Haute Ecole
« ICHEC – ECAM – ISFSC »

Enseignement supérieur de type long de niveau universitaire

The impact of mergers and acquisitions on the financial performance of pharmaceutical companies in Belgium

Mémoire présenté par
Kim Nhi NGUYEN

Pour l'obtention du diplôme de
Master en gestion de l'entreprise

Année académique 2023-2024

Promoteur :
Valérie KINON

Boulevard Brand Whitlock 6 - 1150 Bruxelles

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Last but not least, I would like to thank my family and close friends for their continuous support.

Déclaration sur l'honneur sur le respect des règles de référencement et sur l'usage des IA génératives dans le cadre du mémoire ou d'un travail

Pour les travaux et le mémoire, l'étudiant mentionne sur la page de garde qu'il a pris connaissance des règles en matière de référencement des sources et qu'il les a respectées dans le travail en question, en insérant et signant le paragraphe suivant :

> « Je soussigné, NOM, Prénom, Année d'études, déclare par la présente que le travail ci-joint respecte les règles de référencement des sources reprises dans le règlement des études en signé lors de mon inscription à l'ICHEC (respect de la norme APA concernant le référencement dans le texte, la bibliographie, etc.) ; que ce travail est l'aboutissement d'une démarche entièrement personnelle; qu'il ne contient pas de contenus produits par une intelligence artificielle sans y faire explicitement référence. Par ma signature, je certifie sur l'honneur avoir pris connaissance des documents précités et que le travail présenté est original et exempt de tout emprunt à un tiers non-cité correctement.» Date et Signature.

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Type d'assistance		**Case à cocher**
Aucune assistance	J'ai rédigé l'intégralité de mon travail sans avoir eu recours à un outil d'IA générative.	x
Assistance avant la rédaction	J'ai utilisé l'IA comme un outil (ou moteur) de recherche afin d'explorer une thématique et de repérer des sources et contenus pertinents.	
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	J'ai utilisé l'IA pour reformuler ou réécrire des parties de mon texte.	
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Autres usages		

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J'ai mis en annexe les questions posées à l'IA et je suis en mesure de restituer les questions posées et les réponses obtenues de l'IA. Je peux également expliquer quel le type d'assistance j'ai utilisé et dans quel but.

Fait à ..... Heverlee ..... (ville), le ..... 21/05/2024 .....(date)

Signature : .....Kim Nhi Nguyen 211863.....[Prénom Nom de l'étudiant(e) et matricule]

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Executive summary

M&A is an attractive area of research and several topics have been addressed, such as understanding the determinants of M&A and the impact of M&A on the performance of acquirers. In this thesis, we focus on understanding the impact of M&A on the performance of acquirers as several studies addressing this issue have shown conflicting results. One possible explanation for the lack of consistency in the results is that several M&A studies focused on samples on a wide geographical area and did not focus on a specific industry. As the characteristics of M&A differ across sectors and geographical areas, it is not easy to conclude whether the results are generally applicable. An interesting approach is therefore to assess M&A performance with a focus on a specific sector and country.

The lack of recent research in assessing the impact of M&A on the financial performance of acquiring firms in Belgium motivated us to investigate whether the same results as previous studies in Belgium could be obtained for acquisitions in a more recent period. We focus on the pharmaceutical industry for two reasons: first, pharmaceuticals are a leading economic sector in Belgium, and second, the pharmaceutical industry is known for its active M&A activity. We address this gap in the literature by examining whether the impact of M&A in Belgium during a more recent period, between 2010 and 2022, is significant for acquirers.

A quantitative research methodology based on accounting data is applied to a sample of 198 acquisitions made by Belgian pharmaceutical companies in the period 2010-2022. We analysed the financial performance of the acquiring firms by comparing the profitability, liquidity and solvency ratios before and after the acquisitions. We used a matching firm approach to mitigate the industry effect, and three different statistical models to test the significance of the impact of M&A on the performance of acquirers. The results of all three statistical models suggest that there is no evidence that acquisitions have a significant impact on the profitability, solvency and liquidity of Belgian acquiring firms.

Keywords: M&A; pharmaceutical; financial performance; acquisitions; financial ratios.

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Chapter 1. Introduction

1.1. M&A overview

More than 790,000 mergers and acquisitions (M&A) transactions have been announced worldwide since 2000 alone, with an estimated total value of USD 57 trillion (IMAA Institute, 2024). M&A are widely recognised as one of the most popular corporate growth strategies and are used across all industries. Figure 1 shows an increasing trend in the number of M&A deals over time. It can also be seen that M&A occur in several waves, as often defined in the literature, following the general economic cycle (Kiymaz & Baker, 2008). What makes M&A an attractive strategy is the expectation of value creation in the form of synergies unleashed by the combined entity after the M&A, synergies that a company would not have been able to achieve on its own (Reed et al., 2007). Synergies can take several forms, including improved profitability, cost savings and market share (Khan & Bin Tariq, 2023).

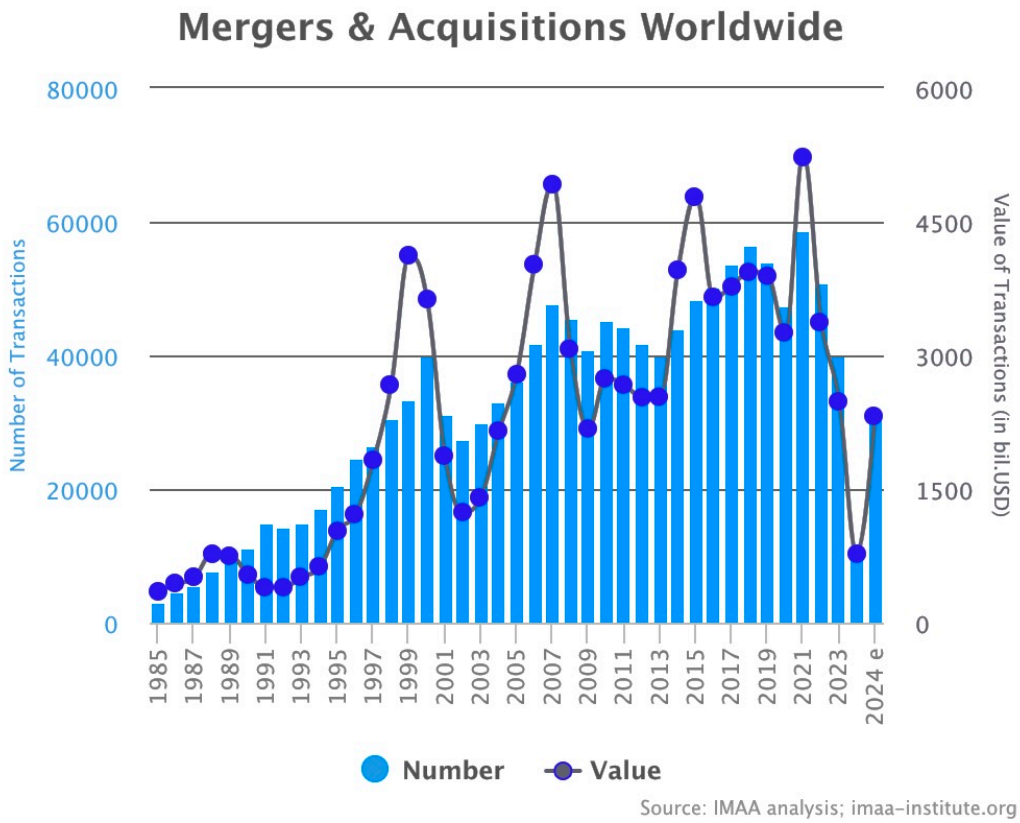

Figure 1. Number and value of M&A worldwide according to IMAA analysis

Source: IMAA Institute. (2024). Number and Value of M&A Worldwide. https://imaa-institute.org/mergers-and-acquisitions-statistics/

Looking at the considerable number of M&A transactions, one would expect that M&A would be able to successfully bring value after the transactions. Interestingly, previous empirical studies show that there is no agreement on the significant impact of M&A on the firm financial performance (Berrioategortua et al., 2018). There are still debates on the impact of M&A in literature. While several empirical studies conclude that M&A bring value and positively impact the firm performance (Mantravadi & Reddy, 2008; Kamra & Gupta, 2016), other studies conclude that M&A destroy value and have a significant negative impact on the firms that expect to benefit from it (Dargenidou et al., 2016; Ooghe et al., 2006; Demirbag et al., 2007; Danzon et al., 2007). Furthermore, there are studies finding no evidence on the impact (Austin et al., 2022; Leepsa & Mishra, 2012; Ghosh, 2001), and other studies finding mixed results (Rani et al., 2015; Cho et al., 2022; Rehan et al., 2018). These inconsistent results highlight that synergies are not always guaranteed. Despite the inconsistent findings, the number of M&A-related publications has grown steadily over the years, reflecting the continued interest of researchers in M&A over time and in line with the increase in the number and volume of M&A deals (Cumming et al., 2023).

Consequently, the answer to the question of the impact of M&A on firm performance remains unclear, despite the vast amount of research on M&A. A potential explanation for the inconsistency in conclusions is that several studies were conducted without focusing on a specific industry and with a wide geographical scope, e.g., deals worldwide, in Europe and in emerging markets. Furthermore, as the characteristics of M&A differ across sectors and geographical areas, it may not be easy to conclude whether the results are generally applicable. It is therefore interesting to examine the significance of the impact of M&A on the financial performance of companies, focusing on a specific industry and on a specific country. This is the aim of this thesis, which focuses on the impact of M&A on firms operating in the pharmaceutical industry and based in Belgium.

1.2. M&A in the pharmaceutical industry

The pharmaceutical industry is a unique economic sector characterised by a particular restrictive regulatory framework, including in Europe (Goethals & Wunderle, 2018). Strict regulations are explained for two main reasons. First, the main products of this sector, medicines, are consumer products that do not share the same special features as other industrial products. Second, these products are closely linked to health risks (Goethals & Wunderle, 2018).

Dominated by few pharmaceutical groups representing around 50% of the world market, the pharmaceutical industry is made up of groups that grew by either internal growth by selling successful products, namely blockbuster drugs, or by external growth

through mergers and acquisitions (Goethals & Wunderle, 2018). Although M&A operations have continued to grow, they have not increased concentration in the sector. This is mainly explained by the expiration of patents on a significant number of blockbuster drugs which has not been fully balanced out by the development and marketing of new drugs.

Alongside big pharmaceutical companies, we find smaller businesses focusing on therapeutic niche, geographical areas or one or more stages in the production processes (Goethals & Wunderle, 2018). Among these businesses, we find drug manufacturers and biotechnology firms. Biotechnology firms focus on research and development (R&D) activities and use innovative methods mainly from life science research, to develop industrial applications including in the field of human health.

As Figure 2 shows, biotechnology and pharmaceuticals have seen an increase in deal volume and value since 1985 worldwide. There are several interesting periods. For instance, although the number of deals increased moderately, the value of deals jumped from less than USD 150 billion in 2013 to more than USD 450 billion in 2014. In fact, it was a particularly active period and characterised by mega-deals (Thomas et al., 2024). The industry reached its most recent peak in 2018, with 2,475 transactions and a total rough value of USD 378 billion (IMAA Institute, 2024).

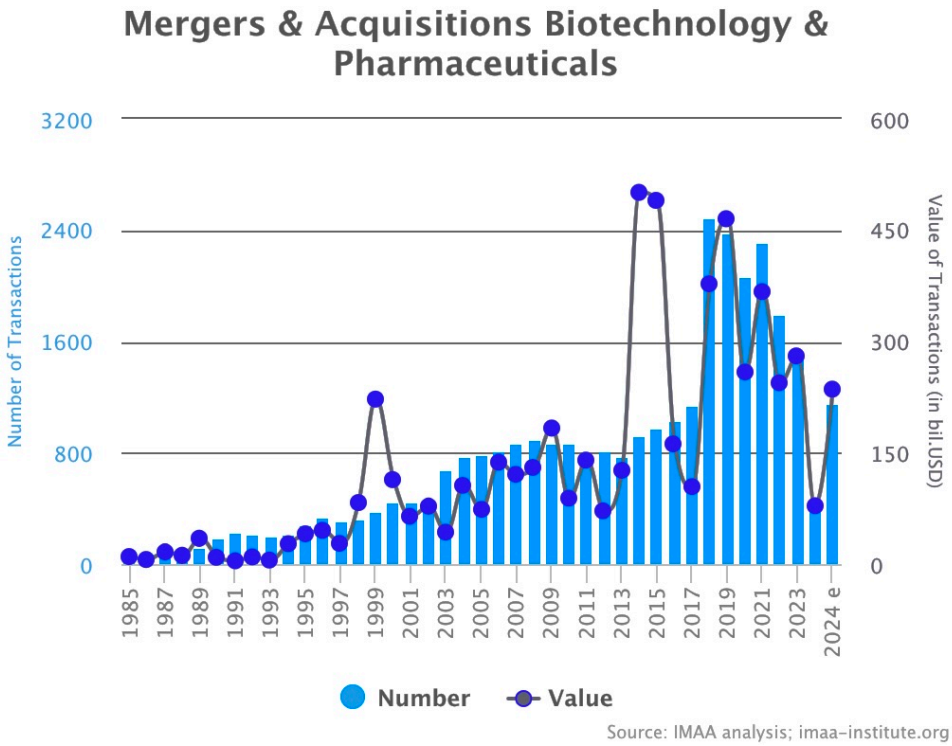

Figure 2. Number and value of M&A transactions per year in the biotechnology and pharmaceutical industry between 1985 and 2024

Source: IMAA Institute. (2024). M&A statistics by industries. https://imaa-institute.org/mergers-and-acquisitions-statistics/ma-statistics-by-industries/

While innovation and investment in R&D are important to the industry's success, companies still face major challenges, such as adapting to changes in market and regulatory requirements and achieving sustainable returns (Deloitte, 2023). Also, top pharmaceutical companies' financial performance and R&D activities have been negatively impacted by increasing pressure coming from generic drugs (Goethals & Wunderle, 2018).

Another challenge that pharmaceutical companies face is the expiration of drug patents, widely known as the "patent cliff", which opens up opportunities for competitors to enter the market, and therefore, leads to a decline in sales. This, in turn, will motivate pharmaceutical companies to anticipate this threat through M&A (Danzon et al., 2007; Thomas et al., 2024). M&A will allow companies to fill in the gap in their pipeline by acquiring new assets to bring innovative products and keep up with the competitive market (Thomas et al., 2024).

In addition to product pipeline management and improvement of innovative capabilities, there are other traditional key drivers of M&A in the pharmaceutical industry. These include growth, geographical expansion, development of drug blockbusters and therapies, and diversification into new technologies (Deloitte 2023; Thomas et al., 2024).

The statistics related to the pharmaceutical industry discussed above show that this industry is still an active sector in M&A. This motivates us to investigate the impact of M&A on firm performance in this industry.

1.3. The Belgian pharmaceutical industry

Although Belgium does not rank among the top European countries in terms of inhabitants, it is one of Europe's leading countries in the pharmaceutical industry (Goethals & Wunderle, 2018; Eurostat, 2022). As can be seen in Figure 3, with an approximate value of EUR 43,300 million in 2021, Belgium represents around 13.4% of European pharmaceutical production (total estimated value of EUR 323,950 million), ranking second behind Switzerland (18.5%) and followed by Germany (10.7%), Italy (10.6%) and UK (8.6%) (EFPIA, 2023).

Belgium is an export-oriented country with almost 70% of 2022 exports to other EU countries (CEDEFOP, 2024; Eurostat, 2022). Pharmaceuticals is one of the most important sectors in the Belgian economy, with medicines and pharmaceutical technology representing two of Belgium's most important export products and

accounting for around 10% of Belgian exports (SPF Economie, 2019; Business.belgium.be, 2024).

In the pharmaceutical value chain (R&D, production, sales and distribution), Belgium is characterised by its particularly high level of specialisation in R&D (Goethals & Wunderle, 2018). With a rough value of EUR 5,196 million in 2021 invested in R&D, Belgium represents around 12.2% of R&D investment by pharmaceutical firms in Europe (total estimated value of EUR 42,533 million), ranking fourth behind Germany (20.1%), Switzerland (19.4%) and the UK (16.1%) (EFPIA, 2023).

EFPIA 2021	€ million		€ million
Austria	1,387	Latvia	321
Belgium	43,300	Lithuania	n.a
Bulgaria	291	Malta	307
Croatia	451	Netherlands	6,180
Cyprus	253	Norway	1,432
Czech Rep.	950	Poland	2,515
Denmark	16,819	Portugal	1,734
Estonia	n.a	Romania	655
Finland	1,851	Russia	6,459
France	23,557	Slovakia	356
Germany	34,579	Slovenia	3,402
Greece	1,585	Spain	17,457
Hungary	3,607	Sweden	9,616
Iceland	89	Switzerland	59,823
Ireland	19,305	Turkey	3,497
Italy	34,400	U.K.	27,772
TOTAL			323,950

Note:
All data based on SITC 54
Austria, Croatia, France, Norway, Russia, Spain, Turkey, U.K.: 2020 data; Cyprus: 2018 data; Slovakia: 2017 data; Iceland: 2016 data; Bulgaria: 2015 data; Ireland: 2014 data; Romania: 2013 data; Netherlands: 2010 data
Croatia, Denmark, France, Ireland, Italy, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland: estimate
Bulgaria, Croatia, Cyprus, France, Hungary, Ireland, Latvia, Norway, Poland, Portugal, Romania, Slovenia: veterinary products excluded

Source: EFPIA member associations (official figures)

Figure 3. Pharmaceutical production in Europe
Source: EFPIA. (2023). The Pharmaceutical Industry in Figures. https://www.efpia.eu/media/rm4kzdlx/the-pharmaceutical-industry-in-figures-2023.pdf

Figure 4 shows that Belgium has seen a considerable growth in the number of M&A deals, reaching a total of more than 12,000 transactions announced since 1985 with a rough total value of EUR 1 trillion (IMAA Institute, 2024).

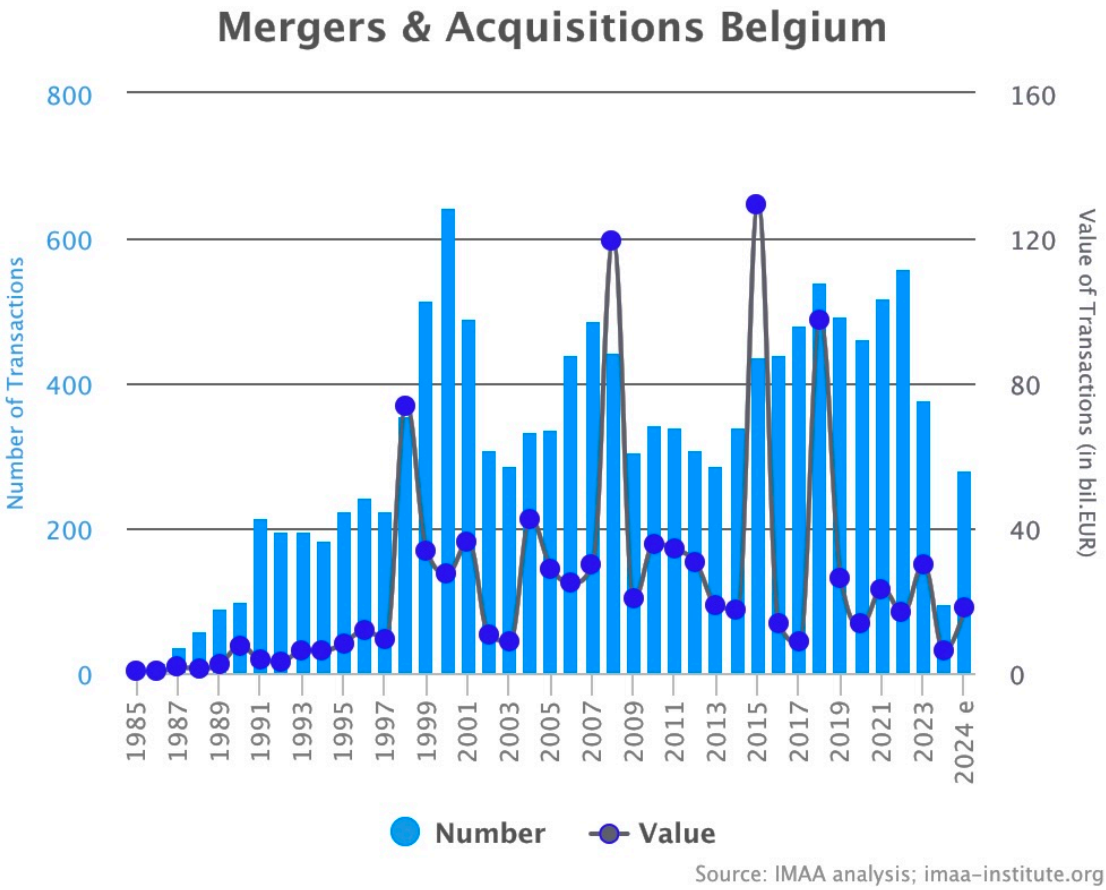

Figure 4. Number and value of M&A transactions per year between 1985 and 2024 in Belgium
Source: IMAA Institute. (2024). M&A statistics by country. https://imaa-institute.org/mergers-and-acquisitions-statistics/ma-statistics-by-countries/

According to a survey carried out in 2021 (Luypaert & Spolverato, 2022), the top M&A motives for strategic buyers in Belgium are economies of scale, cross-selling, new technologies, attracting talent and foreign markets (see Figure 5). Compared to 2021, revenue improvement and external growth (buy-and-build) remain the two top motives for financial buyers (see Figure 6). The survey also revealed that, in terms of the average enterprise value/EBITDA multiple of M&A deals in 2021, the pharmaceutical industry is in the lead with a multiple of 9.4 (see Figure 7).

