn of 2008-2009 and the subsequent period.

Our second criterion affects the current deal status. For our data collection, it is of high importance that the deal is completed and confirmed. Since we focus on value creation and want to measure that in terms of the abnormal return for shareholders while looking at the changes in stock prices, we have to assume that non-completed deals and rumors could lead to incorrect reflected stock prices due to the uncertainty of the deal. As it is known from previous literature, if an acquisition never happens it is highly likely that the target's stock price will drop as uncertainty can lower prices (Learningmarkets, 2009).
To not include the risk to consider stock prices that incorrectly reflect the market's reaction to the deal and hence incorrect price movements, we only include completed deals in our data set.

In selecting the relevant data for our analysis, only acquiring companies whose stocks are officially traded on the stock exchange have been considered and this is the object of our third criteria. The advantage related to these companies lies in the possibility of having access to their financial data. In fact, as it will be further elaborated during the methodology section, the event study framework will be used in order to investigate the value creation generated by mergers and acquisitions in the pharmaceutical industry and therefore share prices are necessary to calculate the abnormal returns resulting from the announcement of the deals.
The public listing criterion however applies only to the acquirers and not to the target firm, as we could only find one listed target companies and decided to move forward with non-listed target companies and only investigate value creation for shareholders of the bidding firms. In fact, over the last twelve years, the so-called big pharma have often engaged in the acquisitions of biotech startups, innovative and emerging firms with limited cash reserves which are not listed on the stock exchange (Malik, 2009, p. 181). According to this, considering only the listed target companies would have resulted in the exclusion of many significant deals from our research.

Since we want to achieve empirical results regarding value creation in mergers and acquisitions, we dedicate our fourth criteria to the fact that we only consider mergers and acquisitions and hence do not include any events like management buy-outs or buy-ins, increases in capital or stake, joint ventures or share buy backs. This has the reason to further emphasize our focus of the thesis. In fact, while collecting our data sample from Zephyr and applying these criteria, we have found that there was no pharmaceutical merger between 2007 and 2018 and only acquisitions. Due to this outcome,

we will from now on still use the term ‘mergers and acquisitions’ but with the meaning of only considering acquisitions.

Our last and fifth criteria is related to our hypotheses: Since some of our hypotheses are about the geographies and the method of payment, we didn’t exclude any region or and any payment method to achieve the data set that we need to answer to these hypotheses.

As a result, our data sample used for the empirical research consists out of 504 deals. Besides the above mentioned, general criteria that we decided to apply, there are some more criteria that we think are important also in terms of methodology and that we will apply after retrieving the data from Zephyr.
For methodologic reasons, we therefore decided to choose the estimation window for stock prices as follows:

- we only consider stock prices of the acquirer company which need to be available 260 days before 5 days of the actual event plus another 5 days after the actual event. It is long enough to evaluate the effect of an acquisition, and at the same time the period is sufficient to exclude any noise. In this case, the event means the announcement of the acquisition. We will further elaborate on that in the methodology part.
- we decided to not move forward with deals that appeared to have happened internally. The reason for that is that we believe that internal deals will not result in significant abnormal returns for shareholders or to be more precise at not in as significant abnormal returns as when an acquisition happens externally. As a result, we excluded 14 internal deals from our previous data set. On further notice, we want to mention that in the 14 deals that have been excluded, there were also some deals where the acquirer or the target company was not part of the pharmaceutical company and it would bias our data sample if we had included them

The financials needed to measure abnormal return is retrieved from Thomson Reuters and Zephyr. To be more specific, we got the daily stock prices for all deals of our data sample 260 prior to 5 days before the event (-265, -5), the announcement dates and for all deals 5 days after the deal was announced. The chosen time window was applied to ensure that the stock prices are not anyhow biased by the announcement of the event, which could create noise in our results. This could be the case since sometimes information get leaked before the public announcement of the deal (Bowman,

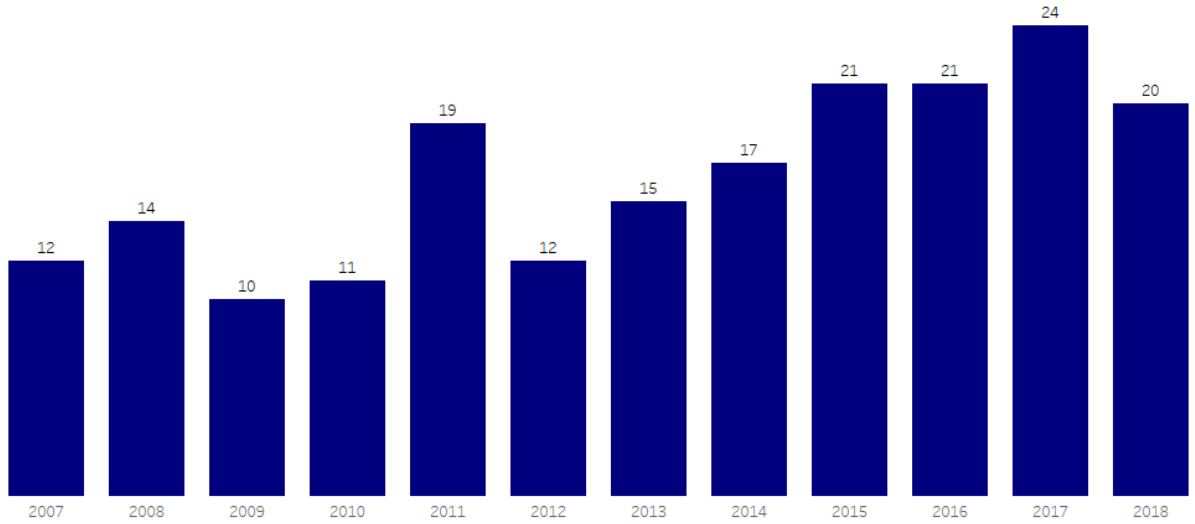
1983, p. 564) and to avoid this case, stock prices until 5 days prior the announcement will be used for calculations. We will further elaborate on that in the methodology part.
After studying literature about some of the most popular event studies of MacKinlay (1997) and Brown & Warner (1980, 1985), we chose to use daily stock prices for our empirical research. The reason for that is an event study can measure how a certain event impacts that value of a company. Furthermore, assuming semi-strong market efficiency, the stock prices will reflect the effects of the event as soon as it happens and hence studying the daily stock prices of the companies can give insights to how the value of the company is impacted over a short-time period (MacKinlay, 1997, p. 13). This will be further discussed in the methodology part but should give a first insight of how we will proceed.

After retrieving the relevant data from Zephyr and applying the above mentioned five criteria, we had a data sample of 789 deals in the pharmaceutical industry, covering all geographical areas. Among the 789 transactions we have decided to further proceed only with the ones completed and we disregarded the ones appearing as "completed assumed", obtaining a total number of 472 deals. Afterwards, we opted for keeping the deals with the announcement and completed dates and so we got a sample of 466 elements. Finally, we did not consider the acquirers whose stock prices were not available for the whole period of 270 days preceding the announcement date. Furthermore, we eliminated the internal deals as we expect the stock returns to be higher when an external buyer is involved. We also removed all deals that had an overlap in the event window, to avoid event clustering so we can assume that there are no covariances between securities as they are supposed to be zero (MacKinlay, 1997, p. 27). Finally, we got a data sample with a total number of 196 deals which is used for the descriptive statistics as well as for the hypotheses testing in chapter 6.

4.2 Descriptive statistics

In an attempt to provide an overview of the M&A deals completed between 2007 and 2018, some descriptive graphs are shown below. The figures reflect the selection criteria illustrated in the previous chapter and they aim at providing evidence of the hypotheses under discussion.
We want to give a general overview of our data sample in terms of deals per year, geographical distribution of the deals (cross-border vs. domestic acquisitions) and the method of payment, before continuing with the methodology part in chapter 5.

Figure 1. Total number of M&A deals in the pharmaceutical industry from 2007-2018 based on the day the deal was announced.



Source: Zephyr dataset. Data visualized with Tableau Software.

Overall it can be seen that the there are some years where the M&A activity seems to peak and declining in the following years in the from 2007 until 2018. Whereas a report from Statista (see Appendix 7) of the pharmaceutical & biotechnology industry shows the highest number of deals that M&A has ever seen in 2018, our results cannot confirm that. That might be due to the fact that we cut out many deals the make our data sample more accurate and limit down the probability of statistical bias. Furthermore, Statista includes deals from the biotechnology sector, which we did not include in our data sample, hence this might be the reasons for our differences.

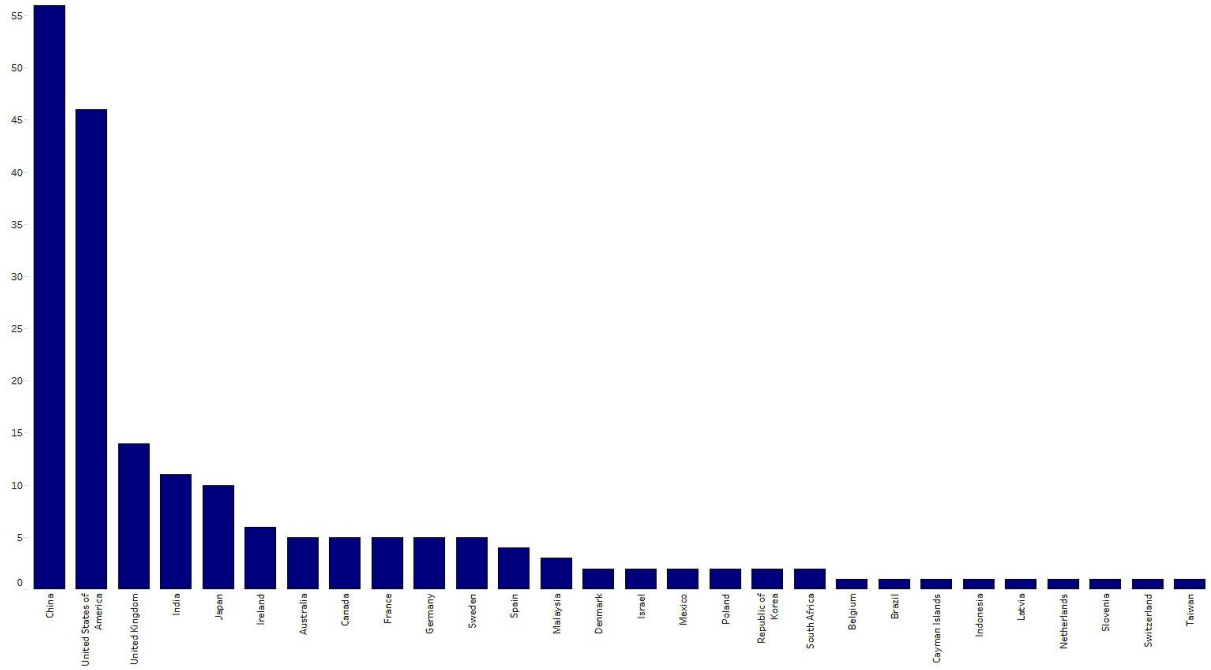
In general, the highest M&A activity in the pharmaceutical industry was seen in 2017, with a total deal dumber of 24, followed by 2016 and 2015 with an equal number of 21 deals. As the years surround the financial crisis of 2008 are of interest for our analysis of the subsequent hypothesis, looking at the years 2007, 2008 and 2009 it can be seen that articular, the M&A activity declined in the year immediately preceding the financial crisis of 2008 with only 10 deals, whereas in the year of the crisis in 2008 there were 14 deals, which was even a higher amount of deals than in 2007 (12 deals). Considering our hypothesis regarding the financial crisis which assumed the number of deals would rise after 2008, we can conclude from the descriptive statistics that this appears to not be the case. Nevertheless, we find that the number of deals increased in 2008, which comes with surprise as Hall (2008) from Reuters has found that the global M&A volume declined in 2008 meaning an end

of five years of constant growth in deal volume. In addition, the global M&A saw a record number of previously agreed deals cancelled in 2008 which is reflected in the low number of deals closed in the year (ibid.). As the number of deals went down in 2009, we agree with Hall (2009) from Reuters when they say that the M&A environment continued to be quiet in 2009 and that the volumes of deals were dragged down still by the economic recession.

In the following years, the graph shows a significant upturn in 2011, followed by a enormous decline in 2012, but is explained by Annema (2013) from McKinsey as that the decline in volumes is due to economic uncertainty. Furthermore, it is always important to recall that M&A activity is of cyclical nature and is influenced by factors such as market trends and regulatory changes (Dieudonne, Cretin & Bouacha, 2014, p. 38). Seven different M&A waves have been identified in history among which the two most recent ones are between 2001-2008 and from 2011 on (ibid.). The sixth wave started right after the 2001 recession as a result of a stimulus from the Federal Reserve and a booming stock market which led to an extremely favorable environment for M&A. The subprime crisis ended this wave of transactions and the seventh one only started in 2011 with a new optimism on the markets and an increasing M&A value (ibid., p. 39). Our graph more or less confirms the waves mentioned earlier and despite 2012, the following years show a vibrant M&A environment with 21 announced deals in 2015, confirmed by Rehm & West (2015) from McKinsey that describe 2015 as a record year in terms of M&A deals announced and of the deals' value.

Since we are interested in the distribution of the deals per geographical area, the following two diagrams in figure 2 and 3 show the geographical distribution of the deals both from an acquirer and a target perspective.

Figure 2. Number of acquirers per country based on number of total deals between 2007 and 2018.



Source: Zephyr dataset. Data visualized with Tableau Software.

Overall the graph shows that there are certain countries that differ tremendously from others. The two acquirers are namely China and the US, followed by the United Kingdom, India and Japan. The remaining acquirer countries are nearly equally distributed with a similar small number of deals.

As China represents the world's third largest drugs market and has over 5.000 pharmaceutical companies according to a study of KPMG China (2011) the dynamic M&A environment is not surprising considering also the double-digit GDP growth, the rapid industrial expansion and the urbanization as JP Morgan (2016) claims. On the opposite of a study by Cools et al. (2007) from BCG 2007 which mentioned the America's exceptional position in terms of deal volume with a deal share of 46.5% for the years between 1997 and 2006, it is shown that China has overtaken that position. According to Ellis (2016) from the Harvard School of Public Health, the US are leader in per capita drug prescription, representing 30-40% of the worldwide drug market. Until the 80's the so called "pharmacy of the world" (Daemmrich, 2011, p. 25) was considered to be located in Europe with Germany, Switzerland and France, but in the 1990s the US were able to become the leading worldwide location for pharmaceutical research, clinical testing, and marketing with is in line with the BCG study that was mentioned before. Other studies attribute the success of the American

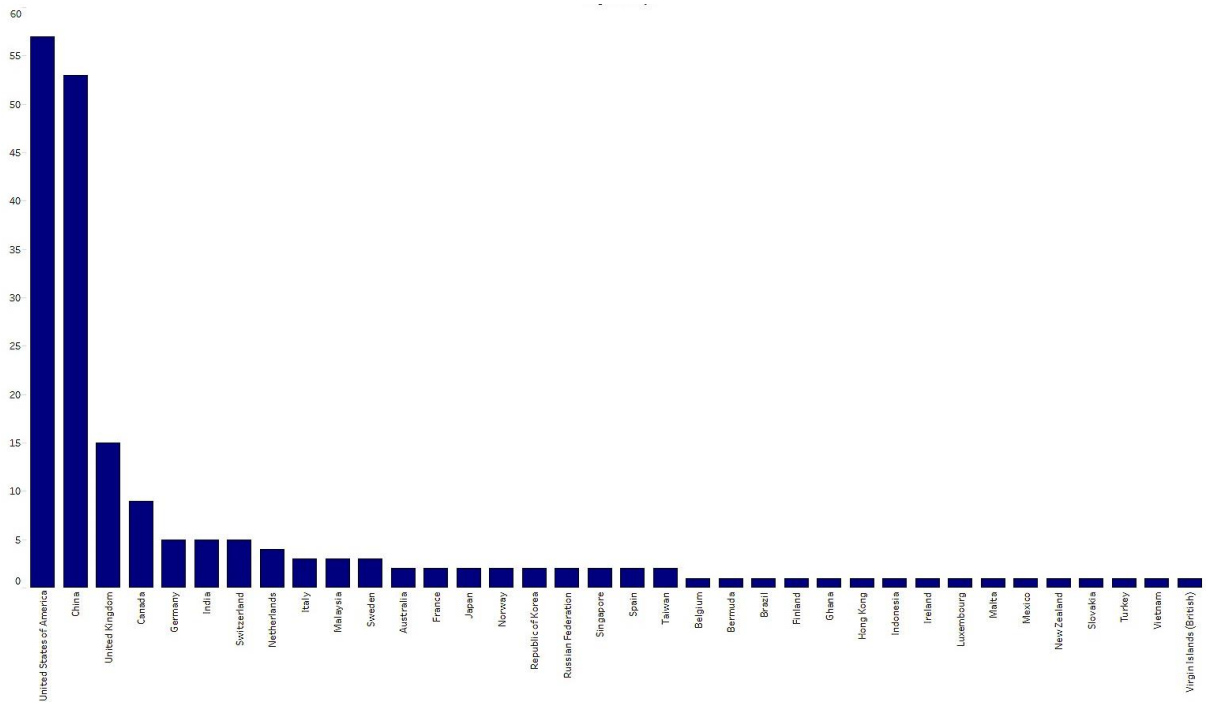
pharmaceutical industry to factors such as the U.S. intellectual property policies, the funds for biomedical research, the absence of government drug price controls and the availability of venture capital (ibid.). The high volume of M&A in the US can on one hand be explained by the patent expiration of many drugs and on the other hand by the willingness of reinforcing the research and development pipelines through the acquisition of biotech startups (Crow & Fontanella-Khan, 2018). Besides the traditional drivers of M&A like economies of scales and the achievement of synergies, American companies seem to choose acquisitions also as a source of innovation (Bansal, De Backer & Ranade, 2018).

The UK represents the third largest acquirer country with a total deal number of 14 deals. A reason for that could be the fact that two of the biggest pharmaceutical companies on a global level, GlaxosmithKline and Astrazeneca, have their headquarters in the United Kingdom and which are also included in our data sample with three deals in total.

The only European country, aside from UK, appearing in the acquirers' top list is Ireland where a recent KPMG survey from Collins & O'Kelly (2018) shows a robust and consistent M&A market focused for the 18% on healthcare and pharmaceuticals deals. The reasons for acquisitions are mainly represented by strategic fit, expansion of customer base and lines of business.

For our empirical research of interest is also India, which according to Hasset et. al. (2017, p. 110) has seen a strong increase in M&A activity. In January 2016, the Indian pharmaceutical industry was estimated to be worth US$ 26 billion and 3.000 pharma companies were registered (Dhanalakshmi, 2016, p. 14). Throughout the years, the Indian subcontinent was able to establish itself as a global manufacturing and research hub mainly due to the presence of skilled workforce that contributed to gain competitive advantage. The desire of strengthening their product portfolios and to expand their business both in existing and new markets, induced the pharma companies to acquire other players (ibid., p. 15). Furthermore, the decision of investing in M&A is mainly driven by the opportunity of increasing the size and therefore achieving higher economies of scale (Tripathy & Prajapati, 2014, p. 189).

Figure 3. Number of deals with target company in that country based on number of total deals between 2007 and 2018.



Source: Zephyr dataset. Data visualized with Tableau Software.

The same pattern as for the acquiring companies can be seen for the target countries, showing that there are few target countries that have seen a similar number of deals, followed by many different countries each having a rather smaller number of deals

In terms of target countries, the pharmaceutical bidding firms mainly decided to invest in the US (57 deals) and in China (53 deals). which is followed by UK (15) with a rather big difference to its Chinese predecessor. As previously mentioned, this in line with the results reported for the acquirer countries, with both acquirer and target top countries being China, the US and the UK. Looking at the countries that follow the top three targets, we can see that Germany, India and Switzerland follow. In the case of Germany, the presence can be explained by the country's long production tradition, the cutting-edge research and by the fact that it is the world's leading medical biopharmaceuticals producer after the US (Germany Trade and Invest Report, 2017, p. 2). Moreover, the Swiss chemical and pharmaceutical industry is leader in the production of chemical specialties and life science products (Science Industries Report, 2012, p. 6). Proven leadership in pharmaceutical and chemical production makes both countries a highly attractive target for investors.

In relation to our hypothesis 2.2., we want to further analyze India's M&A activities as they have shown increasing interest in acquisitions as already mentioned when looking at the acquiring countries (Hassett et al., 2017, p. 110). During the previous year, India has demonstrated to be a major player in the global M&A environment among the emerging countries, second only after China (ibid.).

During the period 2007-2018, the Indian subcontinent closed 11 acquisition deals and it was the sixth preferred target country. India is according to the Morgan Stanley Capital International (MSCI) Emerging Markets Index the only country together with China among all emerging countries, that appears in the top 5 acquirers as shown in Figure 2. This is in line with a report of BCG (2007, p. 10), that states that India is catching up in terms of M&A activity and growing at 20.4%. Since this report is from 2007, it is interesting to see in our graphs that India apparently still seems to be involved in a decent number of deals even though when looking at it in percentages it seems to be a rather small number: as an acquirer, they account for 6% of all deals compared to China with 29% and to the US with 23% (own calculations).

Since we are interested in determining whether the international alliances bring more value for shareholders of the bidding companies than the domestic ones, we lay particular focus on the amount of cross-border deals and compared them to the number of domestic transactions. Our findings are visualized in the figures below. It will later be further investigated if the cross-border acquisitions bring more value for shareholders than domestic ones in our empirical research.

By examining the data, we found that between 2007 and 2018 and according to the selection criteria applied, 121 M&A deals can be categorized as domestic while 75 are cross-border. Relating this to our hypotheses, the difference between cross-border and domestic transactions is overall substantial, with a higher difference in some years and a smaller one in others.

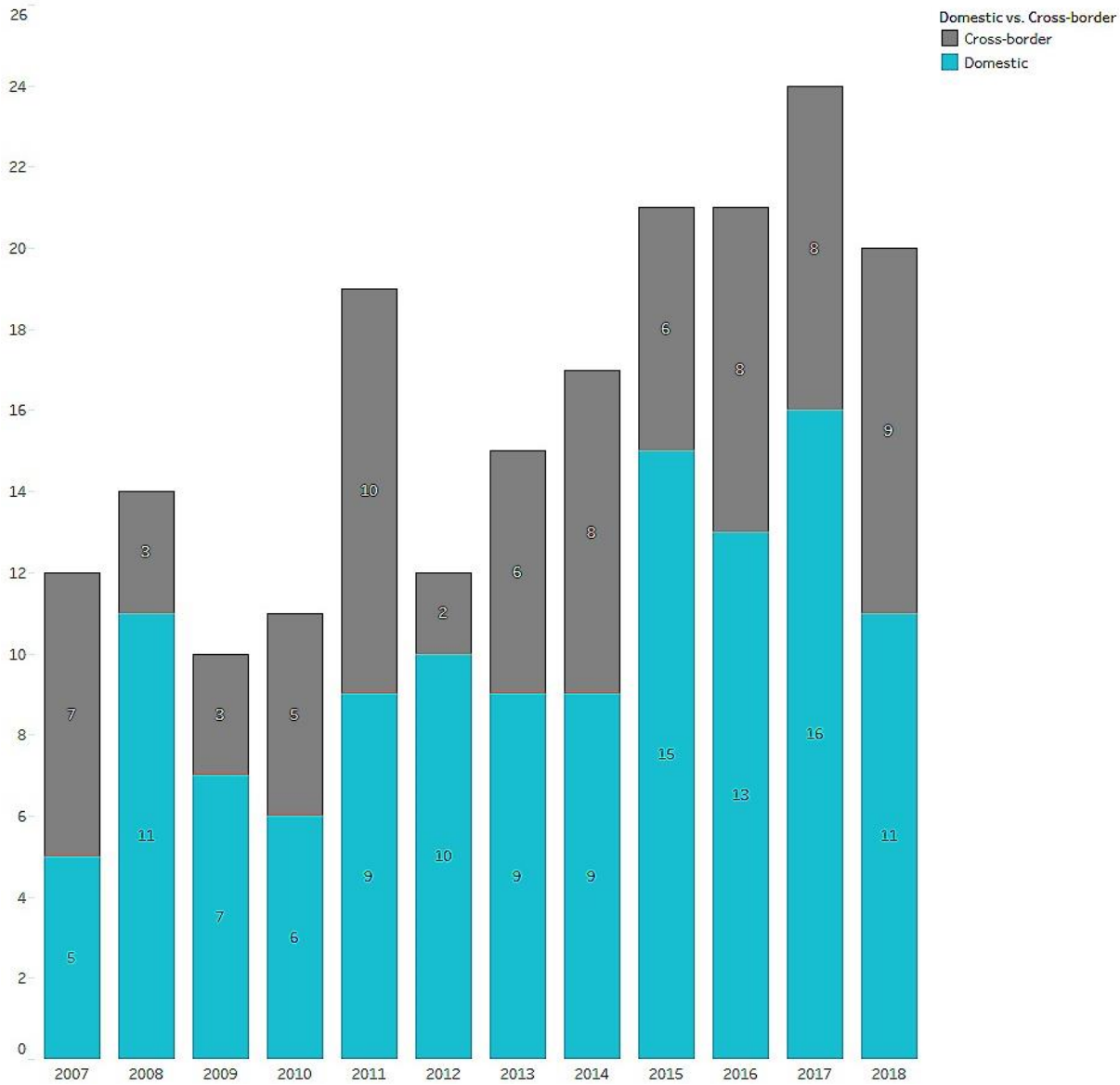
Figure 4. Number of deals cross-border and domestic (per year) from 2007-2018.

Source: Zephyr dataset. Data visualized with Tableau Software.

The trend is shown in the graphs of figure 4. The volume of cross-border acquisitions was higher than the volume of the domestic ones only in the years 2007 and 2011. In all the other years considered, the amount of cross-border deals was always modest until reaching the lowest point in 2012, which showed a decline in transactions compared to 2011 as already mentioned in the paragraph above. The reasons behind the decision of undertaking more domestic acquisitions than cross-border ones can be due to the risks linked to the foreign investments like different tax systems, various regulatory landscapes and the potential difficulties of obtaining reliable financial data (Grice, 2017). Since previous literature has highlighted the advantages related to the cross-border transactions, but the graphs show a tendency to domestic acquisitions, the importance of our empirical research with the results that follow in chapter 6 is emphasized and it will be interesting to see if cross-border transactions showed significant higher abnormal returns for shareholders than the domestic ones and therefore mean that international alliances create more value.

