The influence of cross-border deals on EBITDA multiples - a European analysis

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Abstract

This paper investigates the influence of cross-border deals on EBITDA multiples, analyzing data from 4,207 transactions within Europe sourced from Mergermarket. We use coarsened exact matching to assess the difference in EBITDA multiples between cross-border deals and domestic deals in Europe. The findings show that cross-border deals negatively impact EBITDA multiples. This suggests that transactions involving parties from different countries result in lower EBITDA multiples than domestic deals. The study highlights the significance of geographical boundaries in M&A outcomes and calls for further research to improve the matching method and dataset. These insights are beneficial for policymakers and practitioners aiming to optimize the outcomes of cross-border mergers and acquisitions.

Contents

1 Introduction

Mergers and acquisitions (M&As) are complex and multifaced phenomena that drive business growth, market expansion, and strategic growth (Erel, Liao, and Weisbach 2012). EBITDA multiples are crucial financial metrics used to assess a company's value in mergers and acquisitions (Damodaran et al. 2007). They play an important role in determining the deal value. Mergers and acquisitions can be cross-border, involving multiple countries. This can present different challenges in comparison with domestic deals and may well cause differences in EBITDA multiples. However, how large and significant is the impact of cross-border deals on EBITDA multiples? This paper explores the relationship between cross-border deals and EBITDA multiples in Europe. Understanding this relationship is beneficial for investors, managers, and policymakers aiming to optimize the outcomes of international merger and acquisition activities. This study aims to contribute to the literature by examining cross-border deals and their implications for deal valuation, thus supporting more informed decision-making in the international corporate landscape.

1.1 Background

EBITDA, or Earnings Before Interest, Taxes, Depreciation, and Amortization, is a financial metric used to assess a company's operating performance. It represents the earnings generated by a company before accounting for non-operating expenses such as interest on debt, taxes, depreciation of assets, and amortization of intangible assets. By excluding these non-operating expenses, EBITDA provides a clearer picture of a company's core profitability and cash generation capabilities (Damodaran et al. 2007).

In mergers and acquisitions, the EBITDA multiple is often used to determine the deal value. The EBITDA multiple is used to determine the value of a company in relation to its EBITDA. We can calculate the EBITDA multiple by dividing the enterprise value, the total value of a company's equity and debt, by its EBITDA. Analysts can also estimate the company's enterprise value by multiplying the target company's EBITDA by the selected EBITDA multiple. The estimated enterprise value forms the basis for negotiating the deal price with potential acquirers or investors (Mercer and Harms 2020). Analysts use comparable transactions in the same industry or sector to determine the appropriate EBITDA multiple range. This allows for

a more accurate assessment of a company's valuation relative to its peers and industry norms because each industry has unique characteristics. Therefore, EBITDA multiples are standardized and comparable within the same sector (Koller, Goedhart, Wessels, et al. 2010).

Through access to new markets, diversification of risk, and acquisition of new technologies or skills, cross-border mergers and acquisitions can create value for firms. However, the complexity of integrating operations across different regulatory, cultural, and economic environments can also lead to significant challenges and potential value destruction (Erel, Liao, and Weisbach 2012). EBITDA multiples may vary in cross-border deals compared to domestic deals. These deals often involve higher transaction costs and more significant risks, negatively impacting the EBITDA multiples. Martynova and Renneboog 2008 show that cross-border transactions' perceived risk and uncertainty can lead to lower valuations than domestic deals. The impact on EBITDA multiples is further investigated in this research.

1.2 Research Question

Therefore, the following research question is conducted in this paper:

"What is the impact of cross-border mergers and acquisitions on the EBITDA multiple compared to domestic deals?"

This research question aims to examine the consequences of cross-border transactions on one of the primary valuation metrics, the EBITDA multiple. Through this research question, we aim to determine whether there is a difference between cross-border deal multiples and domestic deal multiples, as well as to assess the extend of this difference.

1.3 Contribution

The existing literature on cross-border mergers and acquisitions has mainly focused on assessing various financial performance metrics, such as transaction prices, premiums, and valuations. However, a gap in research examining the EBITDA multiple in isolation remains. While studies have explored the broader implications of cross-border deals on profitability, stock returns, and shareholder wealth, few have delved into the specific influence of these transactions on the EBITDA multiple as a standalone valuation measure.

This study aims to address this gap by analyzing the relationship between cross-border deals and the EBITDA multiple. Focusing exclusively on this valuation metric, this paper aims to find out if international acquisitions impact the EBITDA multiple. Our research contributes to the literature by offering beneficial insights for investors, managers, and policymakers in making informed decisions regarding the value of a company and mergers and acquisitions.

1.4 Structure and Content of Research Paper

We perform coarsened exact matching to examine the difference in EBITDA multiples between cross-border deals and domestic deals. Matching is based on EBIT, EBITDA, enterprise value, revenue and the target's sector. After matching, a regression analysis is conducted to examine the effect of cross-border deals on EBITDA multiples. This approach allows to isolate the impact of the cross-border nature of the deal on EBITDA multiples, providing insights into the specific effect of international transactions compared to domestic ones within each sector.

The sample for this study was selected from Mergermarket, covering 4,207 completed deals involving European bidders and sellers from January 1, 2000, to April 16, 2024. Only deals with complete information across the variables were included. These variables include deal characteristics like announced and completed dates, sector details, whether a deal is cross-border or domestic, and financial metrics such as EBIT, EBITDA, enterprise value, and revenue.

The rest of this paper is constructed as follows: the second chapter contains a literature review, providing an in-depth exploration of existing literature and studies. The third chapter describes the used data and methodology, from which the results follow in the fourth chapter. In the fourth chapter we also describe several robustness checks performed. Lastly, in the fifth chapter, "Discussion and Conclusion," the findings from the previous chapter are analysed, interpreted, and discussed. This section also provides the limitations of this research.

