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Mega Acquisition in the Pharmaceutical Industry: Analysis of the Industry Rivals' Wealth Effects in the Pfizer – Wyeth Case

Advisor:
Lars Oxelheim

Authors:
Kamile Gimbutaite
Pavel Stanev

Abstract

Title:	Mega acquisition in the pharmaceutical industry: analysis of the industry rivals' wealth effects in the Pfizer – Wyeth case
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Authors:	Kamile Gimbutaite and Pavel Stanev
Advisor:	Lars Oxelheim
Key words:	Mergers and acquisitions, abnormal returns, industry rivals, firm specific characteristics, cash holdings, profitability.
Purpose:	Examination of the post-announcement abnormal returns of the industry rivals and the firm specific characteristics in order to identify which of them determine the post-announcement wealth effects and in which way.
Methodology:	A quantitative approach combining an event study and a linear multiple regression analysis was employed.
Theoretical perspectives:	Seven theories in the finance literature explaining the stock price movements of the rivals were identified. Combining one of them, the Acquisition Probability Hypothesis, with the efficient market hypothesis and linked to the current industry dynamics, potential acquisition targets among the rivals can be identified.
Empirical Foundation:	The Pfizer acquisition of Wyeth in 2009 and the pharmaceutical industry rivals' firm specific characteristics have been studied empirically to obtain the data needed.
Conclusion:	Industry rivals have experienced positive abnormal returns following the announcement of the Pfizer – Wyeth acquisition, supporting the Acquisition Probability Hypothesis, but negative abnormal returns following the closure of the deal, supporting the Productive Efficiency Theory. Significant determinants of the wealth effects of the rivals were found to be cash holdings, influencing the abnormal returns positively, as well as profitability, long-term prospects of R&D and sector of operations, influencing the abnormal returns negatively.

Contents

1. Introduction

In the first chapter we start by introducing the reader to the foundations of this paper: we specify and discuss the problem, justify the choice of the case, provide an overview of the deal in focus, as well as present the purpose and the relevance of the master thesis.

1.1 Background and Problem Discussion

Horizontal mergers and acquisitions (M&A) affect industry rivals in different ways. Depending on the industry dynamics, motives and characteristics of the transaction, they can be either value increasing or decreasing for the competitors (Gaughan, 2011). From the rivals' point of view, horizontal mergers and acquisitions can be seen as a threat disturbing the balance of competitive power (Telser, 1966; Stigler, 1964; Eckbo and Wier, 1985), an example of efficiency improvement possibilities (Farrell, 1957; Snyder, 1996; Shahrur, 2005), a signal of a potential M&A wave within the industry (Song and Walkling, 2000), or an alteration of the relations with suppliers and customers (Galbraith, 1952). Efficient markets react to the acquisition announcements immediately and changes of the rivals' stock prices following the acquisition announcement reflect the effect of the transaction on the rivals perceived by the market (Fama et al., 1969). However, not all of the competitors are affected equally and thus some of the companies experience a large appreciation of their stock price, while other competitors' stock prices react only marginally (Schmitz, 2008). Moreover, it is not uncommon to observe totally different directions of the rivals' stock price movements. Thus the question of interest is, why do rivals in the same industry experience different stock price reactions to the same transaction? Furthermore, which companies react positively and which negatively? Which companies experience a strong stock price reaction and which only marginal? Finally, what determines these differences and is there a particular pattern?

No conclusions regarding where do these differences in the reactions come from can be drawn by looking solely at the stock price movements of the rivals. Finance literature and previous research suggest several theories explaining the particular direction of the wealth effects of the rivals, but they still do not address the differences in the strength of the reactions within the portfolio of the competitors (see Literature overview in Chapter 2). Thus we argue that it must be the firm specific characteristics that contribute to determining which direction and

how strongly any particular company is affected by the acquisition in the industry (MacKinlay, 1997).

As we discuss in the literature overview, previous research has mostly focused on the wealth effects of bidders and targets following the M&A transactions, while it has been less extensive regarding rival companies. Moreover, we were not able to find any studies examining determinants of the rivals' wealth effects in the field of our interest – the pharmaceutical industry. Therefore, in this master thesis we address the above raised questions by examining the rivals' wealth effects in the specific case of Pfizer – Wyeth acquisition in 2009.

1.2 The Choice of the Examined Case

Pharmaceutical industry is particularly suitable for an M&A study. First of all, it is global and engages in M&A activity extensively, both historically and forecast in the future (KPMG, 2011), since there is an inherent incentive for companies to engage in M&As in order to either complement or substitute for early stage research, as we discuss in Chapter 3. Therefore, the findings of a case study in this industry can be applicable in similar M&A cases. Secondly, due to industry specific factors discussed also in the Chapter 3, the market reacts very efficiently to all kinds of events and announcements in this industry, such as drug approvals, collaboration agreements, as well as M&As. Therefore, it allows for an examination of the abnormal returns experienced by the industry players. Finally, due to high Research and Development (R&D) intensity of the industry, it is possible to test specific factors that might determine the abnormal returns, contributing to previous research, which has so far examined several common and mostly financial characteristics such as size, leverage, valuation effects, etc.

We have chosen to examine the effect of a single acquisition announcement primarily following previous studies by Schmitz (2008) on abnormal returns of the rivals after the Arcelor – Mittal transaction in the steel industry and Otchere and Mustopo (2006) focusing on the Citicorp – Travelers merger in financial services. Examining one single transaction allows us to highlight the idiosyncratic characteristics of companies involved and relate them to the current industry dynamics.

Since the Pfizer-Wyeth transaction was the largest pharmaceutical deal of the decade (Stempel and Schiffer, 2009), it can be expected to have significant ramifications affecting more global industry competitors than any other deal thus allowing for a meaningful analysis (Akhigbe and Madura, 1999).

1.3 The Purpose of the Study

The aim of this master thesis is to examine the post-announcement abnormal returns of the industry rivals in order to validate the explanations of the wealth effects established in the previous research for a specific case of pharmaceutical industry, as well as examine the firm level characteristics of the industry rivals in order to identify which of them determine the post-announcement wealth effects and how.

We focus both on factors that are industry specific and most relevant in light of the current industry dynamics, such as quality and prospects of R&D, as well as investigate if the factors found to be the determinants of the wealth effects in the previous research of other industries, such as profitability, keep their influence also in the pharmaceutical industry.

1.4 Practical Implications of the Study

Currently, the pharmaceutical industry is still undergoing consolidation phase with companies engaging in M&As in order to supplement their drug pipelines, remove overcapacity, exploit operational efficiencies and improve competitive position (Danzon et al., 2004; Grabowski, 2011). Although transactions have shifted from mega acquisitions to smaller, more bolt-on ones, as well as to collaboration agreements for joint development and marketing of the drugs, still there have been two deals of over $20 billion and another two of over $10 billion in 2011 (PM Live, 2012). Therefore, the possibility of large size deals is likely to persist during upcoming years. This paper identifies what stock price reaction and wealth effect different rivals can expect in the case of a large acquisition in the pharmaceutical industry depending on their firm specific characteristics.

This paper is relevant for investors since it contributes to the understanding of what kind of pharmaceutical companies can expect to experience value increase after the merger of two

industry competitors, offering immediate trading opportunities (Hassan et al., 2007). Managers and shareholders of the industry rivals may benefit from knowledge of what factors lead to the wealth increase and alter their operational decisions towards achieving respective goals, as well as recognize the market opportunities created by the merger of competitors. The paper also provides a research based insight for the analysts specializing in the pharmaceutical industry which might be used to improve their analysis and forecasting. Finally, since Haleblian et al. (2009) in their extensive review of the M&A research recognize that "little is known about how acquisitions affect rival firms in the market", the existing academic knowledge of the M&A effects on the rival companies is enriched by the pharmaceutical industry specific determinants and insight.

1.5 Overview of the Deal

On January 25th, 2009, Pfizer, the world's largest research-based pharmaceutical company, announced an acquisition of its industry rival Wyeth for $68 billion in the largest pharmaceutical M&A[1] transaction of the decade (Stempel and Schiffer, 2009). Following the announcement, the stock price of Wyeth rose by 12.6% and Pfizer 1.4%, indicating positive market expectations for both companies. The deal was finalized on October 15th, 2009, after all the regulatory approvals were achieved from government authorities.

However, in 2008-2009 Pfizer was facing serious problems. Its third quarter results for 2008 revealed 90% decrease in revenues and 14 of Pfizer's patents were to expire in five years, including Lipitor, the best-selling drug in the world (New York Times, 2009b). Therefore, the motives for the merger were clear: Pfizer attempted to gain access to Wyeth's drug pipeline which included blockbusters such as Prevnar (the world bestselling vaccine), Sutent (treatment for cancer), Geodon (treatment for schizophrenia) and Zyvox (treatment for infections) (Stempel and Schiffer, 2009). The merged entity also intended to benefit from significant cost cuts, as layoffs of 19 500 employees had been announced. While the deal was closed in the middle of the financial crisis, Pfizer still managed to gain a syndicated loan of $22 billion from five investment banks (New York Times, 2009a). The capital inflow signaled strength to the entire industry and positive overall outlook for M&A activity,

[1] The term „Mergers and Acquisitions" is abbreviated in our paper as „M&A" and is used interchangeably with the terms „merger", „acquisition", „transaction" and „deal", since in the context of our study the technical differences between the types of transactions are not meaningful.

suggesting more pharmaceutical and biotechnology deals in the future (Thompson Reuters, 2009).

1.6 Thesis Outline

The rest of this paper is organized as follows. Chapter 2 provides an extensive review of the existing literature on the wealth effects experienced by the rivals. Chapter 3 gives an overview of the pharmaceutical industry focusing on M&A related trends. Chapter 4 develops the hypotheses tested in this paper. Chapter 5 discusses the empirical methodology employed. In Chapter 6 the results are presented, analyzed and interpreted. Chapter 7 concludes the study, discusses its limitations and suggests several considerations for the future research while Chapter 8 provides the bibliography of resources used. Finally, the Appendixes provide additional information and tables not included in the text.

2. Literature Overview

This chapter is comprised of two parts. First of all, we present the theoretical foundation of the paper, i.e. theories, established in the finance and M&A literature that provide reasoning behind the particular direction of the rivals' stock price movements following an M&A announcement in the industry. After that, we provide an overview of the previous empirical studies examining the determinants of the rivals' wealth effects.