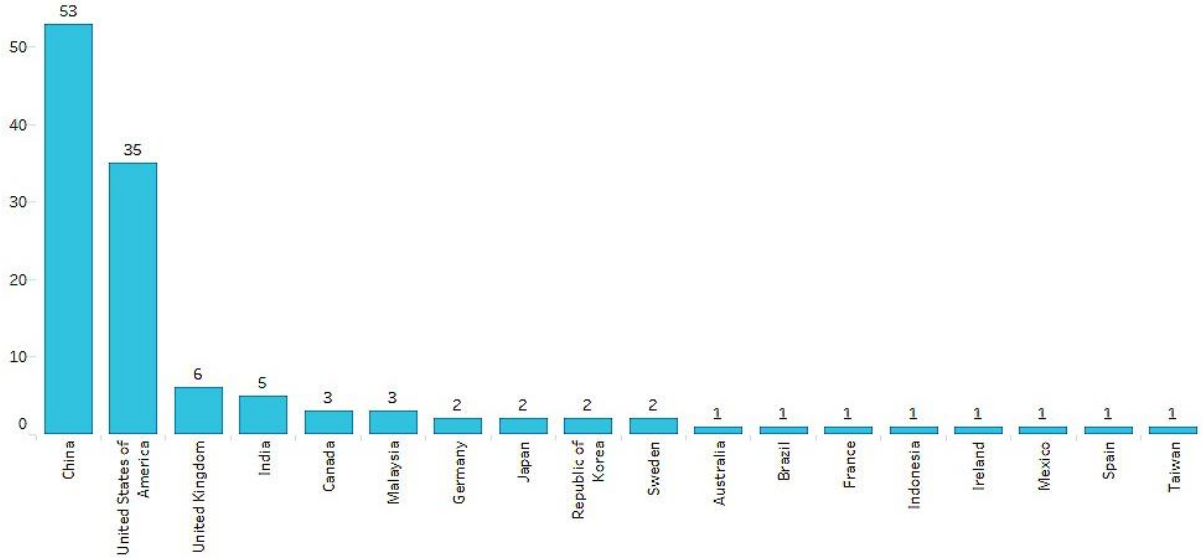
The distribution of cross-border and domestic deals is shown in figure 5, putting the trendline of figure 4 in total numbers and emphasizing that there have been more domestic deals than cross-border ones.

Figure 5. Number of deals cross-border and domestic (per year) from 2007-2018.



Source: Zephyr dataset. Data visualized with Tableau Software.

Figure 6. Number of domestic deals per year based on number of total deals between 2007 and 2018.



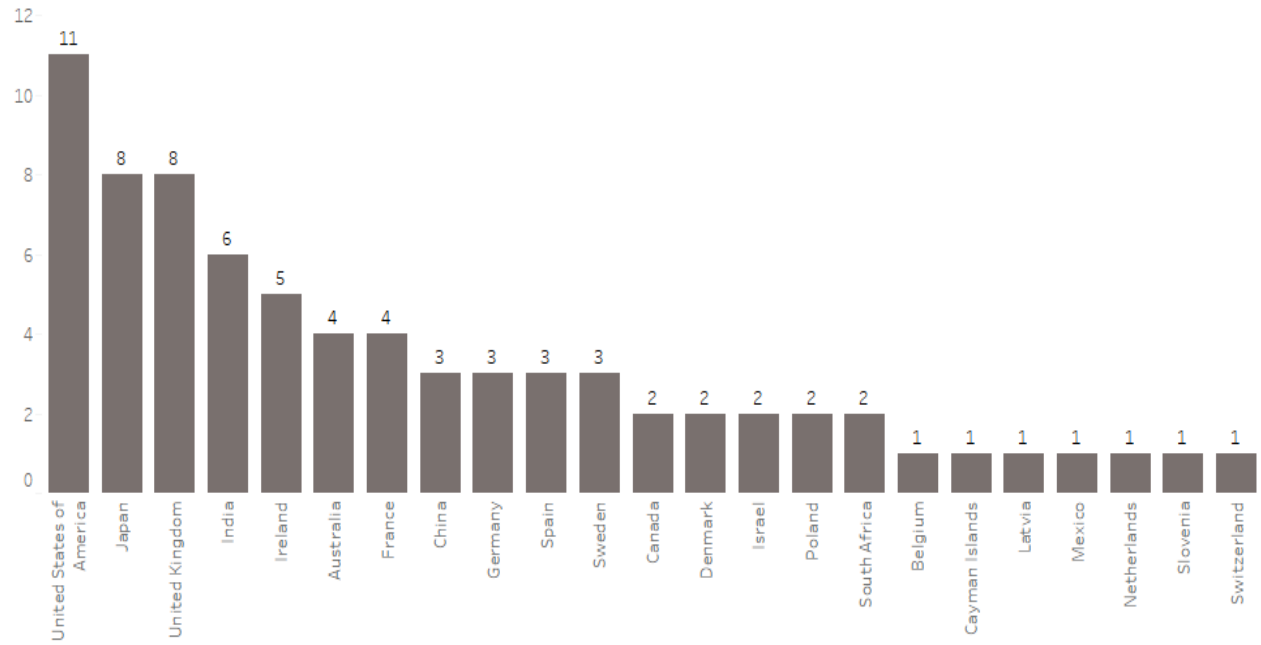
Source: Zephyr dataset. Data visualized with Tableau Software.

Figure 6 shows the total volume of domestic deals per country. We can see that companies based in China and in the US, which have been found as the top two acquirer countries while analyzing our data sample, are doing many domestic transactions. When looking at figure 7 to compare these numbers with the international ones, we see that the US has the most cross-border acquisitions of all countries with 11 deals. This is still a small number compared to the domestic US deals which were 35. The Chinese deals that were registered as domestic account for a number of 53 while the international ones are only 3. This emphasizes again the general trend of domestic transactions. We have further found that among the 121 domestic deals, 55% occurred on the Asian continent (specifically, China, India, Malaysia, Japan, Korea, Indonesia and Taiwan), 33% in America and only 11% in Europe. This in an interesting finding, considering that BCG has reported in 2007 that Europe was the second big player in terms of deals per value after the US (p. 10), which does not seem to be the case for domestic deals and for the years between 2007 and 2018. In general, however, among the Asian countries, only China seemed to prefer domestic deals while the other two Asian players, Japan and India, mainly closed international deals. Putting that in numbers, we found that Japan had 10 deals in total, 8 of which were cross-borders whereas only 2 were domestic. The difference can be explained by the declining population of Japan and a slowing economy according to JP Morgan's M&A team (2017, p. 5) which led the Japanese companies to finalize outbound acquisitions with the

purpose of entering new markets, obtaining new products and capabilities and accessing innovation. Looking at one of our countries in focus, we found that India had 5 transactions that were domestic and 6 that were cross-border. Even though India has seen more cross-border transactions compared to domestic ones, we cannot say that they mainly focus on cross-border deals due to a small data sample of Indian companies. Moreover, we also cannot confirm what other researchers have found, namely that Chinese companies have increased their number of cross-border deals in the previous years (Hassett et al., 2007, p. 110).

To give further insights about China and India as they are emerging countries and their respective M&A activity, Hassett et al. (2017) suggested that due to the slowdown of the Chinese economy, India might have higher M&A activity than China. Looking at the number of deals from the descriptive statistics, we cannot confirm this trend for the pharmaceutical industry: China has had 56 announced deals in total between the years 2007 and 2018, whereas India only had 11 deals overall. We can therefore conclude that at least for the pharmaceutical industry, it doesn't look like India would overtake China in M&A activity.

Figure 7. Number of cross-border deals (per year) based on number of total deals between 2007 and 2018.

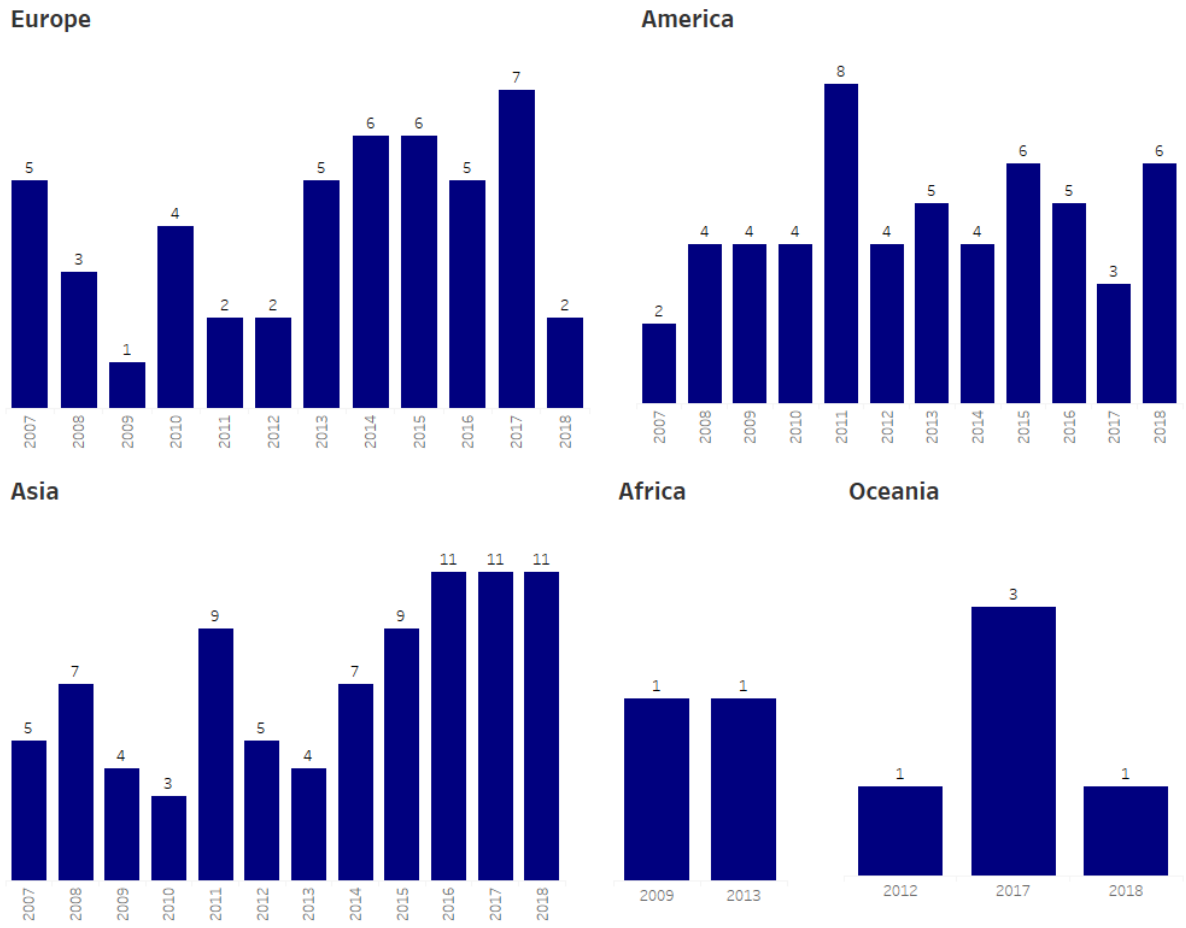


Source: Zephyr dataset. Data visualized with Tableau Software.

Regarding the cross-border deals, the US companies seem to have had the most deals, followed by Japan and the UK. However, despite the US' first position, the gap between the international and national deals is substantial (11 vs. 35), as already mentioned in the previous paragraph. This could be explained by the fact that the US can rely on a very big pharmaceutical market and therefore they can find opportunities within national borders. The United Kingdom, on a par with Japan, reports 8 cross-border deals in contrast to 6 domestic ones. By looking at the percentages per continent and according to Figure 7, the amount of European cross-border deals equals the 47% in contrast to the Asia with 25% and the Americas with 20%. As opposed to the results showed in the domestic deals graph, Europe demonstrated to look more for outbound opportunities.

In order to have another perspective on the geography of the M&A deals, we have grouped the countries per continent to show the most dynamic one.

Figure 8. Number of deals per continent (per year) from 2007-2018.



Source: Zephyr dataset. Data visualized with Tableau Software.

By analyzing the figure 8, the different level of engagement in M&A activities across the continents is visible. In decreasing order, Asia, America and Europe are the three key players with respectively 86, 55 and 48 deals. The Oceanian and African continents don't report significant results and the deals reported are attributable to Australia and South Africa only. Whilst the low volume of deals in the Oceania area, we expect a significant increase in the M&A activity during the next years as reported by a recent survey undertaken by Collins & O'Kelly from KPMG in August 2018 which shows healthy signs of activity from 2018. Regarding South Africa, an interview from 2018 with Morne van der Merwe, managing partner and head of the corporate/M&A Practice at Baker McKenzie in Johannesburg, highlighted the big drop in M&A activity as a result of corruption and suboptimal governance in the country. He further mentions that major political issues and a climate of uncertainty seems to affect investments' confidence and appetite.

Moreover, it is interesting to notice that the years with more intense activity differ according to the geographical area. For instance, Europe had the lowest number of deals in 2009 and the highest in 2017, while America's reported its highest deal number in 2011 and its lowest 2007, having also very few deals in 2017 which represents the opposite to the European transactions. In 2017, where the volumes of deals in America were very low, Asia instead registered the highest amount, together with 2016 and 2018, which is in line with the deal numbers of Europe and Oceania. Again, the number of deals seem to reflect the characteristics of the markets and in fact, Europe, extremely affected by the financial crisis, registered very low numbers in 2008. By looking at the Asian graph instead we notice a growing trend since 2014 which confirms the reported trend from other scholars for emerging countries like India and China.

To conclude our findings when looking at the deal number per continent, they reflect very accurately the trends of the economies across the world. The European graph in fact fully mirrors the setback caused by the financial crisis in 2008 and the succeeding economic revitalization; the graph for the Americas shows a constant levels of M&A activity without significant drops and confirms the existence of a flourishing economy despite being in a late expansion phase of the business cycle (Hofschire et al., 2018, p. 3); the Asian histogram instead provides evidence of a rapidly growing economy especially during the last few years. In connection to the hypothesis 5.1 and in relation to the number of deals after the financial crisis, we seen a decline in the deal number for Europe and Asia in 2009, but a constant number for the Americas. Due to no complete deal data for all years for Africa and Oceania, we cannot make an overall conclusion regarding a trend per continent for the years after the financial crisis.

Figure 9. Method of payment used in the respective deal between 2007-2018.

Year of Announced date	Cash	Shares	Other
2007	11	1	
2008	8	2	4
2009	5	4	1
2010	7	1	3
2011	12	2	5
2012	7	1	4
2013	6	5	4
2014	9	2	6
2015	7	10	4
2016	9	5	7
2017	19	3	2
2018	13	6	1
Grand Total	113	42	41

Source: Zephyr dataset. Data visualized with Tableau Software.

The last figure shows the different methods of payment that are used regularly when it comes to mergers and acquisitions. In order to simplify our results, we have categorized the data in cash, shares, and other. The category "Cash" includes also the deals paid with cash reserves while under the category "Other", we considered all the methods other than cash and shares like bonds, liabilities, earn-outs etc. Overall, since the hypothesis of this thesis regarding the method of payment has focused on whether cash offers yield higher abnormal returns than stock offers to limit our research down, we later will only analyze the deals paid with cash or shares and to give a general overview, we here include the "other" method of payment. Overall, we will later use the "other" payment as the benchmark in our cross-sectional regression and will further elaborate on what that means and which implications that has. Looking at the number of deals, cash clearly seems to be the preferred method of payment when compared to shares and other methods of payment with a total number of 113 deals. The fact that 58% of all deals were cash financed and that therefore cash seem to be the preferred payment method could potentially support our hypothesis according to which cash is preferred because as emphasized by Pautler (2003), markets react better to cash financed acquisitions. 42% of the deals were instead paid with either shares or other payments, while both have an equal distribution of 21%. We conclude, that there is a remarkable difference between the methods of payment, with an even bigger difference when only comparing the deal number that was paid with cash and the one that was paid with shares. Our findings are also coherent with the BCG Report from 2007 mentioned

previously which indicates that there is an increasing number of deals that are only paid with cash, reporting a rise from 58% to almost 75% since 2000 (p. 12).

5 Methodology

5.1 General introduction

After presenting first results in chapter 4 in form of descriptive statistics to give a general overview of our data sample and how the pharmaceutical M&A landscape looked like in the previous years from 2007-2018, we now want to continue with our empirical research and testing our hypotheses. Our hypotheses will be tested in the same order as they are presented in chapter 3, meaning we will start testing the hypotheses 1.1, 1.2 and so on. This can be done by using event studies, which is the most common methodology from other researchers, as can be seen in literature (Binder 1998, Brown & Warner 1980, 1985, MacKinlay 1997, Bowman 1983, Pautler 2003). After testing the first hypotheses about abnormal returns for shareholders, we will run further cross-sectional regressions to control for firm-specific variables. The reason for running the event study at first is that we need the results of the tests for the cross-sectional regression of the remaining hypotheses. Hence, we will start with explaining what event studies are and how we can use them for our research before continuing with the explanation of the cross-sectional regression we want to execute.

5.1.1 Event Studies

Event studies have been used in previous research as has already been mentioned before, but the main papers we base our research on are MacKinlay (1997), Bowman (1983) and the papers of Brown & Warner (1980, 1985) as they are some of the most mentioned papers in other literature reviews. According to them, event studies can be treated as a test of market efficiency, since non-zero abnormal returns that stick after an event are not consistent with the hypothesis that stock prices adjust immediately and hence reflect all relevant information. Furthermore, abnormal performance can be used as a measurement for the impact of the event on the wealth of the company's shareholders. Hence, abnormal performance is consistent with the market efficiency theory since the abnormal returns could only have been achieved if the event could have been predicted with certainty (Brown & Warner, 1980, p. 205-206).

Measuring the effect of an event, like in our case a merger or an acquisition, on the value of the involved firms can be difficult, but, as literature shows, can be facilitated by using event studies. By

using financial market data like stock prices, an event study can measure the impact of the respective event on the firm value (MacKinlay, 1997, p. 13). In particular, by putting that in relation to the semi-strong market efficiency theory, "if markets are semistrong efficient, then prices will adjust immediately to public information such as the announcement of the last quarter's earnings, a new issue of stock, or a proposal to merge two companies." (Brealey, Myers & Allen, 2017, p. 332). Hence, effects of an event like a merger or an acquisition will be reflected immediately in stock prices and can therefore be a good measurement of the impact of the event on the firm value, using stock prices for a specific timeframe (MacKinlay, 1997, p. 13). Furthermore, as stated by Brown & Warner (1980), abnormal returns are consistent with the market efficiency theory. The reason for that is the abnormal returns could only be achievable by an investor if the event could have been predetermined with certainty. Anticipating that the event was not foreseen, abnormal performance at the time of the actual event can be used as a measurement for value creation of shareholders.

In general, the focus of event studies is on the impact of firm-specific events on the prices of the respective stock of the firm. Firm-specific events can be for example stock splits or earnings report (Brown & Warner, 1980, p. 205) or as in our case, the announcement of an acquisition. We hence want to identify the abnormal returns for shareholders by measuring the actual and the expected returns and then investigating whether there is a difference and consequently an abnormal return.

The next section outlines how the event study is carried out and which steps are involved.

5.1.2 Issues with using daily stock data

For our research we choose to use daily stock prices for a certain time window over monthly returns that extend the data sample. Nevertheless, we found in Brown & Warner (1985) that there are several issues with using daily stock returns instead of monthly ones that we want to address in this sub-chapter.

The first issue we can encounter in using daily stock prices is that this type of stock returns for an individual security shows significant deviations from normality in contrast to monthly returns (Brown & Warner, 1985, p. 4). The result is a more fat-tailed distribution that violates the assumptions of the Central Limit Theorem from which in general the event studies is based on (ibid.). The second potential problem is instead related to the fact that many securities are traded infrequently while only few are actively traded in a way that prices are recorded almost continuously (Scholes & Williams, 1976, p. 309). Because of this, it is basically impossible to calculate accurately the returns over any

fixed sequence of period and therefore the OLS estimates of market model parameters can be biased (Brown & Warner, 1985, p. 5). As a consequence of the non-synchronous trading, the estimation of the variance, needed for tests of statistical significance, can present some difficulties among which a serial dependence of the daily prices. Furthermore, it has been demonstrated that variance of stock returns increases for the days immediately around events i.e. an acquisition announcement (ibid.).

Although there are issues regarding the use of daily stock prices, Brown & Warner (1985) have found that using daily data and being able to determine the event day correctly helps to increase the statistical power of the event study technique (ibid., p. 13-14), which is why we decide to move forward with using daily stock data, even though there has been problems found in previous research.

5.2 Modelling the process

For our event study, we followed the set-up suggested by Bowman (1983), which involves five steps:

1) Definition of the event window
2) Calculation of the normal (expected) returns
3) Estimation of the abnormal returns
4) Organize and group the abnormal returns
5) Analyze the results including statistical tests for our research

Following this model, the first step is to determine the date for when the market has received the announcement of the acquisition, which is needed to further set up the
the event windows. For the event window, we then identify a period over which the stock prices of the firms involved in the event will be studied. To capture the effect of the announcements of the acquisitions of our data sample, the studied period should include at least the day of the announcement and the day after the announcement (MacKinlay, 1997, p. 159), but we will further elaborate on that in chapter 5.2.1.
To measure abnormal return, we first need to calculate the normal and thus the expected return, which is the second step. Literature has shown that there are several models like CAPM, the market model, the historical mean model, the single index model, market adjusted model or multi-factor model that can be applied to measure the normal return. In chapter 5.2.2 and 5.2.2.2 we will discuss the different methods in detail and explain which method we have chosen and why.

After getting the normal returns, we can then calculate the abnormal return as the difference between the actual ex-post return and the normal expected return over the period of the event window.
As a next step, the results can be organized before an analysis is possible, which will then be our last step as a statistical analysis to test the significance of our hypotheses. This is in short, the process of testing value creation for shareholders, which each step being further elaborated on in the following chapters.

5.2.1 Determine dates

As briefly mentioned above, the first step in conducting an event study is to determine dates, which is first of all the determination of the event itself and then it is to choose a period that should be used for studying the movements of stock prices. In general, it is common to extend the event window and not only looking at the period of interest (MacKinlay, 1997, p. 14). When investigating a type of event which occur for different companies at different times as in our case, the action of bringing them together into one sample requires the use of event time. The announcement date of the event then becomes time zero in event time (Bowman, 1983, p. 563). We will refer to the announcement date as 0. To give some more clarification, it is important to define some terms. When using event studies, there are two different periods: first, there is the event period, also called event window, which is in our case the day that the acquisition is announced (the event) plus and/or minus some days or months. If one wants to investigate if there have been unusual discrepancies, months would be chosen. The second period is the estimation period, where estimates are derived to measure normal expected returns for each of the companies during the event window (Henderson, 1990, p. 284).
Hence, besides choosing the event window, the estimation window needs to be defined. According to MacKinlay (1997), the most common choice is using a certain period before the actual event window for that purpose. We decided to work with daily stock data: we measured to normal expected returns for 196 acquirer companies for a period of 265 days prior (T_0) to 5 days before the event (T_1). More precisely, we define the announcement day of the event as day 0 as mentioned above for any of the 196 stocks. For each of the stocks we use 270 daily returns for the period of the event, meaning from day -265 and ending at +5 after the actual event (T_2). The first 260 days in the period T_0 to T_1 (-265, -5) is the estimation period, whereas the period from T_1 to T_2 (-5, +5) is the event window. We decided to include only stocks that have available stock prices for the entire period to narrow down the sample and to avoid thin trading (Dimson, 1979; Dimson & Marsh, 1983). In general, the event

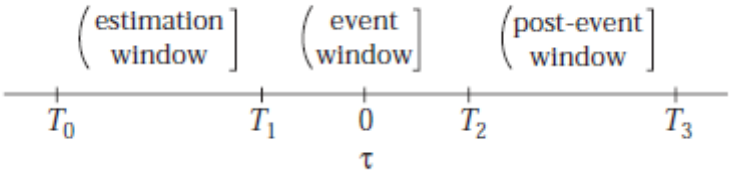
window is not included in the estimation period as it can influence the normal parameter estimates and could bias the results (MacKinlay, 1997, p. 15).

To sum up the above describe different time windows and to give an overview of all the terminology that we will use in our thesis, the following wording has been chosen:

$\tau = 0$ = announcement date
T_0+1 to T_1 = estimation window
T_1+1 to T_2 = event window

The general timeline for an event study as found in MacKinlay (1997, p. 20) can be seen below. Although we will not take the post-event window into our considerations, it is here shown to give a complete overview.

Figure 10. General timeline for an event study based on MacKinlay (1997).



5.2.2 Calculation of the normal (expected) returns

As a second step, a stock's normal expected return needs to be calculated. To measure abnormal returns, it is required to choose a model that generates normal returns since the performance of stock prices can only be considered as abnormal if there is something to compare it to (Brown & Warner, 1980, p. 207). While doing some research, we have found that there are several models that can be used for the calculation of the normal returns. While we have chosen to move forward with the market model, we first want to give insights to the different models and possibilities that come along with each model. According to MacKinlay (1997), the existing models for measuring normal returns can be categorized into two groups: statistical and economical models. We will briefly introduce the two different groups and some models of each category before explaining more detailed the market model.

5.2.2.1 Statistical models

Models that are included in this category are not dependent on any economic arguments and rather follow statistical assumptions, which will be explained after introducing some statistical models that could be used for our event studies. In general, one important aspect of choosing the right model for measuring the expected return is to reduce the variance of ε, one component of the abnormal return (Brown & Warner, 1980, p. 209). This is why it is important to mention that different models have been used in past research and to emphasize which model we have chosen consequently. Two of the models that are mentioned in several papers (MacKinlay 1997, Brown & Warner 1980, Bowman 1983) and seem to be quite common are the constant mean return model and the market model.

While the constant mean return model assumes that the mean return of stocks is constant over a specific period therefore expected to generate the same return that it averaged during the estimation period (Henderson, 1990, p. 285), the market model rather assumes a stable, more linear relation between the market return and the stock return (MacKinlay, 1997, p. 15). This means that a firm is expected to have the same returns as the market during specific chosen event window (Henderson, 1990, p. 285). Comparing the two of them, the market model seems to be an improvement to the constant mean return model since the variance of the abnormal return can be reduced due to the removement of portion of the return related to the variation in the market's return. This in return can lead to a higher probability of finding actual event effects (MacKinlay, 1997, p. 15). When using the market model, the security return is regressed against the market return to find the estimated return (Pettengill & Clark, 2001, p. 3). For both the constant mean and the market model hold the assumptions that the asset returns are equally multivariate normal, independently and identically distributed. Furthermore, it is rather easy to adapt or modify these two models to achieve autocorrelation and heteroskedasticity (MacKinlay, 1997, p. 17). In general, correction for autocorrelation of residuals appears unwarranted since autocorrelation in the residuals is small and appears to not cause serious problems for event studies (Henderson, 1990, p. 293), which is why our focus does not lay on further testing on autocorrelation.