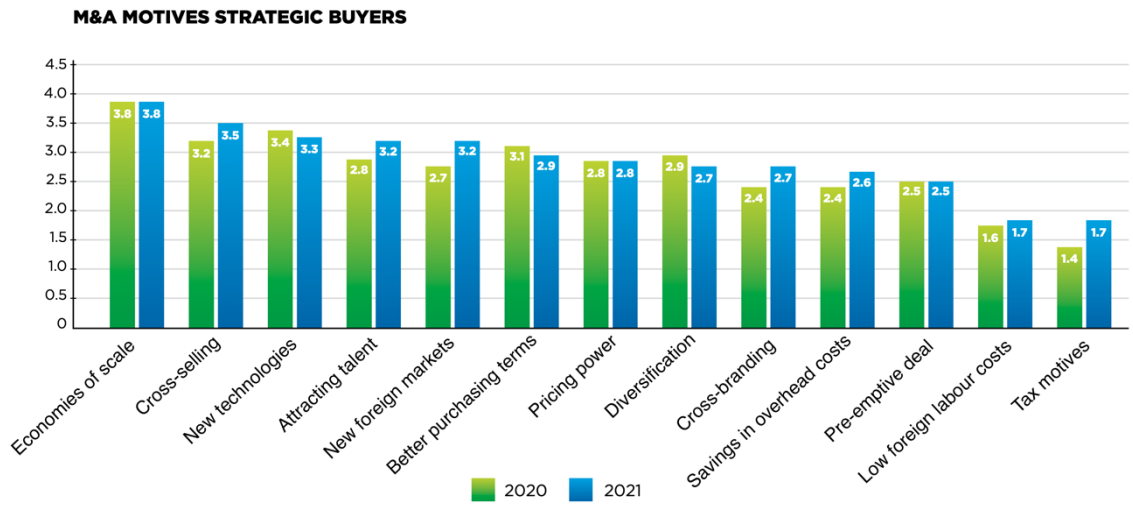

Figure 5. M&A motives for strategic buyers in Belgium in 2020 and 2021

This figure shows the ranking of M&A motives based on the experts' rating from 1 to 5 points, where 1 is not important and 5 is very important.

Source: Luypaert, M., & Spolverato, G. (2022). 2022 M&A Monitor: Shedding light on M&A in Belgium. https://www.overnamemarkt.be/src/Frontend/Files/userfiles/files/2022%20M%26A%20Monitor.pdf

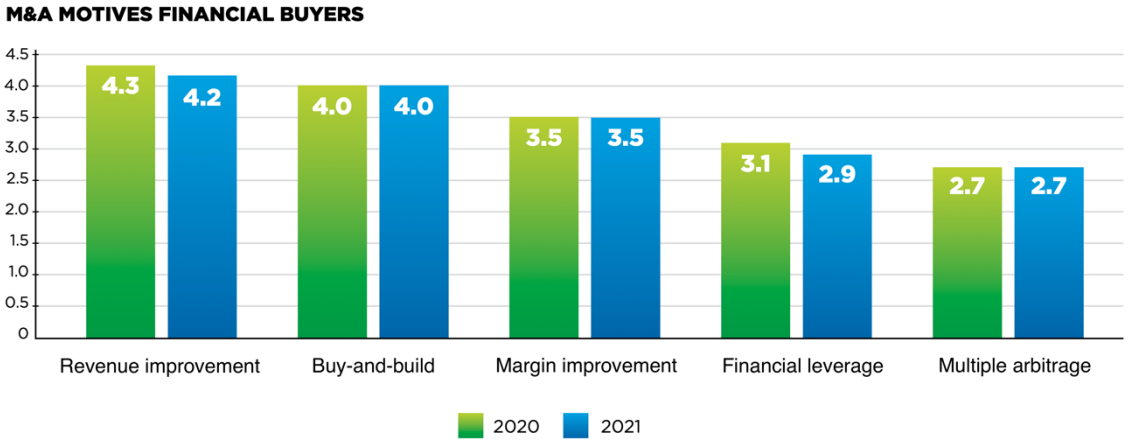

Figure 6. M&A motives for financial buyers in Belgium in 2020 and 2021

This figure shows the ranking of M&A motives based on the experts' rating from 1 to 5 points, where 1 is not important and 5 is very important.

Source: Luypaert, M., & Spolverato, G. (2022). 2022 M&A Monitor: Shedding light on M&A in Belgium. https://www.overnamemarkt.be/src/Frontend/Files/userfiles/files/2022%20M%26A%20Monitor.pdf

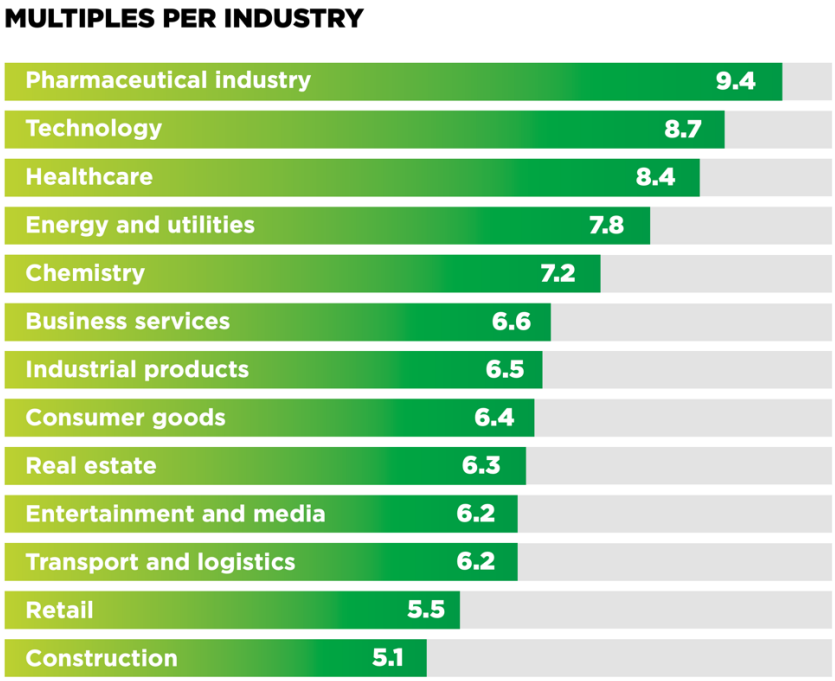

Figure 7. Multiples of M&A deals per industry in Belgium in 2021
Source: Luypaert, M., & Spolverato, G. (2022). 2022 M&A Monitor: Shedding light on M&A in Belgium. https://www.overnamemarkt.be/src/Frontend/Files/userfiles/files/2022%20M%26A%20Monitor.pdf

All these figures related to the pharmaceutical industry in Belgium show that this industry clearly plays an important role in the Belgian economy. This motivates us to focus on this industry in order to examine the impact of M&A on Belgian companies.

1.4. Contributions

To the best of our knowledge, limited research has been done on M&A in Belgium. Furthermore, as discussed in Sections 1.2 and 1.3, the pharmaceutical industry is active in M&A and this industry is important for the Belgian economy. These main points have led us to focus on Belgium and on the pharmaceutical industry. The main goal of this thesis is therefore to answer the following research question:

> *What is the impact of M&A on the financial performance of pharmaceutical companies after M&A transactions in Belgium?*

One would expect an acquisition to have an impact on the acquiring company, and in the case of synergy gains, for example, one would expect this impact to be positively significant. Therefore, this thesis investigates whether there is a significant impact of M&A on the financial performance of acquiring firms operating in the pharmaceutical

sector in Belgium. To answer the research question, we will test three hypotheses, which have been formulated as follows.

H1: Acquisitions have a significant impact on the profitability of Belgian pharmaceutical acquiring firms.

Financial performance can be measured with different techniques, with ratio analysis being one of the most popular ones. Several studies have included in their methodology profitability ratios as financial performance indicators, such as return on equity (ROE), return on assets (ROA), gross profit margin, net profit margin and return on capital employed (ROCE) (Büssgen et al., 2024; Dixit, 2019; Giudici & Bonaventura, 2018; Mihaiu et al., 2021; Borodin et al., 2020).

At a global level, while M&A between 1998 and 2000 had no significant impact on profit margin in the pharmaceutical industry (Demirbag et al., 2007), other studies about M&A in the later period, between 2000 and 2020, found a positive impact on the profitability of leading pharmaceutical companies (Büssgen & Stargardt, 2024; Mihaiu et al., 2021). At the European level, M&A in the period between 1998 and 2008 did not have an impact on public acquiring companies when compared to non-acquiring firms after acquisition (Giudici & Bonaventura, 2018). At the Belgian level, previous researchers analysed M&A between 1992 and 1994 and found out that they had a negative impact on the profitability of acquirers of privately held companies (Ooghe et al., 2006).

Given the lack of recent research about the impact of M&A on the profitability of Belgian firms, this thesis aims at filling this literature gap by examining whether domestic M&A in Belgium in the pharmaceutical industry have a significant impact on the profitability of acquirers also in the period between 2010 and 2022.

H2: Acquisitions have a significant impact on the solvency of Belgian pharmaceutical acquiring firms.

As profitability ratios measure only one aspect of financial performance, we added solvency ratios in the analysis. For instance, it is possible for a company to be profitable while being heavily in debt at the same time. This is an example of the importance of including multiple categories of ratios to have a more comprehensive financial view of a company. Several papers' methodologies (Sephita & Nurazi, 2024; Yunus et al., 2021) included solvency ratios as financial performance indicators, such as debt-to-assets ratio, interest coverage ratio and debt-to-equity ratio.

H3: Acquisitions have a significant impact on the liquidity of Belgian pharmaceutical acquiring firms.

While solvency ratios give an idea of the ability of a company to cover its long-term obligations, liquidity would complement solvency ratios by giving an idea of the ability of a company to cover its short-term obligations. Furthermore, a company can have, for example, a positive solvency and a negative liquidity at the same time. Considering that solvency and liquidity can have an impact on each other, we therefore also added liquidity ratios in our analysis. Several papers' methodologies (Mamahit et al., 2019; Leepsa & Mishra, 2012; Kanimozhi, 2019) included liquidity ratios alongside profitability and solvency ratios as financial performance indicators. Most analysed liquidity ratios are the current ratio and the quick ratio.

While M&A performance studies include various performance measures, such as market measures (e.g., Earnings Per Share) and growth measures (e.g., revenue growth), the three categories mentioned above, i.e., profitability, solvency, and liquidity, are among the most used in M&A performance impact studies using accounting data (Andriuskevicius, 2017).

We contribute to the existing literature by using a unique sample of private and public acquiring firms operating in the Belgian pharmaceutical industry in the period 2010-2022. We therefore aim at filling the gap of recent research on M&A in the Belgian pharmaceutical industry.

We applied a quantitative research methodology based on accounting data collected on Bel-first database. To reduce industry bias, we applied a matching firm approach. In addition, to enhance the robustness of our study, we test the significance of the impact on performance on three different statistical models, which use different assumptions, and across different time windows.

The results of our study show that only a few ratios show a statistically significant result over different time windows and relative years. Therefore, our results suggest that, overall, there is no evidence that acquisitions have a significant impact on the profitability, solvency, and liquidity of acquirers.

The remainder of this thesis is structured as follows. The next chapter, Chapter 2, presents the literature review on M&A, with a zoom on M&A and its impact on firm performance. Chapter 3 details the methodology of the thesis. Chapter 4 describes the data sample. Chapter 5 presents the findings and discussions. Chapter 6 concludes and

discusses the contributions of this thesis, its limitations and directions for future research.

Chapter 2. Literature review

M&A is a popular research topic in corporate finance and the literature on this subject is vast. This chapter will begin with an introduction to M&A terms, M&A types and provide an overview of the previous studies tackling M&A. The chapter will continue with the main topics related to the research question of this thesis. First, we will discuss M&A performance studies and present general conclusions from previous research. Second, we will focus specifically on M&A research in the pharmaceutical industry. Third, we will focus on M&A literature in Belgium. Fourth, we will present the methodologies used to evaluate a firm's post-M&A performance. Finally, we will conclude with a summary of the key points of the literature.

2.1. M&A research overview

In literature, merger is considered as a business transaction in which two companies are combined to obtain only one single existing company, while acquisition is considered as a transaction in which a company, usually referred to as acquirer, buys assets or stocks of another company, or also referred to as target. It should be noted that acquisitions are often considered under different forms. For example, an acquisition can be considered as such when a company acquires a minimum of 50% of ownership of the target company. Another example of an acquisition form is a transaction in which the acquirer obtains full ownership of the target company that will continue to exist after the transaction.

Mergers and acquisitions can be divided into several categories, such as horizontal mergers which involve acquirers and targets operating in the same market, and vertical mergers which involve acquirers and targets belonging to the same supply chain. Other types of M&A include conglomerate mergers or acquisitions which involve acquirers and targets operating in different industries, and congeneric mergers or acquisitions which involve acquirers and targets operating in the same market but offering different products. Some empirical studies evaluated the performance of different types of M&A. For instance, Rozen-Bakher (2018) evaluated horizontal, vertical, and conglomerate M&A. Each type of M&A was again evaluated in different sectors and depending on the type of M&A and the specific sector, success or failure was found. For example, integration success was found for horizontal M&A in the industry sector, but integration failure was found for the services sector. Mixed results were also found by Zhao & Zhang (2020), with different types of M&A having different impacts on the post-acquisition performance in different post-acquisition periods. Horizontal M&A achieved positive impact in the long run, few years after acquisitions, while vertical and conglomerate

M&A only achieved positive impact in the short term. Aik et al. (2015) found instead that the operating performance of Malaysian acquirers between 1994 and 2005 declined in the long run by focusing on only horizontal mergers.

We also find empirical studies narrowing down their research scope by focusing on domestic M&A (Aik et al., 2015; Pervan et al., 2015; Rehan et al., 2018; Hassan et al., 2007; Ooghe et al., 2006), cross-border M&A (Rahman et al., 2021; Liu et al., 2021; Jensen-Vinstrup et al., 2018; Moeller & Schlingemann, 2005; Rahman et al., 2021) or both domestic and cross-border M&A (Dixit, 2019; Kiymaz & Baker, 2008; Rani et al., 2015; Burger et al., 2023). Domestic M&A are referred to as transactions in which the acquirer and the target are based in the same country, while cross-border M&A are transactions in which the acquirer and the target are not based in the same country.

Mergers and acquisitions are known to be driven by several motives, which represent one of the key areas of interest for researchers. Piesse et al. (2022) and Calipha et al. (2010) analysed which are the most recurring motives for M&A. These include synergy gains, diversification, acquisition of a competitor in financial trouble, and increase in market power. Another study focusing on the drivers of M&A is that of Hassan et al. (2018), who aimed at linking motives to the outcome assessment for M&A performance. The authors showed that, in M&A, motives are often not clearly defined in the pre-merger phase, which makes it difficult to assess the performance.

The M&A literature also explores several other topics, making M&A one of the most attractive topics in corporate finance (Thanos & Papadakis, 2012; Berrioategortua et al., 2018; Das & Kapil, 2012; Andriuskevicius, 2017; Krishnakumar & Sethi, 2012). For instance, Adnan et al. (2016) tackled the effect of M&A announcements on stock price both for target and acquirer. Through an event study, the authors observed that there is a spike in stock price in the pre-announcement period, while price decreased in the post-announcement period. Other researchers examined how target characteristics can affect M&A performance. For example, Dong et al. (2021) investigated different factors to see if they influence the M&A performance. A key finding of their research was that customer concentration had a negative impact on M&A performance: the higher the customer concentration, the lower the performance. Finally, other studies aimed at assessing the impact of M&A on certain aspects of a company, such as the ESG performance and employment growth (Barros et al., 2022; Burger et al., 2023).

A considerable part of empirical studies has tackled the assessment of whether M&A create or destroy value for the firms and their stakeholders (Leepsa & Mishra, 2013; Aik et al., 2015; Rani et al., 2015; Demirbag et al., 2007). A merger is often considered successful when the value obtained after a merger of two companies is higher than the sum of values one would obtain from the two companies separately (Reed et al., 2007).

In M&A literature, this is also referred to as synergy gains (Berrioategortua et al., 2018). Whether the initial goal of going through an M&A actually was reached, value was created, and synergies were gained or, on the contrary, M&A destroyed value for shareholders and deteriorated firm performance, this is an ongoing and still popular topic in M&A literature. The next section will present the literature on the studies focusing on the impact of M&A on firm performance.

2.2. M&A performance

M&A literature revealed that the expression "M&A performance" does not have a unique interpretation. It has been used to refer to multiple types of performance, including financial and operating performance (Dixit, 2019; Giudici & Bonaventura, 2018; Aik et al., 2015; Martynova et al., 2007; Ghosh, 2001; Pervan et al., 2015), market performance (Hassan et al., 2007; Cho et al., 2022; Yoo et al., 2013) and innovation performance (Ornaghi, 2009; Doan, 2020).

Furthermore, previous studies tried to answer the question from different perspectives, such as from the global perspective across all industries (Doan, 2020), from an industry specific perspective (Büssgen & Stargardt, 2024; Demirbag et al., 2007; Danzon et al., 2007; Mihaiu et al., 2021), and from a regional perspective (Ooghe et al., 2006; Dixit, 2019; Borodin et al., 2020; Fukuda, 2020; Giudici & Bonaventura, 2018; Powell & Stark, 2005). In addition, time horizons considered in existing studies vary greatly (Thanos & Papadakis, 2012; Andriuskevicius, 2017).

Some authors analysed the impact of M&A on firm performance in the short-term (Kiymaz & Baker, 2008; Büssgen & Stargardt 2024), in the long-term (Martynova et al., 2007), while others examined and compared both short-term and long-term performance (Rani et al., 2015; Xiao & Tan, 2009; Cho et al., 2022; Hassan et al., 2007). Studies in the short-term typically analyse a time horizon of a few days before and after the M&A announcement, whereas long term can refer to a window of several years before and after the transaction period (Andriuskevicius, 2017).

Some researchers studied the impact of M&A on the acquirer (Austin et al., 2022; Grigorieva & Petrunina, 2015; Wang, 2020), some examined the impact on the performance of the target (Burger et al., 2023; Pervan et al., 2015; Feys et al., 2010) and some examined the impact of M&A on both acquirers and targets (Kinateder et al., 2017; Kiymaz & Baker, 2008).

Several authors have examined the performance of European M&A. While Powell & Stark (2005) argued that post-takeover operating performance of UK takeovers between 1985 and 1993 increased moderately, Schoenberg (2006) found no correlation between

performance data of British acquisitions of continental European firms between 1988 and 1990. Interestingly, the performance of European acquirers, measured as EBITDA, decreased significantly after the acquisition taking place in the period 1997-2001, while the performance of acquirers did not change significantly when compared to non-acquiring peers (Martynova et al., 2007). Similar outcomes of no significant changes were obtained by Giudici & Bonaventura (2018), but in terms of ROA and ROS of European listed companies between 1998 and 2008, and by Pervan et al. (2015) who instead focused on the target performance in terms of ROA, ROE and profit margin in Croatia in the period between 2008 and 2011. In contrast, Borodin et al. (2020) found a negative impact of M&A on ROS for both European and US firms between 2016 and 2018. The authors also observed that, while most of the firms were profitable before the deal, their profitability position did not change after the deal. With multiple and different methodologies and countries within Europe, we can see that the authors have not reached a consensus on the results over time.

Moving on to the performance studies that focus on the US, it has been found that the 50 largest US mergers between 1979 and 1984 had positively impacted the operating cash flows of the acquirers (Healy et al., 1992). In the later M&A period 1981-1995, Ghosh (2001) found instead that there was no evidence of an improvement in the operating cash flow of acquirers after the transaction when comparing the performance of acquirers with that of non-acquiring firms. Focusing on the acquisition of fintech firms between 2010 and 2017, Austin et al. (2022) found similar results to Ghosh (2001), with no evidence of an improvement in the operating performance of acquirers. When comparing the performance of cross-border and domestic M&A between 1985 and 1995 by US acquirers, Moeller & Schlingemann (2005) found that cross-border M&As significantly negatively impacted the operating performance.

A vast literature has also been dedicated to M&A in Asia. Starting from East Asia, analysis of Chinese M&A in 2002 showed that the short-term performance of companies increased significantly after M&A, while there was no significant impact on the long-term performance (Xiao & Tan, 2009). Cross-border M&A between 2008 and 2012 did not improve the financial performance of Chinese acquirers, while domestic M&A led to better performance (Liu et al., 2021). In Japan, M&A between 2011 and 2017 had a negative impact on the ROA of acquirers (Fukuda, 2020). Korean M&A between 2015 and 2022 positively impacted cumulative abnormal returns of high-tech acquirers in the short term, while in the long-term M&A negatively impacted the performance of these acquirers based on accounting measures (Cho et al., 2022).

