

Sell-offs in US Biotechnological and Pharmaceutical industries (2000 - 2016)

Taras Rohovets

up201200813@fep.up.pt

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Supervisor:

Professor Jorge Bento Ribeiro Barbosa Farinha

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Bibliographical Statement

Taras Rohovets is 25 years old and was born in Kyiv, the capital of Ukraine. Taras completed a bachelor in International Relations at the Faculty of Arts of the University of Porto, before joining the Master in Finance at the same university. Regarding his professional experience, he did two internships. One in accounting department of Fapomed SA and the other one in Carmo&Cerqueira SROC.

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Abstract

This study intends to analyze the impact of divestitures, namely sell-offs on shareholder value in U.S. Biotechnological and Pharmaceuticals companies. The main aim is to contribute to the scarce literature in this area by checking if indeed the divestitures in these two industries that have high R&D intensity can create value for shareholders. We suggest that companies in high R&D intensity sectors have more growth opportunities because of creation of new technologies, patents, etc.; and by using divestitures as a growth strategy is possible to create value for the company. The data used will be daily stock prices from publicly traded companies. The research questions will be answered by analyzing the announcement effects. Also will be performed a regression in order to check if R&D expenses indeed have an impact on the announcement effect.

Key-words: Divestitures, sell-offs, R&D, Biotechnology, Pharmaceuticals

JEL–codes: G34, L65

Table of Contents

1. Introduction 1
2. Literature review 4
2.1 Divestitures and creation of shareholder value, its market reaction and operational efficiency 4
2.2 Spinoffs versus divestitures with cash generation (sell-offs) 6
2.3 Innovation and impact of R&D intensity on divestitures 8
2.4 Hypotheses 10
3. Methodology 11
3.1 Event Window 11
3.2 Sample Description 12
3.2.1 Sample for events studies 12
3.2.1 Sample for the regression 13
3.3 Daily Abnormal Returns 13
3.4 Average Abnormal Return 14
3.5 Cumulative Average Abnormal Return 15
3.6 Significance Test 15
3.7 Model presentation and descriptive statistics of the variables 16
4. Results 19
4.1 Event study results 19
4.2 Correlation Analysis 23
4.3 Regression Analysis 24
5. Conclusion 26
6. References 28
7. Appendix 31

List of Tables and Figures

Table 1. Performance.....1
Table 2. R&D Intensity in U.S., 2015.....2
Table 3. Summary of theories about divestitures.....9
Table 4. Descriptive Statistics of the variables.....17
Table 5. AAR and CAAR of BioPharma industries.....20
Table 6. AAR and CAAR of all industries.....20
Table 7. Correlation of variables.....23
Table 8. Regression output.....25
Table 9. Event Study Sample (Biotechnology and Pharmaceuticals).....31
Table 10. Abnormal Returns, Average Abnormal Returns, Cumulative Average Abnormal Returns.....37
Table 11. Regression Sample.....38
Table 12. Eviews regression output.....39

Figure 1. Divestiture mechanism: Sell-off.....7
Figure 2. Comparison of AAR of BioPharma and AAR of All industries.....21
Figure 3. Comparison between CAAR of BioPharma and CAAR of All industries.....22

1. Introduction

The main motivation to perform a research in this area is to check if divestitures, mainly sell-offs in industries with high R&D intensity like biotechnology and pharmaceutics are a good corporate strategy for managers to create value for shareholders or for investors to profit from financial markets. Our attention was caught by Biotechnological and Pharmaceuticals industries, first of all, because of their first place in R&D intensity ranking with an impressive 17,1% result according to *The 2015 EU Industrial R&D Investment Scoreboard.* R&D intensity is a very important measure that shows how the company performs in business innovation. Generally it is defined as R&D expenditures divided by firm's revenue. Another important factor that led us to choose these two industries is their size. Biotechnological and Pharmaceuticals sectors in US jointly have a market value of 2.650,18 T$ as for Nov. 4, 2016 (Fidelity Investments site). This is, for example, twice the market value of US Software companies that account for 1.34T$. So, these are quite big industries. Maybe the most decisive factor of our choice was the significant growth rate. If we check history we can find not only impressive growth rates for these two industries but sometimes extraordinary growth of Biotechnological companies, for example, in the Nasdaq exchange. In the following table we can see the performances of the last 10 and 5 years:

Table 1. Stock Exchange Performance

		2006-2016	2011-2016
NASDAQ Biotechnology	NBI	240%	187%
SPDR S&P Biotech ETF	XBI	213%	150%
SPDR S&P Pharmaceuticals ETF	XPH	187%	95%

Source: author´s own creation

Our choice also was conditioned by the fact that there are no studies about this specific theme, at least we didn't find. So, we think this work can somehow be potentially valuable and contribute a little for this specific literature area. Also we noticed that there is too much attention on mergers and acquisition and not on divestitures as a growth

strategy. For example, if we search in Google for M&A we will obtain 40 millions of results while if we search for divestitures we will obtain just 1,73 million results, as for November 2016.

Many studies show a positive market reaction when a company is doing a divestiture. Later these studies will be discussed. And we found this evidence important and interesting, for example, from the point of view of investing, because it will potentially allow investors to profit and take an advantage in the market against other players. And also from the point of view of managers, that will be able to increase the shareholder's value. So, combining these two factors, industries with high growth opportunities and positive effect from divestitures, arose an idea to see if the positive effect continues to exist in these specific industries and if yes, at what level.

Table 2. R&D Intensity in U.S., 2015

SECTOR	US R&D intensity 2015	
Pharmaceuticals&Biotechnology	High	17,1%
Chemicals	Low	3,4%
Health Care Equipment&Services	Low	3,1%
Industrial Engineering	Low	2,9%

Source: The 2015 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD.

After checking if positive announcement effect exists, we will compare our results with the announcement effect of all U.S. industries in order to verify if our specific industries effect is truly higher. The sample for all industries will be composed of divestitures, more exactly sell-offs with similar deal values of Pharmaceuticals & Biotechnological sell-offs sample.

But the idea is not only to check if a positive announcement effect exists, though the evidence suggests that, but also to find what factors have more influence on the announcement effect. Of course, the goal is to check the impact of R&D intensity on the announcement effect, but also we will check for other factors. Maybe biotech and pharmaceutics companies with high level of debt experience a higher positive

announcement effect? Or maybe companies with higher R&D intensity show higher returns? Biotechnology and pharmaceutics were chosen not only because of high growth opportunities and other reasons mentioned before but also because of personal reasons and beliefs. We believe that biotechnology is a very important part of future civilization development as it affects important questions like the increase of life expectancy and the cure of dangerous diseases. Also it may have a big impact on world economy because of the possible ability to solve such problems as global warning, global epidemic, poverty, petroleum crisis and etc. For us, these two industries have not merely financial interest but a general and personal interest as well.

2. Literature review

Although there is not much literature about sell-offs and moreover no literature about our specific topic, we will try to go through main concepts related to our general theme and see what was written and studied previously. This literature review will mainly focus on sell-offs but also in other type of divestitures to show the general picture of divestitures. In order to maintain a coherent logic, we will cover the following topics in order of importance from our point of view. A first topic will cover the literature about the creation of shareholder value and the market reaction. A second topic will be about the cash generation and its impact or, in other words, the difference between sell-offs and spin-offs as main divestiture mechanisms. And the last one will be about the relation between R&D, innovation and divestitures. In the end we will summarize all the stated theories and ideas and present our hypotheses.

2.1 Divestitures and creation of shareholder value, its market reaction and operational efficiency

Almost all reviewed literature states that divestitures create value for shareholders. The main assumption of why divestitures create value for shareholder relies on the idea that markets think that a non-core business can be more valuable in the hands of somebody else (BCG, 2014). It is the so called refocus of the business. In other words, when a business is concentrated on its main activity that brings most of the income to the company, the financial results are much better than when the company tries many areas of activity. There is evidence that when companies announce on their divestment statement a focalization strategy the shareholder value increases to around 2% while when divesting companies don't, the abnormal returns are not very different from 0% (Rangel, 2006). The same idea is supported in Deloitte Research (2013) which found that in volatile markets when companies divest with an intention to focus in core business, markets treat that as an intention to grow. Basically, we see that markets treat

a focalization intention as a very good thing for the company. And it is logical; it has to do not only with financial world but also with everyday life. It is impossible to do something good simultaneously doing other things, unless this person, in our case a company manager is Julius Caesar. There is a historical belief that Caesar was able to write, read and give orders simultaneously. Hanson and Song (1997) in their work also found that there are gains when firms do an inter-firm divestiture. They suggest that the long term performance improves due to the elimination of assets that create negative synergies. On the other hand, the long term performance of the seller does not improve when the assets are divested to another management unit, in other words, not an inter-firm divestiture.

