THE PRIVATE COMPANY DISCOUNT: A COMPARISON OF THE AMERICAN AND EUROPEAN MARKETS

Abstract

This study investigates the discount on the valuation of private companies in the American and Western European markets. We conduct a multivariate regression analysis on M&A transactions from 1993 to 2024 to identify factors influencing valuation multiples, followed by an estimate of the private company discount using the acquisition approach and quantile regressions. The findings reveal that private companies are generally traded at a discount compared to their public counterparts, a phenomenon attributed to the illiquidity premium and other market-specific factors. Comparing the North American and European markets, the research highlights a higher discount in the Western European market. This study contributes to the existing literature by providing a more nuanced understanding of how private company discounts are influenced by regional market dynamics. It offers valuable insights for M&A professionals and investors, enhancing methodologies for valuing privately held firms. Furthermore, the study underscores the importance of considering liquidity and marketability in private company valuation.

1. Introduction

The National Bureau of Economic Research (NBER) indicates that only 1% of companies in the United States are publicly traded, but despite the significance of private companies in the economy, the literature on valuation often overlooks them (Petersen et al. 2006). Consequently, studies on valuation techniques for private companies are essential for obtaining more accurate estimates.

Valuing unlisted firms introduces several complexities. Trading privately owned companies usually involves a risk of not immediately finding a counterparty for a deal, besides substantial other transaction costs (Damodaran 2012). For this reason, the equity value may need to be discounted for the potential illiquidity and other transaction costs, referred to by "illiquidity discount" or "marketability discount". This discount, however, does not account only for liquidity, but can be further decomposed in two major components: liquidity (or marketability) and information asymmetry (Bajaj et al. 2001; Officer 2007). Thus, the broader (and more adequate) term is "private company discount".

Amihud and Mendelson (1986) explain that illiquid assets are harder to trade and have higher transaction costs. In contrast, liquid assets can be sold promptly at market prices with minimum transaction costs. (Amihud et al. 2005) show the presence of illiquidity discounts across various asset classes and its different sources. However, pricing the illiquidity discount remains unresolved.

Various authors have examined the private company discount (PCD), especially in the US market, using methods that compare market information to the prices of traded and non-traded stocks, pre-IPO valuation, or data available on transactions of public and private targets to estimate the differences in acquisition prices.

Although previous studies have already investigated the private company discount outside the US (Koeplin et al. 2000) and in Europe (Klein and Scheibel 2012) they have not directly compared the North American and European markets. Therefore, we seek to answer the following research question: is there a significant difference in the private company discount in M&A transactions when comparing North American and Western European markets?

We find that there is evidence of the private company discount using both the multivariate regression, the quantile regressions and the acquisition approach, and that the

discount is expected to be higher in Western Europe when using most of the selected valuation multiples.

This study offers two main contributions. Academically, it contributes to the finance literature by investigating the private company discount using M&A transaction prices, a topic that has not been extensively analyzed in the last couple years. Since most of the studies were published, the world has gone through several technologic and financial changes, and the subject of valuing private firms is gaining more and more importance with the growth of illiquid markets. Most articles use prices of infrequently traded shares or pre- or post-IPO transactions, leaving a gap in more recent studies. Practically, it has significant contributions as the illiquid markets expand and the interest for private companies grows. The study provides valuable insights for M&A professionals involved in valuing private firms, proposing an estimate and a methodology, and testing if the discount is different for the US and Western European markets, so that practitioners can adjust their valuations when analyzing companies in these markets.

2. Review of Literature and Hypothesis Formulation

2.1 Liquidity and Illiquidity Discount

Valuing private owned firms presents several additional issues when compared to valuation of listed companies. Since there is no market data available to analyze, the estimation of cost of capital is difficult, and the quality of financial information of private firms is usually lower than the public firms', since non-listed companies are not subject of the same level of regulation and requirements (Petersen et al 2006).

According to Feldman (2005), the first step on valuing private firms is to value the company as if it was listed, with high liquidity. The second step is to reduce the estimated value by the illiquidity discount. However, in practice this process is not so straightforward. There is no consensus on the literature concerning the percentage of the illiquidity discount, and there are also other issues that affect the final value of the firm (Damodaran 2005).

Silber (1991) defines liquidity as "the ability to buy or sell an asset quickly, with little premium or discount compared to the equilibrium price". Amihud et al. (2005) state that liquidity is simply the ease of trading a security. That means that liquidity is the measure of how quickly an investor can sell his asset by a price that reflects its intrinsic value and convert it to cash at a low transaction cost (Petersen et al. 2006). Liu (2006) expands the concept and adds

that besides being able to sell great amounts of assets quickly and at a low transaction cost, there should be a low impact on asset prices.

Investors value assets according to their net returns after all transaction costs. Therefore, a less liquid investment would require the seller to lower his bid price to immediately close a deal, thus incurring on a cost. Then, investors will require higher returns to compensate them for their incurring costs related to liquidity (Draper et al. 2006). It is interesting that the seller gets rewarded for the illiquidity cost at the same time that the buyer receives a corresponding discount: when the deal is made (Amihud and Mendelson 1986). As this premium is either paid and collected when the transaction is complete, it can only come from an effect on prices. So, a reduction in stock liquidity results in a reduction in stock prices, which in turn causes an increase in expected stock returns (Amihud et al. 2005).