Moving on to studies focusing on Southeast Asia, M&A between 2006 and 2010 in the Philippines' financial industry did not significantly impact the ROA of acquirers (Tang, 2015). Multiple studies focused on Indonesian M&A, of which some examples follow.

Between 2011 and 2014, the profitability of Indonesian public companies was significantly affected after M&A, while there was no significant impact on liquidity ratios (Mamahit et al., 2019). M&A between 2012 and 2018 also created a mixed impact on Indonesian public companies, with significant impact on ROA, ROE, and total asset turnover ratio, but without impact on other ratios such as debt-to-equity ratio and net profit margin (Yunus et al., 2021). Finally, a case study of the acquisition of PT Telkom Indonesia (Persero) Tbk in the periods 2015-2018 and 2020-2023 revealed that only the current ratio and ROA differed significantly before and after the acquisition, while other ratios did not show significant changes (Sephita & Nurazi, 2024).

Several studies in South Asia analysed M&A involving Indian companies. The following studies are a few examples. Between 1991 and 2003, it has been found that M&A had mixed impacts in different industries on operating performance of the acquirers (Mantravadi & Reddy, 2008). Between 1992 and 2009, studies concluded that M&A had no significant impact on ROA of acquirers (Dixit, 2019). Between 2003 and 2007, no evidence was found regarding the significant impact on profitability, liquidity, and solvency of manufacturing companies (Leepsa & Mishra, 2012). Between 2003 and 2015, M&A positively affected the profitability efficiency, liquidity, and leverage of acquirers (Rani et al., 2016). In addition, some studies focused on other countries. For example, literature showed that the profitability of Pakistani banks, in terms of ROCE, had been significantly affected by M&A between 1996 and 2016 (Rehan et al., 2018).

Some of the literature has focused on M&A in developed countries or emerging countries. As an example, Rahman et al. (2021) analysed the impact of 34 cross-border acquisitions in which the acquirers are based in BRICS countries and the targets are based in developed countries. Results showed that acquirers experienced an improved firm performance after acquisition, but this improvement did not come from the acquisition. Similar results were found by Kinateder et al. (2017) but regarding domestic M&A impact on the performance of public acquirers in BRICS countries between 2006 and 2015, while Grigorieva & Petrunina (2015) found that M&A in emerging markets had a negative impact on acquirers' operating performance between 2003 and 2009.

Besides financial performance, market performance studies are also popular. These studies typically use event study methodology to evaluate the impact of M&A announcements based on stock data. Multiple studies found a negative impact of M&A on abnormal returns of US acquirers, with firms involved in cross-border M&A experiencing significantly lower stock returns than those in domestic M&A (Moeller & Schlingemann, 2005), and abnormal returns being significantly positive for targets (Kiymaz & Baker, 2008). Negative results were also found in European M&A studies between 1985 and 2012 (Dargenidou et al., 2016; Jensen-Vinstrup et al., 2018).

Financial, operating and market performance are not the only aspects of M&A performance that have been studied. It has been found that acquisitions of high-tech scale-up targets in 5 European countries had a positive effect on the revenue and employment growth of the target firms in the long-run, e.g., after 5 years (Burger et al., 2023). Furthermore, there is strong evidence of a significant impact on reducing the risk profiles of acquirers after acquisition of fintech firms (Austin et al., 2022). Moreover, it has been found that marketing efficiency improved partially thanks to M&A (Rahman et al., 2021). Finally, M&A had a positive impact on the ESG scores of companies from 41 countries in different industries between 2002 and 2020 (Barros et al., 2022). These results are based on a few aspects examined in the literature.

Overall, we can observe that, despite the large number of studies on M&A performance, researchers have obtained mixed results on the impact of M&A on firm performance across different industries and regions. It has been discussed that performance studies assume that there are only economic motives that lead to M&A (Krishnakumar & Sethi, 2012). Nevertheless, motives for M&A are not necessarily and primarily economic. As we have seen in Section 2.1 (Piesse et al., 2022; Calipha et al., 2010), there are several other motives that can affect performance outcomes.

In this section, we presented the general findings on M&A performance. The next section continues with the literature on the theme of M&A performance but zooms in on studies that examine M&A in the pharmaceutical industry.

2.3. M&A in the pharmaceutical industry

Key M&A motivations for pharmaceutical acquirers seem to differ depending on the size of the company. For large firms, the main motivation is to anticipate the threat of drug patent expiries, which can lead to an increase in competition, and to the so-called “excess capacity” in the product pipeline. This in turn makes marketing resources ineffective (Thomas et al., 2024; Danzon et al., 2007). Furthermore, the probability of large firms to go through a merger increases when firms have a high enterprise value. For small firms, the probability of a merger increases when they have a small number of products and are in financial stress. This financial stress is caused by the lack of products being promoted, which leads to unpredictable shocks in R&D activities. Therefore, M&A is used as an exit strategy for those firms (Danzon et al., 2007).

Few studies have shown that motivation for M&A can be driven by internal or external factors. Internal factors include synergy effects from specialising in similar or complementary products, acquisition of new technologies and R&D resources, manufacturing capabilities to meet regulatory standards and expansion into new markets. External factors include the issue of national policies aimed at stimulating the

development of innovative drugs. Therefore, acquisitions can be advantageous if targets meet these policy standards, as it would also speed up the expansion into new markets (Wang, 2020).

Given the various benefits that can be gained from M&A, we can therefore expect M&A to have a positive impact on innovation performance. However, an analysis of US pharmaceutical acquirers over the period 1988-2004 suggests that M&A had a negative effect on acquirers' innovation relative to that of their non-acquiring peers (Ornaghi, 2009). Büssgen & Stargardt (2024) studied the top 30 pharmaceutical companies worldwide and found that the acquirer's innovation indicators, such as research and development spending, did not show a significant increase after M&A. Similar to the two previous studies, Doan (2020) concluded that M&A did not consistently improve the innovation performance of pharmaceutical acquirers worldwide between 2006 and 2012. These studies show that M&A do not guarantee a positive impact on innovation performance.

As we have seen in Section 2.2, performance studies occupy a large place in the M&A literature across all industries, and the pharmaceutical industry is no exception. Demirbag et al. (2007) found that M&A had a negative impact on acquirer's research productivity, return on investment (ROI) and profit margin when compared to non-acquiring firms in the period between 1998 and 2000. By analysing the acquisition of Gland by a leading pharmaceutical company in China, Fosun Pharmaceuticals, Wang (2020) also found negative effects of M&A for instance on profitability, solvency, and operating performance. Kamra & Gupta (2016) instead found no statistically significant difference in the profitability of both acquirers when examining two acquisitions, i.e., the acquisition of Ranbaxy Laboratories Limited by Daiichi Sankyo Company and the one of Piramal Healthcare Limited by Abbott Laboratories.

While there is evidence of M&A having a negative impact on performance, Mantravadi & Reddy (2008) found that the profitability of Indian pharmaceutical acquirers had been positively impacted by M&A in the period between 1991 and 2003. Furthermore, Mihaiu et al. (2021) found that M&A generally increased the financial performance of 70 out 100 publicly listed pharmaceutical acquirers worldwide during the period between 2011 and 2020. However, this study did not compare the performance of acquirers to that of non-acquiring peers. Büssgen & Stargardt (2024) also found evidence of positive impact on performance indicators including revenue, gross and net profit and return on assets.

Furthermore, other studies have obtained mixed results regarding the M&A impact. On the one hand, there is evidence of different effects when mergers and acquisitions are analysed separately, with acquisitions having a positive effect and mergers having moderate or negative effects (Hassan et al., 2007). On the other hand, the results also

differ according to the size of the firm: compared to non-acquiring peers, large acquirers experience no significant difference in growth of enterprise value, sales, employees and R&D spending, and a negative effect on operating growth, while small acquirers have slower R&D growth (Danzon et al., 2007).

This section has shown that the motives for M&A in the pharmaceutical industry are diverse, and that these motives differ according to the size and the financial situation of the company. And again, there is no clear consistency in the results for the impact of M&A on both the financial and innovation performance. In the next section, we present studies that focus on M&A in Belgium.

2.4. M&A in Belgium

In M&A performance literature, several papers tackled M&A focusing on public listed companies (Yunus et al., 2021; Mamahit et al., 2019; Mihaiu et al., 2021; Kinateder et al., 2017; Giudici & Bonaventura, 2018), often due to availability of data, such as in the case of M&A impact on market performance based on stock prices (Krishnakumar, 2012). Belgian M&A studies have the advantage of the availability of accounting data. In fact, all Belgian companies are required to publish their annual accounts, under different predefined forms according to the company size. Therefore, researchers using accounting data can include in their sample not only large and publicly listed companies, but also medium and small privately held companies.

Despite this advantage mentioned above, we found, to the best of our knowledge, limited M&A research including privately held Belgian companies in the data sample. For instance, Ooghe et al. (2006) focused on the post-acquisition performance and found that acquisitions in the period between 1992 and 1994 have negative impacts on the profitability, solvency, and liquidity of acquirers. Huyghebaert & Luypaert (2010) instead examined the factors that lead to growth achieved through M&A by analysing explanatory variables, such as firm characteristics and financial market variables, and the impact of these variables on the M&A profitability. The sample included both Belgian private and listed bidders participating in more than 900 M&A during 1997-2007. The main findings of this research were that the transfer of intangible assets, high industry concentration and the fact that firms operate at a smaller scale had a positive effect on the M&A decision, while ownership concentration and high dependence on bank loans had a negative effect.

The previous examples presented above focused on the acquirers, while Feys et al. (2010) focused on target firms in Belgium and analysed the impact of domestic versus cross-border acquisitions on their performance during the period from 2000 to 2004. The research concluded that targets of domestic acquisitions performed worse than

non-acquiring firms, while targets of cross-border acquisitions performed better than non-acquiring firms.

Based on the papers discussed above, we can conclude that, even in Belgium, the conclusions regarding M&A impact on performance are inconsistent. Moreover, the papers tackling financial performance of M&A acquirers in Belgium are not recent. This motivates us to investigate whether we would obtain similar results to these papers, which focus on the financial performance of Belgian acquirers, by including acquisitions that took place in a more recent period. We therefore examine Belgian acquisitions between 2010 and 2022.

2.5. Methodologies in M&A performance

Various methods are used to determine the impact of M&A on acquirers' post-acquisition performance (Krishnakumar & Sethi, 2012; Andriuskevicius, 2017; Das & Kapil, 2012). This section presents some of the common methodologies in M&A performance, which are event study (Hassan et al., 2007; Cho et al., 2022), accounting-based study (Borodin et al., 2020; Büssgen & Stargardt, 2024; Mamahit et al., 2019; Dixit, 2019; Giudici & Bonaventura, 2018), questionnaire method (Reus & Lamont, 2009; Verma & Bhattacharyya, 2019), innovative performance (Büssgen & Stargardt, 2024; Doan, 2020; Ornaghi, 2009) and case study (Sephita & Nurazi, 2024; Wang, 2020; Hassan et al., 2018). Some authors also combined multiple approaches (Healy et al., 1992; Schoenberg, 2006; Cho et al., 2022; Moeller & Schlingemann, 2005). Several empirical studies include only one category of M&A performance measures in their methodology, such as market measures or accounting measures, and some papers limit themselves to a single measure (Das & Kapil, 2012).

As previously discussed in Section 2.1, synergy gains of an M&A are often considered to be achieved when the value obtained after a merger of two companies is higher than the sum of values one would obtain from the two companies separately (Reed et al., 2007). For this reason, we generally see researchers assess M&A performance by measuring the difference between pre-M&A and post-M&A performance (Berrioategortua et al., 2018; Krishnakumar & Sethi, 2012).

2.5.1. Event study

A big part of the M&A literature applied an event study (Krishnakumar & Sethi, 2012; Berrioategortua et al., 2018). The event study consists of measuring the impact of M&A announcements on the acquirers' stock prices. In other words, it consists of examining the stock market reaction to M&A announcements, by estimating abnormal returns around the announcement date. Therefore, with no surprise, most of these studies

focused on the short-term M&A performance to assess the effect of announcement more reliably within a short time horizon (Hassan et al., 2007; Cho et al., 2022; Rani et al., 2015; Kiymaz & Baker, 2008).

The popularity of this methodology may be partly due to the advantage of data availability and accessibility, making it easier to construct a large sample (Krishnakumar & Sethi, 2012; Adnan et al., 2016). However, this methodology presents the following limitations. As event study measures the stock market perception of success and not overall acquisition performance, it has been criticised as inappropriate for the measurement of the impact of mergers and acquisitions on the company's financial performance (Krishnakumar & Sethi, 2012). Moreover, there is a big assumption in this methodology, i.e., that the market is efficient and can react correctly and promptly to the M&A event (Berrioategortua et al., 2018; Das & Kapil, 2012; Krishnakumar & Sethi, 2012). Furthermore, the event study cannot be implemented to analyse private firms and, therefore, it is limited to M&A transactions involving public firms (Danzon et al., 2007; Andriuskevicius, 2017).

We also found that there is no agreement on the selection of the event window (Krishnakumar & Sethi, 2012). However, it is common to find analyses based on short event windows to avoid external influences (Das & Kapil, 2012). For instance, Hassan et al. (2007) conducted a short-term event study with daily data and different event windows, with the biggest event windows being 30 days in the pre-announcement period (-30 to -1) and 250 days in the post-announcement period (+1 to +250 days). Other authors used shorter time windows, such as Cho et al. (2022) who analysed 10 days before the announcement day up till 1 day after the announcement day. Meanwhile Rani et al. (2015) had the event window of 18 days in the pre-announcement period (-20 to -2) and 41 days in the post-announcement period (-20 to +20).

2.5.2. Accounting-based study

Another classic methodology in M&A performance research is the one using accounting-based measures (Borodin et al., 2020; Büssgen & Stargardt, 2024; Ooghe et al., 2006; Leepsa & Mishra, 2012). It consists of measuring performance based on accounting data, most of the time by comparing ratios of acquirers before M&A with the same ratios of the same firms after the M&A. Then, researchers test the significance in the difference between the post- and pre-M&A performance.

The accounting measures used in M&A studies vary widely. Papers about literature review group these accounting-based measures into various categories of measures, such as growth measures (e.g., revenues, and profits), profitability ratios (e.g., ROE, ROA, and ROCE), solvency ratios (e.g., debt-to-equity ratio and debt-to-assets ratio) and

liquidity ratios (e.g., quick ratio, and current ratio) (Cumming et al., 2023; Thanos & Papadakis, 2012). The most common measures are profitability, liquidity and solvency ratios (Dixit, 2019; Sephita & Nurazi, 2024; Leepsa & Mishra, 2012).

In order to overcome industry bias, researchers also typically compare the difference in performance of acquirers with a control group (Dixit, 2019; Giudici & Bonaventura 2018; Pervan et al., 2015; Huyghebaert & Luypaert, 2010; Martynova et al., 2007; Ornaghi, 2009; Danzon et al., 2007; Demirbag et al., 2007), which is a group of non-acquirers, usually operating in the same industry as the acquirers. However, some papers did not include a control group in the methodology (Yunus et al., 2021; Mihaiu et al., 2021; Rehan et al., 2018).

In accounting performance studies, researchers often use statistical models to measure the difference in performance between before and after the event. A popular model is the change model (Ghosh, 2001; Feys et al., 2010; Ooghe et al., 2006). Other models include the intercept model (Grigorieva & Petrunina, 2015; Dargenidou et al., 2016) and the difference-in-differences model (Austin, 2022; Fukuda, 2020; Dixit, 2019). In this thesis, we measure the performance of acquirers using financial ratios and by applying the three aforementioned models. The methodology section provides a detailed explanation of the models applied in this thesis (Section 3.3).

Different results have been found depending on the models applied. For instance, Martynova et al. (2007) applied two statistical models, the change model and the intercept model to measure four aspects of long-term operating performance in European mergers and acquisitions. This study revealed that the statistical model employed impacts the conclusions: for instance, profitability increased according to the intercept model, meanwhile the change model showed a smaller increase in profitability. Powell & Stark (2005) also found different results by implementing different models to examine the operating performance of UK takeovers. The results revealed that post-takeover operating performance of UK companies moderately increased, and that these improvements tended to be higher using the intercept model than using the change model.

Like any methodology, as discussed by Krishnakumar & Sethi (2012), accounting-based measures have their advantages and disadvantages. Starting with the disadvantages, researchers often point to the lack of homogeneity of accounting standards across countries. Accounting-based methods are not suitable for comparing the accounting data of companies located in different geographical regions, due to significant differences in regulation and accounting standards (Thanos & Papadakis, 2012). Another drawback is that this methodology assumes that the motivation for M&A is solely economic and therefore ignores other motives leading to M&A. Nevertheless, there are

benefits, such as the fact that combining multiple accounting measures in a single study provides researchers with a more integrated view of M&A performance. Another advantage is that it allows the inclusion of data from both public and private companies and does not depend on market perception or efficiency characteristics, whereas, as we have seen above, the event study is subject to market efficiency and has the constraint related to data from public companies.

2.5.3. Alternative methodologies

Besides event studies and accounting-based studies, there are various alternative approaches to measure performance. In this section, we will briefly present some of these alternative methodologies, which are innovative performance, case study and questionnaire.

The impact of M&A on innovation or R&D activity has been evaluated in innovative performance studies. Researchers typically used the number of patents held by acquirers as indicator of innovation (Doan, 2020; Ornaghi, 2009). Nevertheless, other indicators have also been used, such as R&D spending (Büssgen & Stargardt, 2024). This methodology is suitable for researchers analysing firms operating in industries known to have strong R&D activities, such as pharmaceuticals and biotechnology industries. However, this methodology faces the challenge of measuring innovation due to the typically long waiting period before the results from innovation can be seen.

Researchers using the case study method often focus on a small number of acquisitions and perform in-depth analyses of some specific aspects to understand M&A outcomes (Krishnakumar & Sethi, 2012). For instance, Wang (2020) conducted a case study to analyse the motivations of M&A and the financial performance of the acquisition of Gland by a leading pharmaceutical company in China, Fosun Pharmaceuticals. Sephita & Nurazi (2024) also carried out a case study to measure the financial performance using financial ratios from 2015-2018 to 2020-2023 before and after the acquisition of PT Telkom Indonesia (Persero) Tbk. Hassan et al. (2018) carried out four case studies to link motives to outcome assessment for M&A performance. An advantage of this method is that we can understand the acquisition in depth. A disadvantage is that it is difficult to generalise the results.

The questionnaire method involves surveys to M&A professionals. For instance, Verma & Bhattacharyya (2019) surveyed practitioners in cross-border M&A regarding different aspects of post-merger integration. Reus & Lamont (2009) used a survey to evaluate the impact of cultural distance on acquisition performance. The survey was completed by high-level executives from acquirers. This method is useful for analysing aspects that are challenging to measure objectively and considers the fact that M&A can be motivated

by a variety of factors and not just economic ones (Krishnakumar & Sethi, 2012; Andriuskevicius, 2017). Nevertheless, this method is subject to interviewee bias (Krishnakumar & Sethi, 2012).

Some authors have applied multiple methodologies to the same set of acquisitions. By comparing the results of these methodologies, researchers reached contradictory outcomes (Krishnakumar & Sethi, 2012). For instance, Healy et al. (1992) used the change model and intercept model and found a positive relationship between the techniques, whereas Schoenberg (2006) found a negative relationship between four different methods used, namely the event study, different managers assessments, divestment data and expert informants. Other authors have used and compared results obtained from event studies with those from accounting measures (Cho et al., 2022; Hassan et al., 2007).

2.6. Summary

Our literature review showed that there are many studies focusing on financial performance, including in the pharmaceutical industry. In line with other authors conducting literature review (Andriuskevicius, 2017; Das & Kapil, 2012), we can observe that there is no clear agreement on definitions of M&A performance, methodologies and variables applied to assess the performance of firms involved in M&A, as well as research findings (Das & Kapil, 2012; Berrioategortua et al., 2018; Krishnakumar & Sethi, 2012, Thanos & Papadakis, 2012).

Having considered the advantages and limitations of the various aforementioned methodologies, we have chosen to use accounting-based measures in this thesis for the following reasons. First, as Belgian firms are required to publish their annual accounts, accounting measures are available for both public and private firms. Second, as our research focuses on M&A in one country, Belgium, the accounting-based measures method is suitable for comparing financial ratios over different time periods between firms using the same accounting standards. The next section presents the methodology of this thesis in detail.

Chapter 3. Methodology

This section explains our research methodology. First, we describe the financial performance measures. Second, we explain the matching firm selection approach used to mitigate the industry effect. Third, we describe the time windows that are used for comparison and the three different statistical models that are used to test the significance of the impact of M&A on the firms' financial performance.

3.1. Financial performance measures

The purpose of this thesis is to assess the performance of acquirers through a quantitative analysis based on accounting data. This methodology consists of analysing the accounting performance of the combined entity post-acquisition using financial ratios. Ratio analysis is a common technique used to examine financial performance. It typically involves the comparison of various financial ratios over time (historical trend analysis) and the comparison of financial ratios between industry peers with an industry average.

We have chosen accounting data for three reasons. First, the accounting-based study measures the actual outcome of an M&A based on elements reported in the financial statements (Harrison et al., 1991; Krishnakumar, 2012; Thanos & Papadakis, 2012). Second, an advantage of using accounting data is that the analysis can include mergers involving both private firms and subsidiaries of a public firm (Danzon et al., 2007). Third, the accounting method allows us to measure the long-term performance effects of M&A (Danzon et al., 2007).