2 Literature Review

Cross-border mergers and acquisitions represent a significant aspect of global corporate strategy, allowing firms to enter new markets, achieve economies of scale, and acquire new technologies and capabilities. An important aspect of these transactions is the valuation of the target company, often assessed using the EBITDA multiple. This literature review aims to explore existing research on the relationship between cross-border deals and EBITDA multiples, investigating if cross-border mergers and acquisitions result in higher or lower EBITDA multiples.

2.1 Existing Research

Cross-border mergers and acquisitions have been extensively studied for their strategic benefits. These transactions allow companies to expand their market presence, mitigate domestic market risks, and leverage international operation synergies (Shimizu et al. 2004). Research by Morosini, Shane, and Singh 1998 highlight that cross-border acquisitions can provide firms with valuable resources and capabilities that are not available in their home countries.

Valuation in mergers and acquisitions is a complex process, with the EBITDA (multiple) being a widely used metric due to its simplicity and comparability across firms and industries. Unlike other financial metrics, the EBITDA multiple focuses on a company's core operating performance, stripping out the effects of financing and accounting decisions (Damodaran et al. 2007). This makes it a reliable measure of a company's operational efficiency (Fernandez et al. 2001).

Research into the valuation differences between cross-border and domestic deals often reveals higher premiums for cross-border mergers and acquisitions. Erel, Liao, and Weisbach 2012 found that cross-border transactions typically involve higher premiums than domestic deals, suggesting that acquirers perceive more significant strategic advantages or synergies. However, their analysis focused on overall deal value rather than isolating EBITDA multiples.

Studies on post-acquisition performance frequently use EBITDA as a performance indicator. Chari, Ouimet, and Tesar 2004 investigated the post-acquisition performance of U.S. firms acquiring foreign targets and noted improvements in EBITDA margins, indicating successful operational integra-

tion. However, this research did not specifically analyse the used EBITDA multiples in the deal valuation.

Some analyses have looked into the European market for the impact of cross-border deals on EBITDA multiples. A study by KPMG found that cross-border transactions in Europe often result in higher EBITDA multiples than domestic deals, driven by market expansion strategies and access to new customer bases (*European M&A Outlook 2022* 2022). Furthermore, Dealsuite's analysis shows that the presence of international buyers often leads to higher transaction prices, reflecting the premium associated with cross-border synergies and market expansion potential (Dealsuite 2023).

Cultural and institutional differences significantly impact the success and valuation of cross-border mergers and acquisitions. Kogut and Singh 1988 developed an index to measure cultural distance and found that greater cultural differences can lead to higher integration costs, affecting valuation. Personal preferences can significantly influence decision-making processes in mergers and acquisitions. However, due to their subjective nature, these preferences are often challenging to measure or observe directly (Jenter and Lewellen 2015). Similarly, Porta et al. 1998 discussed how legal and regulatory environments influence merger and acquisition outcomes, indirectly affecting EBITDA multiples by altering the perceived risk and required return on investment.

Research by Moeller and Schlingemann 2005 highlights that cross-border acquisitions often command different EBITDA multiples compared to domestic deals due to market growth potential, risk diversification, and regulatory environments. Similarly, a study by Martynova and Renneboog 2010 suggests that cross-border deals can lead to higher valuations due to synergies that are less accessible in domestic transactions.

Looking at more recent research, we can also find that EBITDA multiples vary significantly across different sectors, influenced by industry-specific factors. Dealsuite's M&A Monitor reports provide extensive data on how sectoral differences impact EBITDA multiples in cross-border transactions. For instance, the average EBITDA multiple for the Healthcare and Pharmaceuticals sector in the U.K. is notably higher compared to similar sectors in other Western European countries, indicating a premium valuation in cross-border contexts (Dealsuite 2022).

Research by Dealsuite has consistently shown that cross-border deals often present opportunities for arbitrage, where firms in higher-multiple regions acquire companies in lower-multiple regions. This is particularly visible in

sectors like I.T. Services and Healthcare, where there is a considerable spread in EBITDA multiples across different countries. For example, companies in the Netherlands and France generally sell for lower EBITDA multiples compared to those in the U.K. and Ireland, providing advantageous acquisition opportunities for buyers from higher-multiple regions (Dealsuite 2022 & Dealsuite 2023).

Some literature argue that cross-border deals often result in higher EBITDA multiples compared to domestic deals. Rahman, Lambkin, and Shams 2021 highlight that cross-border M&A activities in emerging market economies contribute positively to firm performance, with EBITDA multiples experiencing a significant increase. Bertrand and Zitouna 2008 validate these findings, emphasizing the value-increasing effects of cross-border deals in the European context, where firms experience growth prospects and operational efficiency, leading to higher EBITDA multiples. Moreover, Shimizu et al. 2004 state that cross-border transactions are associated with increased valuation multiples, including EBITDA multiples, driven by strategic motives, market diversification, and synergies.

2.2 Gap in and Contribution to Literature

Studies have been examining the relationship between cross-border deals and various measures of financial performance, including the EBITDA multiple. Much of the existing literature incorporates multiple factors or assess overall performance rather than focusing exclusively on the EBITDA multiple. These studies have explored the impact of cross-border deals on financial performance metrics such as profitability, stock returns, and market value. However, these studies often consider multiple financial indicators or use combined measures of performance, making it challenging to isolate the specific influence of cross-border deals on the EBITDA multiple.

