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## HEALTHCARE M&A SUCCESS: AN EVENT STUDY ON KEY VALUE DRIVERS

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## Abstract

This thesis aims to identify value creation for all participants in M&A deals in the healthcare industry between 1981 and 2021.

On average, M&A transactions in the healthcare industry lead to positive abnormal returns for target firms shareholders and for the combined entities.

Furthermore, we analyse the key drivers. For targets' shareholders, we find positive significant impact in the acquiring company size (market capitalisation) and in the target R&D intensity (as a percentage of target enterprise value). For the hypothetical combined entity, we observe a positive significant impact in the deal size (as a percentage of acquirer enterprise value).

## Keywords

M&A, Healthcare, Abnormal Return, Event Study, Pharmaceutical Industry, MedTech, Biotechnology, Healthcare Services.

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# 1. Introduction

Business professionals, scholars, and regulators have been watching the current boom in mergers and acquisitions (M&A) with growing interest as activity in the market for corporate control has increased. It may not come as a surprise, as there has always been tremendous curiosity about the dynamics and effects of M&A transactions, which are frequently crucial to the firm's performance because they force businesses to reorganise their structures, revise their strategies, and make pivotal decisions.

Over the years, there has been a lot of academic discussion regarding the wealth effects of such corporate actions. Researchers have put together a wide range of hypotheses that forecast varying degrees of value creation or destruction, which are frequently contradictory. For instance, Weston, Mitchell, and Mulherin (2004) and Weston and Halpern (1983) posit that business transactions produce synergies that benefit shareholders. The hubris hypothesis, put forth by Roll (1986), contends that people in charge of taking decisions in a transaction frequently overestimate their skills, which damages shareholders' wealth.

Regrettably, no convincing evidence favouring one side of the debate over the other has resulted from empirical investigation. The majority of scholars concur that M&A transactions benefit the shareholders of target companies, but there is little agreement on how these transactions will ultimately affect acquirers. Furthermore, most studies focus on determining the outcome rather than identifying variables that influence transaction effectiveness or predicting market trends and prospects. Due to contradictory results, we believe that more research is still required to understand such operations fully.

This thesis looks at how M&A transactions in the Healthcare industry altered wealth between 1981 and 2021. We chose this specific sector for our analysis for several reasons. First, its importance has risen steadily, enhanced by the pandemic. Patients can now manage and

overcome previously incurable diseases and disabilities thanks to cutting-edge medications, medical devices, and hospital procedures. However, this has come at a high cost; according to WHO, healthcare expenditure has been increasing substantially over the years. Given these enormous costs, it's critical to comprehend how effectively the healthcare businesses operate. An idea could be examining if the deals they engage in actually add value, albeit these decisions typically impact a wide range of stakeholders. For instance, a hospital merger may directly impact patient care, and a competitor's purchase of a pharmaceutical company may result in higher costs for life-saving drugs. Additionally, layoffs and other internal restructuring often affect employees as a result of M&A transactions. However, since it is typically simpler to observe and interpret, we will limit our study to the impact on the involved firms' stockholders. We utilise cumulative abnormal returns as a proximate of value creation in line with academic literature. We compute them around the transaction's announcement date in short and medium term windows to reflect the variations in expected cash flows to shareholders brought about by the deal. We calculated it for shareholders of the acquiring and target firms and a combination of the two. We also investigate whether and to what extent different deal and firm factors can be employed to forecast the abnormal shareholder returns of the firms involved.

Notwithstanding the size of the Healthcare industry and its relevance to people's welfare and lives, there has not been much research of this kind in this specific sector. Furthermore, we found no paper which thoroughly analysed the returns for shareholders of the target, acquirer, and a combination of these, as well as an analysis of the key drivers.

This thesis is organized as follows. Appendix 1 gives an overview of the current state of the global M&A market, with a particular focus on the Healthcare sector and the critical dynamics of this business. Appendix 2 reviews relevant papers on event studies conducted in relation to M&A. Appendix 3 describes the methodology used in this research. Chapter 2

cover the hypothesis that this research is testing. Chapter 3 explains the creation of our sample and the determination of the variables. Chapter 4 shows and comments the analysis results. Chapter 5 reports the conclusions of this thesis.

## 2. Hypothesis Formulation

This study's primary goal is to accurately analyse the effects of merger and acquisition activity on wealth in the healthcare industry. Furthermore, our analysis of the body of literature has shown that there are a number of crucial elements that are frequently intimately linked to abnormal returns in deals of this kind. Therefore, we will look for comparable interlinkages in our sample of Healthcare M&A deals.

As previously mentioned, we have only been able to identify a small number of studies that focus on this specific economic sector. Furthermore, none of them offer a thorough examination of the industry and its subsectors from the standpoints of the shareholders of the acquiring and target firms as well as a combination of both. Our study will therefore try to close this hole in available literature.

The hypotheses we will test in this thesis are the following:

Hypothesis 1a: On average, M&A transactions in the Healthcare industry create value for bidders' shareholders in the short run

Hypothesis 1b: On average, M&A transactions in the Healthcare industry create value for bidders' shareholders in the medium run

Hypothesis 2a: On average, M&A transactions in the Healthcare industry create value for targets' shareholders in the short run

Hypothesis 2b: On average, M&A transactions in the Healthcare industry create value for target's shareholders in the medium run

Hypothesis 3a: On average, M&A transactions in the Healthcare industry create value for bidders' and targets' shareholders in the short run

Hypothesis 3b: On average, M&A transactions in the Healthcare industry create value for bidders' and targets' shareholders in the medium run.

### 3. Data

To collect the data for our analyses, we used a variety of sources. Refinitiv's SDC Platinum database was utilised to gather data on M&A deals history. Such a platform allows not only to collect data from a huge sample of M&A deals, but also to pull information on share prices, R&D expenses, enterprise values and market capitalization regarding both target and acquiring companies in our sample.

#### 3.1 Sample Selection

The transactions included in our sample had to meet the following requirements:

1. Sector of the acquirer and the target: Companies hav to be classified as belonging to either “pharmaceuticals”, “biotechnology”, “healthcare equipment & supplies” or “healthcare providers & services (HMOs)”, according to the Mid-Industry code defined by SDC

2. Ownership structure of the acquirer and the target: Companies need to be listed on the stock exchange at the date of the announcement of the M&A event and the period surrounding it
3. Status of the transaction: The deal has to be completed
4. Acquisition of control: The transaction is characterized through a real change of ownership, meaning that prior to the M&A announcement, the acquirer must have held less than 50% of the target and it must be seeking to acquire 50% or more with such transaction (Ma, Pagán and Chuc, 2009)
5. Transaction size: The value of the transaction is at least \$1 million.

Finally, we eliminated any event for which there was insufficient information about the stock prices of either the targets or the acquirers on neither Refinitiv nor Capital IQ. Thus, once the pool of companies under analysis has been identified, the data is extracted into an Excel file. The sample consists of 123 datapoints.

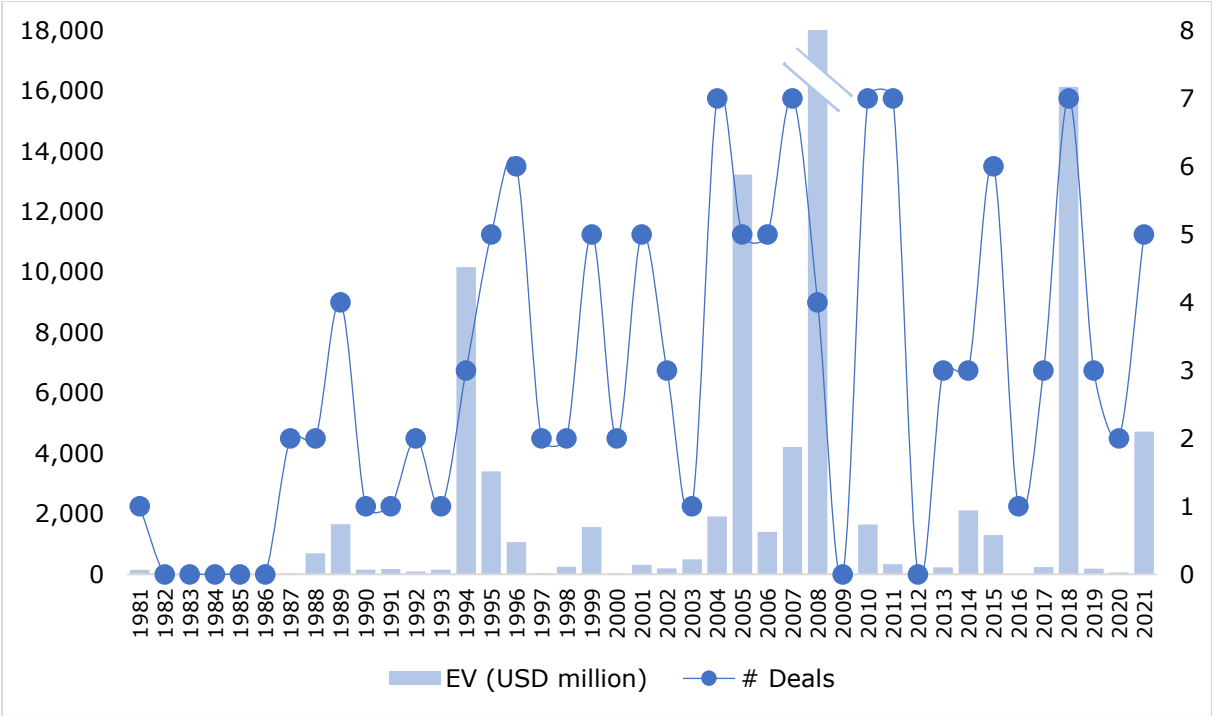
Figure 1 below displays how the transactions volume and value are allocated across the years. At first sight, the beginning of the analysed period shows a low number of deals, indeed, data for the first several years is not readily available. We notice a rise in value prior to the financial crisis and a sizable decrease following it, which is to be expected.

Furthermore, the column representing the value of the deals announced in 2008 has been cut in order to better show the scale of the other years because such exceptional year is driven by a couple of very large transactions occurred which drive the total value for the year 2008 to almost \$30 billion.

We may observe a decline in the volume of trades at the conclusion of the analysed period, with the exception of 2021 which has been an extremely active year across all sectors. The fact that we chose to include only completed deals may be the cause of this phenomena.

Consequently, it is reasonable to anticipate that there will be comparatively fewer deals which were announced and closed in a relatively short period of time.

Figure 1: Deals count and total value by year – Source: author’s elaboration



On Figure 2 below, we can observe the classification of our deals in the respective subsector of the Healthcare industry. Clearly, the pharmaceutical and biotech sectors consist of more than half of our sample because, for the several reasons explained in Appendix 1, they are the two most active in M&A due to the nature of businesses focusing on the clinical trial, production and distribution of drugs. Secondly, we can see that almost 1 out of 3 transactions in our sample is classified as Medtech. Indeed, such industry participants view M&A as a crucial strategic tool to address industry changes like healthcare and regulatory reform, industry consolidation and convergence, technological advancements (such as wearable technology), and adverse pricing trends coupled with stagnant health care spending (Deloitte,

2017). Overall, albeit healthcare services seems to be slightly misrepresented compared to the other subsectors, we can state that our sample covers, to a great extent, M&A deals occurred in all verticals of the Healthcare industry, bringing further robustness to our model potential results.