Acharya and Pedersen (2005) propose an adjusted CAPM model to account for illiquidity. They generalize the illiquidity risk, analyzing it not only for the stock itself, but in a broader context: the market liquidity. The authors also find that the frequency of trading affects the liquidity risk, with stronger effects when investors trade more frequently, consistent with Amihud and Mendelson (1986) and Silber (1991).

Damodaran (2012) suggests that analysts adjust firm valuations for both ownership control and illiquidity. This is especially true for valuing private firms, which do not trade on the stock market and, therefore, their investors may incur in greater risk of not finding a counterparty for a trade. In their study concerning issues in valuing private firms, Petersen et al. (2006) found that around 55% of participants in their study add a risk premium to cost of equity to compensate for illiquidity costs, but at the same time some participants in their research argued that the marketability discount still involves a great deal of guesswork.

Amihud et al. (2005) list several sources of illiquidity. Some are related to transaction costs such as brokerage fees and transaction taxes that lead the buyer to anticipate these costs and require a higher return, so the higher the trading frequency, the higher the transaction costs and the illiquidity discounts. Others come from the information asymmetry that is present in markets, both concerning the asset performance and the order flow. Furthermore, literature on stock liquidity finds a relation between asset liquidity (in terms of balance sheet assets) and stock liquidity. In that case, firms that are less likely to reinvest their liquid assets experience an improvement in their stock liquidity (Gopalan, Kadan, and Pevzner 2012).

Amihud et al. (2005) state that a fundamental source of illiquidity is the fragmentation of the investors and the markets. This means that a seller may arrive to the market at a time when there is no natural buyer available. In the stock market, it is possible that a market maker is present to provide the needed demand. In the private transactions market, there is hardly a market maker available. If traders need to sell their positions, they need to find a counterparty willing to buy their assets, negotiate the price and close the deal. Two issues come from this: transaction costs due to intermediary fees, and costs related to each trader's possibilities of finding outside options for the trade (Amihud et al. 2005). The lack of potential buyers is a main problem for low liquidity markets (Bun 2017). For instance, if a seller has more than one possible buyer, he is probably in a better negotiating position and thus can be less flexible on price. Generally, there is a tradeoff between taking the time to search for counterparties, with the corresponding opportunity costs, and quick trading at a discount. Other than the bargaining power, factors that influence the prices of assets in non-listed markets are also risk averseness and volatility (Duffie, Gârleanu, and Pedersen 2007).

Amihud and Mendelson (1986) found strong evidence that higher-spread stocks have higher excess returns, considering that the bid-ask spread may be viewed as the reward demanded by the trader for providing immediate liquidity for a trade. They also found evidence that the expected stock returns increase at decreasing rates as the bid-ask spread increases, what means that the higher the spread, the lower the returns' sensitivity to spread. Amihud and Mendelson (1986) also note that the longer the period over which the stock is held, the lower the return required to compensate for illiquidity cost. In the context of emergent markets, Bun (2017) and Minardi, Sanvicente, and Monteiro (2006) also find evidence of illiquidity premiums when studying the bid-ask spread in the Brazilian stock market.

Amihud et al. (2005) reviewed the theory on liquidity effects concerning several classes of assets. First, they examined a situation where two assets with the same cashflow and differences in liquidity have different prices, using both Treasury bonds and restricted shares to test whether illiquidity costs exist, with positive results consistent with Silber (1991). The authors proceed by stating that, in cases where there are different cashflows and different characteristics among assets, the analysis must include control variables and then test if the liquidity coefficient is significant in relation to the difference in asset prices. According to the authors, there is also a small firm effect in place with stocks, with small stocks typically being less liquid and earning higher returns.

Angel et al. (2004) advance towards the OTC market and private firms, suggesting that firms must experience a decline in value when they suffer from a drastic liquidity loss. Using data from involuntary regulatory delisting from NASDAQ, the authors confirmed that firms experience a reduction in liquidity following their delisting – they highlight, however, that firms still have some trading activity, so there is still some liquidity and trading information available to investors, what does not happen within privately owned companies.

2.2 Empirical evidence of illiquidity discounts on private owned companies' valuation

There are four approaches to calculating the illiquidity discount for privately owned companies: the restricted stock approach, the pre-IPO approach, the expected exit multiple, and the acquisition approach (Björklund 2010). These methods attempt to create proxies using public companies to discount the firm value of privately owned companies, but it must be noted that they do not account only for the illiquidity costs, but rather they have to be interpreted as private company discounts as a broader concept.

The restricted stock approach was used by Silber (1991) and Bajaj et al. (2001) to examine the influence of liquidity in stock prices, examining the price differences across identical assets, in which the only difference was liquidity. In both cases, the authors gathered data on restricted stocks, that can only be resold after a holding period in private placements.