2.1 Theoretical Foundation

In this section we review the theories explaining the stock price reaction of the portfolio of industry rivals developed in existing literature and critically discuss which of them are relevant in pharmaceutical industry and can be expected to hold based on the current industry situation. In addition, we present the previous studies that have examined these theories and found support or rejected them. Although most of the studies often focus only on one of the theories, we review and analyze all seven found in the literature and either accept or reject them based on their applicability in the focal case in the pharmaceutical industry.

2.1.1 The Market Collusion Theory

Stigler (1964) argues that it is easier to form a cartel and collude on prices when the number of participants is smaller since the costs of identifying the potential secret price-cutter are lower. Thus, a horizontal merger reducing the number of industry rivals should be beneficial for the rest of the companies in the same industry by increasing the market concentration and facilitating the opportunity of collusion, and this consequently should be reflected in the positive post-announcement abnormal returns for the rivals.

However, we argue that there is a little incentive to collude in pharmaceutical industry since it is a global industry meaning that most of the companies are geographically diversified and drugs are marketed and sold worldwide, while normally price collusion is more effective when the competitors are located in the same region (Prager, 1992). Moreover, pharmaceutical companies are under the scrutiny and pressure of payers, such as insurance companies and public health care authorities that presumably perform close enough

monitoring to preclude the opportunities of price collusion. Finally, the Market Collusion Theory has been rejected in the previous research. Eckbo (1983), Stillman (1983), Eckbo and Wier (1985), Fee and Thomas (2004), Shahrur (2005) have examined rival firms' stock price reactions to horizontal mergers in different industries and found no support for the Market Collusion Theory. Therefore we conclude that in case our results show positive wealth effects for the industry rivals, these value gains are explained by other factors than the market collusion opportunity.

2.1.2 The Predatory Pricing Model

The Predatory Pricing Model suggests that financially strong companies are able to temporarily cut prices intending to push the competitors out of the market (Telser, 1966). Considering a merger, the combined entity presumably achieves economies of scale providing room for price cuts and is able to start a price war against the rivals. Therefore, the wealth effects of industry competitors can be expected to be negative following the merger announcement.

However, we perceive this theory to be less relevant in our case in the pharmaceutical industry. First of all, predatory pricing is subject to competition laws and generally illegal in most countries (OECD, 1989) decreasing the likelihood that companies would engage in it. Furthermore, in general, pharmaceutical companies compete more on knowledge, innovation and research capabilities of introducing new drugs, at least in the branded drugs sector. Among the generic drugs price is more a subject of competition, but Pfizer has been holding merely a 4% of the global generic drugs market share (Wall Street Journal, 2008) with the largest part of its revenues coming from branded drugs where the price competition is minimal since the drugs are protected by patents. Thus we believe that the market would not expect Pfizer to engage in the predatory pricing and consequently the wealth effects of the industry rivals should not be negative because of the threat of a price war.

2.1.3 The Buyer Power Theory

The Buyer Power Theory suggests that a horizontal merger between two industry rivals strengthens the overall bargaining position of all industry players against their suppliers, since

suppliers after the merger have fewer companies to sell to (fewer buyers). Therefore, the buyers can exploit their bargaining power over suppliers by posing specific requirements, negotiating discounts and better conditions (Galbraith, 1952). Moreover, if the merged company is able to exploit the synergies and increase productivity, it might lead to a lower demand for the production factors. This in turn would increase the competition among the suppliers benefiting other industry players as well (Shahrur, 2005). Snyder (1996) has empirically proved a model showing that increased buyer power of the merged entity indeed strengthens the rivalry among the suppliers, benefiting not only the new combined company but the industry competitors as well. Therefore, in case the market considers an increase in the buyer power to be possible and beneficial for the industry competitors, they should experience positive abnormal returns following the acquisition announcement.

However, we argue that the Buyer Power Theory has a limited potential to hold in the pharmaceutical industry. First of all, a fraction of the industry players are vertically integrated, e.g. chemical companies that have become pharmaceuticals and produce inputs in-house, depending much less on the suppliers and having fewer opportunities to exploit the buyer power (Rediff, 2004). Moreover, in general, pharmaceutical companies already have an inherent buyer power over their suppliers since the inputs are mainly widely available commodity-like organic chemical materials and there is a high competition among suppliers (KPMG, 2011) meaning that the announcement of a merger of two industry rivals is not expected to influence the balance of power so significantly that it would determine positive wealth effects for the rivals.

2.1.4 The Productive Efficiency Theory

As a large body of research has found, related or horizontal mergers and acquisitions achieve more operating synergies than vertical or diversifying ones (Healy et al., 1992; Maquieira et al., 1998; Maksimovic and Phillips, 2001). Subsequently, the Productive Efficiency Theory suggests that horizontal mergers achieve high level of production efficiency coming from successful synergy realization, and resulting in a more efficient combined entity able to gain competitive advantages against the industry rivals (Farrell, 1957). Hence, the wealth effects of the rivals are expected to be negative after the announcement of a horizontal acquisition since a more intense competition in the industry is anticipated.

We believe that this theory has the potential to hold in our case of pharmaceutical industry. Firstly, the Pfizer-Wyeth acquisition was strongly motivated by operational synergies, claimed to amount to $4 billion during the first 36 months after the effective date of the acquisition, and would be realized mainly by cutting the overhead costs, combining R&D laboratory operations and reducing the number of employees, resulting in a considerable improvement of the operational efficiency (Pfizer, 2009). Moreover, Wyeth adds the complementary capabilities and broadens the portfolio of the combined company since it is diversified into consumer and nutritional businesses as well as in the biotechnology sector in which it has developed several promising products (Stempel and Schiffer, 2009). This is, in turn, supported by the empirical evidence of Makri et al. (2010) who found that complementary scientific and technological knowledge contribute to higher invention performance of the combined company resulting in higher quality and novelty of inventions, which is the essence of competition in the pharmaceutical industry. To conclude, the combined entity can indeed be expected to become a significant threat to the industry rivals and negative wealth effects for the rivals are very likely to be determined by the competitive advantage Pfizer is gaining due to the acquisition of Wyeth.

2.1.5 The Market Power Hypothesis

The Market Power Hypothesis is somewhat similar to the Productive Efficiency Theory in the sense that it also suggests a better competitive position for the merged company, but due to the increase of the market power (Stigler, 1964; Eckbo and Wier, 1985). Furthermore, Shepherd (1982) argues that companies are better positioned to exploit their market power in pricing their products mainly when they possess large market shares and have differentiated product portfolios. Kim and Singal (1993) found support for the Market Power Hypothesis in the airline industry evidenced by the increased airfares of the routes controlled by companies involved in the mergers. Therefore, theoretically a merger, similar to the one in the focus of this paper, which will not only combine two companies into the largest drug maker in the world but also will bundle complementary drug portfolios of both companies together, could be expected to generate negative abnormal returns to the industry rivals.

However, the Market Power Hypothesis has been generally rejected in other previous studies by Eckbo (1983), Stillman (1983), Eckbo and Wier (1985), Shumann and Salinger (1989) and Long (2003). After all, the Pfizer-Wyeth transaction has not been challenged by the antitrust

authorities (Stempel and Schiffer, 2009) indicating that the deal was not seen as significantly increasing the market power of the merged entity and impeding the competition in the industry. Thus we argue that the post-announcement wealth effects to the rivals should not be negative due to the expectation of increased market power of the merged company.

2.1.6 The Information Effect Theory

The Information Effect Theory suggests that a horizontal merger signals to the competitors and investors about the potential operational improvements, sources of synergies and an industry wide increase in productivity, available for other companies as well (Snyder, 1996; Shahrur, 2005). Moreover, Song and Walkling (2000) argue that the acquisition announcement additionally signals to the market a value increase of the industry specific resources. Finally, acquisition in the industry provides the competitors a signal of a new threat to their market share, spurring them to respond by improving their operations as well. Thus the new information available in the market after the announcement of the acquisition should be reflected in the positive abnormal returns of the industry rivals.

We argue that the Information Efficiency Theory might hold in the focal case of the pharmaceutical industry. First of all, the acquisition revealed that there is potential for operational efficiency improvements such as cost cuts and layoffs as well as R&D and other types of synergies between rivals which are possible to copy and implement in order to cope with current industry challenges. The efficient market is expected to recognize which of the companies are most capable to utilize this information and price their stocks accordingly (Fama et al., 1969). Moreover, the acquisition itself signals that consolidation can be beneficial for the industry competitors, although this effect has been distinguished as the Acquisition Probability Hypothesis, which will be discussed next. Finally, support for this theory has been found in the previous research by Long, (2003), Eckbo (1983), Stillman (1983) and Shahrur (2005). Therefore, we argue that in our sample positive abnormal returns of industry rivals' portfolio might reflect the recognized opportunities for operational improvements.

2.1.7 The Acquisition Probability Hypothesis

Song and Walkling (2000), who separated the Acquisition Probability Hypothesis from the Information Effect Theory and developed it, argue that an acquisition within an industry signals that the perceived gain from an acquisition attempt exceeds the cost of it for at least one industry player and indicates an increased likelihood of a beneficial restructuring opportunity in that industry. This gain reflects either the expected synergies between the rivals or failure of managements of underperforming targets to anticipate and incorporate needed changes, and leads to a revision in the value of rival firms based on their individual characteristics. In other words, corrections in stock prices of competitors occur because the perceived probability of acquisition attempts changes depending on individual firm characteristics.

Since it has been established in the finance literature that on average target shareholders experience gains from acquisitions (Jensen and Ruback, 1983) evidenced in the acquisition premium over the market price, industry rivals, who are perceived by the market to be potential acquisition targets, can be expected to experience positive wealth effects following the acquisition announcement. Moreover, in their study Song and Walkling (2000) also examined whether the market is able to identify correctly at the time of the announcement which rivals will subsequently become targets and found that abnormal returns for those rivals who indeed later became targets were higher: in the sample of 2459 rivals, the abnormal returns for subsequent targets were 1,36%, while only 0,32% for those that had not been attempted to acquire. Finally, the authors have tested several exclusively financial characteristics of the potential targets based on previous empirical research about the differences between target and non-target firms. The results demonstrated that on average targets have higher leverage, are smaller in terms of market value of equity and sales, have lower Tobin's Q and levels of managerial ownership.