Figure 2: Pie chart showing the proportion of deals in each Healthcare subsector of our sample – Source: author’s elaboration

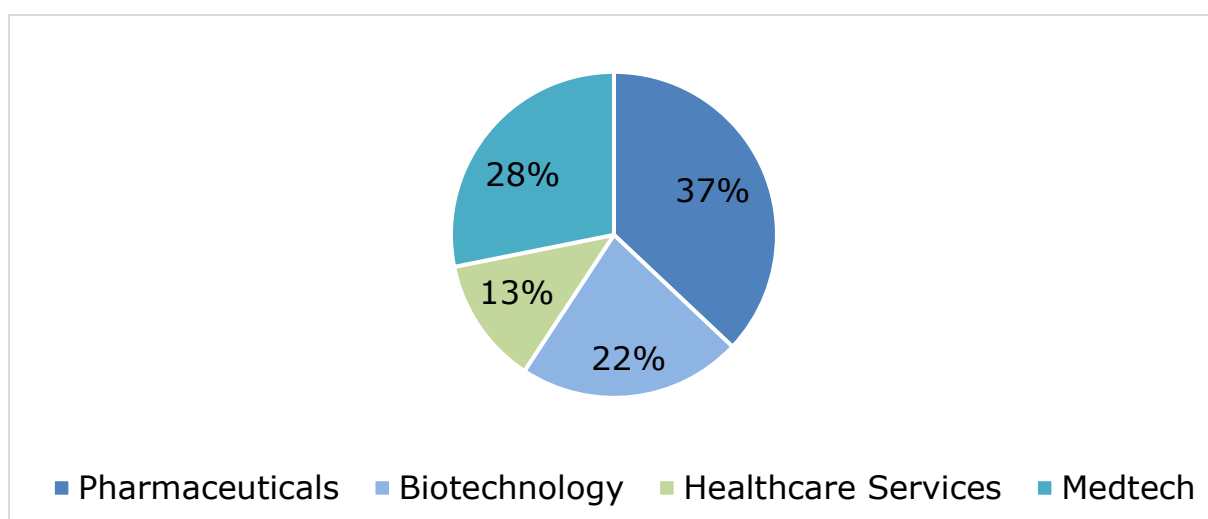


Table 1: Geographical distribution of the deals in our sample – Source: author’s elaboration

<b>Region/Country</b>	<b>Targets</b>	<b>Acquirers</b>
Brazil	1	0
Canada	8	7
Puerto Rico	1	0
United States	47	40
<b>Americas</b>	<b>57</b>	<b>47</b>
Australia	5	5
Hong Kong	2	2
India	7	8
Japan	20	25
Malaysia	2	1
Singapore	1	1
South Korea	3	3
Taiwan	0	1
Vietnam	1	0
<b>Asia and Pacific</b>	<b>41</b>	<b>46</b>
Austria	0	1
Belgium	2	1
Denmark	1	2
France	3	3
Germany	0	3
Ireland	0	2
Israel	2	1
Lithuania	0	1
Poland	3	1
South Africa	1	0
Sweden	2	2
Switzerland	3	6
United Kingdom	8	7
<b>Europe, Middle East and Africa</b>	<b>25</b>	<b>30</b>

We look at the distribution of the target and acquiring companies across continents and nations in Table 1 above. As we can see, almost 50% of all transactions in our sample have an target or acquirer based in the United States. Asia, specifically Japan, seems to be the second-most active area. Additionally, it appears that there are many deals in Europe, with Switzerland, the United Kingdom and France leading the pack. China is regrettably not represented in our sample; this is primarily due to the challenge of retrieving accurate information on deals in such nation and the common transactions between linked organisations, which we chose to ignore.

Lastly, The selection of the market index is, a crucial factor in determining normal returns. Given that all of our transactions are in the same industry, we chose to utilise an index on the healthcare business as a substitute of market returns. This ought to increase the market model's explanatory power. The MSCI International ACWI Health Care Index offered by Refinitiv is the specific index that we have selected, following the research of Nazarova (2018). It is a value-weighted index that incorporates both developing and developed country companies in a large industry sample.

### 3.2 Variables

In our regression analysis, a variety of variables were used. SDC Platinum provides information on transaction factors, e.g. the means of payment, transaction size, industry classification and the internationality of the deal. When it was possible, we also double-checked the data we pulled from SDC Platinum against press releases from the target and acquiring companies as well as the financial press. Moreover Lastly, data on targets' R&D spending, acquirers' market capitalization, and targets' and acquirers' sizes — defined as the

companies' enterprise value 21 days prior to the event — were pulled from Refinitiv, and in some cases, Capital IQ, due to a few lack of information in the previous data provider.

Table 2: Descriptive statistics of the dataset – Source: author’s elaboration

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>s.d.</b>	<b>Min</b>	<b>Max</b>
DEALVAL_AQEV	123	0.134	0.147	0.002	0.366
MKTCAPLOG	123	14.481	2.185	11.091	18.214
TARD_TAEV	123	0.064	0.057	0.002	0.184
CROSS_BORDER	123	0.398	0.492	0.000	1.000
BIOPHARMA	123	0.602	0.492	0.000	1.000
CASH	123	0.634	0.484	0.000	1.000

Descriptive statistics are provided for each of our variables in Table 2. As shown, DEALVAL AQEV, TARD TAEV, and MKTCAPLOG cover a wide range of magnitudes. This is also one of the reasons why , we have chosen to use two ratios and a logarithm, respectively, to represent companies' sizes and accounting values, strengthening our model. As predicted by the subsector analysis in the previous sentence, we can see that biotechnology and pharmaceutical deals (represented by the BIOPHARMA dummy variable) account for about 60% of the sample as a whole. A similar percentage also applies to the all-cash transactions included in our sample (represented by the CASH dummy variable). Finally , although they make up less than half of our sample, international deals (entailed in the CROSS BORDER dummy variable) still allow us to draw potential conclusions from our analysis.

Before running the regressions, a 90% winsorization has been performed on all the continuous variables of our sample.

## 4. Empirical Results

### 4.1 Event Study Results

Table 3 below shows the results of our event study analysis.

Table 3: Cumulative average abnormal returns analysis results – Source: author’s elaboration

<i>Panel A:</i>					
<b>Acquirer Results</b>					
Event Window	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
<b>CAAR</b>	<b>0.0144</b>	<b>0.0039</b>	<b>-0.0068</b>	<b>0.0004</b>	<b>0.0081</b>
t-Statistic	1.32	0.56	-1.33	0.11	0.38
Observations	123	123	123	123	123

<i>Panel B:</i>					
<b>Target Results</b>					
Event Window	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
<b>CAAR</b>	<b>0.2922***</b>	<b>0.2578***</b>	<b>0.2402***</b>	<b>0.2062***</b>	<b>0.2150***</b>
t-Statistic	9.95	10.27	11.07	11.45	7.08
Observations	123	123	123	123	123

<i>Panel C:</i>					
<b>Combined Results</b>					
Event Window	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
<b>CAAR</b>	<b>0.0381***</b>	<b>0.0309***</b>	<b>0.0205***</b>	<b>0.0192***</b>	<b>0.0303</b>
t-Statistic	3.32	4.39	3.57	4.62	1.50
Observations	123	123	123	123	123

Note: the symbols \*, \*\*, \*\*\* denote statistical significance at the 10%, 5% and 1% levels, respectively

As previously stated in this paper, we have assumed and tested that the distribution of the cumulative abnormal returns of the different datapoints in the our dataset can be approximated to a normal distribution, thus we have assigned the significance level using the t-Statistic methodology described in Appendix 3.

Panel A displays the Cumulative Average Abnormal Returns for the acquiring firms in the event windows we have picked and their empirical significance.

The cumulative abnormal return obtained, on average, by bidder companies is definitely lower than target firms and combined entities. Overall, the values are slightly positive for all event windows except [-5, +5] when it reaches  $-0.68\%$ . This could suggest that stock prices of acquiring firms generally do not spike when the market is informed of their new M&A intentions, supporting the research results obtained by Goergen and Renneboog (2003). However, differently from the other two sections of our analysis (Panel B and C), the acquirers' returns are not significantly different from 0 at the generally accepted significance levels.

On the other hand, as shown in Panel B, the average cumulative abnormal returns obtained by the targets' owners during the [-20, +20] and [-5, +5] event windows are positive and highly statistically significant at 29.22% and 24.02%, respectively. This outcome is in line with other M&A research. However, comparing the different short-run intervals analysed, the CAAR rises with the widening of the time interval studied, starting from a significant 20.62% in the [-2, +2] period. Interestingly, this trend could allow us to assume that the consensus has been somewhat expecting the sale, perhaps as a result of information leak, rumours or insiders. Looking at the medium-run window, targets cumulative average abnormal return successfully shows a strongly significant value which stabilises at 21.50%, confirming an impressive value creation for target firms' shareholders.

Lastly, we have analysed the cumulative average abnormal return of the acquiring and target companies as a properly weighted hypothetical combined entity, following the steps described in the Methodology chapter (Appendix 3). As it can be seen in Panel C, the positive results show a strong significance level for all of the four short-term event windows, ranging from

1.92% in the [-2, +2] interval to 3.81% in the [-20, +20] interval. The same rising trend we observed in Panel B is verifying again; indeed, the percentage return in the [-20, +20] interval is almost twice as high as the return in the shortest interval analysed in this thesis. In addition, the medium term analysis run for combined entities shows a positive return of 3.03% which unfortunately does not represent a statistically significant result. Notwithstanding the large returns observed for target firms' shareholders (almost 10 times higher than the results for the combined firms) , the reported values this time are barely positive. The fact that bidders are frequently significantly larger than their competitors can easily explain this trend. Therefore, this substantial discrepancy massively skews the results in favor of the acquirers values when computing abnormal results using a weighted average approach.

In conclusion, based on the previously described results we can state that deals in the Healthcare industry create value for the shareholders of the target firms (Hypothesis 2a and 2b) both in the short and medium-term. On the contrary, we do not find any significant data to confirm the same phenomenon in relation to acquiring companies shareholders (Hypothesis 1a and 1b) in any of the event windows analysed in this paper. Finally, our results suggest that there is value creation in the overall transaction if we look at the combined entity cumulative average abnormal returns in the short run (Hypothesis 3a), but there is no standard acceptably significance level to confirm such hypothesis also in the medium-run (Hypothesis 3b).

## 4.2 Regression Analysis Results

Since our event study demonstrated that M&A transactions increase shareholder wealth, at least for target firms, we conducted fifteen multivariate ordinary least squares (OLS) regressions to deepen the research. Our objective is determining if specific key firm and

transaction features can affect a transaction's ability to create value. We employ the Cumulative Abnormal Returns for the target and acquiring corporations as well as for the hypothetical combined entities as our dependent variables. We use each of them to do a regression analysis utilising the explanatory variables mentioned in the Methodology section for each event window that we have selected.

We compute the Variance Inflation Factor to test the null hypothesis of no multicollinearity (VIF). No values higher than 3 are observed. Therefore, we can state that our analysis ought not be impacted by any issues of perfect multicollinearity.

We then check to see if the linear model we used for our regressions is well-specified. For the great majority of the regression models we examine, using the RESET test (Ramsey, 1969), we are unable to reject the null hypothesis of a mis-specified model.

The Table 4 below shows the statistical results of the five regressions that use as dependent variables the CAR of acquiring companies for the five-event windows described in Appendix 3.

Table 4: Study results for acquiring companies' Cumulative Abnormal Returns – Source: author's elaboration

<b>Acquirer CAR</b>					
	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
Intercept	0.102 (0.289)	0.018 (0.770)	0.016 (0.722)	0.018 (0.568)	0.387** (0.041)
DEALVAL_AQEV	0.022 (0.807)	0.047 (0.421)	0.033 (0.441)	0.011 (0.715)	-0.261* (0.089)
MKTCAPLOG	-0.006 (0.332)	-0.001 (0.884)	-0.002 (0.545)	-0.001 (0.579)	-0.019* (0.095)
TARD_TAEV	0.353* (0.094)	-0.142 (0.288)	-0.007 (0.944)	-0.058 (0.372)	-0.011 (0.978)
CROSS-BORDER	0.012 (0.600)	0.005 (0.722)	0.013 (0.239)	0.004 (0.594)	-0.060 (0.191)
CASH	0.000 (0.984)	0.008 (0.583)	0.004 (0.696)	0.002 (0.837)	0.000 (0.993)
BIOPHARMA	-0.045** (0.044)	-0.017 (0.272)	-0.015** (0.044)	-0.003 (0.709)	-0.058 (0.218)
R squared	0.069	0.042	0.045	0.023	0.081
Adj R squared	0.021	-0.008	-0.004	-0.027	0.033
Observations	123	123	123	123	123
Note:	*p<0.1; **p<0.05; ***p<0.01				

First, we can observe that the variable DEALVAL\_AQEV, representing the ratio between the value of the deal over the enterprise value of the acquiring company, show a positive sign in all the short-run event windows. However, such coefficient are not statically significant. At the same time, it is very interesting to observe that the medium-run regression analysis brought a statistically significant negative relation. This explains how large transformational transactions may be initially perceived as industry-shaping but also entails a high level of risk for the bidder, which might hinder value creation for the acquiring firm's shareholders once the market has had the time to properly digest and analyse the deal.

Moving to the MKTCAPLOG variable, we have obtained negative results for all the five event windows we have considered. However, with the exception of the [-2, +150] time interval, none of them is statistically significant. This can be explained by the fact that the larger the acquiring company is, the lower the abnormal returns for the acquiring company will be.