Silber (1991) found that the average discount in his sample was 37,75%, while Bajaj et al. (2001) found a mean discount of 22,21% for all issues, expanding the analysis and comparing the discount of registered (14,04%) and unregistered (28,13%) issues. Although the difference in discounts of registered and unregistered issues can be considered closer to a "pure" marketability discount of 14,09%, this interpretation should not be taken at face value since the economic conditions were not identical for all issues. The results were consistent with previous studies such as Hertzel and Smith (1993) and Wruck (1989).

Surprisingly, the earnings variable in Silber (1991) study was insignificant when it was entered as dollar value of earnings or earnings per share (EPS), but the dummy variable captured the relevance of the earnings' effect on the relative price of restricted stocks, that is, if the company is lucrative at all. Silber (1991) also finds that investors with longer expected holding periods require a smaller discount, consistent with Amihud and Mendelson (1986). Both Silber (1991) and Bajaj et al. (2001) highlight that the factors such as the duration of the restrictions, information asymmetry and the size of the company can be associated with the magnitude of the discounts.

Emory (1997) used the pre-IPO approach to compare the prices of shares in pre-IPO transactions with prices of the same shares after the IPO event. Emory (1997) examined 310 transactions and reported a median discount of 43% and a mean discount of 44%. Emory also updated his studies later, in 2000 and 2002, and found similar results, even with a sample of 543 transactions (Emory Sr, Dengel III, and Emory Jr 2002).

Koeplin et al. (2000), Kooli et al. (2003), Block (2007), Officer (2007) and Goetz (2021) used the acquisition approach to examine the private company discount, with similar results. The authors gathered data on transactions involving public and private targets and matched the transactions so they could compare the valuation multiples of the transactions involving private companies and the transactions involving public companies as targets. While the approach was generally the same for all papers, there were some interesting differences: first, while Koeplin et al (2000) and Block (2007) both matched transactions based on the target companies, the former excludes from the analysis firms of the financial and regulated utilities industries to avoid distortions. Second, Kooli et al. (2003) and Officer (2007) formed portfolios of public firms to match the characteristics of the corresponding private firms. Finally, Goetz (2021) did not match the transactions based on industry, but rather on firm characteristics such as risk, profitability and growth, arguing that the industry itself is not a crucial criterion for finding comparable companies.

Table 1 shows the estimated private company discount for each of the studies.

[Insert Table 1 about here]

Koeplin et al. (2000), Kooli et al. (2003) and Officer (2007) also use multivariate regressions to measure how the public status of the target is related to the valuation multiples. The authors related the multiples to variables such as size, growth, industry, and type of transaction (dummy variable, differentiating private to public targets) to test if the differences in valuation could come from variations in growth rates. Still, the results indicate that the private company discount is significant (Koeplin et al. 2000; Kooli et al. 2003). Other factors that are related to the private company discount are the higher degree of uncertainty brought by accounting problems and poor auditing in private companies, that lead to higher information asymmetry, the liquidity scarcity of the market, and the liquidity restrictions of parent firms in the case of subsidiaries, all factors that influence the target firm's bargaining power (Officer

2007). Lastly, Block (2007) performed a chi-square independence of classification test to test whether the industry effect is statistically significant, with positive results with an alpha of 0,01.

Even though Koeplin et al. (2000) include companies from outside the US in their study, they do not specifically focus on the European market. Klein and Scheibel (2012) use the acquisition approach to investigate the private company discount in European companies within the Eurozone, reinforcing that the results capture more than just the illiquidity discount. The authors use data covering from 1999 to 2009, matching 138 pairs of transactions for testing their hypothesis that there is a discount for private companies in the European market. Using the multiple of EBITDA as the measure of value, they find that the private company discount in the European market is around 5%, therefore much lower when compared to the studies investigating the US market. Rodríguez López and Rubio Martín (2019) used a multivariate regression to investigate the marketability discount in Spanish Firms, controlling for several variables and interacting the dummy variable of the firm status (i.e public or private) with financial variables. They found a significant discount of 32% for EV/EBITDA and 24% for EV/Sales.

Lastly, Das et al. (2002) used the expected exit multiple to analyze financing rounds and estimate the private equity discounts among firms in different stages of development. After categorizing the stage of the firms and estimating the probabilities of exit, the authors estimated the exit multiples and provided an equation to estimate the illiquidity discount. However, the authors highlighted that the discount also captures the reward for guidance, monitoring and mentoring often provided by investors.

2.3 Formulation of Hypothesis

As seen in the literature review, there is evidence of private company discount in several studies (Bajaj et al. 2001; Björklund 2010; Block 2007; Das et al. 2002; Emory Sr, Dengel III, and Emory Jr 2002; Klein and Scheibel 2012; Koeplin et al. 2000; Kooli et al. 2003; Officer 2007; Silber 1991). Therefore, the first hypothesis is whether there is evidence of private company discount in the investigated time frame and regions.

H1: Privately owned companies are negotiated at a discount.