Another statistical model is the multifactor model which includes additionally to the market index other industrial indexes but the gains from using that model are perceived as rather small (ibid., p. 18), due to the only little explanatory power of the additional factors which do not reduce the variance of the abnormal returns appropriately (ibid.). One popular example for a multifactor model is the Three-Factor Model by Fama & French from 1992, which reject the market beta associated with the CAPM and instead find that stock size and book-to-market ratio better capture the cross-sectional

variation in average stock returns (Erdinç, 2018, p. 71). It has to be mentioned that we considered to use a multi factor model because MacKinlay (1997, p. 18) stated that "the variance reduction will typically be greatest in cases where the sample firms have a common characteristic, for example they are all members of one industry or they are all firms concentrated in one market capitalization group. In these cases, the use of a multifactor model warrants consideration. Nevertheless, we decided to move forward with the market model, since it has seen a lot of popularity in other researches and due to the above-mentioned fact that the additional factors of multi factor models often have no explanatory power.

The last one that we want to mention, but which is rather constrained due to the pre-specification of α and β, is the market-adjusted return model where α is restricted to zero and β to one. Consequently, the recommendation of MacKinlay (1997, p. 19) is to use restricted models only if necessary, since the mentioned restriction could bias the results.

5.2.2.2 Economic models

Compared to the statistical model category, models that can be grouped into the economic category tend to rely on assumptions regarding investors' behavior rather than on statistical assumptions. Nevertheless, when using economic models must still make statistical assumptions which further results into more precise measures when calculating the normal returns (MacKinlay, 1997, p.17). In general, it has been showed that the statistical models can eliminate the biases that come e.g. with one of the economic models, namely the CAPM and this is the reason why the use of statistical models for event studies is more common (ibid., p. 19). The two most common models are the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). While the expected return calculated with the CAPM is estimated by its covariance with the market portfolio, the expected return using the APT for measuring is a linear combination of multiple risk factors. Fama and French (1996) have shown that the standard firm characteristics for average returns on stocks related to the firm's size or short-term past return cannot be explained by CAPM, and whose anomalies could be resolved by their Three-Factor-Model. The critical factor for the APT is that there are no big gains in comparison to the market model, since the most important factor comes from the market factor and the other factors do not add any relevant explanatory influence.

Calculating the expected return with the market model controls for market-wide changes during and after the event and with estimating beta, the different levels of risk of the individual stocks are taken

into consideration for the calculations of the abnormal returns (Werner, 2010, p. 57). Due to these factors, the apparent popularity of the market model in event studies and the application of the model in well-known papers like Brown & Warner (1985), we will move forward with that model, continuing at first with the estimation process, but also elaborating more in detail about the problems of the market model.

5.2.2.3 Estimation of the market model

When using event studies as a method for investigating and testing the relationship between stock prices and an economic event like a merger or an acquisition empirically, employing statistical and econometric practices to the results is acknowledged as giving the research some sort of credibility. Hence, event studies are deeply connected to econometrics and to be more specific, often depend on estimates from regression models (Coutts, Mills & Roberts, 1994, p. 150)

The usual procedure to estimate the market model parameters is doing an ordinary least squares (OLS) regression. A regression is in general "concerned with describing and evaluating the relationship between a given variable and one or more other variables. More specifically, regression is an attempt to explain movements in a variable by reference to movements in one or more other variables" (Brooks, 2008, p. 27). The standard regression is simply explained by

$$y = \alpha + \beta x \tag{1}$$

This is only the ideal regression, since calculating a and ß and a given value of x would allow us to define y with certainty which means that the model would fit the data perfectly and all of the data would lay exactly on a straight line if one imagines a scatter plot. To make the model more realistic, an error term is added:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \tag{2}$$

Applying this to our methodology means that y_{it} is the return on the i-th security during time t, x_{it} is the return on the market index associated with this stock during time t, α and β are the security specific intercept and slope coefficients and ε_{it} is the unpredictable component, also called error term, of our return y_{it}.

One assumption for the market model is that y_{it} equals a systematic component that is linear to the market return x_{it} and an unsystematic error term ε_{it} that is assumed to be independent of x_{it} and consequently, the return of security y_{it} can be considered as being abnormal (Coutts, Miller & Roberts, 1994, p. 151).

Looking at the independent variable x_{it}, which is the return on the market, it needs to be further clarified whether this index should be measured on a value- or an equal-weighted basis. While theory supports to use a value-weighted index since that most accurately reflects the total market performance, equal-weighted indexes are more likely to find abnormal returns (Henderson, 1990, p. 291). For our research we take value-weighted pharmaceutical indexes of the different continents into consideration, that has been previously calculated by Thomson Reuters. To be more specific, we used the Thomson Reuters Pharma Index of North America for all US-based and all Canadian companies, the European one for all European pharmaceutical companies, the Asian-Pacific one for all Asian companies (including Russia), the African one for the companies in South Africa since there were only companies from South Africa in our data sample, and finally the Australian index as a benchmark for companies from Australia. Hence, we used five different indices to measure the market returns x_{it}. We chose to use these indices, as a benchmark for the market returns as we think that this is the most correct and appropriate way to measure relevant expected returns. Since there is not a pharmaceutical index for each country, we would have had to use the indices that included all big companies and not only pharmaceutical ones. We choose not to use these indices since we think it is not an accurate measure for our calculations of the market returns.

Looking again at our model, the most common method that is used to fit a line to the respective data, which means estimating the parameters α and β, is the ordinary least squares regression (OLS). This method minimizes the total sum of squared residuals (RSS), by taking the vertical distances from the point to the line and squaring it. The equation for the plotted line with the minimized total sum then looks like this:

$$\hat{y}_{it} = \hat{\alpha} + \hat{\beta} x_{it} + \varepsilon_{it} \quad (3)$$

with $\hat{\alpha}$ and $\hat{\beta}$ being the estimators of α and β. Since we will use the data analysis tool 'Regression' from Excel to calculate our expected returns, $\hat{\alpha}$ and $\hat{\beta}$ will be automatically calculated by Excel and we will only insert the data of the stock returns and the market returns. To use the OLS for our research

and to get the best linear unbiased estimators (BLUE) (ibid., p. 153), there are several requirements that need to be fulfilled (Brooks, 2008, p. 44): first of all, the model must be linear in its parameters α and β must be chosen to use OLS which means that it must be possible to display the relationship between x and y as mentioned above as a straight line. In this case, linear means that the parameters are not multiplied with each other to give an example (ibid., p. 38). Further assumptions that need to be met to validate our results, derived from Brooks (2008) and Gujarati (2003), are going to be introduced in the following paragraphs.

For the classical linear regression model and as mentioned before, we assume that the regression model is linear in the parameters and that the error term ε is normally distributed.

Furthermore, given the value of x, the mean value of the error term ε_{it} is zero which means that the conditional mean value of ε_{it} is zero and which is shown as: $E(\varepsilon_{it}) = 0$.

To be more specific, this means that the factors that are not explicitly included in the model, do not systematically affect the mean value of y. Hence the error term is assumed to be uncorrelated with the explanatory variable.

Unpredictable factors like systematic risk could cause correlation but are not supposed to influence our regression as we chose large data sample over a period of more than 12 years.

The assumption of zero conditional mean implies the next assumption, which is

$$Var(\varepsilon_{it}) = \sigma^2 \tag{4}$$

Here the variance of the errors each x_i is a positive constant number equal to σ^2, which reflects the assumption of homoscedasticity. It means that the variation around the regression line does not increase or decrease as x varies, but rather is the same for all x values (Gujarati, 2003, p. 68). Whenever the conditional variance of the y population varies with x and hence is not constant, we say the regression is lacking homoscedasticity and is affected by heteroscedasticity.

The next assumption concerns autocorrelation between the error terms: the covariance $cov(\varepsilon_{it}, \varepsilon_{jt})$ should equal zero, which means that the errors are linearly independent of one another or that there is no serial correlation. This means that the error terms of two observations in the regression are not correlated.

As a last assumption, the covariance $cov(\varepsilon_{it}, x_{it}) = 0$ and $cov(\varepsilon_{it}, x_{2t}) = cov(\varepsilon_{it}, x_{3t})$, which means that there is no relationship between the error term and the explanatory variable x and as an extension, that there is zero covariance between ε_{it} and every other x variable (Gujarati, 2003, p. 71). Hence, we assume that ε and x influence y separately. If they are positively correlated though, x increases when ε increases and decreases when ε decreases. The same applies for negative correlation: x will increase if ε decreases and vice versa. It can be concluded that measuring the individual effects of ε and x on y is difficult when correlation occurs (ibid.).

If these assumptions hold, the estimators $\hat{\alpha}$ and $\hat{\beta}$ are the best linear unbiased estimators and this in return means among other things that the $\hat{\beta}$ estimator has only minimum variance, which is in favor for our analysis. These few concepts of econometrics are used for our further empirical research and to clarify how we want to proceed. An example mentioned in Brooks (2008, p. 28) was how asset returns vary with their level of market risk or the measurement of the relationship between stock prices and dividends which is why we assume that using a regression for our empirical research is appropriate despite the popularity of the market model in form of an OLS regression in literature.
Due to the statistical assumptions towards the behavior of security returns that are mentioned in chapter 5.2.2.1, it can be further highlighted that the OLS is consistent and efficient if all assumptions hold (MacKinlay, 1997, p. 20).

5.3 Calculation of the abnormal returns

As explained in detail in chapter 5.2.2.3, we use the market model to first measure the normal return and using an OLS regression, before calculating the abnormal return.
We remember:

$$y_{it} = \alpha + \beta x_{it} + \varepsilon_{it} \quad (5)$$

where y_{it} is the return on a security and x_{it} the return on the market portfolio. To get the excess return, we can reform the equation:

$$\varepsilon_{it} = y_{it} - (\alpha + \beta x_{it}) \quad (6)$$

with the assumptions being

$$E(\varepsilon_{it}) = 0 \text{ and } \sigma(\varepsilon_{it}, \varepsilon_{jt}) = 0 \quad (7)$$

which means that since the expected value of the error term is zero, any term that is unequal 0 can be treated as the excess return (Bowman, 1983, p. 568). Consequently equation (6) is used to measure the abnormal return by first calculating the individual return of each security, which in our case are the stock returns of the acquiring companies, before accumulating the returns and grouping the results, which is part of the next chapter.

5.4 Organize and group the results

In chapter 5.3 we explained that first the individual returns on each stock will be calculated, before organizing the results for all deals. This means, analyzing the returns of each company by aggregating them into one portfolio over the same time window. This can be done by calculating the Cumulative Abnormal Return (CAR):

$$CAR_i\ (T_1 + 1, T_2)\ = \sum_{t=T_1+1}^{T_2} AR_{it} \tag{8}$$

Measuring the Cumulative Abnormal Return means getting the overall impact of an event over a certain period of time, namely the event window. We further choose several event windows, to see if there are differences when the event window is narrowed down. The following event windows have been chosen:

(-5; +5), (-3; +3), (-1; +1)

which means we are first looking at an event window with a length of 11 days, then with 7 days and finally only looking at 3 days including the announcement day itself. For the hypotheses about the financial crisis we also included the event window of (-2; +2). The reasons for that will be discussed in detail in chapter 6.6.

By adding the ARs across firms at one point in time and dividing it on the number of observations N, we will find the Average Abnormal Return, AAR, at a point in time:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (9)$$

According to MacKinlay (1997, p. 21), tests with only one event observation are not likely to give beneficial results about the impact of an event. Therefore, we can accumulate the abnormal return observations for the event window and across observations of the event and by doing that we get the Cumulative Average Abnormal Return (CAAR), which means summing up the average abnormal returns for the different acquiring companies during the event window only and which gives us:

$$CAAR(T_1 + 1; T_2) = \sum_{t=T_1+1}^{T_2} AAR_t \quad (10)$$

The following terminology will be used for the whole thesis as from now on:

AR = Abnormal Return

AAR = Average Abnormal Return

CAR = Cumulative Abnormal Return

$CAAR$ = Cumulative Average Abnormal Return

N = Number of observations / Number of companies used for data sample

5.4.1 Problems with event studies

Before discussing how to prove the significance of our results, we first want to pay attention to several issues that need to be taken into consideration when performing event studies. These issues are classified in two categories: general problems and more specifically, problems that are related to the market model.

5.4.1.1 General problems

One of the most found problems in scholars (Henderson, 1990; MacKinlay 1997; Brown & Warner 1980) is event clustering. Event clustering means that the event windows of different observations overlap and therefore a cross-sectional dependence in stock returns exist (Bernard, 1987, p. 1). If there is no sign of overlapping, it can be assumed that the abnormal return and the CAR are independent between securities which further means that the covariances between the different

abnormal returns are zero. If there is a sign of overlapping, the covariances will not be zero and are thus cross-sectional dependent. As a consequence, the results can be biased (MacKinlay, 1997, p. 27). Even though an OLS regression is assumed to ignore cross-sectional dependence (Bernhard, 1987, p. 1), researchers like Christie (1987) and Brown & Warner (1980, 1985) argue that cross-sectional dependence in event studies does not cause severe bias in standard errors. Especially Christie emphasizes, that when using daily or monthly stock data, there are no noticeable biases. Nevertheless Bernard (1987) argues that when extending the use of data to quarterly or annual data or when having a large data sample, the probability of detecting biases increases (p. 27).

As we have chosen the time frame for the analysis of our data sample randomly to be from 2007 to year-end 2018 and because of the finding of Christie (1987) that there are no severe biases when using daily data, we assume that there is no cross-sectional dependence that we need to pay attention to.

When it comes to using daily stock prices, more issues arise according to Brown & Warner (1985) which namely are non-normality, non-synchronous trading and variance estimation and which have been discussed more in detail in chapter 5.1.2. The three factors were investigated and to conclude this chapter, the use of daily stock prices for our empirical analysis seems does not seems to evoke problems

5.4.1.2 Problems with the market model

Even though the literature that we have studied describes the Market Model in general rather positive in comparison to others, one finding in regards to the Market Model is the fact that a higher level of uncertainty about the event dates makes it more difficult to detect abnormal performance (Dyckman et al., 1984). Therefore, when using this model, it is important establish the event date with certainty in order to increase the probability of capturing the abnormal results. For the purposes of our analysis, this aspect does not seem relevant since we have reported the announcement dates with accuracy.

5.5 Analyze the results including statistical tests

After getting our expected and abnormal returns and then organizing the results, they need to be tested for statistical significance. There are different methods that can be used for event studies, which are categorized into parametric and non-parametric tests by MacKinlay (1997, p. 32), but also in other papers like Bowman (1983) and Kolari & Pynnonen (2010). Verification to use both kind of tests can

be found in Bowman (1983): "The point is to verify the reasonableness of all statistical test procedures used, nonparametric as well as parametric" (p. 572).

According to Brown & Warner (1980, p. 20), when there is positive cross-sectional correlation and it is not accounted for in the model, it can result in an underestimation of the variance of the mean excess return, which means that the null hypothesis would be rejected too often. They also indicate that not all models do need to make adjustments, e.g. for the case of no event clustering where the degree of dependence is small and for which ignoring the dependence would not cause highly biased results. As we use the market model to detect abnormal returns, for which Brown & Warner (1980, p. 253) indicate that cross-sectional correlation is likely to be rather small, we do not have to account or test for cross-sectional correlation in our event study, as it is suggested e.g. by the Patell Test (Patell, 1976). We therefore assume that there is no cross-sectional correlation in our data sample, and it is enough to perform the only one parametric and two non-parametric tests, which have been widely used by other researchers and which are introduced in the following chapters.

5.5.1 Parametric tests

When it comes to parametric tests, assumptions about the distribution of the abnormal returns have to be made.

As found in Kothari & Warner (2006, p. 12), a test statistic (t-statistic) is usually used for the CAR to compute and compare its assumed distribution under the null hypothesis, which in our case means that the abnormal returns are zero. We reject the hypothesis if the test statistic exceeds a critical value, also called p-value, which usually is either 10%, 5% or 1%. If the hypothesis is rejected at the 1% level, we can call the result highly statistically significant and further, if the hypothesis is rejected at the 1% level it is automatically also rejected at the 5 and 10% level (Brooks, 2002, p. 63). We get the t-statistic by dividing the respective CAR for each event window by an estimate of its standard deviation, which is the square root of the variance (Kothari & Warner, 2006, p. 12). It is supposed to be well-specified if the variance of the one-period mean abnormal return is measured correctly. In case of event clustering, the estimated standard deviation could be biased downwards, and the t-statistic could be biased upwards. Since we already explained that we don't assume to have event clustering in our data sample, we will expect the t-statistic to deliver correct results and that the cumulative abnormal returns are independent across securities.

As mentioned before, the abnormal return is the disturbance term of the market model or also called error term. When testing our hypotheses for statistical significance, the abnormal returns AR under

the null hypothesis will be jointly normally distributed with a zero conditional mean and with variance $\sigma^2(AR_{it})$.

We remember that we must aggregate the individual abnormal returns across time and across securities to analyze the returns of each company. Therefore, we aggregate them into one portfolio over the same time window. Furthermore, measuring the cumulative abnormal return means getting the overall impact of an event over a certain period, namely the event window. Hence, we recall:

$$CAR_i\,(T_1 + 1, T_2) \;=\; \sum_{t=T_1+1}^{T_2} AR_{it} \tag{11}$$

and the variance of the one-period mean abnormal return calculated as

$$\sigma_i^2(T_1 + 1, T_2) = L_2 + \sigma_{\varepsilon_i}^2 \tag{12}$$

multiplying the variance σ^2 with the length of each event window. Since we choose the event windows (-5; +5, -3; +3; -1; +1) and for the hypothesis of the financial crisis also (-2; +2), we will eventually calculate four different CARs with each having one respective variance σ^2.

Our t-statistic then can be calculated as

$$t = CAR_i(T_1 \;+\; 1, T_2) \,/\, \sqrt{\sigma_i^2(T_1 + \;1, T_2)} \tag{13}$$

By using the formula from the above shown equation, we say that the CAR has a higher variance when the event window is longer and also anticipates that there is time-series independence of the one-period mean abnormal return. Furthermore, the CAR is assumed to be normally distributed (Kothari & Warner, 2006, p. 13). $AAR_t = 1/N \sum AR_{it}$

The following formulas are based on MacKinlay (1997). We further aggregate the abnormal returns of each security from the different bidding firms with

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{14}$$

to see if there is one or more days that has shown abnormal returns. The corresponding variance of the AAR can be calculated as

$$\sigma_i^2(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N}\sigma_{\varepsilon_i}^2 \tag{15}$$

For the average abnormal returns, our t-statistic is calculated as follows:

$$t = \frac{AARt}{\sqrt{\sigma_i^2(AARt)}} \tag{16}$$

We can then accumulate the average abnormal returns over the event window, to see the average of the abnormal returns across all firms for event windows with different lengths.
For any interval in the event window we calculate:

$$CAAR_i(T_1 + 1; T_2) = \sum_{t=T_1+1}^{T_2} AAR_{it} \tag{17}$$

with the variance being calculated by multiplying the variance of the AAR for the event window by the numbers of days of the subsequent event window:

$$\sigma_i^2 CAAR(T_1 + 1; T_2) = \sum_{t=T_1+1}^{T_2} \sigma_i^2(AAR_t) = \sigma_i^2(AAR_t)L_2 \tag{18}$$

Finally, we can find t-statistic of the cumulative average abnormal return (CAAR) by dividing the CAAR of each event window by its subsequent standard deviation of the event window:

$$t = \frac{CAAR(T_1 + 1, T_2)}{\sqrt{\sigma_i^2 CAAR(T_1 + 1; T_2)}} \tag{19}$$

with the variance being as in equation (18).

After calculating all relevant measures that are necessary to get the t-statistic, we then get our p-values according to which we can decide if our results show significance and if we can accept or reject the null hypothesis.

5.5.2 Non-parametric tests

As a supplement of parametric tests, there are non-parametric tests which according to Bowman (1983) disregard any assumptions of the distribution of the return due to a large sample size. Non-parametric tests can enhance the analysis of an event study when the required assumptions for parametric testing might not be met. Using non-parametric tests as a complement to a parametric test can improve the validity of statistical inferences (p. 571).

Two common tests which are discussed by MacKinlay (1997) are the Rank and the Sign test. He found that the sign test "may not be well specified if the distribution of abnormal returns is skewed as can be the case with daily data" (MacKinlay, 1997, p. 32).

Corrado & Zivney (1992) have also found that the rank test is acknowledged as being superior in comparison to the performance of the sign test when it comes to obtaining non-parametric inferences with regard to abnormal security price performance in event studies. This is in line with Cowan (1992) who says that the rank test is known to be superior to the sign test, as it includes an element of the size in the estimates.

In general, non-parametric tests are used as a supplement but not as a substitute to the parametric test to provide a robustness check of the findings from the parametric test (MacKinlay, 1997, p. 32).

Rank Test

The rank test is considered to be superior to parametric tests when abnormal performance is present, due to non-normal distributions of daily stock returns. Nevertheless, this advantage over the parametric tests diminishes when the return intervals become longer and if the above described conditions for the t-test hold, the t-test is supposed to be more powerful than the rank test eventually. Hence, the rank test has to be seen as a supplement instead of a substitute (Corrado, 1989, p. 395).

For the rank rest, we need to transform the abnormal returns we calculated for each security into their respective ranks for both the estimation period and the event window, with the following denotation:

$$K_{it} = rank\,(AR_{it}), \qquad t = -265, .., +5 \tag{20}$$

According to Corrado & Zivney (1992), we further standardize the ranks to account for missing returns by dividing by one plus the number of non-missing returns (M_i) of each security:

$$K_{i,t} = rank(AR_{i,t}) \,/\, 1 + M_i \tag{21}$$

where K_{it} represents the standardized rank value, which is between 0 and 1, and rank (AR_{it}) equals the ranking of each abnormal return among all observations within one company.
After ranking the abnormal return among all observations within the company, we want to measure the average rank for the event window for all companies by using the following equation:

$$\overline{K}(T_1 + 1, T_2) = \frac{1}{L_2} \sum_{t=T_1+1}^{T_2} K_{it} \tag{22}$$

To analyze a multi-day event period, we need to get $\bar{K}$ as the calculation of the sum of the mean excess rank for the event window to get the t-rank-statistic:

$$t_{rank} = \sqrt{L_2} \left(\frac{\overline{K}(T_1 + 1, T_2) - 0.5}{\sqrt{\sigma_{\overline{K}}^2}} \right) \tag{23}$$

with the variance being calculated as:

$$\sigma_{\overline{K}}^2 = \frac{1}{L_1 + L_2} \sum_{t=T_0}^{T_2} (\overline{K_t} - 0.5)^2 \tag{24}$$

Sign Test

In general, the sign test investigates whether the number of stocks with positive cumulative abnormal returns in the event window exceeds the expected number when there is no abnormal performance (Cowan, 1992, p. 5), which means under the null hypothesis p^ should not significantly differ from 0,5. Hence, the sign test investigates whether the CAR was positive or negative, assigning a 1 for

each positive return and a -1 for each negative one. If the number of positive CARs is higher than 50% in the event window, we can assume that there are abnormal returns.

For the test statistic we use the normal approximation to the binomial distribution with parameter $\hat{p}$. We can then calculate the test statistic and get our p-value to test whether the CARs for each event window are significantly different from zero with the following equation:

$$t_{sign} = \sqrt{N}\left(\frac{\hat{p} - 0.5}{\sqrt{0.5(1-0.5)}}\right) \quad (25)$$

5.5.3 Cross-sectional regression analysis

To extend our results from the linear regressions, to provide a more complete picture of event study related tests and to answer the rest of our hypotheses, for which the calculations of only linear regressions are not enough, we will further investigate the interdependence between the abnormal returns and some deal-relevant characteristics. This can, according to MacKinlay (1997) be done by running a cross-sectional regression of the abnormal returns, as in our case are the cumulative abnormal returns. We will perform the cross-sectional regression for the hypotheses about the method of payment and for the one about cross-border vs. domestic acquisitions. This will show how the stock price effects of an event are related to different firm characteristics, as the abnormal returns are regressed against several firm characteristics (Kothari & Warner, 2006, p. 21).

By regressing factors on the firm specific CARs, we are able to check and test the influence of other variables on the dependent variable and we will be able to conclude whether certain firm specific components influence the value creation through M&A. Hence, as mentioned, the cumulative average abnormal returns (CAR) of each event window that has been calculated before, will be used as the dependent variable. Several firm KPIs will be used as control variables to minimize the error term. We include Dummy variables in our regression that are between 0 and 1, to quantify our characteristics related to each hypothesis. This is according to Gujarati (2003, p. 298), who claims that these dummy variables are useful to classify data into categories like in our case cash or shares, or cross-border vs. domestic.

The regression model used is:

$$y_i = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \varepsilon_i \quad (26)$$

with y being the dependent variable, which in our case is the cumulative abnormal return, ε the stochastic disturbance or also called error term, and D being the dummy variables with a value of either 0 or 1. When there is no dummy variable assigned to a category, we call it benchmark or omitted category and all comparisons are made in relation to that category (ibid., p. 302), as we will show later in the empirical part of our study. Further, $\beta_1$represents the mean value of this benchmark category and the coefficients that are attached to the dummy variables are called differential intercept coefficients. For the empirical research they explain how much the value of the intercept that receives the value of 1 differs from the intercept coefficient of our benchmark category.

Applying the fact that we use CAR as the dependent variable, our equation used for the regression generally is:

$$CAR_i(t_1 + 1, t_2) = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \cdots + \varepsilon \tag{27}$$

As for the linear regression, there are several requirements that the regression must meet to make sure the results can be trusted. We recall from the OLS model:

(1) the linear regression is linear in its parameters and the error term ε_t is normally distributed
(2) $E(\varepsilon_i) = 0$, which means the errors have zero mean
(3) $Var(\varepsilon_t) = \sigma^2$, which means the variance of the errors is constant and finite over all values in of x_t and which means homoscedasticity
(4) $cov(\varepsilon_i, \varepsilon_j) = 0$, which means the errors are linearly independent of one another or no serial correlation
(5) $cov(\varepsilon_t, x_t) = 0$ and $cov(\varepsilon_t, x_{2t}) = cov(\varepsilon_t, x_{3t})$which means that there is no relationship between the error and the x variable and also that there is zero covariance between ε_t and each x variable

In addition to the assumptions of the linear model we further assume that the cross-sectional model is correctly specified, that there is a random sampling of the values of the regressors and sufficient variability in the values of the regressors (Gujarati, 2003, p. 203). Furthermore, we assume that for the cross-sectional model there is no exact collinearity between the X variables, which means no exact

linear relationship between x_2 and x_3, which needs to be fulfilled when using multiple regressions (ibid.). For the assumption of the random selection of the data sample, we can confirm that our data sample and the consequent financials are chosen randomly, by only including companies that correspond to our selection criteria, which are:

- companies must be listed and more specifically, must be operating in the pharmaceutical industry
- the financials used as independent variables must be publicly available

Consequently, our data sample is assumed as randomly selected.