Another important variable we have included in the model is the R&D intensity of the target compared to its size. According to our results, the variable TARD\_TAEV is negative for all the intervals considered except [-20, +20]. It is very interesting to note that such event window, not only is the only one displaying a positive relation but is also the only one providing an acceptable level of significance. This shows that the more the targets are focused on R&D activities, the more chances there are for acquiring companies' shareholders to create value with the M&A deal.

Further examining Table 4, we can observe the positive values reported by the CROSS\_BORDER dummy variable in the short run. Such variable, however, becomes negative in the medium-run time range that we have analysed. Unfortunately, the variables' estimated parameters do not deviate significantly from zero.

Whether a transaction consideration employs cash or stock, or a combination of the two is represented in the dummy variable CASH. Cash is used in cash offers from a variety of sources, including the purchasing firm's balance sheet, a loan issuance, disposals, or a capital increase. Our variable is positive and sharply increasing as the time interval considered widens, hence, the market most likely takes this decision of consideration as a sign of buyer's management team confidence. However, results turn to 0 in the [-20, +20] and [-2, +150] windows. Anyway, none of these are statistically significant; hence we are not able to draw robust conclusions.

Finally, BIOPHARMA dummy variable is the one proving the highest level of significance in our model for acquiring companies CAR both in [-20, +20] and [-5, +5]. Looking at Table 4, we can observe negative values for the whole 5 event windows considered, which massively rise as the time span analysed increases. Thus, we can conclude that transactions in Pharmaceuticals & Biotechnology provoke, on average, abnormal returns to buyers' shareholders below those in transactions occurring in Healthcare Services and Medical Devices & Technology.

Table 5: Study results for target companies' Cumulative Abnormal Returns – Source: author's elaboration

	<b>Target CAR</b>				
	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
Intercept	-0.732*** (0.001)	-0.559*** (0.006)	-0.487*** (0.007)	-0.281* (0.057)	-0.016 (0.952)
DEALVAL_AQEV	0.243 (0.246)	0.285 (0.136)	0.251 (0.137)	0.071 (0.611)	-0.215 (0.382)
MKTCAPLOG	0.064*** (0.000)	0.048*** (0.000)	0.044*** (0.000)	0.031*** (0.001)	0.025 (0.140)
TARD_TAEV	2.083*** (0.000)	1.276*** (0.002)	1.067*** (0.009)	0.839** (0.010)	0.402 (0.484)
CROSS-BORDER	0.071 (0.195)	0.055 (0.276)	0.041 (0.352)	0.056 (0.133)	-0.005 (0.934)
CASH	-0.106* (0.053)	-0.033 (0.380)	-0.021 (0.630)	-0.038 (0.296)	-0.125* (0.054)
BIOPHARMA	-0.027 (0.638)	0.000 (0.994)	-0.023 (0.608)	-0.040 (0.285)	-0.072 (0.279)
R squared	0.304	0.207	0.178	0.181	0.098
Adj R squared	0.268	0.166	0.136	0.139	0.051
Observations	123	123	123	123	123

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 5 above shows the statistical results of the five regressions that use as dependent variables the CAR of target companies for the same five event windows described in

Appendix 3 and used for acquiring companies regression analysis. Such values are generally more significant than those of the acquirer firms.

The effect of the proportion of deal size compared to the bidder one on targets' abnormal returns is described in the coefficient of DEALVAL\_AQEV. Such coefficients are positive across the different short-term periods, turning negative in the medium-term one. Differently, Asquith, Bruner, and Mullins (1983) reported that in case of transformational M&A the bidder is under increased pressure to thoroughly determine the target's genuine worth, limiting the chances of overpayment. However, all of our results are statistically insignificant preventing us from drawing any conclusions.

Another crucial aspect that has frequently been looked at in the event study literature is the bidder's magnitude (MKTCAPLOG). Table 5 shows that the predicted parameters for this variable for the various time intervals are all positive and increase as window range widens. Excluding the longest period, such results are often extremely significant. Roll (1986) and Moeller, Schlingemann, and Stulz (2004) contend that the hubris theory can account for this. Which posits that management of the bidder organisations frequently overestimate its valuation abilities, which might imply that this effect will be even more prominent at large corporations. They are willing to overpay as a result of this overestimation, which leads to enhancement of abnormal returns for the shareholders of the targets.

Moving on with the TARD\_TAEV variable, we can successfully observe a highly statistical significance across all the short-term event windows, with coefficients drastically increasing as the range of time widens, probably affected by the higher chance of information leakage as the official announcement date approaches. This result could be explained by the fact that such R&D intensity employed by the target gives a positive signal to the market once an acquiring company shows to be willing to pay a premium in order to absorb it. In other terms,

M&A announcements, in this case, might reduce the information asymmetry which affects market analysts who cannot fully understand companies operating in the Healthcare sector due to its the high technicality. This additional confirmation allows abnormal returns to verify for targets' shareholders.

Moving forward, we look at M&A transaction's geographic features, specifically distinguishing between domestic and international deals, hence checking if it was carried out by parties from the same nation or from separate ones. The resulting coefficients for the dummy variable CROSS\_BORDER seem slightly positive, except for the [-2, +150] window, but largely insignificant.

Looking the coefficients of the dummy variable CASH, we see a consistent negative sign across the whole five event windows analysed in this thesis. Such results show a significance at the 10% confidence level for the two largest intervals, i.e. [-20, +20] and [-2, +150]. Hence, on average, as opposed to deals paid in stock or a mix of stock and cash, all-cash agreements result in smaller abnormal returns to the targets' shareholders. These findings appear to confirm the notion that the market perceives such deals as less favourable for the targets' shareholders, probably as a result of the ambiguity around the bidder's capability to afford and complete the transaction, as well as the doubtful future financial stability of the whole entity once incorporated. Our unusual results contradict the research drawn by Goergen and Renneboog (2003) on U.S. transactions from diverse industries.

Finally, the BIOPHARMA dummy variable shows negative coefficients across all the time windows considered in our analysis, meaning that transactions in these subsectors bring lower abnormal returns to the targets' shareholders. Unfortunately, we cannot draw robust conclusions as none of our results can be considered statistically significant.

The results of the last five regression analysis we have ran in our research are displayed in Table 6 below and the consider the CAR of the fictitious combined organisation as the dependent variable.

Table 6: Study results for combined companies' Cumulative Abnormal Returns – Source: author's elaboration

	<b>Combined CAR</b>				
	[-20, +20]	[-10, +10]	[-5, +5]	[-2, +2]	[-2, +150]
Intercept	0.067 (0.508)	-0.034 (0.566)	0.021 (0.648)	0.005 (0.881)	0.362** (0.042)
DEALVAL_AQEV	0.142 (0.137)	0.196*** (0.001)	0.160*** (0.000)	0.098*** (0.004)	-0.127 (0.446)
MKTCAPLOG	-0.003 (0.648)	0.001 (0.707)	-0.002 (0.610)	0.000 (0.992)	-0.019* (0.099)
TARD_TAEV	0.229 (0.279)	0.282** (0.033)	0.104 (0.343)	-0.004 (0.961)	0.180 (0.665)
CROSS-BORDER	0.019 (0.443)	0.015 (0.297)	0.014 (0.225)	0.009 (0.305)	-0.045 (0.305)
CASH	-0.006 (0.800)	0.008 (0.572)	-0.002 (0.845)	-0.001 (0.930)	-0.006 (0.895)
BIOPHARMA	-0.035 (0.171)	-0.015 (0.319)	-0.016 (0.188)	-0.004 (0.655)	-0.049 (0.276)
R squared	0.058	0.150	0.171	0.106	0.066
Adj R squared	0.009	0.106	0.129	0.060	0.018
Observations	123	123	123	123	123

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

First, we observe that the DEALVAL\_AQEV variable shows a positive sign across all the short-term time intervals while it turn negative in the medium-term. Interestingly, such results are highly significant at the 1% confidence level for the three shortest time intervals. As previously explained, bigger trades usually push decision-makers to find a particularly accurate valuation of the target entity. As an alternative, a bigger target's ownership may be dispersed, which may make lower offers more acceptable. In both instances, the potential for

overpaying will be reduced, which will have different implications on the target and acquiring corporations. This suggests that these conflicting impacts are, on average, skewed by the frequently larger buyers, producing a positive coefficient for the deal as a whole.

Further examining Table 6, an further major predictive factor for the CAR to all shareholders in an M&A execution appears to be the scale of the acquirer (MKTCAPLOG). Across all of our analyses, we discover that the projected parameter is negative, albeit it is slightly significant on in the [-2, +150] event window. This suggests that for agreements closed by bigger bidders, the overall Cumulative Abnormal Return is smaller. This unfavourable result may be attributed to the hubris hypothesis, which was previously discussed, as well as to its detrimental impact on bidders' abnormal returns and considerable relevance in the computation of the dependent variable.

Next, we examine the variable TARD\_TAEV which shows a positive sign across all the event windows considered except in [-2, +2]. Interestingly, such results are highly statistically significant only in [-10, +10]. Adding on to the reasoning we described for the target shareholders model, we could explain this phenomenon by considering the following: since R&D is a pivotal aspect of the soundness of Healthcare players, the high efforts (and results) related to it could increase the probability of creation of high synergies with M&A. Interestingly, our results contradict the work done by Kirchhoff and Schiereck (2011), albeit they computed their metrics comparing R&D expenditure with the company total sales.

As we go on to the model's next variable, we observe that the parameters of the CROSS\_BORDER dummy variable are positive in the analysed short-run time intervals and negative in the medium-run. Nevertheless, none of them statistically differ from zero at the levels of significance that are usually recognised. Therefore, we lack adequate data to draw any firm conclusions on how it affects the CARs of the combined entity.

Furthermore, we examine the dummy variable CASH. The sign of the coefficients are negative, with the exception of the [-10, +10] event window, as per the target shareholders analysis and opposingly to the acquirer shareholders analysis. However, none of these are statistically significant.

Finally, all of the estimated coefficients for the dummy variable BIOPHARMA have a minus sign. Hence, on average, deals classified as Pharmaceutical or Biotechnology present abnormal returns that are lower than transactions in Healthcare Services and Medical Devices & Technology. Regrettably, because none of the coefficients in our event windows are significant, we are unable to establish any statistical support for different trends between the groups.

## 5 Conclusions

Notwithstanding the long history of empirical and theoretical studies on the impacts of M&A transactions on shareholders' wealth, the current lack of agreement among researchers imply a need for more research on this subject. Healthcare is a sector of the economy that is becoming increasingly important globally, and the enormous volume of transactions makes it an ideal environment for such analysis.

In this paper, we look into whether the announcement of deals in the healthcare sector results in shareholder wealth creation. The calculation of abnormal returns within a range of time surrounding the announcement date, is used to study this phenomenon. Such metric is used as a proxy for value creation because it should reflect changes in future cash flow expectations resulting from the transaction. We discover that within a [-2, +2] event window, shareholders

of target firms experience positive and significant abnormal returns of 20.62% on average. Additionally, the outcome appears to improve throughout all the examined short-term intervals around the announcement, while it exhibits a significant 21.50% for the medium-term range [-2, +150]. On the other hand, in none of the selected event windows we found a confirmation that the CAR of bidders' shareholders are significantly different from zero. Next, we looked at how a transaction ultimately affected each party involved. For the [-2, +2] event window, there is evidence of 1.92% in cumulative abnormal returns, which is low but significant. Similarly, as the short-term event window widens, such results increase for the combined entity analysis. These findings suggest that while healthcare transactions generally add value, the targets' investors nearly exclusively benefit from it, sometimes even at the expense of bidders. The results of this study broadly agree with the body of prior research on the subject.

Having determined the existence of wealth creation in our models for targets' and combined entities' shareholders, we analysed the potential key drivers that could impact it. According to the hubris hypothesis put forward by Roll (1986), we discover that the size of the acquiring business has a favourable effect on the abnormal returns for targets' owners and a negative impact on acquirers' ones. However, results do not statistically diverge from zero for the acquirers. Further supporting the aforementioned notion, the coefficient's overall sign for the transactions is somewhat negative but not highly significant. In addition, consistently with Asquith, Bruner, and Mullins's (1983) work, our results suggest that bigger transactions provoke higher CAR for the fictitious combined organisation, probably thanks to its transformational power. Furthermore, as previously stated in this paper, R&D intensity is not a standard metric used in existing literature, probably due to its relevance in the Healthcare industry specifically. Nevertheless, we have found a great potential to create value for the target's shareholders and the combined entity, albeit significant only in the [-10, +10] event

window for the latter. Finally, we have seen that deals classified as Pharmaceutical and Biotechnology decrease the chances of obtaining abnormal returns for bidders' shareholders. This is probably due to the tendency to purchase targets with products in too early stages in the clinical trials pipeline that often fail to come to the market.