Returning to the market reactions, a study of 266 sell-offs and equity carve-outs in listed firms in Taiwan between 1995 and 2004 showed positive significant cumulative returns on the announcement date (Sun, 2012). As said before, this in line with the statement that divestitures represent good news for the market. In another study about divestitures in Portugal between 1997 and 2003, positive abnormal cumulative returns of 1, 21% were also shown in first three days window (Rangel, 2006). Going in a deeper analysis of the market reaction to divestitures a research (BCG, 2014) found that markets reward more distressed companies than non-distressed. We find this important, because this finding suggests that the more the company is in a bad situation the more will be the positive announcement effect or the increase of shareholder value after a divestiture. Regarding the debt factor, Nguyen in his paper (2013) says that levered companies show higher excess returns when divesting and the market reaction is stronger when the seller is less focused. A potential explanation is that these higher excess returns are related to the possibility of reducing the debt using the cash proceeds. This rationale will be discussed later, in the next section. Also the expected returns are positively related to expected increase in focus and expected decrease in leverage.

It is interesting to mention that when U.S companies divest foreign assets, the announcement returns are 0, 55% lower compared to domestic divestitures. This seems to be not related with the information leakage, but when the transaction size increases so does the market reaction (Kaprielyan, 2016).

In the operational efficiency framework, and operational efficiency is very similar to the refocus theory discussed above, many studies show that after a sell-off the operational efficiency improves. This may make sense as these transactions tend to improve their operations on the remaining activities (BCG, 2014). Also, there is evidence that firms that divest through sell-offs have significantly better operating performance than firms that divest their assets through spinoffs (Prezas and Simonyan, 2015). This is due to the fact that spinoffs represent more a strategic, organizational decision. A new company is created but the shareholders in most cases remain the same and also we don't see an injection of cash in any company (parent and new) after the spinoff. This issue will be discussed in more detail in the following section.

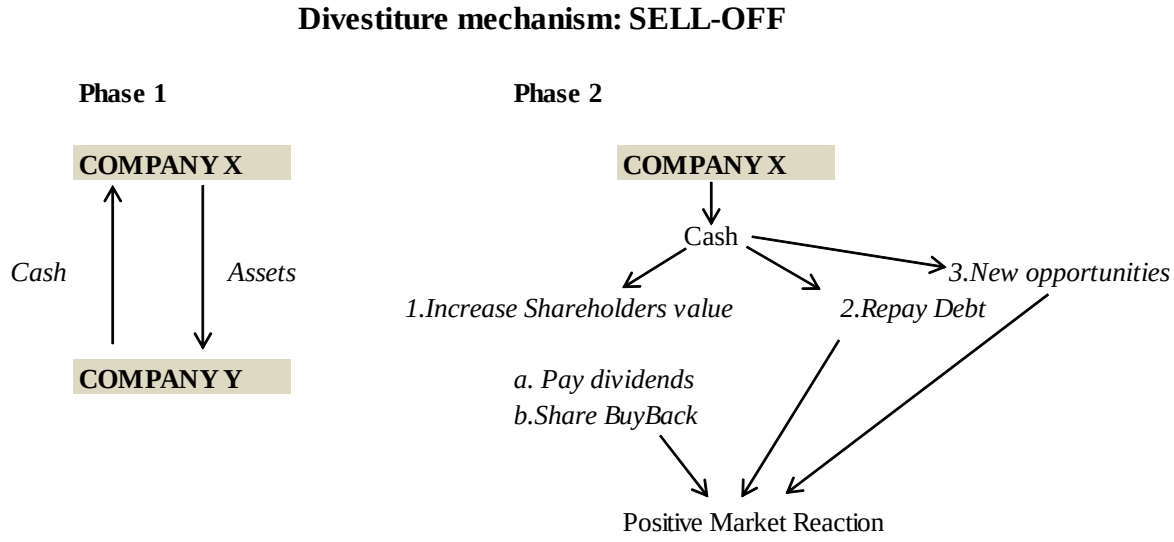
2.2 Spinoffs versus divestitures with cash generation (sell-offs)

In this section we will explain why we choose to conduct our study about selloffs and not about spinoffs and present the corresponding literature. These, of course, are two of the most used divestiture mechanisms by the financial world. The idea and the empirical effect of sell-offs of producing a positive impact on the creation of the shareholder value by injecting the received cash from the sale is not only interesting from the academic point of view but also has a big impact on the financial expectations of divestitures. While spinoffs don't generate cash and they are purely strategic (BCG, 2014), sell-offs bring not only positive reaction from the market but also cash. And here we think is important to recall a very famous expression – "Cash is king". Having a lot of cash at hand allows the company to be more flexible in what regards business decisions. The divestment motivation and the following use of received cash are crucial factors in generating firm value gains, i.e. the profit on the sale over the "value-in-use" of the divested assets have big positive impact on the abnormal returns and in determining the positive market reaction (Clubb and Stouraitis, 2002). The following statement found in BCG (2014) seems to us very important regarding our study, because it is related directly with how managers can increase the shareholder value through sell-offs. It says that managers of divesting companies can use the received

cash to directly increase the shareholder value by doing a shares buy-back or by paying dividends. Another important factor in the usage of cash proceeds is that markets like to reward companies with high level of leverage, because they use the received cash to reduce debt (BCG, 2014). Sun (2012) also confirms that the ability of cash flows of firms is stronger to repay current debt after a divestiture. Also we think the proceeds can be invested in new opportunities and thus fuel future growth.

Summarizing, we can say that doing a sell-off brings to us four advantages or, more exactly, four methods of increasing the shareholder's value that we couldn't obtain with a spinoff. Firstly, and the most impart with spinoff the company receives cash. Secondly, with that cash the company can directly increase the equity value by distributing dividends or by doing a shares buyback. Thirdly, the company can use the obtained cash to reduce debt, for example if it is distressed company, and this will bring an excess return for the company due to strong market reaction. And, fourthly, a company can invest in new opportunities. Graphically it can be represented as follows:

Figure 1. Divestiture mechanism: Sell-off



Also it's important for company's management think strategically and know which restructuring strategy to implement, considering various implementation routes, i.e. to do a spinoff or a sell-off. A study conducted by Bergh, Jonhson and Dewitt (2008), found that firms that have high diversification and use sell-offs, tend to have better

initial performance than their peers that used spinoffs. And the opposite can also happen. Firms that have higher specialisation and adopt a sell-off will have lower financial results than when such firms use a spinoff.

Another important aspect in the comparison of spinoffs and sell-offs is that sell-offs bring a much better long term performance of stock returns, while spinoffs show a bigger announcement effect in the short term. Maybe this is due to cash proceeds? But both show large positive announcement effects (Prezas and Simonyan, 2015). The same is confirmed in another study by Rubera and J.Tellis (2014). They confirmed that spinoffs have higher profits in the first two years than buyouts but in the long term buyouts are more profitable. Rosenfeld (1984) also confirms that spinoffs outperform selloffs, but also that the gains of shareholder for the seller and acquirer are nearly identical.

2.3 Innovation and impact of R&D intensity on divestitures

In this section we will present the available literature about the connection between divestitures and R&D and innovation. Even if we won't include innovation in our study, we decided to maintain it in our review as its appears much in the literature and is always strongly connected with R&D intensity and with pharmaceutical and biotechnological industries. Unfortunately, no literature was found about the impact of R&D intensity on the announcement effect of sell-offs.

As said before, R&D intensity is directly connected with firm innovation. Biotechnological and Pharmaceuticals industries have the highest R&D intensity among all the U.S industries rounding 17% in 2015. As Moschieri and Mair (2003) stated, divestitures can be an important tool for innovation and can lead for upside growth, wealth creation and even survival for the parent company. Also, there is evidence that R&D intensity stimulates the trade of assets, particularly in the divestiture link and increases the opportunities to find synergies with external assets (Ushijima, 2009). Besides the increase in opportunities, investing in R&D may be more profitable than

investing in commercialization strategies, and this also explains why sell-offs are much more profitable than spinoffs in the long term (Rubera and J.Tellis, 2014).

We see that high R&D intensity is very positive factor and has a lot of advantages. We think it is appropriate to quote the National Science Foundation that said: "R&D expenditures indicate the level of effort dedicated to producing future products and process improvements while maintaining current market share and increasing operating efficiency."