Most of the studies on illiquidity or private company discount were conducted using data from the US market. Koeplin et al. (2000), Klein and Scheibel (2012) and Rodríguez López and Rubio Martín (2019) used data from foreign transactions to investigate the private company

discount, but with conflicting results. Furthermore, the studies have not compared directly the results in the US and Western European markets. Thus, this study seeks to investigate the difference in the private company discount in US and Western European markets.

H2: Privately owned companies are negotiated at different discounts when comparing US and Western Europe markets.

3. Research Design

3.1 Sample selection and description

We collected the sample from the Eikon database, where we screened M&A transactions from 1993 to 2024. The first filter was that the transaction needed to be either completed or unconditional and involve a controlling interest acquisition. Secondly, the target's country needed to be either the USA or Western European countries. Since the UK has left the European Union in 2020, the British target companies were not included in this study. The target company was determined to be either public or private, and we excluded sectors such as banking services and insurance to avoid distortions, as seen in Koeplin et al. (2000). To reduce the number of observations without information or information that would distort the analysis, we also filtered so that the transactions should have positive valuation multiples.

The final sample consists of 6.736 transactions, which can be further divided into 1.267 transactions involving private targets ("private transactions") and 5.467 transactions involving public targets ("public transactions"). Of the total transactions, 66% took place in the US, followed by almost 8% in France. Although this shows that the sample is highly concentrated in US transactions, the proportion is close to 66% to 34% if we consider Western Europe as a whole, what can be useful to compare the private company discount between regions.

Breaking down the sample by industry, we still can see more representative sectors. Around 10,5% of the transactions had Software & IT Service companies as targets, accounting for 15,3% of the total private transactions and 9,5% of the public transactions. Machinery, tools, heavy vehicles, trains and ships accounted for 7,4% of the total transactions, but it is interesting to note the prevalence of the service sector at the top of the ranking.

The chart shows that the number of transactions is increasingly high during the 1990's, what may be related to the number of deals involving targets in the Software & IT Services industry, since the number of transactions declines sharply after the Dotcom bubble. Then, the market shows signs of reaction until 2007, followed by another fall after the subprime crisis

and by years of relative stability until the low of 2020, possibly due to the COVID-19 pandemics, and the slight recovery in 2021 and 2022, with a following decrease in the number of deals in 2023, possibly due to effects of the Ukrainian and the Israeli-Palestinian wars.

[Insert Chart 1 about here]

3.2 Description of the variables

The dependent variables consist of the logarithm of the valuation multiples for each of the transactions, as shown in Table 2. These variables were also used by Block (2007) and Koeplin et al. (2000) in their studies.

[Insert Table 2 about here]

The variables of interest are Target Private, a dummy variable that equals 1 if the target is a private company, or 0 otherwise, and Target Europe, a dummy variable that is equal to 1 if the target company is based in Western Europe or zero otherwise.

The independent variables were used to control the different characteristics of the target companies and the acquiror companies. There are two kinds of independent variables to conduct this study. First, the dummy variables that account for non-numeric characteristics. Second, the financial ratios that account for the characteristics of the firms involved in the transactions, both concerning the financial conditions for each firm and how one firm stands in comparison with the other. The financial ratios can be applied to both private and public companies, not relying on market-based information that would not be available for private companies (Björklund 2010). Since there are financial variables that may affect one another (for example, ROA and earnings-related margins), we have done a correlation matrix to select the variables with the lowest possible degree of correlation and avoid incurring in multicollinearity issues as much as possible. The control variables were chosen based on the studies of Damodaran (2007) and Harbula (2009), where they investigated the drivers and determinants of valuation multiples and are shown in Table 3. The size variable was based on Goetz (2021), but we used the logarithm of Net Sales instead of Total Assets to avoid distortions in book value of assets, especially for private firms.

[Insert Table 3 about here]

Table 4 shows the crisis and events that were considered for this analysis.

[Insert Table 4 about here]

Table 5 shows the sectors we controlled for fixed effects due to higher valuation multiples overall.

[Insert Table 5 about here]

3.3 Methodology

First, we conduct a descriptive analysis of the sample to gather initial information on the transactions. Second, we conduct a Multiple Linear Regression (OLS), using the variables mentioned above to analyze their relationship with the valuation multiples. Third, we use a quantile regression approach to analyze the private company discount at different levels of the distribution, that is, at the 10th, 25th, 50th, 75th and 90th percentile. This approach was introduced by Koenker and Bassett (1978) and recently used by Bortoluzzo, Sanvicente, and Bortoluzzo (2024) to study the determinants of capital structure. The approach using quantile regression is interesting because it provides insights into the variability of the coefficient across different quantiles.

All regressions were conducted using robust standard error to account for heteroscedasticity. The variables for the OLS regressions were winsorized on the 2,5% top and 2,5% bottom to reduce the effect of outliers (Wilcox 2005; Wilcox 2012). A similar method for reducing the effect of outliers was used by Goetz (2021). The quantile regressions used the variables without winsorization due to their robustness to outliers. The regressions were conducted without pairing public and private transactions.

