ID Cover Page

Summary of WP Student Team

The impact of R&D intensity on company valuation in form of EBITDA multiples in the healthcare industry and certain sub-sectors in North America

Group constitution:

Student Name	Program	Individual Title
Christopher Otto Küffner	Management	The impact of R&D intensity on company valuation in form of EBITDA multiples in the healthcare industry in North America - a focus on the healthcare equipment and supply sub-sector
Leonard August Aloys Theissen	Management	The impact of R&D intensity on company valuation in form of EBITDA multiples in the healthcare industry in North America - a focus on the healthcare pharmaceuticals, biotechnology and life science sub-sector

Work project carried out under the supervision of:

Advisor: Antonio Nogueira Leite

Note: this template is a support document for the jury members before the defense, only.

A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

THE IMPACT OF R&D INTENSITY ON COMPANY VALUATION IN FORM OF EBITDA MULTIPLES IN THE HEALTHCARE INDUSTRY AND CERTAIN SUB-SECTORS IN NORTH AMERICA

CHRISTOPHER OTTO KÜFFNER
LEONARD AUGUST ALOYS THEISSEN

Work project carried out under the supervision of:

Professor Antonio Nogueira Leite

17/05/2023

This study investigates the relationship between R&D intensity and company valuations in the North American healthcare industry, using EBITDA multiples as a valuation metric. Through a multiple regression analysis, the research reveals a significant positive correlation between R&D intensity and company valuations, particularly in the sub-sector healthcare pharmaceuticals, biotechnology, and life sciences, which has been investigated next to the healthcare equipment and supplies sub-industry. The findings emphasize the role of R&D in company valuations, contributing valuable insights to M&A decision-making processes within the healthcare sector.

Keywords: R&D intensity, EBITDA multiples, Healthcare Industry, North America

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

1 INTRODUCTION 3

2 BACKGROUND 4

2.1 M&A IN HEALTHCARE 4
2.1.1 Valuation in M&A 5
2.1.2 Measuring Valuation in M&A 6
2.2 R&D IN HEALTHCARE 6
2.2.1 The Research and Development Process within the Healthcare Industry 7
2.2.2 Economical and Societally Benefits of R&D in Healthcare 8

3 LITERATURE REVIEW 8

3.1 R&D INTENSITY AND COMPANY VALUATION 8
3.2 INDUSTRY FOCUS: HEALTHCARE INDUSTRY 9
3.3 SUB-SECTORS WITHIN THE HEALTHCARE INDUSTRY 10
3.4 HYPOTHESIS DEVELOPMENT 12

4 RESEARCH METHODOLOGY 13

4.1 RESEARCH DESIGN AND APPROACH 13
4.2 DATA COLLECTION AND SAMPLING 14
4.3 VARIABLE DEFINITION AND MEASUREMENT 18
4.3.1 Categorization Specific Variables 18
4.3.2 Regression Specific Variables 19
4.4 DATA ANALYSIS TECHNIQUES 20

5 ANALYSIS 20

5.1 IMPACT OF R&D INTENSITY ON EBITDA MULTIPLES (TOTAL) 21
5.1.1 Regression Output Analysis 21
5.1.2 Findings and Summary 25
5.2 THE IMPACT OF R&D INTENSITY ON EBITDA MULTIPLES (HCPBLS) 26
5.2.1 Description Sub-Sector 26
5.2.2 R&D within Sub-Sectors 28
5.2.3 Regression Output Analysis 30
5.2.4 Discussion of Results 34
5.2.5 Sub-Sector Comparison to Total 35
5.3 THE IMPACT OF R&D INTENSITY ON EBITDA MULTIPLES (HCES) 37
5.3.1 Description Sub-Sector 37
5.3.2 R&D within Sub-Sectors 39
5.3.3 Regression Output Analysis 41
5.3.4 Discussion of Results 45
5.3.5 Sub-Sector Comparison to Total 47

6 CONCLUSION 48

6.1 SUMMARY 48
6.2 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE RESEARCH 49

BIBLIOGRAPHY 51

LIST OF ABBREVIATION 58

APPENDIX 59

1 Introduction

The assessment of company valuations is a crucial component within mergers and acquisitions (M&A). Comprehending the determinants that impact these evaluations is of significant concern to investors, for both strategic- and financial buyers. The level of research and development (R&D) intensity within companies has emerged as a significant factor that has garnered notable attention. R&D capabilities are frequently regarded as catalysts for fostering innovation, expansion, and competitiveness (Brown, Martinsson and Petersen 2017). Such key performance indicators (KPIs) conceivably exert an influence on a firm's financial performance and valuation metrics.

The present research seeks to analyze how R&D intensity impacts EBITDA multiples, which stands for earnings before interest, taxes, depreciation, and amortization. EBITDA multiples constitute a frequently employed instrument in the field of corporate finance for the purpose of evaluating the value of a businesses. The metric is utilized to determine the worth of a company in correlation to its profitability. These hold significant importance in academic research as they allow for comparisons between numerous businesses and their valuations in relation to EBITDA. The current study seeks to examine the association between the degree of R&D intensity and EBITDA multiples to determine if there is a tendency to pay greater M&A transaction sums for firms that are actively engaged in R&D.

The research question addressed in this study is:

> *"What is the impact of R&D intensity on company valuations within the healthcare industry and certain sub-sectors in North America?"*

The aim of this academic study is to acquire an enhanced comprehension regarding the impact of R&D intensity on the evaluations of companies operating in the healthcare sector and its

diverse sub-industries. By conducting a thorough analysis of the healthcare industry, which encompasses various sub-sectors like healthcare pharmaceuticals, biotechnology, life sciences, equipment, and supplies, one can gain a comprehensive and all-encompassing understanding of the relationship between R&D intensity and company valuations within the market.

2 Background

This chapter informs about the topic of company valuation in M&A and the role of R&D within the healthcare sector. It will cover the aspects of healthcare M&A, valuation approaches, and delve into the significance and impact of R&D. These discussions form the basis for understanding the link between R&D intensity and company valuations.

2.1 M&A in Healthcare

The healthcare sector has witnessed substantial growth in recent years, attributable to various factors such as the COVID-19 pandemic, an aging demographic, technological advancements, and heightened demand for medical services. Consequently, M&A has emerged as a crucial strategic instrument for organizations within this industry, enabling the expansion of market presence, enrichment of product portfolios, and attainment of competitive advantages (Rudden 2021). In an increasingly globalized economy, healthcare organizations are confronted with escalating competition and a constant need to innovate (Shenkar, Liang und Shenkar 2021). M&A transactions serve as a means to respond to these pressures, fostering collaboration and the sharing of resources and expertise. Moreover, the pursuit of economies of scale promotes healthcare M&A activity, which may result in cost reductions, improved operational efficiency, and enhanced financial performance. Additionally, the aspiration of operational and financial synergies is a significant driver of M&A transactions in the healthcare industry. The valuation of healthcare companies involved in M&A transactions requires consideration of a variety of factors, challenges, and drivers unique to this industry (McBeath und Bacha 2001).

Next to M&A which describe the inorganic growth of a company, there furthermore exist

organic growth strategies. There is a clear difference between the two types of growth. Organic growth is the expansion of a company's capacity through its own efforts. Furthermore, it is typically characterized by an increase in production efficiency and speed, higher revenues, and improved cash flow. It is critical to the viability of a business.

For this paper, M&A activities that occurred between 2011 and 2021 serve as underlying research material. Especially the valuation of the target companies of the before mentioned transactions are given substantial importance to. Therefore, this section will further comprise valuation in M&A as well as the required basic financial knowledge which serves as a prerequisite for this thesis.

2.1.1 Valuation in M&A

M&A valuations involve estimating the value of a target company in a M&A transaction. The valuation of target companies in such transactions is contingent upon a multitude of factors, encompassing financial, strategic, operational, and external dimensions (Das and Kapil 2012).

Financial factors play a critical role in determining M&A valuations. Key considerations include historical and projected revenue, profitability, growth rates, EBITDA, cash flow, and balance sheet robustness. Moreover, potential synergies stemming from the amalgamation of acquirer and target company operations can exert influence on valuation.

From a strategic standpoint, elements such as market share, competitive advantages, industry positioning, ownership of intellectual property, and brand reputation are integral to the valuation process. These factors help determine the strategic fit and potential value creation for the acquirer in the long term (Weirens and May 2017).

Operationally, the quality, experience, and capabilities of the target company's management team play a significant role in valuation. In addition, operational efficiency, cost structure, and supply chain considerations can impact the valuation, as they are indicative of the target company's ability to integrate smoothly with the acquirer and generate future value.

External factors, such as prevailing market conditions, the regulatory landscape, and industry dynamics, can also affect the valuation of target companies. These factors are subject to change and may necessitate adjustments to valuations in response to shifts in the broader environment (McKinsey 2010). Given the extensive body of existing research concerning the before mentioned subjects, the authors of this paper decided to put the focus of their research on examining the impact of R&D intensity on company valuations.

2.1.2 Measuring Valuation in M&A

In the world of M&A, accurately measuring the valuation of companies is crucial for both buyers and sellers. There is a variety of valuation methods that are employed to estimate the value of target companies accurately. Common valuation techniques include the market approach, the income approach, the asset-based approach and option valuation models (Degenhardt and Monyroth 2022). Within the context of this thesis, a form of the market approach serves as the method for comparing the valuations of the target companies. The market approach determines a company's value by analyzing transactions involving businesses in the same industry that are comparable in size and operations. A key metric for the market approach is the EBITDA. It is used to calculate the EBITDA multiple in order to compare the underlying valuations of the transactions of the target companies. To calculate the EBITDA multiple, the following formula is applied where EV stands for enterprise value (Chinook 2019):

$$\boldsymbol{EBITDA\ multiple} = \frac{\boldsymbol{EV}}{\boldsymbol{EBITDA}}$$

2.2 R&D in Healthcare

The healthcare industry is constantly evolving, and R&D plays a critical role in keeping pace with the latest advances in medical science. It is highly important as it is a key innovation- and progress driver, enabling advancements and new methods to diagnose, treat or even prevent

conditions and diseases (Gadowska and Różycka 2016). In addition to enhancing patient outcomes, R&D is crucial for the healthcare sector's economic expansion. For businesses within the industry, the discovery of new pharmaceuticals, therapies as well as medical soft- and hardware may result in large financial gains and the creation of employment and economic growth (Burns 2012). From a company's perspective it is a possibility to gain a competitive advantage over its competitors (Lant and Eisner 1998). Therefore, R&D within the healthcare industry is a highly difficult and an expensive process that requires a substantial investment of time and resources.

2.2.1 The Research and Development Process within the Healthcare Industry

Generally speaking, the R&D process within the healthcare sector consists of multiple phases, beginning with fundamental research and progressing, preclinical- and clinical trials, regulatory approval, and market introduction (Spindler 2018). The R&D process demands substantial expertise, facilities, and financial resources. These requirements are topped by a significant challenge due to time constraints, as the introduction of a new drug or medical device to the market may take several years or even decades. The preclinical stage may span several years, while clinical trials may require even more time. The tremendous financial resources required are a barrier, especially for less developed firms and will reduce the number of companies investing in R&D. Regulatory hurdles pose an extra challenge during the R&D process. Meeting the rigorous drug development and approval standards set by the FDA (U.S. Food and Drug Administration) can pose a significant challenge for companies (Van Norman 2016). The regulatory procedure may be prolonged and uncertain, resulting in increased duration and cost in the pharmaceuticals or equipment's development process. Furthermore, regulatory bodies may necessitate supplementary investigations or information prior to granting approval for a product, thereby impeding its market entry.

2.2.2 Economical and Societally Benefits of R&D in Healthcare

R&D in the healthcare industry carries significant economic implications, as healthcare companies allocate a substantial portion of their revenues, averaging 12.4%, to R&D endeavors (Mikulic 2022). Despite the high costs and risks associated with R&D, it plays a pivotal role in fostering sustained growth, profitability, and market competitiveness for firms operating in the healthcare sector (Skrepnek and Sarnowski 2007). It not only enables the development of novel pharmaceuticals and treatments but also reduces dependence on a single product, attracting investor interest and generating employment opportunities (Ulku 2006). Next to improving patient outcomes, R&D investments support addressing unmet medical needs, and potentially reducing long-term healthcare costs by delivering more effective treatments (de la Maisonneuve and Martins 2015). Given these considerations, both corporations and governing bodies must continue to prioritize R&D to ensure the creation of innovative therapies, pharmaceuticals, and medical equipment that cater to global patient needs.

3 Literature Review

This chapter serves as a foundation for the study, helping to establish the theoretical framework and contextual background for the research. Through a systematic examination of previous studies, theories, and empirical evidence, it facilitates a deeper understanding of the research problem. A comprehensive review of existing research pertaining to the relationship between R&D intensity and company valuation, with a specific focus on the healthcare industry and relevant sub-industries, will be performed. Furthermore, this chapter establishes the research hypotheses that will guide the empirical investigation conducted in this study.

3.1 R&D Intensity and Company Valuation

Mergers and acquisitions serve as catalysts for corporate growth and value (Gaughan 2013), with target firm valuation playing a crucial role in determining transaction volume and structure. R&D capabilities contribute to company valuations by generating valuable

intellectual property and creating a pipeline of innovative products and technologies (Dosso and Vezzani 2019). Previous studies have generally found a positive correlation between R&D intensity and firm valuations, demonstrating the impact of R&D investments on anticipated profitability and growth (Johnson & Pazderka, 1993; Ehie & Olibe, 2010; Kim et al., 2018). However, the relationship between R&D intensity and firm value may vary based on factors such as industry maturity, company size, and developmental stage, suggesting the importance of contextual factors (Pindado, De Queiroz and De La Torre 2010).

3.2 Industry Focus: Healthcare Industry

The healthcare sector, with a 17% global R&D contribution in 2021, holds significant weight in R&D activities, with major investments in pharmaceuticals, biotechnology, medical equipment and supplies, and diagnostics (Statista Reserach Department 2023). The correlation between R&D intensity and corporate valuations in this sector is complex due to the intertwined nature of innovation and substantial R&D investments.

R&D investments potentially elevate company valuations by enhancing revenue growth and profitability, as firms that dedicate significant resources to R&D are more likely to develop innovative products and services that meet current and future demands (O. Huang 2023). Nonetheless, R&D investments also increase costs, and short-term profit gains can be achieved by reducing these expenses. Unsuccessful R&D initiatives could lead to substantial losses, and investors may question companies with high R&D spending without clear plans or evidence of success.

Huang (2020) found an inverse relationship between R&D expenditure and short-term financial performance, but a positive association with long-term performance, in a study involving 107 publicly traded healthcare companies in China (Z. Huang 2020).

Several studies have identified a positive correlation between R&D intensity and firm valuations. Rahman and Howlader (2022) found a significant, positive correlation between firm

performance and value and R&D expenditure, and this finding was robust and unaffected by multicollinearity issues (Rahman and Howlader 2022).

Previous research indicates that R&D investments strongly correlate with innovation performance, particularly in new product and service development (Artz, et al. 2010). Roberts (1998) showed that higher profitability is linked to superior R&D engagement in the US pharmaceutical industry (Roberts 1999). DeCarolis and Deeds (1999) found higher initial public offering (IPO) valuations for biotech firms due to their R&D investments, implying a positive relationship between R&D intensity and company valuation.

However, R&D intensity's impact on valuations may differ depending on the healthcare sub-sector, the company's development phase or size, and investor preferences. Early-stage companies may command higher valuations due to their growth potential, despite their lack of significant revenue. Ultimately, the influence of R&D intensity on valuations depends on the specific circumstances of the target firm, the corresponding healthcare sub-sector, and the preferences of the investor.

3.3 Sub-Sectors within the Healthcare Industry

The healthcare industry comprises several sub-sectors, each possessing unique features and dynamics, which is a crucial point to consider. The impact of R&D intensity on firm valuations can vary considerably depending on the particular sub-sector.

The pharmaceutical sector is recognized for its significant R&D focus, with extensive development timelines and high levels of unpredictability and uncertainty. Consequently, companies operating within this particular industry may be evaluated differently in terms of R&D intensity and company valuation, in comparison to those firms operating within other branches of the healthcare sector. Jaisinghani (2016) carried out a research study with the objective to evaluate the dynamic correlation between R&D intensity and company profitability in the pharmaceutical sector of India. He revealed a positive correlation between the level of

R&D intensity and the performance outcomes within the pharmaceutical sector in India. The findings suggest a potential correlation between the level of R&D investment and the degree of profitability.

In comparison, the medical equipment & supplies sector has shorter development timelines and lower levels of uncertainty. Hence, the effect of R&D intensity on valuations of companies in this particular sub-industry varies. Lehenchuk, et al. (2022) analyzed the relationship between the R&D intensity and profitability of the Slovak medical device companies. A sample of 26 companies operating in the Slovak medical device industry for the period of 2015 to 2019 was considered in their research study. The modeling results show that there is a curvilinear (inverted-U) relationship between R&D and profitability. The findings indicate that an increased allocation of resources towards R&D activities can enhance profitability, albeit solely within the optimal range of R&D efforts (Lehenchuk, et al. 2022). This means that R&D investments increase profitability, but only up to a certain level. As the R&D intensity on average is lower in the healthcare supplies and equipment industry compared to for example the pharmaceuticals industry, might explain why the correlation between R&D intensity and firm value appears to be lower in this sub-sector (Sather 2021). It is evident that the impact of R&D intensity on company valuations can vary depending on the healthcare industry sub-sector. It is imperative to consider the distinct attributes of each sub-sector when examining the correlation between R&D intensity and firm valuations (Sather 2021). The correlation between R&D intensity and M&A transaction volumes is intricate and contingent upon various factors, including but not limited to the industry, target company's size and development stage, and the temporal aspect of the M&A transaction. Hence, it is recommended that healthcare enterprises persist in their R&D activities to strengthen their expansion opportunities and increase their attractiveness to prospective investors. However, businesses should also consider the timing and development stage of their R&D projects to ensure that they create value for shareholders

and elevate their attractiveness for potential acquirers.

3.4 Hypothesis Development

The objective of this study is to examine the correlation between the two variables R&D intensity and M&A valuations, in the healthcare sector in North America. The authors are eager to determine whether the correlation is statistically significant. Based on the existing literature, the following hypotheses are proposed:

> ***H1:*** *There is a significant positive correlation between R&D intensity and company valuation within the healthcare industry (total)*

The first hypothesis assumes a noteworthy correlation between the level of R&D investment and the valuation of companies operating within the healthcare sector. Several researchers have found supporting findings for a significant positive relationship between R&D intensity and company valuations in general. Our hypothesis posits a positive correlation between elevated levels of R&D intensity and increased company valuations in the healthcare sector.

> ***H2:*** *There is a significant, strong positive correlation between R&D intensity and company valuation within the sub-industry healthcare pharmaceuticals, biotechnology and life sciences (HCPBLS)*

The second hypothesis declares that the correlation between the level of investment in R&D and the market value of firms is more pronounced in the pharmaceutical sub-sector of the healthcare industry.