In the following table it will be presented a summary of discussed above theories and methods to increase shareholders value or to have a positive market reaction and also the papers where these theories were described and mentioned:

Table 3. Summary of theories about divestitures

Motives of divestitures that increase shareholder value

Theories	Determinants	Authors
Refocus	Markets treat refocus as good news.	Rangel (2006) Nguyen(2013)
	By refocusing the company stops	BCG (2014)
	to suffer the diversification discount	Hubbard e Pahlia (1999)
	Elimination of negative synergies	Deloitte(2013) Hanson and Song (1997)
Operational Efficiency	Improvement of the remaining operations. Thus, creating additional value	Prezas and Simonyan(2015)
Level of Debt	By using cash proceeds from selloffs markets tend to reward firms	BCG (2014)
	Increase of the ability to repay current debt	Sun (2012)
	Expected decrease in leverage	Nguyen(2013)
R&D Intensity	R&D intensity increases the opportunities to find synergies with external assets	Ushijima (2009)
	Investing in R&D more profitable than investing in commercialization strategy	Rubera and J.Tellis (2014)

Source: author´s own creation

2.4 Hypotheses

After a detailed analysis of the main literature that was of our interest and which is connected to our research we will present in this section our hypotheses questions to which we will try to answer later in this work. Most of the studies show evidence that divestitures, mainly sell-offs can bring positive announcement effect for the parent in different time periods, though no studies seems to exist about sell-offs of biotechnological and pharmaceutical companies. Also there is evidence that the level of debt can positively impact on the announcement effect. And there are no studies about the effect of R&D on sell-off performance. So, the main objective of this study is to check whether sell-offs in biotechnological and pharmaceutical industries can create shareholder value for the parent by measuring it through the announcement effect. Simply saying, we want to check the market reaction of sell-offs, whether the stock price goes down or up after the divestiture. Then, in order to give more depth to our results we will compare the announcement effects of biotechnological and pharmaceuticals companies with the announcement effects of companies from all other industries in order to see if the returns from sell-offs are indeed higher in biotechnological and pharmaceutical industries. After that, the intention is to break down the announcement effect according to level of debt, R&D intensity and size, with a purpose of testing whether these three factors have an impact on the announcement effect. Therefore, the research questions would be:

H1. *"Does trade-sales in US Biotechnology and Pharmaceutical industries have positive announcement effect for the seller/parent in the short, middle and long term?"*

H2. *"Are the sell-off announcement effects in Biotechnological & Pharmaceuticals industries higher than in all other companies/industries?"*

H3. *"Do the following parameters of the seller: Level of debt, R&D intensity and size make a significant impact on the announcement effect?"*

3. Methodology

In this section we will present our methodologies. Our study can be divided in three parts. In the first part we will search for any positive announcement effects and we'll use a traditional event study methodology similar to that of Fama, Fisher, Jensen, and Roll (1969). This methodology is also very similar to the one used by Rosenfeld (1984). In this part our intention is to confirm our hypothesis 1, ie, if sell-offs of biotechnological and pharmaceuticals companies increase shareholders wealth of the parent company. In the second part, we will use the same methodology as in the first part, but the sample will consist of companies from all industries, including biotechnological and pharmaceutical. Additionally, here we will order the companies from all industries by similar deal values of biotechnological and pharmaceuticals industries. And finally, in the third part we will test the impact of the R&D, Level of debt and size factors on the announcement effect. For that purpose we'll perform a regression, more exactly we will use the Ordinary Least Squares (hereafter OLS) method.

3.1 Event Window

The time perspective for our test was chosen taking into the consideration some assumptions. First, we wanted to test the immediate effect of the sell-off on the seller. For that it is perfectly suitable a time period of some days. Second, we wanted to see a longer effect of sell-offs on the parent in order to be able to confirm a longer term value creation. For that we think a three month period serves perfectly. Thus, the event window in our study will be 61 days, -1 prior to the announcement and +60 days after the announcement. The event study will be presented by the following three periods in order to test our hypotheses:

Event window:

One week window: 6 days abnormal returns -1 to 5 *trading days*

One month window: 21 days abnormal returns -1 to 20 *trading days*

Three months window: 61 day abnormal returns -1 to 60 *trading days*

3.2 Sample Description

3.2.1 Sample for events studies

Our sample consists of divestitures (sell-offs) of listed U.S. companies from biotechnological and pharmaceutical industries. We used Zephyr Database to find those sell-offs. The period we choose goes from 1.1.2000 to 31.12.2016. We think it is an adequate period for our tests. Then, in order to separate different types of divestitures from sell-offs we had to put a criteria that the divested stake is a minimum of 50%, meaning that the companies when divesting lose control over the subsidiary or its assets. Also we selected listed firms, because we wanted to study only publicly traded companies in major American exchanges: NYSE, NASDAQ and AMEX. This was done to remove the possibility of not having price data. The industries were selected according to NAICS 2012: 3254 - Pharmaceutical and Medicine Manufacturing, 541711 - Research and Development in Biotechnology. The sample we received accounts for 107 divestitures. From that sample we had to delete all the deals that didn't have values, because we didn't want sell-offs with very low deal values. Also we deleted deals where companies were divesting assets not related with R&D activity, such as sites, brands, and etc. Our final sample consists of 52 sell-offs.

After receiving our sample with divestitures we needed the daily stock prices. For this purpose we used Thomson Reuters to download the daily stock prices. The stock prices were the daily closing ones.

The same process was applied for constructing the sample for all industries. The only difference was that instead of two industries we selected all the industries in NAICS 2012. After that, we calculated the average deal value for Biotechnological and Pharmaceuticals sell-offs, which was 696 000 000$. And then we filtered the sell-offs of all industries by similar deal values. The average deal value for "All industries" sample was 692 000 000$.

3.2.1 Sample for the regression

The sample for our regression model is almost the same, with the exception of two deals which we had to exclude due to the lack of data. So our sample comprises 50 sell-offs, divestitures. As we are measuring the impact of factors on the announcement effect, the independent variable can't be in absolute values. For that we had to transform out factors into ratios. More detailed information about variables will be given in the respective section below. The analysis of the variables will be described below in respective chapter. The data for the variables was downloaded from the balance sheets and income statements for the respective years. In other words, if the divestiture occurred in 2014 the data from the balance sheet for the needed item, for example for total assets was taken from the company's balance sheet ending 31 December 2014. The same method was applied to the items from the income statement. The data was downloaded from Thomson Reuters.

3.3 Daily Abnormal Returns

Starting from this section we'll perform calculations and use different procedures in order to test our hypotheses. Briefly, our steps for calculating the announcement effect will be as follows:

1. Daily Abnormal Returns

2. Avarage Abnormal Returns (AAR)

3. Cumulative Abnormal Returns (CAAR)

4. Significance Test(T-test)

The first step in our announcement effect calculation is to calculate the daily abnormal returns of each stock. Basically the computational formula is the difference between the prices of day one and those of the following day. But daily return individually of each stock is very affected by the market movements. So, here we need to isolate the effect of the event from other market impacts. To solve this problem we'll use a model called "Market return model". The idea of this model is to subtract from stock returns the return of a market index. The formula of the model is represented in the following way:

$$AR_{i,t} = R_{i,t} - R_{M,t}\ , \tag{1}$$

where $R_{M,t}$ is the return of a market index (e.g., S&P 500).

As a market index was chosen S&P 500 index, since S&P 500 is considered the main index among the other two major American indexes (Dow Jones and Nasdaq), where our stocks are quoted. So, our daily return after an event, in our case after a sell-off is obtained by the difference between changes in stock prices minus the changes in S&P500.

3.4 Average Abnormal Return

After obtaining the daily abnormal returns we'll calculate the Average Abnormal Returns (AAR) for each day of the estimation period. The formula used is the following:

$$AAR_t = \frac{\sum_{i=1}^{n} AR_{i,t}}{n} \tag{2}$$

where, AARt is the average abnormal return at time t, and n is the number of sell-offs in our sample.

3.5 Cumulative Average Abnormal Return

Cumulative Average Abnormal Return (CAAR) is very useful statistical measure as it helps to get a sense of an aggregate view of the abnormal returns. The formula of CAAR consists in summing the results from (2) over the T days in the event.

$$CAAR_T = \sum_{t=1}^{T} AAR_t \quad (3)$$

where, $CAAR_T$ is the cumulative average abnormal return over T days in the event.

3.6 Significance Test

In order to determine a statistical significance of the hypothesis we'll use a statistical Cross-Sectional t-Test. A simple test for AAR is presented by the following formula:

$$t_{AAR_t} = \sqrt{N}\,\frac{AAR_t}{S{*}\,AAR_t}\ , \quad (4)$$

where S is the standard deviation across firms at time t

$$S_{AAR} = \frac{1}{N-1}\sum_{i=1}^{n}(AR_{i,t} - AAR_t)^2 \quad (5)$$

The standard deviation we obtained for our sample of Biotechnological and Pharmaceuticals sell-offs is 28,9%. This standard deviation can be considered high, which indicates a high volatility of returns in our sample. We think this related with biotechnological pumps that not rarely show dozens or even hundreds percent of returns in a short period of time, while the standard deviation for all industries sample is much lower, just 7,21%. This means that the returns for all industries sample are less volatile than in the biotechnological and pharmaceuticals sample.