Despite all of our efforts, our study has certain restrictions. The size of our dataset is probably not large enough to suggest robust conclusions. Thus, future researchers might find it interesting to conduct similar research using a higher amount of datapoints. This could be conducted by looking for deals that occurred before 1981 and also look for additional data points coming from different data providers. Furthermore, we could have filtered our sample by individual countries/continents or restricted our research to transactions that took place over a shorter period so that the data collected would have come from markets experiencing the same economic and financial situations, avoiding any systematic bias. Moreover, as mentioned before, regions like the Middle East, Africa, and China are relatively underrepresented in our thesis. This was mostly because it was challenging to get accurate information on transactions from these continents, which sometimes required familiarity with the regional languages. Hence, researchers with the necessary language abilities may be able to create a sample of M&A activities that reflects better the whole Healthcare market. Additionally, expanding the study to include deals between privately held and publicly traded firms might produce fascinating results while massively increasing the sample size. But, it could lead to unsymmetric datasets, making it challenging to analyse the wealth creation for all shareholders involved.

Future studies may use different or more extensive variables to describe CARs. Subject to availability of data, good candidates could be parties' ownership structures characteristics, their financial performance before the deal, or the frequency with which they engage in M&A

activity. Moreover, in-depth case studies and manager surveys are two additional methodologies that could be used to gain innovative insights.

Lastly, this thesis findings fill a gap in the literature about creation of value in M&A deals. Thus, the management of businesses in the healthcare sector can use our findings to assess inorganic growth prospects. Moreover, since most of our sample companies also play in the high-tech industry, our results are at least partially transferable to other sectors like Information Technology, where innovation is a fundamental competitive force and a key driver of external growth decisions.

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[dBPOJUP4VsC&redir\\_esc=y](https://books.google.bg/books/about/Econometric_Analysis_of_Cross_Section_an.html?id=cdBPOJUP4VsC&redir_esc=y).

## Appendix 1 - M&A trends in the Healthcare industry

This dissertation is explicitly focused on the Healthcare industry for several reasons. First, each vertical of this sector has a global nature, but mostly, the players of the industry have been engaging a lot in M&A activities across the last several decades. As a result, conclusions for the industry are generally applicable. Second, the exorbitant expense of bringing a medicine to market and the known poor success rate for pipeline drugs set this business apart from most others. A corporation has an inherent motive to employ M&A activities to either complement or replace early stage research. Given the larger returns required to balance increased risks, a finding of anomalous short-term returns may be envisaged. The results of improved post-M&A efficiency and accounting impacts appear to support the synergies asserted in business explanations of their rationales for joining. Third, the sector is recognised for seeking M&A deals with businesses that produce so-called "blockbuster drugs", i.e. extremely popular drugs that generate billions of sales per year (or have the potential to generate them) for the firms that sell them.

The assumption of abnormal profits from M&A is supported by the monopoly or oligopoly structures that exist in a number of pharmaceutical and biotech product sectors, at least while patent protection is in place (Bottazzi et al., 2001). The opportunity for abnormal returns over the long term may be restricted since over 80% of revenue is lost at the time of patent expiration and the patent duration is very brief, indeed the majority of papers on the sector refer to short and medium run windows.

## 1.1 Global overview of the current market trends

According to the data of the latest report published by Mergermarket (Mergermarket, 2022), M&A activity globally largely recovered from the initial impact of the Covid-19 pandemic since the second half of 2020. 2021 has been an incredible year with M&A volumes reaching 2007 levels. However, in the first half of 2022 a tremendous downturn impacted the global dealmaking which has been brought down in line with historical levels.

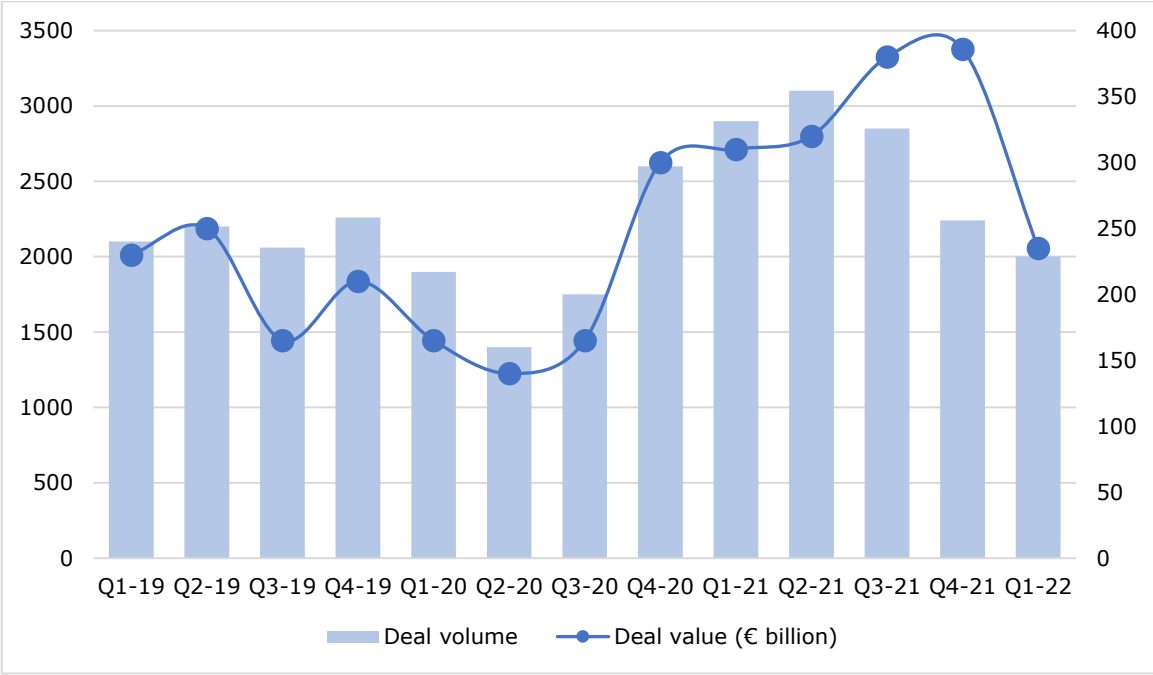
After some very positive years for the M&A market, the second quarter of 2020 saw an immediate decline in the number of deals across all sectors due to the start of the pandemic, but, with a gradual adaptation to new conditions, the deal flow then recovered in the second half of the year. Adaptation to the new reality has in fact acted as an accelerator for two main reasons: the huge packages of monetary and fiscal stimulus introduced by governments in response to the crisis they have increased the cash reserves of companies and funds, which are already thriving thanks to the low level of interest rates, and the need for a transformation in the way of conducting their work in most sectors. In addition, the introduction of vaccines gradually paved the way towards a return to normal as regards the economic conditions and life in society.

Since the beginning of 2022, stock markets moved into negative territory in the first weeks of the year, with investors conscious of stalling growth, the prospects of runaway inflation, and imminent policy measures to curb spiralling prices. And then came Russia's invasion of Ukraine, weighing further on already dampened risk sentiment. This has clearly reduced M&A appetite.

In particular, in EMEA (Europe, Middle East and Africa) €223 billion of deals have been registered during the first quarter of 2022, a 27% decline compared to the first quarter of the previous year, while the M&A volume fell further by 31% to 2,007.

Figure 3 shows the fashion in value and number of M&A transactions that took place in the EMEA region between the beginning of 2019 and the first quarter of 2022.

Figure 3: EMEA M&A activity, 2019-Q1 2022 – Source: Mergermarket



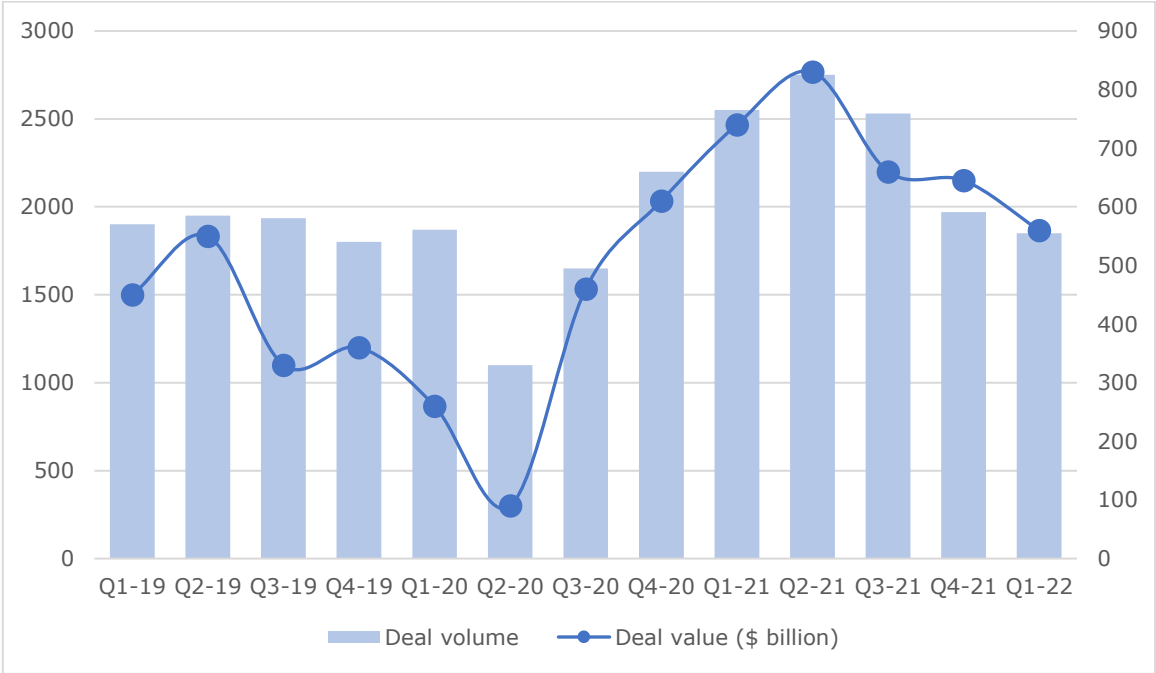
Also the M&A activity in the Americas enjoyed the governmental stimulus and low interest rates in the five quarters following the outbreak of the covid-19 pandemic. Since the last quarter of 2021, the dealmaking has slowed down significantly, reaching pre-pandemic levels. Anyway, according to Mergermarket (Mergermakert, 2022) the overall deal activity is as healthy as it has ever been and, at least at the ground level, reasons for optimism remain.

The total deal value in the first quarter of 2022 was \$545 billion, 16% less than the previous quarter and 25.2% down compared to the same quarter of the previous year. Total M&A

volume decreased to 1,875 transactions in the first quarter of 2022, 5.8% less than the last quarter of 2021.

Figure 4 shows the fashion in value and number of M&A transactions that took place in the Americas region between the beginning of 2019 and the first quarter of 2022.

Figure 4: Americas M&A activity, 2019-Q1 2022 – Source: Mergermarket



### 1.2 Unique characteristics of Healthcare firms

The Healthcare sector, in its simplest sense, is made of all of those companies that manufacture medical equipment or drugs or offer services of healthcare to patients. This industry tends to be analysed in four sub-sectors:

1. Pharma: companies with a well-defined portfolio of pharmaceuticals products, focused on manufacturing, outsourcing, and marketing, as well research and development.

2. Biotech: companies tend to be smaller in size, they are very focused on research and development to create new drugs, devices, and methods of treatment.
3. Medtech, Healthtech, Life science and Diagnostics: companies that manufacture medical devices, from the simplest equipment to cutting-edge technological products.
4. Healthcare Services: companies that supply health services to patients, such as hospitals, clinics, laboratories, nursing homes, etc.