Lastly, following the previous studies using the acquisition approach, especially Koeplin et al. (2000), we matched the transactions forming the closest possible pairs, each consisting of one transaction involving a private company and one transaction involving a public company. Two sets of pairs were matched. For the first set, the following criteria were used: first, the transactions should be in the same year, country and sector. After the exact matches, the two targets with the closest sales were picked to form the pairs. For the second set, the only difference is that the public and private transactions did not have to be in the same Western European country, but rather both must have happened in Western Europe – therefore, considering the region as a common market. To further analyze the data, we have also conducted

tests refining the matching using propensity score matching. In this case, we first matched exact variables such as target sector, country and transaction year, and then we formed the closest pairs based on covariates such as Target EBITDA Margin, Target ROA, Target Net Sales 3-year growth and Target Total Assets. Chart A1 (see Appendix) shows the Covariate Balance Plot for the matched transactions after forming the pairs. To treat outliers, we have used the interquartile range (IQR) method, which identifies values that fall significantly outside the central distribution of the data. Specifically, we calculated the first quartile (Q1) and the third quartile (Q3) for the PCD values in all models and defined the IQR as the difference between Q3 and Q1. Observations below Q1 - 1.5 × IQR or above Q3 + 1.5 × IQR were considered outliers and removed from the dataset. This approach ensures that the analysis focuses on the central tendency of the data, reducing the influence of extreme values while preserving the underlying variability of the sample. Chart A2 and Chart A3 (see Appendix) illustrate the difference in the distribution of the discounts with and without outliers. While the example provided uses EV/EBITDA, the same procedure was applied to EV/EBIT and EV/Sales, yielding similar results. After all matching procedures, we then estimated the private company discount for the overall transactions and segregating by region.

4. Results

The descriptive statistics shown in Table 6 indicate that even after the winsorization there is still a high degree of variability within the sample.

[Insert Table 6 about here]

Even though the data shown on the descriptive analysis cannot be taken as face value of the private company discounts, since it does not control for any other variables, it indicates that the multiples for private companies are lower in all cases. The same applies to the multiples in the Western Europe market when compared to the US market.

The regression models can be expressed by the following equation, where *i* corresponds to the M&A transaction *i*:

$$
\begin{aligned}
&\log(Valuation\ Multiple)_i \\
&\quad = \beta_0 + \beta_1 \times (Target\ Private_i) \\
&\quad + \beta_2 \times (Target\ Europe_i \times Target\ Private_i) \\
&\quad + \beta_3 \times (Target\ EBITDA_i\ or\ EBIT\ Margin_i) \\
&\quad + \beta_4 \times (Target\ ROA_i) \\
&\quad + \beta_5 \times (Target\ Total\ Debt\ to\ EBITDA_i) \\
&\quad + \beta_6 \times (Target\ EBITDA\ or\ EBIT\ 3-year\ growth\ rate_i) \\
&\quad + \beta_7 \times (Acquiror\ Private_i) + \beta_8 \times (Target\ Europe_i) \\
&\quad + \beta_9 \times (Different\ Sector_i) + \beta_{10} \times (Different\ Country_i) \\
&\quad + \beta_{11} \times (Cash\ Acquisition_i) \\
&\quad + \beta_{12} \times (Relative\ size\ sales_i) + \beta_{13} \times (Crisis\ year_i) \\
&\quad + \beta_{14} \times (Sector\ fixed\ effects_i) + \beta_{15} \times (Size_i) + \varepsilon_i
\end{aligned}
$$

In all cases, we have used the logarithmic form for the dependent variables, so the results must be interpreted accordingly. The equation is similar for all models, with the exception of the EV/EBIT model, which uses the Target EBIT Margin and Target EBIT 3-year growth as variables, instead of the variables using EBITDA.

Table 7 shows the results of the regressions for EV/EBITDA, Table 8 for EV/EBIT and finally Table 9 for EV/Sales.

[Table 7, Table 8 and Table 9 go about here.]

Overall, the models exhibited highly significant F- statistics, and the model EV/Sales has the highest explanatory power, with an R-squared of 0,4955. The quantile regressions show Pseudo-R-squared of 0,636 (on average) for EV/EBITDA and around 0,521 (on average) for EV/EBIT and EV/Sales.

The results indicate a consistent negative association between the valuation multiples and the dummy Private Target, even though the intensity of the association varies, and so does the statistical significance. The results for the EV/EBITDA OLS model indicate a discount on the valuation multiple of the overall transactions of 21,8% when the company is private, significant at the 1% level and consistent with results of Koeplin et al. (2000) for transactions involving US targets, and also with Block (2007) and Officer (2007). The quantile regression also shows that, overall, private targets are valued at lower multiples, but with different intensity across quantiles. The results indicate that firms in the lower bound (10th quantile) tend to be

more discounted (38,5%) than firms in the higher quantiles (23,7% on the 90th quantile). The median discount is 15,8%. All Target Private coefficients but the 75th quantile are statistically significant. The interaction between Target Europe and Target Private, although negative, is not statistically significant in any of the EV/EBITDA models.