There is no standard way to determine the financial ratios to include in the analysis (Das & Kapil, 2012; Ooghe et al., 2006, Mihaiu et al., 2021, Danzon et al., 2007; Kanimozhi, 2019; Austin, 2022; Büssgen & Stargardt, 2024). Therefore, in this thesis, we include various ratios from different categories to evaluate multiple aspects related to financial performance (Yunus et al., 2021; Sephita & Nurazi, 2024; Rani et al., 2016; Leepsa & Mishra, 2012; Kanimozhi, 2019; Mantravadi & Reddy, 2008; Wang, 2020). The selected ratios can be grouped into three categories: profitability, solvency, and liquidity. For each category, several financial ratios are chosen to ensure the robustness of the results.

3.1.1. Profitability

The first group of ratios measure profitability, which is the ability of a firm to generate income over a period of time from its resources. These ratios typically analyse elements

such as revenue and expenses. The profitability ratios used in the analysis are return on equity, return on assets, net profit margin and return on capital employed.

Return on equity (ROE) is one of the most common profitability indicators used in M&A performance studies (Berrioategortua et al., 2018; Mihaiu et al., 2021; Mamahit et al., 2019; Yunus et al., 2021; Kamra & Gupta, 2016; Wang, 2020). It measures the net income generated by the investment made by shareholders. ROE is calculated as in Equation (1).

$$ROE = \frac{Net\ income}{Shareholders'\ equity} * 100 \quad (1)$$

Return on assets (ROA) is also one of the most used indicators to measure the effectiveness of M&A transactions (Borodin et al., 2020; Büssgen & Stargardt, 2024; Mamahit et al., 2019; Mihaiu et al., 2021; Dixit, 2019; Giudici & Bonaventura, 2018; Austin, 2022; Yunus et al., 2021; Kanimozhi, 2019). It measures the company's ability to make a profit from its total assets. As ROA varies considerably between industries, this ratio is best used as a comparative measure within the same industry, which is the case in this thesis, as these firms have a similar asset base. ROA is calculated as in Equation (2).

$$ROA = \frac{Net\ income}{Total\ assets} * 100 \quad (2)$$

Net profit margin or **net margin** has been used to measure how much net income is generated from a firm's sales (Mamahit et al., 2019; Yunus et al., 2021; Kanimozhi, 2019; Kamra & Gupta, 2016). This ratio is typically used to examine whether the company has made enough profit from its revenues. Low margins do not necessarily reflect poor performance: they may be caused by considerable one-off events, such as expansion or restructuring costs, which reduce profits in the current period. Net profit margin is calculated as in Equation (3).

$$Net\ profit\ margin = \frac{Net\ income}{Revenue} * 100 \quad (3)$$

Return on capital employed (ROCE) has been used to measure the firm's ability to generate sufficient profit from its capital (Leepsa & Mishra, 2012; Rani et al., 2016; Kanimozhi, 2019). ROCE is calculated as in Equation (4).

$$ROCE = \frac{EBIT}{Capital\ employed} * 100 \quad (4)$$

where *Capital employed* is equal to the sum of shareholders' equity and long-term liabilities.

3.1.2. Solvency

Solvency ratios assess the ability of a company to meet its financial obligations. The solvency ratios used in the analysis are the solvency ratio, the interest coverage ratio, the debt-to-assets ratio and the debt-to-equity ratio.

The **solvency ratio** or **shareholders equity ratio** or **financial independence ratio** measures the proportion of a company's assets that are financed by issuing equity rather than by borrowing. The lower the ratio, the more debt the company has used to cover its assets. In other words, it assesses a company's financial independence and its ability to raise external capital. The higher the ratio, the healthier the company's financial position. The solvency ratio is calculated as in Equation (5).

$$Solvency\ ratio = \frac{Shareholders'\ equity}{Total\ assets} * 100 \quad (5)$$

The **interest coverage ratio** has been used to measure a firm's ability to pay interest given the firm's available earnings (Leepsa & Mishra, 2012; Ong, 2012). In general, a higher ratio is preferred. A ratio lower than 1.5 might suggest that the firm has some difficulties in paying interest on its debts. The interest coverage ratio is calculated as in Equation (6).

$$Interest\ coverage\ ratio = \frac{Operating\ P/L}{Debt\ charges} * 100 \quad (6)$$

The **debt-to-assets ratio,** or **debt-to-total assets ratio** or **debt ratio** has been included to measure the percentage of assets covered by debt (Sephita & Nurazi, 2024; Leepsa & Mishra, 2012). A lower ratio suggests a positive position for creditors, meaning that there are sufficient assets to cover long-term liabilities. On the contrary, a higher ratio indicates higher financial risks. If the ratio is higher than 1, a significant part of a firm's assets is financed by debt, meaning that the company has more liabilities than assets

and that shareholders' equity is negative. The debt-to-assets ratio is calculated as in Equation (7).

$$Debt - to - \ assets\ ratio \ = \frac{Total\ liabilities}{Total\ assets} * 100 \qquad (7)$$

The **debt-to-equity ratio (D/E),** or **total debt ratio** is a solvency ratio widely used in this type of study (Leepsa & Mishra, 2012; Mihaiu et al., 2021; Mantravadi & Reddy, 2008; Yunus et al., 2021; Kamra & Gupta, 2016). It compares debts to equity. Compared to D/E ratios of peer firms, a higher ratio might indicate a higher investment risk, while a lower ratio indicates that the firm is less reliant on debt. The D/E ratio is calculated as in Equation (8).

$$D/E\ ratio \ = \frac{Total\ liabilities}{Shareholders'\ equity} * 100 \qquad (8)$$

3.1.3. Liquidity

Liquidity ratios measure a firm's ability to meet short-term liabilities with its available liquid assets (Mamahit et al., 2019). The liquidity ratios used in the analysis are the current ratio and the quick ratio.

The **current ratio** is a common liquidity indicator in M&A performance studies (Leepsa & Mishra, 2012; Yunus et al., 2021; Kanimozhi, 2019). This ratio measures a company's ability to pay short-term debts with current assets. A ratio greater than 1 indicates that the company has sufficient assets to meet its current liabilities. A ratio of 2 or above generally indicates good health. Therefore, the higher the ratio, the better the liquidity position of a company as the more funds a firm has available to meet its short-term liabilities. The current ratio is calculated as in Equation (9).

$$Current\ \ ratio \ = \frac{Current\ assets}{Current\ liabilities} * 100 \qquad (9)$$

The current ratio may not always be accurate: as it includes all current assets, not all of them are liquid. To overcome this limitation, we added the quick ratio.

The **quick ratio** or **acid-test ratio** is also included in other studies (Leepsa & Mishra, 2012; Wang, 2020). It measures a company's ability to pay short-term liabilities with

current assets, excluding inventories, which are not as liquid as other current assets, such as cash and cash equivalents, and trade receivable. A ratio equal to 1 or above is generally considered healthy. The quick ratio is calculated as in Equation (10).

$$Quick\ ratio\ = \frac{Current\ assets\ -\ inventory}{Current\ liabilities} * 100 \qquad (10)$$

3.1.4. Challenges of financial ratio analysis

Ratio analysis presents some common challenges. These challenges include the difficulty in comparing companies due to differences in accounting standards across countries. However, this thesis overcomes this limitation by focusing on the analysis of domestic M&A in Belgium.

Furthermore, ratios are best interpreted together with the context in which they are calculated. For instance, as we have seen above, low margins do not always indicate poor profitability, as they might be affected by one-off significant events that can be seen as investments to improve profitability levels in the future. In this thesis we include three different categories of financial ratios to provide a broader view of financial performance. However, as this thesis uses a quantitative method, no contextual analysis per acquisition is carried out. Therefore, the results are analysed from a general perspective.

3.2. Matching firm method

One challenge is that a firm's financial performance is influenced not only by M&A transactions but also by other factors. Therefore, the matching firm method is used in research papers on M&A performance to mitigate bias in the measurement of performance (Huyghebaert & Luypaert, 2010, Krishnakumar, 2012; Martynova et al., 2007; Ornaghi, 2009). It consists of creating a control group of non-acquiring firms to eliminate the industry effect. Non-acquiring firms are selected based on multiple criteria. For instance, Huyghebaert & Luypaert (2010) selected matching firms based on comparable size in terms of similar total assets, the same company status (public or private), and the condition of not having been involved in any M&A during a predefined period prior the year of acquisition.

Matching firm method has advantages over using industry median in reducing bias in the results (Ghosh, 2001). The industry median-adjusted method adjusts firm's performance based on the median performance calculated from all firms in the same industry. Using the industry median biases the performance results for the following

reasons: first, firms typically make acquisitions after a period of high performance; second, acquirers tend to be larger than industry median firms (Ghosh, 2001). Furthermore, Ghosh (2001) stated that acquiring firms and matching firms should have similar characteristics in terms of performance in the period before acquisition in order to correctly analyse the performance in the period following the acquisition. Following this reasoning, we used the matching firm method to discount industry effects rather than industry median-adjusted method. We applied the matching firm method based on the criteria of size, industry, and country. Since the matching firms are of the same industry, country, and size as the acquirers, it can be assumed that the matching firms will provide a reliable benchmark for this study.

Only Belgian pharmaceutical companies are considered in this thesis. For each M&A data sample, a matching non-acquiring firm is assigned. The matching firm must also belong to the pharmaceutical industry in Belgium. In other words, all matching firms and acquirers belong to the same industry (pharmaceuticals) and the same country (Belgium). In the case of an M&A data sample, the matching firm is the firm whose total assets is closest to that of the acquiring firm in the year preceding the M&A event. At the same time, the matching firm may not be involved in an M&A event in the period from three years before the M&A event to three years after the M&A event. Using this matching method, the largest difference in total assets between acquirers and matching firms in this study is 108%.

In this thesis, “matching firm-adjusted” refers to the difference between the acquirers and the matching firms. The term “performance” refers to the financial ratios described in Section 3.1.

3.3. Statistical models

In order to assess the impact of M&A on the performance of acquirers in the Belgian pharmaceutical industry, multiple statistical models and different time windows were used to ensure the robustness of the results. In total, we used three different statistical models over five different time windows.

3.3.1. Comparison time windows

There is no consensus on the time windows used to assess the change in a firm's performance before and after mergers and acquisitions (Thanos & Papadakis, 2012). For example, Danzon et al. (2007) examined the impact of acquisitions on various performance measures of firms in the post-merger period between year t (the year in which the merger took place) and up to t+4. Dixit (2019) focused on the ROA of acquiring and control firms for three years in each pre- and post-acquisition period. Other authors

analysed the evolution of firm performance over longer periods, such as 10 years (Mihaiu et al., 2021). Büssgen & Stargardt (2024) considered a pre-merger period of two years and a post-merger period of three years. Martynova et al. (2007) analysed the operating performance over a period of three years before and after the acquisitions.

In this thesis, change in performance will be examined using five time windows:

- One year before acquisition compared to one year after acquisition (-1 to +1).
- Two years before acquisition compared to two years after acquisition (-2 to +2).
- Three years before acquisition compared to three years after acquisition (-3 to +3).
- One year before acquisition compared to two years after acquisition (-1 to +2).
- One year before acquisition compared to three years after acquisition (-1 to +3).

3.3.2. Change model

The first model we applied, the change model, has been used to estimate the post-acquisition performance improvement (Ghosh, 2001; Martynova et al., 2007; Powell and Stark, 2005; Healy et al., 1992). The change model compares the difference between the pre-acquisition and post-acquisition performance of the acquirers, where performance can be industry-adjusted or matching firm-adjusted. The advantage of the change model is that it is easy to implement and interpret.

In this thesis, the change model consists of two comparisons. In the first comparison, the differences between the financial performance of acquirers and matching firms were calculated per relative year around the acquisition years. Financial performance was measured using the financial ratios described in Section 3.1. The differences of each year were then tested using T-test and Wilcoxon test for statistical significance. We selected six years for comparison, including three years before acquisitions and three years after acquisitions. This comparison provides an insight into the difference in the performance of acquirers and matching firms per year. In the years before acquisitions, if the matching firms are well selected, there will be no significant difference in performance between acquirers and matching firms. In the years after acquisitions, if there are significant differences in performance between acquirers and matching firms, we can conclude that acquisitions have a significant impact on the performance of acquirers.

In the second comparison, five time windows were used, as explained in Section 3.3.1. For each time window, we compared the acquirer's matching firm-adjusted performance in the year before the acquisition with the acquirer's matching firm-adjusted performance in the year after the acquisition. This comparison provides an insight into the changes in the performance differences between the acquirers and the

matching firms between the pre- and post-acquisition periods. The formula to obtain the change in the performance, represented by a financial ratio for each time window, is as in Equation (11).

$$\text{Change in performance} = (Acq_i - Mat_i)_{post} - (Acq_i - Mat_i)_{pre} \quad (11)$$

where:

- $(Acq_i - Mat_i)_{post}$ is the performance difference between the acquirer i and the matching firm i in the period after acquisition.
- $(Acq_i - Mat_i)_{pre}$ is the performance difference between the acquirer i and the matching firm i in the period before acquisition.

Figure 8 illustrates how the changes were calculated in the second comparison. The significance of the changes was tested using the T-test and the Wilcoxon test. The T-test can indicate whether the mean of the changes is statistically significant, assuming that the performance measures are normally distributed. As the financial measures may not follow a normal distribution (Ooghe et al., 2006), the Wilcoxon-Test was also performed as it shows the statistical significance in the median of the financial measures and does not require the assumption of a normal distribution (Martynova et al., 2007; Grigorieva & Petrunina, 2015). To validate H1, H2 and H3, the resulting p-values of the tests must be less than 0.1, i.e., the differences are significant at 10% level.

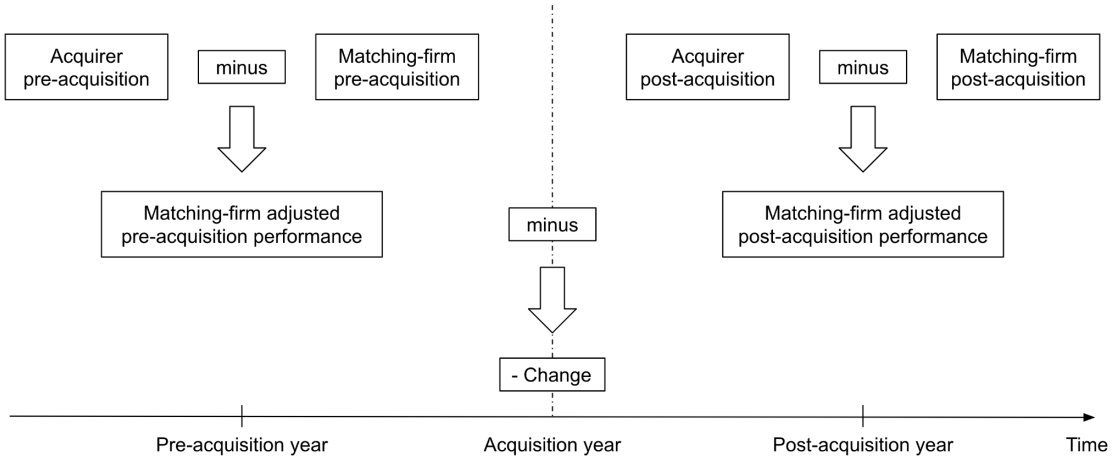

Figure 8. Calculation of the change in matching firm-adjusted performance

The Change block in the figure has a negative sign because the Change value is defined as the subtraction of the pre-acquisition performance from the post-acquisition performance.

3.3.3. Intercept model

The intercept model is another widely used statistical model to examine the change in performance between the pre- and post-acquisition periods (Powell and Stark, 2005; Healy et al., 1992; Ghosh, 2001; Martynova et al., 2007; Grigorieva & Petrunina, 2015; Dargenidou et al., 2016; Giudici & Bonaventura, 2018; Mamahit et al., 2019). This model can take into account persistence effects in firm performance measures over time (Healy et al., 1992). It uses a linear regression model and the Ordinary Least Squares (OLS) method to estimate the impact of the acquisition on the financial ratios.

In this thesis, we used matching firm-adjusted financial ratios to discount industry bias effects. This was done using the Equation (12).

$$AdjPerformance_{i,t} = Acq_{i,t} - Mat_{i,t} \quad (12)$$

where:

- $Acq_{i,t}$ is the performance of the acquiring firm i in year t.
- $Mat_{i,t}$ is the performance of the corresponding matching firm i in year t.

The adjusted performance represents the difference between the performance of the acquirer and the performance of the matching firm. The regression equation was then defined as in Equation (13).

$$AdjPerformance_{i,post} = \alpha + \beta * AdjPerformance_{i,pre} + \varepsilon_i \quad (13)$$

where:

- $AdjPerformance_{i,post}$ is the post-acquisition matching firm-adjusted performance measured by a financial ratio.
- $AdjPerformance_{i,pre}$ is the pre-acquisition matching firm-adjusted performance measured by a financial ratio.
- α represents the intercept measuring the impact of the acquisition on the performance of the acquirer.
- β is the correlation in performance between the pre- and post- acquisition periods. It represents the persistence of the financial ratio between the pre- and post- acquisition periods.
- ε_i represents the impact of unknown factors on the post-acquisition performance.

In order to validate H1, H2 and H3, the α coefficient in Equation (13) should be statistically significant at 10% level, i.e., with a p-value of less than 0.1.

3.3.4. Difference-in-differences model

Difference-in-differences (DD) is a technique that compares the difference in the change in performance before and after an event for a treatment group and a control group (Roberts & Whited, 2013). The treatment group is the group that has experienced an event, while the control group is the group that did not. This technique has been used in several economic and financial studies, including papers examining changes in financial and operating performance in the context of mergers and acquisitions (Dixit, 2019; Austin, 2022; Büssgen & Stargardt, 2024).

For each of the five time windows described in Section 3.3.1, two time periods were considered, one before and one after the M&A event (Roberts & Whited, 2013). The treatment group is represented by the Belgian pharmaceutical acquirers, while the control group is represented by the non-acquiring matching firms identified based on criteria described in Section 3.2. The DD model assumes a parallel trend between the performance of the control group and that of the treatment group. In the context of this thesis, this means that the model assumes that the financial ratios of the acquirers and the matching firms follow a parallel trend. The validity of this assumption is supported by the fact that all acquirers and matching firms are in the same industry, in the same country and of similar size. Similar to Dixit (2019), the regression equation implemented in the analysis is as in Equation (14).

$$Y_{i,t} = \beta_0 + \beta_1 * \text{Event Dummy}_i + \beta_2 * \text{Post Dummy}_t + \beta_3 * \text{Event Dummy}_i * \text{Post Dummy}_t + \varepsilon_{i,t} \quad (14)$$

where:

- $Y_{i,t}$ is the performance, measured as the financial ratio of firm i in year t.
- Event Dummy_i is a binary variable equal to 1 if firm i is an acquirer and 0 if firm i is a matching firm.
- Post Dummy_t is a binary variable equal to 1 if the year t is after the acquisition year and 0 if the year t is before the acquisition year.
- β_0 represents the average performance of the matching firms in the pre-acquisition period.
- β_1 represents the difference in the performance between acquirers and matching firms in the pre-acquisition period.

- β_2 represents the difference in the performance between the matching firms before and after the acquisition.
- β_3 represents the change in the difference in the performance from pre-acquisition to post-acquisition between the group of acquirers and the group of matching firms, i.e., the difference in differences.
- $\varepsilon_{i,t}$ represents the effect of unknown factors on the performance of firm i in year t.

Figure 9 illustrates the meaning of the coefficients β_0, β_1, β_2 and β_3, as well as the parallel trend assumption in the DD model. In this thesis, the most important coefficient is β_3, which represents the interaction effect, equal to the financial ratios' difference-in-differences between acquirers and matching firm. In other words, it represents the impact of M&A on the performance of the acquirers in the post-M&A period.

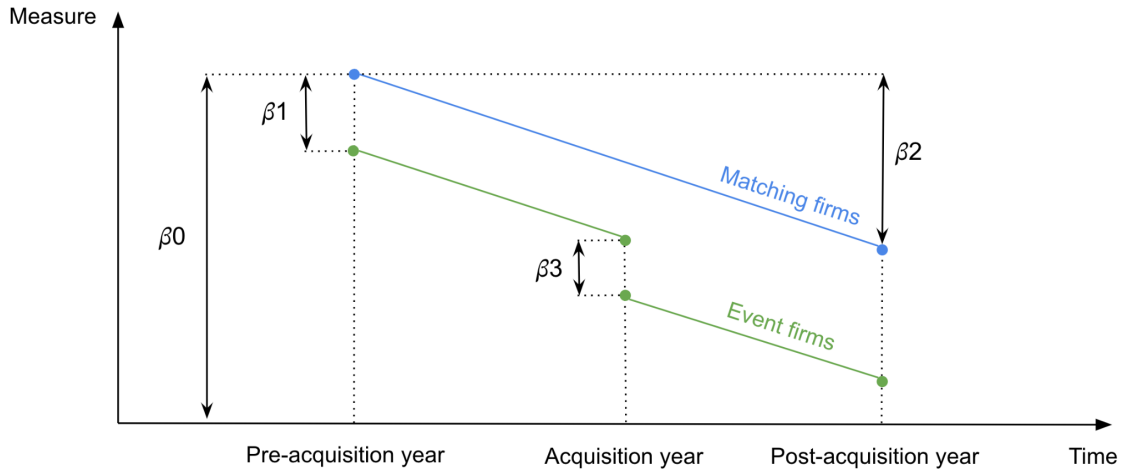

Figure 9. The meaning of each coefficient in the difference-in-differences model
The blue line shows the financial measure of matching firms. The green line shows the financial measure of event firms.