We think that in our case of the pharmaceutical industry this theory has the highest probability to hold meaning that potentially positive wealth effects of industry rivals are very likely to be determined by the acquisition probability because of the following reasons. First of all, the industry has already been consolidating for several years as a reaction to industry specific economic shocks, such as massive patent expirations of the blockbuster drugs (Gort 1969; Song and Walkling, 2000). Industry competitors have been looking for ways to supplement their drug portfolios and gain access to innovative technologies, often through M&A activity.

Thus increased M&A activity following the Pfizer-Wyeth merger can indeed be anticipated. The evidence shows that in pharmaceutical acquisitions target shareholders gained a takeover premium ranging from at least 30%, to over 100% (MorningStar, 2010); therefore positive abnormal returns of the rivals are likely to be determined by the possibility to increase the value due to the takeover premium as well as the stock price movement can be expected to clearly identify potential targets.

Table 1. Theories explaining rivals' wealth effects

Theory	Expected stock price reaction of the rivals	Applicability in the pharmaceutical industry*
1. The Market Collusion Theory	Positive	No
2. The Predatory Pricing Model	Negative	No
3. The Buyer Power Theory	Positive	No
4. The Productive Efficiency Theory	Negative	Yes
5. The Market Power Hypothesis	Negative	No
6. The Information Effect Theory	Positive	Yes
7. The Acquisition Probability Hypothesis	Positive	Yes

Note: *The applicability is based on the industry analysis by the authors.

Source: Authors' composition

To conclude our conjecture, we argue that in case the wealth effects to the industry rivals following the Pfizer – Wyeth transaction were negative, they could be explained by the Productive Efficiency Theory. Otherwise, in case the rivals experienced positive abnormal returns, those could potentially be a result of either the Information Effect Theory or the Acquisition Probability Hypothesis, the latter being a more likely explanation due to the ongoing consolidation in the industry, discussed in Chapter 3.

However, as presented in Table 1, either positive or negative abnormal returns to the industry rivals following an acquisition announcement in the industry can potentially be explained by more than one theory. Moreover, due to the fact that significant differences of the wealth

effects within the portfolio of the pharmaceutical companies have been observed in our focal case, we stress that the firm specific characteristics also contribute to determining the strength and particular direction of the abnormal returns of the competing companies. Thus in the next section we present an overview of the previous studies concerning firm specific characteristics that were found to determine the wealth effects of the rivals.

2.2 Empirical Research on the Determinants of the Rivals‘ Wealth Effects

An extensive amount of research has examined the abnormal returns to the target and bidder companies and the associated firm-specific characteristics (among others Fama et al., (1969), Moeller et al., (2005), Servaes (1991), Capron and Shen (2007) and Faccio et al., (2004)). Regarding acquirer's stock returns, factors that were found to have a negative influence are market capitalization, managerial share ownership, cash holdings and management overconfidence, while a positive effect was found to result from a previous M&A experience. Regarding target's stock returns, age, size and intangible assets were found to have a negative influence, while international scope and profitability – a positive effect.

However, much less attention has been paid to the rival companies, suggesting a field of contribution. While most of the previous research that do study rival wealth effects is based on the types of transactions (Bley and Madura, 2003), industry characteristics (Shahrur, 2005; Kim and Singal, 1993), acquirers' and targets' characteristics (Schmitz, 2008), relates to the antitrust policy in the US (Eckbo, 1983; Stillman, 1983) or to the influence of the merger waves (Andrade and Stafford (2004), Floegel et al. (2005)), several studies have been conducted examining specifically the influence of the rival firm specific characteristics on the wealth effects following an acquisition in the industry. While researchers are not in consensus which of the theories, discussed in previous section, hold, several firm specific characteristics, such as size, geographical presence, market value of equity over the book value of equity (MV/BV) ratio have been identified and found to significantly determine rivals' wealth effects following the acquisition announcement. We provide an overview of previous studies of the firm level characteristics in the next section.

2.2.1 Rivals' Firm Specific Characteristics

The Bendeck and Waller (2007) empirical study of the banking industry consolidation concluded that rivals earn positive abnormal returns depending on geographical presence and target's financial distress.

While the Bendeck and Waller (2007) study was focused on US listed public firms, Otchere and Mustopo (2006) conducted a similar study in the financial services industry investigating the effects for the global competitors. Their study, encompassing a single case of Citicorp – Traveler transaction in 1996, confirmed that the positive abnormal returns of the rivals were determined by geographic presence, size of the company and the MV/BV ratio.

Size was found to be an important determinant of the abnormal returns for the rivals in the study of Funke et al. (2008) as well. The authors investigated 2511 transactions between 1985 and 2005 without distinguishing different industries and concluded that smaller firms, measured by market capitalization, are more likely to be acquired. However, Funke et al. (2008) took a different approach and instead of short term abnormal returns studied the buy-and-hold abnormal returns a year after the acquisition announcement.

Finally, the company size and geographic presence have been confirmed to be significant determinants of the rivals' wealth effects also by Clougherty and Duso (2008) in their study of M&As in European product markets.

While the previous studies in this field have focused more on US companies, Bley and Madura (2003) established a relation between the rivals' wealth effects and European companies. They concluded that when the rival companies were members of the Eurozone, their stock returns were greater, suggesting a potential currency effect.

The relationship between increased rival returns and the use of the same currency has been further confirmed by Hunsader et al. (2007) who studied US rivals' abnormal returns when the target was an international, foreign company. They found a significant negative relationship between a stronger US dollar and negative return for rivals using non US currency suggesting that the same currency base significantly determines the greater wealth effect for the rivals. However, no significant support has been found with regards to financial variables such as free cash flow, Tobin's Q, intangible assets and return on equity.

Schmitz (2008) has investigated the influence of the firm level characteristics on the abnormal returns of the rivals following the Arcelor – Mittal transaction in the steel industry in 2006. Besides the rival characteristics identified in the previous research, he tested if the firm level characteristics that were previously found to determine the wealth effects to bidders and targets also have influence for the rivals. However, only three of them were found to significantly determine the rivals' wealth effects, those particularly being the diversification level (negative effect), headquarters location (positive effect) and international scope (positive effect).

Several studies have investigated if the profitability of the rivals has any effect on the abnormal returns following the acquisition announcement. Despite the measurement of the profitability in various ways, such as return on equity (Chatterjee, 1986; Hunsader et al., 2007; Otchere and Mustopo, 2006) or return on assets (Artmann et al., 2011), none of them has so far shown any significant influence on the rivals' wealth effects.

3. Industry Overview

In this section we provide a short overview of the current structure and the most important trends in the pharmaceutical industry mainly focusing on factors influencing the M&A activity which will be later utilized in the hypotheses development.

3.1 The Drug Development Process

The pharmaceutical industry is distinguishable mainly due to the process of drug development and approval including the interference of the regulatory bodies. First of all, the drug development is a very expensive, long and risky process with a low rate of eventual success, as in the USA only 8% of the drugs that enter clinical trials gain regulatory approval from the Food and Drug Administration (FDA Review, n.d.). Secondly, the competition in the pharmaceutical industry is focused mostly on the clinical evidence and value, requiring significant amount of specialized resources. Consequently, the pharmaceutical industry is more R&D-intensive compared to other industries as reflected in the R&D/Sales ratio which in the USA is on average 18% in pharmaceutical industry compared to a 4% of overall manufacturing industry (Danzon et al., 2004).

3.2. Economic Uncertainty

The current trends forming the industry landscape include, first of all, the general uncertainty due to a prolonged economic downturn. Since drugs and other health care solutions are a necessity and enjoy a constant demand, the pharmaceutical industry generally is considered to have strong business fundamentals and even pricing power, hence being less sensitive to economic downturns (Ganguin and Bilardello, 2005). However, current national budget deficits of many developed countries together with increasing costs of the publicly funded health care systems due to aging population pose a strong pressure to the pharmaceutical industry pricing. Moreover, the economic downturn has impeded growth in countries with more self-funded health care systems, such as Russia, Mexico or South Korea (IMS Health, 2009). In conclusion, although being partially resistant to the macroeconomic downturns, the pharmaceutical industry has been experiencing a slowdown in the recent years.

3.3 Imbalance between New Product Introduction and Patent Loss

They key challenge that the "Big Pharma" companies are facing currently is the expiration of the patent protection for many of the world's best-selling drugs combined with stagnant new product pipelines. Patents of most of the current blockbuster drugs are expiring before 2015 (KPMG, 2011). After that, producers will face the competition of generic drugs that are additionally supported by the health care payers, since they are cheaper than the branded ones. It has been estimated that after the patent expiration of a blockbuster drug, producer's sales decrease by approximately 90% (Daily Finance, 2011). Moreover, despite the increasing R&D spending, the drug pipelines of the pharmaceutical companies are currently considered to be weak with few potential blockbusters to enter the market and be able to compensate for the revenue loss in the next few years (Hornke and Mandewirth, 2009). Thus, this two-fold problem is one of the drivers of the M&A activity in the pharmaceutical industry.

3.4 Consolidation

The pharmaceutical industry has experienced a series of major mergers since the 1990s and it is still in a process of continued consolidation with the industry concentration of around 20% (Harvard Business Review, 2002). Consolidation is mainly driven by the attempts to shift or share the costs and risks inherent in the drug development process, overall excess productive capacity accumulated in the industry as well as the above discussed combination of expiring patents of the branded drugs and weak pipelines of new products. Furthermore, industry consolidation is forecast to continue in the following years as well (KPMG, 2011).

3.5 Shift towards the Biotechnology Sector

In the last few decades biotechnology companies have increased their role in the industry significantly. In 1978, 30 patents were filed by the biotechnology companies, while in 2001 the number of yearly patents had increased to 34 527 (Thompson, 2002). Furthermore, 25% of the pharmaceutical firms' products are outputs from biotechnology firms' pipeline (IMS Health, 2011) since biotechnology companies research, develop and modify recombinant DNA (rDNA) to create new molecules and drugs (Haeussler, 2007).