The next assumption is about no perfect collinearity, which means that there should be no exact linear relationship between x_{2i} and x_{3i} and therefore none of the regressors can be written as the exact linear combinations of the rest of the regressors. Hence, if
$X_{2i} + 4x_{3i} = 0$ and $X_{2i} = -4x_{3i}$, the two variables will have perfect collinearity (Gujarati, 2003, p. 204).
According to Gujarati (2003, p. 205) when doing empirical research, it is difficult to guarantee that there will not be correlation among the regressors which means that it is difficult to find two or more variables that might not be correlated. This does not indicate problems for our research, as it is only required that there are no exact relationships among the regressors.
For our hypotheses, we will use different variables as control variables and hence will take this drawback into consideration when analyzing our results. As we only use variables that are supposed to explain different things, we do not expect our results to be influenced by perfect collinearity.

Lastly, some assumptions apply also for the choice of the variables included in the regression. According to Brooks (2008), in fact, two types of errors can occur when adding the determinants variables: omitting an important variable and including an irrelevant one. In the first case, the result would be a biased estimate of the coefficients leading consequently to biased forecasts. In the second case, the consequence would be the inefficiency of the estimators and so variables which would be marginally significant may no longer be so in the event of irrelevant variables. As the determinants of our regressions are chosen based on previous published researches in the field of M&A, we do not expect our findings to be biased by the choice of the variables included in the regressions.

6 Empirical results

We will explain our empirical results in a chronological order which means we will first present the results of first hypothesis regarding value creation for shareholders of the bidding companies, followed by the other hypotheses about cross-border vs. domestic deals, the method of payment and the impact of the financial crisis.

When we chose the data for our data sample, we made the assumption that we only look at listed acquiring companies, which after applying our selection criteria led to a deal number of 196.

Our thesis focuses on value creation in pharmaceutical mergers and acquisitions, which we separated into different hypotheses. We start with discussing the first hypothesis regarding value creation for shareholders, since the results we gained from that research will be the baseline for the following hypotheses and the CAR we got from the abnormal return calculations will be used as the dependent variable in our cross-sectional regression, as described in the methodology part. We wanted to see how the stock price of the acquiring companies reacted to the announcement of a M&A deal, using different event windows to see if there are differences when changing the time frame.

6.1 Hypothesis 1.1

H1.1: Zero abnormal return for shareholders of the bidding firm when merger or acquisition is announced

This hypothesis is the core of our thesis, as the following hypotheses are built on the results from the linear regressions.

As already mentioned, our first hypothesis investigates the occurrence of abnormal returns in a certain time window, namely the event window, which in our case was split into event windows with different lengths to see if there are remarkable differences.

In the literature review we discussed that there are several gains that can be achieved through a M&A transaction like cost synergies, but that there is also evidence that acquisitions are not always successful. Furthermore, previous research has shown that there are mixed results regarding whether there are abnormal returns for shareholders when the deal is announced or not. As described in the methodology and due to the fact that the pharmaceutical industry has not been investigated intensively in the last years, we want to detect whether there are abnormal returns for shareholders surround the day that the deal was announced. Based on that and after calculating the abnormal returns, we test

our results for statistical significance with a parametric and two non-parametric tests, to account for non-normal distribution of the abnormal returns. The two non-parametric tests will be namely the rank and the sign test, both showing popularity in previous event studies by renowned scholars.

By applying the parametric test, we get several t-statistics and their p-values and based on those we can decide if the abnormal returns have shown statistical significance within that event window, meaning if we can reject our hypothesis or not.

The following table will show the results of the parametric t-test that we did. The t-statistic was calculated based on the respective CAAR for each event window (-5; +5, -3; +3, -1; +1).

6.1.1 Results

Parametric tests

Table 1. Parametric test for cumulative average abnormal return of bidding firms

This table reports the results from the parametric t-test for cumulative average abnormal return of bidding firms ±5, ±3 and ± 1 days surround the announcement day of the acquisition.

Event window	(-5;+5)	(-3;+3)	(-1;+1)
CAAR	2,10%	2,04%	2,03%
Variance	0,01%	0,005%	0,002%
t-statistic	2,27	2,77	4,21
p-value	0,02	0,01	0,00
Significance	significant on 10% and 5%	significant on 10%, 5% and 1%	significant on 10%, 5% and 1%
N	196	196	196

Source: own calculations

As can be seen in Table 1, the CAAR is positive for all three event windows with at least 2%. It is the highest when considering 11 days as the event window but becomes slightly smaller when the event window is narrowed down. Furthermore, the CAAR of each event window shows statistical significance, but on different levels. While the CAAR of the longest event window and for the 7 days event window is significant on a 10% and 5% level, the CAAR for 3 days shows statistical significance on 10%, 5% and 1% level, which indicates high significance of our results when the event window is short. This significance means that for the event window of 3 days, there is a probability of below 1% of committing a type 1 error, which means that this is the probability of rejecting a true hypothesis. In our case, this indicates that there are abnormal returns for the shareholders of the acquiring companies for all event windows.

Additionally, it can be seen that the CAAR becomes slightly smaller when the event window is narrowed down to only one day before and after the announcement day. To see the subsequent

average abnormal returns for each day of the longest event window and to see if there are also indications for significance of the AAR, we will show the AAR of each day 5 days before and after the announcement day in Table 2.

Table 2. Average abnormal returns 5 days prior and after the event.

This table reports the abnormal average return (AAR) of the bidding companies for the total data sample with N = 196.

Day	AAR	t-statistic	p-value
-5	-0,14%	-0,49	0,63
-4	-0,05%	-0,17	0,86
-3	0,23%	0,82	0,42
-2	-0,34%	-1,22	0,22
-1	0,49%	1,77	0,08
0	**0,82%**	**2,96**	**0,00**
1	0,71%	2,55	0,01
2	0,18%	0,66	0,51
3	-0,06%	-0,20	0,84
4	0,19%	0,67	0,50
5	0,05%	0,19	0,85

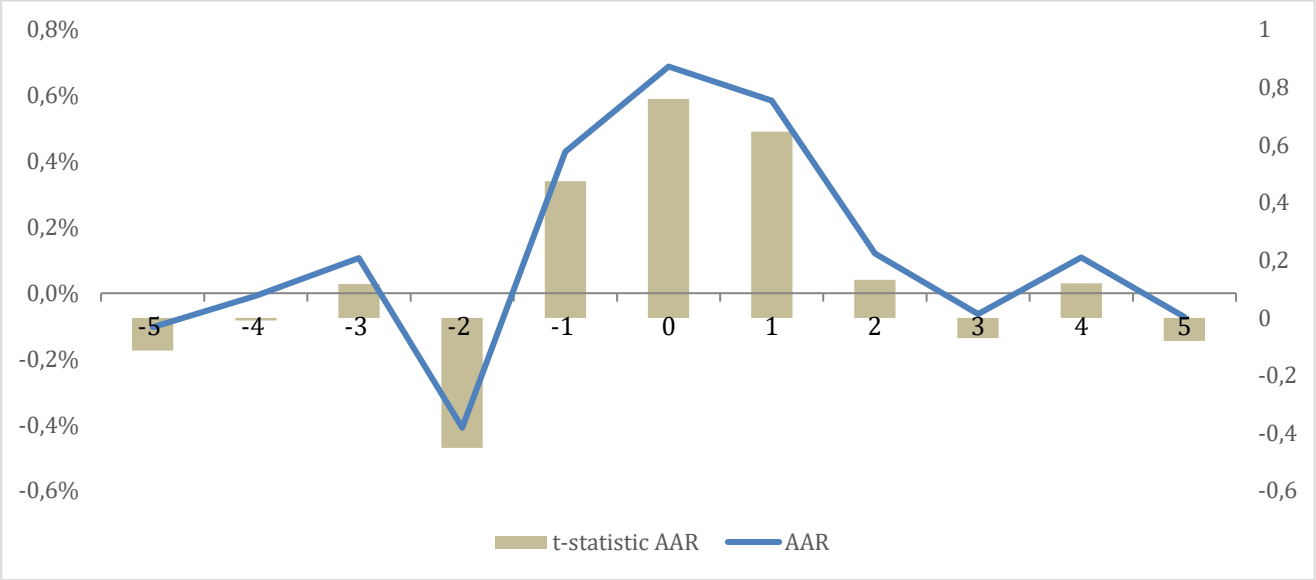
Source: own calculations

The actual event day shows the highest AAR with 0.82% and is statistically significant on a 1% level. Another observation is that the closer we get to the announcement day, the more significant the results get. Comparing these results with the significance of the CAAR, it can be seen that only the AAR of day -1, 0 and +1 show statistical significance, but also on different levels (10%, 1% and 5%). Even though there are slightly small positive returns on average on the day before the announcement day which could indicate that there has been rumors or insider trading, we assume that the market still seems to be efficient, as the results show only small significance on a 10% level.

We therefore conclude that there is a stock price effect on the announcement day and that the market seems to be efficient, as the stock price reactions seem to adjust quickly to the information of the announcement of the deal.

Figure 11. Trend of AAR and the t-statistic.

This figure shows the correlation between the average abnormal return and the respective t-statistic of the AAR.



Source: own calculations

Figure 11 shows the trendline for the average abnormal returns and the t-statistic of the AAR. It can be seen that both the AAR and the t-statistic show a similar trendline and hence a correlation between the two is assumed. It further shows that the abnormal returns on the announcement day and on one day before and after the event are positive, whereas the development for the other event windows varies a bit more with both positive and negative abnormal returns. After having the highest abnormal returns on the day of the announcement, the average abnormal decreases and become slightly negative on day 3 after the announcement, before becoming positive again after that day. It is overall shown that the abnormal returns are highest, when the event window is small. These findings are overall interesting, considering the mixed findings previous research about abnormal returns for shareholders of the bidding firm when the deal is announced. We will further discuss that after finalizing the empirical research for all hypotheses.

Non-parametric tests

As the next step, we performed the Rank and the Sign test as described in the methodology.

By applying the non-parametric tests, we standardize the abnormal returns to get a general average of abnormal returns, signaling whether the returns have been positive or negative.

The tables 3 and 4 summarize the results.

Table 3. Rank test for bidding firms

This table summarizes the results from the non-parametric rank test. Whenever the event window average is above 50%, we assume abnormal returns. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
Average abnormal return	51,04%	51,90%	53,94%
Variance	0,10%	0,100%	0,108%
t-statistic	1,11	1,59	2,08
p-value	0,27	0,11	0,04
Significance	no significance at all levels	no significance at all levels	significant on 5%
N	196	196	196

Source: own calculations

From the rank test we only get significant results for the shortest event window of 3 days. Even though the average range for all three different event windows is slightly above 50%, indicating that there are abnormal returns during that period, only the event window of 3 days proves to be significant on a 5% level. As the average range increases when the event window is narrowed down and also the t-statistic increases, we assume that there is a correlation between these two. Furthermore, it seems that the more the average range exceeds the 50%, the more significant the results get. This indicates that the shorter the event window, the higher the abnormal returns get.

As a complement to the rank test, we apply the sign test to see whether there are significant abnormal returns when the event window average is higher than 50%.

Table 4. Sign test for bidding companies.

This table summarizes the results from the non-parametric sign test. Whenever the event window average is above 50%, we assume abnormal return. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	2,10%	2,04%	2,03%
Variance	0,01%	0,01%	0,00%
Number of positive CARs	100	105	108
Number of negative CARs	96	91	88
Average of positive CARs in the event window	51,02%	53,57%	55,10%
t-statistic	-0,21	-0,93	-1,36
p-value	0,83	0,35	0,18
Significance	no significance at all levels	no significance at all levels	no significance at all levels

Source: own calculations

Looking at table 4 which summarizes the results of the sign test and comparing it to the results of the rank test, there is no significance on all levels for all event windows for abnormal returns, even though the number of CARs with a positive sign is higher than the number of CARs with a negative sign. This indicates that there are no abnormal returns for shareholders of the bidding companies when a deal is announced. The sign test suggests abnormal return if the event window average is higher than 50%, which means if there are more 1s than 0s, positive abnormal returns are supposed to occur in the event window. Nevertheless, there is no significance and hence no proof for abnormal returns even though the number of CARs with a positive sign (i.e. 1) is higher than the one with a negative one (i.e. 0) and despite the occurrence of average positive abnormal returns above 50% in all event windows.

6.1.2 Conclusion from the statistical tests

The findings from our empirical studies are mixed and therefore interesting for further discussion. The parametric test with the t-statistic shows positive returns for all event windows and despite a slightly decreasing CAAR when the event period is narrowed down, the significance of the results is increasing for the 7-days and 3-days event window, proving high significance for the cumulative average abnormal return of 2.03%. This means that a bidding company in the pharmaceutical industry can expect a 2.03% significant abnormal return on average when the event window has a length of 3 days. The fact that the CAAR becomes slightly smaller when the event window is narrowed down is disregarded in the analysis, since the increasing significance of our results is proven when the event window is narrowed down as the t-statistic is also increasing.

The significance of these results is in line with the findings from the non-parametric rank test which we applied to account for non-normal distribution. This test proved significance for the 3-days event window with having an event window average above 50% in the test. Even though the rank test shows an event window average above 50% for all three event windows, statistical significance could only be found for the shortest event period, indicating that there are positive abnormal returns -1 and +1 day surround the announcement day.

Nevertheless, the sign test could not prove statistical significance and is hence the only test that supports our hypothesis of no abnormal returns for shareholders of the bidding company when the acquisition is announced.

Our findings are interesting when it comes to analyzing and comparing them to previous research of other scholars: among several studies from the previous decades, Jensen & Ruback (1983) and Hitt

et al. (2012) suggest that there are no abnormal returns for shareholders of bidding companies when looking at different event windows and companies from different industries. Nevertheless, we agree with Ravenscraft & Long (2000) who found significant positive abnormal returns for bidding companies for horizontal pharmaceutical M&A, as we have also seen significant positive abnormal returns.

To summarize it all, we can reject our hypothesis and conclude that there are abnormal returns for shareholder of the acquiring company when the deal is announced and the event window has only 3 days, with significant results for that event window. It can further be concluded that market efficiently adjusts to the new information about the deal and reflects that in the stock prices and supports the efficient market theory.

6.2 Hypotheses 1.2 and 1.3

Besides analyzing the overall stock price behavior for all bidding companies, there are some countries that are of interest for a more detailed research, namely India and China which are both emerging countries. Hence, the hypothesis regarding zero abnormal returns when the deal is announced will also be applied to India and China. We recall our hypotheses:

H1.2: Zero abnormal returns for shareholders of Indian firms when merger or acquisition is announced

H1.3: Zero abnormal returns for shareholders of Chinese firms when merger or acquisition is announced

When looking at the descriptive statistics, we can see that China and India are the ones from Asia-Pacific with the highest number of deals. Since Rani, Yadav & Jain (2011) have found that between 2001 and 2007 the Indian pharmaceutical industry has seen significant positive abnormal returns for shareholders, it is in our interest to investigate if that trend continued for the years after 2007. A report by The Boston Consulting Group (2007) shows that the value of deals in China and India grew by 20% per year between 2002 and 2006 which indicates to be the second-fastest growth rate after the US, who are supposed to account for the majority of deals by value.

Appendix 4 from Statista shows the global pharmaceutical sales from 2016 to 2018 per region, indicating that the emerging market countries have further grown and are therefore of interest for investigation.

We will follow the same methodology for India as for the first hypothesis which was investigating if there are abnormal returns for shareholders of the bidding company when the deal is announced. We used a linear regression in combination with the market model to first get the expected returns and then the abnormal ones before testing the results for statistical significance with the same parametric and non-parametric tests as in hypothesis 1.1. As for hypothesis 1.2 and 1.3, we can only analyze the returns for the shareholders of the bidding companies, since we did not find enough deals for listed companies in India to further investigate returns for the target companies. We choose to move forward first with India due to the above-mentioned literature before looking closer at the deal activity of China. When analyzing the hypotheses for all cross-border vs. domestic deals in chapter 6.3, we will also have a more detailed look at India and China as individual countries.

6.2.1 Results for India

Parametric tests

Table 5. Parametric test for cumulative average abnormal return of Indian bidding firms.

This table reports the results from the parametric t-test for cumulative average abnormal return of bidding firms ±5, ±3 and ± 1 days surround the announcement day of the acquisition.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	3,28%	3,78%	2,56%
Variance	0,05%	0,03%	0,01%
t-statistic	1,43	2,06	2,13
p-value	0,19	0,07	0,06
Significance	no significance at all levels	significant on 10%	significant on 10%
N	11	11	11

Source: own calculations

As can be seen in Table 5, the CAAR is positive for all three event windows with more than 3% on average the 11- and 7-days event window, whereas it is slightly smaller with 2.56% when the event window has only 3 days. First, the CAAR shows an increase when the event window is narrowed down to 7 days but decreases when it is further narrowed down to only 3 days as mentioned before. Nevertheless, the abnormal returns are only statistical significant for the 7-day and 3-day event

window, but only on a 10% level which is not highly significant and hence the probability of rejecting the hypothesis even though it is true is 7% for the 7-days event window and 6% for the 3-days event window.

The next table will show the average abnormal return for each of the 11 days of the longest event window, to see if there is one or more days where the AAR is especially significant and to see whether there are indications regarding the market efficiency theory.

Table 6. Average abnormal returns for Indian bidding firms 5 days prior and after the event.

This table reports the abnormal average return (AAR) of the bidding companies for the total data sample with N=11.

Day	AAR	t-statistic	p-value
-5	0,66%	0,95	0,37
-4	-1,10%	-1,59	0,15
-3	0,82%	1,19	0,27
-2	-0,87%	-1,25	0,24
-1	0,09%	0,13	0,9
0	**1,47%**	**2,12**	**0,06**
1	1,00%	1,44	0,18
2	-0,05%	-0,07	0,95
3	1,31%	1,88	0,09
4	-0,03%	-0,05	0,96
5	-0,02%	-0,03	0,98

Source: own calculations

From table 6 we can see that only 2 out of 11 days show statically significant average abnormal returns which are the actual announcement date and the third day after the deal has been announced. On the announcement day and the mentioned third day afterwards, the abnormal returns are the highest with an AAR of 1.47% and 1.31%. Furthermore, we can see that both are statistically significant on a 10% level, which is in line with our parametric test from table 5 that proved significance on a 10% level.

As the abnormal returns are most significant when the event window is short and as it can be seen from table 6 that the AAR is both highest and significant on the announcement day, taking into consideration the theory of efficient markets, we assume that the Indian markets are efficient since

the stock price seems to adapt quickly to the announcement. Even though there are abnormal returns on day 3 after the announcement day, we conclude the markets are efficient as the returns are only significant on a 10% level and that the returns could be explained by outliers.
The next step is analyzing the non-parametric tests, to see if the abnormal returns are different from zero.

Non-parametric tests

Table 7. Rank test for Indian bidding firms.

This table summarizes the results from the non-parametric rank test for Indian bidding companies. Whenever the event window average is above 50%, we assume abnormal returns. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
Average abnormal return	53,19%	57,02%	60,45%
Variance	0,11%	0,120%	0,135%
t-statistic	3,27	6,71	9,42
p-value	0,01	0,00	0,00
Significance	significant on 1%	significant on 10%, 5% and 1%	significant on 10%, 5% and 1%
N	11	11	11

Source: own calculations

The average range for all three event windows is evidently above 50%, while increasing when the event window is narrowed down. This is supported by the results we get from the t-statistic and p-value from the rank test as they show highly significant results for all three event windows with each t-statistic being highly significant on a 1% level.
With using the rank test for our cumulative abnormal returns, we can see that the test indicates that there are abnormal returns for shareholders of Indian companies on average.

Looking at the results from the sign test in table 8, it indicates abnormal returns since the event window average is higher than 50%, which means that there are more CARs that are positive and hence get a 1 assigned than CARs that are negative and consequently get a 0 for measuring the event window average. Even though the event window average is above 50% for all event windows, we

cannot test these results for statistical significance. Due to the small data sample with N=11, we are not able to perform the sign test for the shortest event window. Therefore, we decided not to include the results from the sign test into our conclusions, as it cannot give any statistical predictions regarding abnormal returns for the shortest event window but only indications, with the average of positive signs is above 50%. Consequently, we have to be cautious about the validity of the results from that test.

Table 8. Incomplete Sign test.

This table summarizes the results from an incomplete non-parametric sign test. Whenever the event window average is above 50%, we assume abnormal return, but this could not be tested for statistical significance and is therefore assumed as an incomplete test. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	3,28%	3,78%	2,56%
Variance	0,05%	0,03%	0,01%
Number of positive CARs	7	7	6
Number of negative CARs	4	4	5
Average of positive CARs in the event window	63,64%	63,64%	54,55%

Source: own calculations

6.2.2 Results for China

As mentioned in the introduction of that chapter, India and China are the two emerging countries showing the most M&A activity in the recent years. We remember our hypothesis is:

H1.3 No abnormal returns for shareholders of Chinese companies when the deal is announced

Parametric test

Table 9. Parametric test for cumulative average abnormal return of Chinese bidding firms.

This table reports the results from the parametric t-test for cumulative average abnormal return of Chinese bidding firms ±5, ±3 and ± 1 days surround the announcement day of the acquisition.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	0,67%	1,84%	1,30%
Variance	0,01%	0,01%	0,00%
t-statistic	0,56	1,93	2,08
p-value	0,58	0,06	0,04
Significance	no significance at all levels	significant on 10%	significant on 10% and 5%
N	56	56	56

Source: own calculations

From table 9, we can see that the CAAR is slightly indifferent from zero but insignificant for the 11-days event window. The abnormal return is highest with 1.84% for the 7-days event window and significant on a 10% level, whereas the abnormal return for the 3-days event window is slightly smaller with 1.30% on average but nevertheless proves to be more significant than the CAAR of the 7-days window with a p-value of 0.04. We can conclude that there are abnormal returns for shareholders of Chinese bidding firms when the event window is either 7 or 3 days long. Since the CAAR first becomes smaller when the event window is narrowed down and then increases again, we want to look at the AAR of each day for the event period.

As can be seen in table 10, the AAR is insignificant for almost each day including the announcement day. The two exceptions are day +1 and +2 after the deal has been announced, showing significance on a 5% and 1% level, which means the market reacted quickly and positively but with a small delay to the actual announcement day with no signs for significance on that day. Considering the efficient market theory, we cannot confirm that the market adjusted immediately when the deal was announced. We cannot see a stock price effect on the announcement day, but rather a delayed reaction of the market on day 1 and 2 after the announcement.

Table 10. Average abnormal returns 5 days prior and after the event of Chinese bidding firms.

This table reports the abnormal average return (AAR) of the Chinese bidding companies for the total data sample with N=56.

Day	AAR	t-statistic	p-value
-5	-0,56%	-1,55	0,13
-4	-0,36%	-0,99	0,33
-3	-0,44%	-1,23	0,23
-2	0,27%	0,75	0,46
-1	-0,26%	-0,73	0,47
0	**0,41%**	**1,13**	**0,26**
1	1,15%	3,21	0
2	0,73%	2,02	0,05
3	-0,01%	-0,03	0,98
4	0,20%	0,56	0,57
5	-0,46%	-1,28	0,21

Source: own calculations

Non-parametric tests

Table 11. Rank test for Chinese bidding firms.

This table summarizes the results from the non-parametric rank test for Chinese bidding firms. Whenever the event window average is above 50%, we assume abnormal returns. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5;+5)	(-3;+3)	(-1;+1)
CAAR	49,33%	51,37%	52,10%
Variance	0,090%	0,098%	0,101%
t-statistic	-0,74	1,16	1,15
p-value	0,46	0,25	0,26
Significance	no significance at all levels	no significance at all levels	no significance at all levels
N	56	56	56

Source: own calculations

Recalling the rank test from previous hypotheses, it is supposed to prove abnormal return if the average abnormal return exceeds the 50% level and additionally shows significance.

As seen in table 11, the event window average is only for the 7-days and 3-days event window above 50% but not for the longest one with 11 days. Nevertheless, none of the them proves to be statistically significant which indicates that there are no abnormal returns on average.

As seen in table 12 from the sign test, the average of positive CARs exceeds the 50% level for the 7-days and 3-days event window, with both event windows having the same number of positive and negative CARs overall (31 positive and 25 negative ones).
Again, for all three event window statistical significance could not be proven which is in line with the rank test. We can therefore conclude that both non-parametric tests do not prove abnormal returns.

Table 12. Sign test for Chinese bidding companies.

This table summarizes the results from the non-parametric sign test. Whenever the event window average is above 50%, we assume abnormal return. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	2,10%	2,04%	2,03%
Variance	0,009%	0,005%	0,002%
Number of positive CARs	25	31	31
Number of negative CARs	31	25	25
Average of positive CARs in the event window	44,64%	55,36%	55,36%
t-statistic	-0,67	-0,67	-0,67
p-value	0,50	0,50	0,50
Significance	no significance at all	no significance at all levels	no significance at all levels

Source: own calculations

6.2.3 Conclusions from statistical tests

The applied parametric test finds that there are abnormal returns on average of 2% for the event windows with a length of 7 and 3 days for shareholders of Chinese bidding firms. Nevertheless, the average abnormal returns for each day show no significance on the actual announcement day but rather on the first two days after the deal has been announced.
By accounting for non-normal distributions in the observations, the two non-parametric tests that has been applied both do not prove significant returns and hence indicates that there are no abnormal returns for shareholders on average. As there is no stock price effect on the announcement day, we can conclude that the market reacts delayed to the announcement of the deal.

Despite the insignificance of the two non-parametric tests and only small positive significant abnormal returns, we reject the hypothesis that there are no abnormal returns for shareholders of Chinese bidding firms.

Comparing the results of China with the results for India, we reject the same hypothesis for shareholders of Indian bidding firms due to the findings of positive abnormal returns of 4% and 3% for the respective event windows (-3; +3) and (-5; +5), with both showing significance at a 10% level. Furthermore, the rank test proves significance for all event windows, being highly significant when the event window is narrowed down. The sign test was incomplete and did not deliver any valuable results since the data sample was too small to make any conclusive statements.
According to BCG (2007), China and India accounted for 20% of growth in deal value when it comes to mergers and acquisitions. Looking at the two emerging countries, we agree with Rani, Yadav & Jain (2011) who have found significant positive abnormal returns for shareholders in the Indian pharmaceutical industry between 2001 and 2007, which according to our empirical results seemed to continue after 2007, whereas also China seem to achieve positive abnormal returns, but which could only be proven by the parametric test.