For example, research by Hijzen, Görg, and Manchin 2008 examined the impact of cross-border mergers and acquisitions on acquirer earnings but did not specifically focus on the EBITDA multiple as the primary outcome variable. Similarly, studies by Globerman and Shapiro 2003 and Fleuriet 2008 examined the effects of cross-border deals on shareholder wealth and acquirer performance, respectively, without providing detailed analyses of the EBITDA multiple as a standalone measure.

These studies contribute valuable insights into the implications of cross-border deals. Nevertheless, research specifically focusing on the EBITDA

multiple would fill a gap in the literature. Due to the significant influence of the EBITDA multiple on the deal value, further research into the relation between cross-border transactions and EBITDA multiple as a standalone measure is suggested.

Examination of the relationship between cross-border deals and the EBITDA multiple could provide valuable insights into the differences in EBITDA multiples between cross-border deals and domestic deals. Research could help investors, managers, and policymakers better understand the valuation of cross-border deals and make informed decisions regarding international mergers and acquisitions.

2.3 Hypotheses

An important metric used to evaluate mergers and acquisitions is the Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA). The EBITDA (multiple) stands out as a key indicator of a firm's financial health and attractiveness to potential acquirers. Despite the literature on merger and acquisition valuation methodologies, a gap remains in the isolated relationship between EBITDA multiples and cross-border deals.

Cross-border mergers and acquisitions involving firms from different countries present unique challenges and opportunities compared to domestic deals. These challenges often result from differences in regulatory environments, cultural nuances, and economic conditions between the countries involved. Given these complexities, it is reasonable to question whether valuation determinants, such as EBITDA multiples, vary significantly between cross-border and domestic transactions. Hence, this study proposes the following hypothesis:

"There is a significant difference in the distribution of EBITDA multiples between firms engaging in cross-border deals and firms that engage in domestic deals"

This hypothesis serves as the center point for the examination of the relationship between EBITDA multiples and cross-border merger and acquisition activity.

In addition to the first hypothesis, a second hypothesis is introduced based on the research conducted by Rahman, Lambkin, and Shams 2021, Bertrand

and Zitouna 2008, and Shimizu et al. 2004. Building upon existing literature suggesting a positive relationship between cross-border deals and EBITDA multiples, we propose the following hypothesis:

"Engaging in a cross-border deal has a positive impact on the EBITDA multiple, unlike engaging in a domestic deal"

This hypothesis aligns with the findings of Rahman, Lambkin, and Shams 2021, Bertrand and Zitouna 2008, and Shimizu et al. 2004, who provide empirical evidence that cross-border transactions contribute positively to firm performance metrics, including EBITDA multiples.

An empirical approach will be employed to examine these hypotheses, leveraging a dataset of mergers and acquisitions including different industries and geographic regions across Europe.

3 Data and Methodology

This section provides an overview of the data and methodology employed in this study to investigate the relationship between cross-border deals and the EBITDA multiple. In paragraph 3.1, we describe the dataset used in this study. Secondly, the included variables are described and divided into dependent, independent, and matching variables. In paragraph 3.3 and 3.4 the methodology used: coarsened exact matching is described, as well as the justification and alternative methods. Then, in paragraph 3.5, the construction of the matching observations is described. Finally, paragraph 3.6 will discuss any assumptions and limitations of this method.

3.1 Sample

For this research, we conducted a sample selection from Mergermarket. Mergermarket is a major global source for information on mergers and acquisitions. It provides detailed data and analysis on corporate deals worldwide and tracks deal information such as announcement dates, deal values, target and bidder details, and various financial performance metrics (a.o. EBITDA, multiples, and enterprise value).

In total, 4,207 deals were included in the sample with a timeframe from January 1, 2000, to April 16, 2024, with the most recent deal included in the dataset completed on April 12, 2024. All the deals used in this research are completed and both have a European bidder and seller. We collected the following variables for this research: announced date, completed date, target, bidder, and seller sector and country, EBIT, EBITDA, enterprise value, revenue and the used EBITDA multiple. For this research, we only used deals from Mergermarket with no missing values for the selected variables. This selection ensures that the analysis is based on complete information, allowing for accurate and reliable results. We created a binary variable where one implies that the deal is cross-border and zero that the deal is domestic. To allow for the coarsening, we created a categorical variable for each sector, which takes a value of 1 up to 22, each representing a sector. The EBITDA multiple is the outcome variable used in the analysis.

It is crucial to account for the influence of other variables than whether a deal is cross-border to obtain accurate and reliable estimates. Including covariates helps to eliminate potential endogeneity issues and isolate the effect. Without controlling for these variables, the estimated effect of cross-

border deals on the EBITDA multiple may be biased due to omitted variable bias or confounding factors.

3.2 Variables

3.2.1 Dependent Variable

The EBITDA multiple assesses a company's value by comparing its enterprise value (EV) to its earnings before interest, taxes, depreciation, and amortization (EBITDA). It is a key indicator of a company's financial performance and valuation. As the main outcome being investigated, the EBITDA multiple is the dependent variable because its value is expected to be influenced by other variables in the study, such as whether the deal is cross-border or domestic and, among other things, the sector in which the target company operates.

In this research, we are interested in understanding how different types of deals (cross-border vs. domestic) and sector-specific characteristics affect the valuation, measured by the EBITDA multiple. By examining the changes in EBITDA multiples, we can determine the impact of the independent variable.

3.2.2 Independent Variable

Whether a deal is cross-border or domestic is considered the independent variable in this research. A binary variable is created, which takes a value of one if the deal is cross-border and zero if the deal is domestic. This variable is the independent variable because it is the main factor whose impact on the EBITDA multiple is being investigated. The expectation is that cross-border deals have different implications for company valuation due to regulatory differences, cultural integration challenges, and potential market expansion benefits. Thus, whether a deal is cross-border or domestic is the variable expected to influence the dependent variable, the EBITDA multiple.