In this dissertation we will focus on the first two sectors, as they have a lot of synergies and they are comparable from the point of view of business dynamics; therefore, also in this chapter there will be a focus on them

### **Most important factors**

Below we analyse the most important factors which have always exercised an influence on healthcare players and particularly on pharmaceutical and biotechnological companies performance:

- *Population growth and development:* Nowadays, the global average life expectancy is continuously increasing and the older part of the population is the one that has always relied significantly on the health system (University of Oxford, 2019).
- *Innovation:* Over the years, the capital invested in research and development has increased massively to develop novel and more effective drugs, such numbers are expected to continue rising to cope with the continuous improvement in understanding human genes and the proteins they encode (IQVIA, 2021).
- *Market penetration:* To compensate for the huge investments required to launch a new drug, pharmaceutical companies have learned to apply new strategies to penetrate the markets more and more quickly and extensively, hiring more representatives and

always going in search of as many medical indications as possible for products already in their portfolio (McKinsey & Co., 2020).

- *Industrialisation and health budgets:* As the GDP per capita of developing nations increases, so does the ability of governments to invest in a better healthcare system and make better medicines available to their population. Furthermore, regardless of a country's level of development, it is almost always true that investing in medicines is more cost-effective than hospitalising people (Deutsche Bank, 2005).
- *Patents:* The expiry of patents protecting the most important drugs is one of the major sources of pressure suffered by pharmaceutical companies, which face competition from generic companies and the resulting declines in revenues and cash flow (Deutsche Bank, 2005).
- *Research costs:* As already mentioned, the pharmaceutical industry is largely based on intense R&D efforts and, although science continues to make great strides, the time it takes to bring products to the market and the costs to develop new chemical entities do not decrease (Schlander, 2021).
- *Government pressure on "pricing":* With the exception of the United States, drug, equipment and services prices are predominantly determined by government-controlled authorities. Given the significance of healthcare costs to an economy's GDP and the need for this service for an ageing population, companies are under great pressure from governments to continuously monitor and revise their prices (Deutsche Bank, 2005).

### **New trends brought by the Covid-19 pandemic**

Today, about two years and a half after the start of the pandemic, the focus is on biopharmaceutical companies, due to the strategic importance of the subsector at this time,

and this also brings with it many questions on important topics such as drug “pricing” and R&D efficiency.

In addition to validating new and old vaccine technologies and the emergence of new trends, the pandemic has accelerated existing trends: the development of digital solutions such as virtual clinical trials; the provision of online health services and telemedicine.

According to the latest annual report published by Evaluate Pharma (Evaluate Vantage, 2021), the most important trends that the pandemic has brought with it, with reference to the biopharmaceutical market, are as follows:

- *Public image at risk:* Although the production of vaccines initially put the world's big pharmaceutical companies in a good light, their reputation is now shaky due to a number of more recent critical events, including: pressure on “pricing” from the new Biden government, the FDA's controversial approval of Biogen's Alzheimer's drug, and the inequitable distribution of vaccines around the world.
- *Increased pressure on “pricing”:* As already mentioned, the new Biden administration is intent on enacting a comprehensive prescription drug “pricing” reform, as well as an extension of the “Medicare” programme for additional age groups. However, while small legislative and regulatory measures could pass, experts say it is unlikely to be able to enact any major reforms into law.
- *The rise of China:* The market for Chinese biotech companies has emerged from the pandemic much stronger than before and is moving from the production of generics to the production of new successful drugs, aiming to excel in areas of great interest such as immuno-oncology drugs. An interesting competitive advantage of these companies is also their cheaper “pricing”, due to their strong focus on efficiency in R&D processes.

- *Antitumour drugs:* For many years now, oncology has been the therapeutic area in which the most capital has been invested, and Covid-19 has not changed this trend; on the contrary, there have been research breakthroughs, such as new generations of immuno-oncology targets (LAG-3 and TIGIT).
- *Focus on anti-infective drugs:* Whereas before the pandemic the area of vaccines and anti-infectious drugs was definitely of secondary interest from the point of view of R&D efforts, today the situation has reversed, so much so that antimicrobial resistance and pandemic preparedness have entered the G7 agenda.
- *M&A more closely monitored:* The increased focus on the biopharmaceutical sector due to the pandemic also brings with it increased pressure from regulators. The US Federal Trade Commission seems intent on increasingly curbing those M&A transactions that could result in price increases or other anti-competitive practices in general. Nevertheless, even during the pandemic, M&A continued to be an important growth driver for the industry, as we will see in more detail in the next section.

### 1.3 Healthcare M&A

M&A has long been a significant value lever in the Healthcare industry and is expected to continue to be an important part of the post-pandemic strategies of companies in the sector (McKinsey & Co., 2020). Even before the advent of the Covid-19 pandemic, which brought both negative and positive effects on this industry, activity in the Healthcare sector had reached extremely high levels. Historically, the main strategic reasons why Healthcare companies have undertaken mergers or acquisitions have been three (McKinsey & Co., 2020).

Firstly, the continuous drive towards innovation: these types of companies base their growth on large investments in Research & Development and the ability to pioneer new technologies. To do this, it is very often more cost-effective to acquire small companies with years of research behind them and a single, very promising product, rather than to develop everything in-house.

Figure 5 shows the R&D expenditure trend for pharmaceutical companies between 2012 and 2026 on a global level.

Figure 5: Development of pharmaceutical companies' R&D expenditure between 2012 and 2026 at global level - Source: Evaluate Pharma (2021)



Secondly, the attempt to create economies of scale: as is well known, the processes of developing, approving and marketing a drug are extremely time-consuming and require a high level of investment, with an equally high level of risk of failure. For this reason, similarly to the above, it is often economically viable for a financially strong pharmaceutical company to create strategic partnerships, “joint ventures” or make acquisitions, in order to outsource this fundamental phase of its “business”.

Finally, perhaps the most important factor driving Healthcare companies to want to make acquisitions is the need to update their product portfolio: continuing with the example of pharmaceutical companies, one of the most critical tasks for their executives is the strategic management of the commercial “pipeline” of products. In fact, the cash availability and revenues of such companies can fluctuate considerably when a new drug enters the market or a patent expires, causing them to lose exclusivity on a certain product and leaving room for generic manufacturers. Therefore, it is important to keep the product portfolio monitored and to be able to bridge any losses in cash flow through divestments or acquisitions.

Figure 6 shows the trend in the volume of revenues at risk due to patent expiry for pharmaceutical companies between 2012 and 2026 on a global level.

Figure 6: Trend in the volume of revenues at risk due to patent expirations of pharmaceutical companies between

2012 and 2026 globally - Source: Evaluate Pharma (2021)



To date, these trends are still driving the reasons why healthcare companies make acquisitions. In addition, a number of other factors have to be considered, among which the strategic importance of being a leader in a specific product category, rather than acting differentially in the broad “Healthcare” market. Various market researches show a clear

relationship between category leadership and value creation in this market (Bain & Company, 2022) and this reality is reflected in targeted M&A strategies, of which we can mention many examples: GSK became a leader in vaccines by acquiring Novartis's vaccine business, Novartis acquired GSK's cancer drug portfolio, Bristol-Myers Squibb sold its diabetes drug “business” to AstraZeneca and, finally, in 2022 GSK has successfully completed the “spin-off” its “consumer healthcare” “business” Helion, precisely in order to focus on being a pharmaceutical “pure player”.

All the factors mentioned are still relevant, but it is also necessary to dwell on the effects Covid-19 had on the healthcare sector from 2020 onwards. As mentioned, Covid-19 gave a boost to a sector that was already doing very well from an M&A perspective: despite the difficulties of the beginning of the pandemic, such as the travel freeze and the suspension of many “clinical trials”, companies adapted quickly to working remotely and during 2020, many large transactions emerged including the acquisition of Alexion by AstraZeneca for USD 39 billion and the merger between the two Medtech giants Teladoc and Livongo (Evaluate Vantage, 2021). In general, in 2020, investors' attention focused heavily on Biopharma companies, whose valuations fluctuated a lot on the stock market, especially in favour of those that started to develop vaccines and treatments for Covid-19, among which Moderna, BioNTech and Novavax stood out (Evaluate Vantage, 2021).

The relevance of the sector continued in 2021: the Nasdaq Biotech Index gained more than 30 per cent in 2020 and reached an all-time high in early 2021 (Evaluate Vantage, 2021), the value of M&A deals rose to USD 288.9 billion, a 38 per cent increase over 2020, and the number of “deals” also increased by 25 per cent year-on-year (White & Case, 2022). The protagonists of these deals are private equity funds, which used their dry powder to make large acquisitions, such as that of Medline by a consortium led by The Carlyle Group (White & Case, 2022). Moving to 2022, such index has worsened its performance mostly due to the

global stock crash which began around March 2022 with the war in Ukraine. However, industry analysts expect that giant drugmakers, some of whom are facing the patent expirations of their cash cow drugs, will pursue M&A deals with biotech targets that are closer to bringing their pipeline to market or that already have a drug approved (Reuters, August 2022).

## Appendix 2 - Literature Review

Over the past few decades, a lot of research has been conducted on the subject of M&As and their impacts, including if they destroy or create value. However, the majority of researchers in this area concentrate primarily either on deals involving financial institutions or on transactions from a diverse range of industries. In the healthcare industry there are comparatively few empirical studies on value creation through M&A. Here, we offer a brief review of the literature with an emphasis on a number of particular subjects.

First, we look at academic papers that discuss the returns to shareholders of acquiring companies, target companies and combined entities surrounding the date of an M&A announcement. Next, we review studies that look at the most prevalent factors that may be responsible for abnormal returns in this kind of deals. In this paragraph, we quite adhere to Bruner (2002). Our interest, however, is primarily on recent research that look at deals from the past 30-40 years. Jensen and Ruback (1983) and Datta, Pinches, and Narayanan (1992) provide a more thorough analysis of the historical literature.

All healthcare sub-sectors have been included in our research. Here, we look at both theoretical and empirical studies on value creation, both of which focus on the trends and forces that influence M&A activity in the whole industry. Further description of M&A trends in this sector have already been discussed in the previous Appendix 1.

## 2.1. Cumulative Abnormal Returns to Acquiring Firms

Contrary to research focused on target companies, there is little agreement regarding the total abnormal returns to acquiring firms.

The vast majority of empirical study on the topic concentrates on daily returns during the relatively short window of time following the announcement. Results, however, differ depending on the study sample. Asquith, Bruner, and Mullins (1983), for example, determine statistically significant positive announcement returns, Dodd (1980) finds negative ones, while other researchers have come to the conclusion that there is no evidence of significant abnormal returns.

There is a significant range of research on the long- and medium-term performance of acquiring firms. The majority of studies have come to the conclusion that acquisitions don't give the acquirer better abnormal returns. In fact, most researchers, including Asquith et al. (1983), Agrawal, Jaffe, and Mandelker (1992), and Andrade, Mitchell, and Stafford (2001), come to the conclusion that acquirers experience significantly negative abnormal returns in the one to three years following the transaction. According to Fuller, Netter, and Stegemoller (2002), the fact that these studies only concentrate on public targets is to blame for the poor long-term performance. Their sample of targets includes both private firms and subsidiaries. They discover that while long-term returns are negative for buyers of publicly traded targets, they are positive for deals involving private or subsidiary targets. However, these results are not consistent across all research, indeed, multiple studies using a variety of samples have not found evidence of significant underperformance, like Franks, Harris, and Titman (1991).

The results of the 11 academic research that we have reviewed are quite contradictory and they are summarized in Table 7 below.

Table 7: Summary of existing research on acquirers' cumulative abnormal returns – Source:  
author's elaboration

Study	CAR (%)	Event window (days)	Sample size	Sample period	Sector examined	Region/ Nation	Note
Kohers, Ninon and Kohers (2000)	1.26***	[0, +1]	1634	1987-1996	Tech	USA	
Walker (2000)	-0.84*	[-2, +2]	278	1980-1996	Non-financial and non-utilities	USA	
DeLong (2001)	-1.68***	[-10, +1]	280	1988-1995	Financial Institutions	USA	Only deals involving at least a bank
Beitel, Schiereck, and Wahrenburg (2004)	-0.20 -0.01	[-20, +20] [-1, +1]	98	1985-2000	Financial Institutions	EU-15 Switzerland and Norway	Focus on banking sector
Hamza (2011)	-0.27 1.60 1.05* 2.39 0.85 2.97	[-10, -6] [-5, -1] [0, 0] [-5, +5] [+6, +20] [-20, +20]	58	1997-2005	All	France	
Dakessian and Feldmann (2013)	0.10	[-5, +5]	607	1989-2011	All	Central and South America	
Craninckx and Huyghebaert (2015)	0.35* 0.11	[-35, +1] [-1, +1]	342	1997-2007	All	EU-27	Examine impacts of different ownership on wealth
Alexandridis, Antypas, and Travlos (2017)	-1.08*** 1.05***	[-1, +1]	4194 579	1990-2009 2010-2015	All	USA	
Boateng et al. (2018)	0.45*** 0.74*** 1.18*** 1.49***	[-1, +1] [-2, +2] [-5, +5] [-10, +10]	2009	1998-2012	Non-financial	USA	
Dogan (2018)	-1.41*** -1.07** -1.07	[-1, +1] [-2, +2] [-30, +5]	214	2000-2014	Banking	USA	Study of US commercial banks
Nazarova (2018)	0.65***	[-1, +1]	204	2008-2017	Healthcare	USA, Europe	Healthcare deals in developed markets

A little more than half of them report positive CARs, and the remaining ones discover evidence of negative abnormal returns. It is challenging to make judgments about the overall sign or magnitude of the return to acquiring firms in light of this contradictory empirical data.