Lately biotechnology companies have experienced an increased acquisition interest from pharmaceutical companies. First of all, biotechnology companies add complementary products to the pharmaceutical companies' portfolios increasing at the same time the level of diversification. Moreover, acquiring biotechnology companies offers the pharmaceutical counterparts an attractive alternative for developing the biotechnological research knowledge and capabilities in-house (Haeussler, 2007). Finally, since the financial crisis in 2008 lowered the capital inflow and constrained the cash and forced the R&D intense sector to consolidate for survival, this shift towards biopharmaceuticals is forecasted to continue until 2020 (IMS Health, 2011).

3.6 Strengthening Emerging Markets

Emerging markets, especially the BRIC region (Brazil, Russia, India, China), has recently demonstrated impressive growth rates in the pharmaceutical industry. The trend of improving living standards and increasing income in these regions strengthens the demand for pharmaceutical products and places emerging markets among the drivers of the global health care spending (KPMG, 2011). Until 2015 the emerging markets are forecast to grow by 10-16% annually, while Western Europe and the US are expected to demonstrate only 1-3% growth (IMS Health, 2011). Subsequently, pharmaceutical companies are shifting their focus to the emerging markets not only to cut the production costs, but also to establish a foothold position and capture a share in this high growth market, predicting an increased M&A activity in this region.

4. Hypotheses Development

In this section we develop the hypotheses tested in our study. In order to ascertain what the determinants of the stock price movement for the rivals are, previous studies have attempted to examine mostly financial factors as well as industry characteristics and types of deals. In our study we focus on firm specific variables typical for the pharmaceutical industry and relevant in light of the current industry trends. Moreover, after critically assessing all the theories of the rivals' reaction in Chapter 2 and considering the consolidation trend in the industry, we develop our hypotheses in the Acquisition Probability Hypothesis framework identifying characteristics of potential acquisition targets. The expected effects are based on the finance and M&A literature and complemented with the current industry characteristics and dynamics. Factors affecting the strength and the particular direction of the abnormal returns to the rival firms are called "the determinants".

4.1 Quality of Research and Development

We argue that the quality of the R&D process can be evidenced by the output it produces (Makri et al., 2010), more precisely, by the number of projects that have entered the clinical trials indicating the success of the drug development process. Since drug development is a very long and costly process with low rates of eventual success (FDA Review, n.d.), it can be argued that it is reasonable for companies to replace the in-house development with acquiring rivals that have already entered the process. Moreover, companies that have already passed the early stages of development have more promising products in their portfolio and shorter time period left to bringing them to the market, thus offering reduced risk of a non-approval. As the patents of many best selling drugs are expiring in the next 5 years while the new drugs under development are lacking and will take uncertain amount of time to be brought to the market (FDA Review, n.d.), pharmaceutical companies can be expected to prefer acquiring competitors which already have products that have successfully passed the early phases of clinical trials. This has been investigated in the biotechnology sector analysis by Thompson Reuters (2009), where industry analysts, investors and portfolio managers have been surveyed and most of the respondents confirmed that they wouldn't invest in the companies that do not have products moved beyond Phase 1 and 2 of clinical trials. However, other factors, for example financial indicators, could also influence their decision. Thus we are interested to test

if the market recognizes the progress of the drug development process and considers it a determinant of the acquisition probability.

H1: The relation between the quality of R&D and the abnormal returns is expected to be positive

4.2 Long-term Prospects of Research and Development

While with the previous hypothesis we have looked more at the potential short term, i.e. up to three years (FDA Review, n.d.), benefits that acquirers might look for when screening for the targets, here we want to additionally investigate if companies that are better positioned to compete in the research and development field in a longer time horizon can also be identified by the market as potential targets. Grabowski and Mueller (1974) have found that high R&D increases the profitability of the company and Lev and Sougiannis (1996) found R&D expenses to be positively correlated with future returns of investigated companies. Since investments in R&D have been found to materialize on the financial accounts several years after the research dollars were spent (Sougiannis, 1994), the current R&D investment should reflect the long-term prospects of company's R&D productivity and competitive position possibly indicating another characteristic of interest for potential acquirers.

H2: The relation between the long-term prospects of R&D and the abnormal returns is expected to be positive.

4.3 Sector

The biotechnology sector has recently experienced its own industry shock evidenced in difficulties in justifying the high expectations, capital constraints and structural weakness, implying that a merger could be a solution from biotechnology companies' point of view. (Haeussler, 2007) On the other hand, biotechnology firms offer their pharmaceutical counterparts the diversification of revenue sources, complementary knowledge as well as technology that is unique and very costly to mimic (Hornke and Mandewirth, 2009). Moreover, Cockburn and Henderson (2001) in their study investigating the clinical projects of drug development found a strong relation between the diversity of firms' development efforts

and the success probability of individual projects. Furthermore, scope was found to be a determinant of superior performance of drug development rather than scale, implying that biotechnology firms can be an attractive target from the pharmaceutical companies' point of view as well. These findings are consistent with already mentioned empirical results of Makri et al. (2010), who found that complementary scientific and technological knowledge contribute to higher invention performance of the combined company evidenced in higher quality and novelty of inventions. After all, a trend of pharmaceutical companies starting to develop biotechnology products internally has been recently evidenced (IMAA, n.d), supporting that an acquisition of a biotechnology company could possibly be a cheaper and faster alternative way.

H3: ***The relation between operating in a biotechnology sector and the abnormal returns is expected to be positive.***

4.4 High Growth Regions

Currently in the pharmaceutical industry BRIC region has been achieving a rapid growth, driven by increased health care access and government spending, and is expected to continue so during the following years (IMAP, 2011). Thus expansion into this region could be justified by opportunities to capture the value of the high growth in this region. Moreover, a special characteristic of the companies in BRIC region is that most of them are generic drug makers. Thus, additionally to the high growth of the region, generic drugs can diversify and reduce the risk of the branded drugs portfolio. Finally, expansion to the BRIC region offers traditional pharmaceutical companies an advantageous position for responding to the currently increasing rivalry among generic drugs, thus placing companies located in BRICs among the potential acquisition targets.

H4: ***The relation between being located in BRIC countries and the abnormal returns is expected to be positive.***

4.5 Profitability

Haleblian et al. (2009) argue that lower performing targets present more restructuring opportunities and therefore merging into high performing acquirers contribute to increasing the overall performance of the combined entity. This has been evidenced in the study of takeovers by Chatterjee (1986) and bank mergers by Houston et al. (2001). This could be further supported by the tax arguments regarding the utilization of net operating losses. The tax loss carry-forwards, carry-backs and tax credits may offer an important source of value for an acquirer attempting to reduce its tax liability. Loss carry-forwards and carry-backs reflect firm's losses that can be, depending on how the transaction is structured, used to reduce the combined entity's taxable income in the future or recoup some portion on taxes paid in previous years (DePamphilis 2009, p. 239). Moreover, Auerbach and Reishus (1988) argue that the presence of the tax benefits possible to utilize, evidenced in 318 mergers and takeovers over the years 1968-1983, were found to influence merger activity. Finally, some companies can also have losses "programmed" to occur in the future, which is likely to be true in the pharmaceutical industry considering high investments in the drug development process that challenge profitability in early stages but implies good long-term prospects and payoff when drugs are brought to the market. Thus we argue that less profitable companies should be more attractive acquisition targets.

H5: The relation between the profitability and the abnormal returns is expected to be negative.

4.6 Cash Holdings

Companies holding relatively large amount of cash have an option to decide between paying out the cash to the shareholders and investing the cash holdings in profitable growth opportunities (Pettit, 2007). Companies operating in competitive and R&D intense industries, including pharmaceuticals, are known to maintain higher levels of cash (Pettit, 2007) in order to be ready to exploit arising growth opportunities and improve their competitive position. Moreover, cash reserves, kept as a buffer, provide firms the opportunity to invest even when current cash flows would not suffice to meet the investment demands. Finally, cash reserves help avoid external financing constrains due to imperfect information in the market and thus prevent the underinvestment problem (Harford, 1997).

On the other hand, according to the free cash flow hypothesis in the agency theory framework (Jensen, 1986), managers tend to exploit imperfect monitoring and use cash holdings for inefficient empire building acquisitions (Harford, 1997). This point might be particularly relevant in pharmaceutical industry, currently being in a consolidation phase and thus presenting inherent incentives for engaging in M&As. In addition, since it has been proven empirically in previous studies that shareholders of the acquiring companies tend to loose wealth or merely break even (Gaughan, 2011), potential acquirers might see opportunities to capture value by stepping in and preventing suboptimal M&A activities of the target's management. (Harford, 1997) Moreover, in the framework of The Acquisition Probability Hypothesis, we further argue that companies with large cash holdings might be seen as more attractive acquisition targets since the acquirers might be able to finance the acquisition utilizing the cash held by the target itself (Song and Walking, 2000; Akhigbe and Madura, 1999). Finally, cash-rich targets might be attractive for rivals that are cash constrained, but have good investment opportunities (Harford, 1997; Opler et al., 1999).

H6: The relation between the amount of cash holdings and the abnormal returns is expected to be positive.

4.7 Taxation Regime

It is not unusual to witness cross-border acquisitions in a global industry as pharmaceuticals, motivated by such factors as facilitation of easier entry into the foreign markets, increase of the market share and power, access to the new resources or technologies, diversification, etc. (Glaister and Ahammad, 2010). Besides these motives, Arulampalam et al. (2010) also investigated the effect of the different corporate tax rates on the cross-border acquisition decisions. They tested the tax effect depending on the acquisition motives and the opportunities to shift profits between countries or reduce costs in the target company proving that the tax rate in the country of the target company may have either a positive or a negative impact on the probability of the acquirer choosing a target in that country, mainly depending on the particular situation and motives of that particular acquisition. However, after observing several recent cross-border acquisitions between countries with different taxation regimes, such as Switz company Roche acquiring US-based Genentech in 2009, or Israel based Teva acquiring German Ratiopharm in 2010, we argue that acquiring a company located in a high tax rate country offers an opportunity to reduce the tax burden by subordinating the target's

operations in a lower tax rate country. The reduction of the taxes paid leads to the increase of the expected future free cash flow, which, in turn, increases shareholder value (Culp, 2001).