The t-Test for CAAR is almost identical and is presented in following equation:

$$t_{CAAR_t} = \sqrt{N}\,\frac{CAAR_t}{S{*}\,CAAR_t}, \tag{6}$$

where the S is the standard deviation of the cumulative abnormal returns across the sample.

All the above tests were presented by Muller (2015) and they are also in line with those described by Brown and Warner (1980).

3.7 Model presentation and descriptive statistics of the variables

In order to test *Hypothesis 3* and also to understand and to test the impact of different factors on the abnormal return of the sell-offs, it was decided to do an OLS regression. The main attention was focused on the impact of the R&D intensity on the abnormal returns in the long term. We think that in ultra short period there is a low probability to see some effect of R&D on the announcement returns. Beside R&D, we also want to test if debt and size have an impact and to what extent. Additionally, like in many other studies, we introduce two control variables: Return on Assets as a proxy to performance and Market-to-Book ratio as a proxy for growth opportunities. Also, as said before, we can't use the absolute values in the regression, consequently we took ratios instead. Thus, the model to be estimated is the following:

$$60AR = \beta_0 + \beta_1 R\&D/Sales + \beta_2\, Debt/Assets + \beta_3 log(Size) + \\ + \beta_4\, ROA + \beta_5 MtB + u_{it} \tag{7}$$

In this regression *60AR* is the dependent variable and represents the abnormal return of sell-offs in the long term. Long term in our study is 3 months. In the right side of the

equation, the first explanatory variable is *R&D/Sales*, which represents a % of R&D spending from total company's sales. This ratio was obtained by dividing the R&D spending from Income Statement by the Sales or Revenue. This ratio is the exact formula for the R&D intensity. The next explanatory variable is *Debt/Assets*, which is a proxy for amount of debt. This ratio was calculated by dividing the Short-term Debt and Long-term Debt from the Balance Sheet by Total Assets also from the Balance Sheet. And the last explanatory variable *log(Size)* is the log of company's size. The proxy for Size here is the Total Assets from the Balance Sheet. The two control variables Return on Assets (*ROA*) and Market to Book (*MtB*) as said before are the proxies for performance and growth opportunities, respectively. Return on Assets was calculated using the following formula:

$$ROA = \frac{Net\ Income}{Total\ Assets} \tag{8}$$

In addition, the Market to Book ratio was obtained by doing the following calculation:

$$MtB = \frac{Market\ Capitalization}{Book\ value\ of\ equity} \tag{9}$$

The last two variables *ROA* and *MtB* were introduced into the model with the intention of providing robustness to the conclusions of our model and to compensate the small number of independent variables that could cause biases.

In the next table we can see the descriptive statistics of our variables, in order to better understand the characteristics of our variables in the regression. In the table we presented the tMean, Std.dev, Min and Max statistics for our variables.

Table 4. Descriptive Statistics of the variables

Variable	*R&D/Sales*	*Debt/asssets*	*Size(Assets)log*	*Return on Assets*	*MtB Ratio*
Mean	0,47	0,26	9,87	0,06	2,66
Std.dev	1,03	0,36	1,25	0,17	3,74
Min	0,01	0,01	7,33	-0,40	-17,26
Max	6,01	2,62	11,33	0,93	13,52

The variable R&D/Sales shows us that our sample companies in Biotechnological and Pharmaceuticals spend on average 47% in R&D from their Sales income. This can be considered extremely high when comparing with the average in the market. For example such tech giants as Intel and Microsoft have this ratio around 15-20%. The maximum is 6,01 (or 601%), while the minimum is just 1%. Regarding the debt, companies from our sectors don't seem to be overleveraged. On average companies have a Debt ratio of 0, 26 while the maximum value for the Debt ratio is 2,62. The Return on Assets variable shows that on average companies have a 6% return. The maximum return in our sample is 93% and the minimum is -40%.

4. Results

In this section, we present the results of our two event studies and the results of our regression. Firstly, we will present the results of the announcement effects for Biotechnology and Pharmaceuticals industries sample and for "All industries" sample. Afterwards, we will present the results of our OLS regression to see the impact of debt, size and R&D on the announcement effects.

4.1 Event study results

In order to test our hypotheses 1 and 2, we performed two event studies. One was for the biotechnological and pharmaceutical industries and the other one for all industries. The following two tables show the Average Abnormal Return (AAR) of the sell-off sample for the Biotechnological and Pharmaceutical industries (Table 5) and for All industries (Table 6). The Cumulative Average Abnormal Return(CAAR) is also shown in the tables as well as the t-values calculated on the basis of AARs. First of all, it is very important to state that all AAR values are statistically significant.

As you can see from Table 5 our Hypothesis 1 holds, as these two industries do have positive announcement effect in the short, medium and long term. In the short term the Average Abnormal Return is **1,95%,** in the medium term – **3,13%** and in the long term – **5,41%.** It is also important to notice that not all stocks experienced a positive announcement effect.

Table 5. AAR and CAAR of BioPharma industries

Biotechnological and Pharmaceuticals industries			
Day	**AAR**	**t**	**CAAR**
1	1,78%	3,46	1,78%
5	1,95%	7,73	10,31%
20	3,13%	15,46	48,96%
60	5,41%	26,77	194,14%

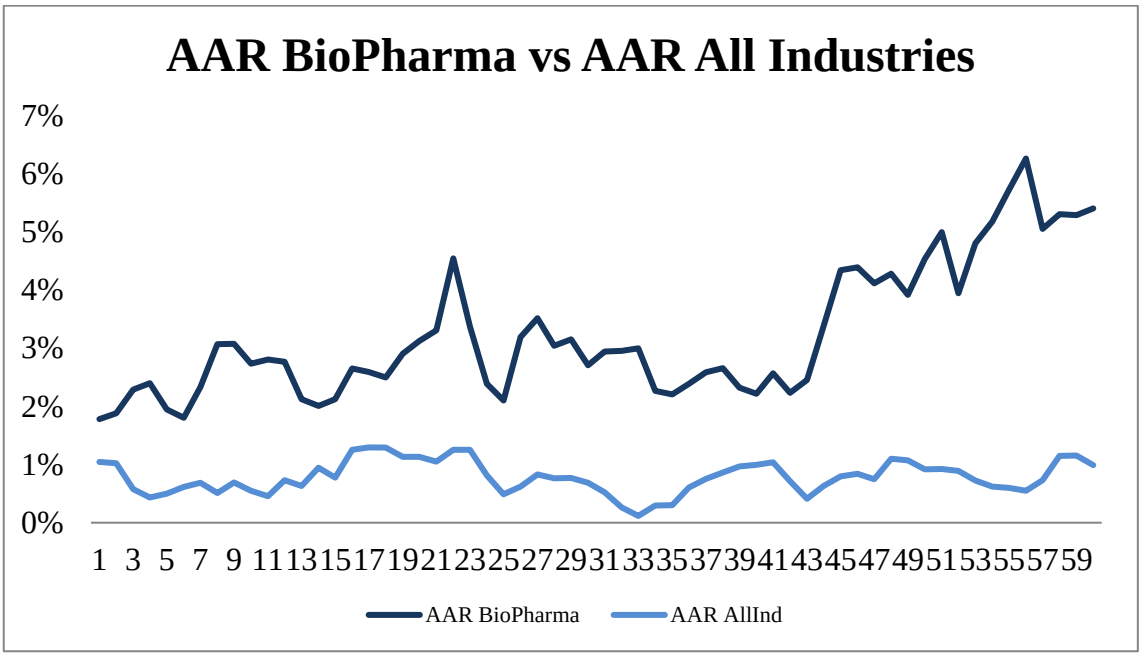
In Table 6 it is possible to notice that the AAR of All Industries sample is lower than that of the Biotechnological and Pharmaceuticals sample. This result is very crucial for our study because it is supporting our Hypothesis 2. The reasons from our point of view rely on the statement that Biotechnology and Pharmaceuticals have more high growth opportunities than any other industry. And these high growth opportunities are the consequence of big investments in innovations or R&D and high price premiums (Aggarwal, 2007). The positive announcement effect in Biotechnology & Pharmaceuticals sectors is higher than when comparing the effects for all industries. For example, in the 6 day window period, the positive announcement effect in Biotechnological and Pharmaceutical sectors is **1, 45%** higher, in 21 days period – **1,99%** higher and in 61 days period – **4,42%** higher.