3.2.3 Matching Variables

In this analysis, the following variables are used to execute coarsened exact matching:

- EBIT
- EBITDA

- Enterprise value
- Revenue
- Target's sector

Including the target's sector is based on the understanding that sector classification is a main factor for differences in EBITDA multiples. EBITDA multiples can vary significantly across different sectors due to varying industry characteristics, market dynamics, and financial performance standards (Dealsuite 2022). We maintain the following classification of sectors from mergermarket: Agriculture, Automotive, Biotechnology, Chemicals, Computer, Construction, Consumer, Defence, Energy, Financial Services, Industrial, Internet, Leisure, Manufacturing, Media, Medical, Mining, Real Estate, Services, Telecommunications, Transportation and Utilities. A categorical variable represents the sectors, which takes a value of 1 up to 22, each specifying a specific sector, respectively. This categorical variable is a matching variable because it accounts for industry-specific effects that could influence the EBITDA multiple.

The EBIT, EBITDA, enterprise value, and revenue are also matching variables. Including these variables as matching variables is based on the understanding that they are determinants of differences in EBITDA multiples. EBITDA multiples can vary significantly across different firms and industries due to variations in financial performance, profitability, and market conditions (Dealsuite 2022). EBIT, EBITDA, and revenue reflect the firm's financial health, operational efficiency, and revenue generation capabilities. Enterprise value represents the total value of a firm's equity and debt, providing a comprehensive measure of its overall worth. In the end, EBITDA and enterprise value are used to calculate the EBITDA multiple.

By including these variables as matching variables, this analysis aims to create matched pairs comparable across these dimensions. This approach helps to reduce bias and confounding factors, as described in paragraph 3.1, thereby enhancing the accuracy and validity of the analysis. Accounting for these variables ensures that any observed differences in EBITDA multiples between cross-border and domestic deals are more likely attributable to the cross-border nature of the transactions rather than differences in firm size, financial performance, or industry characteristics.

3.3 Coarsened Exact Matching

Coarsened Exact Matching (CEM) is a statistical method used in observational studies to create comparable groups when randomization is not possible or ethical. It involves grouping individual parameters based on their observed characteristics or covariates into similar categories. Then, it pairs the treated and controlled parameters with the same covariate pattern. This process ensures that treatment and control groups are balanced regarding observed characteristics, allowing for reliable comparison. Coarsening helps to reduce model dependence and avoid overfitting by ensuring that the matching process is not overly sensitive to small changes in the covariate values (Iacus, King, and Porro 2012).

As said in paragraph 3.2, the dataset from mergermarket is divided into groups based on the EBIT, EBITDA, enterprise value, revenue, and target's sector to ensure that we compare units with similar characteristics. Each group, or stratum, represents a unique combination of sector characteristics. In total, 90 strata are created, covering various industry sectors. Exact matching with coarsened strata ensures that treated and control units are as similar as possible concerning the observed covariates, reducing bias due to confounding variables (Blackwell et al. 2009).

Within each stratum, coarsened exact matching is used to pair observations of cross-border deals with domestic deals. This approach ensures that treated and control units within each group are comparable, considering the matching variables mentioned in paragraph 3.2. Unmatched variables are excluded from the research. Excluding unmatched units reduces the risk of bias from unmatched observations. It helps to ensure that the analysis focuses on comparable groups, enhancing the reliability of the estimated treatment effects (Iacus, King, and Porro 2012).

After matching, we assess the balance between treated and control groups in each stratum. We examine the distances and imbalances to confirm the comparability of the matched groups. This step is important to ensure that any observed effects of cross-border deals on financial metrics are not influenced by differences in sector characteristics or other matched variables. Assessing balance is crucial to confirm that the matching process has successfully reduced the differences between the treated and control groups, thereby enhancing the validity of causal inferences (Blackwell et al. 2009).

We perform a regression analysis to explore the impact of cross-border deals on the EBITDA multiple. The regression model, incorporating the

matched pairs resulted from coarsened exact matching, controls for the potential confounding variables. The following regression equation is considered for this research:

$$\text{EBITDAmultiple} = \beta_0 + \beta_1 \times \text{CrossBorderdeals} + \beta_{k+1} \times \text{EBIT} + \beta_{k+2} \times \text{EBITDA} + \beta_{k+3} \times \text{Enterprise\_Value} + \beta_{k+4} \times \text{Revenue} + \sum_{i=1}^{k} \beta_{i+1} \times \text{Sector}_i + \epsilon$$

3.4 Alternative Methods and Justification for Coarsened Exact Matching

While coarsened exact matching is the chosen method for this study, it is essential to justify this choice by comparing it to alternative methods, such as inverse probability weighting and difference-in-differences. Each method has its assumptions, pros, and cons, which result in the justification of the use of coarsened exact matching.

The used dataset does not include variables that determine whether a deal is cross-border or domestic. The EBITDA, or enterprise value, for example, have no influence on this phenomenon. This makes it impossible to work with propensity scores. Inverse probability weighting and propensity score matching do work with propensity scores and therefore these methods are not appropriate for this research. With no observable variables in the dataset that determine whether a deal is cross-border or domestic, coarsened exact matching is the right methodology since it is robust in situations where unobservable variables influence the treatment assignment, which is the case in this research. The flexibility of coarsened exact matching in handling such cases reduces the risk of bias from unobserved confounders (Iacus, King, and Porro 2012).

Coarsened exact matching is suitable for cross-sectional data where only one period of data is available. Unlike difference-in-differences, which require pre-treatment and post-treatment data, coarsened exact matching can be applied to datasets with a single observation period. This makes it relevant for our study, which lacks longitudinal data.