6.3 Hypothesis 2.1

Our second hypothesis is measuring whether the abnormal returns for shareholders of the bidding firm are higher in cross-border acquisitions**.**
As a consequence of globalization, need for innovation and desire of building a competitive advantage, the pharmaceutical companies showed an increasing interest towards outbound M&A in the recent years, according to the literature (Kyvik, 2013, p. 1). Despite that, with our results presented in the descriptive statistics, we demonstrated that there is a difference between domestic and cross-border deals which proved a preference for the domestic acquisitions, but without proven statistical significance. Disregarding the continents or the countries, bidding companies in general are looking for more domestic opportunities than cross-border ones. Consequently, it is interesting to see if although the number of domestic acquisitions is higher, the cross-border ones are more value creating as supported by the foreign direct investment theory which identifies opportunities in the outbound deals in terms of increasing efficiency and competitive advantage (Park & Choi, 2014, p. 104). By considering the nature of the pharmaceutical industry, a knowledge based, globalized and highly

regulated industry, and by taking into account the constituted potential opportunities by the FDI, we therefore decided to formulate and test the following hypothesis:

H2.1: International alliances create more value for shareholders of the bidding companies than the national ones

In order to test this hypothesis, we first calculated the cumulative abnormal returns (CAR) for the different event windows (-5; +5), (-3; +3), (-1; +1), to see if there is a stock price effect on the day of the announcement. In fact, since we are assuming semi-strong efficiency of the markets, we believe that abnormal returns represent a good approximation of the markets' reaction to a new announced acquisition.

For our analysis we used a cross-sectional regression to test for statistical significance by regressing a dummy variable equal to 1 if the deal was a cross-border one, to predict the values of our dependent variable, which in our case is the CAR for each event window. For the control variables we chose different financial, publicly available key performance indicators, from which we believe that they can be influential, or which have been widely used in previous studies. We decided to use the market capitalization, the debt-to-equity ratio and the beta of the firms. We decided to use the market capitalization in its logarithmic form as it is common approach and widely used in similar event studies and to take into account the firm's size. The debt-to-equity ratio expresses the company's financial leverage that is the extent to which the firm's' operations are funded by lenders versus shareholders. Due to the elevated number of researches in literature investigating the impact of acquisitions on the financial leverage of the acquiring companies (i.e. Agyei-Boapeah (2015), Bouraoui (2014)) we thought it was relevant to include this ratio for our analysis. Both the market capitalization and the debt-to-equity ratio were withdrawn by Osiris, the Bureau van Dijk's flagship company database. The risk component of the deals instead was taken into account by including the beta in our cross-sectional regression. The betas used have been calculated by the linear regressions run formerly to get the actual returns. Due to the relationship between beta and the debt-to-equity ratio we considered the impact that the former could have on the latter but after further investigations we came to the conclusion that the financial leverage does not have significant impact on the beta of our sample. Hence the decision of including both measures. Lastly, since we are interested in proving that the cross-border acquisitions induce a more positive reaction in the markets in comparison to the

domestic ones, we have used dummy variables for taking into account these two types of acquisitions. Although our initial sample was composed of 196 elements, due to the lack of available financial information for each of them, the cross-sectional regression was conducted on 135 deals. Despite a reduced number of deals, the sample still consists of more than 100 deals and will consequently be large enough for analysis purposes.

6.3.1 Results

The results were obtained by performing the following multiple linear regression:

$$CAR_{acquirer}[-t,+t]_{\,i} = \beta_0 + \beta_1 D_{cross-border,i} + \sum \beta_i \, x_i + \varepsilon_i$$

where:

CAR represents the dependent variable, β is a parameter estimate that explains variations in the dependent variables, D represents the dummy variables, $\sum \beta_i \, x_i$ represents the remaining control variables and ε denotes the error term. As mentioned above, we chose the dummy variable to be 1 when the deal was cross-border and zero whenever it was a domestic deal. Therefore, and as explained in the methodology domestic is chosen as the benchmark and can be interpreted as the intercept output from our regression.

Looking at the results for the 11 days event window, a cross-border transaction yields a positive but insignificant cumulative abnormal return on average of 8.1% for the acquiring firms which is slightly higher than the average returns of 7.9% for domestic deals, but which is also not significant. Narrowing the event window down to 7 days, we notice that the CAR for domestic deals is on average is 6.6% while if we consider cross-border transactions, the CAR is again higher for with 6.7%, but both results are overall insignificant. We get different results when the event window is shortest: In the 3-days event window, the cumulative abnormal returns are on average higher for the domestic acquisitions than for the cross-border ones. In the case of domestic deals, the CAR equals 7.3% on average whereas for cross-border deals we find a CAR of 6.5%, which means that the average returns for cross-border deals are lower than for the domestic deals. It is interesting to notice that the result reported for the 3-days event window is the only one showing statistical significance on a 5% level for the intercept, which equals the domestic deals. Hence, the cumulative average returns for domestic deals are not only higher than cross-border deals when the event window is shortest, but also proven to be statistically significant.

We can therefore reject our hypothesis which anticipated that international deals create higher abnormal returns for shareholders than domestic ones.

Table 13. Results from the cross-sectional regression for cross-border vs. domestic deals.

In the following table, the response variable is represented by the CARs for three event windows (-5; +5), (-3; +3) and (-1; +1). The estimation period of the regressions instead corresponds to 260 days prior to the 11 days event window (-265; -5). The dummy variable cross-border equals 1 when acquirer and target coincide while equals 0 otherwise. Market cap stays for the logarithm of market capitalization and is expressed in thousands $US. Beta coefficients were calculated through a linear regression model according to the estimation window already mentioned.

The sample is composed of 135 deals.

	CAR [-5; +5]		CAR [-3; +3]		CAR [-1; +1]	
	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
Intercept	0,0793	1,3710	0,0662	1,4014	0,0735	2,0117**
Cross-border	0,0014	0,0750	0,0005	0,0350	-0,0090	-0,7571
Market cap	-0,0041	-0,9931	-0,0033	-0,9933	-0,0035	-1,3496
D/E ratio	-4,8E-05	-4,5E-01	1,6E-05	1,9E-01	6,8E-05	1,0E+00
Beta	0,0088	0,4519	0,0039	0,2410	-0,0064	-0,5204

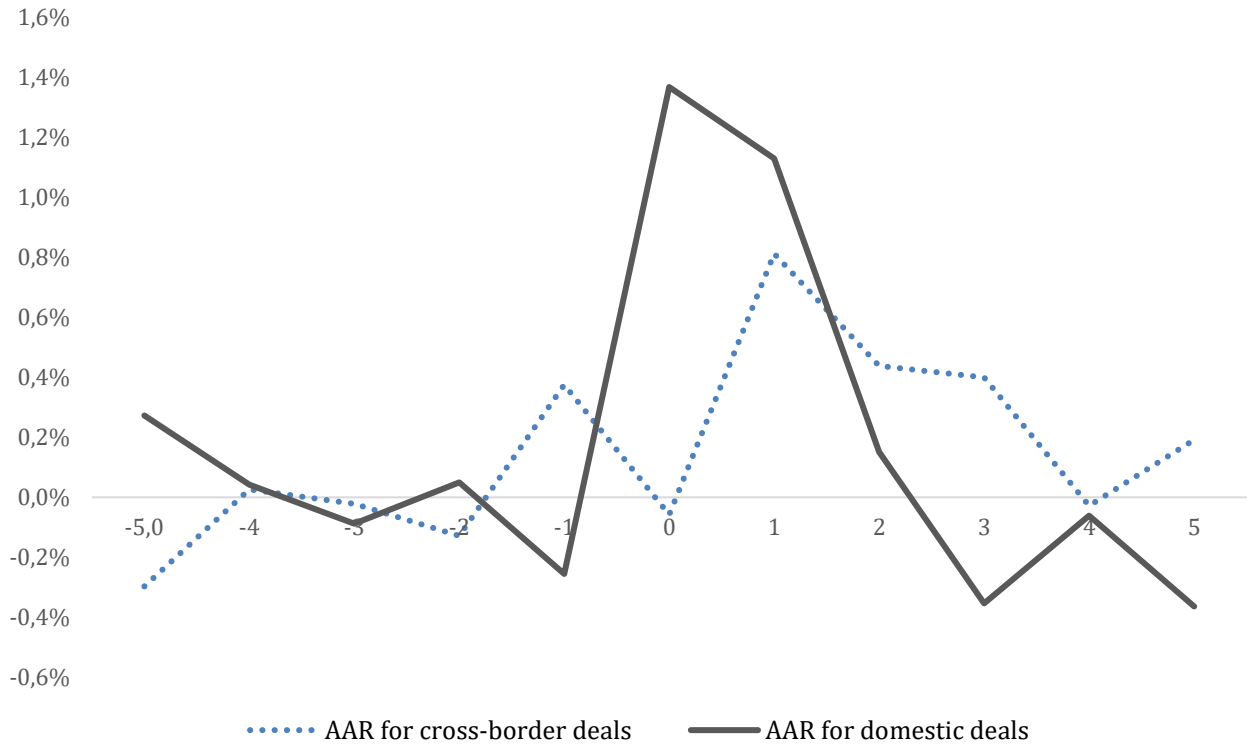
*, **, *** *indicate significance level of 10%, 5%, 1%.*

Source: own calculations

In order to bring an additional perspective, we have also inserted figure 12 below showing the average abnormal returns for the 135 deals considered in our sample throughout the entire event window of 11 days (-5, +5 days around the announcement date). The two lines in particular represent the domestic and the cross-border deals respectively. By comparing the two types of acquisitions, it is evident that while the trend for the cross-border deals is variable and irregular with positive returns on the day before the deal is announced, the AAR development for the domestic transactions instead shows a stock price effect on the day of the announcement with a peak in the average abnormal returns. The highest abnormal returns on average are in fact reported on day 0 and 1 (the day of the announcement and the following one).

This proves the efficiency of the market which show a rapid adjustment of the stock prices to the release of new public information (in this case a positive reaction to the announcement of an acquisition) when both the bidding and the target company has been within the same country, which can also be seen in figure 12.

Figure 12. Average Abnormal Returns for cross-borders and domestic deals.

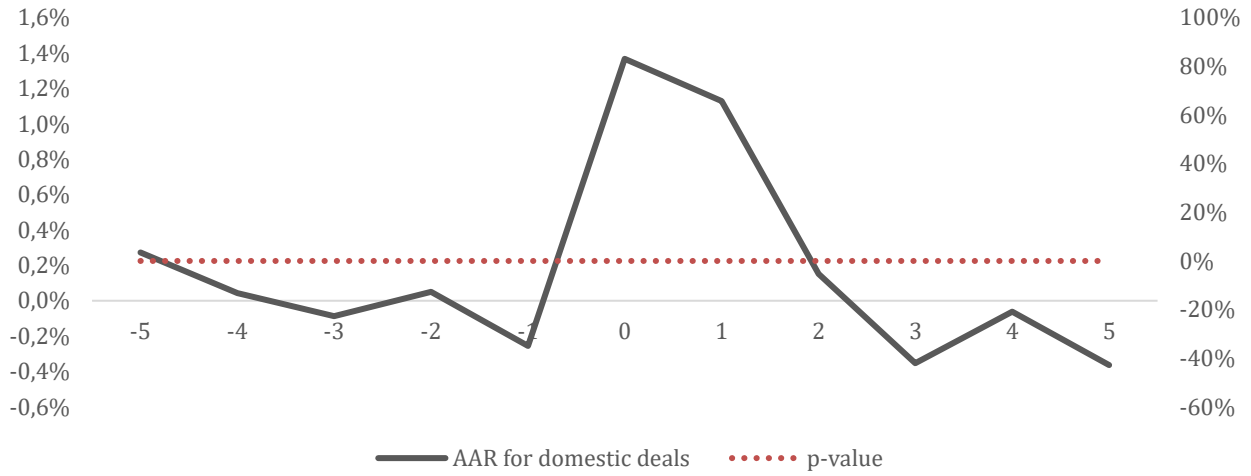


Source: own calculations

Looking at Figure 13, we can see again the course of the average abnormal returns for domestic deals for each day of the longest event window and the subsequent p-values. When looking at the p-values of each day, it is shown that there is a high significance on the announcement day and also on the day after the deal has been pronounced, confirming our results from the cross-sectional regression which proved significant abnormal returns on average of 7.35% for shareholders when the event window has a length of only 3 days and when the deal was executed domestically. Finally, we assume that the market seems to be efficient as the stock prices seem to adjust quickly when both bidding and target company are from the same country.

Figure 13. AAR for domestic deals and the p-values.

This figure reports the development of the AAR for domestic deals (left axis) and of the p-value (right axis) for each day of the longest event window (-5; +5).



Source: own calculations

6.3.2 Conclusions from statistical tests

Our investigation contradicts the previous researches when it comes to compare the abnormal returns upon announcement between cross-border and domestic acquisitions. Different previous scholars have stated that both cross-border as well as domestic acquisitions enhance shareholders' wealth of the acquirer company on the announcement day, but that the outbound deals generate higher abnormal returns in general (Rani, Yadav & Jain, 2011). By considering the pharmaceutical industry only, our results instead suggest that on average the cumulative abnormal returns of the cross-borders deals are higher in comparison to the domestic transactions when the event window is either 11 or 7 days long, but that they lack any statistical support. When we narrow the event window down to only 3 days, we get results with statistical validity that prove higher cumulative abnormal returns of on average 7.35% for domestic acquisitions. This is in line with our analysis shown in the descriptive statistics which shows an overall trend towards domestic acquisitions (see descriptive statistics).

Based on these findings, we can reject our hypothesis. Overall, it is correct to say that in the pharmaceutical industry, the cross-border deals do not seem to generate higher returns for shareholders in comparison to the domestic deals. Due to the fact there is a lack of studies aiming to investigate this topic in a complex sector like the pharmaceutical one, we suggest additional research to further validate the foundation of our findings.

6.4 Hypotheses 2.2 and 2.3

We also want to further analyze the geographical aspect for both India and China. Even though Hassett et al. (2017) have found that cross-border M&A from emerging countries have increased, we cannot see that in the pharmaceutical industry for China or India: Whereas China had 53 domestic and only 3 cross-border deals, India has seen 5 domestic vs. 6 cross-border deals during 2007 until 2018. Due to the small sample size of deals by Indian bidding companies, we cannot draw any conclusions about the likelihood that there will be an increasing trend towards cross-border deals, even though they have had one more cross-border than domestic deal. This is the opposite for China, as they have had a remarkably high number of domestic deals and which does not seem to change in the near future, with having only domestic deals in 2018 (results based on data set from Zephyr). The high number of domestic deals in China could be due to the need of short-term drug approvals, as it is one motive for domestic mergers in the pharmaceutical industry according to research of Banerjee & Nayak (2015).

Based on these findings and as we are interested to further investigate that topic, we recall our hypotheses as:

H2.2: Cross-border deals create higher returns for shareholders of Indian firms

H2.3: Cross-border deals create higher returns for shareholders of Chinese firms

6.4.1 Results

We used the same methodology as for the overall analysis of all deals, using a cross-sectional regression to control for financial KPI of the bidding firms, which we choose to be the logarithm of the market capitalization, the debt-to-equity ratio and the beta of the firms, retrieved from the linear regressions we did before.

Analyzing the Indian deals, we found that on average cross-border transactions yield higher cumulative abnormal returns on average for the bidding firms in each event window, but none of these results proved to be statistically significant with very high p-values. Nevertheless, it generally indicates that there are higher returns on average for cross-border deals. As the data sample of deals executed by Indian bidding companies is very small with only using 9 deals for the multiple regressions, we cannot draw any further conclusions.

For China we find that on average, cross-border deals achieve significant higher cumulative abnormal returns for the shareholders of bidding companies in each event window (41.6% on average for the 11-days event window, 28.4% for the 7-days event window and 9.3% for the 3-days event window). We found all results significant on a 5% level.

6.4.2 Conclusions from statistical tests

This comes with surprise considering that our data sample comprises 53 domestic Chinese deals and only 3 cross-border ones. We therefore must be cautious about how to interpret these results. Due to this small sample, we do not want to conclude that cross-border deals create higher returns despite proven significance, as the small sample of only three deals might not give a correct picture.

Finally, we reject the hypothesis for Indian bidding firms, as we have found higher abnormal returns when the deal was carried out internally, and accept it for the Chinese ones, keeping in mind the above-mentioned small data sample of cross-border deals which has to be considered with cautiousness (see Appendix 9 and 10 for numerical results).

6.5 Hypothesis 3

Many studies as also mentioned in the literature review (Travlos (1987), Fishman (1989), Martin (1996)) proved that bidders making cash offers achieve higher returns than the ones making stock offers when the deal is announced. Research done by Rappaport & Sirower (1999) has detected a better performance for shareholders in cash transactions and unveiled that the early performance differences between the two methods of payments become more significant over time. Furthermore, when there is a cash transaction, the roles of the acquiring and the target companies are clear cut and the money exchange enshrines the transfer of ownership while in the case of shares' exchange, determining the two parties is more complicated. In general, the buyers paying with stocks share the value and the risk of the transaction with the shareholders of the acquired company. More specifically, the synergy risk is shared in proportion to "the percentage of the combined company the acquiring and the selling shareholders will own" (Rappaport & Sirower, 1999, p. 147). By considering the evidence of higher returns for shareholders in cash transactions demonstrated by numerous studies, the lack of ownership clarity in stock transactions and the share of the synergy risk between acquirer and target firm during stocks offers, we test the following hypothesis:

H3: Market reacts better to cash financed acquisitions

We first calculated the cumulative abnormal returns (CAR) for the different event windows (-5; +5), (-3; +3), (-1; +1), to see if there is a stock price effect on the day of the announcement. In order to test our hypothesis, we then calculate the mean difference in CAR for deals paid with either cash, shares or other payments.
We used the CAR as the dependent variable for our cross-sectional regression. Since we are assuming semi-strong efficiency, we believe that abnormal returns represent a good approximation of the market's reaction to a new announced acquisition. As previously stated during our paper, we have decided to focus on two main types of payments which are cash and stock and consequently we grouped all the other types of payments within the category 'other'.

For our analysis we used a multiple regression to test for statistical significance by regressing a dummy variable equal to 1 if the deal was paid with cash (stock) and 0 if otherwise, to predict the value of our dependent variable, which in our case is the CAR for each event window. The omitted and therefore our benchmark is other payments, which equals one when the deal was paid with 'other' payments and zero otherwise.
For the control variables we chose different financial, publicly available KPIs, from which we believe that they can be influential, or which have been used in previous studies. We decided to use the market capitalization, the debt-to-equity ratio and the beta of the firms. We decided to use the market capitalization in its logarithmic form as it is common approach and widely used in similar event studies and to take into account the firm's size. The debt-to-equity-ratio expresses the company's financial leverage that is the extent to which firm's operations are funded by lenders versus shareholders. Due to the elevated number of researches in literature investigating the impact of acquisitions on the financial leverage of the acquiring companies i.e. (Agyei-Boapeah (2015), Bouraoui (2014)) we thought it was relevant to include this ratio for our analysis. Both the market capitalization and the debt-to-equity ratio were withdrawn by Osiris, the Bureau van Dijk's flagship company database. The risk component of the deals instead was taken into account by including the beta in our cross-sectional regression. The betas used are retrieved by the linear regressions run formerly to get the actual returns. Due to the relationship between beta and the debt-to-equity ratio, we considered the impact that the former could have on the latter but after further investigations we came to the conclusion that the financial leverage does not have significant impact on the beta of our sample. Hence the decision of including both measures. Lastly, since we are interested in proving that

the cash -financed acquisitions induce a more positive reaction in the markets in comparison to the stock-financed ones, we have used dummy variables for each method while using the other payments as benchmark in the regression. Although our initial sample was composed of 196 elements, due to the lack of available financial information for each of them, the cross-sectional regression was conducted on 135 deals. Despite a reduced number of deals, the sample still consists of more than 100 deals and will consequently be large enough for analysis purposes.

6.5.1 Results

The results reported in the table 14 are calculated through the following multiple regression:

$$CAR_{acquirer}[-t,+t]_{\,i} = \beta_0 + \beta_1 D_{cash,i} + \beta_2 D_{stock} + \sum \beta_i x_i + \varepsilon_i$$

where:

CAR represents the dependent variable, β is a parameter estimate that explains variations in the dependent variables, D represents the dummy variables, $\sum \beta i \; xi$ represents the remaining control variables and ε denotes the error term.

Table 14. Results from the cross-sectional regression for cross-border vs. domestic deals.

In the following table, the dependent variable is represented by the CARs for three event windows (-5; +5), (-3; +3) and (-1; +1). Cash and shares are the dummy variables assuming value 1 if the payment was cash or stocks and assuming value 0 otherwise. Other payments are used as reference (benchmark) variable assuming value 1 when the deal offer was different to cash or shares and 0 otherwise. The logarithm of market capitalization is expressed in thousands $US. Beta coefficients were calculated through a linear regression model with estimation period of 260 days prior to the 11 days event window (-265; -5). A sample of 135 deals was used.

	CAR [-5; +5]		CAR [-3; +3]		CAR [-1; +1]	
	Coefficient	t-Stat	Coefficient	t-Stat	Coefficient	t-Stat
Intercept	0,1179	1,8241*	0,1056	2,0042**	0,1015	2,4930**
Cash	-0,0296	-1,3995	-0,0242	-1,4032	-0,0239	-1,7892*
Shares	-0,0240	-0,7086	-0,0404	-1,4665	-0,0081	-0,3788
Market cap	-0,0053	-1,2741	-0,0047	-1,3756	-0,0046*	-1,7671
D/E Ratio	-0,00003	-0,2853	0,0000	0,4605	0,0071	1,0446
Beta	0,0076	0,3838	0,0003	0,0192	-0,0067	-0,5351

, **, * indicate significance level of 10%, 5%, 1%.*

Source: own calculations

From Table 14, we can notice that the cash offers during the 11 days event window, on average yielded lower returns in comparison to the stock offers with a CAR of 9.4% when the deals was paid with shares and 8.8% when paid with cash. Evaluating the results of the 7-days event window, the difference between the two means of payment coefficients is significant. On average the cash financed deals reported cumulative abnormal returns equal to 8.1% while the stock-financed ones achieved only a CAR of 6.5%. Neither of these results are significant, despite the other method of payment, which proves significance on 10% for the 11-days event window with abnormal returns of 11.8% on average and on a 5% level for the 7-days event window with abnormal returns of 10.6%, yielding the highest CAR on average for all three payment methods. Lastly, when considering the 3-days event window, the average returns generated by the cash offers are approximately 7.8% in contrast to 9.3% of the stock deals, with proven significance on 10% level for cash-financed deals. Overall, it is evident that only for the event window with 7 days the cash-financed acquisitions reported higher CARs on average compared to deals paid with stock. In addition, the other methods of payment seem to generate returns of approximately 11.8% with proven significance on a 10% level when the event window is 11 days long, 10.6% and 10.1% respectively when the event window is either 7 or 3 days long showing significant results on a 5% level. Hence the performance of the other methods, constituting a benchmark in our analysis, is also supported by the statistical significance of the results. If we consider only the shortest event window, the in comparison to stock-financed lower gains of the cash-financed acquisitions are validated by a p-value of 7.6%.

6.5.2 Conclusions from statistical tests

Overall, the coefficients reported in table 14 suggest rejecting the hypothesis previously formulated, which means that in the pharmaceutical industry the cash-financed acquisitions do not create more value in comparison to the stock offers. Even though cash yields lower but significant cumulative abnormal returns than when paid with shares and when the event window is 3 days long, we can still see a higher CAR of 10.1% with a p-value of 1.4% for other payments, which indicates high significance. From table 15 we can also see, that the market seems to react slightly delayed to the announcement, showing a 0.03% insignificant average abnormal return on the day of the announcement for cash-financed transactions, but highly significant returns of 0.8% on the day after the announcement. This is in line with our before described conclusions which justifies the rejection of our hypothesis.

Despite the fact that the results do not confirm the evidence of a better market reaction when a cash offer happens, our findings still find support in the previous literature, especially in a research conducted by Heron & Lie from the University of Washington, who investigated a sample of over 800 deals between 1985 and 1997 and concluded that there is no evidence of significant differences in the abnormal returns between the two means.

Table 15. Average abnormal return for cash-financed acquisitions.

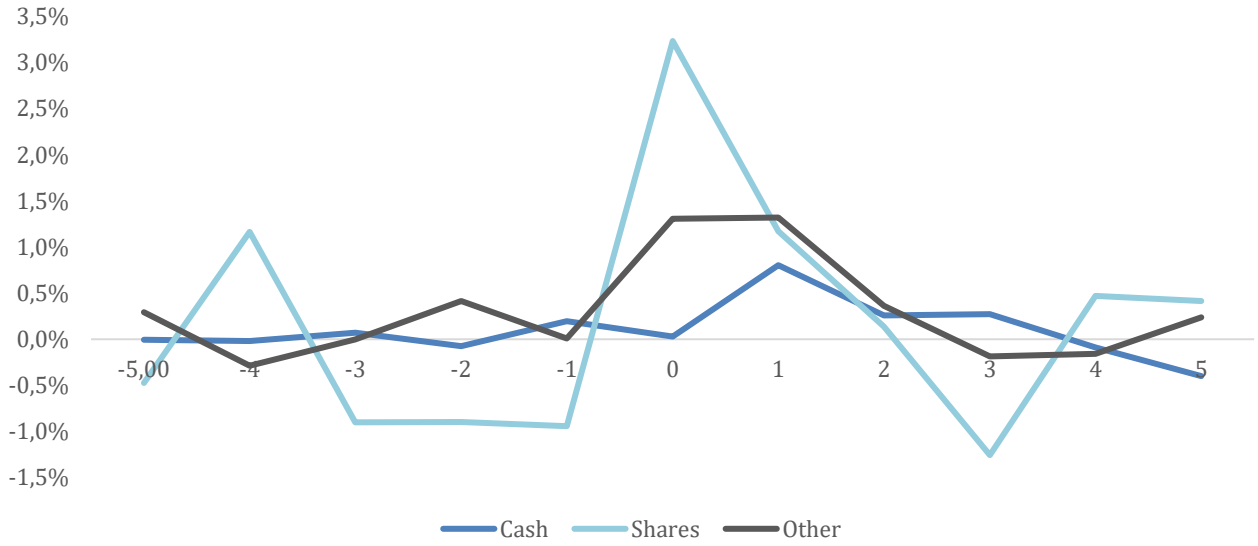
This table reports the abnormal average return (AAR) of bidding companies for the total data sample with N=135.

Day	AAR	t-statistic	p-value
-5	-0,01%	-0,03	0,98
-4	-0,02%	-0,07	0,95
-3	0,07%	0,26	0,79
-2	-0,08%	-0,29	0,77
-1	0,20%	0,74	0,46
0	**0,03%**	**0,12**	**0,91**
1	0,80%	3,04	0
2	0,26%	0,98	0,33
3	0,27%	1,03	0,31
4	-0,09%	-0,34	0,74
5	-0,40%	-1,51	0,13

Source: own calculations

In Figure 14 we have summed up our results from the perspective of the average abnormal returns for the 135 deals in our sample. The market seems extremely reactive to the announcement of an acquisition when is financed with shares. In fact, the day of the announcement reports the highest return which progressively decreases after the peak on day zero. Nevertheless, we have not found significant results for higher abnormal returns when the deal was paid with shares. The AAR of other methods of payment indicates a more moderate reaction in the market, which is coherent with our conclusions from the cross-sectional regression. The cash line in the graph is instead quite flat and reaches the highest point only on the day after the announcement, anticipating a delayed reaction of the markets to the announced deal, notwithstanding adjusting relatively quickly afterwards. When the deal was paid with other methods of payment, we can see a stock price effect on the day of the announcement indicating market efficiency.