H3: *There is a significant, moderate positive correlation between R&D intensity and company valuation within the sub-industry healthcare equipment and supplies (HCES)*

The third hypothesis supposes a less significant correlation between R&D intensity and corporate valuations within the medical equipment and supplies sub-sector. The aforementioned hypothesis is substantiated by the diverse array of products within the medical equipment and supplies industry, with varying degrees of innovation. R&D investment may have a relatively lesser impact on the progress of medical equipment and supplies compared to the development of innovative pharmaceuticals. Hence, it is hypothesized that the correlation between the level of R&D investment and the valuations of firms is not as significant within the medical equipment and supplies sub-sector.

4 Research Methodology

In the following chapter, the previously developed theoretical foundations are substantiated by means of an empirical study. A multiple linear regression analysis is used for this purpose. The research design and approach, the data collection and cleaning process, the variable definition and measurement as well as the data analysis techniques are presented within this chapter.

4.1 Research Design and Approach

The research design employed in this study is a correlational design within the broader context of a quantitative approach. This design intends to investigate the relationship between R&D intensity and EBITDA multiples in the healthcare sector. Due to the availability of data and similarities in the healthcare systems and markets (emphasis on the private sector participation, a growing demand for healthcare services and similar proportions of gross domestic product (GDP) dedicated to healthcare) (Sociomed 2012), the North American market (specifically the United States and Canada) was selected as a geographical focus.

The rationale for selecting a correlational design lies in its ability to identify potential

relationships between variables without manipulating them directly. Furthermore, a quantitative approach allows for the rigorous examination of potential associations between variables, while controlling for the effects of dummy variables (company size and EBITDA margin). The correlational design addresses the research questions by employing a regression analysis to examine the relationships between the independent variable (R&D intensity), the dependent variable (EBITDA multiples), and the control variables (company size and EBITDA margin). This approach offers insights into the specific effects of R&D intensity on EBITDA multiples across various segments of the North American healthcare industry.

By analyzing the relationship between these variables, the study aims to understand how R&D investments may affect a company's market value. The inclusion of company size and EBITDA margin as dummy variables is justified by their potential influence on the dependent variable (EBITDA multiples). Company size can affect a firm's access to resources, economies of scale, and market power, which in turn may influence its valuation. EBITDA margin serves as a proxy for a company's operating profitability, which can also impact its valuation. Including these dummy variables helps account for their potential effects on the relationship between R&D intensity and EBITDA multiples, providing a more comprehensive analysis of the research question.

4.2 Data Collection and Sampling

The main goal of this study is to measure the impact of R&D intensity on the valuation of target companies involved in M&A that have been conducted over the past 10 years in the healthcare industry. This valuation has been measured in form of EBITDA multiples. The geographical focus for the population of interest for this study was the North American healthcare sector.

As secondary data collection was required for this study, the platform Capital IQ was utilized for the data gathering process. No modifications to existing instruments or development of new instruments were necessary, as the research is based on existing financial data. Raw financial

data from Capital IQ was transformed into the dependent, independent, and control variables according to their operational definitions. Capital IQ is a financial research and analysis platform provided by S&P Global Market Intelligence, mainly used by finance professionals working in the investment banking, private equity, and corporate finance sector. Due to its reputation, Capital IQ was selected as the primary data provider for this paper for delivering accurate and reliable financial data. The platform draws information from multiple sources, including company filings, press releases, and proprietary data. This exhaustive approach to data acquisition helps ensure the precision and reliability of the presented information. In addition, Capital IQ employs thorough quality control procedures, such as automated checks and manual reviews by a team of financial analysts, to help maintain data consistency and reduce errors or discrepancies. The platform offers a vast amount of information, requiring a thorough understanding of the platform's features and functionalities to effectively navigate and retrieve the desired data. Therefore, the data gathering and cleaning process was time-consuming and labor-intensive.

Once the relevant data was extracted, it was essential to ensure its accuracy and consistency. The data cleaning process involved identifying and addressing any missing, inconsistent, or incorrect values. This process was particularly challenging due to the large volume of data and the need for precise attention to detail. Information about the following variables was necessary in order to conduct an impactful regression:

4.3.1 Categorization Specific Variables	4.3.2 Regression Specific Variables

▪ Announced Date of Transaction
▪ Target Name
▪ Geographic Location
▪ Industry Classifications
  o HC Equipment and Supplies
  o HC Technology
  o HC Pharmaceuticals, Biotechnology and Life Sciences
	▪ EBITDA Multiples
	  o Total Transaction Value of Merger
	  o EBITDA at Announcement
	▪ R&D Intensity
	  o R&D Expenses at Announcement
	  o Target Total Revenue at Announcement

Table 1: Relevant Variables

The sample size for this study was determined based on the availability of data within the selected industries and time frame. In regard to industry classifications, the sample originally provided information about the following industries: healthcare facilities, distributors and services; managed healthcare; healthcare equipment and supplies (HCES); healthcare technology (HCT); and healthcare pharmaceuticals, biotechnology, and life sciences (HCPBLS). For this paper the focus is put on only three of the before mentioned industries, HCT, HCES, and HCPBLS. In the context of this research paper, when the term "total healthcare industry" is utilized, it encompasses solely the HCT, HCPBLS, and HCES sectors. This is justified by the fact that these sectors represent important segments of the healthcare industry that have a particular impact on innovation and technological progress. In addition, these sub-industries share common characteristics, such as high R&D investment, rapidly developing technologies, and a strong emphasis on product development and innovation (Platonova 2023). Furthermore, the HCES and HCPBLS sub-industries are examined in more detail in the course of the research paper. The HCT industry will not be discussed in detail, as there is not enough information provided in the dataset. Nevertheless, it is included in the total healthcare sample.

As mentioned before, a more in-depth analysis was conducted for the HCES, and HCPBLS sub-sectors. This additional focus allowed for a better understanding of the relationship between R&D intensity and EBITDA multiples within these specific industry segments, while controlling for company size and EBITDA margin as dummy variables. By analyzing the sub-industries, the study aimed to identify any differences in the relationship between the variables of interest in the different segments of the healthcare industry.

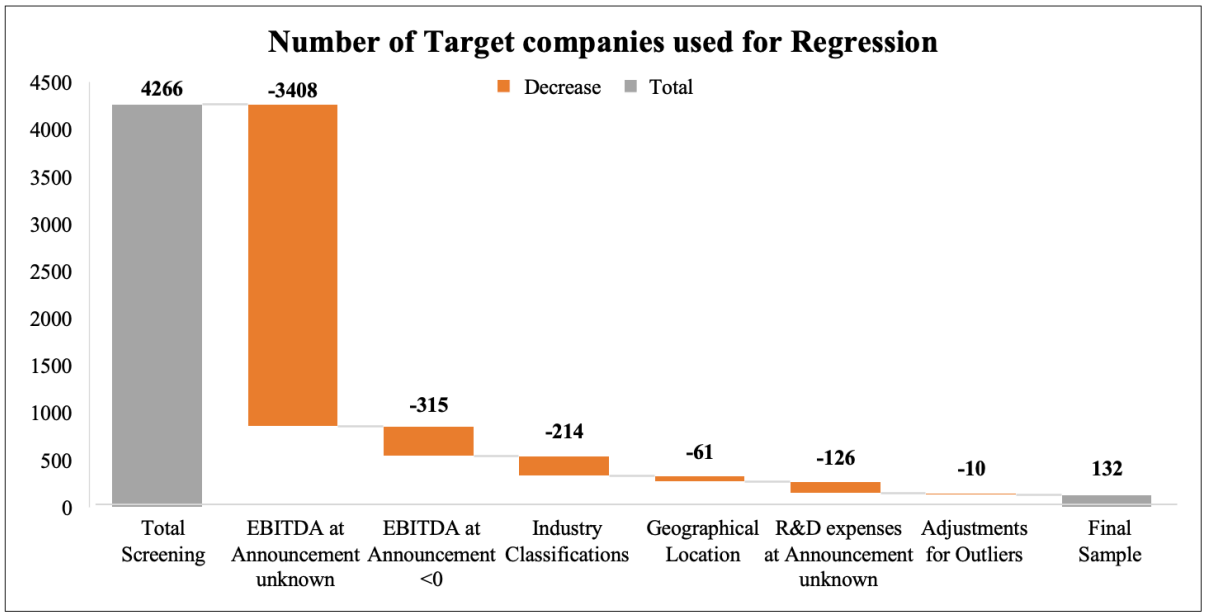


Figure 1: Dataset Sample Waterfall

The composition of the dataset is apparent from the waterfall diagram presented in the figure above (Figure 1). The initial screening procured information on 4,266 M&A transactions that potentially aligned with the research objectives. Nevertheless, to ensure the suitability and relevance of the dataset, it was necessary to establish specific filters and ascertain the availability of essential information for each M&A transaction.

Given the significance of EBITDA information for this study, all M&A transactions lacking information on the target company's EBITDA at the time of announcement were excluded. Consequently, 3,408 M&A transactions were eliminated from the sample. Moreover, the sample was further refined to include only target companies with a positive EBITDA at announcement. Employing EBITDA multiples facilitates the comparison of companies possessing positive earnings. Incorporating companies with negative EBITDA could potentially skew the interpretation of the results, as their EBITDA multiples may not be directly comparable to companies with positive EBITDA. By excluding such companies, the analysis concentrates on a more homogeneous sample, thereby permitting more meaningful comparisons and interpretations of the outcomes.

As previously delineated and justified, this investigation emphasizes the HCT, HCES and HCPBLS sub-industries. Additionally, a geographical focus was implemented, resulting in the exclusion of further companies. Challenges such as unreported R&D expenses at announcement and adjustments for outliers led to the elimination of additional companies from the sample. Ultimately, the final sample comprised a substantial number of 132 companies.

4.3 Variable Definition and Measurement

As mentioned above in Table 1 under 4.2., information on variables for categorization, i.e. "categorization specific variables", and information on variables with which the regression analysis was completed, i.e. "regression specific variables", were sourced.

As Capital IQ proved to be the perfect platform for this process, the database was used for this entire variable sampling process. In the following sub-chapters, the variables used, and the measurement will be further defined and explained for a better understanding. All monetary variables in the study are measured in the same currency (USD) for consistency and comparability.

4.3.1 Categorization Specific Variables

The announced date of transaction variable represents the date on which the business transaction, was publicly announced. The inclusion of this variable allows to determine the timeframe of the mergers. Overall, the transaction's time span ranges from 2011 to 2021. The target name refers to the name of the company or entity that is the subject of the transaction. This variable aids in the identification of individual cases in the dataset. The geographic location variable captures the region where the target company operates. As explained before, this paper focuses on transactions in North America (USA and Canada). The industry classifications variable is used to categorize the target companies based on their primary focus of operation. This paper concentrates on two main industries, HCES and HCPBLS.

4.3.2 Regression Specific Variables

The regression specific variable EBITDA multiple is used as the dependent variable in this study. It represents the target company's valuation and is derived by dividing the total transaction value of the respective M&A transaction by the EBITDA of the target company upon announcement.

$$\boldsymbol{EBITDA\ Multiples = \frac{Total\ Transaction\ Value}{EBITDA\ at\ Announcement}}$$

The M&A transaction value takes various forms of compensation into consideration, i.e. cash, stock, and debt. The total transaction value poses as a proxy for enterprise value in this study. EBITDA at the time of the announcement refers to the target company's earnings before interest, taxes, depreciation and amortization in the fiscal year preceding the announcement of the transaction. The regression analysis aims to capture the impact of R&D intensity on the valuation of the target companies in M&A transactions. This is achieved by using EBITDA multiples as the dependent variable.

The independent variable in the regression analysis is R&D intensity. It is calculated by dividing the R&D expenditure of the respective target company at the time of announcement by the total revenue of the target company. R&D expenditure is an indicator of companies' investments in promoting innovation and technological progress (Brown, Martinsson and Petersen 2017). The total amount generated by the respective target company from its operations in the fiscal year immediately preceding the announcement of the transaction is specified by the target company's total revenue at the time of the announcement.

$$\boldsymbol{R\&D\ Intensity = \frac{R\&D\ Expenses}{Target\ Total\ Revenue\ at\ Announcement}}$$

In addition to the primary independent variable, two control variables, dummy variables, were introduced: Company size and EBITDA margin. In this study company size is measured by total revenue of the target companies at announcement to account for the possible impact of company size on the EBITDA multiples. It was divided into two sub-groups, small (revenue <

1.023,22 USDmm) and large (revenue > 1.023,22 USDmm.) EBITDA margin is calculated by EBITDA divided by total revenue of the target companies at announcement and reflects the operating profitability of a company. This dummy variable was measured in moderate (margin < 20,91%) or high (margin > 20,91%). The threshold values were determined by calculating the average of the respective values in our data set and categorized accordingly. Both control variables are measured using financial data from the Capital IQ database.

4.4 Data Analysis Techniques

In order to examine the relationship between R&D intensity and EBITDA multiples, the study employs a regression analysis. More specifically, a multiple linear regression is used to model the association between the dependent and independent variables while controlling for the effects of the dummy variables. Herewith, the correlation between R&D intensity and EBITDA multiples can be assessed in the best possible way referring to the related data. A multiple linear regression is a statistical approach used to study the relationship between one dependent variable and numerous independent variables, allowing for the simultaneous examination of many aspects on a certain outcome. This approach allowed the researchers to analyze the effect of R&D intensity on EBITDA multiples while controlling for other variables like company size and EBITDA margin, enabling a more accurate interpretation of how R&D intensity specifically contributes to company valuations within the healthcare industry.

The analysis is performed separately for the total healthcare sample, the HCPBLS and the HCES, to gain insights into the potential differences in the relationship between the variables across these segments. The regression results, including the coefficients, standard errors, and significance levels are then interpreted to draw conclusions about the research hypotheses and the overall effect of R&D intensity on EBITDA multiples in the healthcare industry.

5 Analysis

A multiple linear regression study is used to examine how R&D intensity affects healthcare

EBITDA multiples. This research approach is suitable for this study in particular for various reasons. It helps to establish the direction and strength between the independent and dependent variables which allows for a better understanding how they may be influenced by each other. Furthermore, the multiple linear regression analysis can adjust for confounding factors such as company size and EBITDA margin that may manipulate the overall outcome. This is necessary to guarantee that the observed association between R&D intensity and EBITDA multiples is not an artifact of other factors. Finally, multiple linear regression may estimate the relative relevance of each independent variable in explaining the variation in the dependent variable, allowing a more nuanced understanding of the variables that affect EBITDA multiples. The selection of dependent and independent variables in this study is based on the objectives of the investigation.

Three multiple regression analysis have been conducted independently. One for the total healthcare sample, one for the HCPBLS sub-industry, and one for the HCES sub-sector respectively. Reasoning for this is the aim of drawing conclusions and making comparisons between the total healthcare sector and the two beforementioned sub-industries.

5.1 Impact of R&D Intensity on EBITDA Multiples (Total)

This sub-section analyzes the relationship between R&D intensity and EBITDA multiples in the total healthcare industry. The focus is primarily on the results of the multiple regression analysis, as previous chapters have already covered the healthcare industry in general in greater detail.

5.1.1 Regression Output Analysis

In the following, the multiple regression analysis between the dependent variable EBITDA multiples and the independent variables R&D intensity, company size (categorized in small and large) as well as EBITDA margin (classified as moderate or high) is being analyzed for the total healthcare industry. The total sample comprises 132 observations. Within those 132

observations 61 observations are transactions related to the HCPBLS, 54 are corresponding to the HCES sub-sector and 17 associated to HCT.

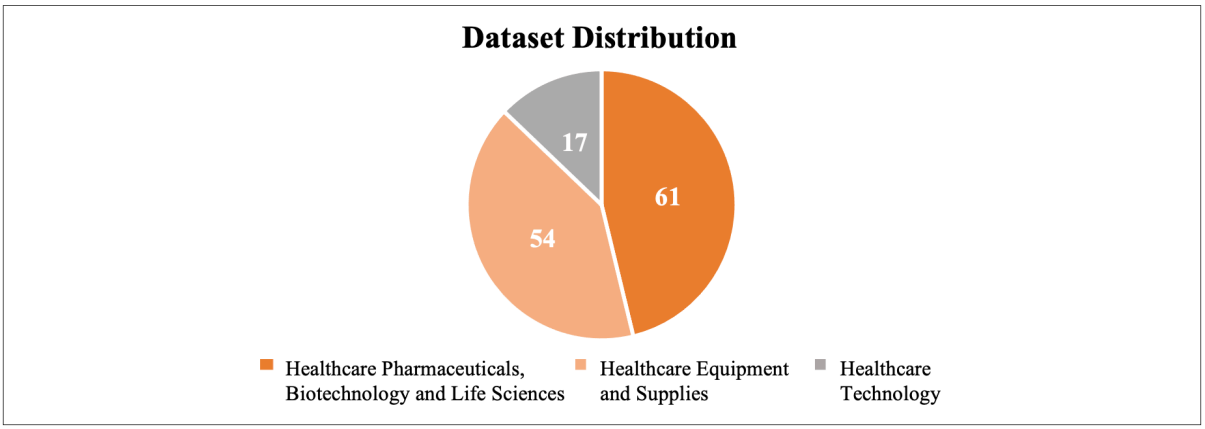


Figure 2: Total Healthcare Industry Dataset Distribution according to Sub-Sectors

This study aims to analyze how R&D intensity affects EBITDA multiples, taking into account factors like company size and EBITDA margin. For that, a multiple regression analysis was conducted. The analysis was carried out using EBITDA multiples as the dependent variable (Y) and R&D intensity, company size, and EBITDA margin as the independent variables (X).

Regression Statistics	
Multiple R	0,4855
R Square	0,2357
Adjusted R Square	0,2178
Standard Error	119,0629
Observations	132

Table 2: Regression Statistics (total healthcare industry)

The regression statistics provide an outlook over the model's performance. The R value (0.4855) indicates the correlation between actual and predicted dependent variable values. There is a moderate positive correlation between predicted and actual EBITDA multiples. This implies that the independent variables partially account for the variation in the dependent variable. The R square (0.2357) measures the proportion of dependent variable variation explained by independent variables. It indicates that around 23.57% of the EBITDA multiples

variation can be explained by the independent variables (R&D intensity, company size, and EBITDA margin). This indicates that the model has some explanatory power, but a significant portion of the variation in the dependent variable remains unexplained. The adjusted R square (0.2178) is a modified version of R square, adjusted for the number of predictors in the regression analysis. It considers the potential for more predictors to inflate the R square value. The adjusted R square value of 0.2178 suggests that when taking into account the number of predictors in the model, approximately 21.78% of the variation in EBITDA multiples can be attributed to the independent variables. The standard error (119.0629) measures the difference between predicted and actual values of the dependent variable. In this model, it shows that the estimated EBITDA multiples differ from the actual EBITDA multiples by around 119.06 units on average.

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	559579,3845	186526,4615	13,1579	0,00000015
Residual	128	1814523,8717	14175,9677		
Total	131	2374103,2562			

Table 3: ANOVA (total healthcare industry)

The ANOVA table indicates the regression model's significance. The F statistic (13.1579) tests if all regression coefficients are zero, indicating no significant effect of the independent variables. The F value (0.00000015) represents the probability of observing the F statistic if the null hypothesis is true. A low Significant F value rejects the null hypothesis, showing a significant effect of at least one independent variable on the dependent variable.