By coarsening the data and creating exact matches, coarsened exact matching reduces the model dependence that can arise from specifying a complex model for propensity scores or other weighting methods. This reduction in model dependence enhances the robustness of the causal inferences drawn from the matched sample (King and Nielsen 2019).

The theoretical justification for using coarsened exact matching is based on its ability to reduce model dependence and improve causal inference by ensuring comparisons between similar units. By coarsening the data and creating exact matches within strata, coarsened exact matching helps to control for confounding variables and mitigate bias from observed covariates. This method is useful in observational studies where randomization is not possible, as it allows for more robust comparisons between treated and control groups.

The use of coarsened exact matching and its advantages are verified in literature. Iacus, King, and Porro 2012 provide a comprehensive overview of the methodology and its application in multiple contexts. They highlight how coarsened exact matching improves the balance between treated and control groups, reducing the risk of bias in estimating treatment effects. The method's robustness and flexibility make it a valuable tool for empirical research in social sciences and economics.

3.5 Construction of Matching Observations

As described, to construct matching observations, we use coarsened exact matching. Coarsened exact matching involves several steps to ensure that the matched groups (cross-border and domestic deals) are comparable on key characteristics.

We coarsen the matching variables by categorizing them into discrete bins. This coarsening process transforms continuous variables into categorical ones to enable matching. In table 4 you can see the ranges in which the variables are divided. There are 5 ranges for each variable. The target's sector variable contains a range from 1 to 22, with each step being 1. This means that each sector corresponds to a different category and no sectors are grouped together.

Then, we divide the dataset into strata based on the coarsened variables. Each stratum represents a unique combination of the coarsened values of the matching variables. A total of 90 strata are created. Within each stratum, deals are matched exactly on the coarsened values of the matching variables. This means we pair cross-border deals with domestic deals within the same stratum.

Units that cannot be matched within their strata are excluded from the analysis. This step ensures that the comparison between treated and control groups is based only on comparable units. In this research, a total of 48

strata are excluded from the analysis.

After matching, we assess the balance between the treated (cross-border deals) and control (domestic deals) groups to see if the matching was successful. It involves checking the distribution of the means and standard errors of the matching variables in both groups to ensure they are similar.

3.6 Assumptions and Limitations

In employing coarsened exact matching to investigate the impact of cross-border deals on the EBITDA multiple, we must be mindful of its underlying assumptions and the potential limitations in its application.

Firstly, the success of coarsened exact matching depends on certain assumptions. We assume independence among units within each stratum, meaning that the treatment status of one unit does not influence that of another within the same group. Correct model specification is also important; we must accurately identify and include relevant covariates for matching. In this case, the EBIT, EBITDA, enterprise value, revenue, and target's sector are the variables used for matching, as explained in paragraph 3.2.3. Furthermore, the assumption of common support, meaning that there are similar units in both the treatment and control group, is essential. This ensures that both treated and control units are present within each stratum, enabling valid comparisons.

A notable limitation of coarsened exact matching lies in its restriction to the number of observed covariates. Unobserved variables affecting treatment assignment and outcome may introduce bias. Moreover, the process of coarsening, where we convert continuous variables into categories, may result in information loss and potential bias if not executed carefully.

Furthermore, the generalizability of the findings of coarsened exact matching may be limited, as its effectiveness can vary depending on dataset characteristics and the variables being matched. Results derived from coarsened exact matching should thus be interpreted cautiously and may not extend to other contexts or populations.

Moreover, there is a risk of overfitting if the number of covariates is too large relative to the sample size. This can lead to matched groups that are overly similar, potentially affecting the robustness of the analysis. Lastly, the conditional independence assumption, meaning that the assignment of the treatment is independent of the potential outcomes, may be violated. This could be the case if unobserved factors influence treatment assignment,

leading to selection bias and biased treatment effect estimates.

Understanding and acknowledging these assumptions and limitations is essential for drawing valid conclusions from the coarsened exact matching analysis. By considering these factors, we can better understand the validity and reliability of the results obtained and ensure that our conclusions correctly reflect the differences in EBITDA multiples between cross-border and domestic deals.

4 Results

In this section, we delve into the results and findings of this study, examining the difference in EBITDA multiples of cross-border deals versus domestic deals. Additionally, we explore the robustness of these findings through various checks. This section presents the findings objectively, and we have yet to conclude in section 5.

4.1 Main Findings

4.1.1 Coarsened Exact Matching

The treatment group (cross-border deals) comprised 1,846 observations, whereas the control group (domestic deals) contained 2,361 observations. This reflects the distribution between the treatment group and the control group and implies that the control group (domestic deals) is approximately 25% larger. However, the distribution is sufficient to perform matching. The coarsened exact matching analysis produced 90 strata, indicating the number of groupings formed based on the matching variables. Within these strata, only 42 were successfully matched. This means that 48 strata remained empty, which may suggest that the ranges as shown in table 4 are not divided proportionately and the assumption of common support does not entirely hold. Post-matching, 1,818 observations in the treatment group and 2,329 in the control group were successfully matched, leaving 28 and 32 unmatched observations, respectively. This means that only a small percentage of observations remain unmatched, approximately 1.5% and 1.3% of the total observations (1,846 and 2,361), respectively. This low percentage of unmatched observations indicate that the matching procedure has been effective. With about half of the strata empty, but only 60 of the 4,207 observations omitted, it could be that ranges are not evenly distributed. This could be the case because extreme values occur less often.

The multivariate L1 distance, measuring the overall imbalance, was approximately 0.29. Looking at the threshold of 0.3, implying that anything above 0.3 has a significant degree of imbalance, a relative large degree of imbalance between the treatment and the control group is observed (King, Nielsen, et al. 2011).