Table 6. AAR and CAAR of all industries

All Industries			
Day	**AAR**	**t**	**CAAR**
1	1,04%	13,88	1,04%
5	0,50%	31,03	3,58%
20	1,14%	62,07	16,28%
60	0,99%	107,51	47,10%

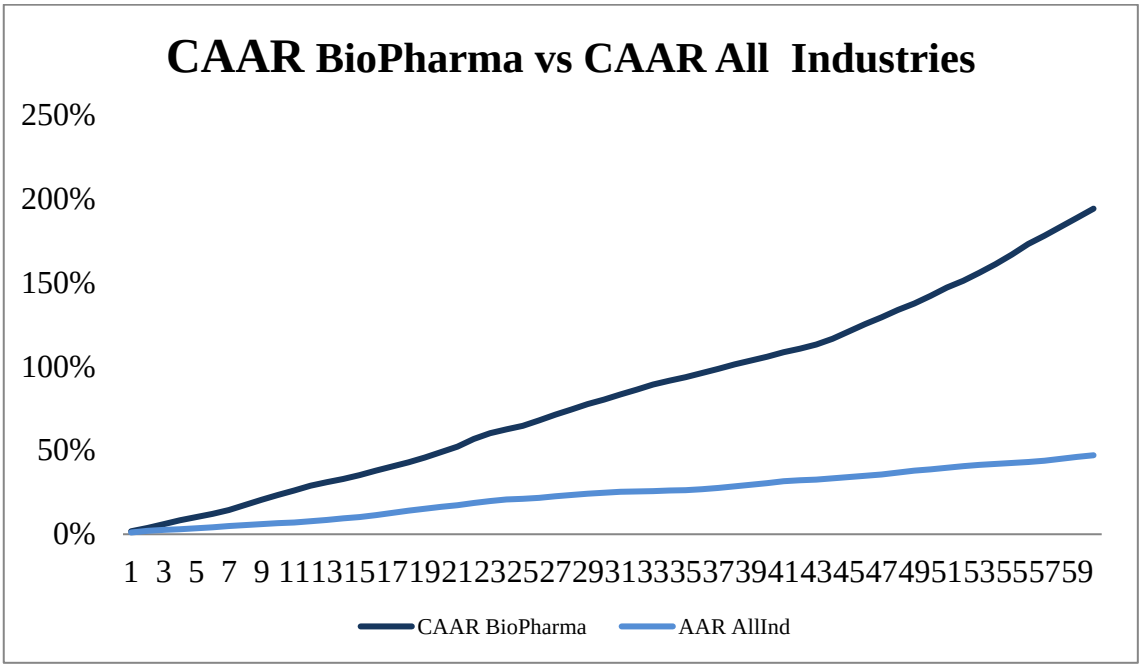
Figure 1 shows the comparison of AAR between our two samples. As we can see, the returns of sell-offs of biotechnological and pharmaceutical companies are not only higher comparing with all industries, but also keep growing from about 2% to more than 5% during the 61 days period. At the same time, the abnormal returns for all industries are only about 1% during the whole period.

Figure 2. Comparison of AAR of BioPharma and AAR of All industires



The next figure, Figure 2 shows to us the comparison between CAAR of BioPharma and CAAR of all industries. As we would expect, the CAAR performance of BioPharma industries is much better (about four times) than the CAAR for all industries. In the three month window period the cumulative average abnormal return of BioPharma industries is almost 200% while the CAAR of all industries is less than 50%.

Figure 3. Comparison between CAAR of BioPharma and CAAR of All industries



Summarizing this section, from our results for hypothesis 1 and hypothesis 2 it is clear that sell-offs in US Biotechnological and Pharmaceuticals sectors create value during the first three months. As we have seen the average abnormal return at day 60 is **5,41%.** And this result is actually not a surprise. As said before, eliminating negative synergies (Hanson and Song, 1997) and refocusing (Hubbard and Pahlia, 1999) the core business of the vendor is perceived by the capital markets as positive news (Rangel, 2006). What actually is interesting is that these two industries have higher abnormal returns when comparing with the whole market. In the long term biotechnological and pharmaceutical companies outperform other companies from all other industries by **4,42%.** And this finding is not actually much studied in the academic world. Actually, we didn't find any similar study. But this result was to be expected, because Biotechnology and Pharmaceuticals are fast growing industries that have a lot of good investing opportunities. The percentage of good high growth opportunities is probably much higher than in the overall market. As an example, we can mention that in the NASDAQ exchange where a lot of Biotechnological and Pharmaceuticals companies trade and one

can observe 10%,50%, 100% or even larger returns in very short periods. Of course, this high returns are very often are related to the approval of drug tests. But this doesn't negate the fact returns are often higher comparing to the whole market. As a concrete example we can mention here the Pharmacyclics (PCYC) company whose shares went from below 1$ in 2008 to about 250$ per share in 2015 and one of the main shareholders of Phamracyclics Robert Duggan who had 13 million shares in possession made a 70-fold return and become a billionaire.

4.2 Correlation Analysis

In order to understand better the regression estimation that will be presented later, we think it is important to see how the independent variables are correlated. This information is also valuable to prevent distortions in the regression that can arise from high correlations between variables. These results are presented in the following table:

Table 7. Correlation of variables

Variables	R&D/Sales	Debt/asssets	Size(Assets)log	Return on Assets	MtB Ratio
R&D/Sales	1				
Debt/asssets	0,07	1			
Size(Assets)log	-0,47	-0,12	1		
Return on Assets	-0,06	-0,08	0,11	1	
MtB Ratio	-0,37	0,15	0,33	0,00	1

As we can see from the table, we don't have very high values. The highest value (0,33) is between Size and MtB Ratio, and it is normal that they should be correlated because the two are proxies for size. This table suggests thus that there are no correlations between independent variables that would cause major problems to our model estimation.

4.3 Regression Analysis

This section presents the results of the estimation of our model. Our model presented before has the aim of testing the impact of R&D, Size and Debt on the announcement effect of the sell-offs in Biotechnological and Pharmaceutical industries. Firstly, we should say that our model in general is significant with an R-Squared of 0.72 and Prob. (F-statistic) of 0.00. Moving to the variables analysis the only not significant variable we obtained in our model is the **log of size**. Starting with our most important variable, we can see that **R&D intensity** has a statistically significant impact on the 3 months Abnormal Return. For every increase of 1% in R&D intensity Abnormal Returns in 3 months will change by 0.26 percentage points, *ceteris paribus*. This is in line what we expected. Our Hypothesis 3 is supported and we can say that yes, R&D intensity has an impact on the announcement returns of the sell-offs in the long run(3 months).

Another interesting finding is that **debt** has a negative impact on the long term abnormal returns. The coefficient is -0.24 or -24 percentage points, *ceteris paribus*. This finding is in line with the empirical evidence and confirms again to some extent that the debt/equity ratio is negatively related with stock returns (Bhandari, 1988). The last two variables are "control variables" that, as said in the previous chapter, try to make the model more robust. The control variable *ROA* is statistically significant and has a coefficient of 1,569, which is a significant impact on the dependent variable. And the MtB variable is also statistically significant with a coefficient of 0.036. Simply saying, high growth investment opportunities have a positive impact in Biotechnological and Pharmaceuticals sell-offs announcement returns.

Below it is possible to see Table 8 with the regression output.

Table 8. Regression output

Variables	AR 60
C	0.009 (0.320)
R&D/Sales	0.265*** (0.038)
Debt/Assets	-0.247** (0.096)
Log(Assets Size)	-0.020 (0.031)
Return on Assets	1.589*** (0.204)
Market-to-Book ratio	0.036*** (0.010)
R-squared	0.728
Prob(F-Statistic)	0.000
Observations	50

Legend: *p<.1; **p<.05; ***p<.01

5. Conclusion

The aim of this dissertation was to check if sell-offs create value for shareholders in Biotechnological and Pharmaceuticals industries. Speaking more practically, we wanted to see if it is good for managers to consider doing a sell-off. The same applies for investors who are searching new opportunities to profit in the market. In order to provide a deeper analysis of our research and to answer our questions from different points of view we studied also the impact of different factors on the announcement effect such as debt and size. R&D intensity was used as a factor in the regression to see if indeed it has impact on the announcement effect.

Our results showed as expected a positive effect on shareholder wealth of **1,78%** in the next day after the announcement. The abnormal return for longer periods also showed an increase in shareholder value. The results for one week, one month and three months were **1,95%, 3,13%** and **5,41%,** respectively. This indicates that the sell-off for the seller is not only positive, but the effect increases gradually over time. It is very important to say that all these four AARs are statistically significant. Also these findings are in line with our 1st hypothesis and the theories described in the literature review. So, our results confirm that divestitures, mainly sell-offs are good news for the market (Rangel, 2006). The market will reward companies that will do sell-offs. And the market treats these as good news because the reasons and consequences will be the refocus of the core-business (Hubbard and Pahlia, 1999), elimination of negative synergies (Hanson and Song, 1997) and/or improvement of remaining operations (Prezas and Simonyan, 2015). Besides the positive reaction from the market that already brings value creation for the shareholders, the seller also receives injection of cash after the divestment. And this cash also increases the shareholders value if it is used to repay the company's debt or if it is paid directly to them through dividends or shares buy back or used to fund new profitable projects.