The multiple regression equation for this analysis can be depicted as the following:

$$\boldsymbol{EBITDA\ multiples_{HC\ total}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1} * (\boldsymbol{R\&D\ Intensity_{HC\ total}}) + \boldsymbol{\beta_2} * (\boldsymbol{Company\ Size_{HC\ total}}) + \boldsymbol{\beta_3} * (\boldsymbol{EBITDA\ MArgin_{HC\ total}})$$

Where:

- β_0 is the intercept or the baseline EBITDA multiple when all independent variables are zero
- β_1 is the change in the EBITDA multiples for each unit change in R&D intensity, holding all other variables constant
- β_2 is the change in the EBITDA multiples for each unit change in company size, holding all other variables constant
- β_3 is the change in the EBITDA multiples for each unit change in EBITDA margin, holding all other variables constant

Regression Coefficient Table								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	14,1466	21,0213	0,6730	0,5022	-27,4476	55,7409	-27,4476	55,7409
R&D intensity	671,4155	131,3095	5,1132	0,0000	411,5973	931,2336	411,5973	931,2336
Company Size	-22,9232	25,3131	-0,9056	0,3669	-73,0095	27,1631	-73,0095	27,1631
EBITDA Margin	-49,3826	22,3444	-2,2101	0,0289	-93,5948	-5,1704	-93,5948	-5,1704

Table 4: Regression Coefficient Table (total healthcare industry)

The regression coefficient table provides crucial information regarding the influence of each independent variable (R&D intensity, company size, and EBITDA margin) on the dependent variable (EBITDA multiples). The table presents the estimated coefficients, standard errors, t-statistics, p-values, and confidence intervals for each variable in the model of multiple linear regression. The R&D intensity coefficient is 671.4155, with a standard error of 131.3095. A positive coefficient implies that higher R&D intensity equals higher EBITDA multiples. The t statistic (5.11) and p-value (0.00) indicate a significant relationship between R&D intensity and

EBITDA multiples with 95% confidence. The 95% confidence interval is 411.5973 to 931.2336, confirming a positive relationship between R&D intensity and EBITDA multiples. The company size coefficient is -22.9232 with a standard error of 25.3131. The negative coefficient indicates that larger companies have lower EBITDA multiples than smaller ones. The t-statistic (-0.9056) and p-value (0.3669) suggest that the link between company size and EBITDA multiples is not significant at a 95% confidence level. The 95% confidence interval (-73.0095 to 27.1631) includes zero, indicating no statistical significance of company size on EBITDA multiples. This suggests that company size does not significantly impact EBITDA multiples. The EBITDA margin coefficient is -49.38 with a standard error of 22.34. The t-statistic (-2.2101) and p-value (0.0289) indicate a significant connection between EBITDA margin and EBITDA multiples at a 95% confidence level. The p-value for EBITDA margin (0.0289) indicates a statistically significant negative relationship between EBITDA margin and EBITDA multiples. Higher EBITDA margins correspond to lower EBITDA multiples for companies.

5.1.2 Findings and Summary.

The regression analysis indicates a positive and significant correlation between higher R&D intensity and higher EBITDA multiples. Investors may value R&D-focused companies for their growth potential or innovation capabilities. Company size does not significantly affect EBITDA multiples, indicating that valuation may not be dependent on size. This finding challenges the hypothesis that larger companies have lower EBITDA multiples due to limited growth potential. There's a significant negative correlation between EBITDA margin and EBITDA multiples. In summary, the regression analysis indicates that R&D intensity significantly impacts EBITDA multiples.

5.2 The Impact of R&D Intensity on EBITDA Multiples (HCPBLS)

This sub-section analyzes the relationship between R&D intensity and EBITDA multiples in the HCPBLS sub-industry. The sub-sector and R&D within the sub-industry is described, the regression output analysis is conducted and then compared to the regression output analysis of the total healthcare industry.

5.2.1 Description Sub-Sector

The life sciences industry refers to all organizations and companies whose work is centered around R&D focused on living things (animals, plants, human beings). That is why the pharmaceuticals industry is frequently categorized as a life science industry due to its emphasis on the development, production, and distribution of medicines that improve the health of living organisms (Straits Reserach 2022). The biotechnology sector also referred to as biotech is a subset of each of these. Utilizing or manipulating living organisms to create a useful product is the focus of the expanding biotech industry, researching in few key areas, such as medicine/healthcare, agriculture/food production, and the environment (Diehl 2020). Life sciences are a combination of interdisciplinary research fields. This includes companies operating in the fields of pharmaceuticals, biotechnology, biomedical technologies, nutraceuticals, cosmeceuticals, food processing, and others that dedicate their efforts to creating products to improve the lives of organisms, in other words, an industry that is quite broadly diversified (Proclinical 2022).

The healthcare sector and more accurate the life sciences comprise the pharmaceutical and biotechnology industry, which play a crucial role in the advancement of drugs, therapeutics, and diagnostics. Although there are certain commonalities between these sectors, they also have notable differences in terms of their respective areas, approaches to development, and strategies for commercialization.

The pharmaceutical sector primarily concentrates on the development and advancement of

products to address prevalent chronic diseases such as hypertension, diabetes, and hyperlipidemia, alongside infectious pathologies and neoplastic disorders (Scherer 2000). The pharmaceutical sector is subject to stringent regulations and rigorous safety and efficacy evaluations prior to receiving approvals from regulatory bodies such as the U.S. Food and Drug Administration (FDA) (Kumar, Kumar and Nanda 2018). The market is consolidated by a limited number of prominent transnational corporations, namely Pfizer, J&J, Roche, Merck, and Novartis, which exert significant influence and allocate substantial resources towards R&D (Dunleavy 2022). Typically, these corporations have extensive product pipelines in progress and engage in in-house R&D as well as external partnerships and collaborations to identify drug targets and the respective drugs and therapies in the most effective manner. In general, the pharmaceutical sector can be characterized as highly competitive. Prominent industry leaders and emerging enterprises are competing to capture a larger market share in critical therapeutic areas, including oncology, cardiology, and immunology, which offer substantial revenue generation potential.

Conversely, the biotechnology sector directs its attention towards the advancement of biological and genetic commodities, including monoclonal antibodies, gene therapies, and cell-based therapies (Encyclopaedia Britannica 2023). These therapeutic agents are designed to selectively modulate distinct biological pathways and molecular targets within the human body, thereby offering the possibility of tailored and individualized interventions for patients afflicted with intricate medical conditions. The biotechnology sector is host to a diverse array of enterprises, encompassing both nascent entrepreneurial ventures and established multinational corporations. Enterprises of this nature tend to concentrate on a particular therapeutic domain or pathological condition and strive to create groundbreaking innovations and remedies that are customized to the distinctive requirements of patients afflicted with such ailments. Typically, biotechnology enterprises possess more limited product pipelines and concentrate their R&D

capacities on a specific domain (Segal 2023). Partnerships and collaborations are integral to the operations of biotechnology firms, especially in the identification of novel targets and the development of innovative products. These strategic alliances are often established with academic research institutions and other stakeholders. The advancement of innovative products and solutions is a crucial determinant for the pharmaceutical and biotechnology sectors. The initial phase of this R&D process typically commences with basic research, wherein researchers investigate the underlying biological processes that cause a disease. On the basis of this, investigators can discern plausible drug targets or biomarkers that may be employed to devise therapeutic interventions or diagnostic. The identified product must then undergo rigorous preclinical and clinical testing to evaluate safety and efficacy as well as to ascertain any possible side effects or hazards (Umscheid, Margolis and Grossman 2015). Companies face intense regulatory challenges and intellectual property protection is of great importance, given the substantial R&D investments. Patents give companies the exclusive right to distribute their products and regain the invested capital (Cockburn and Long 2015). Given the shared R&D focus, business models, organizational structures, and regulatory constraints, it is beneficial to combine pharmaceuticals, biotechnology, and life sciences in a multiple regression analysis. The commonality in these sectors suggests shared success factors, and their regulatory environments significantly impact the time and cost of new product introduction. Thus, a combined sample analysis is carried out to ascertain the role of R&D intensity as a critical success factor in these industries.

5.2.2 R&D within Sub-Sectors

R&D drives innovation in the healthcare industry, especially in the HCPBLS sub-sector. Creating a new medication, drug or therapy requires several steps companies must undergo. These include discovery, preclinical research, clinical trials, regulatory approval, and post-market surveillance. Each step is crucial to the product or treatment's development and demands

great attention to detail within the multilayered process.

Drug discovery is the first stage in life sciences R&D. It involves identifying and evaluating potential pharmacological targets and developing new treatment methods. Primary research dominates the discovery phase and can take several years. Drug development requires high-throughput screening, structure-based drug design, and computer modeling (Farid, et al. 2019). Potential drug candidates are tested for pharmacokinetics, safety, and efficacy during preclinical research. Candidates must be assessed for safety before human testing. The drug's optimum dose regimen is one of the preclinical goals. This phase also identifies possible drug-drug interactions. The preclinical phase is of great importance as it is essential for the preparation of the clinical phase (Shegokar 2016).

The clinical phase within the R&D process is the most resource-intensive and time-consuming stage. This phase involves thorough testing and assessment of proposed therapies or interventions on human beings. At this stage the process is highly regulated to guarantee that therapies and drugs that reach the market are safe and effective. Clinical studies include giving the proposed medicine to humans to assess its effectiveness, safety, and pharmacokinetics (World Health Organization 2023). This stage of the R&D process is significant since it reveals the medicine's advantages and hazards. Based on this, the researching scientists can make adjustments to increase the effectiveness of the innovation. Clinical trials guarantee that new pharmaceuticals are safe and effective for broad use via rigorous testing and analysis. Multiple-phase clinical studies assess a medication candidate's potency. Each clinical trial phase is carefully planned to answer particular drug candidate questions (Ospina, et al. 2009). This technique gathers data on the drug candidate's therapeutic potential and safety profile to inform regulatory authorities about its clinical usage. Phase I clinical studies generally comprise a few dozen healthy volunteers. These studies aim to find the drug's optimum dose. Phase II clinical trials, which involve a larger patient cohort, are critical to drug development because they assess

the treatment's safety and efficacy in the target population. This phase involves profound and systematic drug testing to generate trustworthy data for further clinical trials. Phase II studies establish the drug's therapeutic potential and appropriate dose and delivery. These trials can reveal the drug's safety and therapeutic efficacy in the target group. Phase II clinical trials accelerate medication development and improve patient outcomes. Phase III clinical studies verify medication efficacy and safety at a much larger group of volunteers (BrightFocus Foundation 2021). These trials carefully include many probands at different geographical locations, to assure statistical significance and demographic representation, the studies involve thousands of patients. A new drug application (NDA) is submitted to the relevant regulatory authority, such as the FDA in the US for a comprehensive evaluation and approval. Preclinical and clinical study data is included in the NDA. The dataset covers medication manufacture, labeling, and safety (Kumar, Kumar and Nanda 2018). To meet all requirements, regulatory authorities may be in need of further information or explanation.

Once a drug hits the market constant post-marketing surveillance is required. After approval, it monitors the drug's performance. This stage requires continuous data gathering and analysis to identify and manage pharmacological hazards and side effects. Thus, post-marketing surveillance is essential to public health and medication safety. Drug candidates' safety and efficacy must be monitored after licensure. This step is crucial because it identifies any overlooked side effects or safety issues from the pre-licensing phase (Li Wan Po 2007). The monitoring procedure ensures that the pharmaceutical candidate continues to meet safety and effectiveness requirements and makes sure that upcoming safety concerns can be addressed. Pharmacovigilance, continual safety monitoring, and labeling changes based on new safety findings are part of the post-market development process which is indefinite.

5.2.3 Regression Output Analysis

In the following, the multiple regression analysis between the dependent variable EBITDA

multiples and the independent variables R&D intensity, company size (categorized in small and large) as well as EBITDA margin (classified as moderate or high) is being analyzed for the healthcare industry's sub-sector HCPBLS. The total sample comprises 61 observations. Within those 61 observations of the HCPBLS 30 observations are transactions related to the pharmaceuticals industry, 17 corresponding to the biotechnology sub-sector and 14 associated to life sciences.

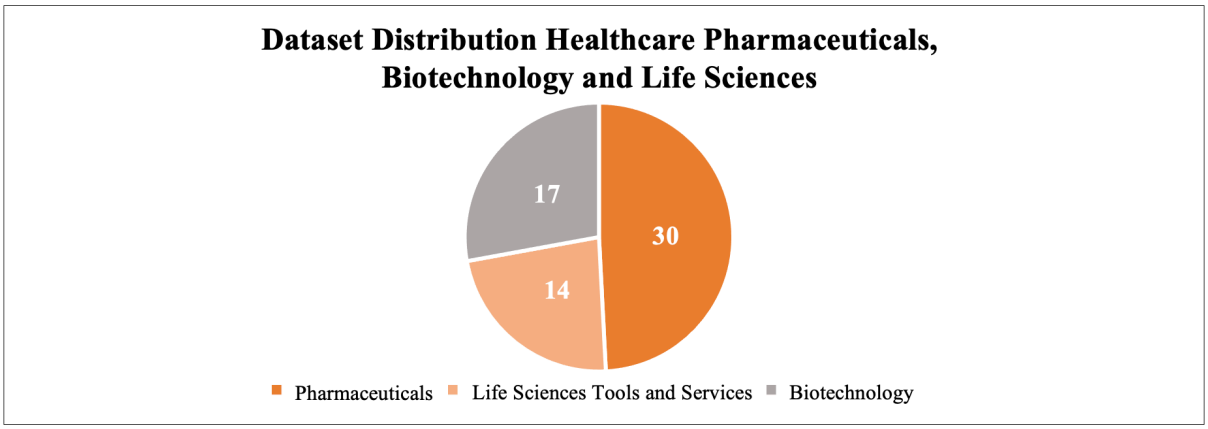


Figure 3: Sample Distribution among the HCPBLS Sub-Sector

The multiple regression analysis conducted for this study aimed to investigate the impact of R&D intensity on EBITDA multiples in the healthcare HCPBLS sub-industry. In order to gain a deeper understanding of the relationship between the independent and dependent variables, two dummy variables were incorporated into the analysis. These variables were company size and EBITDA margin. A multiple regression analysis was conducted using EBITDA multiples as the dependent variable and R&D intensity, company size, and EBITDA margin as the independent variables. Herewith, an accurate analysis can be drawn. The following section will present the comprehensive analysis of the findings, with a particular emphasis on the interpretation of the metrics, attributes, and the general implications and verdict of the research.

Regression Statistics	
Multiple R	0,7022
R Square	0,4931
Adjusted R Square	0,4664
Standard Error	82,2348
Observations	61

Table 5:Regression Statistics (HCPBLS)

According to the regression statistics, the value of multiple R, which represents the correlation coefficient, is 0.7022. The aforementioned value denotes a significant, positive, strong correlation between the independent variables (R&D intensity, company size, and EBITDA margin) and the dependent variable (EBITDA multiples). The coefficient of determination, commonly referred to as R square, has a value of 0.4931. This indicates that the chosen independent variables can explain approximately 49.31% of the variation observed in EBITDA multiples. The adjusted R square value of 0.4664, in the meantime, takes the number of predictors in the model into account and offers a more conservative evaluation of the explained variance. The regression's standard error is 82.2348. The respective standard error represents the average distance that the observed values deviate from the regression line.

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	374946,9360	124982,3120	18,4815	0,000000017
Residual	57	385466,1802	6762,5646		
Total	60	760413,1163			

Table 6:ANOVA (HCPBLS)

The presentation of the regression analysis results is done through the ANOVA table. Based on the obtained F-statistic value of 18.4815 and the highly significant p-value of 0.000000017, it can be inferred that the regression model exhibits statistical significance and adequately conforms to the data. The ANOVA table implies that there exists compelling evidence indicating that, in the model, at least one of the independent variables has a significant impact on the dependent variable, namely EBITDA multiples.

The multiple regression equation for this analysis can be depicted as the following:

$$\boldsymbol{EBITDA\ multiples_{HCPBLS}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1} * (\boldsymbol{R\&D\ Intensity_{HCPBLS}}) + \boldsymbol{\beta_2} * (\boldsymbol{Company\ Size_{HCPBLS}}) + \boldsymbol{\beta_3} * (\boldsymbol{EBITDA\ MArgin_{HCPBLS}})$$

Where:

- β_0 is the intercept or the baseline EBITDA multiple when all independent variables are zero
- β_1 is the change in the EBITDA multiples for each unit change in R&D intensity, holding all other variables constant
- β_2 is the change in the EBITDA multiples for each unit change in Company Size, holding all other variables constant
- β_3 is the change in the EBITDA multiples for each unit change in EBITDA Margin, holding all other variables constant

Regression Coefficient Table								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-14,1724	22,9245	-0,6182	0,5389	-60,0780	31,7331	-60,0780	31,7331
R&D intensity	751,2027	115,1396	6,5243	0,0000	520,6396	981,7658	520,6396	981,7658
Company Size	-37,5891	25,0316	-1,5017	0,1387	-87,7141	12,5358	-87,7141	12,5358
EBITDA Margin	-27,2170	22,8994	-1,1885	0,2395	-73,0723	18,6383	-73,0723	18,6383

Table 7:Regression Coefficient Table (HCPBLS)

The R&D intensity coefficient amounts to 751.2027 with a standard error of 115.1396. This coefficient indicates a positive relationship between R&D intensity and EBITDA multiples. Controlling for other variables and keeping them constant, it can be observed that a rise of one unit in R&D intensity leads to an increase of 751.2027 units in EBITDA multiples. Based on the statistical analysis, it can be concluded that the impact of R&D intensity on EBITDA multiples is statistically significant. Further evidence for this claim is provided by the t-statistic

of 6.5243 and a significantly low p-value of (0.0000). The confidence interval for the coefficient is 95%, and it extends from 520.6396 to 981.7658. This outcome strengthens the evidence of a positive correlation between R&D intensity and EBITDA multiples.

The coefficient for company size is -37.5891. Herewith, it can be inferred that there exists a negative correlation between EBITDA multiples and company size. The aforementioned suggests that under the condition that all other variables remain constant, large companies tend to have lower EBITDA multiples compared to smaller companies. The statistical analysis reveals that the relationship lacks statistical significance at the 5% level, as evidenced by the t-statistic of -1.5017 and a p-value of 0.1387. Therefore, the impact of company size on EBITDA multiples remains inconclusive.

The coefficient for EBITDA margin is -27.2170, which suggests an adverse negative correlation with EBITDA multiples. It can be derived from the data that corporations exhibiting a substantial EBITDA margin tend to possess EBITDA multiples that are comparatively lower than those of entities with a moderate margin. The statistical analysis reveals that the relationship lacks statistical significance at the 5% level, as evidenced by the t-statistic of -1.1885 and a p-value of 0.2395. The uncertain impact of EBITDA margin on EBITDA multiples is a consequential matter.