4.1.2 Regression Results

Looking at table 5, the regression analysis of cross-border deals on the EBITDA multiple yielded a coefficient estimate of -13.997. This means that engaging in a cross-border deal has a negative impact of -13.997 on the EBITDA multiple compared to domestic deals. This suggests that, on average, cross-border deals tend to have lower EBITDA multiples than domestic deals. This can be caused by the cultural and institutional differences following from cross-border transactions as described in section 2.1. These differences can result in higher integration costs, affecting the valuation negatively. Since the effect we found is also negative, these higher integration costs can be the cause of the negative result.

The standard error is 8.080, which is relatively large compared to the coefficient (-13.997). This reflects a high degree of variation around the estimated impact of cross-border deals. The F-statistic is 3.0 with a corresponding p-value of 0.083, showing significance at the 0.1 level. This means that the observed effect is likely not due to chance, and there is sufficient evidence to suggest that there is a significant relationship between cross-border deals and the EBITDA multiple.

The intercept term (constant) has a coefficient estimate of 39.536 with a standard error of 6.048 and significance at the 0.01 level. This means that in domestic deals the expected EBITDA multiple is 39.536. The significance indicates a high level of confidence in this estimate. Same as with the coefficient estimate, the standard error of the constant is relatively large (6.048), implying that there may be relative large deviations. The adjusted R-squared value was 0.001, indicating that the model explains only 0.1% of the variance in the EBITDA multiple. This low value suggests that the model does not capture much of the variability in the EBITDA multiple and could imply that the dataset does not contain any variables that influence the EBITDA multiple, which indicates omitted variable bias.

So, from these results we can derive that there are little to no variables included in the dataset that affect the EBITDA multiple. Therefore, it is important to consider what variables do have an effect. As described in section 2.1, personal preferences are an example of an unobservable variable that can influence the decision of doing a cross-border transaction (independent variable). Meanwhile, legal and regulatory environments can influence merger and acquisition outcomes (dependent variable) as stated by Porta et al. 1998 in section 2.1. It is important to acknowledge that these factors

can indirectly affect the EBITDA multiple but are not accounted for in this study.

4.2 Robustness Checks

To validate the results obtained from coarsened exact matching and check if the findings are replicable across different specifications and methodologies we perform several robustness checks. The following robustness checks are performed:

- Assessing balance
- Univariate Imbalance
- Nearest Neighbour Matching

Assessing balance

First, the balance of the matching variables between domestic and cross-border deals is examined. Table 2 presents the descriptive statistics before matching and table 3 presents the descriptive statistics after matching. These balance checks are essential to assess the effectiveness of the matching process. They help to ensure that the treatment and control groups are comparable across the key covariates, thereby reducing the risk of bias in estimating treatment effects.

Comparing the means of cross-border deals and domestic deals in table 2 (before matching) and table 3 (after matching), several observations can be made regarding the balance check. Firstly, for variables like EBITDA, enterprise value, and revenue, the means appear to be closer between cross-border and domestic deals after matching compared to before matching, suggesting improvement in balance. However, for the EBIT and the target's sector, the means seem to remain relatively similar before and after matching, indicating less improvement in balance for these variables. Additionally, the standard deviations for all variables in table 3 appear lower than table 2, suggesting reduced variability within the matched samples. Overall, the matching process has improved the balance for most variables and reduced the variability within the matched samples. However, there still remains a notable difference between EBIT, EBITDA, enterprise value, and revenue. This indicates that the matching could be better and thus should be taken into consideration when interpreting the results.

Univariate Imbalance

Next, univariate imbalance across the matching variables is assessed. Table 6 displays the results of this analysis, indicating the standardized mean differences for each variable between the treatment and control groups. This examination ensures that the matching process effectively balances the distribution of covariates between domestic and cross-border deals.

Looking at the results of the univariate imbalance check in table 6, focusing on the L1 distances for each matching variable, the L1 distances quantify each variable's absolute mean differences between cross-border and domestic deals. A distance of 0 is optimal in the context of L1 distances, indicating exact correspondence after matching. Higher L1 values indicate a more significant imbalance between the treatment and control groups. All variables exhibit relatively low L1 distances close to zero, suggesting a minimal univariate imbalance between cross-border deals and domestic deals. It is essential to note that the L1 distance for the target's sector is almost zero, indicating a near-perfect balance in this variable. Overall, these results suggest that the matching process effectively reduced univariate imbalances across the matching variables.

Nearest Neighbour Matching

Furthermore, we employ nearest neighbour matching as an additional robustness check. Table 7 presents the regression results after nearest neighbour matching. Matching is done based on the same variables as used in the coarsened exact matching. This analysis helps to confirm the robustness of the main findings by employing a different matching technique and assessing the consistency of results across methodologies.

Looking at the regression results after nearest neighbour matching in table 7, the coefficient value of -16.555 suggests that cross-border deals have a negative effect of -16.555 on the EBITDA multiple; this result is consistent with the regression analysis after coarsened exact matching (-13.997). The coefficient for cross-border deals has a p-value of 0.05, indicating that this effect is statistically significant at the 0.05 significance level. This effect is more significant than the regression analysis after coarsened exact matching (0.1 significance level). As for coarsened exact matching, the standard error of nearest neighbour matching (7.528) also indicates a relatively large variance compared to the coefficient of cross-border deals (-16.555). The sample size of 4,207 observations suggests that no observations are omitted in this analysis, meaning no information got lost in this analysis. Since nearest

neighbour matching shows similar results as coarsened exact matching, this method contributes to assessing the robustness of the findings.

As mentioned, nearest neigbour matching shows the same negative result of cross-border deals on EBITDA multiples as coarsened exact matching. It is important to consider where this negative effect can stem from. Firstly, it can stem from higher integration costs by cultural and institutional differences. Secondly, it is important to consider that there are potential unobservable variables that are not taken into account in this research but do have an effect on the dependent or independent variable. As mentioned before, personal preferences can have an impact on whether a deal is cross-border or domestic and legal and regulatory environments can have an impact on the EBITDA multiple. This can potentially deviate the results.