In order to test our hypothesis 2, we compared our AARs for Biotechnological and Pharmaceutical industries with the AARs for all industries. Our results support our hypothesis 2 that the shareholder value increases more in sell-offs done in

Biotechnological and Pharmaceutical industries than in all other industries. The AARs in our studied industries are **1, 45%** higher in one week period, in 21 days period – **1,99%** higher and in 61 days period – **4,42%** higher than the sample consisting of sell-offs from all industries. We suggest that this is due to high growth opportunities in these two industries. It is not rare to see companies growing in short periods of time by several hundred of percentage points. Another possible explanation for these two industries showing such good results for shareholders can rely on the assumption that high growth opportunities are very closely related with R&D intensity. Investments in R&D increase opportunities to find synergies with external assets (Ushijima, 2009), therefore additional opportunities to create value for shareholders.

After doing a regression we found that the impact of a 1 percentage point R&D change on the announcement returns for three months is 0.26 percentage points, *ceteris paribus*. This is in line with our 3rd Hypothesis that R&D do have an influence on the sell-offs performance. Also we tested the influence of debt on the announcement results. The result suggests that the more levered the company is the lower will be the excess return. The last parameter we tested in our model was size, but it was not significant.

6. References

Aggarwal S. (2007), "What's fueling the biotech engine?", *Nature Biotechnology*, 25, pp. *1097 - 1104*

BCG, 2014, "Creating Shareholder Value with Divestitures"

BCG, 2014, "Maximizing Value: Choose the Right Exit Route"

Bergh D.D., Johnson A.J. and Dewitt R-L. (2008), "Restructuring through Spin-off or Sell-off: Transforming information asymmetries into financial gain", *Strategic Management Journal*, 29, pp. *133-148*

Bhandari, Laxmi Chand.(1988), "Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence", *The Journal of Finance*, 43, pp. *507-528*

Brown J.S and Warner B.J. (1980), "Measuring security price performance", *Journal of Financial Economics*, 8, pp. *205-258*

Casey M. and Hackett R. (2014), "The 10 biggest R&D spenders worldwide", http://fortune.com/2014/11/17/top-10-research-development/ accessed on 11 of June, 2017

Clubb C. and A. Stouraitis (2002), "The significance of sell-off profitability in explaining the market reaction to divestiture announcements", *Journal of Banking & Finance*, 26, pp. *671 – 688*

Deloitte, 2013, "Divestments: Creating shareholder value", UK

Fama E.F, Fisher L., Jensen C.M. and Roll R. (1969), "The Adjustment of Stock Prices to New Information", *International Economic Review*, 10(1), *pp 1-22*

Gara A. (2015), "Billionaire Robert Duggan's Bet on Pharmacyclics Stands among Top Trades of Crisis Era", https://www.forbes.com/sites/antoinegara/2015/03/05/pharmacyclics-billionaire-top-trade-robert-duggan-abbvie/#65935ece6593 accessed on 16 of May, 2017

Hanson R.C. and Song H.M (1997), "Long Term Performance of Divesting Firms and the Effect of Managerial Ownership", Working Paper, College of Business Eastern Michigan University

Hernandez H, Hervas F., Tubke A., Vezzani A., Dosso M., Amoroso S.,Grassano N., Coad A. and Gkotsis P. (2015), "The 2015 EU Industrial R&D Investment Scoreboard", European Commission

Hubbard R.D and Pahlia J.D. (1999), "A re-examination of the conglomerate merger wave in 1960s: An internal capital market view.", *The Journal of Finance*, 54, pp. *1131-1152*

Kaprielyan M. (2016), "Valuation consequences of the decision to divest in the globalized world", *Journal of Multinational Financial Management,*36, pp. *16-29*

Moschieri C. and J. Mair (2003), "Divestitures as facilitators of innovation ", Working paper, IESE Business School

Muller S. (2015), *"Significance tests for Event Studies",* http://www.eventstudytools.com/significance-tests accessed on 15 of January, 2017

Nguyen P. (2013), "Divestitures and value creation: does leverage matter?", *Journal of Applied Financial Economics*, 23, pp.*1145-1154*

NSF (2010), "Research and Development: National Trends and International Linkages (Ch. 4)", *Science and Engineering Indicators 2010,* Arlington, VA, USA: National Science Foundation, National Center for Science and Engineering Statistics, National Science Board.

Prezas P. A. and K. Simonyan (2015), "Corporate divestitures: Spin-offs vs. sell-offs", *Journal of Corporate Finance*, 34, pp. *83 – 107*

Rangel, A. (2006), "Desinvestimentos – Causas e Efeitos em Portugal", *Cadernos do Mercado de Valores Imobiliarios*, pp. *121-138*

Rosenfeld D.J. (1984), "Additional Evidence on the Relation Between Divestiture Announcements and Shareholder Wealth", *Journal of Finance*, 39, pp. *1437 – 1448*

Rubera G. and G. J.Tellis (2014), "Spinoffs versus Buyouts: Profitability of alternate routes for commercializing innovations", *Strategic Management Journal,* 35, pp. *2043 - 2052*

Shrestha R. (2010), "The Importance of Biotechnology in Today's Time", https://raunakms.wordpress.com/2010/06/04/the-importance-of-biotechnology-in-todays-time/ accessed on 7 of June, 2017

Sun, M. (2012), "Impact of divestiture activities on corporate performance: evidence from listed firms in Taiwan", *The International Journal of Business and Finance Research*, vol.6, no.5, pp. *59-67*

Ushijima, T. (2009), "R&D intensity and acquisition and divestiture of corporate assets: Evidence from Japan", *Journal of Economics and Business*, 61, pp. *415-433*

"Value Relevance of Analysts' Earnings Forecasts", https://www.princeton.edu/~markus/teaching/Eco467/04Lecture/04Event%20Study%20Description.pdf accessed on 15 of January, 2017

https://eresearch.fidelity.com/eresearch/markets_sectors/sectors/sectors_in_market.jhtml accessed on 7 of November, 2016

http://eventstudymetrics.com/index.php/event-study-methodology/ accessed on 15 of January, 2017

7. Appendix

Table 9. Event Study Sample (Biotechnology and Pharmaceuticals)

	Target name	Target country code	Deal type	Vendor name	Announced date
1.	MERCK & COMPANY INC.'S CONSUMER HEALTH BUSINESS	DE	Acquisition 100%	MERCK & COMPANY INC.	06/05/2014
2.	PFIZER INC.'S INFANT NUTRITION BUSINESS		Acquisition 100%	PFIZER INC.	23/04/2012
3.	ABBOTT LABORATORIES INC.'S NON-US DEVELOPED MARKETS SPECIALITY AND BRANDED GENERICS BUSINESS IN EUROPE		Acquisition 100%	ABBOTT LABORATORIES INC.	14/07/2014
4.	PFIZER INC.'S ADAMS DIVISION	US	Acquisition 100%	PFIZER INC.	17/12/2002
5.	PFIZER INC.'S SCHICK-WILKINSON SWORD UNIT	US	Acquisition 100%	PFIZER INC.	21/01/2003
6.	BRISTOL-MYERS SQUIBB COMPANY'S US AND CANADIAN CONSUMER MEDICINES BUSINESS	US	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	14/07/2005
7.	BAXTER INTERNATIONAL INC.'S COMMERCIAL VACCINES BUSINESS	US	Acquisition	BAXTER INTERNATIONAL INC.'S VACCINE MANUFACTURING FACILITY IN	30/07/2014