5.2.4 Discussion of Results

The multiple regression analysis yields significant insights into the correlation between EBITDA multiples and independent variables, specifically R&D intensity. The findings of the multiple regression illustrate that there is a positive and significant correlation between R&D intensity and EBITDA multiples. This implies that companies with higher R&D intensity tend to have higher EBITDA multiples within the HCPBLS sub-sector. The statistical analysis reveals a significant relationship between R&D intensity and EBITDA multiples at a 99.99% confidence level, as evidenced by the t-statistic of 6.5243 and a tremendously small P-value

(0.0000). The research indicates that higher R&D intensity is positively correlated with increased EBITDA multiples, while controlling for other variables. The R&D intensity coefficient of 751.2027 implies that a unit rise in R&D intensity will result in a corresponding increase of 751.2027 units in EBITDA multiple, while keeping all other factors constant.

The dummy variables representing company size and EBITDA margin lack statistical significance at a 95% confidence level. The study suggests that R&D intensity is a significant factor in explaining the variability of EBITDA multiples, independent of company size or EBITDA margin.

In brief, this study offers empirical evidence to substantiate the proposition that the level of R&D investments has a noteworthy impact on the EBITDA multiples of firms operating in the HCPBLS sub-sector. The results hold significant implications for investors seeking to comprehend the factors that influence company valuation in this particular industry. Further investigation could be conducted in the field of EBITDA multiples to examine other potential variables that may impact them, including market dynamics, patent holdings, and competitive environment. This would lead to a more comprehensive examination of the factors that determine company value within this innovative sector.

5.2.5 Sub-Sector Comparison to Total

The present study undertakes a comparative analysis to examine the relationship between R&D intensity and EBITDA multiples in the healthcare industry as a whole and the HCPBLS sub-industry. The findings indicate a noteworthy positive correlation between the R&D intensity and EBITDA multiples in the healthcare sector (total) as well as its sub-sector HCPBLS. This highlights the significance of R&D capabilities in propelling the worth of an organization operating in the healthcare industry. The results indicate a positive correlation between extensive investments in R&D and elevated company valuations, as reflected in higher EBITDA multiples.

The findings suggest that the influence of R&D intensity on EBITDA multiples is more pronounced in the HCPBLS sub-sector than in the broader healthcare industry (total). The aforementioned observation implies that R&D capabilities may be valued more highly and with a greater significance within the HCPBLS sub-sector, which is frequently typified by arduous R&D efforts, protracted product development timelines, and substantial investments in innovation.

The elevated coefficient observed for R&D intensity in the HCPBLS sub-industry may be attributed to the potential for significant revenue and profitability growth resulting from successful R&D outcomes, such as the creation of novel drugs or therapies. Consequently, it is plausible that investors and stakeholders may assign a higher value to companies operating within the HCPBLS sub-industry that exhibit a greater degree of R&D intensity on average. This could lead to higher company valuations resulting in elevated EBITDA multiples.

5.3 The Impact of R&D Intensity on EBITDA Multiples (HCES)

This sub-section analyzes the relationship between R&D intensity and EBITDA multiples in the HCES sub-industry. The sub-sector and R&D within the sub-sector is described, the regression output analysis is conducted and then compared to the regression output analysis of the total healthcare industry.

5.3.1 Description Sub-Sector

The healthcare equipment and supplies industry plays a major role in today's global healthcare system, significantly influencing practices related to the diagnosis, treatment, and management of various health conditions (SP Global 2022). This industry, being responsible for manufacturing a spectrum of implants and devices along with a wide array of medical supplies and instruments, forms the backbone of day-to-day operations for stakeholders engaged with health-related issues. The industry's contribution extends to facilitating the delivery of targeted therapies and monitoring patient progress through surgical instruments, implants, and patient monitoring systems. Simultaneously, the sector ensures product quality and safety, collaborates effectively with stakeholders, and maintains an organization's operational licensure. In the context of infection prevention and control within healthcare facilities, personal protective equipment, disinfectants, and sterilization supplies emerge as indispensable entities (PAHO/WHO 2022). Equally vital are the hospital beds, wheelchairs, and mobility aids that enhance patient care by offering comfort and support. Further, assistive gadgets contribute to improving patient autonomy and overall quality of life. Despite grappling with budget constraints, healthcare reform, and the impact of the COVID-19 pandemic, the medical equipment and supplies business has been successful in identifying growth opportunities. This success can be attributed to the emergence of less invasive technologies and rising income levels (Maine.gov 2020). Companies in this sector that have proved to be sustainable are those that implement value-based and stakeholder-focused business strategies. These strategies

include efficient management of human and intellectual capital and the incorporation of transparent reporting mechanisms. Medical equipment, forming an essential part of modern medicine, refers to a range of medical devices that necessitate calibration, maintenance, repair, user training, and decommissioning. The healthcare equipment sub-sector comprises an extensive assortment of equipment, including but not limited to imaging systems, pacemakers, surgical instruments, implants, and patient monitoring systems (WHO 2011). This sub-sector has witnessed rapid growth and is projected to reach a market size of $612 billion by 2025 (Fortune Business Insights 2021). This growth is driven by factors such as an aging population, the prevalence of chronic diseases, medical advances, and an increasing desire for individualized medicine. Remarkably, the US medical equipment sales exceeded $190 billion in 2020, employing about 500,000 people and supporting two million jobs in adjacent businesses (AdvaMed 2023). Within the broad spectrum of medical equipment, certain entities such as X-ray, MRI, and ultrasound machines, pacemakers, defibrillators, stents, and catheters hold significant importance for their critical roles in diagnosis and treatment. Concurrently, non-invasive devices like hearing aids, dental braces, and prosthesis have proven instrumental in enhancing patients' quality of life (STERIS 2021). The industry faces rigorous regulation to ensure safety and efficacy. The FDA classifies American medical devices into Class I, Class II, and Class III based on risk (Taylor, et al. 2020), and mandates good manufacturing practices (GMPs) to ensure the quality of medical device design, manufacture, and testing (Tarabah 2015). Despite facing challenges such as rising healthcare costs, complex regulations, increased competition, disrupted supply chains, and an increased medical demand due to the COVID-19 pandemic, the healthcare equipment business continues to innovate and grow. This growth is propelled by technological advancements, new markets, and chronic diseases, with value-based healthcare emphasizing better patient outcomes at lower costs (Fortune Business Insights 2021).

In contrast to medical equipment, medical supplies are designed for short-term use and are disposed of after their first use. These include incontinence products, protective gloves, bandages, and other disposable items, which are discarded by healthcare workers after a single use. This practice, is crucial for ensuring the health and safety of both the healthcare workers and their patients, given that these materials often come into contact with bodily fluids (Cascade 2023). On the other hand, the healthcare supply sector, despite its own set of challenges, remains critical in providing indispensable products and services that enhance patient care and overall healthcare system efficiency. This sector primarily encompasses consumables, disposables, and single-use items such as syringes, gloves, and gowns, which play a vital role in preventing infection and contamination during medical treatments (Hinrichs-Krapels, et al. 2022). However, the manufacture, usage, and disposal of healthcare supplies pose significant environmental challenges. The process is energy-intensive and heavily reliant on natural resources. Additionally, the industry contributes to pollution through its use of plastic and other non-biodegradable materials. The accumulation of healthcare waste, particularly plastic, in landfills and the release of harmful chemicals during incineration further exacerbate the environmental impact (GlobalData Healthcare 2022). Consequently, the healthcare supplies industry is tasked with the urgent need to prioritize sustainability while continuing to meet the demand for essential healthcare products and services.

5.3.2 R&D within Sub-Sectors

R&D is an indispensable driver of innovation within the healthcare equipment and supplies sector, bolstering patient outcomes and driving down costs (Goel and Ramalingegowda 2020). This progress is facilitated by the emergence of novel technologies and materials, which aid in addressing existing constraints and fulfilling the escalating demand for safer, more efficient, and patient-friendly medical equipment. Underpinning R&D in the sector is the global demand for medical devices. As the world is confronted with an aging population and a rise in chronic

illnesses, there is an increasing need for advanced medical technology to diagnose, treat, and manage these disorders. In response to this, companies are investing extensively in R&D to generate groundbreaking products and solutions, meeting the needs of this evolving industry. However, the path to innovation is not without its challenges. The development of novel medical equipment is a complex and costly process, involving stringent testing and regulatory procedures that span over several years (Within3 2022). This process usually engages a multidisciplinary team consisting of engineers, materials scientists, doctors, and regulatory specialists, further adding to the complexity and cost (Citron 2012). Consequently, R&D investment tends to be concentrated within large, established enterprises capable of navigating these challenges (Yu and Xu 2022). In an effort to streamline the development process and reduce costs, researchers and manufacturers are employing several innovative strategies. Simulation and modeling are being leveraged to identify design issues and enhance device performance prior to the construction of physical prototypes, thus simplifying subsequent physical testing and aiding manufacturers in more effectively meeting regulatory criteria (Citron 2012). Furthermore, open innovation models are fostering collaborations between companies, universities, research institutions, and other industry stakeholders, accelerating development and mitigating costs (Herrera and de las Heras-Rosas 2021). The development of a medical device typically follows a series of steps: concept development, design, manufacturing, and regulatory approval. Concept development involves assessing clinical needs and proposing innovative solutions, which may necessitate the creation of new technologies or the adaptation of existing ones. The design step refines the concept, detailing the materials, dimensions, and production procedures for the device (Within3 2022). Following the design phase, the device undergoes numerous prototype iterations to enhance the design and address any concerns identified during testing. This stage may require simulation, modeling, and physical testing to evaluate the device's safety, effectiveness, and biocompatibility (Liao

and Cooper 2023). Upon finalizing a prototype, the device enters the manufacturing phase, during which large-scale production processes are established and validated to ensure product quality. Devices are tested for performance, safety, and reliability throughout production, with in-process inspections and final product testing ensuring compliance with design specifications and regulatory requirements (Integer 2023). The final step entails obtaining regulatory approval, a rigorous process that involves a comprehensive review of the device's design, manufacturing methods, and clinical data to ascertain its safety and efficacy for intended use. This process may necessitate clinical trials to demonstrate the device's effectiveness and safety in real-world settings (Within3 2022). Despite the hurdles, the healthcare equipment and supplies sector continues to innovate, fueled by technological advancements, global demand, and a commitment to improving patient outcomes. As R&D in the industry evolves, medical devices are set to become increasingly sophisticated, networked, and personalized, transforming healthcare delivery and enabling new and improved treatments for a wide range of diseases (Goel and Ramalingegowda 2020). With companies and researchers pioneering new ways to streamline the development process and reduce costs, the pace of innovation in healthcare equipment and supplies is expected to escalate further (Barnes 2023).

5.3.3 Regression Output Analysis

In the following, the multiple regression analysis between the dependent variable EBITDA multiples and the independent variables R&D intensity, company size (categorized in small and large) as well as EBITDA margin (classified as moderate or high) is being analyzed for the healthcare industry’s sub-sector equipment and supplies. The total sample comprises 54 observations. Within those 54 observations of the HCES 43 observations are related to the equipment and 11 associated to supplies sub-industry.

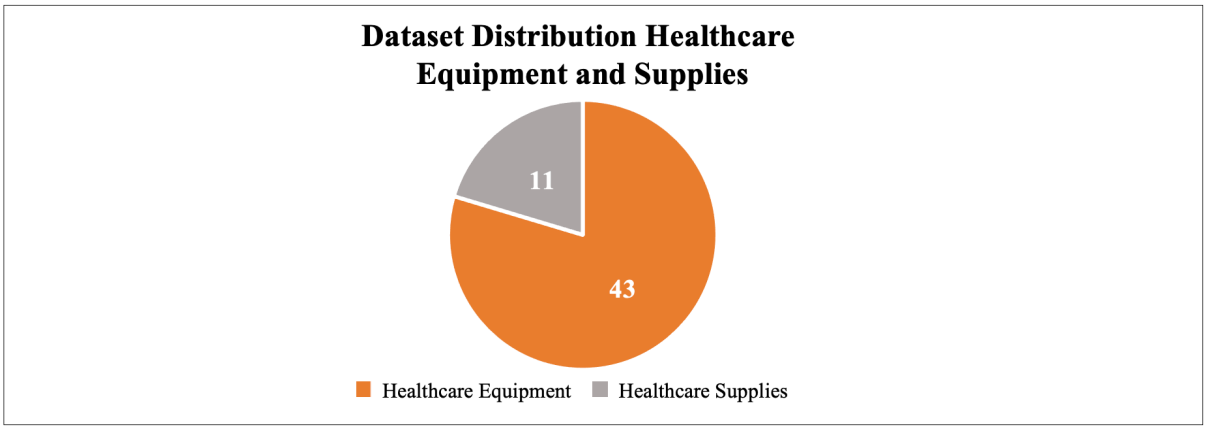


Figure 4: Sample Distribution among the HCES Sub-Sector

The analysis of the multiple regression model shows the relationships between the dependent variable, EBITDA multiples and the three independent variables, R&D intensity, company size and EBITDA margin. The focus is mainly on the effect of R&D intensity since company size and EBITDA margin were introduced as dummy variables.

The correlation coefficient (multiple R) is used as an indicator for this purpose. This is used to check whether the changes in R&D intensity, company size and EBITDA margin correspond to a certain extent to the changes in the EBITDA multiples. For general understanding, -1 means a perfect negative correlation, +1 a perfect positive correlation and 0 no correlation. In this analysis the multiple R is 0.4004. The metric suggests a moderate positive correlation between the independent variables and the dependent variable. This value indicates that to a certain extent R&D intensity, firm size, and EBITDA margin coincide with EBITDA multiples.

Regression Statistics	
Multiple R	0,4004
R Square	0,1603
Adjusted R Square	0,1099
Standard Error	162,4738
Observations	54

Table 8:Regression Statistics (HCES)

The independent variables R&D intensity, company size and EBITDA margin explain about 16.03% of the variance of EBITDA multiples. This is indicated by the coefficient of

determination (R squared), which is 0.1603. However, this also means that a large portion, 83.97% of the variance of the dependent variable, is not adequately explained by the independent variables. This indicates that the EBITDA multiplies may be significantly influenced by factors not included in this model.

The adjusted R square, which is 0.1099 or 10.99%, takes the degrees of freedom into consideration and provides a more accurate measure of the model's fit, particularly when comparing multiple models. This value is less than the R square, indicating that some of the model's variables may not substantially explain the variation in EBITDA multiples.

The standard error is 162.4738, which is relatively high. This shows a high degree of dispersion and unreliability in the predicted values of EBITDA multiples, suggesting the model might not be very precise in its predictions.

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	251960,2202	83986,7401	3,1816	0,0318
Residual	50	1319886,3311	26397,7266		
Total	53	1571846,5513			

Table 9:ANOVA (HCES)

The ANOVA table is used to present the results of the regression analysis. In this case, the F-value is 3.1816 and the significance level displayed by the p-value is 0.0318. The ANOVA table indicates that at a standard alpha level of 0.05, the model is statistically significant, as the p-value is less than 0.05. This means that at least one of the independent variables has a significant impact on the EBITDA multiples.

The multiple regression equation for this study can be depicted as the following:

$$\boldsymbol{EBITDA\ Multiples_{HCES}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1} * (\boldsymbol{R\&D\ Intensity_{HCES}}) + \boldsymbol{\beta_2} * (\boldsymbol{Company\ Size_{HCES}}) + \boldsymbol{\beta_3} * (\boldsymbol{EBITDA\ Margin_{HCES}})$$

Where:

- β_0 is the intercept or the baseline EBITDA multiple when all independent variables are zero
- β_1 is the change in the EBITDA multiples for each unit change in R&D intensity, holding all other variables constant
- β_2 is the change in the EBITDA multiples for each unit change in company size, holding all other variables constant
- β_3 is the change in the EBITDA multiples for each unit change in EBITDA margin, holding all other variables constant

Regression Coefficient Table								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-2,4470	48,0930	-0,0509	0,9596	-99,0447	94,1506	-99,0447	94,1506
R&D intensity	1087,5967	427,3994	2,5447	0,0141	229,1398	1946,0536	229,1398	1946,0536
Company Size	10,1331	63,0561	0,1607	0,8730	-116,5187	136,7849	-116,5187	136,7849
EBITDA Margin	-80,7414	58,2611	-1,3859	0,1719	-197,7624	36,2795	-197,7624	36,2795

Table 10:Regression Coefficient Table (HCES)

The regression coefficients represent the mean change in the dependent variable for one unit of change in the independent variable while holding other independent variables in the model constant. From the data of the regression coefficient table the effects of the three independent variables on the dependent variable can be further investigated.

First, the coefficient of R&D Intensity is 1087.5967. This suggests that for every unit increase in R&D intensity, the EBITDA multiples increase by approximately 1087.5967 units, holding all other factors constant. The relationship between R&D intensity and EBITDA multiples is statistically significant at the 5% level. This is indicated by the t-statistic of the R&D intensity which is 2.5447. The corresponding p-value comprises 0.0141. This points out that the value is below the 0.05 threshold from which one can conclude that there's strong evidence to suggest that R&D intensity has a meaningful positive impact on EBITDA multiples in the healthcare

equipment and supplies sub-industry. The 95% confidence interval for this coefficient ranges from 229.1398 to 1946.0536, reinforcing the positive effect of R&D intensity on EBITDA multiples.

Second, the coefficient for company size is 10.1331, implying that moving from a small to a large company, on average, increases the EBITDA multiples by approximately 10.13 units, assuming all other variables are held constant. However, the t-statistic is 0.1607 and the p-value is 0.8730, which is greater than 0.05. This suggests that the company size is not statistically significant in explaining the EBITDA multiples in this model.

Finally, the coefficient for EBITDA margin is -80.7414. This means that for each unit increase in the EBITDA margin, the EBITDA multiples decrease by approximately 80.74 units, holding all else constant. However, the t-statistic is -1.3859 and the p-value is 0.1719, which is greater than 0.05. This suggests that the EBITDA margin is not statistically significant in this model.

The 95% confidence intervals for the coefficients also provide useful information. For instance, the confidence interval for the R&D intensity ranges from 229.1398 to 1946.0536. This implies that there is a 95% confidence that the true population coefficient for R&D intensity lies within this range. Since this range does not contain zero, it further confirms the statistical significance of R&D intensity. The confidence intervals for the company size and EBITDA margin, however, contain zero, further confirming that these variables are not statistically significant.

5.3.4 Discussion of Results

The key takeaway from the study is the statistically significant positive relationship between R&D intensity and EBITDA multiples. The positive coefficient of R&D intensity in the regression model suggests that increased investments in R&D activities correspond to higher EBITDA multiples. Specifically, the coefficient of 1087.5967 means that, holding all other factors constant, a unit increase in R&D intensity is associated with an approximate 1087.5967 unit increase in EBITDA multiples. The statistical significance of this relationship (p-value =

0.0141) provides strong empirical support for the idea that R&D intensity is a critical factor in driving company valuations in the healthcare equipment and supplies subindustry. Moreover, the 95% confidence interval for the R&D intensity coefficient, which ranges from 229.1398 to 1946.0536, further confirms the positive impact of R&D intensity on EBITDA multiples. Given that the entire range of plausible values for the true coefficient is positive, it is reasonable to assert that R&D intensity has a beneficial effect on EBITDA multiples in this sub-industry. However, this analysis also underscores the nuanced nature of the relationship between R&D intensity and EBITDA multiples. For instance, while the positive association suggests that higher R&D intensity generally leads to higher EBITDA multiples, the specific magnitude of the effect can vary. The wide confidence interval for the R&D intensity coefficient indicates that the exact size of the impact could be substantially different from the point estimate, depending on various other factors that might influence the relationship. While the impact of R&D intensity on EBITDA multiples is significant, the results for the other variables in the model, company size and EBITDA margin, are not statistically significant. This indicates that, within the scope of this study, the mentioned factors do not have a significant influence on EBITDA multiples in the healthcare equipment and supplies sub-sector. However, this does not necessarily mean that these variables are insignificant in all contexts or that they should be overlooked in business or investment evaluations. Further research could investigate these variables in more depth or consider other elements that could affect EBITDA multiples.