Figure 14. Average Abnormal Returns for acquiring firms according to different methods of payment.



Source: own calculations

The literature (e.g. Myers & Majluf (1984)) has often highlighted that a cash offer sends a positive signal to the market and many empirical studies (e.g. Fuller et al. (2002)) showed that shareholders of the acquiring firms have a more positive attitude towards cash offers than towards stock offers.
Our overall results suggest that the deals paid with stock achieve higher abnormal returns than the cash-financed acquisitions when we get closer to the announcement date but without proven significance. Furthermore, we have found that the CAR is highest when the method of payment is 'other', being highly significant on 1.4% when the event window is only three days long.
Despite a major part of the previous research support the opposite view, our outcome is -as briefly mentioned before- in line with an empirical investigation conducted on 1300 completed transactions in Canada which demonstrated the over enthusiastic reaction of the markets when a stock-financed acquisition is announced (Dutta, Saadi & Zhu, 2013). The higher returns could therefore be explained by an overestimation in response to the announcement which leads to the market's adjustment in the long run and to a subsequent underperformance in comparison to the cash-financed deals in the long term. Because of the inexistence of specific studies in the pharmaceutical industry on that subject, only further investigations considering different variables, or a bigger data sample might attempt to accept or dismiss our hypothesis.

6.6 Hypotheses 4.1 and 4.2

For most of the companies, closing a deal during an economic crisis represents a risky investment. The markets are depressed and that is why the number and value of deals diminished during and immediately right after a downturn (Rajan & Harding, 2009). The decrease in the M&A activity is in particular due to the skepticism about the availability of funding, especially equity capital (Kostic, 2013, p. 123, p.123). However, for companies that are strong both from a strategic and financial point of view, crises can constitute an opportunity to consolidate and improve their position through the M&A activity (ibid.). Additionally, in October 2008 some of the biggest equity indices showed a drop of about 25 percent (Ravichandran, 2009, p. 1). This is confirmed by a report by Capaldo, Cogman & Suonio (2009) from McKinsey, where they report that stock markets saw a decline of 40 to 50% compared to the January's market performance. As our whole event study is about stock returns and the reaction of the market, we find it of interest to investigate the stock returns for shareholders during both the year of the financial crisis and the year afterwards, as the stock indices seem to record a monumental drop towards the year-end of 2008. Therefore, we want to investigate whether this trend is also seen in the pharmaceutical industry.

Through an analysis of the years around 2008, we will verify whether the following hypotheses are supported by evidence:

H4.1: The number of M&A decreased after the financial crisis

H4.2: Higher abnormal returns for the shareholders in the year after the financial crisis compared to the returns in the year of the crisis

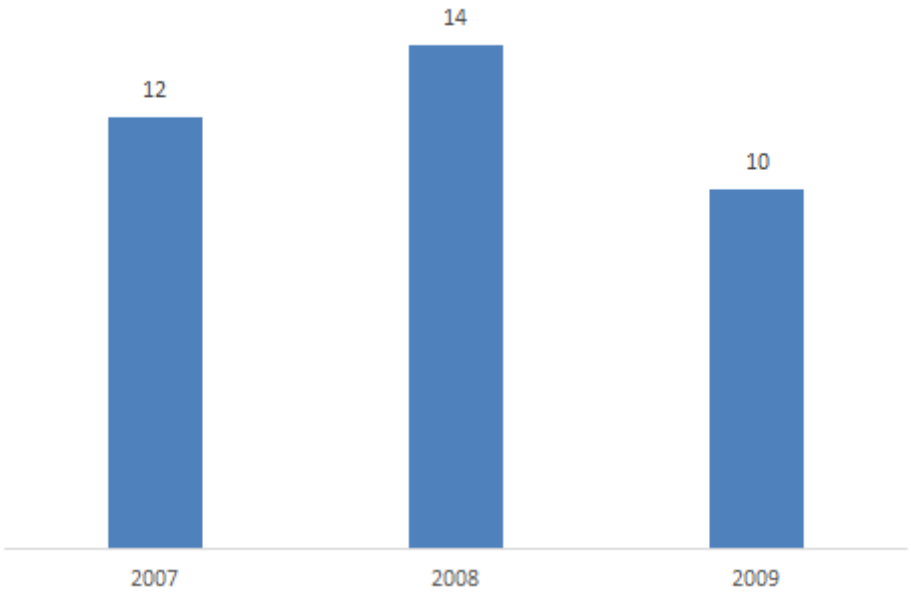
The investigation of hypothesis 4.1 is less sophisticated than the calculations that are required to give relevant evidence regarding hypothesis 4.2.

We first need to make some limitations regarding the financial crisis: when using the phrasing 'before the financial crisis' we mean all deals that has been announced before 2008, which was the year when the global bank Lehman Brothers went bankrupt (The Economist, 2013). Since we only look at deal data between 2007 and 2018, this further means we only consider deals that have been announced in 2007. Consequently, by mentioning the year of the financial crisis, we mean all deals that were announced in 2008. When analyzing the deal volume 'after the financial crisis' we only focus on

deals that were announced in 2009 since this is the first year after the crisis. Figure 15 shows the total deal number of the years 2007, 2008 and 2009.

Figure 15. Total deal number 2007-2009.

This figure reports the number of deals for each year from 2007 to 2009 within the pharmaceutical industry.



Source: own calculations, based on data from Zephyr

From only looking at the deal number for each of the different years, our hypothesis appears to be true, since the number of deals decreased to only 10 announced deals after peaking in 2008 with a total number of 14 deals. In literature we have found different opinions regarding M&A activity during or after a crisis, but we agree with Rajan & Harding (2009) who say that markets are rather depressed, and the number of deals often decreases right after a crisis. This is also in line with a graph from Statista presented in Appendix 7, which shows the number of deals for the biotechnology and pharmaceutical sector worldwide from 1985 to 2018.

When comparing this with our findings for the years before, during and after the financial crisis, we can see that our results are aligned with the numbers of Statista. Hence, we can assume, that the financial crisis in general has led to a decreased number of acquisitions and we can accept our hypothesis that said there will be in a decreased number of deals in the year after the financial crisis.

Nevertheless, by only looking at the deal numbers for the different years, we cannot give any evidence for statistical significance of our finding. Consequently we will continue with carrying out research for our second hypothesis, by testing if the abnormal returns for shareholders of the bidding company were significantly higher in the year after the financial crisis, meaning we will run linear regressions to get the actual returns of the bidding companies for 2008 and 2009 and then again use a parametric and non-parametric tests for further testing.

6.6.1 Results

Parametric test

From table 15, we see that the CAAR for the 11-days and 7-days event window are both negative, with small positive returns of 0.17% on average when the event window is 3 days long. Nevertheless, these results are not statistically significant, which means we can assume that in 2008, there were no abnormal returns for shareholders of the bidding companies. This is supported by the results of the non-parametric tests from table 18 and 20, which both indicate that there are no significant abnormal returns.

As can be seen in table 16 and hence the results for the returns from 2009, the CAAR is positive for all three event windows with the highest percentage of 5.1% during the event window with 7 days. Nevertheless, the only statistical significance that can be found is for the CAAR of the 3-days event window, with a significance level of 10%. For the other two event windows the results are not statistically significant, even though the p-value for the 7-days event window is very close to the 10% level and therefore close to proving significance. For our results this overall indicates that there are abnormal returns for shareholder of the bidding firms in 2009, the year after the financial crisis, but only when the event window is short. Since the 7-days window indicates to be almost significant, it could be interesting to further investigate if the p-value becomes already smaller than 10% for an event window of (-2; +2).

Hence, we take a closer look at the event window of 5 days, as we want to see if the results become already significant for that length.

Our calculations give us a CAAR of 7.7%, with a t-statistic of 3.2 and a consequent p-value of 0.012, which proves that the result is highly significant on 1.2%. This result indicates that the abnormal returns are higher for an event window of 5 days than for an event of only 3 days.

Table 15. Parametric test for cumulative average abnormal return of bidding firms during 2008.

This table reports the results from the parametric t-test for cumulative average abnormal return of bidding firms ±5, ±3 and ± 1 days surround the announcement day of the acquisition.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	-2,86%	-0,85%	0,17%
Variance	0,00%	0,00%	0,00%
t-statistic	-0,84	-0,31	0,09
p-value	0,42	0,76	0,93
Significance	no significance at all levels	no significance at all levels	no significance at all levels
N	14	14	14

Source: own calculations

Table 16. Parametric test for cumulative average abnormal return of bidding firms during 2009.

This table reports the results from the parametric t-test for cumulative average abnormal return of bidding firms ±5, ±3 and ± 1 days surround the announcement day of the acquisition.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	2,78%	5,09%	4,10%
Variance	0,124%	0,079%	0,034%
t-statistic	0,79	1,81	2,23
p-value	0,45	0,11	0,06
Significance	no significance at all levels	no significance at all levels	significant on 10%
N	10	10	10

Source: own calculations

Due to the above-mentioned findings regarding the abnormal returns in 2009, we inserted table 17 to show the average abnormal return for each day of the longest window (11 days), to draw further conclusions regarding the efficiency of the market. Looking at the table, we can see why the CAAR is highest for the event window with 5 days: it shows abnormal returns of 2% on the two days before the announcement day, both with a p-value of 6% and therefore significant.

Table 17. Average abnormal returns 5 days prior and after the event in 2009.

This table reports the abnormal average return (AAR) of the bidding companies for the total data sample with N=10.

Day	AAR	t-statistic	p-value
-5	-0,79%	-0,75	0,48
-4	-0,23%	-0,21	0,84
-3	-1,76%	-1,65	0,14
-2	2,37%	2,23	0,06
-1	2,32%	2,19	0,06
0	**-0,86%**	**-0,81**	**0,44**
1	2,63%	2,48	0,04
2	1,19%	1,12	0,3
3	-0,81%	-0,76	0,47
4	-1,12%	-1,06	0,32
5	-0,17%	-0,16	0,88

Source: own calculations

Moreover, we can see that there are negative returns on the day of the announcement, but with high significant positive returns of 2.6% on average on the day afterwards. Comparing this to our previous hypotheses and results, it is indeed the first time we find negative average abnormal returns on the day of the announcement and no signs of significance on that day. As touched upon briefly before, we find positive average abnormal returns on the day before and two days before the announcement, both showing significance on a 10% level. Due to the signs of significance on the two days prior to the announcement day, we assume noise in the observations on that days, as there could have been rumors or insider trading which could have caused the positive abnormal returns in these days.

From table 17 showing the average abnormal return, we can conclude that there seems to be no stock price effect on average at the announcement day but with significant effects on the two days before the announcement, which could be a signal for insider trading. Hence, we will apply the non-parametric tests to see if it will reveal that abnormal return the other days were significantly different from zero.

Non-parametric tests

Table 18. Rank test for bidding firms for deals in 2008.

This table summarizes the results from the non-parametric rank test. Whenever the event window average is above 50%, we assume abnormal returns. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
Average abnormal return	47,52%	49,63%	51,92%
Variance	0,084%	0,091%	0,100%
t-statistic	-2,84	-0,32	1,05
p-value	0,0149	0,755	0,3244
Significance	significant on 5%	no significance at all levels	no significance
N	14	14	14

Source: own calculations

Table 19. Rank test for bidding firms of deals in 2009.

This table summarizes the results from the non-parametric rank test. Whenever the event window average is above 50%, we assume abnormal returns. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-2; +2)	(-1; +1)
Average abnormal return	50,90%	53,62%	56,52%	52,12%
Variance	0,10%	0,106%	0,000%	0,101%
t-statistic	0,96	2,93	4,24	1,16
p-value	0,37	0,02	0,00	0,28
Significance	no significance at all levels	significant on 10% and 5%	significant on 10%, 5% and 1%	no significance at all levels
N	10	10	10	10

Source: own calculations

As described above, we included for the test of significance for the returns in year 2009 an additional event window (-2; +2) to see if the abnormal returns have been different from zero since we saw from table 17 showing the AAR, that the returns for the day before the announcement day and two days before showed significant results which could have been due to insider trading. Moreover, we have found that there have been no significant average returns on the announcement day, which is different compared to the results of the other hypotheses that showed significant returns on the announcement day.

When looking at the rank tests for 2008, we see that the average range only exceeds the 50% margin when the event windows has 3 days, assuming abnormal returns but without statistical significance. For the event window of 11 days, we can see statistical significance of 5%, assuming negative abnormal returns as the CAAR for that event window is negative.

The rank test for 2009 shows that the average range for all four event windows is clearly above 50%, increasing when the event window is narrowed down until 56.5% in event window (-2; +2), but decreasing afterwards which is also uncommon when comparing to the results of our other rank tests. The same pattern applies for the t-statistic: it increases to 4.2 and is highly significant on a 1% level in event window (-2; +2) but falls to 1.2 when the event window is the shortest with only 3 days and proving to be not significant on any level. With using the rank test for our cumulative abnormal returns in 2009, we can see that the test indicates that there are abnormal returns for shareholders of bidding firms on average when the event window is either 7 or 5 days long. Finally, this could mean that the market reacts delayed regarding the deal announcement, since no abnormal returns seem to stem from announcement day in that case.

As we have already mentioned and want to emphasize again, this could result from bias in the observations like rumors or insider trading. Furthermore, rank tests are often affected by the size of the abnormal return which indicates that the effect on the announcement day will affect the significance of the results. This means that longer event windows appear to be significant, which can be evidently seen from our calculations. What also needs to be considered is the fact that the data sample for our calculations has been very small with only 14 and 10 observations, meaning observing only 14 and 10 bidding companies which could also be a reason for these results.

Table 20. Sign test for bidding companies of deals in 2008.

This table summarizes the results from the non-parametric sign test. Whenever the event window average is above 50%, we assume abnormal return. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-1; +1)
CAAR	-2,86%	-0,85%	0,17%
Variance	0,12%	0,07%	0,03%
Number of positive CARs	6	5	6
Number of negative CARs	8	9	8
Average of positive CARs in the event window	42,86%	35,71%	42,86%
t-statistic	-0,27	0,8	-0,27
p-value	0,79	0,42	0,79
Significance	no significance at all levels	no significance at all levels	no significance at all levels

Source: own calculations

Table 21. Sign test for bidding companies of deals in 2009.

This table summarizes the results from the non-parametric sign test. Whenever the event window average is above 50%, we assume abnormal return. The chosen event windows are (-5; +5), (-3; +3) and (-1; +1), to show whether there are abnormal returns surround the announcement day.

Event window	(-5; +5)	(-3; +3)	(-2; +2)	(-1; +1)
CAAR	2,78%	5,09%	7,66%	4,10%
Variance	0,12%	0,08%	0,06%	0,03%
Number of positive CARs	5	4	7	5
Number of negative CARs	5	6	3	5
Average of positive CARs in the event window	50,00%	40,00%	70,00%	50,00%
t-statistic	0,32	0,60	-0,95	0,32
p-value	0,76	0,56	0,37	0,76
Significance	no significance at all levels	no significance at all levels	no significance at all levels	no significance at all levels

Source: own calculations

As seen in table 20, the sign test for the returns in the year 2008 indicates that there are no abnormal returns, not exceeding the 50% margin when considering the average of positive CARs in the respective event windows.

Looking at table 21, the average clearly exceeds the 50% margin only for the event window of 5 days (-2; +2), indicating that this is the only event window where there are more positive than negative abnormal returns. None of the event windows contains statically significant abnormal returns and thus we cannot conclude that there are abnormal returns.

6.6.2 Conclusions from statistical tests

The results for 2008 show that the CAAR for the 11-days and 7-days event window are both negative, with small insignificant positive returns of 0.17% on average when the event window is 3 days long. Nevertheless, these results are not statistically significant, which means we can assume that in 2008, there were no abnormal returns for shareholders of the bidding companies. This is supported by the results of the non-parametric tests from table 18 and 20, which both indicate that there are no significant abnormal returns. Only the rank test for the event window of 11 days shows significance on a 5% level, indicating negative abnormal returns.

Looking at our results from the parametric test, we can find significant abnormal returns on average of 4.1% for the event window with a length of 3 days, and even higher returns when the event window is 5 days long, showing abnormal returns of 7.7% with a p-value of 0.012. Nevertheless, only the

rank test suggests abnormal returns for the 7-days and 5-days event window on 5% and 1% respectively, while the sign test shows no statistical significance.

As we saw that the average abnormal returns were positive on the days before the announcement day and that there are lower cumulative average returns with a 10% significance level than for the longer event windows, we conclude that the results are biased by rumors or insider trading, even though the results are not significant.

Comparing the acquisition gains during and after the financial crisis, we can conclude that there were higher returns in 2009 on average than in 2008 with a sample of 14 acquisitions. In 2008 the stock returns were mostly negative, and we only see positive significant returns of 4.10% when the event window is the shortest with a sample of 10 acquisitions.

The empirical findings also suggest that the CAAR on the event day for pre-crisis period is 0.2% compared to significant CAAR of 2.3% on a 10% level during post-crisis period. It is evident that market response has increased after the financial crisis, which is not in line with Rani & Asija (2017), finding CAAR of 4.3% before the crisis and only 1.7% after the crisis. There are only few papers investigating the effects of the financial crisis, indicating that there is the need for further research, especially as there are no specific studies about the pharmaceutical industry to make further assumptions about beneficial implications for stakeholders.

7 Concluding discussion

The aim of this paper was to investigate mergers and acquisitions activity in the global pharmaceutical industry during the period between 2007 and 2018. The topic was addressed by measuring value creation for shareholders, looking at stock returns to detect abnormal returns. By conducting an event study, different hypotheses were tested with the purpose of giving statistical validity to our findings. For our empirical research, we retrieved the data from Zephyr, the Bureau van Dijk's solution containing the most comprehensive deals' information, and we exclusively focused on transactions of publicly listed bidding as well as target companies categorized as merger or acquisition and as completed. In the end, a sample of 196 deals was analyzed, with the main focus being on the bidding companies. The stock returns were determined based on the stock prices and market returns available on the Thomson Reuters platform. In our analysis, an event study methodology was conducted using the market model to calculate the expected returns. As a last step, we ran several cross-sectional regressions to test our results for statistical significance. In the following paragraphs, we will summarize our results.

When testing the hypothesis of zero abnormal returns on the announcement date for shareholders of the bidding companies, we -on the contrary to previous research that showed no abnormal returns for shareholders of the bidding firms- find positive abnormal returns on average of 2% throughout all event windows (11, 7 and 3 days) with increasing statistical significance when the event window is narrowed down. Overall, we can reject our first hypothesis due to proven significance of the positive abnormal returns.

In an attempt to determine the difference in terms of value creation between domestic and cross-border acquisitions in the pharmaceutical industry, we incorporated dummy variables for both inbound and outbound transactions. In addition, some control variables were included, and the statistical significance of the dummy variables was tested. Despite many scholars having reported the advantages related to international transactions, our research suggests significant abnormal returns of 7.35% on a 5% level when the deal is carried out domestically and when the event window is short (-3; +3). However, when a bidding firm acquires a cross-border target it shows higher but insignificant returns for the 11- and 7-days event window. We therefore reject our hypothesis that cross-border deals create higher abnormal returns and can conclude that when the event window is short, the domestic deals create more value meaning higher abnormal returns for shareholders of the bidding company.

Due to increasing M&A activity reported in literature for the Indian subcontinent and China, we have decided to analyze these two countries more in detail. In particular, we primarily assumed zero abnormal returns for the shareholders of Indian and Chinese bidding firms when the deal is announced. In the case of India, our hypothesis was supported by a significant parametric test which indicates abnormal returns on average of 2.6% for the shortest event window. The significance of our findings is confirmed by the results of the non-parametric rank test. Nevertheless, we must be cautious about rejecting the hypothesis regarding abnormal returns, as it is only significant on 10% and the data sample had a size of only N=11, which means the sample is not large enough to draw sufficient conclusions. Considering the hypotheses regarding value-creation for cross-border vs. domestic deals, we found that on average cross-border transactions yield higher, but non-significant cumulative abnormal returns for Indian bidding firms in each event window.

Regarding China, the parametric test suggests that there are on average positive abnormal returns of 2% which is not supported by the non-parametric tests that both show no signs of significance. Even though the results from the non-parametric tests indicate no abnormal returns, we reject the hypothesis

which says zero abnormal returns when the deal is announced. In terms of cross-border vs. domestic acquisitions, we find that for China on average cross-border deals achieve significant higher cumulative abnormal returns for the shareholders of Chinese companies in each event window.

Because of the broad discussion in literature about the effect of the payment methods on the performance of the acquisitions, we decided to address this topic also in our research. Specifically, we were interested in further investigating the difference between the cash-financed and the stock-financed deals. In performing our analysis, we assigned dummy variables to cash and stock while we used the other payment methods as a benchmark. In addition, some control variables were included. The results contradict the hypothesis of a better market reaction when the deal is a cash-financed acquisition in comparison to a stock offer. On the contrary, the other methods of payment showed high abnormal returns of at least 10% proven to be statistically significant in every event window.

Lastly, we included the event of the financial crisis as our last hypothesis with the purpose of determining its impact on the M&A activity and value creation. By comparing the deals announced in 2008 and 2009, we investigated whether the economic downturn of the 2008 led to a decreasing amount of deals in the pharmaceutical industry in the following years. The results suggest accepting the hypothesis but, because of the lack of any statistical proof, further research was needed. After conducting an event study for both years 2008 and 2009, we cannot reject the hypothesis of higher abnormal returns for the shareholders of bidding firms after the financial crisis, as we have found higher CAAR on the event day during 2009 than in 2008 with proven significance at 10%.

8 Implications and relevance for stakeholders

In the following chapter we will present the contributions brought by our research of M&A activities. We will explain the impact of our findings for the stakeholders which, as already stated in Chapter 1.4, are constituted by the shareholders of the bidding firms, the beneficiaries of a wealth increase if abnormal returns are achieved.

Based on our results, we have derived the following implications for stakeholders:

1. The stakeholders of the bidding firms in the pharmaceutical industry can gain positive returns, on average, from the announcement of an acquisition.
2. The stakeholders of the bidding firms can benefit more from a domestic than from a cross-border deal within the pharmaceutical industry and hence they should reconsider their focus on mainly outbound acquisitions.

3. Investors of Indian pharmaceutical companies should continue focusing on cross-border transactions as they seem to create more value than the domestic transactions.
4. Even though Chinese investors of pharmaceutical companies seem, according to our dataset, prefer domestic acquisitions, through cross-border deals they can achieve higher gains.
5. Investors should consider using other method of payments instead of paying only with cash or stocks.

9 Further research

The pharmaceutical is a complex industry which gives a lot of different aspects that could be further investigated. Due to the limitation of pages for this thesis, we will give a short introduction about which topics are worth further research.

As already mentioned before, there are several reasons for two companies to merge: Economies of scale are often a reason for two companies to merge, especially when the companies face high costs like the pharmaceutical industry with their R&D expenditures for the development of new drugs. Since there hasn't been much research about the impact of drug patent expiration and the rise of costs for a new drug application and development on the growth strategy of pharmaceutical companies, it is in our interest to further investigate.

Due to the patent-driven and research-based nature of the pharmaceutical industry, a patent expiration can lead to serious consequences (Danzon et al., 2004). Some blockbuster drugs, for instance, account for 50% or more of the firm revenues and therefore the patent expiration on one or more of these compounds can decimate the firm's revenues, given the lack of a replacement (ibid.). In addition, a patent expiration causes also excess capacity.

The costs for drug development and the subsequent process of a new drug application can have an impact on M&A activities in the pharmaceutical industry. After the publication of a study by Tufts University Center for the Study of Drug Development in 2014 which emphasized the increasing costs of developing a new drug from $802bn. in 2003 to $1,044bn.

in 2014, it can be interesting to see if this publication had any influence on the M&A environment, meaning if there can be seen any increase in M&A activity after the publication and furthermore if this is the case, if there is any correlation between the publication of that study and that increase. There could be an interesting result be found since from 2014 on, the number of deals in the pharmaceutical industry began to rise again, as can be seen in Appendix 7.

Furthermore, for our cross-sectional regression we only considered financial KPIs to measure value creation. As suggested also by Demirbarg, Ng & Tatoglu (2007), it could be of interest to see how R&D productivity can be used as a performance measure to give a clearer picture of value creation in pharma.