The EV/EBIT also shows discounts on all models. On the OLS model, the discount is 32,7%, consistent with Koeplin (2000) and once more we note a high degree of variability among the quantile regressions. In this case, the discount starts high for the 10% percentile, at 50,7%, then decreases to 24,2% in the median and increases again to 34,9% at the 90th percentile. All results for the dummy Target Private are statistically significant and consistent with previous literature, especially Koeplin et al. (2000) and Block (2007). The interaction between Target Europe and Status Target is negative for all models except the 75th quantile, but it is only significant at the 5% level on the quantile regression at the 10% percentile, indicating that transactions of private companies in Europe tend to have a higher discount than in the US. Although interesting, we consider that this result must be interpreted cautiously, because it is the only statistically significant result for the interaction in all models.

The EV/Sales models results show higher discounts than previous literature, indicating that multiples decrease by 44,9% on the OLS model, and all coefficients of Target Private in the quantile regressions are also statistically significant, with higher discounts for the lower quantiles. Similar to EV/EBIT quantile models, the coefficients indicate higher discounts for the lower quantiles, then decrease for the intermediary quantiles and increase again for the 90th quantile. Again, the interaction between Target Europe and Target Private is not statistically significant. Thus, all three OLS models and all quantile models are consistent with previous literature and provide evidence to support hypothesis H1. There is not enough evidence to support H2.

The dummy that controls if the target is an European company is significant for most of the models, with a negative influence on the multiples, indicating that there is evidence of discount on valuation multiples for European Targets in general, but the discount is not associated with private firms. It is possible that this has more to do with market dynamics and overall market liquidity than with the private status of the company in different regions.

The financial variables present a rather surprising result. The Target ROA variable has a positive coefficient in both EV/EBITDA and EV/Sales OLS models, as should be expected – higher returns lead to higher valuation multiples, but not in the EV/EBIT OLS model. In the

quantile regressions, the Target ROA variable is not statistically significant for any quantile in the EV/EBITDA model, but it is highly significant for the EV/EBIT and EV/Sales quantile models. The variables Target EBITDA margin and Target EBIT margin have a negative coefficient on all OLS models except for the EV/Sales, which is counter intuitive and may suggest that different valuation bases might interpret operational efficiency differently. On the other hand, it is consistent with Damodaran (2007), who listed operating margin as a determinant for EV/Sales, but not to EV/EBITDA. It is possible that what drives valuation multiples in terms of profitability is not the direct profit measures, but the profitability versus a company's peers (Harbula 2009). Of all models, the EV/Sales is the most straightforward since its basic information is the firm's net revenue. It may be the case that acquirors are inclined to pay a higher price for companies that may add to their client base and also bring healthier margins. The operating margin is not significant for most of the quantile regression models, except for EV/Sales above-median quantiles.

The variable that relates the valuation multiples to the level of financial leverage of the target firms has a positive coefficient in all OLS and quantile models, except for the lower quantile of EV/Sales. This may be related to tax shield effects of debt. The growth variable resulted either in a very low coefficient or statistically significant, which was also the case of the variable that accounted for the relative size between Acquiror and Target. It may be that the valuation multiples hold a stronger relationship to forecasted growth, instead of historic growth, as noted by Zarowin (1990).

The dummy that controls if the acquiror and target companies are from the same country is generally significant across models and indicate that the valuation multiple is expected to be higher when acquiror and target are from a different country, which is counter intuitive in terms of integration costs, but may be related to acquirors being willing to pay a premium in the valuation to expand geographically. Surprisingly, the dummy controlling by sector was found not to be significant in most models. The reason behind this might be the presence of deals that have financial investors as acquirors, leading to a high variability of impact on the multiples. Lastly, the dummy controlling for Cash Acquisitions resulted in negative coefficients across models, likely reflecting the risk premium demanded by acquirors when paying cash to account for information asymmetry (Hansen 1987; Officer 2007). This variable is significant in all OLS models and in the EV/Sales quantile models.

The Size variable is statistically significant and negative in all models.

The variables Acquiror Private and Crisis Year were not found statistically significant across the models.

We also used the acquisition approach to further investigate the private company discount. As previously explained, we matched the transactions using two sets of criteria. For the first set, the matched transactions should be in the same year, country, and sector. After the exact matching, the two targets with the closest sales were picked to form the pairs (Koeplin et al. 2000). For the second set, the only difference is that we relaxed the country variable and considered Western Europe as the whole region, therefore transactions could be matched if they both occurred in Western Europe in general, not only in the same country. Then, the data was filtered so that we can differentiate the overall results, the results in the US market and the results in Western European markets. We also used a second method where we used PSM to refine the matching procedure and treat the outliers.

In line with Koeplin et al. (2000), we used the following equation to estimate the private company discount for each valuation multiple analyzed in the regression models:

$$PCD = 1 - \frac{Private\ Company\ Multiple}{Public\ Company\ Multiple}$$

Table 10 shows the results for each multiple before using the PSM, using the median as the estimate to ensure robustness against outliers.

[Insert Table 10 about here]

Our results provide evidence supporting the H1 hypothesis, that is, the presence of private company discounts when analyzing the overall markets. This interpretation aligns with the regressions results, where the Target Private variable was significant and had a negative coefficient in all models. Additionally, there is evidence of differences in the private company discount when the data is broken down by different regions using both matching methodologies, thus supporting the hypothesis H2.