5 Discussion and Conclusion

This study investigates the difference in EBITDA multiples of cross-border deals compared to domestic deals, aiming to explain how international transactions affect financial performance. The findings offer valuable insights into the relationship between cross-border deals and the EBITDA multiple, addressing two fundamental hypotheses.

5.1 Findings

The results indicate a significant difference in the distribution of EBITDA multiples between firms involved in cross-border and domestic deals. Engaging in international transactions can lead to differences in financial outcomes, reflecting the challenges and opportunities associated with cross-border deals.

However, contrary to expectations, the analysis shows that cross-border deals tend to negatively impact EBITDA multiples. This negative effect is robust across different matching methods and persists even after accounting for various control variables. These findings contradict the assumption that cross-border deals lead to higher EBITDA multiples.

5.1.1 Hypothesis 1

The first hypothesis examined in this research is: "There is a significant difference in the distribution of EBITDA multiples between firms engaging in cross-border deals and firms that engage in domestic deals." We find a significant difference in the distribution of EBITDA multiples between firms engaging in cross-border deals and firms engaging in domestic deals. The analysis shows this effect at the 0.1 significance level; therefore, we cannot reject the hypothesis. However, it is essential to consider the very low R-squared, highlighting the need for a cautious interpretation of this finding.

5.1.2 Hypothesis 2

The second hypothesis examined in this research is: "Engaging in a cross-border deal has a positive impact on the EBITDA multiple, unlike engaging in a domestic deal." The effect found by regression analysis after coarsened exact matching, with a significance level of 0.1, is negative. Nearest neighbour matching shows the same effect with a significance level of 0.05. Therefore, hypothesis 2 is rejected.

5.1.3 Research Question

To answer the research question: "What is the impact of cross-border mergers and acquisitions on the EBITDA multiple compared to domestic deals?", this study finds that cross-border deals negatively impact EBITDA multiples compared to domestic deals. The analysis shows a significant difference in the distribution of EBITDA multiples, with cross-border deals resulting in lower multiples. This negative effect is robust across different matching methods and remains significant even after accounting for various control variables.

However, it is crucial to approach these results with caution. While the matching process was conducted very carefully, it is not perfect, leading to potential biases in the analysis. Despite our best efforts to balance the treatment and control groups, significant imbalances persisted, which may influence the reliability of the conclusions.

5.2 Limitations

It is important to acknowledge several limitations of this study that could affect the interpretation of the results. Firstly, despite efforts to achieve balance through matching techniques, balancing cross-border and domestic deals could be better. This imbalance may introduce biases into the analysis, potentially influencing the results and limiting the conclusions' reliability. Another important thing to notice is that about half of the strata remains empty, but only 60 of the 4,207 observations are omitted. This suggests that the ranges used in the coarsened exact matching are not divided properly. This also suggests that the assumption of common support does not entirely hold, as half of the strata contains no deals at all or contains only one type of deal (cross-border or domestic). The multivariate L1 distance remains relatively high, comparing it to the 0.3 threshold, indicating that a significant imbalance persists after matching. This highlights the need for more careful and precise matching to ensure comparability between the treatment and control groups.

Secondly, the regression analysis following coarsened exact matching yields a very low R-squared value. This low explanatory power suggests that the model explains only a tiny portion of the differences in EBITDA multiples. The low R-squared value implies that other variables are likely influencing the EBITDA multiple that have not been accounted for in this study and are not available in the used dataset. Therfore, we must exercise caution in

drawing definitive conclusions from these results.

Furthermore, other unobserved variables could significantly impact the EBITDA multiple. Even after matching and controlling for several variables, it is clear that this approach needs to be adapted to isolate the effect of cross-border deals on EBITDA multiples. Personal preferences can play a major role in a deal, as described in section 2.1, but are not observable or measurable. The potential influence of this unobserved characteristic poses a significant limitation to the study, suggesting that the findings should be interpreted cautiously. This highlights the necessity for future research to incorporate a more comprehensive set of variables and to employ more advanced matching and analytical techniques to isolate the effects of cross-border deals better.

Overall, these limitations highlight the need for different ranges or a different dataset to ensure the robustness and reliability of the findings. The study's inability to fully balance the treatment and control groups and the low explanatory power of the regression model highlights the challenges in isolating the specific impact of cross-border deals on EBITDA multiples. It is suggested that future research addresses these limitations by improving the dataset and matching process.

5.3 Relevance findings and implications for policy makers

The findings of this study are relevant for policymakers to understand the impact of cross-border deals on financial performance. By understanding the relationship between cross-border transactions and EBITDA multiples, policymakers can develop targeted strategies to promote international business activities while reducing potential risks.

Considering sector-specific characteristics when drawing policies related to cross-border deals is important. Given the differences in effects across different industries, policymakers should adjust their approaches to a sector's unique characteristics and challenges. Moreover, policymakers should take the limitations identified in this study into account, particularly regarding the low explanatory power of the coarsened exact matching. Furthermore, policymakers can use these findings to set up initiatives to increase domestic firms' competitiveness in international markets. By identifying factors contributing to positive outcomes in cross-border deals, policymakers can

develop programs to stimulate the growth and internationalization of domestic businesses. This could involve providing access to resources, offering training and support services, or facilitating networking opportunities with international partners.

Overall, this study's insights offer policymakers valuable information to inform their decisions and strategies related to cross-border transactions. By understanding the relationship between cross-border deals and financial performance, policymakers can draw policies that promote sustainable economic growth, enhance global competitiveness, and create opportunities for businesses to grow in the international marketplace.