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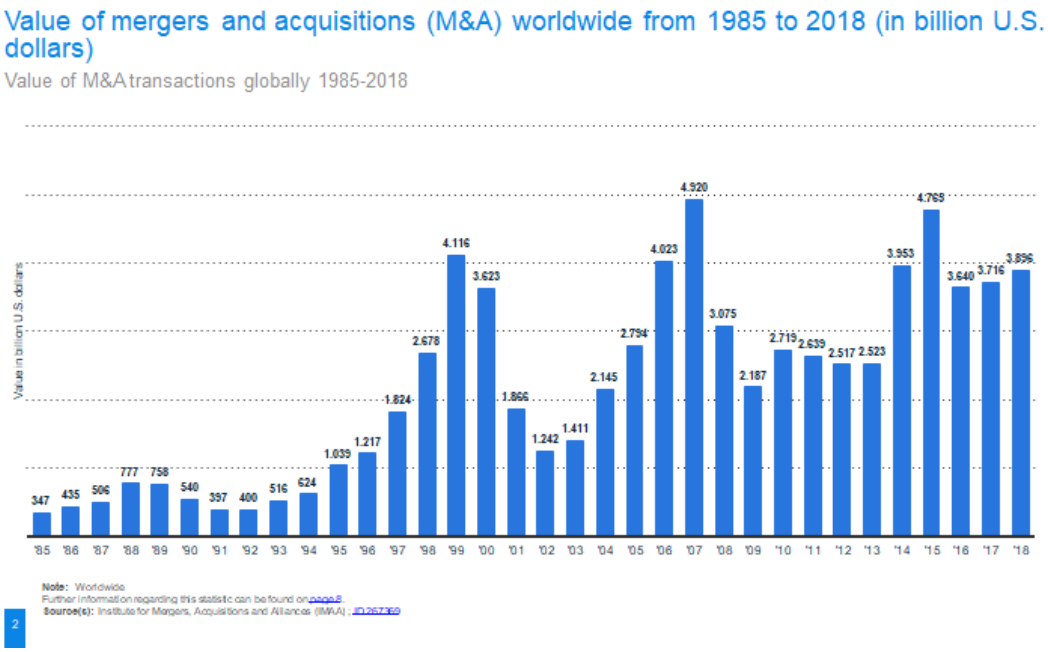
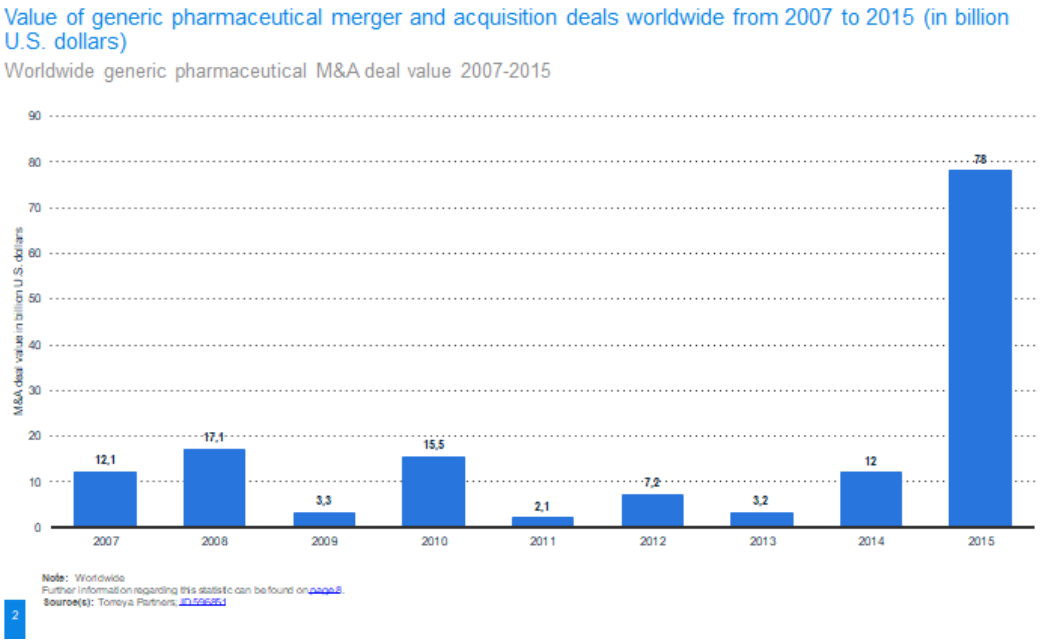
11 Appendices

Appendix 1



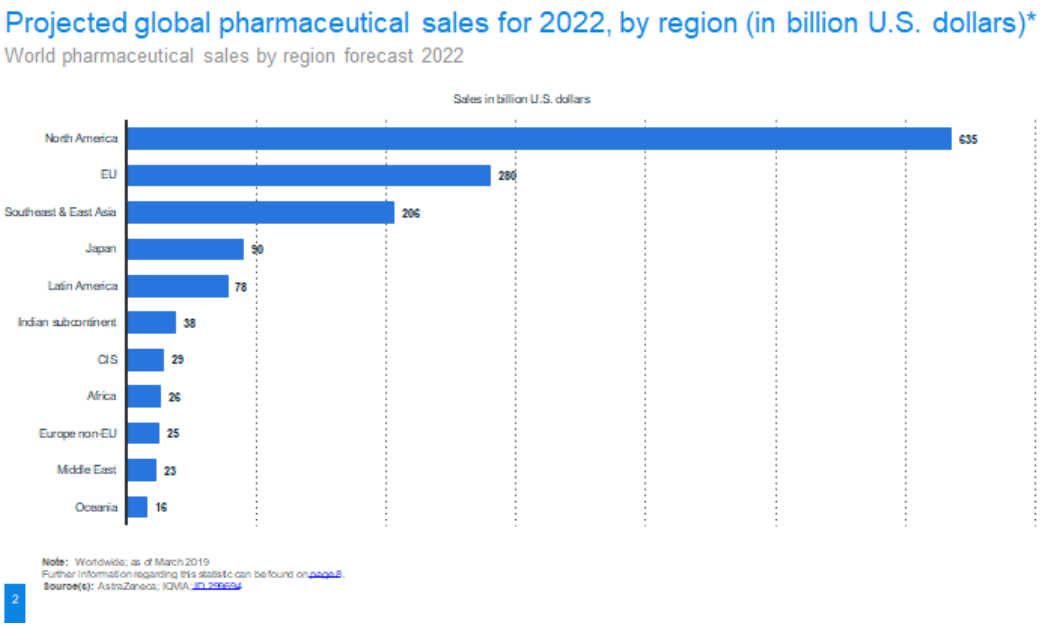
Source: Statista

Appendix 2



Source: Statista

Appendix 3



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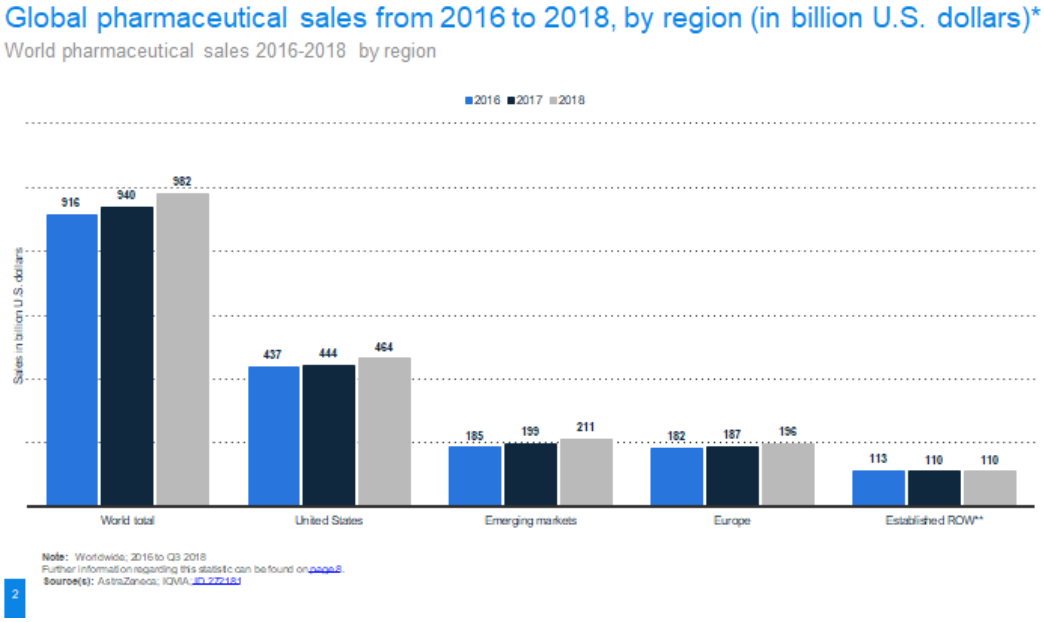
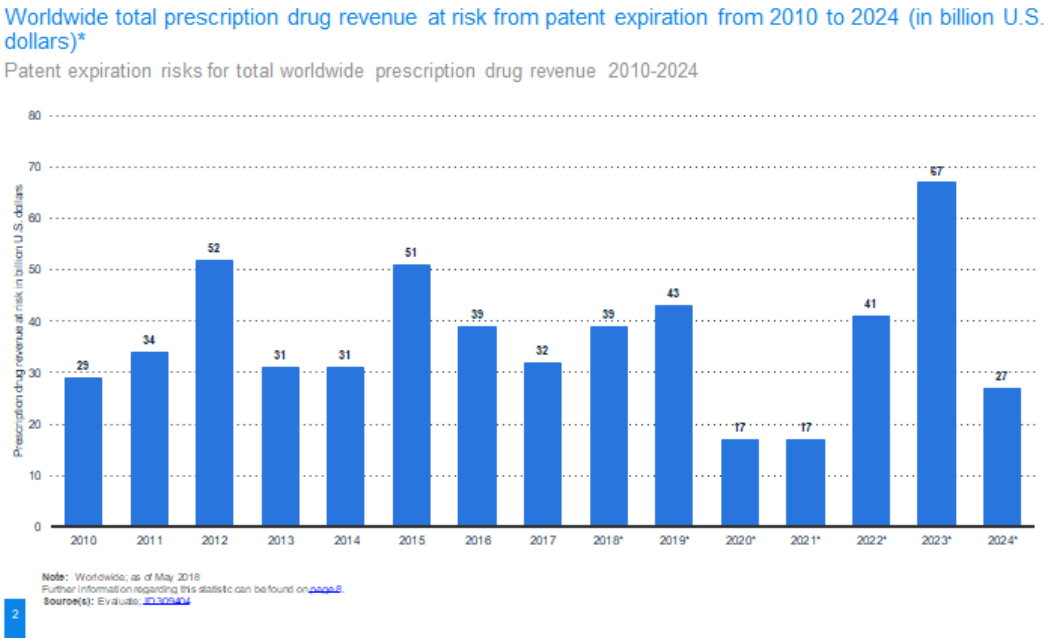
Appendix 4



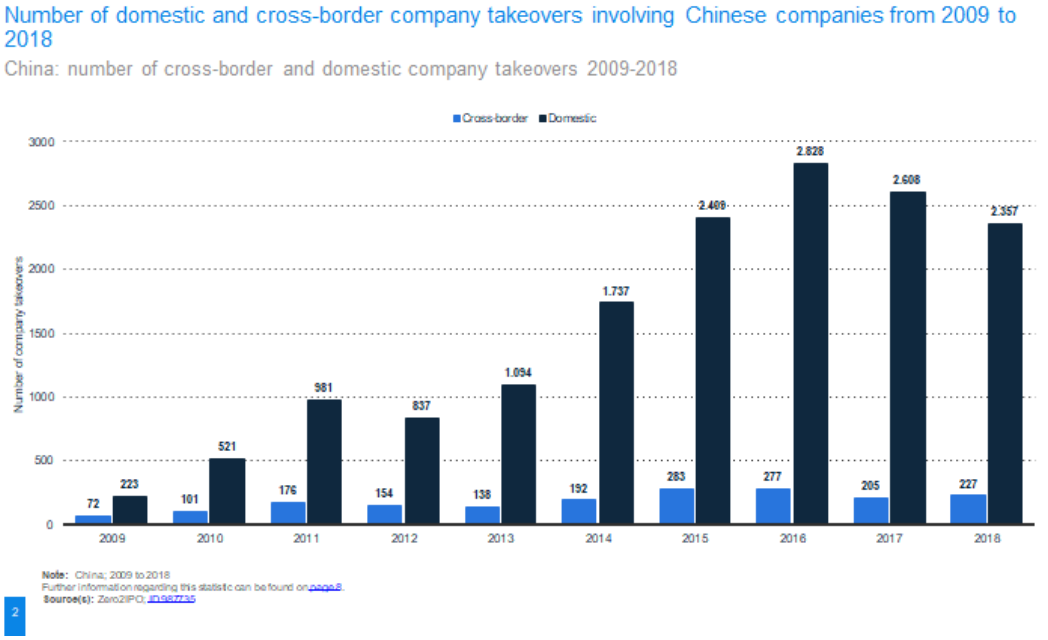
Source: Statista

Appendix 5



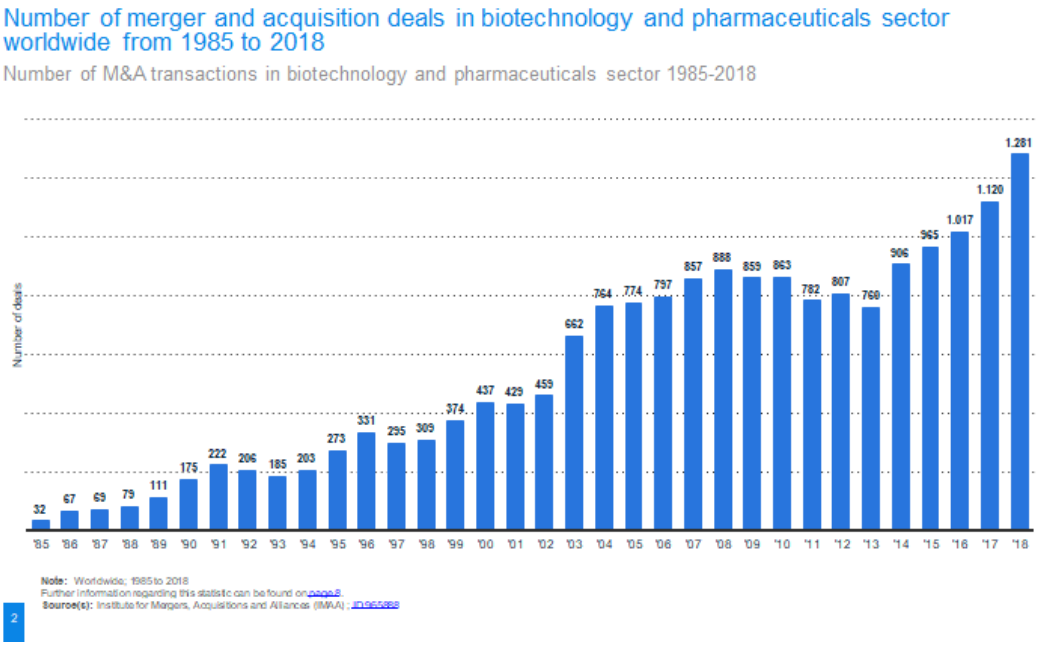
Source: Statista

Appendix 6



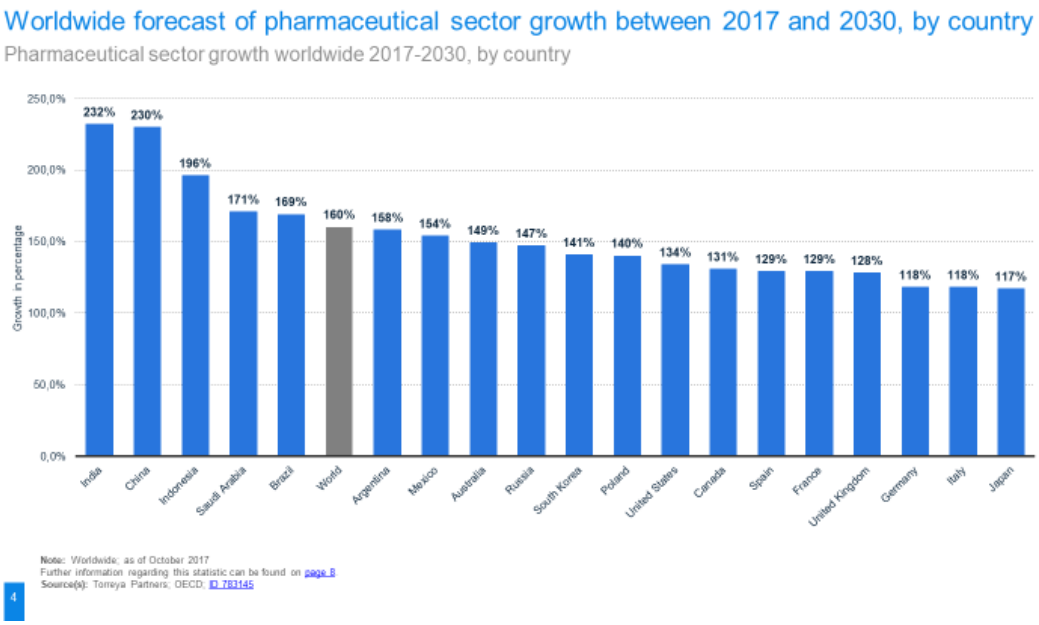
Source: Statista

Appendix 7



Source: Statista

Appendix 8



Source: Statista

Appendix 9

Results from the cross-sectional regression for India.

In the following table, the response variable is represented by the CARs for three event windows (-5; +5), (-3; +3) and (-1; +1). The estimation period of the regressions instead corresponds to 260 days prior to the 11 days event window (-265; -5). The dummy variable cross-border equals 1 when acquirer and target coincide while equals 0 otherwise. Market cap stays for the logarithm of market capitalization and is expressed in thousands $US. Beta coefficients were calculated through a linear regression model according to the estimation window already mentioned.

The sample is composed of 11 deals.

	CAR [-5; +5]		CAR [-3; +3]		CAR [-1; +1]	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept	*0,395370*	*0,493661*	*0,413262*	*0,565749*	*0,572201*	*1,425827*
Cross-border	*0,077591*	*0,556752*	*0,103022*	*0,810503*	*0,066962*	*0,958898*
Market cap	*-0,024522*	*-0,484843*	*-0,027018*	*-0,585704*	*-0,036314*	*-1,432887*
D/E ratio	*-0,001080*	*-0,643986*	*-0,001048*	*-0,685118*	*-0,001058*	*-1,259561*
Beta	*0,001963*	*0,178503*	*0,002855*	*0,284664*	*-0,001228*	*-0,222908*

, **, * indicate significance level of 10%, 5%, 1%.*

Source: own calculations

Appendix 10

Results from the cross-sectional regression for China.

In the following table, the response variable is represented by the CARs for three event windows (-5; +5), (-3; +3) and (-1; +1). The estimation period of the regressions instead corresponds to 260 days prior to the 11 days event window (-265; -5). The dummy variable cross-border equals 1 when acquirer and target coincide while equals 0 otherwise. Market cap stays for the logarithm of market capitalization and is expressed in thousands $US. Beta coefficients were calculated through a linear regression model according to the estimation window already mentioned.

The sample is composed of 56 deals.

	CAR [-5; +5]		CAR [-3; +3]		CAR [-1; +1]	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Intercept	*0,176125*	*0,613468*	*0,101556*	*0,381213*	*0,000385*	*0,002852*
Cross-border	*0,240244*	*0,016897***	*0,182710*	*2,505345***	*0,092962*	*2,516621***
Market cap	*-0,009325*	*0,714338*	*-0,003926*	*-0,201463*	*0,002422*	*0,245421*
D/E ratio	*-0,000125*	*0,571239*	*-0,000079*	*-0,467378*	*0,000032*	*0,377806*
Beta	*-0,061418*	*0,267885*	*-0,042301*	*-1,007961*	*-0,037653*	*-1,771312**

, **, * indicate significance level of 10%, 5%, 1%.*

Source: own calculations

Appendix 11

Acquirer name	Target name	Acquirer country	Target country	Domestic or Cross-border	Announced date	Deal method of payment	CAR 5 days	CAR 3 days	CAR 1 day
ABA CHEMICALS CORPORATION	AMINO CHEMICALS LTD	China	Malta	Cross-border	17/05/2017	Cash	1%	7%	2%
ABA CHEMICALS CORPORATION	SHANGHAI PUYI CHEMICAL CO., LTD	China	China	Domestic	08/12/2015	Shares	46%	42%	22%
ABBOTT LABORATORIES INC.	ALERE INC.	United States of America	United States of America	Domestic	14/04/2017	Cash	-1%	-1%	-1%
ABBOTT LABORATORIES INC.	GARDENKHILS OOO	United States of America	Russian Federation	Cross-border	23/06/2014	Cash	2%	1%	-1%
ABBOTT LABORATORIES INC.	SOLVAY PHARMA BV	United States of America	Netherlands	Cross-border	28/09/2009	Cash	10%	8%	3%
ABBVIE INC.	PHARMACYCLICS INC.	United States of America	United States of America	Domestic	04/03/2015	Cash	-5%	-7%	-6%
ACORDA THERAPEUTICS INC.	NEURONEX INC.	United States of America	United States of America	Domestic	21/12/2012	Other	-2%	-3%	0%
ADAMIS PHARMACEUTICALS CORPORATION	US COMPOUNDING INC.	United States of America	United States of America	Domestic	29/03/2016	Other	7%	5%	-8%
ADCOCK INGRAM HOLDINGS LTD	AYRTON DRUGS MANUFACTURING COMPANY LTD	South Africa	Ghana	Cross-border	23/11/2009	Cash	0%	0%	2%
ADMA BIOLOGICS INC.	BIOTEST PHARMACEUTICALS CORPORATION'S MANUFACTURING AND THERAPY-RELATED ASSETS	United States of America	United States of America	Domestic	23/01/2017	Shares	1%	2%	3%

AKORN INC.	ADVANCED VISION RESEARCH INC.	United States of America	United States of America	Domestic	03/05/2011	Cash	-11%	-5%	-9%
ALEXION PHARMACEUTICALS INC.	TALIGEN THERAPEUTICS INC.	United States of America	United States of America	Domestic	31/01/2011	Cash	-2%	-4%	-1%
ALK-ABELLO A/S	ARTU BIOLOGICALS EUROPE BV	Denmark	Netherlands	Cross-border	26/04/2010	Cash	-2%	-3%	3%
ALLERGAN PLC	AKARNA THERAPEUTICS LTD	Ireland	United Kingdom	Cross-border	20/09/2016	Other	0%	-1%	-3%
ALLERGY THERAPEUTICS PLC	TEOMED AG	United Kingdom	Switzerland	Cross-border	01/07/2010	Cash			
ALLIANCE PHARMA PLC	ASTRAZENECA UK LTD'S PALUDRINE, AVLOCLOR AND SAVARINE ANTIMALARIAL BRANDS	United Kingdom	United Kingdom	Domestic	02/08/2012	Cash	-2%	1%	2%
ALLIANCE PHARMA PLC	SINCLAIRIS PHARMA PLC'S NON-AESTHETICS BUSINESS	United Kingdom	United Kingdom	Domestic	26/11/2015	Other	-10%	-5%	-6%
ALMIRALL SA	AQUA PHARMACEUTICALS LLC	Spain	United States of America	Cross-border	17/12/2013	Other	7%	4%	4%
ALMIRALL SA	POLI GROUP HOLDING SRL	Spain	Italy	Cross-border	30/11/2015	Other	4%	5%	2%
AMAG PHARMACEUTICALS INC.	LUMARA HEALTH INC.	United States of America	United States of America	Domestic	29/09/2014	Other	41%	40%	38%
AMGEN INC.	ALANTOS PHARMACEUTICALS HOLDING INC.	United States of America	United States of America	Domestic	06/06/2007	Cash	10%	6%	4%

AMGEN INC.	BIOVEX INC.	United States of America	United States of America	Domestic	24/01/2011	Other	0%	-1%	0%
AMGEN INC.	MUSTAFA NEVZAT ILAÇ SANAYII AS	United States of America	Turkey	Cross-border	25/04/2012	Cash	3%	3%	2%
ANI PHARMACEUTICALS INC.	WELLSPRING PHARMA SERVICES INC.	United States of America	Canada	Cross-border	07/08/2018	Cash	-18%	-15%	-13%
APELOA CO., LTD	ZHEJIANG APELOA KANGYU DRUG CO., LTD	China	China	Domestic	13/02/2012	Shares	-9%	-6%	-4%
ARALEZ PHARMACEUTICALS INC.	TRIBUTE PHARMACEUTICALS CANADA INC.	Canada	Canada	Domestic	08/06/2015	Shares	43%	18%	16%
ASPEN PHARMACARE HOLDINGS LTD	GLAXOSMITHKLINE PLC'S ARIXTRA & FRAXIPARINE DRUG BRANDS	South Africa	United Kingdom	Cross-border	30/09/2013	Cash			
ASTELLAS PHARMA INC.	OGEDA SA/NV	Japan	Belgium	Cross-border	03/04/2017	Other	1%	-1%	0%
ASTELLAS PHARMA INC.	PERSEID THERAPEUTICS LLC	Japan	United States of America	Cross-border	17/03/2011	Cash	0%	-1%	-2%
ASTRAZENECA PLC	ACERTA PHARMA BV	United Kingdom	Netherlands	Cross-border	17/12/2015	Other	0%	-1%	-2%
BAYER AG	MERCK & COMPANY INC.'S CONSUMER HEALTH BUSINESS	Germany	Germany	Domestic	06/05/2014	Other	2%	0%	0%
BEIJING LEADMAN BIOCHEMISTRY CO., LTD	DIASYS DIAGNOSTIC PRODUCTS (SHANGHAI) CO., LTD	China	China	Domestic	18/09/2014	Other	0%	0%	0%

BEIJING TIANTAN BIOLOGICAL PRODUCTS CORPORATION LTD	CHENGDU RONGSHENG PHARMACEUTICALS CO., LTD	China	China	Domestic	23/06/2008	Cash	-18%	-2%	2%
BIO-GATE AG	BIOEPIDERM GMBH	Germany	Germany	Domestic	20/04/2016	Shares	15%	12%	9%
BIOMARIN PHARMACEUTICAL INC.	ZACHARON PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	07/01/2013	Other	1%	-2%	-2%
BIOMARIN PHARMACEUTICAL INC.	ZYSTOR THERAPEUTICS INC.	United States of America	United States of America	Domestic	17/08/2010	Other	-5%	0%	0%
BIOTON SA	BIOPARTNERS HOLDINGS AG	Poland	Switzerland	Cross-border	09/03/2007	Cash	-9%	-6%	-4%
BIOTON SA	SCIGEN LTD	Poland	Singapore	Cross-border	29/04/2010	Shares	2%	2%	7%
BIOXYNE LTD	GLOBAL TREASURE NEW ZEALAND LTD	Australia	New Zealand	Cross-border	19/04/2017	Shares	-19%	-10%	-5%
BLACKMORES LTD	FIT-BIOCEUTICALS LTD	Australia	Australia	Domestic	02/07/2012	Other	8%	4%	4%
BOIRON SA	LABORATOIRE FERRIER SARL	France	France	Domestic	08/02/2017	Cash	-5%	-6%	-3%
BORA PHARMACEUTICALS CO., LTD	IMPAX LABORATORIES TAIWAN INC.	Taiwan	Taiwan	Domestic	19/12/2017	Cash	12%	15%	10%
BRISTOL-MYERS SQUIBB COMPANY	AMYLIN PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	29/06/2012	Cash	21%	15%	7%
BRISTOL-MYERS SQUIBB COMPANY	ZYMOGENETICS INC.	United States of America	United States of America	Domestic	07/09/2010	Cash	37%	24%	9%

BTG PLC	NORDION INC.'S TARGETED THERAPIES BUSINESS	United Kingdom	Canada	Cross-border	23/05/2013	Cash	-10%	-5%	-2%
BTG PLC	PROTHERICS PLC	United Kingdom	United Kingdom	Domestic	18/09/2008	Shares	17%	9%	3%
BYOTROL PLC	WINCHPHARMA (CONSUMER HEALTHCARE) LTD	United Kingdom	United Kingdom	Domestic	13/03/2017	Cash	8%	4%	2%
CADILA HEALTHCARE LTD	LIVE HEALTHCARE PVT LTD	India	India	Domestic	16/03/2007	Cash	-5%	-6%	-4%
CELLTRION PHARM INC.	HANSEO PHARM. CO., LTD	Republic of Korea	Republic of Korea	Domestic	21/05/2009	Shares	18%	14%	7%
CHEMESIS INTERNATIONAL INC.	DESERT ZEN	Canada	United States of America	Cross-border	13/08/2018	Shares	22%	12%	5%
CHINA RESOURCES DOUBLE-CRANE PHARMACEUTICAL CO., LTD	CHINA RESOURCES SAIKE PHARMACEUTICAL CO., LTD	China	China	Domestic	20/04/2015	Cash	9%	6%	2%
CHINA RESOURCES SANJIU MEDICAL & PHARMACEUTICAL CO., LTD	SANJIU HUANGSHI PHARMACEUTICAL CORPORATION	China	China	Domestic	30/04/2009	Cash	5%	3%	1%
CHINA RESOURCES SANJIU MEDICAL AND PHARMACEUTICAL CO., LTD	KUNMING SHENGHUO PHARMACEUTICAL (GROUP) CO., LTD	China	China	Domestic	27/07/2016	Other	4%	2%	0%
CHONGQING LUMMY PHARMACEUTICAL CO., LTD	SICHUAN HYGIEN PHARMACEUTICAL CO., LTD	China	China	Domestic	09/02/2011	Cash	9%	6%	2%