Lastly, it's important to remember that this regression model accounts for roughly 16% of the variation in EBITDA multiples, as denoted by the R square value of 0.1603. While this suggests that R&D intensity is a critical determinant, it also means that a large portion of the variation in EBITDA multiples is unaccounted for by the model. This underscores the inherent complexity in predicting EBITDA multiples and the possibility that other influential factors haven't been integrated into this model. Factors such as market dynamics, competition,

regulatory environment, and other company-specific characteristics may also significantly influence EBITDA multiples.

Although, the current model provides a rudimentary understanding of the topic, there is room for more advanced modeling approaches to investigate the impact of the dummy variables. In the face of these limitations, the primary finding of this study, the positive and significant impact of R&D intensity on EBITDA multiples, remains robust and noteworthy.

5.3.5 Sub-Sector Comparison to Total

In comparing the two models, it is clear that R&D intensity consistently emerges as a significant predictor of EBITDA multiples in both the broader healthcare industry and the more narrowly defined sub-sector. While there indeed exists a certain degree of congruity in this domain, the implications of the outcomes reveal a distinct variation that cannot be overlooked. The difference in the coefficients (671.4155 in the total model versus 1087.5967 in the sub-sector model) suggests that R&D intensity has a larger impact on EBITDA multiples in the healthcare equipment and supplies sub-sector than in the overall healthcare industry. This could indicate that investors value R&D investment more in this sub-industry, perhaps due to the fast-paced technological advancements or the critical role of innovation in driving growth.

Overall, the comparative analysis reveals interesting trends and differences in how R&D intensity and EBITDA margin influence EBITDA multiples in the total healthcare industry versus the healthcare equipment and supplies sub-sector. The difference in the coefficients of R&D intensity between the two models suggests that the market may place a higher premium on R&D intensity in the healthcare equipment and supplies sub-sector. Similarly, the lack of significance of EBITDA margin in the sub-sector suggests that other factors may be more influential in determining EBITDA multiples for these companies.

6 Conclusion

This research paper sets out to investigate the impact of R&D intensity on company valuations within the healthcare industry and specific sub-sectors.

6.1 Summary

First, the study explored the relationship between R&D intensity and company valuations in the overall healthcare industry. The results indicate a significant positive correlation between R&D intensity and company valuations, supporting H_1. Next, the research objectives delved into specific sub-sectors within the healthcare industry. For the pharmaceuticals, biotechnology, and life sciences sub-sector (HCPBLS), the study identified a significant, strong positive correlation between R&D intensity and company valuations, aligning with H_2. This indicates that R&D investments play a crucial role in driving valuations in this particular sub-sector. In contrast, the analysis of the healthcare equipment and supplies sub-sector (HCES) revealed a moderate statistically significant relationship between R&D intensity and company valuations, supporting H_3. This finding suggests that R&D investments have a significant, moderate positive impact on company valuations within the HCES sub-sector. The results underscore the importance of R&D intensity as a driver of growth and innovation within this specific industry segment.

In conclusion, this research paper contributes to the understanding of the impact of R&D intensity on company valuations within the healthcare industry and certain sub-sectors. The findings confirm the positive relationship between R&D intensity and company valuations in the overall healthcare industry and the HCES sub-sector. Nevertheless, the most significant positive relationship is identified within the HCPBLS sub-industry. These results emphasize the significance of R&D investments in driving growth and innovation, subsequently increasing company valuations. This research paper has successfully addressed the research question and achieved the stated research objectives. By examining the impact of R&D intensity on company

valuations within the healthcare industry and specific sub-sectors, this study has contributed valuable insights to the existing body of knowledge.

6.2 Limitations of the Study and Suggestions for Future Research

As with any academic research, this research paper presents certain constraints that impact the outcomes. To facilitate a more accurate interpretation and classification of the results, and to enable further research in the future, these limitations are enumerated and discussed herein.

This study aimed to investigate the influence of R&D intensity on EBITDA multiples by examining target companies involved in M&A transactions over the past decade. The analysis relied on a dataset obtained from the Capital IQ platform.

It is crucial to note that this investigation employed a strictly quantitative approach, focusing solely on the data available from Capital IQ. Consequently, no additional qualitative information or research was conducted to supplement the provided data on the companies. The potential impact of undisclosed information on target companies' results and interpretation cannot be dismissed.

Given the centrality of valuation in this study, there are inherent limitations to consider. EBITDA multiples were utilized as a valuation method to facilitate comparisons between companies. These multiples were derived from transaction values, but the dataset did not provide any insight into the valuation methods employed in each transaction. By relying on EBITDA multiples in conjunction with transaction values, it is unclear which factors influenced the valuations. It is conceivable that unaccounted factors may have positively or negatively affected the overall valuations. Furthermore, the R&D intensity utilized for regression analysis was based solely on companies' expenditures during the transaction year, relative to their revenues, and did not account for other factors such as intellectual property.

Data availability posed another challenge. The dataset encompassed both public and private companies, leading to limited information for numerous entities. Particularly for private

companies, certain data points, such as R&D expenses from transaction years, were often unavailable. The study's scope, covering the past decade, further complicated information retrieval.

After implementing the filters delineated in the methodology section, a final dataset comprising 132 companies was established. Although these companies were well-suited for the investigation, the dataset exhibited considerable variance among pertinent variables, including EBITDA multiples, R&D intensity, company size (dummy variable), and EBITDA margin (dummy variable). This substantial variation significantly undermines the study's findings.

Moving forward, further research can expand upon these findings by exploring additional factors, increasing the sample size, and considering different geographical regions to deepen the understanding of the complex relationship between R&D intensity and company valuations within the healthcare industry.

Bibliography

AdvaMed. 2023. "Advanced Medical Technology Associtions." *Medical Device Industry Facts.* Accessed 2023. https://www.advamed.org/medical-device-industry-facts/.

American Cancer Society . 2020. *American Cancer Society .* August 18. Accessed 03 19, 2023. https://www.cancer.org/cancer/managing-cancer/making-treatment-decisions/clinical-trials/what-you-need-to-know/phases-of-clinical-trials.html.

Artz, Kendall, Patricia Norman, Donald Hatfield, and Laura Cardinal. 2010. "A Longitudinal Study of the Impact of R&D, Patents, and Product Innovation on Firm Performance." *A Longitudinal Study of the Impact of R&D, Patents, and Product Innovation on Firm Performance.*

Barnes. 2023. *2023 World Industry & Market Outlook.* Barnes.

BrightFocus Foundation. 2021. *BrightFocus Foundation.* September 2. Accessed May 06, 2023. https://www.brightfocus.org/clinical-trials/how-clinical-trials-work/phases-clinical-trials.

Brown, James, Gustav Martinsson, and Bruce Petersen. 2017. *What promotes R&D? Comparative evidence from around the world.* ScienceDirect.

Bruen, Brian, Elizabeth Docteur, Ruth Lopert, Joshua Cohen, Joseph DiMasi, Avi Dor, Peter Neumann, Regina DeSantis, and Chuck Shih. 2016. "The Impact of Reimbursement Policies and Practices on Healthcare Technology Innovation ."

Burns, Lawton Robert. 2012. *The Business of Healthcare Innovation.* Cambridge University Press.

Cascade. 2023. " Durable Medical Equipment Versus Medical Supplies." *Cascade Health Services.* Accessed 2023. https://cascadehealth.com/blog/durable-medical-equipment-versus-medical-supplies/#.

CFI. 2022. "Organic Growth." *CFI.* Accessed 2023. https://corporatefinanceinstitute.com/resources/management/organic-growth/#.

Chinook. 2019. *Valuationa nd EBITDA explained.* Chinook Capital Advisors.

Cimasi, Robert. 2017. *Healthcare Valuation: The four pillars of healthcare value.* Wiley.

Citron, Paul. 2012. *Ethics Considerations for Medical Device R&D.* ScienceDirect.

Cockburn, Iain, and Genia Long. 2015. "The importance of patents to innovation: updated cross-industry comparisons with biopharmaceuticals." *Expert Opinion on Therapeutic Patents.*

Das, Arindam, and Sheeba Kapil. 2012. "Explaining M&A performance: a review of empirical research."

de la Maisonneuve, Christine , and Oliveira Martins. 2015. "The future of health and long-term care spending." *OECD Journal.*

Degenhardt, Dr. Franz, and Sovann Monyroth. 2022. "Introduction to Merger and Acquisition & Valuation."

Diehl, Paul. 2020. *ThoughtCo.* August 21. Accessed May 05, 2023. https://www.thoughtco.com/what-is-biotechnology-375612.

Dosso, Mafini, and Antonio Vezzani. 2019. "Firm market valuation and intellectual property assets." *Industry and Innovation.*

Dunleavy, Kevin. 2022. *FIERCE Pharma.* April 12. Accessed April 18, 2023. https://www.fiercepharma.com/special-reports/top-20-pharma-companies-2021-revenue.

Ehie, Ike, and Kingsley Olibe. 2010. "The effect of R&D investment on firm value: An examination of US manufacturing and service industries." *ScienceDirect.*

Encyclopaedia Britannica. 2023. *Britannica.* March 28. Accessed May 08, 2023. https://www.britannica.com/technology/biotechnology.

Farid, Suzanne, Max Baron, Christos Stamatis, Wenhao Nie, and Jon Coffman. 2019. "Benchmarking biopharmaceutical process development and manufacturing cost contributions to R&D." *mAbs.*

Fortune Business Insights. 2021. "Fortune Business Insights." *Medical Devices Market Size, Share, Growth & Forecast.* Accessed 2023. https://www.fortunebusinessinsights.com/industry-reports/medical-devices-market-100085.

Gadowska, Dominika, and Agnieszka Różycka. 2016. "Innovations, R&D and knowledge transfer in the healthcare sector." *Forum Scientiae Oeconomia* (Forum).

Gaughan, Patrick. 2013. *Maximizing Corporate Value througth Mergers and Acquisitions.* New York City: Wiley.

GlobalData Healthcare. 2022. "Medical Devices and Their Environmental Impact." *MedicalDevice Network.* Accessed 2023. https://www.medicaldevice-network.com/comment/medical-devices-environmental-impact/.

Goel, Nitika , and Chaitra Ramalingegowda. 2020. "Medical Devices Industry – R&D Spend and Talent Trends." *Zinnov.* Accessed 2023. https://zinnov.com/engineering-r-and-d/medical-devices-industry-r-and-d-spend-and-talent-trends-blog/.

Herrera, Juan, and Carlos de las Heras-Rosas. 2021. *Research Trends in Open Innovation and the Role of the University.* ScienceDirect.

Hinrichs-Krapels, Diehl, Hunfeld N, and an Raaij. 2022. "Towards sustainability for medical devices and consumables: The radical and incremental challenges in the technology ecosystem." *SAGE journals.*

Huang, Osbern. 2023. "How to Increase Market Share of Pharmaceutical Products: The Role of R&D and Vision on Brand Image." *Ipsos.*

Huang, Ziyu. 2020. "Empirical Study on the Relationship Between R&D Expenditure and Financial Performance of Healthcare Industry." *ACM.*

Integer. 2023. "Medical Device Research & Development." *Integer.* Accessed 2023. https://integerholdings.co.il/en/medical-device-development-manufacturing/.

Jaisinghani , Dinesh . 2016. " Impact of R&D on profitability in the pharma sector: an empirical study from India." *Journal of Asia Business Studies.*

Kim, Woo Sung, Kunsun Park, Sang Hoon Lee, and Hongyoung Kim. 2018. "R&D Investments and Firm Value: Evidence from China." *MDPI.*

Kumar, Arun, Sandeep Kumar, and Arun Nanda. 2018. "A Review about Regulatory Status and Recent Patents of Pharmaceutical Co-Crystals." *PubMed Central.*

Lant, Theresa, and Alan Eisner. 1998. "Pharmaceutical R&D in an era of managed healthcare: using integrative teams to produce enduring competitive advantage." *Insider Science Online* . January 1. Accessed 05 09, 2023. https://www.inderscienceonline.com/doi/abs/10.1504/IJTM.1998.002616.

Lehenchuk, Serhii, Tetiana Ostapchuk, Alina Raboshuk, Iryna Vyhivska, and Viktoriia Makarovych. 2022. "The Inverted-U Relationship between R&D and Profitability: Evidence from the Slovak Medical Device Industry." *Mykolas Romeris University.*

Li Wan Po, A. 2007. "Postmarketing Surveillance." *Comprehensive Medicinal Chemistry II.*

Liao, Millie, and Kyle Cooper. 2023. *Device testing: Safety and efficacy.* ScienceDirect.

Maine.gov. 2020. "Maine.gov." *Medical Equipment and Supplies Manufacturing Market Profile.* Accessed 2023. https://www.maine.gov/decd/sites/maine.gov.decd/files/inline-files/Final%20Market%20Profile%20%20-Medical%20Equipment%20and%20Supplies%20Manufacturing%20-%20Domestic%20Trade%20Basline%20Study%20-%20State%20of%20Maine%20DECD.pdf.

McBeath, Ian, and Jeffrey Bacha. 2001. "Mergers and acquisitions:A consideration o fthedrivers and hurdles."

McKinsey. 2017. "Mastering three strategies of organic growth." *McKinsey & Company.* Accessed 2023. https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/mastering-three-strategies-of-organic-growth.

McKinsey. 2010. *Perspectives on merger integration.* Mckinsey & Company.

Mikulic, Matej. 2022. *Statista.* September 16. Accessed May 08, 2023. https://www.statista.com/statistics/270324/expenditure-on-research-and-development-by-industry-sectors/.

Ospina, Maria, Kenneth Bond, Mohammad Karkhaneh, Nina Buscemi, Donna Dryden, Vernon Barnes, Linda Carlson, Jeffery Dusek, and David Shannahoff-Khalsa. 2009. "Clinical Trials of Meditation Practices in Health Care: Characteristics and Quality." *The Journal of Alternative and Complementary Medicine.*

PAHO/WHO. 2022. *Medical Devices - PAHO/WHO.* Pan American Health Organization.

Pindado, Julio, Valdoceu De Queiroz, and Chabela De La Torre. 2010. "How Do Firm Characteristics Influence the Relationship between R&D and Firm Value?" *Wiley.*

Platonova, Katerina. 2023. *Kene. Partners.* February 17. Accessed May 11, 2021. https://kene.partners/insights/rd-tax-credits-healthcare-industry/.

Proclinical. 2022. *Proclinical.* Accessed April 09, 2023. https://www.proclinical.com/life-sciences#:~:text=The%20life%20sciences%20industry%20consists,improve%20the%20lives%20of%20organisms.

Rahman, Musfiqur , and Shuvo Howlader . 2022. "The impact of research and development expenditure on firm performance and firm value: evidence from a South Asian emerging economy." *Journal of Applied Accounting Reserach.*

Roberts, Peter. 1999. "Product innovation, product–market competition and persistent profitability in the U.S. pharmaceutical industry." *Wiley* .

Rudden, Jennifer. 2021. *Global Mergers & Acquisitions A Statista Dossier On M&A Worldwide 2019 Vs. 2020 And 2021.* Statista.

Sather, Andrew. 2021. *eB.* March 8. Accessed May 10, 2023. https://einvestingforbeginners.com/rd-spending-as-a-percentage-of-revenue-by-industry/.

Scherer. 2000. "Chapter 25 The pharmaceutical industry." In *Handbook of Health Economics*.

Segal , Troy. 2023. *Investopedia* . April 19. Accessed May 03, 2023. https://www.investopedia.com/ask/answers/033115/what-difference-between-biotechnology-company-and-pharmaceutical-company.asp.

Shegokar, Ranjita. 2016. "Chapter 2 - Preclinical testing—Understanding the basics first." *Drug Delivery Aspects.*

Shenkar, Oded, Guoyong Liang, and Rakefet Shenkar. 2021. *The last frontier of globalization: Trade and foreign direct investment in healthcare.* PubMed Central (PMC).

Siron Clinical. 2021. *Siron Clinical.* September 2. Accessed May 10, 2023. https://sironclinical.com/role-of-agencies-in-clinical-trials/.

Skrepnek, Grant, and Jeff Sarnowski . 2007. "Decision-making associated with drug candidates in the biotechnology research and development (R&D) pipeline." *Springer Link.*

Sociomed, Mater. 2012. *Comparisons of Health Care Systems in the United States, Germany and Canada.* PubMed Central (PMC).

SP Global. 2022. *Health Care Equipment & Supplies.* SP Global.

Spindler, Per . 2018. *frontiers.* 09 07. Accessed 03 11, 2023. https://www.frontiersin.org/articles/10.3389/fmed.2018.00251/full.

Statista. 2023. *Medical Devices - Worldwide.* Statista.

Statista Reserach Department. 2023. *Statista.* Feburary 21. Accessed May 2, 2023. https://www.statista.com/statistics/270233/percentage-of-global-rundd-spending-by-industry/.

STERIS. 2021. "STERIS." *The Different Types Of Medical Equipment And Hospital Supplies* . Accessed 2023. https://www.birkovaproducts.com/blog/the-different-types-of-medical-equipment-and-hospital-supplies/.

Straits Reserach. 2022. *Everything That You Need to Know About the Life Sciences Industry in 2020.* December 07. Accessed May 08, 2023. https://straitsresearch.com/blog/everything-that-you-need-to-know-about-the-life-sciences-industry-in-2020.

Tarabah. 2015. *Regulatory Affairs for Biomaterials and Medical Devices.* ScienceDirect.

Taylor, Russell, Peter Kazanzides, Gregory Fischer, and Nabil Simaan. 2020. *Biomedical Information Technology (Second Edition).* ScienceDirect.

Ulku, Hulya. 2006. "R&D, Innovation, and Economic Growth: An Empirical Analysis." *SSRN.*

Umscheid, Craig, David Margolis, and Craig Grossman. 2015. "Key Concepts of Clinical Trials: A Narrative Review ." *Taylor & Francis Online* .

Van Norman, Gail. 2016. "Drugs and Devices: Comparison of European and U.S. Approval Processes." *ScienceDirect.*

Weirens, Jeff, and Olivier May. 2017. *M&A Making the deal work.* Deloitte.

WHO. 2011. "Medical Devices." *World Health Organisation.* Accessed 2023. https://www.who.int/teams/health-product-policy-and-standards/assistive-and-medical-technology/medical-devices#:~:text=Brief%20definition%3A%20An%20article%2C%20instrument,body%20for%20some%20health%20purpose.

Within3. 2022. "A Deep Dive into the Medical Device Development Process." *Within3.* Accessed 2023. https://within3.com/guides/a-deep-dive-into-the-medical-device-development-process.

World Health Organization . 2023. *World Health Organization* . Accessed May 7, 20203. https://www.who.int/health-topics/clinical-trials#tab=tab_1.