5.4 Further Research

Future research can increase our understanding of the relationship between cross-border deals and EBITDA multiples by addressing several limitations. There is a need to refine the matching process to achieve a better balance between cross-border and domestic transactions. There are two factors that could use improvement. First, half of the strata remains empty, which calls for a different distribution of the ranges. So, larger ranges for the extreme values, and smaller ranges for the average values. Second, a different dataset is suggested since the dataset does not contain any variables that influence the EBITDA multiple, suggested by the low R-squared.

Moreover, exploring industry-specific characteristics, such as sectoral regulations, market dynamics, and competitive landscapes, can provide insights into why certain sectors experience positive or negative impacts on EBITDA multiples following cross-border transactions. Additionally, factors such as cultural differences, legal frameworks, and market integration may influence the outcomes of cross-border transactions and calls for further investigation. Another important aspect that should be considered is personal preference. For example, a seller may not want to sell to a certain country due to personal reasons. These are phenomena that are not observable, cannot be measured, and are therefore unaccounted in this study. Understanding how these factors interact with cross-border deals can provide valuable context for interpreting the observed effects on EBITDA multiples and provide a more complete picture for whether a deal is cross-border or domestic.

In summary, future research should refine matching techniques, explore industry-specific characteristics, as well as deal characteristics, and investigate unobservable characteristics such as personal preference to improve our

understanding of the relationship between cross-border deals and EBITDA multiples. By addressing these limitations, researchers can provide more valid insights into the determinants of EBITDA multiple differences between cross-border and domestic transactions, ultimately contributing to a better understanding of international business dynamics.

5.5 Summary

This study sheds light on the difference in EBITDA multiples between cross-border and domestic deals. It shows that cross-border transactions are closed at a lower EBITDA multiple. However, it is important to interpret these findings carefully, as some analyses did not show strong results, indicating that other factors may be involved.

It is suggested that future research should address these limitations by improving matching methods, examining industry-specific characteristics, and exploring other influences. By addressing these gaps, future studies can contribute to a better understanding of the relation between international deals and financial metrics, facilitating informed decision-making for firms and policymakers. By doing so, policymakers and business leaders can better support entrepreneurial initiatives, stimulating economic growth.

6 References

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7 Appendix

Variable	Obs	Mean	Std. dev.	Min	Max
Cross-border deals	4,207	0.561	0.496	0	1
Reported EBITDA multiple	4,207	31.514	257.651	0.084	8,413.820
Enterprise value	4,207	1,497.953	5,682.056	-20.557	122,602
Reported revenue	4,207	1,026.476	4,486.976	-45.577	83,227
Reported EBITDA	4,207	189.381	1,062.119	-46.598	36,177.570
Reported EBIT	4,207	112.087	657.124	-3,963	19,837.530
Target's Sector	4,207	10.494	5.420	1	22

Table 1: Descriptive Statistics

			Domestic deals		
Variable	Obs	Mean	Std. dev.	Min	Max
Enterprise value	1,846	1,319.190	5,154.234	3.794	90,741.480
Reported revenue	1,846	965.462	4,485.296	0.092	83,227
Reported EBITDA	1,846	161.451	842.521	0.002	21,890
Reported EBIT	1,846	106.476	639.342	-744	15,369.340
Target's sector	1,846	10.625	5.405	1	22
			Cross-border deals		
Enterprise value	2,361	1,637.722	6,060.230	-20.557	122,602
Reported revenue	2,361	1,074.155	4,488.661	-45.577	69,240.990
Reported EBITDA	2,361	211.218	1206.015	-46.596	36,177.570
Reported EBIT	2,361	116.474	670.801	-3,963	19,837.530
Target's sector	2,361	10.391	5.430	1	22

Table 2: Descriptive Statistics Domestic vs. Cross-border deals

			Domestic deals		
Variable	Obs	Mean	Std. dev.	Min	Max
Enterprise value	1,818	1,038.171	3,788.421	3.794	69,003.610
Reported revenue	1,818	705.033	2,680.614	0.092	49,128
Reported EBITDA	1,818	115.627	493.188	0.002	11,367
Reported EBIT	1,818	71.916	344.058	-744	9,879.639
Target's sector	1,818	10.641	5.409	1	22
			Cross-border deals		
Enterprise value	2,329	1,322.318	3,965.611	0.697	64,591.910
Reported revenue	2,329	823.099	2,705.379	0.297	49,128
Reported EBITDA	2,329	149.796	526.899	0.014	11,265.330
Reported EBIT	2,329	88.482	371.061	-1,139.916	9,879.639
Target's sector	2,329	10.397	5.443	1	22

Table 3: Coarsened Exact Matching

Matching variable			Range			
Enterprise value	0	24,590	49,130	73,670	98,210	122,750
Reported revenue	-50	16,610	33,270	49,930	66,590	83,250
Reported EBITDA	-50	7,200	14,450	21,700	28,950	36,200
Reported EBIT	-5,000	0	5,000	10,000	15,000	20,000

Table 4: Coarsened Exact Matching Ranges

Reported EBITDA multiple	Coefficient
Cross-border deals	-13.997*
	(8.080)
Constant	39.536***
	(6.048)
Obs	4,147
R-squared	0.001

Notes: Standard errors are in parantheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Regression Results after Coarsened Exact Matching

	L1
Enterprise value	0.089
Reported revenue	0.091
Reported EBITDA	0.084
Reported EBIT	0.130
Target's sector	1.9e-15

Table 6: Univariate Imbalance

Reported EBITDA multiple	Coefficient
Cross-border deals	-16.555**
	(7.528)
Obs	4,207

Notes: Standard errors are in parantheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7: Regression Results after Nearest Neighbour Matching