CLINIGEN GROUP PLC	QUANTUM PHARMA PLC	United Kingdom	United Kingdom	Domestic	13/09/2017	Cash	22%	14%	6%
CLINUVEL PHARMACEUTICALS LTD	VALLAURIX PTE LTD	Australia	Singapore	Cross-border	01/05/2018	Shares	17%	12%	6%
CRESO PHARMA LTD	KUNNA CANADA LTD	Australia	Canada	Cross-border	18/12/2017	Cash	83%	53%	23%
CYTODYN INC.	PROSTAGENE LLC	United States of America	United States of America	Domestic	28/08/2018	Shares	0%	0%	0%
DA AN GENE CO., LTD of SUN YAT-SEN UNIVERSITY	ZHONGSHAN BIO-TECH CO., LTD	China	China	Domestic	12/01/2007	Cash	-1%	-2%	-1%
DIL LTD	FERMENTA BIOTECH LTD	India	India	Domestic	24/11/2017	Cash	21%	14%	6%
EISAI CO., LTD	SANKO JUNYAKU CO., LTD	Japan	Japan	Domestic	26/04/2007	Shares	-14%	-7%	-3%
ELI LILLY AND COMPANY	NOVARTIS TIERGESUNDHEIT AG	United States of America	Switzerland	Cross-border	22/04/2014	Cash	34%	23%	12%
ELI LILLY AND COMPANY	SGX PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	08/07/2008	Cash	28%	19%	8%
EMERGENT BIOSOLUTIONS INC.	VAXGEN INC'S ANTHRAX VACCINNE ASSETS	United States of America	United States of America	Domestic	05/05/2008	Other	-5%	-1%	3%
FAES FARMA SA	LABORATORIOS DIAFARM SA	Spain	Spain	Domestic	09/06/2017	Other	-17%	-14%	-7%
FUAN PHARMACEUTICAL (GROUP) CO., LTD	YANTAI JUSTAWARE PHARMACEUTICAL CO., LTD	China	China	Domestic	21/12/2015	Cash	11%	10%	6%
FUJIAN COSUNTER PHARMACEUTICAL CO., LTD	JIANGSU ZHONGXING PHARMACEUTICAL CO., LTD	China	China	Domestic	08/06/2018	Cash	0%	0%	0%

FUREN PHARMACEUTICAL GROUP INDUSTRY CO., LTD	KAIFENG PHARMACEUTICAL (GROUP) CO., LTD	China	China	Domestic	22/12/2015	Shares	25%	18%	8%
FUTURECHEM CO., LTD	KAI HEALTH CARE CO., LTD	Republic of Korea	Republic of Korea	Domestic	07/09/2017	Cash	1%	1%	0%
GENMAB A/S	PDL BIOPHARMA INC'S BROOKLYN PARK, MINNESOTA-BASED ANTIBODY MANUFACTURING FACILITY	Denmark	United States of America	Cross-border	21/02/2008	Cash	17%	8%	1%
GENOMMA LAB INTERNACIONAL SAB DE CV	SHEFFIELD PHARMACEUTICALS LLC'S CHERACOLD AND ROSE MILK BRANDS	Mexico	United States of America	Cross-border	14/06/2018	Cash	-32%	-20%	-8%
GENOMMA LAB INTERNACIONAL SAB DE CV	VANART SHAMPOO PRODUCTS BRAND	Mexico	Mexico	Domestic	28/01/2011	Other	19%	10%	3%
GILEAD SCIENCES INC.	CALISTOGA PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	22/02/2011	Other	-4%	-4%	-2%
GILEAD SCIENCES INC.	NAVITAS ASSETS LLC'S CICLETANINE BUSINESS ASSETS	United States of America	United States of America	Domestic	29/05/2008	Other	22%	14%	7%
GLAXOSMITHKLINE PLC	NOVARTIS AG'S VACCINE BUSINESS	United Kingdom	Switzerland	Cross-border	22/04/2014	Cash	25%	15%	7%
GLAXOSMITHKLINE PLC	RELIANT PHARMAC	United Kingdom	United States of America	Cross-border	21/11/2007	Cash			

	EUTICALS INC.								
GONGWIN BIOPHARM HOLDINGS CO., LTD	GONGWIN BIOPHARMA CO., LTD	Cayman Islands	Taiwan	Cross-border	10/07/2018	Cash	1%	1%	0%
GRIFOLS SA	TALECRIS BIOTHERAPEUTICS HOLDINGS CORPORATION	Spain	United States of America	Cross-border	07/06/2010	Other	-1%	-3%	-4%
GRINDEKS AS	HBM PHARMA SRO	Latvia	Slovakia	Cross-border	29/05/2014	Other	-3%	-2%	-1%
GUANGDONG JIAYING PHARMACEUTICAL CO., LTD	HUNAN JINSA PHARMACEUTICAL CO., LTD	China	China	Domestic	18/02/2013	Shares	14%	9%	2%
GUANGDONG TAIANTANG PHARMACEUTICAL CO., LTD	FUSONG TAIANTANG CHANGBAI SHAN GINSENG INDUSTRY PARK CO., LTD	China	China	Domestic	01/11/2014	Cash	18%	12%	5%
GUANGDONG TAIANTANG PHARMACEUTICAL CO., LTD	SHANGHAI JINPIBAO PHARMACEUTICAL CO., LTD	China	China	Domestic	13/07/2011	Cash	8%	5%	2%
GUANGDONG VTR BIO-TECH CO., LTD	WORLD-WAY BIOTECH INC.	China	China	Domestic	11/04/2018	Cash	-6%	-3%	-1%
GUANGDONG ZHONGSHENG PHARMACEUTICAL CO., LTD	GUANGDONG XIANQIANG PHARMACEUTICAL CO., LTD	China	China	Domestic	24/03/2015	Cash	0%	0%	0%

GUANGYUYUAN CHINESE HERBAL MEDICINE CO., LTD	SHANXI GUANGYUYUAN TRADITIONAL CHINESE MEDICINE CO., LTD	China	China	Domestic	24/02/2016	Shares	16%	10%	4%
GUILIN SANJIN PHARMACEUTICAL CO., LTD	SANJIN GROUP HUNAN SANJIN PHARMACEUTICAL CO., LTD	China	China	Domestic	18/05/2012	Cash	-31%	-21%	-9%
GUIZHOU XINBANG PHARMACEUTICAL CO., LTD	JIANGSU JIANMIN PHARMACEUTICAL CO., LTD	China	China	Domestic	31/07/2012	Cash	16%	7%	4%
HEBEI CHANGSHAN BIOCHEMICAL PHARMACEUTICAL CO., LTD	CHANGSHAN BIOCHEM PHARM (JIANGSU) CO., LTD	China	China	Domestic	28/11/2017	Cash	-1%	0%	0%
HENAN TALOPH PHARMACEUTICAL STOCK CO., LTD	HANGZHOU TONGJUNTANG MEDICINE HERBS CO., LTD	China	China	Domestic	25/06/2014	Cash	10%	6%	2%
HENGKANG MEDICAL GROUP CO., LTD	SICHUAN FUHUI MEDICINE CO., LTD	China	China	Domestic	26/11/2014	Cash	7%	4%	2%
HIKMA PHARMACEUTICALS PLC	BEDFORD LABORATORIES'S ASSETS	United Kingdom	United States of America	Cross-border	28/05/2014	Cash	9%	6%	2%
HIKMA PHARMACEUTICALS PLC	ROXANE LABORATORIES INC.	United Kingdom	United States of America	Cross-border	28/07/2015	Shares			
HORIZON PHARMA PLC	CREALTA HOLDINGS LLC	Ireland	United States of America	Cross-border	11/12/2015	Cash	12%	6%	2%

HUBEI MINKANG PHARMACEUTICAL LTD	HBMK PHARMACEUTICAL LTD	United States of America	Virgin Islands (British)	Cross-border	08/07/2011	Shares	50%	32%	14%
HYPERMARCAS SA	LUPER INDUSTRIA FARMACÊUTICA LTDA	Brazil	Brazil	Domestic	19/04/2010	Other	6%	2%	-1%
IBEX TECHNOLOGIES INC.	BIO-RESEARCH PRODUCTS INC.	Canada	United States of America	Cross-border	02/01/2013	Cash	29%	18%	8%
INCYTE CORPORATION	ARIAD PHARMACEUTICALS (LUXEMBOURG) SARL	United States of America	Luxembourg	Cross-border	09/05/2016	Cash	0%	-2%	0%
INDUSTRI JAMU DAN FARMASI SIDO MUNCUL TBK, PT	BERLICO MULIA FARMA, PT	Indonesia	Indonesia	Domestic	06/11/2017	Cash	8%	6%	3%
INNOVUS PHARMACEUTICALS INC.	2464573 ONTARIO INC.'S SUPPLEMENTHUNT.COM'S ASSETS	United States of America	United States of America	Domestic	14/12/2018	Cash	43%	26%	10%
INNOVUS PHARMACEUTICALS INC.	NOVALERE FP INC.	United States of America	United States of America	Domestic	04/02/2015	Shares	13%	7%	4%
INNOVUS PHARMACEUTICALS INC.	SEMPRAE LABORATORIES INC.	United States of America	United States of America	Domestic	30/12/2013	Shares	93%	60%	26%
IPCA LABORATORIES LTD	TONIRA PHARMA LTD	India	India	Domestic	17/09/2011	Shares	-1%	0%	0%
IPSEN SA	MERRIMACK PHARMACEUTICALS INC.'S GLOBAL ONCOLOGY ASSETS	France	United States of America	Cross-border	08/01/2017	Cash	26%	19%	10%

JAZZ PHARMACEUTICALS PLC	EUSA PHARMA INC.	Ireland	United States of America	Cross-border	26/04/2012	Other			
JAZZ PHARMACEUTICALS PLC	GENTIUM SPA	Ireland	Italy	Cross-border	19/12/2013	Cash	23%	15%	6%
JI YAO HOLDING GROUP CO., LTD	CHANGCHUN PUHUA PHARMACEUTICAL CO., LTD	China	China	Domestic	13/09/2018	Cash	-8%	-6%	-2%
JIANGXI BOYA BIO-PHARMACEUTICAL CO., LTD	NANJING XINBAI PHARMACEUTICAL CO., LTD	China	China	Domestic	15/08/2015	Shares	27%	17%	7%
JIANGZHONG PHARMACEUTICAL CO., LTD	JIANGXI DONGFENG PHARMACEUTICAL CO., LTD	China	China	Domestic	20/08/2009	Other	21%	12%	5%
JILIN ZIXIN PHARMACEUTICAL INDUSTRIAL CO., LTD	JILIN CAOHUANDAN PHARMACEUTICAL INDUSTRIAL CO., LTD	China	China	Domestic	05/11/2008	Cash	87%	56%	27%
JIUZHITANG CO., LTD	MUDANJIANG YOUBO PHARMACEUTICAL CO., LTD	China	China	Domestic	26/06/2015	Shares	29%	19%	8%
JOHNSON & JOHNSON	OMRIX BIOPHARMACEUTICALS INC.	United States of America	United States of America	Domestic	24/11/2008	Cash	-2%	-2%	-1%
KANGMEI PHARMACEUTICAL CO., LTD	SHENZHEN IEMAN PHARMACEUTICAL CO., LTD	China	China	Domestic	30/09/2016	Other	-1%	1%	1%
KARO PHARMA AB	BIOPHAUSIA AB	Sweden	Sweden	Domestic	01/11/2016	Cash	-6%	-1%	1%
KARO PHARMA AB	WEIFA ASA	Sweden	Norway	Cross-border	24/08/2017	Cash	-14%	-14%	-12%

KRKA DD	TAD PHARMA GMBH	Slovenia	Germany	Cross-border	09/11/2007	Cash	-3%	-7%	-2%
KUNMING PHARMACEUTICAL CORPORATION	KUNMING CHINESE MEDICINE FACTORY CO., LTD	China	China	Domestic	04/07/2008	Cash	1%	3%	4%
KYOWA HAKKO KIRIN CO., LTD	PROSTRAKAN GROUP PLC	Japan	United Kingdom	Cross-border	21/02/2011	Cash	-1%	-1%	0%
LIGAND PHARMACEUTICALS INC.	NEUROGEN CORPORATION	United States of America	United States of America	Domestic	24/08/2009	Shares	-24%	-13%	-11%
MERCK & COMPANY INC.	CUBIST PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	08/12/2014	Other	-4%	-2%	-2%
MERCK & COMPANY INC.	INSPIRE PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	05/04/2011	Cash	1%	0%	0%
MERCK KGAA	MERCK SERONO SA	Germany	Switzerland	Cross-border	21/03/2007	Cash	2%	2%	1%
MIDSONA AB	BIO-VITA OY	Sweden	Finland	Cross-border	11/02/2011	Other	17%	14%	14%
MIDSONA AB	BRINGWELL AB	Sweden	Sweden	Domestic	15/05/2017	Cash	-2%	4%	4%
MYLAN NV	ABBOTT LABORATORIES INC.'S NON-US DEVELOPED MARKETS SPECIALITY AND BRANDED GENERICS BUSINESS IN EUROPE	Netherlands	United States of America	Cross-border	14/07/2014	Shares			
NICHI-IKO PHARMACEUTICAL CO., LTD	SAGENT PHARMACEUTICALS INC.	Japan	United States of America	Cross-border	11/07/2016	Cash	5%	3%	-5%
NORTH CHINA PHARMACEUTICAL CO., LTD	NCPC CREATE PHARMACEUTICAL CO., LTD	China	China	Domestic	28/01/2010	Cash	-5%	-2%	4%

NOVARTIS AG	GLAXOSMITHKLINE PLC'S ONCOLOGY PRODUCTS UNIT	Switzerland	United Kingdom	Cross-border	22/04/2014	Cash	-4%	-3%	-1%
ONCOLYTICS BIOTECH INC.	PRIVATECO	Canada	Canada	Domestic	09/04/2009	Shares	15%	8%	3%
ORASURE TECHNOLOGIES INC.	DNA GENOTEK INC.	United States of America	Canada	Cross-border	25/07/2011	Cash	-3%	-2%	-8%
OXFORD IMMUNOTEC GLOBAL PLC	IMMUNETICS INC.	United Kingdom	United States of America	Cross-border	12/10/2016	Cash	0%	1%	-2%
PAION AG	CENES PHARMACEUTICALS PLC	Germany	United Kingdom	Cross-border	10/04/2008	Shares	-3%	-1%	-2%
PERRIGO COMPANY PLC	ELAN CORPORATION PLC	Ireland	Ireland	Domestic	29/07/2013	Shares	-1%	-2%	-2%
PFIZER INC.	ASTRAZENECA PLC'S SMALL MOLECULE ANTIBIOTICS BUSINESS	United States of America	United Kingdom	Cross-border	24/08/2016	Other	1%	2%	2%
PFIZER INC.	HOSPIRA INC.	United States of America	United States of America	Domestic	05/02/2015	Other	8%	6%	4%
PFIZER INC.	KING PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	12/10/2010	Cash	-1%	0%	0%
PFIZER INC.	NEXTWAVE PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	22/10/2012	Other	1%	1%	0%
PIRAMAL ENTERPRISES LTD	ASH STEVENS INC.	India	United States of America	Cross-border	16/08/2016	Cash	22%	26%	15%
PROMETIC LIFE SCIENCES INC.	TELESTA THERAPEUTICS INC.	Canada	Canada	Domestic	24/08/2016	Shares	-6%	-1%	7%

QUIDEL CORPORATION	BIOHELIX CORPORATION	United States of America	United States of America	Domestic	06/05/2013	Other	10%	14%	10%
RECIPHARM AB	SANOFI SA'S ASSETS AND BUSINESS IN HOLMES CHAPEL	Sweden	United Kingdom	Cross-border	13/06/2018	Other	7%	3%	8%
SANOFI SA	BIOVERATIV INC.	France	United States of America	Cross-border	22/01/2018	Cash	-1%	-1%	-3%
SANOFI-AVENTIS SA	MERIAL LTD	France	United States of America	Cross-border	30/07/2009	Cash	-2%	-1%	-4%
SANTEN PHARMACEUTICAL CO., LTD	MERCK & COMPANY INC.'S OPHTHALMOLOGY BUSINESS IN JAPAN	Japan	Japan	Domestic	13/05/2014	Cash	16%	13%	11%
SCHERING-PLOUGH CORPORATION	MERCK & COMPANY INC.	United States of America	United States of America	Domestic	09/03/2009	Shares	33%	32%	21%
SCHERING-PLOUGH CORPORATION	ORGANON BIOSCIENCES NV	United States of America	Netherlands	Cross-border	12/03/2007	Cash	2%	1%	2%
SHAANXI KANGHUI PHARMACEUTICAL CO., LTD	SHAANXI XINGAOXIN MEDICINE CO., LTD	China	China	Domestic	25/09/2018	Cash	2%	-1%	2%
SHANDONG JINCHENG PHARMACEUTICAL CO., LTD	BEIJING LANEVA PHARMACEUTICAL CO., LTD	China	China	Domestic	15/05/2015	Shares	56%	37%	19%
SHANDONG JINCHENG PHARMACEUTICAL CO., LTD	SHANGHAI JINCHENG PHARMACEUTICAL CO., LTD	China	China	Domestic	21/02/2017	Cash	5%	3%	0%
SHANDONG XINHUA PHARMACEUTICAL CO., LTD	ZIBO XINHUA PHARMACEUTICAL DESIGN	China	China	Domestic	24/07/2009	Cash	7%	2%	8%

	INSTITUTE CO., LTD								
SHANGHAI HILE BIO-TECHNOLOGY CO., LTD	SHANGHAI JIEMEN BIOTECHNOLOGY CO., LTD	China	China	Domestic	01/06/2018	Cash	10%	0%	-9%
SHANGHAI KAIBAO PHARMACEUTICAL CO., LTD	SHANGHAI KAIBAO XINYI (XINXIANG) PHARMACEUTICAL CO., LTD	China	China	Domestic	19/04/2018	Cash	-1%	1%	-3%
SHANGHAI KEHUA BIOENGINEERING CO., LTD	SHANGHAI KEHUA BIOTECHNOLOGY CO., LTD	China	China	Domestic	11/06/2008	Other	-10%	-8%	-8%
SHANGHAI RAAS BLOOD PRODUCTS CO., LTD	BANGHE PHARMACEUTICAL CO., LTD	China	China	Domestic	02/07/2013	Shares	-3%	3%	5%
SHANGHAI RAAS BLOOD PRODUCTS CO., LTD	TONROL BIOPHARMACEUTICAL CO., LTD	China	China	Domestic	22/11/2016	Cash	-2%	-2%	-1%
SHENZHEN HEPALINK PHARMACEUTICAL CO., LTD	SHANDONG RUISHENG BIOLOGICAL TECHNOLOGY CO., LTD	China	China	Domestic	29/03/2016	Other	9%	6%	0%
SHIONOGI & CO., LTD	SCIELE PHARMA INC.	Japan	United States of America	Cross-border	01/09/2008	Cash	1%	0%	-2%
SORRENTO THERAPEUTICS INC.	IGDRASOL INC.	United States of America	United States of America	Domestic	10/09/2013	Shares	-7%	1%	16%
SORRENTO THERAPEUTICS INC.	SCILEX PHARMACEUTICALS INC.	United States of America	United States of America	Domestic	08/08/2016	Shares	21%	11%	12%

STADA ARZNEIMITTEL AG	THORNTON & ROSS LTD	Germany	United Kingdom	Cross-border	16/08/2013	Other	6%	5%	6%
STAIDSON (BEIJING) BIOPHARMACEUTICALS CO., LTD	BEIJING NUOWEIKANG MEDICAL TECHNOLOGY CO., LTD	China	China	Domestic	05/09/2012	Cash	-25%	-3%	1%
STRIDES ARCOLAB LTD	ASCENT PHARMAHEALTH LTD	India	Australia	Cross-border	29/03/2011	Cash	5%	6%	12%
STRIDES ARCOLAB LTD	GRANDIX PHARMACEUTICALS LTD	India	India	Domestic	11/06/2007	Cash	3%	9%	-2%
STRIDES ARCOLAB LTD	SHASUN PHARMACEUTICALS LTD	India	India	Domestic	29/09/2014	Shares	-7%	-3%	-3%
SUMITOMO CORPORATION	C & O PHARMACEUTICAL TECHNOLOGY (HOLDINGS) LTD	Japan	Bermuda	Cross-border	31/08/2011	Cash	-1%	3%	5%
SUN PHARMACEUTICAL INDUSTRIES LTD	BIOSINTEZ OAO	India	Russian Federation	Cross-border	23/11/2016	Other	5%	3%	-1%
SUN PHARMACEUTICAL INDUSTRIES LTD	CARACO PHARMACEUTICAL LABORATORIES LTD	India	United States of America	Cross-border	22/02/2011	Cash	11%	0%	-2%
SUNZEN BIOTECH BHD	ECOLITE BIOTECH MANUFACTURING SDN BHD	Malaysia	Malaysia	Domestic	26/01/2018	Shares	-3%	-1%	4%
SYNERGY CHC CORPORATION	BREAKTHROUGH PRODUCTS INC.	United States of America	United States of America	Domestic	16/11/2015	Shares	19%	17%	25%
SYNERGY CHC CORPORATION	PER-FEKT BEAUTY HOLDINGS LLC'S ASSETS	United States of America	United States of America	Domestic	22/06/2017	Shares	-14%	-7%	-11%

TAKEDA PHARMACEUTICAL CO., LTD	SHIRE PLC	Japan	United Kingdom	Cross-border	08/05/2018	Shares	-4%	2%	0%
TELIGENT INC.	ALVEDA PHARMACEUTICALS INC.'S ASSETS	United States of America	Canada	Cross-border	13/10/2015	Cash	11%	13%	9%
TEVA PHARMACEUTICAL INDUSTRIES LTD	NUPATHE INC.	Israel	United States of America	Cross-border	21/01/2014	Other	9%	4%	7%
TEVA PHARMACEUTICAL INDUSTRIES LTD	RATIOPHARM GMBH	Israel	Germany	Cross-border	18/03/2010	Cash	3%	3%	1%
TIANJIN CHASE SUN PHARMACEUTICAL CO., LTD	BEIJING TCMAGES PHARMACEUTICAL CO., LTD	China	China	Domestic	29/03/2012	Cash	-6%	-12%	-6%
TIBET RHODIOLA PHARMACEUTICAL CO., LTD	TOPRIDGE PHARMA LTD	China	Hong Kong	Cross-border	13/02/2018	Cash	-13%	-4%	-4%
TPI ENTERPRISES LTD	VISTIN PHARMA ASA'S OPIOIDS AND TABLET MANUFACTURING BUSINESS	Australia	Norway	Cross-border	11/07/2017	Cash	39%	22%	24%
TRINITY BIOTECH PLC	PHOENIX BIOTECH CORPORATION	Ireland	Canada	Cross-border	02/02/2011	Other	-6%	-3%	1%
UCB SA	SCHWARZ PHARMA AG	Belgium	Germany	Cross-border	22/03/2007	Cash	-5%	-5%	-4%
VALNEVA SE	CRUCELL SWEDEN AB	France	Sweden	Cross-border	05/01/2015	Cash	-9%	-6%	-3%

VCANBIO CELL & GENE ENGINEERING CORPORATION LTD	SHANGHAI AOYUAN MEDICAL PRODUCT CO., LTD	China	China	Domestic	05/01/2018	Shares	1%	0%	0%
VECTURA GROUP PLC	SKYEPHARMA PLC	United Kingdom	United Kingdom	Domestic	16/03/2016	Shares	0%	-4%	0%
VIVIMED LABS LTD	UNION QUIMICO FARMACEUTICA SA	India	Spain	Cross-border	01/12/2011	Cash	-12%	3%	7%
WALVAX BIOTECHNOLOGY CO., LTD	HEBEI DA'AN PHARMACEUTICAL CO., LTD	China	China	Domestic	12/07/2013	Cash	4%	0%	2%
WALVAX BIOTECHNOLOGY CO., LTD	SHANGHAI ZERUN BIOTECH CO., LTD	China	China	Domestic	02/11/2015	Shares	-3%	-2%	-1%
WOCKHARDT LTD	NEGMA LERADS SAS	India	France	Cross-border	03/05/2007	Cash	2%	2%	-1%
XIAMEN KINGDOMWAY GROUP CO., LTD	INNER MONGOLIA JINDAWEI PHARMACEUTICAL CO., LTD	China	China	Domestic	19/03/2013	Cash	5%	5%	13%
YABAO PHARMACEUTICAL GROUP CO., LTD	PHARMACEUTICAL FACTORY of BEIJING UNIVERSITY of CHINESE MEDICINE	China	China	Domestic	31/03/2010	Cash	1%	5%	7%
YABAO PHARMACEUTICAL GROUP CO., LTD	SHANGHAI QINGSONG PHARMACEUTICAL CO., LTD	China	China	Domestic	22/09/2016	Cash	-1%	0%	1%
YSP SOUTHEAST ASIA HOLDING BHD	ALPHA ACTIVE INDUSTRIES SDN BHD	Malaysia	Malaysia	Domestic	26/05/2017	Cash	4%	4%	2%

YSP SOUTHEAST ASIA HOLDING BHD	YSP INDUSTRIES (M) SDN BHD	Malaysia	Malaysia	Domestic	13/10/2008	Other	4%	4%	4%
YUNNAN BAIYAO GROUP CO., LTD	YUNNAN PHYTOPHARMACEUTICAL CO., LTD	China	China	Domestic	30/12/2008	Cash	-1%	-1%	1%
ZERIA PHARMACEUTICAL CO., LTD	PHARMACEUTICAL JOINT STOCK COMPANY of FEBRUARY 3RD	Japan	Vietnam	Cross-border	30/06/2016	Cash	5%	-4%	-2%
ZHEJIANG HISOAR PHARMACEUTICAL CO., LTD	ZHEJIANG HISOAR CHUANNAN PHARMACEUTICAL CO., LTD	China	China	Domestic	30/08/2018	Cash	5%	5%	1%
ZHEJIANG JIUZHOU PHARMACEUTICAL CO., LTD	ZHEJIANG RUIBO PHARMACEUTICAL CO., LTD	China	China	Domestic	01/07/2016	Cash	1%	3%	-1%
ZHEJIANG XIANJU PHARMACEUTICAL CO., LTD	EFFECHEM SRL	China	Italy	Cross-border	20/06/2017	Cash	10%	2%	4%
ZHEJIANG YATAI PHARMACEUTICAL CO., LTD	SHAOXING XINGYA PHARMACEUTICAL CO., LTD	China	China	Domestic	15/09/2017	Cash	-4%	-2%	-1%

Source: Statista