Yu, Yabin, and Qian Xu. 2022. *Influencing Factors of Enterprise R&D Investment: Post-Subsidy, Sustainability, and Heterogeneity.* MDPI.

List of Abbreviation

EBITDA	Earnings Before Interest, Tax, Depreciation and Amortization
FDA	U.S. Food and Drug Administration
GMP	Good Manufacturing Practices
HCES	Healthcare Equipment and Supplies
HCPBLS	Healthcare Pharmaceuticals, Biotechnology and Life Sciences
HCT	Healthcare Technology
IPO	Initial Public Offering
KPI	Key Performance Indicator
M&A	Mergers & Acquisitions
NA	North America
NDA	New Drug Application
R&D	Research and Development
US	United States
USD	United States Dollar (official currency of the United States of America)
USDmm	Millions of US dollars

Appendix

Appendix A

Final Data Selection Total adj.

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical r	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical r	R&D Expenses at FY before transacti	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical r	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
01.04.2011	CPEX Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	76,57	Biotechnology	23,3	7,41	7,11	10,77	31,81%	0	1	30,52%
02.07.2011	Beckman Coulter, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	7.392,94	Health Care Equipment	3.663,4	268,6	796,6	9,28	7,33%	1	1	21,74%
03.17.2011	Theragenics Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	101,25	Health Care Equipment	82,2	1,9	11,2	9,04	2,31%	0	0	13,63%
03.29.2011	Cephalon, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	6.605,88	Pharmaceuticals	2.811,06	440,0	1.053,82	6,27	15,65%	1	1	37,49%
04.11.2011	American Medical Systems Holdings	Health Care (Primary); Health Care Equipment and Supplies (Primary)	2.825,1	Health Care Equipment	548,18	54,3	178,11	15,86	9,91%	0	1	32,49%
04.27.2011	Vital Images, Inc.	Health Care (Primary); Health Care Technology (Primary)	247,71	Health Care Technology	59,8	14,4	1,61	153,86	24,08%	0	0	2,69%
04.27.2011	Synthes Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	21.534,55	Health Care Equipment	3.973,8	198,8	1.601,7	13,44	5,00%	1	1	40,31%
05.16.2011	Orthovita Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	331,06	Health Care Equipment	94,4	4,9	2,87	115,35	5,19%	0	0	3,04%
05.17.2011	Shire Regenerative Medicine, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	738,0	Pharmaceuticals	161,36	17,0	27,24	27,09	10,54%	0	0	16,88%
06.23.2011	SeraCare Life Sciences, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	82,0	Life Sciences Tools and Service	43,48	1,28	4,41	18,59	2,94%	0	0	10,14%
07.05.2011	Immucor, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.945,07	Health Care Supplies	333,1	15,9	144,7	13,44	4,77%	0	1	43,44%
07.11.2011	Multimodal Technologies, Inc.	Health Care (Primary); Health Care Technology (Primary)	132,65	Health Care Technology	20,0	4,28	6,82	19,45	21,41%	0	1	34,10%
07.13.2011	Acelity L.P. Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	6.291,64	Health Care Equipment	1.808,2	83,7	626,7	10,04	4,63%	1	1	34,66%
07.25.2011	DNA Genotek Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	53,14	Health Care Supplies	14,86	1,8	0,139	382,30	12,09%	0	0	0,94%
07.25.2011	NEXUS Biosystems, Inc	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	85,0	Life Sciences Tools and Service	32,16	5,15	5,21	16,31	16,02%	0	0	16,20%
08.04.2011	Change Healthcare Holdings, Inc.	Health Care (Primary); Health Care Technology (Primary)	3.428,8	Health Care Technology	1.100,9	32,1	265,6	12,91	2,92%	1	1	24,13%
08.10.2011	Afexa Life Sciences Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	72,82	Pharmaceuticals	55,16	3,94	7,84	9,29	7,14%	0	0	14,21%
08.24.2011	Anchen Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	412,75	Pharmaceuticals	80,97	38,3	0,659	626,33	47,30%	0	0	0,81%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical r	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical r	R&D Expenses at FY before transacti	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical r	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
09.08.2011	Caliper Life Sciences, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	644,2	Life Sciences Tools and Service	123,7	18,0	4,2	153,38	14,55%	0	0	3,40%
09.28.2011	Graceway Pharmaceuticals, LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.129,19	Pharmaceuticals	219,53	14,8	83,33	13,55	6,74%	0	1	37,96%
11.09.2011	Synovis Life Technologies Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	312,7	Health Care Equipment	82,36	4,7	14,25	21,94	5,71%	0	0	17,30%
11.18.2011	Graceway Pharmaceuticals, LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.303,14	Pharmaceuticals	149,63	4,1	41,88	31,12	2,74%	0	1	27,99%
11.30.2011	eBioscience, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	362,47	Biotechnology	71,9	7,5	26,82	13,51	10,43%	0	1	37,30%
12.15.2011	FUJIFILM SonoSite, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	931,35	Health Care Equipment	306,0	41,1	24,4	38,17	13,43%	0	0	7,97%
12.16.2011	ISTA Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	378,95	Pharmaceuticals	160,33	31,6	2,32	163,34	19,71%	0	0	1,45%
01.04.2012	Cardiokine, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	272,79	Pharmaceuticals	54,9	13,1	37,96	7,19	23,86%	0	1	69,14%
01.24.2012	Illumina, Inc. (NasdaqGS:ILMN)	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	7.383,4	Life Sciences Tools and Service	1.055,5	174,7	324,66	22,74	16,55%	1	1	30,76%
01.31.2012	Navilyst Medical Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	374,5	Health Care Equipment	148,63	11,3	21,25	17,62	7,60%	0	0	14,30%
02.13.2012	SeraCare Life Sciences, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	82,04	Life Sciences Tools and Service	44,39	1,38	4,68	17,53	3,11%	0	0	10,54%
03.07.2012	Transcend Services, Inc.	Health Care (Primary); Health Care Technology (Primary)	331,56	Health Care Technology	125,06	4,6	26,18	12,66	3,68%	0	1	20,93%
03.12.2012	ZOLL Medical Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	2.216,18	Health Care Equipment	544,3	44,5	81,28	27,27	8,18%	0	0	14,93%
04.10.2012	eResearchTechnology, Inc.	Health Care (Primary); Health Care Technology (Primary)	423,47	Health Care Technology	193,73	8,4	41,77	10,14	4,34%	0	1	21,56%
04.30.2012	Gen-Probe Incorporated	Health Care (Primary); Health Care Equipment and Supplies (Primary)	4.115,95	Health Care Equipment	606,7	112,8	185,1	22,24	18,59%	0	1	30,51%
05.03.2012	Kensey Nash Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	393,29	Health Care Equipment	83,9	21,8	28,55	13,78	25,98%	0	1	34,03%
06.04.2012	MEDTOX Scientific Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	248,21	Life Sciences Tools and Service	114,7	2,7	14,8	16,77	2,35%	0	0	12,90%
07.16.2012	Par Pharmaceutical Companies Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.238,95	Pharmaceuticals	926,1	46,5	203,8	10,99	5,02%	0	1	22,01%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical r	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical r	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical r	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
07.30.2012	Sunquest Information Systems, Inc.	Health Care (Primary); Health Care Technology (Primary)	1.415,0	Health Care Technology	195,51	15,2	108,85	13,00	7,77%	0	1	55,67%
08.24.2012	OrthoHelix Surgical Designs, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	156,52	Health Care Equipment	22,18	1,96	2,19	71,47	8,85%	0	0	9,87%
09.03.2012	Medicis Pharmaceutical Corporation	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	3.158,4	Pharmaceuticals	759,2	97,6	182,7	17,29	12,86%	0	1	24,06%
09.12.2012	WellSky Corporation	Health Care (Primary); Health Care Technology (Primary)	193,4	Health Care Technology	64,6	5,7	13,64	14,18	8,82%	0	1	21,11%
09.17.2012	IRIS International Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	367,97	Health Care Equipment	122,01	17,7	11,17	32,94	14,51%	0	0	9,15%
11.08.2012	DUSA Pharmaceuticals Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	218,51	Biotechnology	50,16	7,5	7,2	30,35	14,95%	0	0	14,35%
01.07.2013	Epocrates, Inc.	Health Care (Primary); Health Care Technology (Primary)	307,22	Health Care Technology	111,13	20,7	5,67	54,18	18,63%	0	0	5,10%
03.20.2013	Obagi Cosmeceuticals LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	439,07	Pharmaceuticals	120,68	2,2	20,71	21,20	1,82%	0	0	17,16%
04.15.2013	Life Technologies Corporation	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	16.018,53	Life Sciences Tools and Service	3.842,31	338,8	1.199,92	13,35	8,82%	1	1	31,23%
04.29.2013	Conceptus, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.165,05	Health Care Equipment	145,41	10,2	29,75	39,16	7,01%	0	0	20,46%
05.13.2013	Theragenics Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	85,97	Health Care Equipment	78,79	1,1	9,18	9,36	1,40%	0	0	11,65%
05.27.2013	Bausch & Lomb Holdings Incorporate	Health Care (Primary); Health Care Equipment and Supplies (Primary)	8.790,3	Health Care Supplies	3.116,2	248,2	686,9	12,80	7,96%	1	1	22,04%
08.27.2013	Hi-Tech Pharmacal Co., Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	642,74	Pharmaceuticals	232,4	17,1	48,6	13,23	7,36%	0	1	20,91%
09.04.2013	Rochester Medical Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	265,03	Health Care Supplies	67,78	1,2	9,3	28,50	1,77%	0	0	13,72%
11.05.2013	Paladin Labs Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.777,9	Pharmaceuticals	260,6	8,1	87,4	20,34	3,11%	0	1	33,54%
11.07.2013	Santarus, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.154,43	Pharmaceuticals	384,5	26,9	111,6	19,30	7,00%	0	1	29,02%
11.11.2013	ViroPharma Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	3.830,6	Pharmaceuticals	440,6	71,6	60,7	63,11	16,25%	0	0	13,78%
12.11.2013	Emergent BioSolutions Canada Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	219,02	Biotechnology	115,45	18,8	6,47	33,85	16,28%	0	0	5,60%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical r	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical r	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical r	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
12.16.2013	Solta Medical, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	279,22	Health Care Equipment	151,06	20,9	2,46	113,50	13,84%	0	0	1,63%
12.31.2013	Patient Safety Technologies, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	112,57	Health Care Equipment	20,03	0,64	3,06	36,79	3,21%	0	0	15,28%
01.08.2014	Aptalis Holdings Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.900,0	Pharmaceuticals	700,18	76,8	275,6	10,52	10,97%	0	1	39,36%
02.03.2014	ArthroCare Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.453,41	Health Care Equipment	377,99	34,0	85,05	17,09	8,99%	0	1	22,50%
02.18.2014	Forest Laboratories, LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	25.152,92	Pharmaceuticals	3.646,9	759,7	672,0	37,43	20,83%	1	0	18,43%
04.07.2014	Mallinckrodt ARD Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	5.636,39	Pharmaceuticals	985,2	78,6	570,7	9,88	7,98%	0	1	57,93%
04.22.2014	Allergan, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	63.257,09	Pharmaceuticals	6.478,3	1.041,2	2.129,3	29,71	16,07%	1	1	32,87%
06.17.2014	ProteinSimple, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	300,0	Life Sciences Tools and Service	53,84	6,8	6,88	43,60	12,63%	0	0	12,78%
06.26.2014	Ulthera, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	600,0	Health Care Equipment	91,08	7,9	13,58	44,18	8,67%	0	0	14,91%
07.01.2014	Trans Ova Genetics LC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	110,0	Biotechnology	67,8	1,6	8,04	13,68	2,36%	0	0	11,86%
09.15.2014	Alere Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	8.081,59	Health Care Supplies	2.577,0	135,0	505,7	15,98	5,24%	1	0	19,62%
09.22.2014	Sigma-Aldrich Corporation	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	17.333,15	Life Sciences Tools and Service	2.785,0	65,0	847,0	20,46	2,33%	1	1	30,41%
10.05.2014	CareFusion Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	14.191,24	Health Care Equipment	3.842,0	190,0	861,0	16,48	4,95%	1	1	22,41%
10.09.2014	Tower Holdings, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	840,86	Pharmaceuticals	274,03	17,0	57,41	14,65	6,20%	0	1	20,95%
11.17.2014	Allergan, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	72.911,33	Pharmaceuticals	7.226,4	1.188,5	2.474,3	29,47	16,45%	1	1	34,24%
12.02.2014	Ariosa Diagnostics, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	697,21	Biotechnology	63,24	14,1	4,29	162,52	22,30%	0	0	6,78%
12.08.2014	Cubist Pharmaceuticals LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	10.175,26	Biotechnology	1.164,53	416,0	203,55	49,99	35,72%	1	0	17,48%
12.17.2014	Volcano Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.363,51	Health Care Equipment	395,08	60,1	15,74	86,63	15,21%	0	0	3,98%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical r	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical r	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical r	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
01.11.2015	NPS Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	5.298,71	Biotechnology	224,06	90,1	8,39	631,55	40,21%	0	0	3,74%
02.05.2015	Hospira Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	17.743,18	Pharmaceuticals	4.463,7	344,3	729,9	24,31	7,71%	1	0	16,35%
02.22.2015	Salix Pharmaceuticals Ltd.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	15.337,23	Pharmaceuticals	1.133,54	170,3	154,77	99,10	15,02%	1	0	13,65%
03.30.2015	Hyperion Therapeutics, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.110,79	Biotechnology	113,58	20,7	36,32	30,58	18,23%	0	1	31,98%
04.21.2015	Viatris Inc. (NasdaqGS:VTRS)	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	39.678,64	Pharmaceuticals	7.719,6	564,1	2.145,1	18,50	7,31%	1	1	27,79%
05.18.2015	Par Pharmaceutical Holdings, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	10.388,41	Pharmaceuticals	1.378,78	107,9	470,97	22,06	7,83%	1	1	34,16%
06.28.2015	TEI Biosciences Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	218,16	Biotechnology	64,43	2,0	20,65	10,56	3,10%	0	1	32,05%
07.07.2015	Assertio Holdings, Inc. (NasdaqCM:A	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.814,78	Pharmaceuticals	390,4	7,1	252,6	11,14	1,82%	0	1	64,70%
07.22.2015	Thoratec LLC	Health Care (Primary); Health Care Equipment and Supplies (Primary)	3.681,83	Health Care Equipment	483,8	110,7	70,48	52,24	22,88%	0	0	14,57%
08.04.2015	Baxalta Incorporated	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	35.860,97	Biotechnology	5.952,0	569,0	2.153,0	16,66	9,56%	1	1	36,17%
08.06.2015	Merge Healthcare Incorporated	Health Care (Primary); Health Care Technology (Primary)	1.022,72	Health Care Technology	227,59	30,4	39,47	25,91	13,36%	0	0	17,34%
09.02.2015	Synergetics USA, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	196,75	Health Care Supplies	74,5	4,3	10,0	19,68	5,77%	0	0	13,42%
09.15.2015	Sirona Dental Systems Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	5.618,66	Health Care Equipment	1.161,3	54,8	312,2	18,00	4,72%	1	1	26,88%
10.30.2015	HealthFusion Holdings, Inc.	Health Care (Primary); Health Care Technology (Primary)	201,09	Health Care Technology	24,98	0,97	4,42	45,50	3,89%	0	0	17,69%
11.02.2015	MedAssets, Inc.	Health Care (Primary); Health Care Technology (Primary)	2.775,22	Health Care Technology	764,22	33,0	217,76	12,74	4,32%	0	1	28,49%
01.05.2016	NuVasive Specialized Orthopedics, I	Health Care (Primary); Health Care Equipment and Supplies (Primary)	410,0	Health Care Equipment	40,2	8,82	0,351	1168,09	21,95%	0	0	0,87%
01.08.2016	Affymetrix Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.466,59	Life Sciences Tools and Service	359,79	52,9	44,45	32,99	14,70%	0	0	12,35%
01.11.2016	Baxalta Incorporated	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	36.219,87	Biotechnology	6.148,0	699,0	2.105,0	17,21	11,37%	1	1	34,24%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical ri	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical ri	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical ri	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
02.01.2016	Alere Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	8.236,35	Health Care Supplies	2.376,3	108,1	363,2	22,68	4,55%	1	0	15,28%
02.22.2016	Brightree LLC	Health Care (Primary); Health Care Technology (Primary)	800,0	Health Care Technology	113,2	14,5	42,26	18,93	12,81%	0	1	37,33%
03.24.2016	Magellan Biosciences, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	66,04	Health Care Equipment	16,47	1,33	3,44	19,20	8,05%	0	0	20,89%
04.28.2016	St. Jude Medical, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	30.336,55	Health Care Equipment	5.541,0	676,0	1.434,0	21,16	12,20%	1	1	25,88%
07.11.2016	Sagent Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	740,67	Pharmaceuticals	297,8	29,1	12,5	59,25	9,77%	0	0	4,20%
08.22.2016	QHR Corporation	Health Care (Primary); Health Care Technology (Primary)	130,05	Health Care Technology	23,55	2,33	2,07	62,83	9,91%	0	0	8,79%
09.02.2016	Lifeline Scientific, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	81,42	Health Care Supplies	42,55	1,01	8,91	9,14	2,38%	0	1	20,94%
12.02.2016	Vascular Solutions, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.007,2	Health Care Supplies	166,6	28,8	27,9	36,10	17,29%	0	0	16,75%
02.13.2017	ZELTIQ Aesthetics, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	2.471,35	Health Care Equipment	354,2	25,5	16,85	146,67	7,20%	0	0	4,76%
02.14.2017	Cynosure, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.641,88	Health Care Equipment	433,53	29,0	57,2	28,70	6,69%	0	0	13,19%
04.23.2017	C. R. Bard, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	25.785,16	Health Care Equipment	3.714,0	292,8	1.149,2	22,44	7,88%	1	1	30,94%
04.24.2017	Akorn Operating Company LLC	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	5.097,76	Pharmaceuticals	1.116,8	38,8	459,4	11,10	3,47%	1	1	41,14%
05.01.2017	Span-America Medical Systems, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	81,0	Health Care Supplies	61,77	1,1	7,28	11,13	1,78%	0	0	11,79%
06.06.2017	Curia, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.628,71	Life Sciences Tools and Service	680,8	16,2	73,3	22,22	2,38%	0	0	10,77%
08.07.2017	NxStage Medical, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	2.076,1	Health Care Equipment	366,4	31,0	14,7	141,23	8,46%	0	0	4,01%
10.16.2017	Epicore BioNetworks Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	28,79	Biotechnology	11,83	0,61	2,93	9,83	5,11%	0	1	24,77%
10.23.2017	Exactech, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	770,13	Health Care Equipment	264,45	23,2	42,99	17,91	8,77%	0	0	16,26%
11.27.2017	MGC Diagnostics Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	50,34	Health Care Equipment	40,46	2,78	1,79	28,12	6,87%	0	0	4,42%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical ri	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical ri	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical ri	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
12.26.2017	Sucampo Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	1.220,64	Pharmaceuticals	250,47	5,0	107,24	11,38	2,00%	0	1	42,82%
03.12.2018	Cogentix Medical, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	238,09	Health Care Equipment	56,3	4,7	2,4	99,20	8,35%	0	0	4,26%
04.10.2018	Analogic Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.049,89	Health Care Equipment	467,6	62,5	42,7	24,59	13,37%	0	0	9,13%
05.16.2018	Abaxis, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	1.994,63	Health Care Equipment	244,7	23,3	46,41	42,98	9,52%	0	0	18,97%
07.03.2018	Juniper Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	143,07	Pharmaceuticals	55,61	5,9	4,19	34,15	10,61%	0	0	7,53%
11.12.2018	athenahealth, Inc.	Health Care (Primary); Health Care Technology (Primary)	5.941,9	Health Care Technology	1.311,4	187,9	264,8	22,44	14,33%	1	0	20,19%
11.19.2018	DJO Global, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	3.150,0	Health Care Equipment	1.186,21	35,4	187,26	16,82	2,98%	1	0	15,79%
03.12.2019	Osiris Therapeutics, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	660,49	Biotechnology	142,82	6,8	10,33	63,94	4,76%	0	0	7,23%
06.12.2019	Medidata Solutions, Inc.	Health Care (Primary); Health Care Technology (Primary)	6.028,46	Health Care Technology	684,6	179,4	78,1	77,19	26,21%	0	0	11,41%
08.07.2019	Cambrex Corporation	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.604,54	Life Sciences Tools and Service	618,1	14,2	160,1	16,27	2,30%	0	1	25,90%
05.11.2020	TearLab Corporation	Health Care (Primary); Health Care Equipment and Supplies (Primary)	39,35	Health Care Supplies	22,06	3,86	0,77	51,30	17,49%	0	0	3,48%
05.27.2020	Apteryx Imaging Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	30,31	Health Care Equipment	15,61	1,49	0,596	50,86	9,51%	0	0	3,82%
08.02.2020	Varian Medical Systems, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	17.159,96	Health Care Equipment	3.168,2	280,6	520,4	32,97	8,86%	1	0	16,43%
10.19.2020	BioSpecifics Technologies Corp.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	658,34	Biotechnology	36,59	0,6	22,26	29,58	1,63%	0	1	60,84%
12.12.2020	Alexion Pharmaceuticals, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	43.364,73	Biotechnology	6.069,9	1.002,9	3.189,7	13,60	16,52%	1	1	52,55%
12.16.2020	ACell, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	405,4	Health Care Equipment	100,33	7,4	0,878	461,73	7,38%	0	0	0,88%
01.12.2021	Cantel Medical LLC	Health Care (Primary); Health Care Equipment and Supplies (Primary)	4.912,49	Health Care Equipment	1.016,0	32,4	164,4	29,88	3,19%	0	0	16,18%
04.11.2021	Luminex Corporation	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	2.137,56	Life Sciences Tools and Service	437,7	55,6	85,6	24,97	12,70%	0	0	19,56%