				ORTH, AUSTRIA	
8.	NERVIANO RESEARCH CENTRE	IT	Acquisition 100%	PFIZER INC.	31/05/2004
9.	PFIZER INC.'S SURGICAL OPHTHALMOLOGY BUSINESS	US	Acquisition 100%	PFIZER INC.	21/04/2004
10.	CAMBREX CORPORATION'S BIOPRODUCTS AND BIOPHARMA SUBSIDIARIES	US	Acquisition 100%	CAMBREX CORPORATION	24/10/2006
11.	ZOGENIX INC.'S ZOHYDRO ER BUSINESS	US	Acquisition 100%	ZOGENIX INC.	10/03/2015
12.	PFIZER'S CORTIZONE HYDROCORTISONE ANTI-ITCH BUSINESS	US	Acquisition	PFIZER INC.	12/12/2006
13.	MEAD JOHNSON & COMPANY'S GLOBAL ADULT MEDICAL NUTRITION BRANDS	US	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	16/12/2003
14.	PFIZER INC'S TETRA AQUARIUM AND POND SUPPLIES DIVISION	US	Institutional buy-out 100%	PFIZER INC.	06/11/2002
15.	PFIZER INC'S FEED ADDITIVE PRODUCTS DIVISION	US	Acquisition 100%	PFIZER INC.	02/10/2000
16.	CHARLES RIVER LABORATORIES INTERNATIONAL INC.'S PHASE II - IV CLINICAL SERVICES BUSINESS	US	Acquisition 100%	CHARLES RIVER LABORATORIES INTERNATIONAL INC.	09/05/2006

17.	PDL BIOPHARMA INC'S BROOKLYN PARK, MINNESOTA-BASED ANTIBODY MANUFACTURING FACILITY	US	Acquisition 100%	PDL BIOPHARMA INC.	21/02/2008
18.	BRISTOL MYERS SQUIBB COMPANY'S MATURE PRODUCTS BUSINESS	EG	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	15/10/2008
19.	PFIZER INC.'S PORTFOLIO of 60 EUROPEAN OTC AND PERSONAL CARE BRANDS		Acquisition 100%	PFIZER INC.	26/05/2004
20.	MCNEIL PPC INC. AND JOHNSON & JOHNSON INC.'S STAYFREE PAD, CAREFREE LINER AND O.B. TAMPON FEMININE HYGIENE BRANDS IN THE US, CANADA AND THE CARIBBEAN		Acquisition 100%	JOHNSON & JOHNSON	31/07/2013
21.	VIVUS INC.'S EVAMIST ASSETS	US	Acquisition 100%	VIVUS INC.	30/03/2007
22.	JOHNSON & JOHNSON'S SURGICAL PRODUCTS BUSINESS	MX	Acquisition 100%	JOHNSON & JOHNSON	19/02/2001
23.	BRISTOL-MYERS SQUIBB COMPANY'S ESTRACE TABLETS HORMONE REPLACEMENT THERAPY BUSINESS	US	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	02/07/2001
24.	BRISTOL-MYERS SQUIBB CO'S HUNGARIAN MANUFACTURING PLANT	HU	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	25/06/2002
25.	INSMED INC.'S FOLLOW-ON BIOLOGICS PLATFORM ASSETS	US	Acquisition 100%	INSMED INC.	12/02/2009

26.	ELI LILLY AND COMPANY'S VANCOCIN BRAND	US	Acquisition 100%	ELI LILLY AND COMPANY	18/10/2004
27.	PANVERA LLC'S COMMERCIAL LINE of ASSETS	US	Acquisition 100%	VERTEX PHARMACEUTICALS INC.	04/02/2003
28.	NEKTAR THERAPEUTICS PULMONARY DRUG DELIVERY UNIT	US	Acquisition 100%	NEKTAR THERAPEUTICS INC.	20/10/2008
29.	ABBOTT LABORATORIES INC' RAPID DIAGNOSTICS BUSINESS	US	Acquisition 100%	ABBOTT LABORATORIES INC.	01/10/2003
30.	BAXTER INTERNATIONAL INC.'S US GENERIC INJECTABLES BUSINESS	US	Acquisition 100%	BAXTER INTERNATIONAL INC.	29/10/2010
31.	ABBOTT LABORATORIES INC.'S MUREX BRAND AND ASSETS		Acquisition 100%	ABBOTT LABORATORIES INC.	10/03/2010
32.	ABBOTT LABORATORIES INC'S DETERMINE/DAINASCREEN RAPID DIAGNOSTIC BUSINESS	US	Acquisition 100%	ABBOTT LABORATORIES INC.	31/05/2005
33.	BRISTOL-MYERS SQUIBB COMPANY'S ESTABLISHED BRAND PORTFOLIO AND MANUFACTURING FACILITY	AU	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	07/09/2009
34.	CELSION CORPORATION'S PROLIEVE ASSETS	US	Acquisition 100%	CELSION CORPORATION	18/04/2007
35.	ELI LILLY AND COMPANY'S GREENFIELD, INDIANA-BASED LABORATORIES	US	Acquisition 100%	ELI LILLY AND COMPANY	06/08/2008

36.	PHOTOMEDEX INC.'S XTRAC AND VTRAC DERMATOLOGY BUSINESS	US	Acquisition 100%	PHOTOMEDEX INC.	23/06/2015
37.	PFIZER INC'S SHANBALLY CORK BASED PHARMACEUTICAL MANUFACTURING COMPLEX	IE	Acquisition 100%	PFIZER INC.	23/06/2011
38.	PFIZER INC'S INSULIN FACILITY AT INDUSTRIEPARK HOECHST, FRANKFURT AM MAIN, GERMANY AND RELATED ASSETS	DE	Acquisition 100%	PFIZER INC.	08/06/2009
39.	BAXTER INTERNATIONAL INC.'S CONTINUOUS RENAL REPLACEMENT THERAPY (CRRT) BUSINESS	US	Acquisition 100%	BAXTER INTERNATIONAL INC.	30/07/2013
40.	BRISTOL-MYERS SQUIBB COMPANY'S WAKE COUNTY PLANT	US	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	17/02/2003
41.	CYPRESS PHARMACEUTICAL INC.'S CERTAIN ASSETS	US	Acquisition 100%	PERNIX THERAPEUTICS HOLDINGS INC.	09/08/2013
42.	VIVUS INC.'S MUSE ASSETS	US	Acquisition 100%	VIVUS INC.	04/10/2010
43.	BRISTOL-MYERS SQUIBB COMPANY'S MIDDLE EAST BRANDED GENERICS BUSINESS		Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	02/07/2009
44.	PFIZER INC'S PROTINEX BRAND AND DUMEX TRADEMARK IN INDIA	IN	Acquisition 100%	PFIZER INC.	27/11/2002

45.	CYTORI THERAPEUTICS INC.'S MACROPORE BIOSURGERY SPINAL AND ORTHOPAEDIC BUSINESS UNIT	US	Acquisition 100%	CYTORI THERAPEUTICS INC.	01/06/2007
46.	ZOETIS INC.'S AQUACULTURE VACCINE AND DEVELOPMENT ASSETS	US	Acquisition 100%	ZOETIS INC.	17/02/2014
47.	NOVAVAX INC'S CERTAIN NON-CORE PRODUCT ASSETS	US	Acquisition 100%	NOVAVAX INC.	23/09/2005
48.	PHOTOMEDEX INC.'S SURGICAL SERVICES DIVISION	US	Acquisition 100%	PHOTOMEDEX INC.	07/08/2008
49.	LIGAND PHARMACEUTICALS INC.'S COMBINATORIAL CHEMICAL LIBRARY AND ASSOCIATED PROPIETARY TECHNOLOGY	US	Acquisition 100%	LIGAND PHARMACEUTICALS INC.	07/10/2010
50.	REAL HEALTH LABORATORIES INC.'S CATALOG AND INTERNET BUSINESS	US	Acquisition 100%	NATURAL ALTERNATIVES INTERNATIONAL INC.	04/08/2008
51.	CODEXIS INC.'S LABORATORY OPERATIONS IN BUDAPEST, HUNGARY	HU	Acquisition 100%	CODEXIS INC.	13/03/2014
52.	BRISTOL-MYERS SQUIBB'S MEYMAC PRODUCTION FACILITY	FR	Acquisition 100%	BRISTOL-MYERS SQUIBB COMPANY	15/01/2010

Table 10. Abnormal Returns, Average Abnormal Returns, Cumulative Average Abnormal Returns