If a significant value is obtained for β_3, we can conclude that the change in the performance of the acquirer is different from that of the matching firms over the same time period.

Chapter 4. Data

This section presents the data collection approach and describes the sample of data used in the three statistical models.

4.1. Data collection

The data used in this thesis were collected using Bel-first. Bel-first is a data platform containing extensive information on the annual accounts of Belgian and Luxembourg companies provided by Bureau van Dijk. Bel-first has been used to collect data for other M&A studies (Huyghebaert & Luypaert, 2010; Ooghe et al., 2006). In our study, only Belgian companies were considered.

First, similar to Goethals & Wunderle (2018), we selected pharmaceutical firms by filtering based on the NACE-BEL 2008 classification. Following the same code selection procedure as Goethals & Wunderle (2018), the selected acquisition firms belong to the primary activity code 21 "Pharmaceutical industry", which includes the activities "Manufacture of basic pharmaceutical products" (NACE-BEL Code 21.10) and "Manufacture of pharmaceutical preparations" (NACE-BEL Code 21.20). We also included companies specialising in certain activities upstream and downstream of the production process that falls within the scope of the pharmaceutical sector. These activities are "Biotechnology research and development" (NACE-BEL Code 72.11) and "Wholesale of pharmaceutical products" (NACE-BEL Code 46.46).

The selected firms were then filtered according to the size criteria of "Medium-sized", "Large" and "Very Large" companies. Since Bel-first contains data of all public and private companies in Belgium, including very small companies with very small acquisitions, in this thesis we focused only on acquisitions with acquirers of at least medium-sized and avoid mini-acquisitions where the acquirers are very small. Therefore, we selected medium-sized, large and very large companies. From this set of medium-sized, large and very large pharmaceutical companies, both acquirers and matching firms were then selected. According to Bel-first, company size is defined as follows.

Very large companies meet at least one of the conditions below:

- Operating revenue of at least EUR 100 million.
- Total assets of at least EUR 200 million.
- Number of employees of at least 1000.

Large companies meet at least one of the conditions below:

- Operating revenue of at least EUR 10 million.
- Total assets of at least EUR 20 million.
- Number of employees of at least 150.
- Not very large.

Medium-sized companies meet at least one of the conditions below:

- Operating revenue of at least EUR 1 million.
- Total assets of at least EUR 2 million.
- Number of employees of at least 15.
- Not very large or large.

Similar to Ooghe et al. (2006), from the set of selected pharmaceutical companies above, we identified acquisitions by filtering the legal event "Company absorbing an(other) company/ies". Company absorption refers to the event in which a company absorbs another company to form one active company and after the absorption, only one company exists, while the other becomes inactive. Only the absorptions that took place in the period 2010-2022 are considered. Among all the identified legal events "Company absorbing an(other) company/ies", we analysed case by case and manually filtered out the legal events that are similar to internal restructurings involving companies belonging to the same group.

In the context of this thesis, we will refer to M&A or acquisition as a completed transaction in which the acquirer fully absorbs the target which will stop existing after the transaction. Furthermore, our sample includes only domestic M&A involving companies based in Belgium. Finally, targets in our sample do not necessarily belong to the same industry of the acquirer. Furthermore, an M&A event refers to an acquisition involving an acquirer and a year. This means that for an M&A event, the acquirer must make at least one acquisition in the corresponding year. If an acquirer makes several acquisitions in one year, these acquisitions are counted as one data sample. All financial ratios discussed in Section 3.1 were collected on Bel-first for both selected acquirers and matching firms.

4.2. Descriptive analysis

Using the search criteria mentioned in the previous section, there are 1395 medium, large and very large pharmaceutical companies in Belgium. Figure 10 shows the distribution of the companies extracted from Bel-first. There are 836 medium-sized companies (59.9%), 421 large companies (30.2%) and 138 very large companies (9.9%).

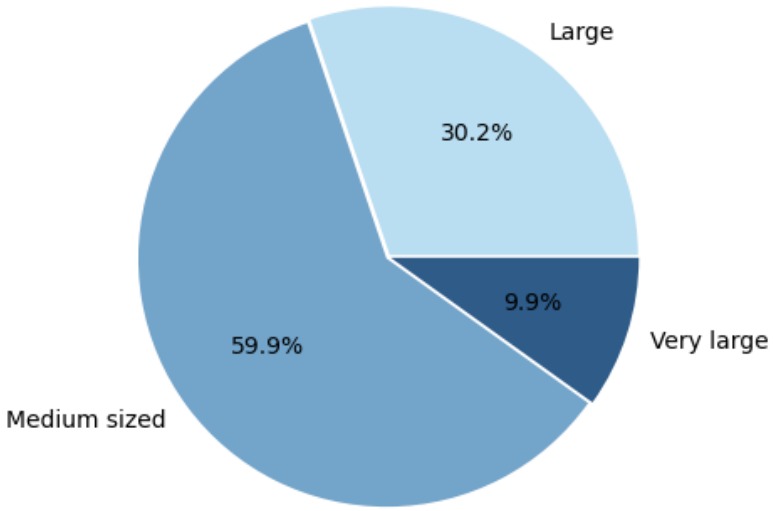

Figure 10. Distribution of Belgian pharmaceutical companies by size

Figure 11 shows that out of the 1395 companies selected, 334 companies (23.9%) have activities related to the NACE-BEL Code 21, “Manufacture of basic pharmaceutical products and pharmaceutical preparations”. 1011 companies (72.5%) have activities related to the NACE-BEL Code 46.46, “Wholesale of pharmaceutical goods”. 220 companies (15.8%) have activities related to the NACE-BEL Code 72.11, “Research and experimental development on biotechnology”. It should be noted that a company may have activities related to more than one NACE-BEL Code.

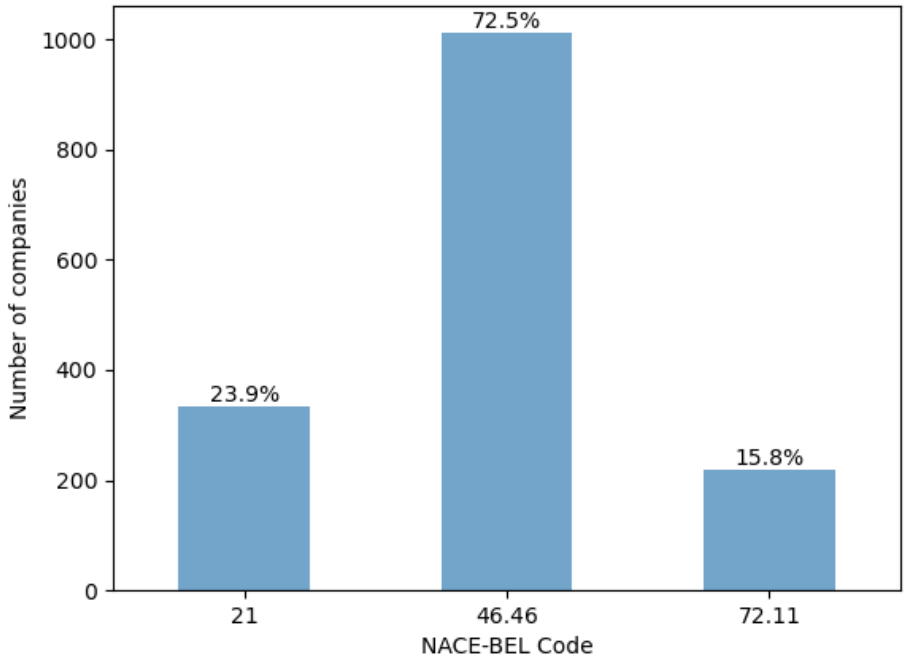

Figure 11. Distribution of Belgian pharmaceutical companies by NACE-BEL Code

Between the period 2010 and 2022, there are 198 identified acquisitions, with 124 different acquirers (see APPENDIX 1: List of domestic acquisitions in Belgium between 2010 and 2022 collected on Bel-first). In total, 51 acquisitions (25.8%) were made by medium-sized acquirers, 92 acquisitions (46.5%) by large acquirers and 55 acquisitions (27.8%) by very large acquirers. Figure 12 shows the distribution of the acquisition over years and Figure 13 describes the distribution of the acquisitions per size category of acquirers.

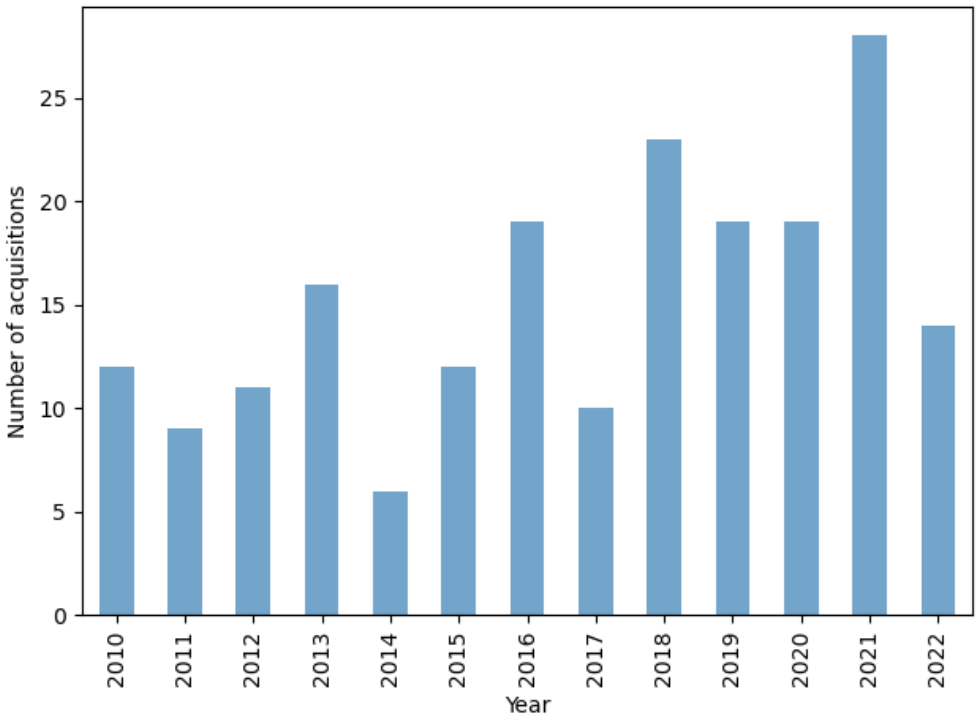

Figure 12. Distribution of acquisitions over the period 2010-2022

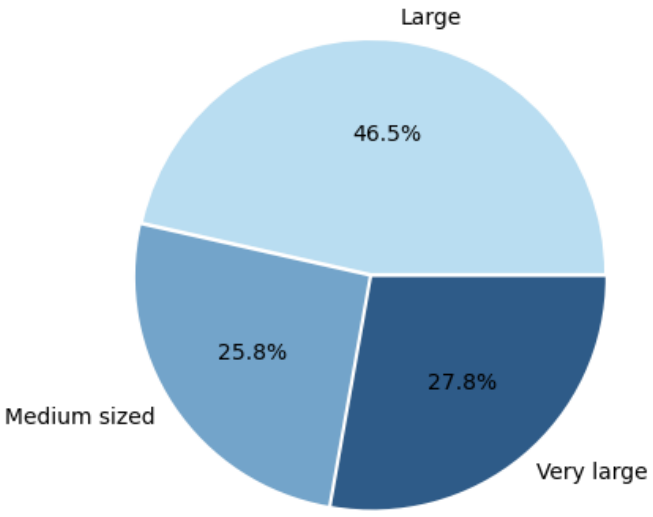

Figure 13. Distribution of acquisitions by the size of acquirer

Figure 14 shows that, out of 198 acquisitions in the period 2010-2022, 39 acquisitions (19.7%) have acquirers with activities related to NACE-BEL Code 21, “Manufacture of basic pharmaceutical products and pharmaceutical preparations”. 181 acquisitions (91.4%) have acquirers with activities related to the NACE-BEL Code 46.46, “Wholesale of pharmaceutical goods”. 9 acquisitions (4.5%) had acquirers with activities related to NACE-BEL Code 72.11, “Research and experimental development on biotechnology”. Note that, an acquirer may have activities related to several NACE-BEL Codes.

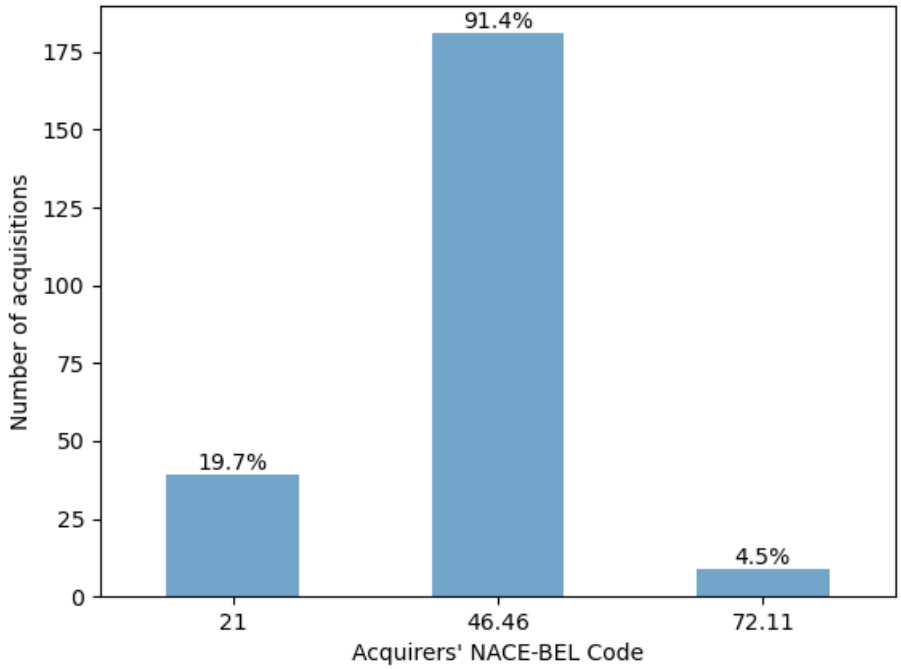

Figure 14. Distribution of acquisitions by the NACE-BEL Code of acquirers

Acquisitions with the same acquirer and in the same year are counted as one data sample. This results in a total of 164 data samples between 2010 and 2022. As Bel-first does not always contain all accounting measures for each year, the number of samples per measure per year varies. At the same time, following our matching procedure, the sample size was further reduced as for some acquirers there is no matching firm with complete accounting information. Table 1 shows the sample size per relative year and per financial ratio after the matching procedure.

Table 1. Sample distribution per relative year after matching procedure

Out of 164 data samples, depending on the financial ratio and the relative year, the number of data samples with complete accounting information reduces further. Each cell in the table shows the number of data samples with complete accounting information for the corresponding financial ratio and relative year.

Category	Financial ratio	Relative year					
		-3	-2	-1	+1	+2	+3
Profitability	ROE	86	102	110	97	82	65
	ROA	94	109	116	102	83	68
	Net profit margin	44	52	57	52	45	37
	ROCE	80	96	105	90	79	64
Solvency	Solvency ratio	93	109	116	102	83	68
	Interest coverage ratio	62	70	66	66	58	46
	Debt-to-assets ratio	81	96	105	90	79	65
	D/E ratio	80	96	104	90	79	65
Liquidity	Current ratio	88	101	108	94	80	67
	Quick ratio	87	100	107	94	80	67

In our statistical models, we used five different time windows to compare pre- and post-M&A performance, as explained in Section 3. One data sample in each time window contains the performance of the acquirer and the corresponding matching firm in the corresponding years before and after the M&A. For example, a sample comparing the "Return on assets" measure in the -1 to +1 time window requires the availability of the "Return on assets" data for both the acquirer and the matching firm and in both the year before and the year after the M&A event. As some matching firms do not have the required data in the time window comparison, the sample size is further reduced. Table 2 shows the sample size of the time window comparison in our statistical models.

Table 2. Sample distribution by financial ratio for each time window

Out of 164 data samples, depending on the financial ratio and the time window, the number of data sample with complete accounting information reduces further. Each cell in the table shows the number of data samples with complete accounting information for the corresponding financial ratio and time window.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -2 to +2	Year -3 to +3	Year -1 to +2	Year -1 to +3
Profitability	ROE	92	72	40	78	62
	ROA	102	77	47	83	68
	Net profit margin	47	33	21	41	34
	ROCE	86	69	38	76	62
Solvency	Solvency ratio	102	77	45	83	68
	Interest coverage ratio	52	45	31	40	37
	Debt-to-assets ratio	86	69	39	76	63
	D/E ratio	85	68	38	75	62
Liquidity	Current ratio	93	72	46	79	66
	Quick ratio	92	71	46	78	65

Chapter 5. Results

This chapter presents the results of the quantitative methods described in Chapter 3. All the statistical models were implemented in Python (see APPENDIX 2: Python code for statistical models). First, we present the test results of each statistical model. Then, we discuss the results and whether they support the research hypotheses.

5.1. Change model - Relative year comparison

This section presents the result of the first comparison in the change model. In this comparison, we analysed the financial ratios in the six-year period around acquisition years. The mean and the median of the financial ratios were calculated and analysed. We also analysed the difference between the acquirers' and the matching firms' financial ratios for each relative year around the acquisitions.

Figure 15 shows the mean of each profitability ratio per relative year and the mean differences between the acquirers and the matching firms' ratios. The acquirers have constantly higher ROE, ROA and ROCE than the matching firms three years after acquisitions, while there is no clear pattern about the performance differences in those ratios in the pre-acquisition period. For example, compared to the matching firms, the acquirers have a lower mean ROE in year -2, lower mean ROA in year -3, and lower mean ROCE in year -2 and -1. The only profitability ratio where the acquirers have a lower mean value than the matching firms in the post-acquisition period is the net profit margin, where the acquirers have lower mean values in years +2 and +3.

Table 3 shows the statistical significance of those differences by applying T-Test to the mean differences. According to the resulting p-value of T-Test, in the pre-acquisition periods, there are no statistically significant differences at 10% level (p-value is less than 0.1) between the acquirers and the matching firms in any profitability ratios. It means that in terms of profitability, the matching firms are well-matched with the acquirers. In the first year after acquisitions, significant increases in ROE and ROA are found. It might indicate that the acquirers perform better than the matching firms in ROE and ROA in the first year after the acquisitions. However, a significant decrease is found in the net profit margin ratios three years after acquisitions. It means that the acquirers suffered significantly lower net profit margin compared to the matching firm in the third year after acquisitions. There is no significant difference in ROCE in both pre- and post-acquisition periods. In brief, there is no strong evidence that there is a significant difference between the profitability ratios of acquirers and of matching firms in the years after the acquisitions.