It is important to notice that in their study Arulampalam et al. (2010) have included only the statutory, effective marginal and effective average corporate tax rates ignoring the tax rate of the dividend income, which imposes a double taxation effect to the shareholders. We aim to emphasize the role of the personal tax rate on the dividend income and to investigate if it can have an influence on the acquisition decision.

H7: The relation between the combined corporate and personal income tax rate of the country of the headquarters location and the abnormal returns is expected to be positive.

Table 2. Overview of the Hypotheses

Hypothesis	Characteristic	Variable	Expected effect
H1	Quality of research and development	Phase 3 Projects in Clinical Tests / All Projects in Clinical Tests	Positive
H2	Long term prospects of research and development	R&D investments / Sales	Positive
H3	Sector	Binary variable	Positive
H4	High growth regions	Binary variable	Positive
H5	Profitability	OPM / Sales	Negative
H6	Cash holdings	Cash and short term investments / Total Assets	Positive
H7	Taxation regime	Binary variable	Positive

Source: Authors' composition

5. Data and Methodology

In this chapter we present and explain the methodology we have employed to achieve the aim of this master thesis. In order to identify the average wealth effect experienced by the whole portfolio of the industry rivals following an acquisition announcement we have conducted an event study examining the abnormal returns of the competitors after the acquisition of Wyeth by Pfizer. Furthermore, the impact of the firm level factors has been tested using the standard linear multiple regression analysis.

5.1 Sample Selection and Reliability

Our sample of industry competitors includes pharmaceutical and biotechnology companies sorted in the Reuters 3000 Xtra database according to sector and located in Western Europe (United Kingdom, Germany, France, Netherlands, Belgium, Switzerland, Austria, Denmark, Sweden, Norway), United States, Canada, Japan, as well as India and China, allowing the construction of a representative sample accounting for the geographic dispersion and global competition in the market.

The initial sample of all the industry competitors has been narrowed down to 426 companies by only including rivals that have been listed on stock exchange during both event windows that we analyze in this master thesis, i.e. the announcement of the acquisition and the completion of the transaction (presented later in this chapter). The choice of listed companies is driven by the necessity of publicly available stock price data in order to examine the abnormal returns. Moreover, the sample has been significantly narrowed down by only including companies that had information concerning the development phases of projects under clinical trials publicly available from the Internet database www.clinicaltrials.gov, which we discuss later in this chapter as well. Finally, due to the differences in the requirements of the disclosure among countries, the accounting data was limited for some of the companies, rendering to exclude them from the sample.

Application of the aforementioned selection criteria resulted in the final sample of 122 industry rivals. The list of the rival companies included in the sample is provided in the Appendix 1. The stock price data for the final sample has been obtained from the public service Thomson Datastream 5.0.

5.2 Event Study

For the first part of the analysis, we have employed the standard event study methodology to find out the average abnormal returns experienced by the whole sample of industry rivals. Following the guidelines of McKinlay (1997), first of all, we identified the event dates. We chose to examine two announcements related to the Pfizer-Wyeth transaction, in particular, the initial announcement date, and the transaction completion date. Studying two events allows us not only to compare the rival wealth effects but also to test the surprise effect of the acquisition announcement as well as draw conclusions when exactly the market recognizes and prices the opportunities or threats inherent in the transaction. Therefore:

Event 1 (E1): Announcement of the acquisition 2009-01-26

Event 2 (E2): Completion of the transaction 2009-10-15

Following common approach of the previous literature (among others Eckbo, 1983; Otchere and Mustopo, 2006; Banerjee and Eckard, 1998), we studied two different event windows: 10 days before the event allows accounting for market anticipation of the transaction or any possible information leakage when calculating market expected returns in the market model. 1 and 5 days after the event, first of all, accounts for the time zone difference between opening and closing times of stock exchanges around the world, as well as gives the market time to "digest" the news and price the stock of the competitors. Finally, different event windows enhance our analysis and allow drawing conclusions about the timing of the stock price reaction by providing a comparison.

Therefore, two event windows have been studied for each event:

Event window 1 (W1): (-10, 1)

Event window 2 (W2): (-10, 5)

Next, following again the common approach and the guidelines of MacKinlay (1997), the estimation window for calculating the normal returns has been chosen as 120 days before the start of each event window: (-131; -11).

In order to identify possible confounding events during the estimation window, we defined them as other M&As in the industry of the size larger than USD 20 billion and screened the media announcements for such events. No events of significance similar to the focal case

were detected during the estimation windows; therefore, we argue that normal returns were not distorted by confounding events.

The abnormal returns for each of the rivals in the sample were calculated using the traditional market model (MacKinlay, 1997). However, slightly differently than in most of similar studies, instead of using S&P 500 Index for the market portfolio returns, we have employed the S&P1200 Global Pharma&Biotech Index, which is industry-specific and therefore more accurate. We argue that by using this index we are able to capture the effects of pharmaceutical trends specific to this industry such as R&D development or FDA approval decisions (Standard and Poors, 2012).

The resulting abnormal returns (ARs) have been accumulated over time of the event window following MacKinlay (1997) to derive the cumulative abnormal returns (CARs) for each of the company in the sample.

As already mentioned, we conjecture that in our case of pharmaceutical industry the Productive Efficiency Theory, the Information Effect Theory and the Acquisition Probability Hypothesis have the highest potential to hold; therefore, our event study additionally allows to implicitly support these theories, i.e. positive abnormal returns would suggest that either the Acquisition Probability Hypothesis or the Information Effect Theory might be the explanation, while negative abnormal returns would suggest that the Productive Efficiency Hypothesis might be the reasoning behind them instead.

5.3 Regression Model

In order to test our hypotheses we have constructed a linear multiple regression model using the Ordinary Least Squares (OLS) estimation method and applied it to both focal events of this paper. This section starts with the description of variables included in the model, followed by a discussion of methodological issues.

5.3.1 Variables

In this section we present the specification of dependent, independent and control variables used in the regression model which is demonstrated in Exhibit 1.

Exhibit 1. Regression model

$$CAR = C + \beta 1BRICS + \beta 2CASH + \beta 3OPM + \beta 4PHASE\_3 + \beta 5R\_D + \beta 6SECTOR + \beta 7TAX + \beta 8LNTA + \varepsilon$$

CAR	=	Cumulative Abnormal Returns of the rivals
β1BRICS	=	High growth region, binary variable
β2CASH	=	Cash holdings, Cash and short term investments / Sales
β3OPM	=	Profitability, OPM / Sales
β4PHASE_3	=	Quality of R&D, Phase 3 projects in clinical trials / All projects in clinical trials
β5R_D	=	Long-term prospects of R&D, R&D investment / Sales.
β6SECTOR	=	Sector, binary variable
β7TAX	=	Taxation Regime, binary variable
B8LNTA	=	Control variable, natural logarithm of Total assets

Source: Authors' composition

5.3.1.1 Dependent Variable

The focal parameter of our paper is the cumulative abnormal returns (CARs) of the industry rivals following the acquisition announcement that have been calculated in the first part of the analysis for both of the events. In order to identify which of the firm specific characteristics determine CARs, they have been used as the dependent variable in the regression model.

5.3.1.2 Independent Variables

- **Quality of Research and Development**

In order to test H1 we have constructed a variable of the quality of R&D by calculating the percentage of the phase 3 drug development projects relative to the overall number of projects each of the companies in the sample had under the clinical trials at the time of the acquisition announcement. In order to specify the quality of the R&D previous literature has more often used the patent count, (Makri et al., 2010; Chen and Chang, 2010) therefore we took a similar approach, but we argue that the number of the phase 3 drug development projects is a more

accurate proxy because patents capture a wider output of R&D including also innovations of manufacturing technology and processes, while phase 3 drug development projects indicate solely the number of drugs that are at the last stage before being introduced to the market and sold. We have utilized the public database of federally and privately supported clinical trials conducted in the US and around the world available at www.clinicaltrials.gov.

- **Long-term Prospects of Research and Development**

In order to test H2 we have, following previous research (among others Kostellou and Tsakiri, 2009; Kamien and Schwartz, 1975), constructed a variable of the long-term prospects of R&D by calculating the R&D investment ratio (the percentage of R&D investment over sales) for each of the companies in the sample using the accounting data provided in the Thomson Datastream 5.0 database.

- **Sector**

In order to test H3 we have operationalized the sector variable as a binary having the value of 1 for companies operating in biotechnology sector (filtered in the Reuters 3000 Xtra database) and 0 for companies operating in pharmaceutical sector (Brooks, 2008).

- **High Growth Regions**

Similarly as the Sector variable, we have defined the High growth regions variable as a binary, assigning the value of 1 for the companies headquartered in the BRIC region and 0 otherwise (Brooks, 2008).

- **Profitability**

In order to test H5 we have constructed a profitability variable calculating the operating profit margin (OPM), which equals operating income over sales, using the data provided in the Thomson Datastream 5.0 database. This measure of profitability has been used by Danzon et al (2004), while additionally, we find the OPM to be the most suitable among other profitability measures in our case since compared with the net profit margin (PM) and return on equity (ROE) OPM accounts for the profitability before the R&D investments, helping to avoid the potential correlation with the R&D investment variable.

- **Cash Holdings**

In order to test H6 we have constructed a cash holdings measure following previous literature (among others Harford, 1997; Danzon et al., 2004; Opler et al., 1999; Lang et al. 1989) as a ratio of cash over total assets. Cash was defined as cash and short term investments and the data has been retrieved from the Thomson Datastream 5.0 database.

- **Taxation Regime**

In order to test H7 we have specified the taxation variable as another binary. First of all, using the net top statutory rate paid at the shareholder level, which includes both Corporate Income Tax and Personal Income Tax as well as takes into account all types of reliefs we have set a threshold of 46,8125% tax rate which is the average of the respective tax rates of sample countries. Next, we have assigned a value of 1 for companies headquartered in countries where the tax rate is above the threshold (i.e. high tax rate), and 0 otherwise (Brooks, 2008). The OECD tax database (OECD, 2012) played a crucial role in obtaining the aforementioned net top statutory rates. The utilized net top statutory tax rates of the sample countries are presented in the Appendix 2.