All Transactions Announced Date	Target/Issuer	Industry Classifications [Target/Issuer]	Total Transaction Value ($USDmm, Historical ri	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical ri	R&D Expenses at FY before transact	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical ri	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenu	Company Size (small=0, large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
08.03.2021	Translate Bio, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	3.098,25	Biotechnology	225,1	66,8	45,1	68,70	29,68%	0	0	20,04%
08.19.2021	Inovalon Holdings, Inc.	Health Care (Primary); Health Care Technology (Primary)	7.433,26	Health Care Technology	749,6	37,1	219,6	33,85	4,95%	0	1	29,30%
09.02.2021	Hill-Rom Holdings, Inc.	Health Care (Primary); Health Care Equipment and Supplies (Primary)	12.268,77	Health Care Equipment	3.018,7	144,9	645,3	19,01	4,80%	1	1	21,38%
09.14.2021	Agena Bioscience, Inc.	Health Care (Primary); Pharmaceuticals, Biotechnology and Life Sciences	300,79	Life Sciences Tools and Service	87,36	10,6	26,0	11,57	12,13%	0	1	29,76%
12.20.2021	Cerner Corporation	Health Care (Primary); Health Care Technology (Primary)	30.201,21	Health Care Technology	5.764,8	782,3	1.545,1	19,55	13,57%	1	1	26,80%
12.23.2021	Ortho Clinical Diagnostics Holdings p	Health Care (Primary); Health Care Equipment and Supplies (Primary)	8.424,11	Health Care Equipment	2.042,8	126,2	458,4	18,38	6,18%	1	1	22,44%

Source: Own representation based on S&P Capital IQ

Appendix B

Regression Analysis Total adj.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,4855
R Square	0,2357
Adjusted R S	0,2178
Standard Err	119,0629
Observations	132,0000

ANOVA

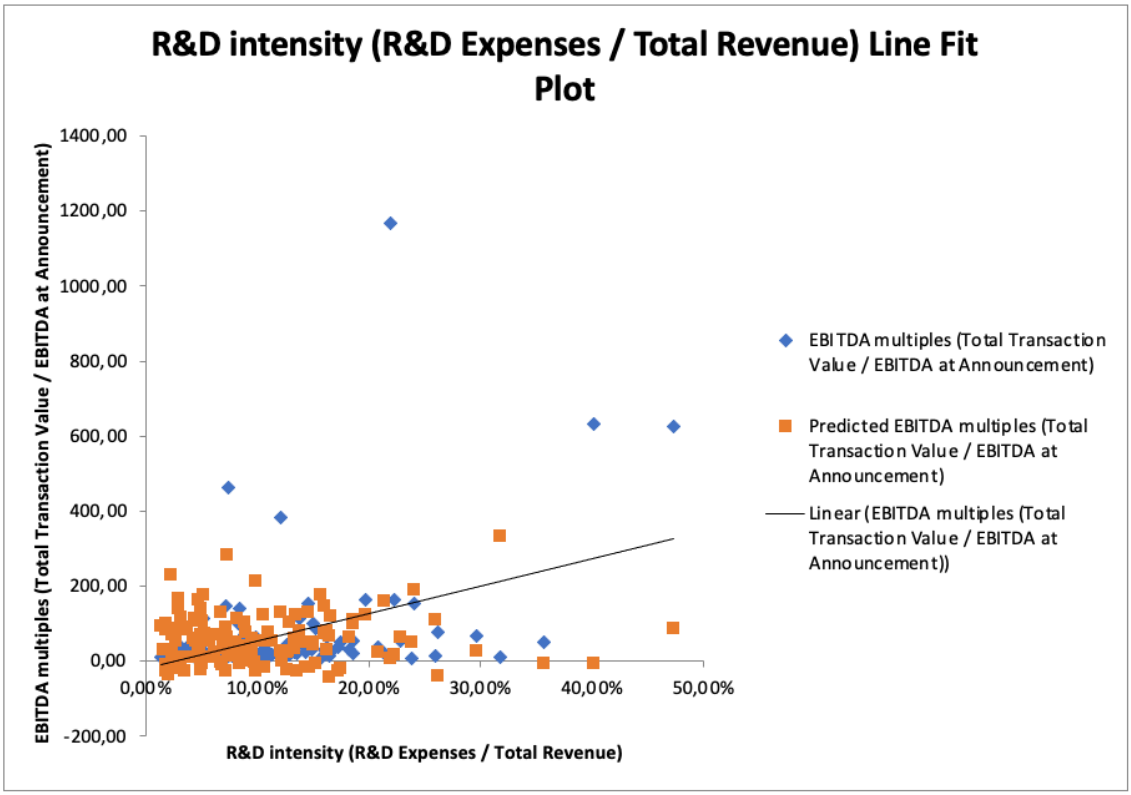
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3,0000	559579,3845	186526,4615	13,1579	0,00000015
Residual	128,0000	1814523,8717	14175,9677		
Total	131,0000	2374103,2562			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	14,1466	21,0213	0,6730	0,5022	-27,4476	55,7409	-27,4476	55,7409
R&D intensit	671,4155	131,3095	5,1132	0,0000	411,5973	931,2336	411,5973	931,2336
Company Siz	-22,9232	25,3131	-0,9056	0,3669	-73,0095	27,1631	-73,0095	27,1631
EBITDA Marg	-49,3826	22,3444	-2,2101	0,0289	-93,5948	-5,1704	-93,5948	-5,1704

Source: Own representation

Appendix C

Line Fit Plot Total adj.



Source: Own representation

Appendix D

Final Selection HCPBLS adj.

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical rate)	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical rate)	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=1	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revenue at Announcement)
01.04.2011	CPEX Pharmaceuticals, Inc.	76,57	Biotechnology	23,3	7,41	7,11	10,77	31,81%	0	1	30,52%
03.29.2011	Cephalon, Inc.	6.605,88	Pharmaceuticals	2.811,06	440,0	1.053,82	6,27	15,65%	1	1	37,49%
05.17.2011	Shire Regenerative Medicine, Inc.	738,0	Pharmaceuticals	161,36	17,0	27,24	27,09	10,54%	0	0	16,88%
06.23.2011	SeraCare Life Sciences, Inc.	82,0	Life Sciences Tools and Se	43,48	1,28	4,41	18,59	2,94%	0	0	10,14%
07.25.2011	NEXUS Biosystems, Inc	85,0	Life Sciences Tools and Se	32,16	5,15	5,21	16,31	16,02%	0	0	16,20%
08.10.2011	Afexa Life Sciences Inc.	72,82	Pharmaceuticals	55,16	3,94	7,84	9,29	7,14%	0	0	14,21%
08.24.2011	Anchen Pharmaceuticals, Inc.	412,75	Pharmaceuticals	80,97	38,3	0,659	626,33	47,30%	0	0	0,81%
09.08.2011	Caliper Life Sciences, Inc.	644,2	Life Sciences Tools and Se	123,7	18,0	4,2	153,38	14,55%	0	0	3,40%
09.28.2011	Graceway Pharmaceuticals, LLC	1.129,19	Pharmaceuticals	219,53	14,8	83,33	13,55	6,74%	0	1	37,96%
11.18.2011	Graceway Pharmaceuticals, LLC	1.303,14	Pharmaceuticals	149,63	4,1	41,88	31,12	2,74%	0	1	27,99%
11.30.2011	eBioscience, Inc.	362,47	Biotechnology	71,9	7,5	26,82	13,51	10,43%	0	1	37,30%
12.16.2011	ISTA Pharmaceuticals, Inc.	378,95	Pharmaceuticals	160,33	31,6	2,32	163,34	19,71%	0	0	1,45%
01.04.2012	Cardiokine, Inc.	272,79	Pharmaceuticals	54,9	13,1	37,96	7,19	23,86%	0	1	69,14%
01.24.2012	Illumina, Inc. (NasdaqGS:ILMN)	7.383,4	Life Sciences Tools and Se	1.055,5	174,7	324,66	22,74	16,55%	1	1	30,76%
02.13.2012	SeraCare Life Sciences, Inc.	82,04	Life Sciences Tools and Se	44,39	1,38	4,68	17,53	3,11%	0	0	10,54%
06.04.2012	MEDTOX Scientific Inc.	248,21	Life Sciences Tools and Se	114,7	2,7	14,8	16,77	2,35%	0	0	12,90%
07.16.2012	Par Pharmaceutical Companies Inc.	2.238,95	Pharmaceuticals	926,1	46,5	203,8	10,99	5,02%	0	1	22,01%
09.03.2012	Medicis Pharmaceutical Corporation	3.158,4	Pharmaceuticals	759,2	97,6	182,7	17,29	12,86%	0	1	24,06%
11.08.2012	DUSA Pharmaceuticals Inc.	218,51	Biotechnology	50,16	7,5	7,2	30,35	14,95%	0	0	14,35%
03.20.2013	Obagi Cosmeceuticals LLC	439,07	Pharmaceuticals	120,68	2,2	20,71	21,20	1,82%	0	0	17,16%

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical rate)	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical rate)	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=1	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revenue at Announcement)
04.15.2013	Life Technologies Corporation	16.018,53	Life Sciences Tools and Se	3.842,31	338,8	1.199,92	13,35	8,82%	1	1	31,23%
08.27.2013	Hi-Tech Pharmacal Co., Inc.	642,74	Pharmaceuticals	232,4	17,1	48,6	13,23	7,36%	0	1	20,91%
11.05.2013	Paladin Labs Inc.	1.777,9	Pharmaceuticals	260,6	8,1	87,4	20,34	3,11%	0	1	33,54%
11.07.2013	Santarus, Inc.	2.154,43	Pharmaceuticals	384,5	26,9	111,6	19,30	7,00%	0	1	29,02%
11.11.2013	ViroPharma Inc.	3.830,6	Pharmaceuticals	440,6	71,6	60,7	63,11	16,25%	0	0	13,78%
12.11.2013	Emergent BioSolutions Canada Inc.	219,02	Biotechnology	115,45	18,8	6,47	33,85	16,28%	0	0	5,60%
01.08.2014	Aptalis Holdings Inc.	2.900,0	Pharmaceuticals	700,18	76,8	275,6	10,52	10,97%	0	1	39,36%
02.18.2014	Forest Laboratories, LLC	25.152,92	Pharmaceuticals	3.646,9	759,7	672,0	37,43	20,83%	1	0	18,43%
04.07.2014	Mallinckrodt ARD Inc.	5.636,39	Pharmaceuticals	985,2	78,6	570,7	9,88	7,98%	0	1	57,93%
04.22.2014	Allergan, Inc.	63.257,09	Pharmaceuticals	6.478,3	1.041,2	2.129,3	29,71	16,07%	1	1	32,87%
06.17.2014	ProteinSimple, Inc.	300,0	Life Sciences Tools and Se	53,84	6,8	6,88	43,60	12,63%	0	0	12,78%
07.01.2014	Trans Ova Genetics LC	110,0	Biotechnology	67,8	1,6	8,04	13,68	2,36%	0	0	11,86%
09.22.2014	Sigma-Aldrich Corporation	17.333,15	Life Sciences Tools and Se	2.785,0	65,0	847,0	20,46	2,33%	1	1	30,41%
10.09.2014	Tower Holdings, Inc.	840,86	Pharmaceuticals	274,03	17,0	57,41	14,65	6,20%	0	1	20,95%
11.17.2014	Allergan, Inc.	72.911,33	Pharmaceuticals	7.226,4	1.188,5	2.474,3	29,47	16,45%	1	1	34,24%
12.02.2014	Ariosa Diagnostics, Inc.	697,21	Biotechnology	63,24	14,1	4,29	162,52	22,30%	0	0	6,78%
12.08.2014	Cubist Pharmaceuticals LLC	10.175,26	Biotechnology	1.164,53	416,0	203,55	49,99	35,72%	1	0	17,48%
01.11.2015	NPS Pharmaceuticals, Inc.	5.298,71	Biotechnology	224,06	90,1	8,39	631,55	40,21%	0	0	3,74%
02.05.2015	Hospira Inc.	17.743,18	Pharmaceuticals	4.463,7	344,3	729,9	24,31	7,71%	1	0	16,35%
02.22.2015	Salix Pharmaceuticals Ltd.	15.337,23	Pharmaceuticals	1.133,54	170,3	154,77	99,10	15,02%	1	0	13,65%

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical ra	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical ra	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=1)	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revenue at Announcement)
03.30.2015	Hyperion Therapeutics, Inc.	1.110,79	Biotechnology	113,58	20,7	36,32	30,58	18,23%	0	1	31,98%
04.21.2015	Viatris Inc. (NasdaqGS:VTRS)	39.678,64	Pharmaceuticals	7.719,6	564,1	2.145,1	18,50	7,31%	1	1	27,79%
05.18.2015	Par Pharmaceutical Holdings, Inc.	10.388,41	Pharmaceuticals	1.378,78	107,9	470,97	22,06	7,83%	1	1	34,16%
06.28.2015	TEI Biosciences Inc.	218,16	Biotechnology	64,43	2,0	20,65	10,56	3,10%	0	1	32,05%
07.07.2015	Assertio Holdings, Inc. (NasdaqCM:A	2.814,78	Pharmaceuticals	390,4	7,1	252,6	11,14	1,82%	0	1	64,70%
08.04.2015	Baxalta Incorporated	35.860,97	Biotechnology	5.952,0	569,0	2.153,0	16,66	9,56%	1	1	36,17%
01.08.2016	Affymetrix Inc.	1.466,59	Life Sciences Tools and S	359,79	52,9	44,45	32,99	14,70%	0	0	12,35%
01.11.2016	Baxalta Incorporated	36.219,87	Biotechnology	6.148,0	699,0	2.105,0	17,21	11,37%	1	1	34,24%
07.11.2016	Sagent Pharmaceuticals, Inc.	740,67	Pharmaceuticals	297,8	29,1	12,5	59,25	9,77%	0	0	4,20%
04.24.2017	Akorn Operating Company LLC	5.097,76	Pharmaceuticals	1.116,8	38,8	459,4	11,10	3,47%	1	1	41,14%
06.06.2017	Curia, Inc.	1.628,71	Life Sciences Tools and S	680,8	16,2	73,3	22,22	2,38%	0	0	10,77%
10.16.2017	Epicore BioNetworks Inc.	28,79	Biotechnology	11,83	0,61	2,93	9,83	5,11%	0	1	24,77%
12.26.2017	Sucampo Pharmaceuticals, Inc.	1.220,64	Pharmaceuticals	250,47	5,0	107,24	11,38	2,00%	0	1	42,82%
07.03.2018	Juniper Pharmaceuticals, Inc.	143,07	Pharmaceuticals	55,61	5,9	4,19	34,15	10,61%	0	0	7,53%
03.12.2019	Osiris Therapeutics, Inc.	660,49	Biotechnology	142,82	6,8	10,33	63,94	4,76%	0	0	7,23%
08.07.2019	Cambrex Corporation	2.604,54	Life Sciences Tools and S	618,1	14,2	160,1	16,27	2,30%	0	1	25,90%
10.19.2020	BioSpecifics Technologies Corp.	658,34	Biotechnology	36,59	0,6	22,26	29,58	1,63%	0	1	60,84%
12.12.2020	Alexion Pharmaceuticals, Inc.	43.364,73	Biotechnology	6.069,9	1.002,9	3.189,7	13,60	16,52%	1	1	52,55%
04.11.2021	Luminex Corporation	2.137,56	Life Sciences Tools and S	437,7	55,6	85,6	24,97	12,70%	0	0	19,56%
08.03.2021	Translate Bio, Inc.	3.098,25	Biotechnology	225,1	66,8	45,1	68,70	29,68%	0	0	20,04%
09.14.2021	Agena Bioscience, Inc.	300,79	Life Sciences Tools and S	87,36	10,6	26,0	11,57	12,13%	0	1	29,76%

Source: Own representation

Appendix E

Regression HCPBLS adj.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,70219884
R Square	0,4930832
Adjusted R S	0,46640337
Standard Err	82,2348136
Observations	61

ANOVA

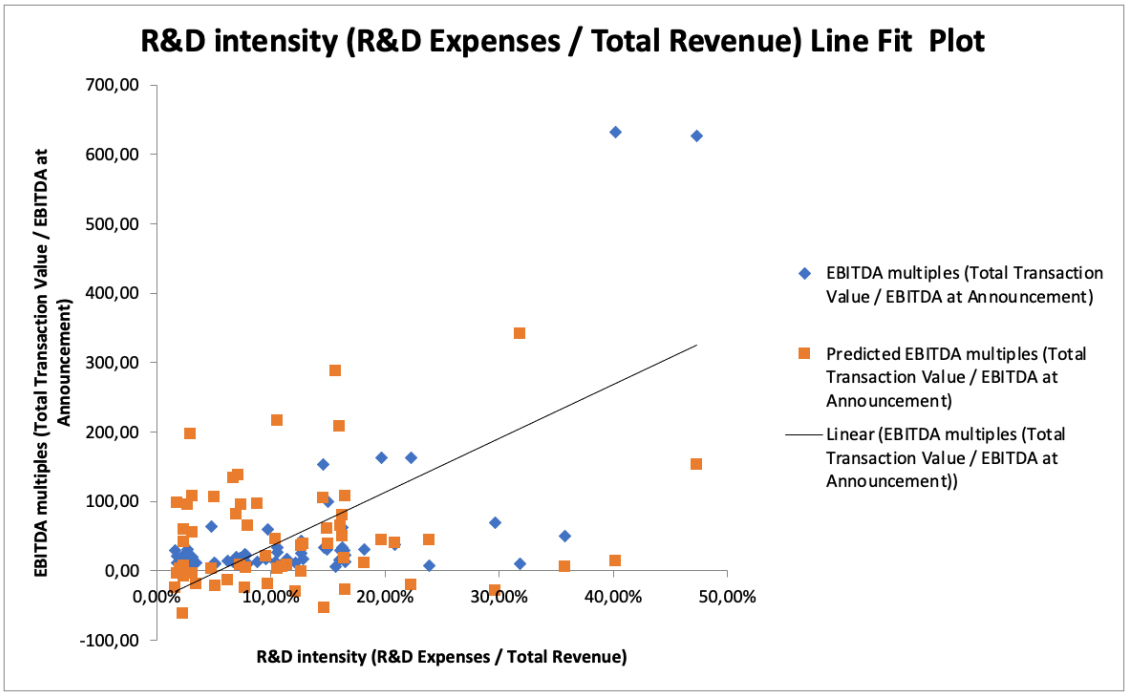
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	374946,936	124982,312	18,4814963	1,6985E-08
Residual	57	385466,18	6762,56457		
Total	60	760413,116			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-14,172437	22,9244975	-0,6182224	0,53889133	-60,077951	31,7330775	-60,077951	31,7330775
R&D intensit	751,202677	115,139626	6,52427583	1,9656E-08	520,639554	981,7658	520,639554	981,7658
Company Siz	-37,589134	25,0316274	-1,5016656	0,13870334	-87,714104	12,5358349	-87,714104	12,5358349
EBITDA Marg	-27,217011	22,8994039	-1,1885467	0,23954649	-73,072276	18,6382547	-73,072276	18,6382547

Source: Own representation

Appendix F

Line Fit Plot HCPBLS adj.