Name/Days	1	5	20	60
AR MRK	-0,24%	-2,60%	-1,99%	-3,22%
AR PFE	0,79%	0,10%	4,45%	5,34%
AR ABT	-0,60%	3,71%	3,37%	2,04%
AR PFE	-0,36%	3,03%	-4,00%	0,88%
AR PFE	4,83%	4,66%	3,12%	6,82%
AR BMY	0,99%	0,01%	-0,34%	-5,39%
AR BAX	-0,17%	0,09%	-2,84%	-8,51%
AR PFE	0,75%	0,35%	-4,80%	-7,18%
AR PFE	-2,38%	-2,62%	-1,53%	-10,96%
AR CBM	11,86%	8,37%	1,23%	-3,79%
AR ZGNX	-26,77%	-21,97%	-14,15%	2,13%
AR PFE	0,94%	3,29%	4,67%	1,65%
AR BMY	1,29%	1,20%	7,49%	-8,03%
AR PFE	4,33%	3,53%	-4,92%	-1,18%
AR PFE	-0,79%	-1,59%	0,31%	8,23%
AR CRL	-15,95%	-14,31%	-10,79%	-20,91%
AR PDLI	1,02%	3,08%	-36,30%	-44,62%
AR BMY	-2,53%	3,89%	19,15%	31,25%
AR PFE	1,16%	2,01%	-4,57%	-7,33%
AR JNJ	-0,60%	0,23%	-4,10%	-4,80%
AR VVUS	12,33%	10,50%	9,54%	1,82%
AR JNJ	6,07%	4,85%	8,26%	6,81%
AR BMY	1,76%	7,71%	14,15%	25,03%
AR BMY	4,68%	1,55%	-3,22%	10,51%
AR INSM	71,78%	83,10%	125,15%	212,43%
AR LLY	-1,91%	-10,84%	-7,12%	-6,42%
AR VRTX	1,08%	4,27%	-23,59%	-16,97%
AR NKTR	17,58%	38,58%	48,73%	74,24%
AR ABT	-1,03%	-5,21%	-4,44%	0,05%
AR BAX	-0,74%	-2,47%	-2,97%	-9,67%
AR ABT	0,49%	-2,81%	-8,63%	-8,46%
AR ABT	0,40%	1,71%	2,89%	-7,32%
AR BMY	-0,40%	-2,43%	-1,68%	3,46%
AR CLSN	6,63%	-1,85%	-9,78%	30,55%
AR LLY	1,02%	1,16%	0,18%	-5,56%
AR PHMD	-9,11%	-23,27%	-40,89%	-50,27%
AR PFE	0,47%	-1,02%	-5,53%	-4,49%
AR PFE	-2,87%	-0,88%	6,83%	6,72%
AR BAX	0,26%	-1,83%	0,19%	-14,02%
AR BMY	0,50%	7,29%	-1,73%	6,96%
AR PTX	2,12%	-0,84%	-8,68%	-37,37%
AR VVUS	-1,57%	0,01%	4,27%	37,21%
AR BMY	0,00%	0,49%	0,46%	-3,02%

AR PFE	-3,40%	-2,75%	-2,20%	0,24%
AR CYTX	0,74%	-0,78%	-4,57%	-16,84%
AR ZTS	0,10%	0,48%	-3,84%	-0,17%
AR NVAX	1,72%	4,25%	127,58%	169,16%
AR PHMD	0,88%	-3,86%	-5,29%	-9,07%
AR LGND	-0,45%	3,21%	0,39%	-15,41%
AR NAII	-0,80%	-6,89%	-4,31%	-0,55%
AR CDXS	4,56%	3,94%	-2,27%	-27,76%
AR BMY	2,24%	1,63%	1,31%	-2,82%
AAR	1,78%	1,95%	3,13%	5,41%
CAAR	1,78%	10,31%	48,96%	194,14%

Table 11. Regression Sample

AR 60	R&D/Sales	Debt/asssets	Size(Assets)log	Return on Assets	MtB Ratio
0,02037667	0,0638119	0,1887341	10,61568708	0,05533616	2,3267441
0,00049821	0,0939815	0,1602233	10,42676074	0,103049401	1,88034281
-0,0846491	0,1059068	0,2837651	10,77424146	0,077797237	0,89664297
-0,0731841	0,0815281	0,1641645	10,46450748	0,11571245	1,5125566
-0,085128	0,0567217	0,3287032	10,41358473	0,096346028	1,29785384
-0,0967035	0,0567301	0,3293292	10,40181396	0,079765303	1,22349016
-0,1401651	0,071245	0,2503288	10,24276498	0,081193893	1,45911375
-0,0539148	0,1439398	0,3054588	10,44929323	0,106617386	3,48781294
-0,0803225	0,1221787	0,3791271	10,43887447	0,113064686	4,02141842
0,31249671	0,1982501	0,2285491	10,46961586	0,211049312	3,54809917
0,25032349	0,1195411	0,2369442	10,43227964	0,172302916	9,70855822
0,10514951	0,1218381	0,3122053	10,39832202	0,085404844	4,14198614
0,03456714	0,1939068	0,2051406	10,49147376	0,340879773	3,1841979
0,06959947	0,1221787	0,3791271	10,43887447	0,113064686	4,02141842
-0,0301986	0,1939068	0,2051406	10,49147376	0,340879773	3,1841979
-0,0282027	0,183022	0,1752156	10,49242511	0,099819797	3,74538129
-0,0379415	0,0459379	0,2677728	8,782742004	-0,049639168	1,53881327
-0,2776259	0,6446176	0,0360542	7,682343669	-0,396907859	3,55626895
-0,2090805	0,3396548	0,2236759	9,407823114	-0,021817806	1,3354506
2,12432913	0,8878496	0,0331821	8,102759476	0,934133154	0,78264535
-0,0480132	0,111118	0,0722823	10,58532534	0,147266681	6,66632241
0,06814029	0,1147493	0,1004499	11,12281528	0,104240935	2,98102562
-0,15412	0,9390213	0,4087534	7,878286202	-0,137640784	5,06092773
-0,0642401	0,1941911	0,2618933	10,39562339	0,072787228	3,55472365
-0,0555881	0,1885382	0,3581331	10,46557021	-0,070928298	2,66237832

-0,0321733	0,1546511	0,1901561	10,99270812	1,21218E-07	1,13773884
-0,0055121	0,0146699	0,0347704	7,56156645	-1,09772E-08	1,79646272
0,74242757	1,7119401	0,4197804	8,74860351	-6,11914E-08	1,20873697
1,69162001	6,012	0,3601835	7,926249815	-4,08973E-07	2,40370569
-0,4462415	0,5673012	2,6158458	8,281356126	3,57849E-07	5,00210315
0,05337324	0,1439889	0,2016168	11,26904103	7,84185E-08	1,53703664
0,00881748	0,1602775	0,2547459	10,66610595	1,96868E-07	5,93130577
0,06819351	0,1594018	0,1247955	11,06734988	3,34832E-08	3,37126417
-0,0718273	0,1568547	0,1499386	11,09231352	9,1855E-08	2,31446702
-0,1096409	0,1568547	0,1499386	11,09231352	9,1855E-08	2,31446702
0,01648315	0,1570983	0,0694898	11,06008184	1,68386E-07	2,32563967
-0,0118234	0,1602775	0,2547459	10,66610595	1,96868E-07	5,93130577
0,08228872	0,1702822	0,161504	10,52517443	1,11191E-07	13,5165674
-0,0733407	0,1568547	0,1499386	11,09231352	9,1855E-08	2,31446702
-0,0449445	0,1314983	0,2071361	11,27416247	5,32388E-08	1,35325925
0,06723366	0,1592279	0,2285148	11,3282756	4,05496E-08	1,05853428
0,00241955	0,1602775	0,2547459	10,66610595	1,96868E-07	5,93130577
-0,5027306	0,0316092	0,1857515	7,669449557	-2,41896E-07	0,45990792
-0,0907266	0,0172991	0,014255	7,536230073	-1,00657E-06	0,75056861
-0,3737396	0,0565135	0,0866161	8,325076827	-1,21105E-07	0,72645839
-0,1696864	2,8890883	0,4898338	8,859985036	-2,71669E-07	0,91101382
0,37207029	0,4877697	0,0560844	8,299483328	-1,20428E-08	4,27252476
0,02134811	1,0250184	0,0731567	8,485702976	8,54285E-08	1,77956478
-0,1683957	3,3090909	0,0445436	7,332579835	-1,33305E-06	-17,264866
-0,0017047	0,0827586	0,5524444	9,820004307	8,82397E-08	4,34834106

Table 12. Eviews regression output

Dependent Variable: AR_60
Method: Least Squares
Date: 05/29/17 Time: 18:26
Sample: 1 50
Included observations: 50

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009074	0.320477	0.028313	0.9775
R_D_SALES	0.265833	0.038576	6.891220	0.0000
DEBT_ASSSETS	-0.247974	0.096616	-2.566599	0.0137
SIZE_ASSETS_LOG	-0.020805	0.031679	-0.656743	0.5148
RETURN_ON_ASSETS	1.589683	0.204699	7.765963	0.0000
MTB_RATIO	0.036732	0.010131	3.625819	0.0007

R-squared	0.728022	Mean dependent var	0.049804
Adjusted R-squared	0.697115	S.D. dependent var	0.429525
S.E. of regression	0.236389	Akaike info criterion	0.065490
Sum squared resid	2.458708	Schwarz criterion	0.294933
Log likelihood	4.362753	Hannan-Quinn criter.	0.152863
F-statistic	23.55555	Durbin-Watson stat	1.988733
Prob(F-statistic)	0.000000		