5.3.1.3 Control Variable

In order to control for alternative determinants of the abnormal returns, we have constructed a model including a control variable accounting for the size of the company. Size has been one of the most often studied rival characteristics in the previous research (Otchere and Mustopo, 2006; Funke et al. 2008; Fee and Thomas 2004; Schmitz, 2008). The results of different studies have been quite equivocal, but negative effect on the rivals' abnormal returns has been found more often (Fee and Thomas 2004; Funke et al. 2008). We have decided to use the total assets recorded in 2008 as a measure of the size following previous studies of Harford (1997) and Otchere and Mustopo (2006). However, in order to avoid the size effect to dominate our model as well as to improve the quality of the measurement we have, following Brooks (2008), specified the size variable using the natural logarithm of the total assets of the rival companies from our sample. Accounting data has been extracted from the Thomson Datastream 5.0 database.

5.3.2 Methodological Issues

In order to validate the usage of the OLS model for our hypothesis testing, formal tests, suggested in Brooks (2008) have been performed for the OLS assumptions and other potential methodological issues. Initially, eight outlier companies have been found to cause the non-normality of the residuals' distribution. It has been solved by removing the respective outliers. The normality test for the final sample is reported in the Appendix 3. Moreover, the model has been found to be heteroscedastic, which has been solved using the White coefficient covariance matrix. Finally, no pairwise correlation between the variables as well as no non-linearity has been detected. Therefore, we conclude that OLS regression model is suitable for testing our hypotheses.

6. The Results

In this chapter we present the overall results of our empirical study and the test of the robustness for the regression model employed. It is followed by the analysis and economic interpretation of the results.

6.1 Empirical Results

We start the discussion of the results with the outcome of the event study followed by the presentation of the regression model results.

6.1.1 Event Study

As already mentioned, we studied two event windows, W1 (-10, 5) and W2 (-10, 5), for both of the Events: E1 - the announcement of the acquisition and E2 - the closure of the transaction. Table 3 presents the average cumulative abnormal returns (CARs) for two Event windows of both Events.

Table 3: Cumulative Abnormal Returns (CARs) and statistics

Event 1	**N**	**Mean**	**Std. dev.**	**t-Statistic**	**Probability**
CAR (-10, 1)	122	0,002114	0,191783	0,121762	0,9033
CAR (-10, 5)	122	0,027778	0,179043	1.713661*	0,0892
Event 2					
CAR (-10, 1)	122	-0,025698	0,131107	-2.164975**	0,0324
CAR (-10, 5)	122	-0,036295	0,159503	-2.513358**	0,0133

Note: * - significant at a 10% level. ** - significant at a 5% level.

Source: Authors' composition

We found the average CARs experienced by the portfolio of industry rivals for the Event 1 to be positive during both of the Event windows, but statistically significant at 10% level (t-statistic=1.71) only for the W2. The average CAR for the rivals five days after the acquisition announcement was found to be 2,78%.

The average CARs for the Event 2 were found to be negative and significant at the 5% level (t-statistic=-2.16, for W1 and t-statistic=-2.51 for W2). Moreover, the average CARs were again found to be higher for the W2, equal to -3,63%, than for the W1, equal to -2,57%.

In conclusion, the industry rivals experienced positive wealth effects following the acquisition announcement and negative wealth effects following the closure of the deal. The CARs in both cases were higher during the event window from ten days before the event to five days after the event.

However, we acknowledge the potential impact of diversification on the reaction of the rival companies, as found by Schmitz (2008). To be more exact, it can be expected that more diversified companies, i.e. those having their revenues coming from different sources, such as branded drugs, generic drugs, therapeutics, chemicals, etc., might experience a weaker reaction to the acquisition announcement in the industry since it might impact only a fraction of their business and revenues (McAfee and Williams, 1988). However, the database available did not allow filtering companies according to the sub-sectors they operate in, and due to the time constraint we were not able to obtain this data from other sources.

6.1.2 Regression Analysis

The previous section has presented the average cumulative abnormal returns to the portfolio of rivals while in the following part of our empirical study, after conducting the regression analysis, we identify the determinants of the CARs to individual rivals.

Since the event study demonstrated that W2 (-10, 5) captured higher CARs for both of the studied events, we ran the regression model twice for both Event 1 and Event 2 using the CARs of the W2 as a dependent variable.

As shown in Table 4, the regression model derived a highly significant result for Event 1, while it was not able to significantly explain the CARs for the Event 2. Therefore, we proceed

further with the empirical results for the Event 1, while the outcome of the model for the Event 2 is reported in the Appendix 4.

Table 4. **Significance and explanatory power of the regression model**

Event 1	**F-value**	**F(prob)**	**R-squared**	**Adj. R - squared**	**S.E of reg.**
(-10, 5)	3.006490***	0,004456	0,186374	0,124383	0,116266
Event 2					
(-10, 5)	1,477584	0,174135	0,101186	0,032705	0,121424

*Note:*** significant at a 1% level

Source: Authors' composition

Although we acknowledge that the overall explanatory power of the model is quite low, capturing only 12.4% of the variation of the dependent variable, it has been observed in previous studies that models predicting stock returns quite commonly have as low as 5-10% explanatory power since stock prices are to a large extent determined by factors which are extremely hard to quantify and account for in statistical models (Duke University, n.d.). This can notably be applicable in our case considering that the year 2009 can be characterized by various external factors resulting from the overall macroeconomic uncertainty and potentially affecting the stock returns. Moreover, stock returns are also highly influenced by irrational and behavioral factors. After all, the aim of this paper is to examine particularly the firm specific characteristics affecting the abnormal returns, and due to the time constraint, limiting the scope of the paper, we were not able to additionally include and study the external factors. To sum up, reflecting only firm specific factors, we consider the explanatory power of the model to be sufficient in the focal case.

We found four of the studied factors to be significant in explaining the variation of the cumulative abnormal returns. As seen in the Table 5, these are the cash holdings, profitability, long-term prospects of research and development and sector of operations.

Table 5: Regression model results

Hypotheses	Characteristic	Regression coefficient	t-Statistic	Probability
H1	Quality of R&D	0,0006	0,0170	0,9864
H2	Long term prospects of R&D	-0,0008	-1,9783 *	0,0505
H3	Sector	-0,0524	-1,8866 *	0,0620
H4	High growth regions	-0,0257	-0,9241	0,3576
H5	Profitability	-0,0001	-2,2212 **	0,0285
H6	Cash holdings	0,1741	3,2055 ***	0,0018
H7	Taxation regime	0,0237	1,1140	0,2678
Control	Size	0,0021	0,3778	0,7064

Note: *Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

Sources: Authors composition

Our data sample supported two of the hypotheses of this study. First of all, cash holdings were found to positively and strongly (17,4%) affect CARs for the rivals at a 1% level of significance, thus supporting H6. Moreover, we found profitability to have an expected negative effect on the CARs at a 5% significance level, though determining the dependent variable only marginally (0,01%), but still supporting the H5.

On the other hand, we found the long-term prospects of research and development, specified as R&D investment ratio, to have a negative impact of 0,08% on the CARs, rejecting H2 at a 10% level of significance. In addition, the sector of operations has been found to have a 5,24% negative effect on the CARs for the rivals, thus also rejecting H3 at a 10% level of significance.

All other variables were found to be insignificant even at a 10% level and unable to explain the variation of the CARs in our sample, thus we cannot make any conclusions regarding them.

6.1.3 Robustness

In order to examine the robustness of our model, we attempted to replace some of the measures used to specify our variables with different ones. First of all, we specified profitability using Return on Equity (ROE) instead of OPM. Moreover, we tested the effect of size using the natural logarithm of sales instead of the natural logarithm of total assets. Both of the models gave very similar results in terms of the significance of the whole model (1% level), explanatory power (12% and 11.8%, respectively) and supported H6 at a 1% level of significance.

However, we argue that measures used in the original model are of a higher quality. First of all, using ROE for measuring profitability we would implicit account for R&D investments twice in the model, therefore we consider OPM, which is calculated before the R&D investments, to be more suitable. Second, although sales volume has been used as a proxy for the size in previous research (Schmitz, 2008), we argue that total assets is a less volatile and thus more suitable measure than the sales volume. Therefore, we conclude that the regression model is robust.

6.2 Analysis and Interpretation

In this section we provide an extensive analysis, economic interpretation and discuss the implications of the results of our empirical study.

6.2.1 Event Study

The results of the event study suggest that the Acquisition Probability Hypothesis could possibly be the explanation of the positive rivals' wealth effect evidenced in the Event 1. Interpreted in the framework of this hypothesis, positive wealth effects of the rivals might imply that the Pfizer-Wyeth acquisition announcement signaled opportunities for the change of the corporate control for other companies in the industry as well as expectations of increased M&A activity in general. We further argue that, under the Acquisition Probability Hypothesis, the positive wealth effects for the rivals confirm our conjecture that consolidation was perceived by the market to be the way of solving the industry challenges that most of the

companies were facing at the time of the focal deal, such as expiring patents of the branded drugs, weak pipelines of new products and excess productive capacity.

On the other hand, negative wealth effects for the rivals following Event 2 implicitly provide support for the Productive Efficiency Hypothesis. Interpreting the results in the framework of this hypothesis, we argue that after the official completion of the transaction, when the combined entity was established with high expectations of exploiting the synergies and increasing the productivity, the market recognized the merged company to be a new strong threat to the rivals increasing the competition in the industry and thus reflected in negative abnormal returns. Moreover, prior to the acquisition of Wyeth, Pfizer was known to be screening the market for the targets to acquire; therefore, after the deal was finalized, one potential acquirer was removed from the market decreasing the further chances for the rivals to be acquired and consequently eliciting the negative stock price reaction.

We interpret that the opposite returns for the two events examined in the study highlight the industry-wise importance of the transaction as well as demonstrate the objectivity of the market in responding to different signals sent by each of the events and rendering the investors to revalue their holdings of the rival companies.

Finally, the event study revealed that the full reaction of the market was observed not immediately, but in a period of 5 days implying that the market needed time to fully price the new information.