The work of Nazarova (2018) is particularly pertinent to our study. She looks at mergers and acquisitions in the healthcare industry in the decade before 2017 in developed western countries. The researcher focuses exclusively on bidders' returns and discovers a statistically significant CAR of 0.65%.

Significant academic attention has also been paid to the long-run wealth variations resulting from M&A deals. Sudarsanam and Mahate (2006) collected data on 519 acquisitions occurred in the United Kingdom from 1983 to 1995. The authors compute abnormal performance index returns (APRs) three years after the acquisition and discover negative returns between -7% and -14%. A peculiar characteristic of this research is the decision of the authors to employ this methodology rather than the standard CAR, since some of the biases connected to it are reduced, particularly in a more extended event windows.

Gregory (1997) analysed 452 British deals ranging from 1984 to 1992. He observed value disruption between 10% and 18% over the two years after the purchase. In the same paper, he points out that, while the magnitude may vary depending on the methodology used, the existence of value disruption is verified with all the approaches used.

These results broadly agree with the more thorough literature overview conducted by Bruner (2002). He concludes that given the inconsistent empirical findings in the literature, abnormal returns to bidders' shareholders are typically close to zero. It's noteworthy that he also presents some flimsy proof of a long-run value creation.

## 2.2 Cumulative Abnormal Returns to Target Firms

On average, target company shareholders receive returns that are almost always significantly positive. Despite variations in industry focus, time period, and event window length, the

results of the 8 papers that we analysed show significant CARs. These results agree with earlier reviews of the relevant literature by Jensen and Ruback (1983) and Datta, Pinches, and Narayanan (1992). These authors observe CARs around 20–30%. Recent studies seem to find significantly lower CARs, though. Such value creation typically take place on the announcement date or in the few following days according to the majority of the research under consideration, and as the event window widens, their magnitude typically rises and becomes more significant. Nevertheless, Campa and Hernando (2004) discover considerable gains even in the intervals before the announcement date. Such results may imply that the market foresaw the acquisition or that there was information leakage. A summary of the research' results that we considered is displayed in Table 8 below.

Table 8: Summary of existing research on targets' cumulative abnormal returns – Source: author's elaboration

Study	CAR (%)	Event Window (days)	Sample Size	Sample Period	Industry Coverage	Country Coverage	Notes
Campa and Herando (2004)	6.60** 5.30** 3.93** 8.90**	[-90, -1] [30, -1] [-1, +1] [-30, +30]	262	1998-2000	Diversified	EU	domestic deals in regulated vs.
Beitel, Schiereck, and Wahrenburg (2004)	16.00*** 12.39***	[-20, +20] [-1, +1]	98	1985-2000	Banking	Switzerland and Norway	Study of European bank deals
Dogan (2018)	23.41*** 23.14*** 26.04***	[-1, +1] [-2, +2] [-30, +5]	214	2000-2014	Banking	US	Study of US commercial banks
Craninckx and Huyghebaert (2011)	6.12*** 7.56*** 9.79*** 13.90*** 15.65*** 17.47***	[-1, 0] [-1, +1] [-5, +1] [-20, +1] [-35, +1] [-50, +1]	221	1997-2006	Diversified	EU-27	Focuset on the relation between abnormal returns and long-term
Coergen and Renneboog (2004)	9.01*** 12.96*** 23.10*** 21.66***	[-1, 0] [-2, +2] [-40, 0] [-60, +60]	136	1993-2000	Diversified	EU	Includes only large deals-<\$100 milions
Mulherin and Boone (2000)	21.20***	[-1, +1]	376	1990-1999	Diversified	US	
Huyghebaert and Luipaert (2013)	10.48* 12.97* 20.45* 20.74*	[-1, +1] [-5, +5] [-35, +5] [-50, +5]	130	1997-2008	Diversified	EU-27	European horizontal acquisitions
Maquieira Megginsons, and Nail (1998)	41.65*** 38.08***	[-60, +60]	47 55	1963-1996	Conglomerate Non-conglomerate	US	Stock-for-stock mergers

### 2.3 Cumulative Abnormal Returns to Target and Acquiring Firms Combined

Questions about the whole wealth creation impact of an M&A deal are raised by combining of positive abnormal returns to the shareholders of target companies and breakeven returns to the shareholders of acquiring companies. At first glance, this calculation appears to be fairly simple, but the sometimes substantial size differences between the parties of a transaction can greatly affect the overall return. Consequently, a loss to the acquiring company may more

than offset a sizable gain to the target. We looked at 6 studies in this field, and they all showed significant positive Cumulative Abnormal Return around 1–3%.

A summary of the empirical research that we considered are summarised in Table 9 below.

Table 9: Summary of existing research on acquirer and targets combined cumulative abnormal returns – Source: author’s elaboration

Study	CAR (%)	Event window (days)	Sample Size	Sample Period	Sector examined	Region/ Nation	Note
Campa and Hernando (2004)	3.57** 1.16 1.04** 0.95	[-90, -1] [-30, -1] [-1, +1] [-30, +30]	262	1998-2000	All	Europe	Focus on cross-border vs. domestic
Beitel, Schiereck, and Wahrenburg (2004)	1.29* 1.40***	[-20, +20] [-1, +1]	98	1985-2000	Financial Institutions	EU-15, Norway and Switzerland	Focus on banking sector
Dogan (2018)	2.24*** 2.52*** 3.29***	[-1, +1] [-2, +2] [-30, +5]	214	2000-2014	Financial Institutions	USA	Focus on commercial banking
Craninckx and Huyghebaert (2015)	2.52*** 1.37***	[-35, +1] [-1, +1]	342	1997-2007	All	EU-27	Examine impacts of different ownership on wealth
Craninckx and Huyghebaert (2011)	1.19** 1.10*** 1.89*** 2.34** 2.63* 2.89*	[-1, 0] [-1, +1] [-5, +1] [-20, +1] [-35, +1] [-50, +1]	178	1997-2006	All	EU-27	Focus on abnormal returns vs. long-term inferior returns
Mulherin and Boone (2000)	3.56***	[-1, +1] [-2, +2] [-30, +5]	281	1990-2006	All	USA	

## 2.4. Drivers of M&A Value Creation

Numerous factors, including acquirer and target characteristics, transaction-specific attributes, and the state of the economy as a whole, have been proposed and tested in decades of academic studies on the subject of wealth creation in M&A. While reviewing 89 M&A

studies that were published over the course of the previous 25 years, Hitt et al. (2009) identified the variables that were most frequently used. According to their analysis, such factors are if the deal is diversified or focused (58%), the sizes of the parties involved (52%), the bidder's involvement in prior M&A deals (28%) and the payment consideration (18%). The conclusions of these studies, however, also sharply differ, and it is unclear how many of these factors will actually affect the situation.

The effect of the means of payment on shareholders wealth following the deal is a common topic in empirical research, albeit its exact impact is ambiguous. In general, acquirers are more willing to offer only cash as consideration the more faith they have in a takeover (Fishman, 1989). As a result, using stock as payment may indicate that the buyer has some scepticism about the probability of realising value thanks to the transaction and wants to split a part of the risk with their counterparts. Empirical data appear to support this way of thinking. According to Martynova and Renneboog (2009) analysis of a sample of 1361 European transactions from the years 1993 to 2001, stock transactions perform worse than cash acquisitions. Additionally, similar findings are found by Moeller, Schlingemann, and Stulz (2004) in their analysis of American transactions from 1980 to 2001.

Moreover, the price paid to close an M&A deal is another significant factor. Asquith, Bruner, and Mullins (1983) found a positive relationship between acquirer returns and the relative size of the target. This factor has been taken into consideration in numerous academic studies. They posit that as the size of the deal grows, the purchasing company is under more pressure to carefully determine the target's true worth. But according to Hayward and Hambrick (1997), high-value deals have a detrimental impact on a company's value because the buyer pays the target company premiums that are higher than its market value.

In addition, some analysis has been conducted on the size of the acquirer, as many large multinational firms dispose of a significant amount of dry powder to be spent in M&A

activity. Roll (1986) promotes the advantages of large-buyer deals. He contends that big businesses are more likely to use stock as a form of payment because it enables paying lower premiums and produces better returns. But according to Moeller, Schlingemann, and Stulz (2004), there is a bad correlation between acquirers' CAR and size. They believe that these kind of deals are mostly due to managerial hubris, namely larger firms are more likely to offer higher premiums because their experienced managers believe that they would manage the target more efficiently. Therefore, larger companies are frequently willing to pay higher sums of money than the actual value of a target company, according to Eckbo (2010).

Furthermore, execution of the deal between companies from the same or different countries is another aspect that could influence the value creation in a merger and acquisition. Aw and Chatterjee (2004) lend credibility to the theory that M&A deals involving businesses from diverse nations increase value. The research finds a significantly lower CAR after merging with firms from the same nation. In such paper, they examine the behaviour of UK businesses following transactions with US and EU companies. In light of this, Campa and Hernando (2004) observed insignificant returns for bidders in international European deals. Additionally, Morresi and Pezzi (2011) report highly statistically significant returns of almost 3% of Italian companies completing cross-border deals, while Goergen and Renneboog (2004) report similar findings for European cross-border transactions. On the other hand, Moeller and Schlingemann (2005) observe that international transactions have the opposite impact, indeed, in their paper, they show a negative effect on M&A deals in the United States disregarding the sector.

## 2.5. Research on the Pharmaceutical and Biotechnology M&A Effectiveness

The Pharmaceuticals & Biotechnology sectors are the most researched verticals of the Healthcare industry. The studies driven look at both the theoretical and empirical aspects of value creation in M&A transactions.

Hassan et al. (2007) explore 405 mergers and acquisitions between 1981 and 2004 in the US pharmaceutical sector. According to their analysis, the shareholders of the acquiring firms experienced a positive and significant CAR of 1.81% during the [-1, +1] event window. Although it is shown that the returns for mergers are not statistically different from zero, such findings mainly hold true for a subsample of acquisitions. Higgins and Rodriguez (2006) found targets and buyers to have positive and significant Cumulative Abnormal Returns of 16.00% and 3.91%, respectively, in a three-day event window by analysing pharmaceutical deals between 1994 and 2001. Kirchhoff & Schiereck (2011), on the other hand, look at a sample of 104 pharmaceutical and biotechnology transactions that occurred between 1996 and 2006, and they find that in a [-1, +1] event window, acquirer returns were statistically significantly negative at -3.17%. In line with earlier studies on the subject, the researchers also find significant abnormal returns of 21.02% to shareholders of target companies during that time period. Furthermore, it is demonstrated that these abnormal returns gradually rise with increasing event window length. In a short-term event study on pharmaceutical mergers that focused on the acquirers, Sorescu et al. (2003) calculated significant CARs of around -1% in a 3- and 5-day interval. Bednarczyk (2006) restricted their event study to the European pharmaceutical industry. Although potential combined entities have not been included in this research project, their sample between 1997 and 2005 not only showed positive value creation impacts for the target companies but also low positive CARs for the buyers. Finally, 65 pharmaceutical deals from 1985 to 1996 are examined by Ravenscraft and Long (2000). They

find statistically significant Cumulative Abnormal Returns of 13.31% for targets and -2.12% for buyers.

Many papers focus also on the strategic drivers that generally foster pharma and biotech firms to engage in M&A transactions. Danzon, Epstein, and Nicholson (2007) analyse a dataset of 383 companies from 1988 to 2001. They discover that mergers are frequently a way for big businesses to anticipate excess capacity brought on by patent expirations and gaps in their product portfolio. Higgins and Rodriguez (2006) study a smaller sample of pharmaceutical transactions and find additional support to this theory. Additionally, they discover that businesses are generally more likely to make acquisitions if their product sales or research pipelines are deteriorating. Their research also shows that bidders' CARs are positively correlated with the level of information they had about the target company prior to the acquisition, such as through sales experience or partnerships in the relevant product category.