The EV/EBITDA results are consistent with Koeplin et al. (2000) both for the US and foreign markets, but lower than other previous studies considering overall transactions (Block 2007; Officer 2007). Also, the EV/EBITDA findings align with the second regression in the previous section. While the EV/EBIT is consistent with Koeplin et al. (2000) when analyzing

domestic (US) transactions, it is lower than the discount estimated by Block (2007). Finally, the EV/Sales discount is lower than all other referenced studies.

The results suggest a different interpretation than what was found by Klein and Scheibel (2012). When matching transactions using the target country as one of the exact criteria, the results of the present study suggest that the private company discount in the European market is higher than in US market for the EV/EBITDA and EV/Sales multiples, with similar results when using the EV/EBIT valuation multiple. It is possible that one reason for this is the higher number of transactions in the US market when compared to Europe – there were 1.072 matched transactions for American targets and 224 transactions when using Western European targets, what may suggest that the market in US is more liquid and, therefore, results in a lower private company discount. On the other hand, it must also be noted that the variability of the data in the US is much higher than in Western Europe. The kurtosis is much higher for the matched US transactions than for European's, what suggests a higher number of outliers and fatter tails.

When we analyze the data using the second matching methodology, which considers Western Europe as a whole for the target region, the results for EV/EBITDA remain similar, but different insights emerge when comparing EV/EBIT and EV/Sales. In this case, although the private company discount found in Western European transactions is higher than in US transactions when comparing EV/EBITDA and EV/EBIT, the discount is lower when comparing EV/Sales. Notably, the difference in the EV/Sales discount for Western European transactions is substantial—21.8% when matching exact target countries compared to 6.7% when considering Western Europe as a whole. This discrepancy suggests that specific factors and country-specific characteristics significantly influence acquirers' behavior and cannot be ignored in transaction analysis.

Finally, Table 11 shows the results of the Private Company Discount for the matched transactions after applying the PSM refinement in the pairing procedure.

[Insert Table 11 about here]

The results of the earnings-related multiples reveal differences when considering the overall discount and the EV/EBITDA multiple for the US market, Western European transactions exhibit less variability across pairing methods. Among the multiples, EV/Sales shows the most significant variation across methods, which may indicate differences in valuation approaches when analysts prioritize Sales multiples over other financial ratios.

Nevertheless, the results of EV/EBITDA, EV/EBIT and EV/Sales using the PSM refinement align more closely with the quantile regressions from the earlier analysis. The findings confirm a persistent difference in valuation multiples between regions, with Western Europe exhibiting higher discounts for EV/EBITDA and EV/Sales but the opposite trend for EV/EBIT. Importantly, these regional differences are less pronounced after applying the PSM refinement, suggesting that this method enhances the robustness of the results.

5. Conclusion

Despite the economic importance of private owned firms, most of the academic literature on valuation is focused on public companies, for which there are not only readily available market data, but also the possibility of buying and selling shares in an organized market. Valuing private companies presents additional challenges – even if the overall methodology is the same, the enterprise value must be adjusted for the unique characteristics of this kind of asset.

Previous studies have investigated the private company discount, namely Koeplin et al. (2000), Block (2007) and Klein and Scheibel (2012) with the acquisition approach, but without comparing different regions. Drawing on previous studies, we used the acquisition approach to compare the private company discount, both for the overall sample and segregating transactions in US and Western Europe. Furthermore, we also used a different approach and conducted multiple linear regressions to explore the variables associated with the variation of the valuation multiples and how each variable is related with the enterprise value, using the target status as variable of interest.

The results of the OLS regression and the quantile regressions of the entire dataset showed that there is evidence of the private company discount in all three models, EV/EBITDA, EV/EBIT, and EV/Sales, thus supporting the hypothesis H1 and consistent with previous studies using different methodology (Bajaj et al. 2001; Koeplin et al. 2000; Officer 2007). The interaction term between Target Europe and Target Private was not statistically significant, although Target Europe alone showed a significant negative coefficient in all models. This, however, does not mean that the private company discount in Western Europe is higher than in the US, but rather that there is evidence that valuation multiples in Western Europe are overall lower than in United States.

The acquisition approach also provides evidence of the private company discount for the overall transactions, thus supporting H1. The results also provide evidence to support H2,

that is, the acquisition approach is different among regions, consistent with Koeplin et al. (2000) and Klein and Scheibel (2012). The median discount for the transactions in Western Europe was higher for both EV/EBITDA (USA: 16,1% and Western Europe: 28,3%) and EV/Sales (USA: 10,0% and Western Europe: 21,8%). When using EV/EBIT, the discount was slightly lower in Western Europe, 32,1% versus 33,3% in the US when matching exact countries, but with different results when matching regions (USA: 33,3% and Western Europe: 50,8%). The difference in the results of EV/Sales when using different matching criteria also highlights the importance of taking country-specific factors into account when analyzing the transactions. Furthermore, the application of the PSM refinement in the pairing process ensured that transactions were matched not only on exact variables, such as country, sector and year, but also on key financial covariates that influence firm fundamentals and valuation drivers. This allowed for a more precise comparison between public and private transactions, reducing the influence of confounding factors such as differences in profitability, growth, or size across regions. By addressing these factors, the PSM refinement enhanced the robustness and reliability of the results, providing a clearer view of the private company discount. These findings underline the significance of regional differences and the methodological approach in analyzing private company discounts.