6.2.2 Regression Analysis

As mentioned earlier, the regression model was able to explain the abnormal returns only for the Event 1 – the acquisition announcement. Since the event study has previously demonstrated positive abnormal returns for this event, providing support for the Acquisition Probability Hypothesis, consequently our interpretation of the regression model results is also mostly based on this hypothesis. On the other hand, our industry analysis did not allow us to reject the Information Effect Theory, which could also possibly be the explanation of positive abnormal returns for the rivals, therefore we consider the regression outcome in the framework of this theory as well.

6.2.2.1 Cash Holdings

In our empirical study we found a positive effect of cash holdings on the abnormal returns for the industry rivals which, under the Acquisition Probability Hypothesis, implies that companies having more cash on their balance sheets were recognized by the market as potential acquisition targets.

We argue that higher cash holdings in the current situation of the pharmaceutical industry can be interesting for acquirers for several reasons. First of all, cash can be invested in further R&D or potential growth opportunities, as well as used to finance the acquisition. Moreover, in times of macroeconomic uncertainty cash reserves can serve as a buffer helping to maintain stability of the business when the operating cash flows are volatile. Finally, in terms of effective corporate control, potential acquirers might see opportunities to create value by redeploying the cash in better ways than the current management.

Considering that high growth companies are usually keeping higher cash balances, it can be inferred that the results suggest high growth companies to be potential acquisition targets. However, it has to be perceived with caution and more as an insight than a strong conclusion, since cash holdings is just one of the characteristics of high growth companies and it is, moreover, very firm-specific. Thus we suggest further research to look deeper into the relation between growth prospects and acquisition probability of pharmaceutical industry players.

On the other hand, interpreted in the framework of the Information Effect Theory, the positive influence of the cash holdings on the CARs might also suggest that companies holding higher cash reserves are recognized as being able to better exploit the new information about efficiency improvement opportunities, such as possible cost cuts or work force layoffs, revealed to the market. Moreover, such companies might as well be able to withstand the increased competition in the market more successfully. We interpret that companies, holding higher cash balances, have more financial flexibility to engage in value increasing productivity improvements.

6.2.2.2 Profitability

Our regression model exhibits a negative influence of profitability on the wealth effects for the industry rivals implying that, under the Acquisition Profitability Hypothesis, less

profitable companies are expected to become acquisition targets. Thus it confirms our previous argumentation that possibly inefficiently operating less profitable companies offer more restructuring opportunities for the potential acquirer as well as allow benefiting from the tax advantages available to the combined entity because of the net operating losses incurred. Besides, if unprofitable companies are approaching financial distress, they might be acquired cheaper than otherwise successful and profitable counterparts.

Moreover, we argue that it is very likely in the pharmaceutical industry for companies to operate unprofitably because of the "programmed" losses in the early stages of their product life cycles when it requires high investments that have not started paying off yet. It has to be noted, however, that our profitability measure – OPM – does not include direct R&D investments of the company, but it still accounts for such expenses as researchers' salaries which might be higher in the early stages of drug development.

Thus our data sample implicitly suggests that either financially weaker competitors or those in an early stage of their product life cycles, e.g. startups, are recognized by the market to be potential acquisition targets. This result is in line with the observed situation of many promising early stage startups being financially constrained and looking for ways of raising funds and continuing the product development, including being acquired.

To conclude, we argue that investors recognize promising outlook for financially weaker and less profitable companies since the results suggest good prospects for such companies to be acquired.

On the other hand, interpreting the result under the Information Effect Theory, less profitable companies might be expected to successfully implement operational improvements utilizing the information that the acquisition has signaled to the market and thus increasing shareholder value.

Two of the hypotheses developed in this master thesis have been rejected at 10% significance level. Next we discuss this unexpected outcome and try to find explanations why those particular factors affect the abnormal returns in the opposite direction than anticipated.

6.2.2.3 Long-term Prospects of R&D

Our data sample shows a negative relation between the long-term prospects of R&D, specified as R&D investment ratio, and CARs, implying that, under the Acquisition Probability Hypothesis, industry rivals currently investing more in R&D are not recognized by the market to be potential acquisition targets. One possible explanation could be that high R&D investment might reflect companies being in an early stage of their product life cycles requiring high investment. Although such companies might have a promising long-term outlook, but the R&D investment has not started paying off yet making them less attractive acquisition targets.

However, while another hypothesis of the effect of current R&D quality on the CARs cannot be discussed since this variable was not found to be significant in the regression model, we cannot make a comparison between short and long-term prospects of R&D and conclude which characteristic is more important for potential acquirers.

On the other hand, since more strategic acquisitions are seen in pharmaceutical industry than financial ones, our results might imply that potential strategic acquirers are looking for targets that would offer possibility to impact the selection of projects to invest in, instead of buying a company with a determined long-term investment plan.

Under the Information Effect Theory negative relation between the long-term prospects of R&D might imply that companies having the investment decisions already made are not recognized to be able to cut costs or implement other operational improvements.

6.2.2.4 Sector

Contrary to our conjecture, the results suggest that biotechnology companies are not recognized as potential acquisition targets, interpreted in the framework of the Acquisition Probability Hypothesis. Pharmaceutical companies might be more attractive to acquire for several reasons. First of all, since the business model of biotechnology companies is relatively new and the operations as well as the success of the product development are characterized by high uncertainty, we argue that pharmaceutical companies having a better established and proven business model might be more attractive targets, especially in times of macroeconomic uncertainty. Moreover, since recent years evidenced more acquirers to be pharmaceutical companies as a reaction to the industry challenges that they were facing, we argue that the

market reacts negatively to attempts of potential diversification into the biotechnology sector, because investors can diversify on their own and company level diversification is not value creating for them.

On the other hand, under the Information Effect Theory, the negative relation between operating in a biotechnology sector and the CARs suggests that these companies are not seen as able to cut costs, lay their workforce off, reduce R&D expenditures or implement other possible improvements signaled to the market by the acquisition.

To conclude, our results show that shareholders of rivals keeping higher cash holdings as well as less profitable ones have experienced increased abnormal returns following the Pfizer-Wyeth acquisition announcement, while shareholders of rivals investing heavily in R&D as well as those operating in biotechnology sector have seen their abnormal returns to decrease.

7. Conclusion

The purpose of this master thesis was two-fold. First of all, we aimed to examine the wealth effects to the portfolio of the industry rivals as a reaction to the Pfizer-Wyeth acquisition. Secondly, we aimed to identify which firm specific factors characteristic to the pharmaceutical industry influence the cumulative abnormal returns of the rival companies.

The purpose of this master thesis was achieved using a two-step research approach. We started with an event study to find out the cumulative abnormal returns experienced by the portfolio of the industry rivals followed by the regression analysis which tested our hypotheses concerning the firm level characteristics' influence on the cumulative abnormal returns.

Our results, first of all, demonstrated a positive reaction of the industry rivals to the Pfizer-Wyeth acquisition announcement implicitly supporting the Acquisition Probability Hypothesis and suggesting that the market interpreted the focal deal as a signal of further opportunities of industry consolidation. Moreover, we could not reject that positive abnormal returns to the rivals might also indicate the valuable information revealed to the market regarding the available operational improvements which rivals could copy and implement. This would mean an implicit support for the Information Effect Theory as well. However, the rivals' reaction to the closure of the deal was negative suggesting that the Productive Efficiency Hypothesis might be the explanation and the new combined entity was perceived as a competitive threat to the rivals. The opposite result for both of the events might confirm the objectivity of the market's reaction as well as the importance of the transaction.

Secondly, the explanatory power of our regression model (12.4%) revealed that the firm specific characteristics are able to determine only a fraction of the variation of the CARs, with macroeconomic, behavioral and other characteristics that were out of the scope of this master thesis influencing the rest of the CARs' variation.

Finally, in line with our argumentation we found the cash holdings to determine the CARs positively and profitability – negatively, while our hypotheses regarding the positive influence of the long-term prospects of R&D as well as sector of operations have been rejected implying these factors determined the CARs negatively. No support for other hypotheses regarding the quality of R&D, high growth regions and taxation regimes was found according to our model.

Consequently, a connection between the acquisition motives and the firm specific characteristics identifying potential targets can be detected. For example, if the acquirer is looking for value increasing inefficiency removal, then either less profitable rivals or the ones holding higher cash balances might be able to offer such opportunities. If the acquirer is aiming for a high synergy realization potential, then again less profitable companies offering restructuring opportunities might be attractive targets. However, our data sample does not support the diversification motive of the acquisition, neither by bundling complementary R&D capabilities together, not by diversifying into the biotechnology sector.

Although unanticipated, our model demonstrated that in such an R&D intense industry as pharmaceuticals, R&D quality and prospects of the rivals, however, were not recognized as the most important and attractive factors for acquirers when screening for potential targets.

7.1 Limitations of the Study

Although examining industry rivals' wealth effects following a single transaction provides the advantage of being able to highlight and account for the idiosyncratic characteristics of the companies involved in the deal as well as relate the studied variables to the industry trends, it limits the generalizability of the results throughout the whole industry. More precisely, the conclusions of the study hold for the focal case of Pfizer and Wyeth, but can be only indicative in application for other transactions conditional on those being similar in terms of motives, size, timing, implementation, relative significance, etc.

7.2 Suggestions for the Future Research

Considering the limitations of the study, the focal research topic still maintains a high potential for further studies to contribute to the academic knowledge, thus next we provide several suggestions for the future research. First of all, in order to obtain more widely applicable results and conclusions, an expansion of the number of transactions examined is recommended. Secondly, since mega deals have been less typical for the industry very recently, with smaller deals in terms of price dominating the M&A activity, we see an opportunity to contribute to the knowledge of this field by examining the rivals' reactions to smaller deals as well. Moreover, our literature overview revealed that financial firm specific

factors and their influence on the stock price movement have so far dominated the studies about the rivals' reactions to the M&A activity. In our work we have tried to examine non-studied factors, such as R&D quality or sector of operations, but we believe this direction could be expanded, especially in the framework of the Acquisition Probability Hypothesis, by including even more non-financial characteristics of the rivals, such as specialization of the products (e.g. cancer treatment, diabetes, or generic vs. branded drugs, etc.) as well as, particularly in the studies of consolidating industries, the history of strategic alliances and joint collaborations with possible acquirers. Finally, the Acquisition Probability Hypothesis could be tested itself expanding the research by examining whether the market was correct in recognizing the potential targets, i.e. whether the takeover probabilities have been correctly priced. Thus as a possible direction of future studies we suggest a more long-term approach in order to validate the post-acquisition reaction by examining which companies were actually acquired later.