On the other hand, Danzon, Epstein, and Nicholson (2007) discover that small businesses frequently use M&A as an escape plan when they are having financial difficulties. Small businesses that have performed well are therefore more likely to continue operating independently.

It is very interesting to note that the topic of M&A in the pharmaceutical and biotechnological industry has been discussed in the literature also from different standpoints. As an example, Arora and Gambardella (1990) assessed the effects of various forms of cooperation. The authors studied four types of cooperation: alliances between commercial corporations, research alliances between universities, acquisitions of minority stakes in biotech firms by pharma firms, and full-fledged acquisitions of biotech firms by pharma firms. Their sample included universities, small- and medium-sized biotech firms, and large pharmaceutical companies. The execution of an additional strategy increased the marginal value of the other one, demonstrating the complementary nature of these four different forms of cooperation.

On the basis of the transaction cost theory, Pisano (1997) compared the two popular cooperation strategies, alliance vs. M&A, and came to a distinct conclusion. When insecure property rights, transaction-specific production goods, and difficult technology transfers are common, mergers and acquisitions (M&A) appear to result in lower transaction costs. Less complicated forms of cooperation are preferable in situations with typically low transaction costs or to prevent knowledge loss due to migration during an acquisition.

## 2.6. Research on the Medical Technology and Healthcare Services M&A

### Effectiveness

Sadly, there is not as much study on M&A in the Healthcare Services and Medical Devices sub-sectors as there is in the Pharmaceuticals & Biotechnology businesses.

In his study from 2007, Ohashi (2007) looked at a dataset of 674 deals from the United States MedTech sector from 1996 to 2006. For shareholders of bidders in a [-1, +1] time interval around the announcement date, the researcher finds significant CARs of 0.4%. Wei and Clegg (2014) conduct a thorough analysis of 6 M&A transactions that happened in the medical technology sector between 1998 and 2008. According to the authors, the primary driving force in such deals was the interest to obtain a portion of the targets' product portfolios and/or R&D capabilities. Another frequent justification for choosing to pursue an M&A deal was expanding into new markets and taking advantage of more developed sales networks.

The pursuit of cost efficiencies appears to be the primary driving force behind mergers and acquisitions in the hospitals subsector. However, Treat (1976) reports that expenses rise massively for hospitals located in urban areas but not for rural ones when he looks at a sample of transactions that happened between 1957 and 1970. Additionally, multihospital systems do

not appear to be any more effective at utilising economies of scale than independent ones, according to Dranove and Shanley (1995). Harrison (2011), instead, looks at a set of deals from the years 1984 to 1998 and reports the realisation of cost savings right after M&A. On the other hand, it is discovered that the achieved synergies are diminishing over time. Additionally, Schmitt (2017) observes that target companies experience cost savings around 4-7% on average during the years following a deal when studying hospital mergers between 2000 and 2010. Modern technological advancements and the increased competitive pressure that businesses in the subsector face can probably be used to explain, at least in part, the improved performance of Healthcare services transactions that has been reported in the last studies.

## Appendix 3 - Methodology

In the existing literature, there are various widely employed methods for gauging value creation in M&A transactions (Bruner 2002).

Accounting studies look at a company's stated financial performance to assess if a transaction has the potential to add or subtract value. This kind of analysis typically compares particular financial measures of a target or bidder prior to and following a deal. This method has the advantage that it is based on certified and audited data, which ought to be and typically is of high standards. It is, however, backward-looking, and comparisons could occasionally be challenging, particularly over lengthy time windows or across various nations.

Clinical studies or case studies concentrate in great detail on a single or a small number of transactions. Interviews with business leaders or subject matter experts are frequently used in this kind of research. Additionally, a deal's context and history are carefully scrutinized. Notwithstanding the profound insights that could be gained from these investigations, their findings are challenging to generalise because of the typically limited sample sizes.

A manager survey is an additional interesting strategy that might be used. In order to make conclusions about the population, a standardized questionnaire is used in this situation. Such investigations may reveal information about a transaction that would not otherwise be publicly known. However, the main drawback of manager survey is that respondents' subjectivity has the potential to skew the results.

Lastly, event study methodology is clearly the most popular way for examining Mergers and Acquisitions. In this kind of research, wealth effects can be investigated by looking at the abnormal shareholder returns over the time period immediately preceding the relevant event. This methodology has a very long history, indeed, it was most likely first used by Dolley

(1933), who investigated the price impact of stock splits. After that, the quality of these studies has greatly increased, making them a methodology with several different applications.

This method's success is mostly due to the fact that it offers a practical and effective technique to examine numerous events simultaneously. Moreover, it also delivers precise findings and has a solid theoretical foundation. However, it does necessitate a number of significant assumptions about how the financial system functions, which in some unusual circumstances might be challenging to satisfy (Bruner 2002).

Since we aim to analyse a significant number of M&A deals, in this paper, we have decided to adopt the event study methodology, as it gives us the best possible balance between efficiency and reliable results that are theoretically supported. Furthermore, these studies often examine the relationships between firm- or deal-specific factors and the CARs derived from the event investigation. Such methodology will be used in our study to look at the variables influencing transactions in the Healthcare industry.

### 3.1 Event study methodology

The premise of market efficiency is crucial to the event study approach. The origins of the efficient market hypothesis can be seen in Louis Bachelier's PhD thesis from 1900, which took a mathematical approach to the theory. But Eugene Fama's work from the 1960s and 1970s is widely recognized as the source of the version that is now conventionally supported. Malkiel and Fama (1970) assert in their study that stock prices must correctly represent all information available at any single moment for a market to be considered efficient. Additionally, they describe 3 types of efficiency: weak form, semi-strong form, and strong form, depending on which information subsets are employed.

The weak form presupposes that share prices accurately represent historical returns. The semi-strong form presupposes that prices instantly take new information that is made available to the public into account. Finally, the strong form adds private information to the information set. Empirical findings support the weak and semi-strong versions of the theory, according to Malkiel and Fama (1970) and a large number of other researchers in this field. However, there doesn't appear to be much proof supporting the powerful form.

To properly use the event study approach, the assumption of market efficiency, at least for the semi-strong version, is required. All information that is readily available to the public, if it is in fact fulfilled, is already reflected in the share prices. As a result, abnormal returns cannot be realized. However, when a significant corporate event, like a merger or acquisition, is announced, new information is revealed that has not yet been factored into the price of the security. Such statements typically change investor expectations to some extent, and the prices change to reflect that. This means that abnormal returns can deviate from zero before the market reaches equilibrium. We utilize this anomalous return specifically as a proxy for the creation or depletion of value for shareholders.

The first step in an event study is to define the event of interest (MacKinlay, 1997). This paper will look at M&A transactions in the Healthcare industry only. In the literature, the day of a transaction's announcement is frequently used as the event date. And if there were no trades on that day, it is moved to the closest trading day following the announcement of the transaction.

The second step is to establish an event window  $W = T_2 - T_1$ , where  $T_1$  is the event window's first day and  $T_2$  is its last day. It is characterized as the time period utilized to gauge value changes resulting from transactions in the trading days preceding and following the event date. As per MacKinlay (1997), it is typical to configure the event window's duration to be

longer than the targeted date. Howbeit, on the precise number of days to include, there is little agreement.

Choosing the ideal event window is challenging since there are two competing factors to take into account. If there is proof of information leakage in the days previous to the public release, a brief period could be hazardous. Furthermore, without accounting for subsequent corrective price movements, an overreaction on the side of the market may skew the results in such a window. Goergen and Renneboog (2003), instead, argue that a rise in the stock price of the purchasing company may occur before the announcement date. As a result, selecting a window that is too long may cause the takeover returns to be overstated.

In our study, we have picked a selection of event windows, gauging the vast majority of previous researchers, to improve the reliability and robustness of our findings. Indeed, we have analysed alternative short-term windows centred on the announcement dates: [-2, +2], [-5, +5], [-10, +10], [-20, +20]. With four different ranges of time, we believe that issues related to information leaking before the event and market overreaction and adjustment following the event could be neutralised to an appropriate extent.

In addition, we have examined a longer event window [-2, +150] to access the potential for the medium-term value creation of M&A deals in the Healthcare industry.

After the event has been defined, its effects on shareholders' wealth can be investigated by examining the abnormal return of the parties to the shares of the companies involved in the transactions. The portion of the stock's actual return that exceeds the normal return within the event window is referred to as an abnormal return (MacKinlay, 1997). The normal return, instead, is the return that would be anticipated in case the event had not happened.

Hence, the abnormal return can be defined as:

$$AR_{j,t} = R_{j,t} - E(R_{j,t})$$

where  $AR_{j,t}$  is the abnormal return of stock  $j$  for the period  $t$ ,  $R_{j,t}$  is the actual observed return of stock  $j$  for the period  $t$  and  $E(R_{j,t})$  is the expected normal return of stock  $j$  for the period  $t$ .

Since the actual return for any share could be seen in the open market, computing it is rather simple. On the other hand, it is difficult to immediately observe the normal return. In academic papers, there are three key modelling methodologies that are commonly applied.

The mean-adjusted return model, often known as the constant-mean-return model, is one of the most basic. It makes the supposition that an investment's expected return is the same across time and it could vary amongst businesses. It is calculated by averaging the returns on the asset over a specific estimation window. However, Brown and Warner (1985) demonstrate that despite its simplicity, it achieves outcomes comparable to those of more complicated models, as the latter typically fail to appreciably reduce the variance of abnormal returns.

Another relatively straightforward approach is the market-adjusted return model. It makes the assumption that the expected returns are the same for all stocks, in contrast to the constant-mean-return approach previously described. However, they are not always the same for each stock across time. This technique effectively compares a stock's predicted return to the one of a market portfolio. Its key advantage is that it does not need an estimating window, and according to MacKinlay (1997), this makes it suited for event studies with little preceding information publicly available, like for an IPO.

The event study literature probably use the market model most frequently as it connects a stock's returns to the returns of a market portfolio. Indeed, given that it takes into account variations across organizations as well as market-wide trends, it can be viewed as an upgrade over the models previously described. The form of the model is:

$$E(R_{j,t}) = \alpha_j + \beta_j R_{m,t} + \varepsilon_{j,t} \text{ with } E(\varepsilon_{j,t}) = 0 \text{ and } Var(\varepsilon_{j,t}) = \sigma_{\varepsilon_t}^2$$

Where  $R_{j,t}$  is defined as previously stated,  $R_{m,t}$  is the return of the market portfolio for the period  $t$  and  $\alpha_j$ ,  $\beta_j$ ,  $\sigma_{\varepsilon_t}^2$  are the parameters of the market model.

Some more intricate statistical and economic models exist, including the factor model, CAPM, and APT. However, MacKinlay (1997) asserts that there are just a few benefits to adopt them. This is mostly due to the fact that the additional components' explanatory power is low and frequently insufficient to balance the rise in complexity.

We carefully considered our options before deciding to use the market model because it strikes the ideal balance among explanatory power, flexibility and execution efficiency.

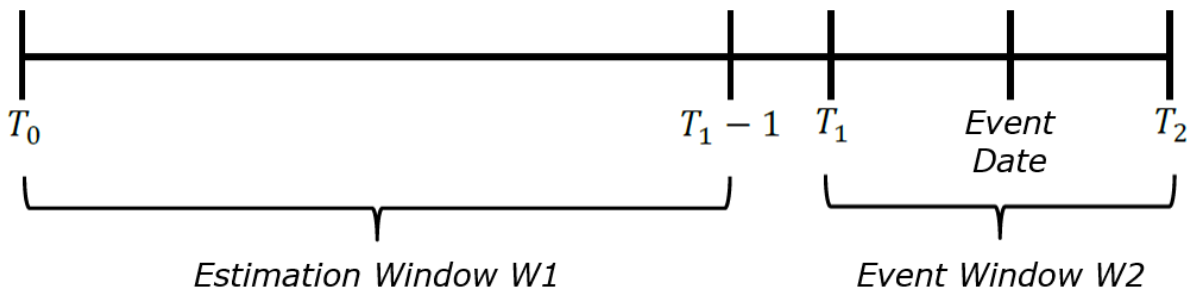
We first estimate the model's parameters before we can determine the normal returns for each security under examination, by using an ordinary least squares (OLS) regression in an estimation window with the predetermined length  $W1=T_1-1-T_0$ , where  $T_0$  is the estimation period's initial day and  $T_1-1$  is its last day.