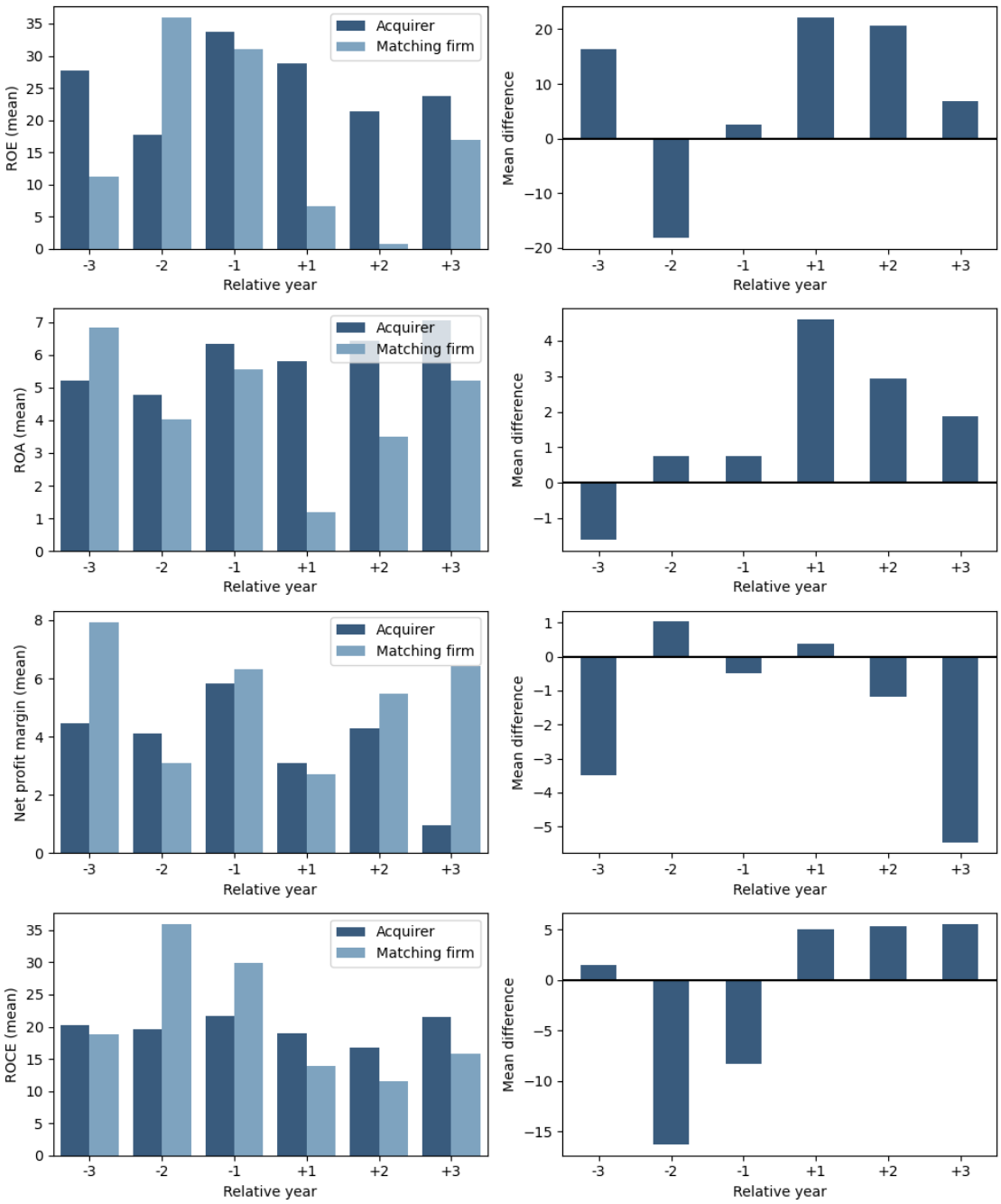

Figure 15. Mean values and mean differences of profitability ratios per relative year

The sub-figures on the left show the mean values of each profitability ratio for acquirers and for matching firms. The sub-figures on the right show the mean differences in each profitability ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

Table 3. Change model and T-test results for profitability ratios per relative year

This table presents the mean differences in profitability ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the T-test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	-2	-1	+1	+2	+3
Profitability	ROE	16.44 (0.21)	-18.18 (0.14)	2.55 (0.85)	**22.17 (0.07)**	20.61 (0.14)	6.84 (0.27)
	ROA	-1.62 (0.55)	0.75 (0.76)	0.76 (0.72)	**4.6 (0.06)**	2.93 (0.19)	1.86 (0.23)
	Net profit margin	-3.48 (0.41)	1.03 (0.69)	-0.49 (0.86)	0.38 (0.9)	-1.18 (0.68)	**-5.46 (0.09)**
	ROCE	1.46 (0.88)	-16.25 (0.2)	-8.32 (0.43)	5.01 (0.31)	5.28 (0.39)	5.57 (0.26)

The mean of each solvency ratio per relative year and their mean differences between the acquirers and the matching firm are shown in Figure 16. In both the pre- and post-acquisition periods, acquirers often have lower solvency ratio and interest rate coverage ratio compared to those of matching firms. Acquirers only have higher solvency ratio in the year -2 and higher interest coverage ratio in the year +3. This could indicate that acquirers have a tendency to have higher debt levels than non-acquiring matching firms. The opposite is observed in the debt-to-assets ratio and D/E ratios, where acquirers often have higher values than matching firms. For debt-to-assets ratio, after being slightly lower than that of matching firms in year -3 and -2, acquirers have consistently higher debt-to-assets ratios than matching firms in the other years. It shows that there is a tendency for acquirers to have more liabilities than assets compared to matching firms. Moreover, acquirers always have higher D/E ratios than matching firms in all years before and after acquisitions. A higher D/E ratio might therefore suggest that acquirers present higher investment risk than non-acquirers.

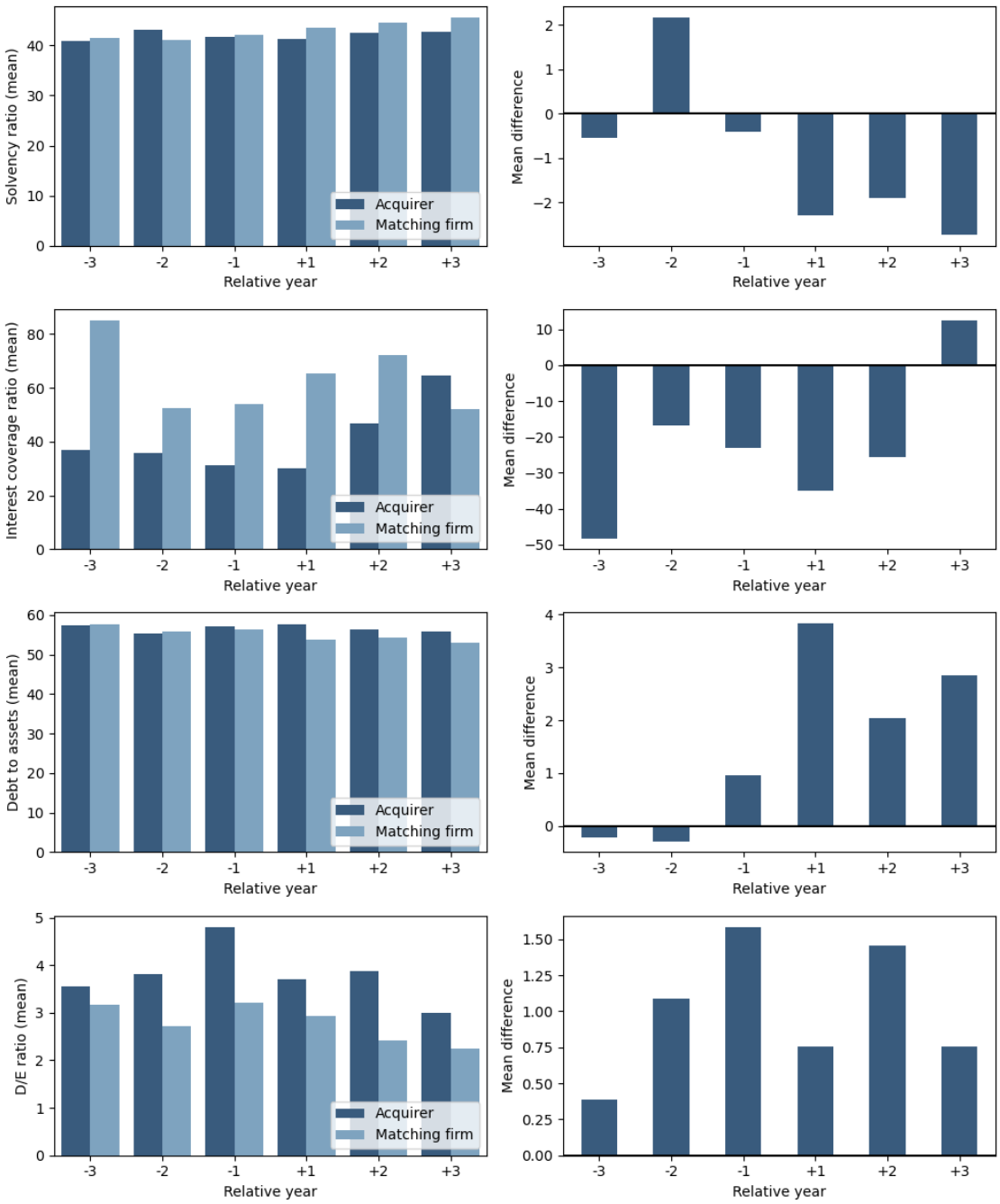

Figure 16. Mean values and mean differences of solvency ratios per relative year

The sub-figures on the left show the comparison of the mean values of each solvency ratio for acquirers and for matching firms. The sub-figures on the right show the mean differences in each solvency ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

Table 4 shows whether the differences in the solvency ratios between acquirers and matching firms are significant in each year. The p-values of the T-Tests indicate that only the difference in the interest coverage ratio in year -3 is statistically significant at 10% level, meaning that acquirers have significantly lower interest coverage ratios than matching firms. Similar to the results of profitability ratios discussed above, the

insignificance in most differences in the pre-acquisition period also suggests that the selected matching firms are good matches in terms of solvency ratios. However, as no significant difference is found in the post-acquisition period, there is no evidence showing that the acquirers were doing better or worse than their matching firms after acquisitions in terms of solvency.

Table 4. Change model and T-test results for solvency ratios per relative year

This table presents the mean differences in solvency ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the T-test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	-2	-1	+1	+2	+3
Solvency	Solvency ratio	-0.54 (0.89)	2.18 (0.54)	-0.4 (0.91)	-2.3 (0.53)	-1.89 (0.62)	-2.73 (0.57)
	Interest coverage ratio	**-48.22 (0.08)**	-16.66 (0.51)	-22.99 (0.18)	-35.09 (0.15)	-25.6 (0.15)	12.53 (0.7)
	Debt-to-assets	-0.21 (0.96)	-0.29 (0.93)	0.96 (0.78)	3.83 (0.31)	2.03 (0.61)	2.84 (0.56)
	D/E ratio	0.39 (0.64)	1.09 (0.3)	1.58 (0.13)	0.75 (0.44)	1.46 (0.14)	0.75 (0.47)

Figure 17 presents the mean of liquidity ratios per year and the mean differences in liquidity ratios between acquirers and matching firms. Two ratios are used, the current ratio and the quick ratio. Both the current ratio and the quick ratio indicate lower values for acquirers, except for year +2, in which the acquirers have higher values than the matching firms. The mean differences show that acquirers often had a worse liquidity position than matching firms and that acquirers had fewer current assets available than matching firms to meet their short-term liabilities. We can also observe that there is a decreasing trend in both ratios for acquirers from year -3 to year -1, whereas there is an increasing trend in the current ratio for matching firms in the same period. As acquirers might need to rely on debt to finance their acquisitions, the decreasing trends in the pre-acquisition period might be in part explained.

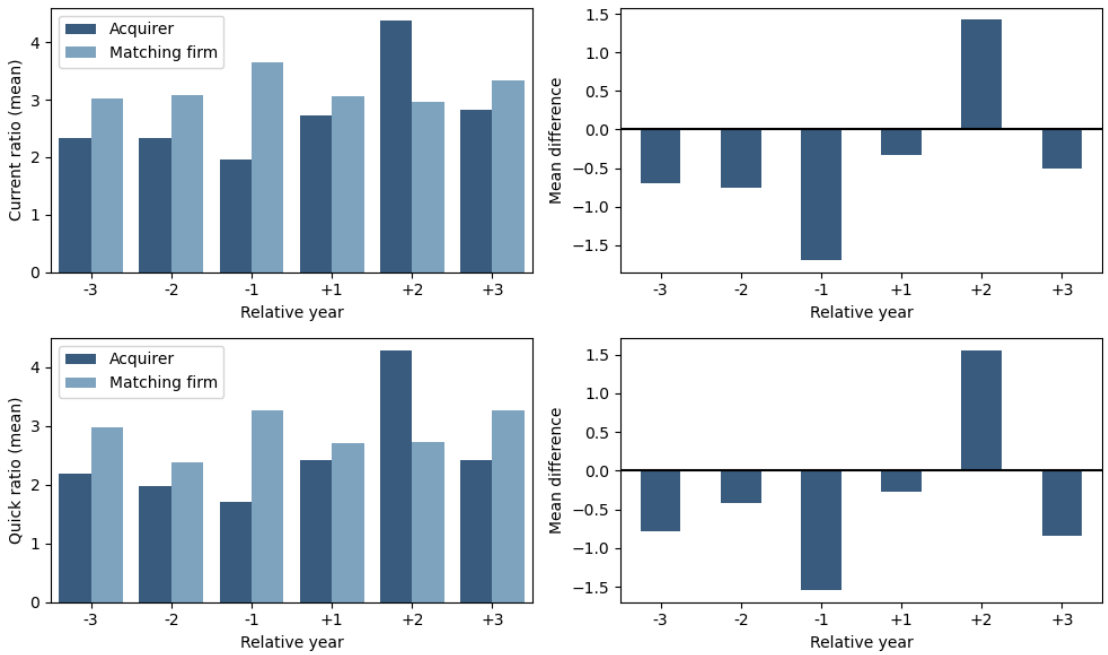

Figure 17. Mean values and mean differences of liquidity ratios per relative year

The sub-figures on the left show the comparison of the mean values of each liquidity ratio for acquirers and for matching firms. The sub-figures on the right show the mean differences in each liquidity ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

The significance of the mean differences between acquirers and matching firms per year is shown in Table 5. Only the mean difference in the current ratio in year -1 is significant at 10% level, where the acquirers have a value that is 1.69% lower than that of the matching firms. There are no other significant differences in the other years.

Table 5. Change model and T-test results for liquidity ratios per relative year

This table presents the mean differences in liquidity ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the T-test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	-2	-1	+1	+2	+3
Liquidity	Current ratio	-0.7 (0.43)	-0.75 (0.33)	**-1.69 (0.09)**	-0.33 (0.68)	1.42 (0.36)	-0.51 (0.63)
	Quick ratio	-0.78 (0.48)	-0.42 (0.52)	-1.54 (0.12)	-0.28 (0.73)	1.56 (0.33)	-0.85 (0.44)

In summary, with many insignificant differences, the T-test results show that there is no strong evidence that the acquisitions had an impact on the financial ratios. The mean differences of each financial ratio per relative year around the year of acquisition

provide some insight into the performance of the acquirers compared to the matching firm. Interestingly, all calculated mean differences consistently show that the matching firm selection is appropriate, as very few significant differences are found in the pre-acquisition years based on the T-test. Nevertheless, most financial ratios also show insignificant differences between the acquirers and the matching firms in the years after the acquisitions. This means that there is no evidence that acquirers can differentiate themselves from non-acquiring firms in terms of post-acquisition financial performance.

So far, the figures and tables show the differences in financial performance between acquirers and matching firms were calculated using means, and show the statistical significance tested by using T-test. However, the use of means is sensitive to the presence of outliers. Therefore, to increase the robustness of the results, we also calculated the median values of the differences and assessed their statistical significance using the Wilcoxon test. While medians are robust to outliers, median differences can sometimes be counterintuitive because a median difference is not the subtraction of two medians, but the median of all differences. This is shown in the median difference in the next figures.

Figure 18 presents the median profitability ratios of acquirers and matching firms and their median differences. The results are consistent with the mean values shown in Figure 15. There are positive median differences in ROE, ROA and ROCE in all three post-acquisition years and there is no clear pattern in the median differences in the three pre-acquisition years. At the same time, we can observe negative median differences in net profit margins in years +2 and +3. Nevertheless, we can see some changes in the period before acquisition. For example, Table 3 shows that in year -2, the mean differences in ROE and ROCE are about -18% and -16%, respectively. On the contrary, Table 6 indicates that the median differences in ROE and ROCE in year -2 are positive. These discrepancies in the results show that there are some outliers that affect the mean differences in year -2. However, the discrepancies do not affect the main conclusion that acquirers tend to have higher ROE, ROA, ROCE and lower net profit margins than matching firms in the post-acquisition period.

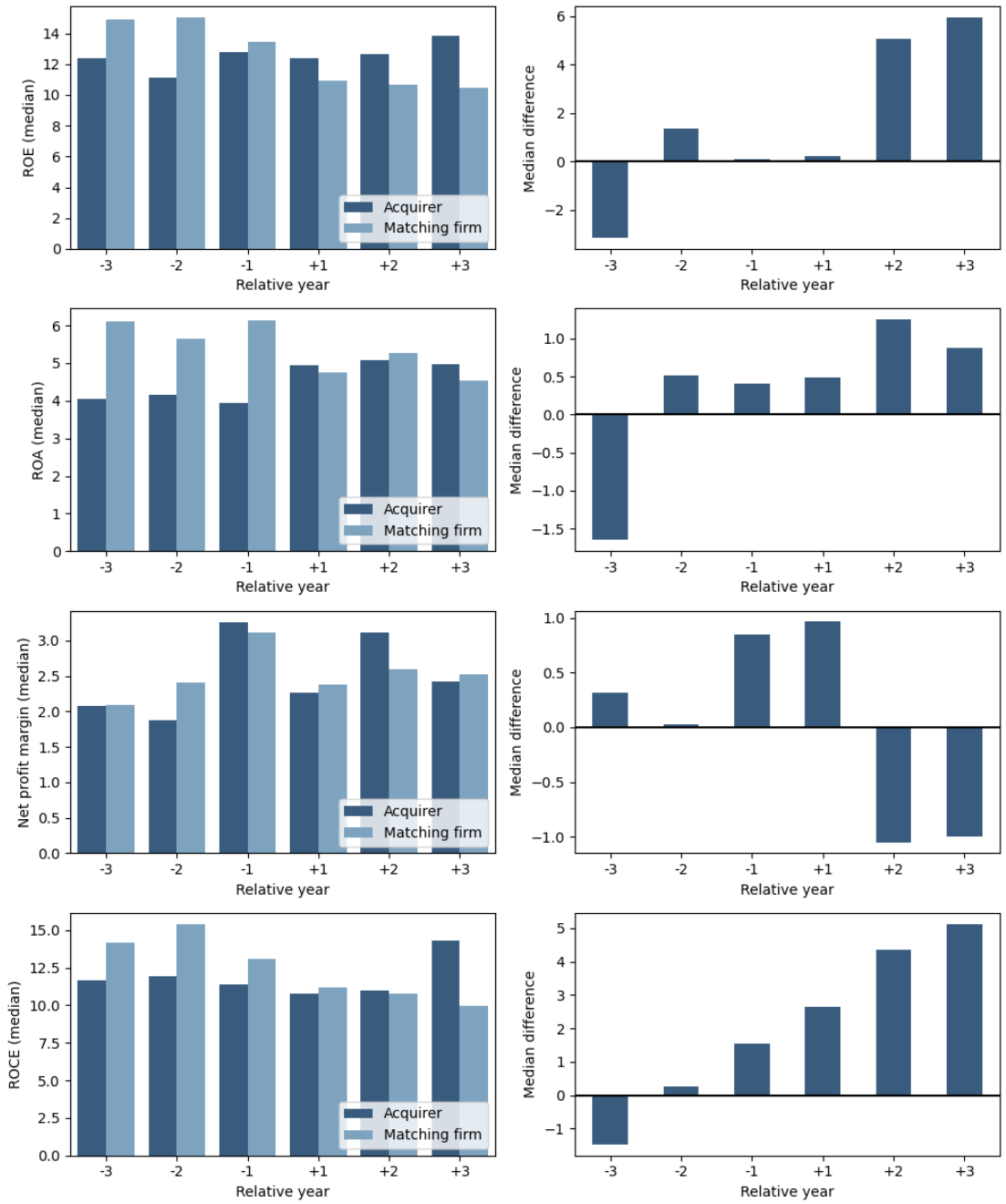

Figure 18. Median values and median differences of profitability ratios per relative year
The sub-figures on the left show the comparison of the median values of each profitability ratio for acquirers and for matching firms. The sub-figures on the right show the median differences in each profitability ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

The Wilcoxon test results in Table 6 reveal no statistical significance in the median differences of the profitability ratios. Given that the T-Test results in Table 3 also reveal only a few statistically significant differences in the post-acquisition period, we can conclude that acquirers' profitability was not significantly different from matching firms' profitability after acquisitions.

Table 6. Change model and Wilcoxon test results for profitability ratios per relative year
This table presents the median differences in profitability ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the Wilcoxon test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	**-2**	**-1**	**+1**	**+2**	**+3**
Profitability	ROE	-3.16 (0.97)	1.36 (0.68)	0.1 (0.59)	0.2 (0.46)	5.04 (0.48)	5.95 (0.27)
	ROA	-1.65 (0.49)	0.51 (0.75)	0.41 (0.96)	0.49 (0.36)	1.25 (0.42)	0.88 (0.21)
	Net profit margin	0.32 (0.79)	0.02 (0.81)	0.85 (0.49)	0.97 (0.51)	-1.05 (0.35)	-1.0 (0.3)
	ROCE	-1.47 (0.98)	0.28 (0.73)	1.56 (0.55)	2.65 (0.5)	4.35 (0.69)	5.13 (0.13)

The median differences in solvency ratios shown in Figure 19 are also in line with the mean differences shown in Figure 16 above. In the post-acquisition period, acquirers tend to have lower solvency ratios and interest coverage ratios, while having higher debt-to-assets ratios and D/E ratios, both in mean and median differences. Similar to the profitability ratios, we can observe some mismatches between the mean and median differences for the different solvency ratios in the pre-acquisition years.

Table 7 shows the results of the Wilcoxon test for the median differences in the solvency ratios. The only two statistically significant results are both for the interest coverage ratio, in years -3 and +2. Three years before the acquisitions, the interest coverage ratio of the acquirers is -3.74% lower than that of the matching firms in terms of median differences, at 10% level of significance. Two years after the acquisitions, the interest coverage ratio of the acquirers is also significantly lower than that of the matching firms in terms of median differences, at -12.43%. While the T-test shows a significant mean difference in the interest coverage ratio only in year -3, the Wilcoxon test shows a significant median difference in both year -3 and year +2. However, both the T-test and the Wilcoxon test show no other significant differences, meaning that acquirers were not different from their non-acquiring counterparts in terms of solvency ratios.