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Appendix

Appendix 1. Sample Composition

#	COMPANY	COUNTRY	SECTOR
1	ASTRAZENECA	UK	PHARMA
2	BTG	UK	PHARMA
3	GLAXOSMITHKlNE	UK	PHARMA
4	SKYEPHARMA	UK	PHARMA
5	ALLERGY THERAPEUTICS	UK	PHARMA
6	GW PHARMACEUTICALS	UK	PHARMA
7	PLETHORA SOL HLDGS	UK	PHARMA
8	BAYER	GER	PHARMA
9	SANOFI	FR	PHARMA
10	IPSEN	FR	PHARMA
11	STALLERGENES	FR	PHARMA
12	ALMIRALL	ESP	PHARMA
13	NOVARTIS	SWI	PHARMA
14	ROCHE	SWI	PHARMA
15	MEDA	SWE	PHARMA
16	OREXO	SWE	PHARMA
17	NOVO NORDISK	DK	PHARMA
18	LUNDBECK	DK	PHARMA
19	ALK-ABELLO A/S	DK	PHARMA
20	LIFECYCLE PHARMA (VELOXIS)	DK	PHARMA
21	PRONOVA	NO	PHARMA
22	ORION	FIN	PHARMA
23	TAKEDA	JP	PHARMA
24	DAIICHI SANKYO	JP	PHARMA
25	CHUGAI	JP	PHARMA
26	DAINIPPON	JP	PHARMA
27	EISAI	JP	PHARMA
28	ASTELLAS	JP	PHARMA
29	SHIONOGI	JP	PHARMA
30	MITSUBISHI	JP	PHARMA
31	HISAMITSU	JP	PHARMA
32	KYOWA	JP	PHARMA
33	SANTEN	JP	PHARMA
34	KISSEI	JP	PHARMA
35	NIPPON SHINYAKU	JP	PHARMA
36	TSUMURA	JP	PHARMA
37	ROHTO	JP	PHARMA
38	KAKEN	JP	PHARMA
39	KYORIN	JP	PHARMA
40	ZERIA	JP	PHARMA

#	COMPANY	COUNTRY	SECTOR
41	GENEREX BIOTECH	CAN	PHARMA
42	CIPHER	CAN	PHARMA
43	CARDIOME	CAN	PHARMA
44	VALEANT	CAN	PHARMA
45	ABBOTT LABORATORIES	USA	PHARMA
46	ELI LILLY	USA	PHARMA
47	MERCK & CO	USA	PHARMA
48	JOHNSON & JOHNSON	USA	PHARMA
49	KV PHARM,'A' (excl)	USA	PHARMA
50	BRISTOL MYERS SQUIBB	USA	PHARMA
51	FOREST LABS,	USA	PHARMA
52	ALLERGAN	USA	PHARMA
53	HOSPIRA	USA	PHARMA
54	VIVUS	USA	PHARMA
55	VIROPHARMA	USA	PHARMA
56	WATSON PHARMS,	USA	PHARMA
57	AVANIR PHARMS,'A'	USA	PHARMA
58	COLUMBIA LABS,	USA	PHARMA
59	MEDICIS PHARM,'A'	USA	PHARMA
60	OXIS INTL,	USA	PHARMA
61	OPTIMER PHARMACEUTICALS	USA	PHARMA
62	SANTARUS	USA	PHARMA
63	QUESTCOR PHARMS,	USA	PHARMA
64	REPROS THERAPEUTICS (excl)	USA	PHARMA
65	DEPOMED	USA	PHARMA
66	BIODEL	USA	PHARMA
67	ENDO PHARMS,HDG,	USA	PHARMA
68	AUXILIUM PHARMS,	USA	PHARMA
69	NEKTAR THERP (excl)	USA	PHARMA
70	MEDICINES COMPANY	USA	PHARMA
71	MAP PHARMACEUTICALS	USA	PHARMA
72	SALIX PHARMS,	USA	PHARMA
73	PAIN THERAPEUTICS	USA	PHARMA
74	POZEN	USA	PHARMA
75	IMPAX LABS	USA	PHARMA
76	CORCEPT THERAPEUTICS (excl)	USA	PHARMA
77	CORNERSTONE THERP,	USA	PHARMA
78	ISTA PHARMS,	USA	PHARMA
79	SUCAMPO PHARMACEUTICALS	USA	PHARMA
80	XENOPORT	USA	PHARMA
81	DURECT	USA	PHARMA
82	NOVABAY PHARMACEUTICALS (excl)	USA	PHARMA
83	ALEXZA PHARMACEUTICALS	USA	PHARMA
84	PROVECTUS PHARMS	USA	PHARMA
85	PHARMOS	USA	PHARMA

#	COMPANY	COUNTRY	SECTOR
86	ADAMIS PHARMACEUTICALS	USA	PHARMA
87	CADILA HEALTHCARE	IN	PHARMA
88	PIRAMAL HEALTHCARE	IN	PHARMA
89	HELIX BIOPHARMA CORP	CAN	BIOTECH
90	BURCON NUTRASCIENCE	CAN	BIOTECH
91	ACTELION	SWI	BIOTECH
92	THROMBOGENICS	BEL	BIOTECH
93	GALAPAGOS	BEL	BIOTECH
94	GENMAB	DK	BIOTECH
95	BAVARIAN NORDIC	DK	BIOTECH
96	NEUROSEARCH	DK	BIOTECH
97	TOPOTARGET	DK	BIOTECH
98	BIOTEST	GER	BIOTECH
99	WILEX	GER	BIOTECH
100	MEDIGENE	GER	BIOTECH
101	SYGNIS PHARMA	GER	BIOTECH
102	4 SC	GER	BIOTECH
103	NICOX	FR	BIOTECH
104	TRANSGENE	FR	BIOTECH
105	BIOALLIANCE	FR	BIOTECH
106	ALGETA (excl)	NO	BIOTECH
107	CLAVIS PHARMA	NO	BIOTECH
108	BIOTEC PHARMACON	NO	BIOTECH
109	PHARMING GROUP NV	NED	BIOTECH
110	GRIFOLS	ESP	BIOTECH
111	BIOINVENT	SWE	BIOTECH
112	SWEDISH ORPHAN BIOVITRUM	SWE	BIOTECH
113	OASMIA PHARMACEUTICA (excl)	SWE	BIOTECH
114	ACTIVE BIOTECH	SWE	BIOTECH
115	DIAMYD MEDICAL	SWE	BIOTECH
116	ANTISOMA	UK	BIOTECH
117	OXFORD BIOMEDICA	UK	BIOTECH
118	ARK THERAPEUTICS	UK	BIOTECH
119	RENOVO	UK	BIOTECH
120	ONCOLYTICS	USA	BIOTECH
121	QLT Inc	CAN	BIOTECH
122	INTERCELL	AU	BIOTECH

Note. excl - excluded from regression model due to methodological issues
Source: Authors' composition

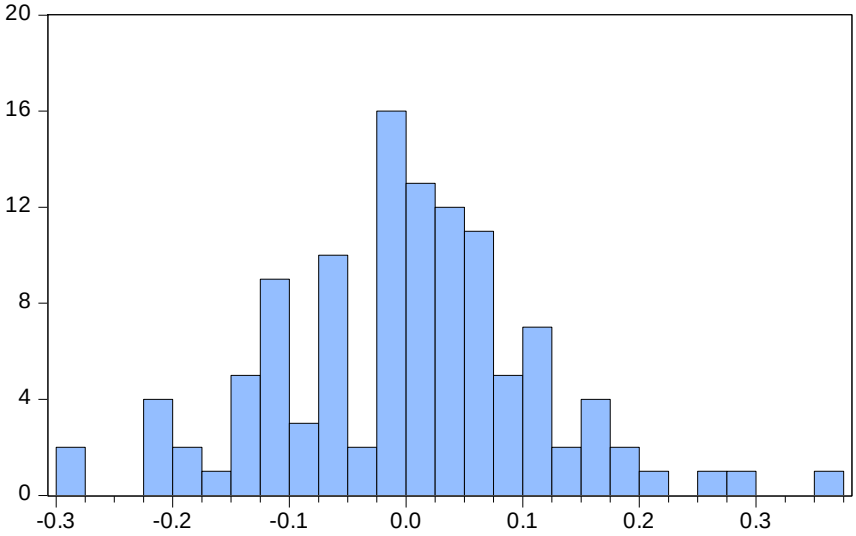
Appendix 2: Combined Corporate and Personal Tax Tates

Country	Overall CIT + PIT rate (%)	Binary
Austria	43,8	0
Belgium	43,9	0
Canada	47,9	1
Denmark	58,8	1
Finland	40,5	0
France	55,9	1
Germany	48,6	1
India	50,0	1
Japan	45,6	0
Netherlands	44,1	0
Norway	48,2	1
Spain	42,6	0
Sweden	49,6	1
Switzerland	41,5	0
United Kingdom	46,0	0
United States	52,0	1

Note: CIT = Corporate Income Tax, PIT = Personal Income Tax

Source: Authors' composition based on the OECD Tax Database (OECD, 2012)

Appendix 3: Test of the OLS Normality Assumption



Series: Residuals	
Sample 1 114	
Observations 114	
Mean	1.29e-17
Median	0.002900
Maximum	0.368260
Minimum	-0.286960
Std. Dev.	0.112075
Skewness	0.134947
Kurtosis	3.750891
Jarque-Bera	3.024232
Probability	0.220443

Appendix 4: Regression Output for Event 2 (-10, 5)

Hypotheses	Characteristic	Regression coefficient	t-Statistic	Probability
H1	Quality of research and development	-0,0393	-1,3030	0,1954
H2	Long term prospects of research and development	-0,0003	-0,3623	0,7178
H3	Sector	0,0384	1,0616	0,2909
H4	High growth regions	-1,6461	-1,6461	0,1027
H5	Profitability	-0,0002	-3,6533	0,0004
H6	Cash holdings	-2,0530	-2,0530	0,0426
H7	Taxation regime	0,0408	2,0211	0,0458
Control	Control variable: size	-0,0006	-0,0893	0,9290

Source: Authors' composition.