In their analyses, the great majority of scholars in this discipline have chosen to use daily data, and that is what we have also done. It should be highlighted that using such frequent measurements may result in a number of problems. Scholes and Williams (1977) point out that daily data may be troublesome since non-synchronous trading can result in inaccurate estimations. They suggest modifying the estimation procedure to take this phenomenon into consideration. But according to Brown and Warner (1985), using methods other than OLS does not clearly benefit situations of this nature.

The next step is to select the best estimating window. Unfortunately, there is no agreement on the ideal length. MacKinlay (1997), on the contrary, advises to avoid any overlap with the event window, as displayed in Figure 7 below. The estimators for the model's parameters can be free from any bias by the event of interest thanks to this architecture. The estimation

window should also be narrow enough to possibly represent recent changes in parameters while still being long enough to minimise estimation mistakes.

Figure 7: Estimation and Event Windows – Source: author’s re-elaboration of MacKinlay (1997)



According to Peterson (1989), while reviewing the approaches used in event studies, daily studies often use estimation windows that range from 100 to 300 days. Due to this, we have selected a time frame with length  $W1=150$  trading days. It begins before the first day of our study's longest short-term event window, hence it is  $[-171, -21]$ . The Datastream World Healthcare Index serves as a substitute great proxy for market returns. Given that all of the companies examined are part of this industry, including an industry index should increase the market model's capacity for explanation.

The abnormal return of stock  $j$  for the time  $t$  is as follows once applying the market model:

$$AR_{j,t} = R_{j,t} - \hat{R}_{j,t} = R_{j,t} - \hat{\alpha}_j - \hat{\beta}_j R_{m,t}$$

Where  $AR_{j,t}, R_{j,t}, \hat{R}_{j,t}, R_{m,t}$  are defined as previously stated, while  $\hat{\alpha}_j, \hat{\beta}_j$  are the OLS estimates for the parameters of the market model from the estimation period previously described.

With this method, we determine two separate sets of abnormal returns for the targets and the bidders for each day of the event windows selected.

Additionally, we compute abnormal returns for the merged entity using these findings. We consider both parties' abnormal returns in the context of their respective enterprise values, which can be expressed as follows:

$$AR_{i,t}^{Co} = \frac{AR_{j,t}^{Ta} EV_{j,\tau}^{Ta} + AR_{j,t}^{Aq} EV_{j,\tau}^{Aq}}{EV_{j,\tau}^{Ta} + EV_{j,\tau}^{Aq}}$$

where  $AR_{i,w}^{Co}$  is the abnormal return for the target and acquirer combined that were involved in deal  $i$  for the period  $t$ ,  $AR_{i,w}^{Ta}$  is the abnormal return of the stock of the  $j$ -th target for the period  $t$ ,  $AR_{i,w}^{Aq}$  is the abnormal return of the stock of the  $j$ -th acquirer for the period  $t$ ,  $EV_{j,t}^{Ta}$  is the enterprise value of the  $j$ -th target, measured at the end of the estimation period i.e. at  $\tau=-21$ ,  $EV_{j,t}^{Aq}$  is the enterprise value of the  $j$ -th acquirer, measured at the end of the estimation period, namely at  $\tau=-21$ .

According to MacKinlay (1997), it is necessary to aggregate the individual abnormal returns over time in order to make conclusions about the event of interest. Each individual stock should be aggregated across time to fully reflect the impact of the news in the analysed event window. When using an event window that spans several days, the idea of Cumulative Abnormal Return (CAR) is required. The total of the abnormal returns in the event window is what is known as the CAR:

$$CAR_j(T_1, T_2) = \sum_{t=T_1}^{T_2} AR_{j,t}$$

where  $CAR_j(T_1, T_2)$  is the Cumulative Abnormal Return of stock  $j$  in an event window that ranges from  $T_1$  to  $T_2$ .

This computation is conducted for each stock of targets, acquirers and for combined entities. Furthermore, such calculation is repeated in all the selected event windows.

The cumulative abnormal returns should be averaged over the event observations to make conclusions about the whole sample. Assuming that each stock has the same weight, it can be defined as follows:

$$CAAR(T_1, T_2) = \frac{1}{N} \sum_{j=1}^N CAR_j(T_1, T_2)$$

where  $CAAR(T_1, T_2)$  is the Cumulative Average Abnormal Return for the whole sample in an event window starting in  $T_1$  and ends in  $T_2$ , and  $N$  denotes the number of observations in the sample.

We perform this last aggregation over the whole sample of shares targets, acquirers and combined entities for all the selected event windows.

After completing all the analyses previously outlined, it is important to check the statistical significance of the results. The alternative hypothesis contends that abnormal returns exist during the selected event window, while the null hypothesis rejects their existence. Individual abnormal returns, cumulative abnormal returns, and cumulative average abnormal returns could all be used to evaluate these assumptions. However, the  $CAAR(T_1, T_2)$  will be the primary focus of our investigation because it will give us details about the entire sample over the entire event window.

As a result, we can define the following as the null and alternative hypotheses for this metric:

$$H_0: CAAR(T_1, T_2) = 0$$

$$H_1: CAAR(T_1, T_2) \neq 0$$

Hypothesis testing has been completed conducting t-Statistic test, following the methodology adopted by Adnan and Hossain (2016) and Ma, Pagán and Chuc (2009).

### 3.2 Regression Analysis

In the event that the preceding study's null hypothesis is rejected and there is evidence that M&A deals in the Healthcare industry, on average, change shareholders' wealth, we move on to investigate the potential causes of these abnormal returns. We use a multivariate OLS regression analysis to do so, which will be carried out on both the target and acquirer sides as well as a combination of both.

We select the CAR for shares on the acquiring and target sides as our dependent variable. In addition, we use the Cumulative Abnormal Return estimated for the fictitious combined entity. For every event window and every dependent variable mentioned above, we run a regression analysis.

The rationale behind the selection of each explanatory variable is explained in this paragraph, while a more thorough description could be read in Table 10 below.

Table 10: Regression variables – Source: author’s elaboration

<b>Variable</b>	<b>Description</b>	<b>Source</b>
<b>Dependent Variables</b>		
CAR_AQ	Cumulative Abnormal Return to the acquiring company	SDC Platinum by Refinitiv and author analysis
CAR_TA	Cumulative Abnormal Return to the target company	SDC Platinum by Refinitiv and author analysis
CAR_CO	Cumulative Abnormal Return to acquiring and target company combined	SDC Platinum by Refinitiv and author analysis
<b>Independent Variables</b>		
DEALVAL_AQEV	Ratio between the value of the deal over the acquiring company Enterprise Value 21 trading days before announcement date	SDC Platinum by Refinitiv and author analysis
MKTCAPLOG	Natural logarithm of the Market Capitalization (in USD million) of acquiring company 21 trading days prior to announcement date	SDC Platinum by Refinitiv and author analysis
TARD_TAEV	Ratio between the target company R&D expense in the latest financial year over the target company Enterprise Value 21 days before announcement date	SDC Platinum by Refinitiv and author analysis
CROSS_BORDER	Dummy variable. It is 1 if bidder and target are headquartered in two different countries, 0 if the deal is domestic	SDC Platinum by Refinitiv
BIOPHARMA	Dummy variable. It is 1 if the transaction is classified as Pharmaceutical & Biotechnology, 0 if it belongs to the other verticals of the Healthcare sector	SDC Platinum by Refinitiv
CASH	Dummy variable. It is 1 if the transaction has been fully paid in cash, 0 otherwise	SDC Platinum by Refinitiv

### *Deal size*

One of the most frequent and significant aspects of any deal is its size and how it relates to the market value of the acquiring firm. Naturally, these variables have also grown to be among the ones that are studied and employed in event studies the most frequently. Strong evidence has been accumulated to support their major impact on atypical returns as a result of this. Therefore, we chose to include the variables DEALVAL\_AQEV and MKTCAPLOG in our study.

### *Research & Development Intensity*

A characteristic that distinguishes the Healthcare industry from other sectors is definitely the high focus on Research & Development activities that the vast majority of players prioritize to fill their product and patent pipeline and generate new cash flow streams. Thus, Research and Development (R&D) has been a major factor behind M&A activity in this sector, as firms with limited research capacities often utilise this strategic option to fill the gap (Deeds and Hill, 1996; James, 2002; and Higgins and Rodriguez, 2006). It is interesting to note that the impact of such metric on value creation after M&A activity is not massively covered in academic literature, probably because of its sector-specific nature. In this thesis, we have decided to represent it in the variable TARD\_TAEV.

### *Geography*

According to previous research, whether a transaction is carried out between firms based in the same country or in another should have a significant impact on the abnormal returns generated during the event window. Hence, we include the variable CROSS\_BORDER to account for the impacts of international transactions.

### *Sub-sector*

We also want to find out how our dependent variable is impacted by a transaction's classification in one of the aforementioned subsectors. We have used the idea of dummy variables to make it easier to analyse such a categorical variable in a regression framework. We have decided to use the variable BIOPHARMA to represent all the deals classified as either Pharmaceutical or Biotech, as these subsectors are the most active in M&A, the ones with the largest existent literature coverage and they show unique characteristics as covered in Appendix 1.

### *Deal consideration*

In previous studies, the effect of payment methods in M&A deals has been thoroughly examined. Many researchers agree that it has a big impact on abnormal returns. Therefore, we choose to incorporate it into our study as a dummy variable labelled CASH, which stands for payments fully made in cash.

Using the variables just mentioned, we create a regression model with the following definition:

$$CAR_j = \alpha + \beta_1 DEALVAL\_AQEV_j + \beta_2 MKTCAPLOG_j + \beta_3 TARD\_TAEV_j \\ + \beta_4 CROSS\_BORDER_j + \beta_5 BIOPHARMA_j + \beta_6 CASH_j + \varepsilon_j$$

where  $\alpha$  is the intercept,  $\beta_1, \dots, \beta_6$  are coefficients for the respective independent variables, and  $\varepsilon_j$  is the random error term.

The regression model's parameters (i.e.,  $\alpha$  and  $\beta_1, \dots, \beta_6$ ) will be estimated using the OLS approach. Several assumptions must hold in order to get unbiased and accurate estimators.

First of all, the linearity assumption is deemed crucial by Wooldridge (2002). It demands the parameters of the regression model to be linear. We can determine whether the functional form that has been chosen is correct using the Ramsey RESET test that Ramsey (1969) suggested. If the null hypothesis is rejected, it is clear that the model suffers from misspecification.

According to Wooldridge (2002), it is essential that the error term has a mean of zero and is uncorrelated with each of the explanatory variables. When an intercept term is present, the first part holds automatically, while the second one needs extra consideration. The latter's violation is frequently referred to as endogeneity. Typically, it is due to Simultaneity or Omitted Variables. Given the nature of our variables and data, simultaneity shouldn't present

any issues. Anyway, it is more challenging to exclude omitted variables. In order to reduce the likelihood of violating this assumption, we have carefully extracted the most thorough set of variables from a wide range of studies in the field of event studies. Nevertheless, despite our best efforts, omitted variable bias cannot ever be completely eliminated.

According to Wooldridge (2002), another presumption that needs to be satisfied is the absence of perfect multicollinearity. This implies that none of the explanatory variables should be a constant and that there should not be any precise linear relationships between them. An OLS estimation won't be achievable if this assumption is not fulfilled. This often becomes less of an issue as the sample size increases, so in our case it ought not be an issue. However, our estimation may still encounter problems due to the imperfect multicollinearity. Although it doesn't exactly go against the assumption described above, it can nevertheless cause issues. Thus, we compute Variance Inflation Factors (VIFs) for each of our variables to test for it.

Homoscedasticity, according to Wooldridge (2002), is a further critical assumption that needs to be verified. This indicates that, subject to the independent variables, the variance of the residuals is equal. We compute heteroscedasticity-robust standard errors as described by White (1980) to take into consideration the potential non-fulfillment of this assumption. Wooldridge (2002) further asserts that we typically presumptively use random sampling, meaning that a sample has to be selected randomly from the population.

Finally, it is typically assumed that the residuals are normally distributed. It is necessary to define certain additional finite-sample properties even though it is not necessary for the correctness of the OLS estimation. The Central Limit Theorem asserts that the residuals should converge to normality if the random sampling assumption is true.