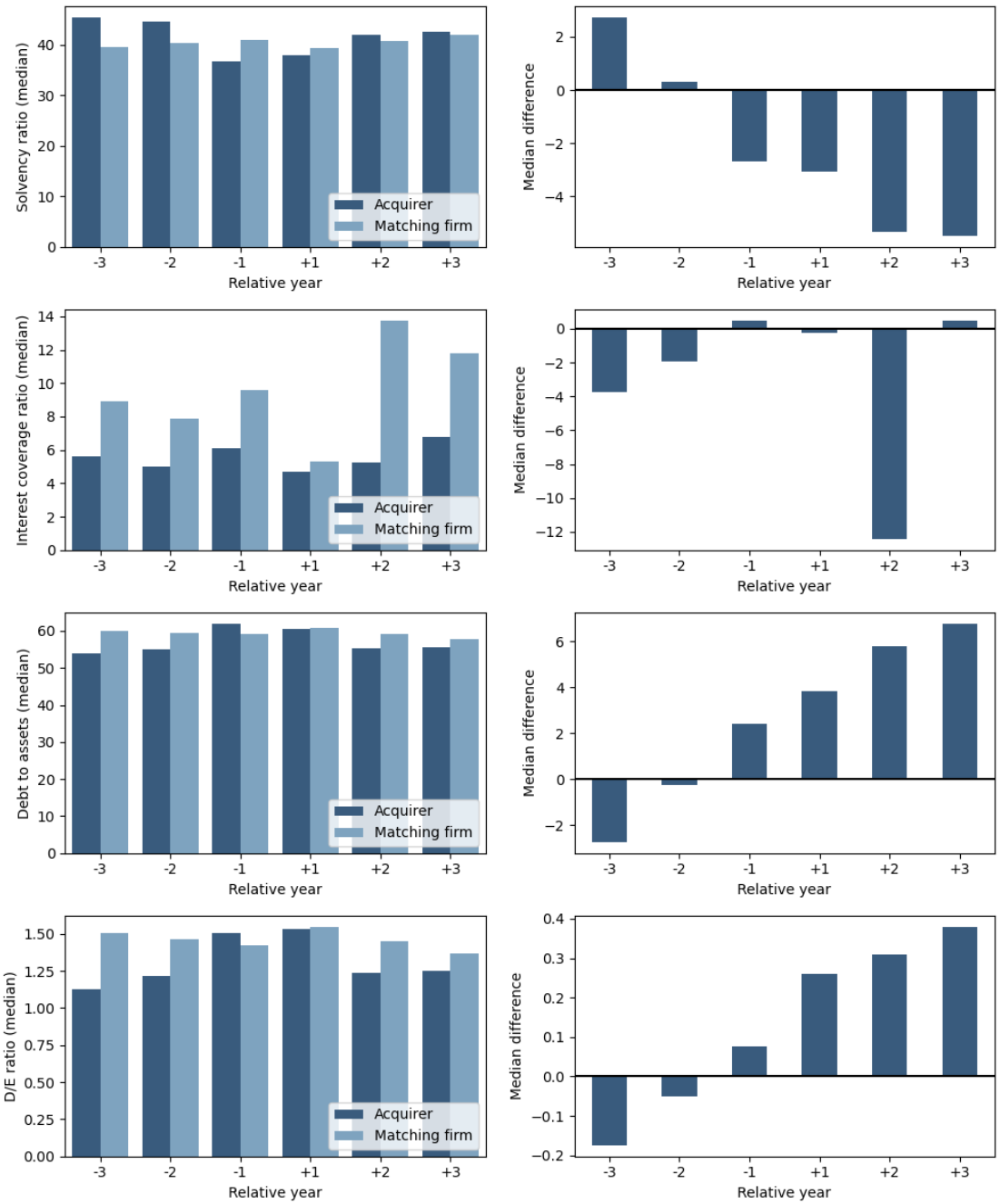

Figure 19. Median values and median differences of solvency ratios per relative year

The sub-figures on the left show the comparison of the median values of each solvency ratio for acquirers and for matching firms. The sub-figures on the right show the median differences in each solvency ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

Table 7. Change model and Wilcoxon test results for solvency ratios per relative year

This table presents the median differences in solvency ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the Wilcoxon test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	**-2**	**-1**	**+1**	**+2**	**+3**
Solvency	Solvency ratio	2.74 (0.91)	0.32 (0.42)	-2.7 (0.76)	-3.06 (0.45)	-5.34 (0.65)	-5.5 (0.57)
	Interest coverage ratio	**-3.74 (0.09)**	-1.95 (0.87)	0.5 (0.52)	-0.22 (0.64)	**-12.43 (0.02)**	0.5 (0.76)
	Debt-to-assets	-2.74 (0.8)	-0.24 (0.67)	2.41 (0.84)	3.85 (0.36)	5.8 (0.64)	6.78 (0.53)
	D/E ratio	-0.18 (0.9)	-0.05 (0.76)	0.08 (0.6)	0.26 (0.29)	0.31 (0.41)	0.38 (0.66)

Figure 20 shows the median difference in the last category of ratios, the liquidity ratios. While the mean differences in the current ratio and the quick ratio are similar, as shown in Figure 17 above, their median differences are different. As shown in Figure 20, there are negative median differences in the current ratios in most years, except for year +3. On the contrary, the median differences in the quick ratio of the acquirers have positive median differences, compared to those of matching firms, except in years -3 and +3. Note that since both the mean and median differences are close to zero, it is not unexpected that the mean and median differences show different trends.

The Wilcoxon test in Table 8 shows no statistical significance for any of the median differences. Therefore, although the mean and median differences show different trends, both indicate that there are no significant differences in the liquidity ratios of acquirers and matching firms.

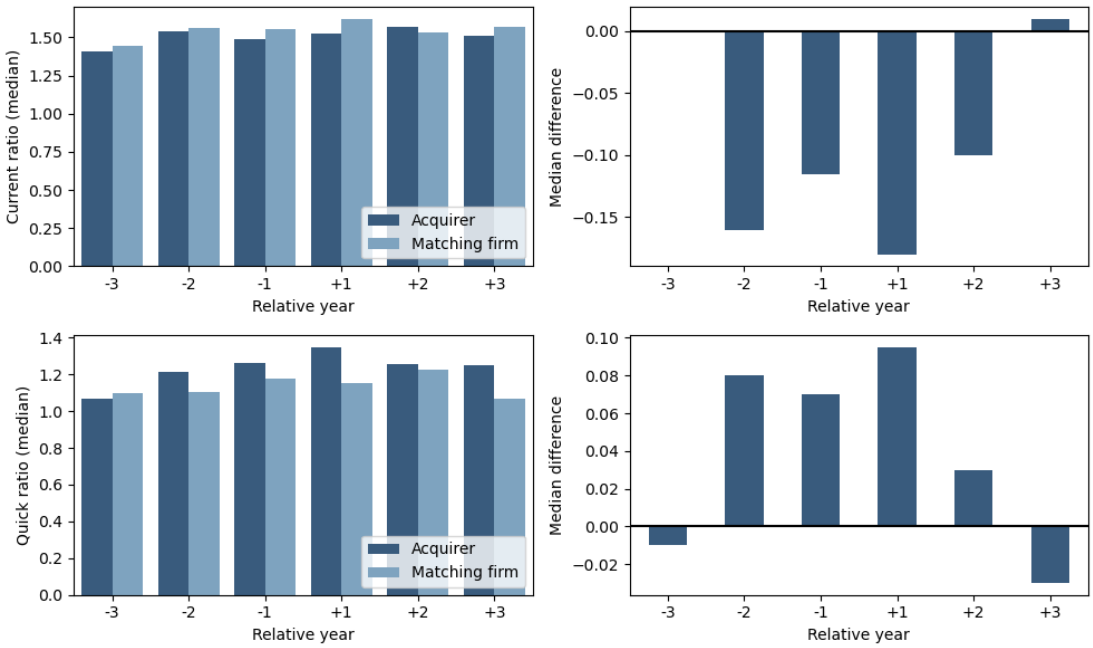

Figure 20. Median values and median differences of liquidity ratios per relative year
The sub-figures on the left show the comparison of the median values of each liquidity ratio for acquirers and for matching firms. The sub-figures on the right show the median differences in each liquidity ratio between acquirers and matching firms. The year is relative to the acquisition year (year 0).

Table 8. Change model and Wilcoxon test results for liquidity ratios per relative year
This table presents the median differences in liquidity ratios between acquirers and matching firms. The year in each column is relative to the acquisition year (year 0). The p-values from the Wilcoxon test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Relative year					
		-3	-2	-1	+1	+2	+3
Liquidity	Current ratio	0.0 (0.75)	-0.16 (0.7)	-0.11 (0.54)	-0.18 (0.88)	-0.1 (0.99)	0.01 (0.95)
	Quick ratio	-0.01 (0.83)	0.08 (0.47)	0.07 (0.95)	0.1 (0.42)	0.03 (0.63)	-0.03 (0.85)

All the mean and median difference results give a strong indication that the matching firms are well selected, as their performance was similar to that of the acquirers in the pre-acquisition period. At the same time, the acquirers did not differ from the matching firms in the post-acquisition period in terms of financial ratios.

5.2. Change model - Time window comparison

In the previous section, the change model compared the difference in performance between the acquirers and the matching firms per relative year around the acquisition years. In this section, the change model directly compares the changes in the matching firm-adjusted performance of the acquirers before and after the acquisitions. As a reminder, matching firm-adjusted performance refers to the difference between the performance of the acquirer and the performance of the matching firm.

Table 9 shows the results of the change model applied to the mean difference of each financial ratio and the significance of the change represented by the T-test p-value. The mean differences represent the changes in the matching firm-adjusted performance of the acquirers between the post-acquisition period and the pre-acquisition period.

Focusing on the profitability ratios in Table 9, it can be seen that the changes in ROA are positive in all time windows. This means that in the post-acquisition period, acquirers widened their gap in ROA with matching firms. Note that this does not mean that acquirers' ROA always increased after acquisitions. For example, it could be the case that both acquirers and matching firms experienced a decrease in ROA, but the ROA of acquirers decreased less than that of matching firms.

All other profitability ratios show mixed results. Different time windows show conflicting trends. The changes in ROE are positive in the -1 to +1, -1 to +2 and -2 to +2 time windows, but negative in the -1 to +3 and -3 to +3 time windows. The adjusted net profit margin is negative in most of the time windows, except for the -2 to +2 time window, where a positive change is observed. The adjusted ROCE also shows a mixed result, with a positive change in the -1 to +1 and -1 to +3 time windows and a negative change in the -1 to +2, -2 to +2 and -3 to +3 time windows. According to the T-test, none of the changes in profitability ratios is statistically significant.

Similar to profitability ratios, none of the changes in the solvency ratios is statistically significant according to T-Test, although some trends are observed in each time window. The acquirers consistently experienced a negative change in the solvency ratio, while they faced a positive change in the debt-to-assets ratio in all time windows. The D/E ratio shows a negative change in most of the time windows, except for the time window -2 to +2, where a positive change of 1.1% is observed. The changes in the interest coverage ratios show mixed results across all time windows.

Table 9. Change model and T-test results per time window

This table presents the mean differences in profitability, solvency and liquidity ratios between acquirers and matching firms. The p-values from the T-test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	10.28 (0.42)	6.54 (0.54)	-10.28 (0.4)	20.96 (0.17)	-10.75 (0.45)
	ROA	2.4 (0.21)	0.96 (0.62)	2.71 (0.17)	1.15 (0.69)	5.27 (0.3)
	Net profit margin	-0.72 (0.8)	-1.73 (0.6)	-6.53 (0.17)	1.45 (0.77)	-7.47 (0.13)
	ROCE	1.58 (0.75)	-0.83 (0.87)	0.95 (0.87)	-0.52 (0.94)	-4.44 (0.62)
Solvency	Solvency ratio	-3.71 (0.18)	-2.51 (0.54)	-0.1 (0.98)	-5.83 (0.18)	-1.24 (0.8)
	Interest coverage ratio	-18.04 (0.32)	-19.11 (0.4)	14.08 (0.57)	-32.88 (0.23)	28.11 (0.48)
	Debt-to-assets	2.59 (0.29)	2.15 (0.58)	0.86 (0.85)	5.23 (0.21)	1.72 (0.73)
	D/E ratio	-0.27 (0.78)	-0.87 (0.51)	-2.07 (0.14)	1.1 (0.31)	-0.2 (0.74)
Liquidity	Current ratio	1.33 (0.14)	**3.25 (0.08)**	1.8 (0.23)	2.07 (0.25)	-0.15 (0.9)
	Quick ratio	1.79 (0.14)	2.48 (0.12)	0.57 (0.54)	2.01 (0.26)	-0.28 (0.81)

The changes in the liquidity ratios show one statistically significant positive change of 3.25% in the current ratio in the -1 to +2 time window. A similar trend is observed for both liquidity ratios, which experience a positive change in all the time windows except in the -3 and +3 time window, where a negative change is shown. As discussed in the previous section, the two liquidity ratios have very similar formulas, which might explain the similar trend for both ratios. None of the other changes are statistically significant.

The results of applying the change model and T-test on the mean differences show that there is no evidence that acquisitions had an impact on the matching firm-adjusted performance of acquirers between the pre- and post-acquisition periods.

We move on to the results from the Wilcoxon test. Table 10 shows the result of the change model using the median changes and the result of the Wilcoxon test for statistical significance.

Regarding profitability, there is one significant change in the net profit margin, which shows a significant negative change of -2.4% in the time window -1 to +3. Other changes are found to be statistically insignificant. Some key observations are as follows. ROA experiences positive changes in all the time windows. ROE and ROCE have negative changes in the time window -1 to +2 and positive changes in all the other time windows. The only positive change in net profit margin happens in the time window -1 to +1, and all the other time windows present negative changes. As there is only one statistically significant change, the median changes and Wilcoxon test results also indicate that there is no strong evidence that acquisitions had an impact on acquirers' profitability in the post-acquisition period.

In terms of solvency ratios, the interest coverage ratio has a significant negative median change of -12.59% at 10% level in the time window -2 to +2. All other changes in the solvency ratios are found to be statistically insignificant. Only the D/E ratio has consistent positive changes in all time windows. The solvency ratio, the interest coverage ratio and the debt-to-assets ratio have mixed positive and negative changes across different time windows.

With regard to liquidity ratios, there is no statistically significant change. Both current ratio and quick ratio have consistently positive changes. The only negative change observed in the table is for the quick ratio in the -1 to +2 time window.

In conclusion, the change model shows consistent results for both mean and median changes. With only very few statistically significant changes found for both mean and median values, there is no clear evidence that acquisitions had an impact on the performance of acquirers.

Table 10. Change model and Wilcoxon test results per time window

This table presents the median differences in profitability, solvency and liquidity ratios between acquirers and matching firms. The p-values from the Wilcoxon test are shown in the parentheses. Statistically significant changes at 10% level are shown in bold.

Category	Financial ratio	Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	3.7 (0.28)	-1.18 (0.95)	0.72 (0.88)	0.27 (0.7)	2.63 (0.82)
	ROA	0.71 (0.37)	0.98 (0.83)	0.71 (0.19)	1.14 (0.86)	1.11 (0.99)
	Net profit margin	0.22 (0.82)	-0.81 (0.13)	**-2.4 (0.06)**	-1.13 (0.96)	-1.49 (0.29)
	ROCE	0.08 (0.48)	-0.33 (0.88)	0.86 (0.7)	0.44 (0.59)	0.49 (0.66)
Solvency	Solvency ratio	0.19 (0.52)	1.77 (0.73)	0.61 (0.84)	-2.53 (0.31)	1.14 (1.0)
	Interest coverage ratio	2.79 (0.68)	-4.98 (0.14)	-0.56 (0.79)	**-12.59 (0.03)**	-2.01 (0.99)
	Debt-to-assets	0.57 (0.45)	0.06 (0.51)	-0.47 (0.88)	3.04 (0.25)	-1.14 (0.85)
	D/E ratio	0.24 (0.29)	0.22 (0.38)	0.23 (0.51)	0.08 (0.87)	0.01 (0.76)
Liquidity	Current ratio	0.14 (0.48)	0.01 (0.87)	0.12 (0.56)	0.04 (0.65)	0.03 (0.97)
	Quick ratio	0.05 (0.68)	-0.07 (0.8)	0.07 (0.94)	0.06 (0.91)	0.08 (0.89)

5.3. Intercept model

This section presents the results obtained by applying the intercept model. Table 11 shows the estimated α values and their corresponding p-values.

Most of the α values for profitability ratios are positive, indicating an increase in profitability for acquirers after acquisitions, under the assumption that there is a persistence effect in the ratios. Only few negative α values are found for profitability

ratios, including ROE in the -3 to +3 time window, net profit margin in the -1 to +3 and -3 to +3 time windows, and ROCE in the -3 to +3 time window. Nevertheless, no α value for the profitability ratios is statistically significant. In a nutshell, under the assumption of persistence effect in the ratios, we still find no evidence showing that acquisitions had an impact on the profitability of acquirers.

Table 11. α values from the intercept model per time window

This table presents the α values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	15.64 (0.19)	9.66 (0.36)	3.55 (0.51)	20.1 (0.19)	-4.2 (0.62)
	ROA	3.01 (0.1)	1.76 (0.3)	2.15 (0.13)	2.42 (0.24)	3.03 (0.28)
	Net profit margin	0.22 (0.89)	0.2 (0.92)	-4.8 (0.12)	2.4 (0.29)	-6.18 (0.14)
	ROCE	2.48 (0.54)	1.63 (0.72)	3.59 (0.38)	1.11 (0.86)	-2.52 (0.7)
Solvency	Solvency ratio	-3.28 (0.19)	-2.16 (0.52)	-1.23 (0.76)	-4.23 (0.23)	0.83 (0.86)
	Interest coverage ratio	-18.53 (0.32)	-23.09 (0.29)	15.04 (0.55)	**-35.68 (0.08)**	42.37 (0.14)
	Debt-to-assets	2.53 (0.28)	1.1 (0.75)	0.9 (0.83)	4.65 (0.19)	0.06 (0.99)
	D/E ratio	-0.0 (1.0)	0.45 (0.5)	-0.35 (0.42)	1.32 (0.22)	-0.5 (0.35)
Liquidity	Current ratio	0.35 (0.58)	1.94 (0.22)	0.13 (0.9)	1.5 (0.39)	0.3 (0.78)
	Quick ratio	0.3 (0.64)	2.28 (0.16)	0.32 (0.73)	1.66 (0.34)	0.17 (0.87)

Regarding the solvency category, we find only one statistically significant α value at 10% level, which is the interest coverage ratio in the -2 to +2 time window. All α values for

solvency ratio are negative, except for the -3 to +3 time window. The α values for the interest coverage ratio and the D/E ratio have mixed positive and negative values. On the contrary, all α values for the debt-to-assets ratio are positive. The results indicate that acquisitions have no significant impact on the solvency of acquirers.

All α values for liquidity ratios, including current ratio and quick ratio are positive. Nevertheless, none is found to be significant.

The resulting α values indicate that there is no evidence that acquisitions had an impact on acquirers' performance, even under the assumption that there is persistence in the financial ratios. This conclusion is consistent with the conclusion from the results found by applying the change model.

We move on to the β values obtained from the intercept model, which are shown in Table 12. The β values represent the persistence in the financial ratios from the periods before acquisitions to the periods after acquisitions. Interestingly, most of the β values are found to be statistically significant at 10% level.

Most of the β values for the profitability ratios are positive, which means that the adjusted profitability of the matching firms tends to increase independently of acquisitions. Only the β values for ROA in the -3 to +3 time window and for net profit margin in the -2 to +2 time window are negative, indicating a trend of decreasing ROA and ROE in the corresponding time windows. Only the persistence of ROE in the -3 to +3 time window and of net profit margin in the -1 to +3 time window are statistically insignificant.

A similar observation can be made for solvency ratios. All β values for solvency ratios are positive, indicating a trend towards a persistent increase in solvency. Most of the β values for solvency ratios are statistically significant. Only the β values for the interest coverage ratio in the -3 to +3 time window and the D/E ratio for the -1 to +2 and -1 to +3 time windows are not statistically significant.

All β values for the liquidity ratios are positive and statistically significant, again indicating an increasing trend in both the current ratio and the quick ratio between the pre- and post-acquisition periods.

Table 12. β values from the intercept model per time window

This table presents the β values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	**0.5 (0.0)**	**0.83 (0.0)**	**0.24 (0.0)**	**0.69 (0.0)**	0.16 (0.13)
	ROA	**0.72 (0.0)**	**0.6 (0.0)**	**0.33 (0.0)**	**0.35 (0.0)**	**-0.27 (0.04)**
	Net profit margin	**0.28 (0.0)**	**0.29 (0.0)**	0.17 (0.16)	**-0.43 (0.0)**	**0.43 (0.04)**
	ROCE	**0.47 (0.0)**	**0.62 (0.0)**	**0.43 (0.0)**	**0.54 (0.0)**	**0.36 (0.0)**
Solvency	Solvency ratio	**0.7 (0.0)**	**0.43 (0.0)**	**0.57 (0.0)**	**0.37 (0.0)**	**0.64 (0.0)**
	Interest coverage ratio	**0.96 (0.0)**	**0.44 (0.06)**	**1.14 (0.0)**	**0.23 (0.08)**	0.04 (0.83)
	Debt-to-assets	**0.78 (0.0)**	**0.5 (0.0)**	**0.54 (0.0)**	**0.48 (0.0)**	**0.66 (0.0)**
	D/E ratio	**0.38 (0.0)**	0.04 (0.58)	0.02 (0.59)	**0.59 (0.0)**	**0.47 (0.0)**
Liquidity	Current ratio	**0.45 (0.0)**	**0.27 (0.04)**	**0.28 (0.0)**	**0.52 (0.01)**	**1.59 (0.0)**
	Quick ratio	**0.13 (0.03)**	**0.67 (0.06)**	**0.79 (0.0)**	**0.45 (0.06)**	**1.54 (0.0)**

In summary, the result of applying the intercept model shows that there is strong evidence of persistence in the matching firm-adjusted performance between the pre- and post-acquisition periods. However, according to the α values obtained, there is no evidence that acquisitions had a significant impact on the matching firm-adjusted performance of the acquirers.