Source: Own representation

Appendix G

Final Selection HCES adj.

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical rate)	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical rate)	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
02.07.2011	Beckman Coulter, Inc.	7.392,94	Health Care Equipment	3.663,4	268,6	796,6	9,28	7,33%	1	1	21,74%
03.17.2011	Theragenics Corporation	101,25	Health Care Equipment	82,2	1,9	11,2	9,04	2,31%	0	0	13,63%
04.11.2011	American Medical Systems Holdings Inc.	2.825,1	Health Care Equipment	548,18	54,3	178,11	15,86	9,91%	0	1	32,49%
04.27.2011	Synthes Inc.	21.534,55	Health Care Equipment	3.973,8	198,8	1.601,7	13,44	5,00%	1	1	40,31%
05.16.2011	Orthovita Inc.	331,06	Health Care Equipment	94,4	4,9	2,87	115,35	5,19%	0	0	3,04%
07.05.2011	Immucor, Inc.	1.945,07	Health Care Supplies	333,1	15,9	144,7	13,44	4,77%	0	1	43,44%
07.13.2011	Acelity L.P. Inc.	6.291,64	Health Care Equipment	1.808,2	83,7	626,7	10,04	4,63%	1	1	34,66%
07.25.2011	DNA Genotek Inc.	53,14	Health Care Supplies	14,86	1,8	0,139	382,30	12,09%	0	0	0,94%
11.09.2011	Synovis Life Technologies Inc.	312,7	Health Care Equipment	82,36	4,7	14,25	21,94	5,71%	0	0	17,30%
12.15.2011	FUJIFILM SonoSite, Inc.	931,35	Health Care Equipment	306,0	41,1	24,4	38,17	13,43%	0	0	7,97%
01.31.2012	Navilyst Medical Inc.	374,5	Health Care Equipment	148,63	11,3	21,25	17,62	7,60%	0	0	14,30%
03.12.2012	ZOLL Medical Corporation	2.216,18	Health Care Equipment	544,3	44,5	81,28	27,27	8,18%	0	0	14,93%
04.30.2012	Gen-Probe Incorporated	4.115,95	Health Care Equipment	606,7	112,8	185,1	22,24	18,59%	0	1	30,51%
05.03.2012	Kensey Nash Corporation	393,29	Health Care Equipment	83,9	21,8	28,55	13,78	25,98%	0	1	34,03%
08.24.2012	OrthoHelix Surgical Designs, Inc.	156,52	Health Care Equipment	22,18	1,96	2,19	71,47	8,85%	0	0	9,87%
09.17.2012	IRIS International Inc.	367,97	Health Care Equipment	122,01	17,7	11,17	32,94	14,51%	0	0	9,15%
04.29.2013	Conceptus, Inc.	1.165,05	Health Care Equipment	145,41	10,2	29,75	39,16	7,01%	0	0	20,46%
05.13.2013	Theragenics Corporation	85,97	Health Care Equipment	78,79	1,1	9,18	9,36	1,40%	0	0	11,65%
05.27.2013	Bausch & Lomb Holdings Incorporated	8.790,3	Health Care Supplies	3.116,2	248,2	686,9	12,80	7,96%	1	1	22,04%
09.04.2013	Rochester Medical Corporation	265,03	Health Care Supplies	67,78	1,2	9,3	28,50	1,77%	0	0	13,72%
12.16.2013	Solta Medical, Inc.	279,22	Health Care Equipment	151,06	20,9	2,46	113,50	13,84%	0	0	1,63%
12.31.2013	Patient Safety Technologies, Inc.	112,57	Health Care Equipment	20,03	0,64	3,06	36,79	3,21%	0	0	15,28%

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical rate)	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical rate)	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
02.03.2014	ArthroCare Corporation	1.453,41	Health Care Equipment	377,99	34,0	85,05	17,09	8,99%	0	1	22,50%
06.26.2014	Ulthera, Inc.	600,0	Health Care Equipment	91,08	7,9	13,58	44,18	8,67%	0	0	14,91%
09.15.2014	Alere Inc.	8.081,59	Health Care Supplies	2.577,0	135,0	505,7	15,98	5,24%	1	0	19,62%
10.05.2014	CareFusion Corporation	14.191,24	Health Care Equipment	3.842,0	190,0	861,0	16,48	4,95%	1	1	22,41%
12.17.2014	Volcano Corporation	1.363,51	Health Care Equipment	395,08	60,1	15,74	86,63	15,21%	0	0	3,98%
07.22.2015	Thoratec LLC	3.681,83	Health Care Equipment	483,8	110,7	70,48	52,24	22,88%	0	0	14,57%
09.02.2015	Synergetics USA, Inc.	196,75	Health Care Supplies	74,5	4,3	10,0	19,68	5,77%	0	0	13,42%
09.15.2015	Sirona Dental Systems Inc.	5.618,66	Health Care Equipment	1.161,3	54,8	312,2	18,00	4,72%	1	1	26,88%
01.05.2016	NuVasive Specialized Orthopedics, Inc.	410,0	Health Care Equipment	40,2	8,82	0,351	1168,09	21,95%	0	0	0,87%
02.01.2016	Alere Inc.	8.236,35	Health Care Supplies	2.376,3	108,1	363,2	22,68	4,55%	1	0	15,28%
03.24.2016	Magellan Biosciences, Inc.	66,04	Health Care Equipment	16,47	1,33	3,44	19,20	8,05%	0	0	20,89%
04.28.2016	St. Jude Medical, Inc.	30.336,55	Health Care Equipment	5.541,0	676,0	1.434,0	21,16	12,20%	1	1	25,88%
09.02.2016	Lifeline Scientific, Inc.	81,42	Health Care Supplies	42,55	1,01	8,91	9,14	2,38%	0	1	20,94%
12.02.2016	Vascular Solutions, Inc.	1.007,2	Health Care Supplies	166,6	28,8	27,9	36,10	17,29%	0	0	16,75%
02.13.2017	ZELTIQ Aesthetics, Inc.	2.471,35	Health Care Equipment	354,2	25,5	16,85	146,67	7,20%	0	0	4,76%
02.14.2017	Cynosure, Inc.	1.641,88	Health Care Equipment	433,53	29,0	57,2	28,70	6,69%	0	0	13,19%
04.23.2017	C. R. Bard, Inc.	25.785,16	Health Care Equipment	3.714,0	292,8	1.149,2	22,44	7,88%	1	1	30,94%
05.01.2017	Span-America Medical Systems, Inc.	81,0	Health Care Supplies	61,77	1,1	7,28	11,13	1,78%	0	0	11,79%
08.07.2017	NxStage Medical, Inc.	2.076,1	Health Care Equipment	366,4	31,0	14,7	141,23	8,46%	0	0	4,01%
10.23.2017	Exactech, Inc.	770,13	Health Care Equipment	264,45	23,2	42,99	17,91	8,77%	0	0	16,26%
11.27.2017	MGC Diagnostics Corporation	50,34	Health Care Equipment	40,46	2,78	1,79	28,12	6,87%	0	0	4,42%
03.12.2018	Cogentix Medical, Inc.	238,09	Health Care Equipment	56,3	4,7	2,4	99,20	8,35%	0	0	4,26%

All Transactions Announced Date	Target/Issuer	Total Transaction Value ($USDmm, Historical rate)	Primary Industry [Target/Issuer]	Target/Issuer LTM Financials - Total Revenue (at Announcement) ($USDmm, Historical rate)	R&D Expenses at FY before transaction	Target/Issuer LTM Financials - EBITDA (at Announcement) ($USDmm, Historical rate)	EBITDA multiples (Total Transaction Value / EBITDA at Announcement)	R&D intensity (R&D Expenses / Total Revenue)	Company Size (small=0 large=	EBITDA Margin (high =1, moderate=0)	EBITDA Margin (EBITDA/ Revene at Announcement)
04.10.2018	Analogic Corporation	1.049,89	Health Care Equipment	467,6	62,5	42,7	24,59	13,37%	0	0	9,13%
05.16.2018	Abaxis, Inc.	1.994,63	Health Care Equipment	244,7	23,3	46,41	42,98	9,52%	0	0	18,97%
11.19.2018	DJO Global, Inc.	3.150,0	Health Care Equipment	1.186,21	35,4	187,26	16,82	2,98%	1	0	15,79%
05.11.2020	TearLab Corporation	39,35	Health Care Supplies	22,06	3,86	0,77	51,30	17,49%	0	0	3,48%
05.27.2020	Apteryx Imaging Inc.	30,31	Health Care Equipment	15,61	1,49	0,596	50,86	9,51%	0	0	3,82%
08.02.2020	Varian Medical Systems, Inc.	17.159,96	Health Care Equipment	3.168,2	280,6	520,4	32,97	8,86%	1	0	16,43%
12.16.2020	ACell, Inc.	405,4	Health Care Equipment	100,33	7,4	0,878	461,73	7,38%	0	0	0,88%
01.12.2021	Cantel Medical LLC	4.912,49	Health Care Equipment	1.016,0	32,4	164,4	29,88	3,19%	0	0	16,18%
09.02.2021	Hill-Rom Holdings, Inc.	12.268,77	Health Care Equipment	3.018,7	144,9	645,3	19,01	4,80%	1	1	21,38%
12.23.2021	Ortho Clinical Diagnostics Holdings plc	8.424,11	Health Care Equipment	2.042,8	126,2	458,4	18,38	6,18%	1	1	22,44%

Source: Own representation

Appendix H

Regression HCES adj.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,40036944
R Square	0,16029569
Adjusted R S	0,10991343
Standard Err	162,473772
Observations	54

ANOVA

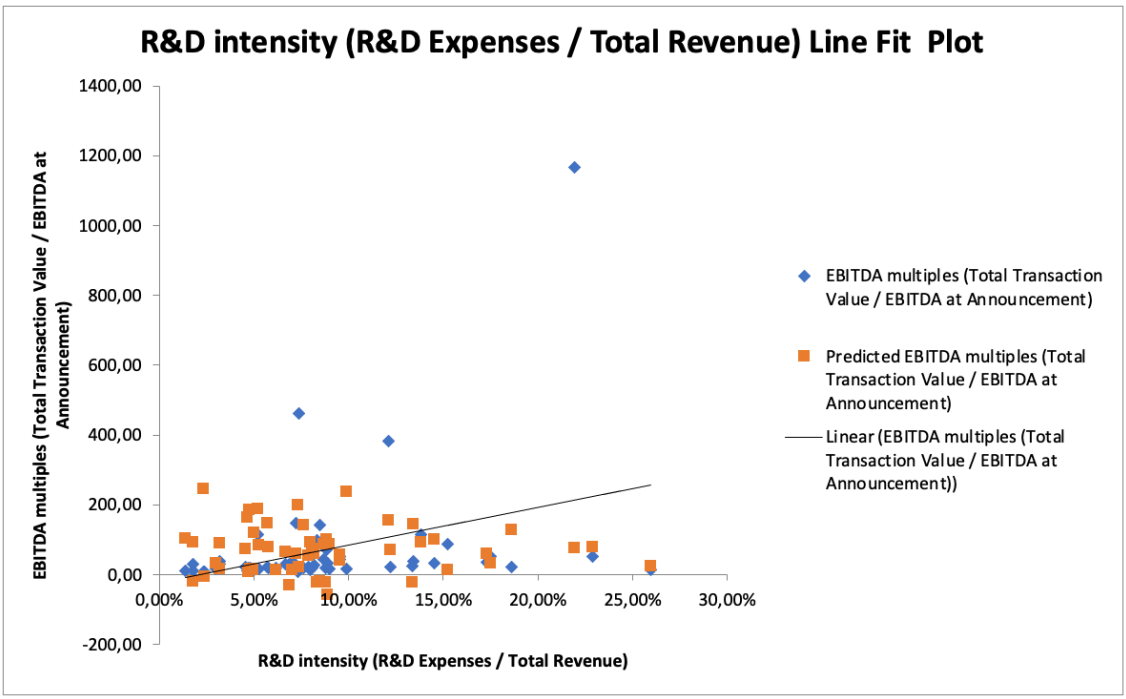
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	251960,22	83986,7401	3,18158989	0,0317732
Residual	50	1319886,33	26397,7266		
Total	53	1571846,55			

	Coefficients	*tandard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	-2,4470461	48,0930097	-0,0508815	0,95962265	-99,044699	94,1506068	-99,044699	94,1506068
R&D intensit	1087,59671	427,399386	2,54468478	0,01407144	229,13978	1946,05364	229,13978	1946,05364
Company Siz	10,133125	63,056057	0,16070026	0,87297701	-116,51869	136,784943	-116,51869	136,784943
EBITDA Marg	-80,741449	58,2611271	-1,3858546	0,17194168	-197,76237	36,279469	-197,76237	36,279469

Source: Own representation

Appendix I

Line Fit Plot HCES adj.



Appendix J

Screen Aggregates Data Total

Transaction Screening Aggregates

Number of Transactions by Status		Number of Transactions by Type	
Announced:	33	Buyback	0
Closed/Effective/Expired:	4044	Shelf Registration	0
Cancelled/Withdrawn/Suspended:	189	Merger/Acquisition	4266
Other Bankruptcy Status:	0	Private Placement	0
Other Investor Activism Status:	0	Bankruptcy	0
Total Number of Transactions:	4266	Spin-Off/Split-Off	0
		Public Offering	0
		Investor Activism	0
Number of Transactions by Sector		**Number of Transactions by Region**	
Energy	0	Asia / Pacific	0
Real Estate	0	Latin America and Caribbean	0
Materials	0	Europe	587
Industrials	0	United States and Canada	3679
Consumer Discretionary	0	Africa / Middle East	0
Consumer Staples	0		
Health Care	4266		
Financials	0		
Information Technology	0		
Communication Services	0		
Utilities	0		

Most Active Buyers/Investors by Number of Transactions		Most Active Buyers/Investors by Total Transaction Size	
Company Name	**Number Of Transactions**	**Company Name**	**Total Transaction Size ($mm)**
Welltower Inc. (NYSE:WELL)	46	Pfizer Inc. (NYSE:PFE)	298.765,17
Boston Scientific Corporation (NYSE:BSX)	31	Bristol-Myers Squibb Company (NYSE:BMY)	135.534,37
Medical Properties Trust, Inc. (NYSE:MPW)	26	Allergan plc	113.896,1
Allergan plc	22	Teva Pharmaceutical Industries Limited (NYSE:TEVA)	91.269,41
Sabra Health Care REIT, Inc. (NasdaqGS:SBRA)	21	Bausch Health Companies Inc. (NYSE:BHC)	86.039,65
CHP Partners, LP	20	The Cigna Group (NYSE:CI)	74.841,26
National Health Investors, Inc. (NYSE:NHI)	20	Shire plc	74.492,29
Acadia Healthcare Company, Inc. (NasdaqGS:ACHC)	18	CVS Health Corporation (NYSE:CVS)	71.991,23
Medtronic plc (NYSE:MDT)	18	Elevance Health, Inc. (NYSE:ELV)	53.215,93
Pfizer Inc. (NYSE:PFE)	18	Gilead Sciences, Inc. (NasdaqGS:GILD)	51.330,68

Merger & Acquisition Statistics

Valuation Summary		Number of Deals by Transaction Ranges	
Total Deal Value($mm):	3.387.195,57	Greater than $1 billion	454
Average Deal Value:	794,0	$500 - $999.9mm	325
Average TEV/Revenue:	9,04	$100 - $499.9mm	1338
Average TEV/EBITDA:	21,43	Less than $100mm	2149
Average Day Prior Premium(%):	47,06	Undisclosed	0
Average Week Prior Premium(%):	49,02		
Average Month Prior Premium(%):	55,16		

Canceled transactions may be included in these statistics.

Source: S&P Capital IQ

Appendix K

Transaction Screening Report Data Total

Screening Criteria

1) **Industry Classifications (Target/Issuer):** Health Care (Primary) **OR** Health Care Equipment and Supplies (Primary) **OR** Pharmaceuticals, Biotechnology and Life Sciences (Primary) **OR** Health Care Technology (Primary)
2) **Geographic Locations (Target/Issuer):** United Kingdom (Primary) **OR** Germany (Primary) **OR** United States and Canada (Primary)
3) **All Transactions Announced Date:** [1/1/2011-12/31/2021]
4) **Total Transaction Value ($USDmm, Historical rate):** is greater than 20
5) **Merger/Acquisition Features:** Acquisition of Majority Stake

Source: S&P Capital IQ