5.4. Difference-in-differences model

This section analyses the result of applying the difference-in-differences (DD) model. Different from the intercept model, the DD model assumes a parallel trend in the financial ratios between acquirers and matching firms.

Table 13 shows the β_3 values and their corresponding p-value. The β_3 value is the most important coefficient as it represents the impact of acquisitions on the acquirers. The p-values show that none of the β_3 values is statistically significant. Our result is consistent with the findings from the change model and the intercept model that there is no evidence that acquisitions have a significant impact on the performance of acquirers.

Although the results are not statistically significant, they provide some insight into the impact of acquisitions on the performance of acquirers. In terms of profitability, the β_3 values for ROE and ROCE show a mix of positive and negative values in different time windows. All β_3 values for ROA are positive, indicating that acquisitions have a positive impact on ROA for acquirers. Most β_3 values for net profit margin are negative, except for the -2 to +2 time window, indicating that acquisitions have a negative impact on net profit margin for acquirers.

Regarding solvency, most of the β_3 values for the solvency ratio and the D/E ratio are negative, except for a positive D/E ratio in the -2 to +2 time window. On the contrary, all β_3 values for the debt-to-assets ratio are positive, indicating a positive impact of acquisitions on this ratio. The interest coverage ratio has a mix of positive and negative β_3 values.

Both liquidity ratios have positive β_3 values in all time windows, except for a negative value in the -3 to +3 time window. This indicates that acquisitions had a positive effect on the liquidity of acquirers.

Table 14 shows the resulting β_2 values and their corresponding p-values. The β_2 values represent the changes in the performance of the matching firms before and after the acquisitions. Similar to the result of the β_3 values, the p-values of the β_2 values show no statistical significance. This means that there was no significant change in the performance of the matching firms between the corresponding pre- and post-acquisition periods of their respective acquirers.

Table 13. β_3 values from the difference-in-differences model per time window

This table presents the β_3 values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	**Year -1 to +2**	**Year -1 to +3**	**Year -2 to +2**	**Year -3 to +3**
Profitability	ROE	10.28 (0.54)	6.54 (0.73)	-10.28 (0.5)	20.96 (0.25)	-10.75 (0.49)
	ROA	2.4 (0.47)	0.96 (0.79)	2.71 (0.33)	1.15 (0.77)	5.27 (0.22)
	Net profit margin	-0.72 (0.85)	-1.73 (0.69)	-6.53 (0.23)	1.45 (0.72)	-7.47 (0.25)
	ROCE	1.58 (0.83)	-0.83 (0.93)	0.95 (0.91)	-0.52 (0.95)	-4.44 (0.69)
Solvency	Solvency ratio	-3.71 (0.49)	-2.51 (0.67)	-0.1 (0.99)	-5.83 (0.35)	-1.24 (0.87)
	Interest coverage ratio	-18.04 (0.47)	-19.11 (0.45)	14.08 (0.68)	-32.88 (0.32)	28.11 (0.48)
	Debt-to-assets	2.59 (0.64)	2.15 (0.71)	0.86 (0.89)	5.23 (0.41)	1.72 (0.83)
	D/E ratio	-0.27 (0.83)	-0.87 (0.52)	-2.07 (0.14)	1.1 (0.39)	-0.2 (0.82)
Liquidity	Current ratio	1.33 (0.34)	3.25 (0.11)	1.8 (0.34)	2.07 (0.31)	-0.15 (0.94)
	Quick ratio	1.79 (0.18)	2.48 (0.14)	0.57 (0.66)	2.01 (0.3)	-0.28 (0.9)

The β_2 values for profitability ratios show a mix of positive and negative values. The majority of the β_2 values for profitability are negative, indicating a decreasing trend in the profitability of the matching firms.

The β_2 values for solvency ratios also show mixed results. All the β_2 values for the solvency ratio are positive, indicating an increase in solvency ratio for the matching firms. Most of the β_2 values for interest coverage ratio are also positive, except the only negative β_2 value in the -3 to +3 time window. On the contrary, most of the β_2 values for

the debt-to-assets ratio and the D/E ratio are negative. The only two positive β_2 values for these ratios are for the debt-to-assets ratio in the time window -3 to +3 and for the D/E ratio in the -2 to +2 time window.

Table 14. β_2 values from the difference-in-differences model per time window

This table presents the β_2 values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	**Year -1 to +2**	**Year -1 to +3**	**Year -2 to +2**	**Year -3 to +3**
Profitability	ROE	-9.89 (0.4)	-13.83 (0.3)	-0.19 (0.99)	-14.41 (0.26)	4.65 (0.67)
	ROA	-2.85 (0.23)	-0.84 (0.74)	-2.06 (0.29)	0.14 (0.96)	-3.7 (0.22)
	Net profit margin	-2.81 (0.3)	-0.78 (0.8)	2.27 (0.56)	0.19 (0.95)	0.95 (0.83)
	ROCE	-5.07 (0.34)	-4.93 (0.46)	-1.73 (0.77)	-3.59 (0.55)	4.97 (0.53)
Solvency	Solvency ratio	2.75 (0.47)	3.01 (0.47)	2.16 (0.64)	3.29 (0.45)	0.31 (0.96)
	Interest coverage ratio	21.5 (0.22)	27.76 (0.12)	17.42 (0.48)	33.94 (0.15)	-9.09 (0.75)
	Debt-to-assets	-2.15 (0.59)	-2.76 (0.51)	-2.58 (0.57)	-1.58 (0.72)	1.27 (0.82)
	D/E ratio	-0.17 (0.85)	-0.56 (0.55)	-0.68 (0.5)	0.03 (0.98)	-0.06 (0.93)
Liquidity	Current ratio	-0.76 (0.44)	-0.83 (0.57)	-1.02 (0.44)	0.0 (1.0)	1.39 (0.35)
	Quick ratio	-1.27 (0.18)	0.06 (0.96)	0.01 (0.99)	0.11 (0.94)	1.31 (0.38)

We also find mixed results for the β_2 values of the liquidity ratios. The current ratio experienced negative β_2 values in three time windows and positive β_2 values in one time window. The β_2 value for the current ratio in the -2 to +2 time window is found to be

zero, meaning that matching firms experience no change in the current ratio between two years before and two years after the acquisitions of their respective acquirers.

We move on to the β_1 values and their corresponding p-values, which are presented in Table 15. The β_1 values represent the difference in performance between the acquirers and the matching firms in the pre-acquisition period. There are only a few β_1 values that are statistically significant. It indicates that there is no significant difference in performance between acquirers and matching firms in the pre-acquisition period.

There is only one significant β_1 value for profitability ratios, which belongs to ROE in the -1 to +3 time window. Most of the β_1 values for profitability ratios are positive, indicating that acquirers often had higher profitability than matching firms in the period before acquisitions. All β_1 values for net profit margin and ROCE are positive. Most of the β_1 values for ROE are also positive, except in the -2 to +2 time window. Three β_1 values for ROA are also positive, while two β_1 values in the -1 to +3 and -3 to +3 time windows are negative.

Regarding solvency ratios, most of the β_1 values of the solvency ratio and the D/E ratio are positive, indicating that prior to acquisitions, acquirers often had a healthier financial position compared to the corresponding matching firms, but also had a higher investment risk. In contrast, most of the β_1 values of the debt-to-assets ratios and the interest coverage ratios are negative, which means that prior to acquisitions, acquirers had lower financial risks but also had more difficulties in paying their debts. There is only one statistically significant β_1 value in solvency ratios, which is the β_1 value for the D/E ratio in the -1 to +3 time window. Interestingly, we observe that the solvency ratio is negative, while the D/E ratio is positive. This suggests that, before acquisitions, acquirers had a worse financial position and higher investment risks compared to matching firms.

All β_1 values for liquidity ratios are negative, indicating that matching firms had a better liquidity position compared to acquirers in the period before acquisitions. Three β_1 values of the liquidity ratios are statistically significant, which are the values of the current ratio in the -1 to +1 and -1 to +3 time windows, and of the quick ratio in the -1 to +1 time window.

Although there are not many statistically significant values, the β_1 values provide some interesting insights into the difference between acquirers and matching firms in the pre-acquisition period.

Table 15. β_1 values from the difference-in-differences model per time window

This table presents the β_1 values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	10.67 (0.37)	17.89 (0.18)	**18.24 (0.09)**	-2.77 (0.83)	7.76 (0.48)
	ROA	2.2 (0.35)	1.97 (0.44)	-0.85 (0.66)	1.95 (0.48)	-1.77 (0.56)
	Net profit margin	1.29 (0.63)	2.71 (0.38)	2.08 (0.59)	0.66 (0.82)	2.25 (0.62)
	ROCE	1.7 (0.75)	6.49 (0.34)	4.64 (0.43)	3.54 (0.56)	3.02 (0.7)
Solvency	Solvency ratio	1.41 (0.71)	0.62 (0.88)	-2.64 (0.56)	2.55 (0.56)	5.72 (0.3)
	Interest coverage ratio	-13.76 (0.44)	-7.16 (0.69)	-6.94 (0.78)	-3.62 (0.88)	14.83 (0.6)
	Debt-to-assets	-0.27 (0.95)	-2.08 (0.61)	0.08 (0.99)	-1.11 (0.8)	-4.95 (0.38)
	D/E ratio	0.44 (0.62)	1.36 (0.15)	**1.76 (0.08)**	0.54 (0.56)	-0.57 (0.38)
Liquidity	Current ratio	**-1.79 (0.07)**	-1.81 (0.21)	**-2.32 (0.08)**	-1.2 (0.41)	-0.77 (0.61)
	Quick ratio	**-1.7 (0.07)**	-0.62 (0.61)	-1.16 (0.2)	-0.62 (0.65)	-0.84 (0.58)

We move on to the last coefficient in the DD model, which is the β_0. This coefficient represents the average performance of the matching firms in the period before the acquisitions. The majority of the β_0 values in Table 16 are statistically significant. This suggests that the ratios of the matching firms are significantly different from zero in the pre-acquisition period.

Table 16. β_0 values from the difference-in-differences model per time window

This table presents the β_0 values for profitability, solvency and liquidity ratios. The p-values from the regression are shown in the parentheses. Statistically significant values at 10% level are shown in bold.

Category	Financial ratio	Time window				
		Year -1 to +1	Year -1 to +2	Year -1 to +3	Year -2 to +2	Year -3 to +3
Profitability	ROE	**18.98 (0.02)**	14.23 (0.13)	**17.12 (0.03)**	**18.4 (0.04)**	**23.96 (0.0)**
	ROA	**4.05 (0.02)**	**4.35 (0.02)**	**7.27 (0.0)**	**2.53 (0.2)**	**7.63 (0.0)**
	Net profit margin	**5.54 (0.0)**	**4.25 (0.05)**	2.95 (0.28)	**3.82 (0.06)**	**5.83 (0.07)**
	ROCE	**21.41 (0.0)**	**16.51 (0.0)**	**17.36 (0.0)**	**17.27 (0.0)**	**20.0 (0.0)**
Solvency	Solvency ratio	**40.81 (0.0)**	**41.4 (0.0)**	**43.31 (0.0)**	**41.43 (0.0)**	**39.08 (0.0)**
	Interest coverage ratio	**31.85 (0.01)**	**29.23 (0.02)**	**32.18 (0.06)**	**35.84 (0.03)**	26.96 (0.18)
	Debt-to-assets ratio	**56.51 (0.0)**	**57.76 (0.0)**	**56.45 (0.0)**	**55.16 (0.0)**	**57.7 (0.0)**
	D/E ratio	**3.17 (0.0)**	**3.02 (0.0)**	**2.91 (0.0)**	**2.5 (0.0)**	**2.9 (0.0)**
Liquidity	Current ratio	**3.83 (0.0)**	**3.8 (0.0)**	**4.4 (0.0)**	**3.58 (0.0)**	**3.02 (0.0)**
	Quick ratio	**3.52 (0.0)**	**2.45 (0.0)**	**3.06 (0.0)**	**2.74 (0.01)**	**2.8 (0.01)**

5.5. Discussion

This section discusses the results. First, we will confirm or reject the three hypotheses presented in the introduction. Second, we will compare our results with those from the literature review on the impact of M&A on the financial performance of acquirers.

We start with the discussion of the results linked to the first hypothesis, which is as follows:

> *H1: Acquisitions have a significant impact on the profitability of Belgian pharmaceutical acquiring firms.*

In the post-acquisition period, the T-test results from the change model per relative year indicated that there are only few statistically significant differences in profitability ratios, which are ROE and ROA in the year +1 and net profit margin in the year +3. Results from the Wilcoxon test indicated no statistically significant differences. In the analysis per time window, the T-test results from the change model showed no statistically significant differences, while the Wilcoxon test showed only one significant negative change of 2.4% at 10% level in the net profit margin in the -1 to +3 window. According to the analysis per time window of the intercept model and the difference-in-differences model, no statistically significant results were found for profitability ratios.

The three models showed consistent results, suggesting that there is no conclusive evidence about a significant impact. Therefore, H1 cannot be accepted because we could not reject the null hypothesis of H1.

We move on to our second hypothesis, which is as follows:

> *H2: Acquisitions have a significant impact on the solvency of Belgian pharmaceutical acquiring firms.*

Almost all of the results regarding solvency ratios in the post-acquisition period are not statistically significant, according to the tests from the three statistical models. Interestingly, there are only three significant changes in solvency. These are from the same ratio, the interest coverage ratio. The first two significant differences in this ratio are found in the change model, a negative difference of -12.43% at 10% level in the relative year +2 from the Wilcoxon test, and a negative change of -12.59% at 10% level in the -1 to +3 window also from the Wilcoxon test. The third significant change in this

ratio comes from the intercept model, which shows a negative difference of -35.68% at 10% level in the -2 to +2 window.

However, the other solvency ratios (debt-to-assets ratio, D/E ratio and solvency ratio) are not statistically significantly different. Again, the three statistical models showed consistent results, suggesting that there is no conclusive evidence about a significant impact. Therefore, H2 cannot be accepted because we could not reject the null hypothesis of H2.

We move on to our third and final hypothesis, which is as follows:

H3: Acquisitions have a significant impact on the liquidity of Belgian pharmaceutical acquiring firms.

In the post-acquisition period, both the T-test and Wilcoxon test results from the change model per relative year showed that there are no statistically significant differences in the liquidity ratios. In the analysis per time window from all three statistical models, we also found no statistically significant differences.

The same conclusion from H1 and H2 applies to H3. The hypothesis H3 cannot be accepted because we could not reject the null hypothesis of H3. In a nutshell, the results from all statistical models consistently indicate that there is no evidence that acquisitions have an impact on the performance of acquirers.

Our general conclusions about the lack of impact of M&A differ from those of Ooghe et al. (2006), who also focused on acquisitions in Belgium and instead found that acquisitions had a negative impact on all three levels of financial performance of Belgian acquirers. However, this difference could be explained by the fact that Ooghe et al. (2006) did not focus on a specific industry, while we focus on the pharmaceutical industry. Moreover, Ooghe et al. (2006) used the industry median approach, while we used the matching firm approach. As discussed in Section 3.2, the use of the industry median biases the performance results because acquisitions tend to occur after a period of high performance and because acquirers tend to be large (Ghosh, 2001).

Regarding M&A studies that focus on the pharmaceutical industry, our results are in line with Kamra & Gupta (2016). Nevertheless, our results are not consistent with the findings of Wang (2020) and Demirbag et al. (2007), who showed that there is a negative impact on the financial performance of acquirers, and of Mihaiu et al. (2021), who found an increase in the performance of acquirers, but without a matching firm technique.

Our conclusions are in line with the results of previous studies in other regions and/or other industries which conclude that M&A has no significant impact on post-acquisition financial performance (Tang, 2015; Leepsa & Mishra, 2012; Austin et al., 2022). We found no significant impact on ROA, which is consistent with some of the previous research (Dixit, 2019; Giudici & Bonaventura, 2018), while other studies found that M&A have an impact on ROA (Fukuda, 2020). While we found insignificant results for all three categories, some studies found mixed results between ratios (Yunus et al., 2021; Rehan et al., 2018; Mamahit et al., 2019; Sephita & Nurazi, 2024), and others found evidence of significant impact on performance (Rani et al., 2016).

A potential explanation for our results on the insignificant impact of acquisitions could be as follows. Since our study is based on financial ratios and this assumes that the main motives are economic, there may be motives other than economic ones. The impact of M&A may not necessarily translate directly into the impact on the financial performance measured by the financial ratios included in this analysis. Motives for M&A, such as the short-term acquisition of know-how, may be less visible in the short-term financial performance if the economic motive is not the primary motive. Pharmaceutical firms are also known for their long drug development pipeline before a product can enter the market, averaging 12-13 years (EFPIA, 2023). Therefore, a potential explanation is that the financial performance may not be seen in the first few years after the acquisition, but in the longer term after the acquisition. A possible direction for future research is to examine the impact of M&A on the set of acquisitions in this thesis over a longer post-acquisition period, i.e., from the fourth year after the acquisition onwards.

Chapter 6. Conclusion

The enormous volume of M&A studies does not decrease the attractiveness of M&A as an ongoing research area. Our thorough literature review around M&A has revealed that researchers have been interested in examining topics ranging from the motives and the determinants of M&A to the impact of firm characteristics on M&A performance. A vast part of the literature has been devoted to examining the impact of M&A on firm performance post-M&A. We have seen that the term "performance" has been interpreted in multiple ways, such as financial performance, innovation performance and market performance. In the scope of this thesis, we focused on the impact of M&A on the financial performance of acquirers.

In M&A performance, there is also no common agreement on methodologies to measure firm performance. Several papers applied only one methodology, and the most common methodologies are the event study, based on stock price data, and the accounting performance study, based on accounting data.

The findings from previous research on M&A performance have not always been consistent. Some studies have found significant results, some have found insignificant results, some partially significant results and some found inconclusive results. Interestingly, despite some studies performing multiple methodologies on the same data sample, they still produced contradictory results. Furthermore, we noted that the methodologies of some papers did not include the matching firm technique. This might partially result in a biased examination of the performance. We also noted that some authors did not distinguish M&A by country of origin and industry. However, some industries have particular characteristics and are subject to stricter regulations, such as the pharmaceutical industry. Therefore, mixing all industries in the same sample and not categorising them by industry may lead to an incorrect interpretation of the results. For these reasons, we decided to focus our study on one country and one industry.

The lack of recent papers on the impact of M&A in Belgium motivated us to investigate whether the same results as previous studies in Belgium could be obtained for acquisitions in the period 2010-2022. As we wanted to focus on a specific industry, we chose the pharmaceutical industry for the following reasons. First, Belgium is one of the leading pharmaceutical countries in Europe, and second, the pharmaceutical industry is known for its active M&A activity. Therefore, we found it interesting to address this gap in the literature by examining whether the impact of M&A in Belgium during a more recent period, between 2010 and 2022, is significant for acquirers.

We investigated the impact of M&A on a sample of 198 acquisitions with acquirers belonging to the pharmaceutical industry. We used a quantitative methodology based on accounting data, which is suitable for comparing ratios over time and between firms if they follow the same accounting standards. To reduce industry bias, for each acquisition we matched the acquirer with a non-acquiring peer. We measured the financial performance in terms of financial ratios. To strengthen our study and provide a more comprehensive view of the financial performance of acquirers, we included three categories of ratios, namely profitability, solvency, and liquidity, and we selected several ratios from each of the three categories. To further increase the robustness of the results, we applied three different statistical models to the same set of acquisitions: the change model, the intercept model, and the difference-in-differences model. Finally, we analysed the ratios over multiple time windows.

We obtained consistent findings about the insignificant impact of M&A on profitability, solvency, and liquidity with all three statistical models. Therefore, we could not accept any of our hypotheses H1, H2 and H3. While our results are consistent with some previous research, they are also not consistent with other previous studies. In short, to answer our research question "What is the impact of M&A on the financial performance of pharmaceutical companies after M&A transactions in Belgium?", we can conclude that there is no clear evidence of a significant impact of M&A on the financial performance of Belgian acquirers.

As any scientific paper, this thesis also presents some limitations. We selected the matching firms based on the criteria of size, industry, and country. However, the selection criteria based on pre-acquisition performance, such as financial ratios, were not included. Although the results show that the firms were well matched, future research could include more selection criteria when applying the matching technique to the same set of acquisitions from this thesis to investigate how this would affect the result.

Another direction for future improvement is to include a deep analysis of the effects of other factors than M&A on firm financial performance. This can be done by specifying these factors when implementing the intercept model and the difference-in-differences model. Future research can investigate whether the impact of M&A is significant when those factors are taken into account.

A potential and final direction for future studies is to apply different methodologies, such as an event study or innovation performance, to the same set of acquisitions to see if there are any differences in the results. Future studies could also look into whether statistically significant results can be obtained by extending the post-acquisition period in the analysis.

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