This research contributes to valuation literature by highlighting disparities between private and public company valuation multiples and exploring regional nuances. Furthermore, it offers a novel approach to examine the relationship between valuation multiples and target status with the use of multiple regressions and analyzing different quantiles of the distribution. While abundant US-focused literature exists, studies examining transactions in Western Europe are limited. This study provides a model for practitioners to adjust valuations for private companies in these regions, which can be updated periodically with new data.

Future research could broaden this scope to include emerging markets, potentially revealing distinct dynamics in private company valuations. Moreover, while this study provides empirical evidence of the private company discount, it does not dissect this discount into its components, such as pure illiquidity or information asymmetry. Further research could explore these elements in depth, enhancing our understanding of what drives private company discounts. Lastly, an expanded investigation into the determinants of these discounts could provide deeper insights into their variability across different contexts.

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Table 1 – Estimated private company discount in previous studies

Paper	Number of observations	EV/EBITDA	EV/EBIT	EV/SALES
Koeplin et al. (2000) - US transactions	84	18%	31%	NS
Koeplin et al. (2000) - Foreign transactions	108	24%	6%	NS
Block (2007)	91	22%	24%	24%
Officer (2007)	364	20%	NT	19%
Rodríguez López et al. (2019)	824	32%	NT	24%
Goetz (2021)	341	13%	NT	NT

Source: prepared by the authors.

Table 2 – Dependent variables

Variables	Description	Type
Dependent		
LN EV/EBIT	Enterprise value divided by EBIT	Valuation multiple
LN EV/EBITDA	Enterprise value divided by EBITDA	Valuation multiple
LN EV/Sales	Enterprise value divided by Sales	Valuation multiple

Source: prepared by the authors.

Table 3 – Control variables

Variables	**Description**	**Type**
Independent - Dummies		
Acquiror Private	Private = 1; Public = 0	Non-numeric
Different sector	Different sector (acquiror and target) = 1; Same sector = 0	Non-numeric
Different country	Different country (acquiror and target) = 1; Same country = 0	Non-numeric
Acquiror Europe	Europe = 1; USA = 0	Non-numeric
Crisis year	Crisis year = 1; Otherwise = 0	Non-numeric
Target Europe	Europe = 1; USA = 0	Non-numeric
Cash Acquisition	Cash = 1; Otherwise = 0	Non-numeric
Sector Fixed Effects	If target is in sector = 1; Otherwise = 0	Non-numeric
Independent - Financial		
Target EBITDA margin	Target EBITDA divided by Net Sales	Financial performance
Target EBIT margin	Target EBIT divided by Net Sales	Financial performance
Target ROA	Target Net Income divided by Assets	Financial performance
Target EBITDA 3-year growth	Percentage of growth in target EBITDA for the last 3 years.	Growth
Target EBIT 3-year growth	Percentage of growth in target EBIT for the last 3 years.	Growth
Target Total Debt to Target EBITDA	Total Debt divided by EBITDA	Leverage
Size - LN of Target Net Sales	Logarithm of Target Net Sales	Size
Independent – Relative		
Acquiror Net Sales to Target Net Sales	Acquiror Net Sales divided by Target Net Sales	Size

Source: prepared by the authors.

Table 4 - Crisis or events for dummy variable

Year	Crisis / Event
2000	Dot Com Bubble
2001	Dot Com Bubble / 11/09
2008	Subprime crisis
2009	Subprime crisis
2020	COVID-19
2021	COVID-19
2022	Ucraine War
2023	Ucraine War / Israeli War
2024	Ucraine War / Israeli War

Source: prepared by the authors.

Table 5 – Sector fixed effects

Sector
Aerospace & Defense
Biotechnology & Medical Research
Electronic Equipment & Parts
Machinery, Tools, Heavy Vehicles, Trains & Ships
Pharmaceuticals
Software & IT Services

Source: prepared by the authors.

Table 6 - Descriptive statistics of the multiples

	# of observations		Mean		Median		Standard Deviation	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
EV/EBITDA								
Overall	5.469	1.267	16,50	15,90	11,10	9,43	16,10	18,80
US transactions	3.876	581	16,60	15,90	11,60	10,10	15,60	17,30
Western Europe	1.593	686	16,10	15,90	10,20	8,53	17,20	20,10
EV/EBIT								
Overall	5.469	1.267	35,90	31,30	18,60	12,90	51,30	53,90
US transactions	3.876	581	35,50	30,80	18,60	14,00	50,00	51,20
Western Europe	1.593	686	36,90	31,70	18,50	12,30	54,40	56,10
EV/SALES								
Overall	5.469	1.267	3,21	2,86	1,77	1,26	3,84	4,10
US transactions	3.876	581	3,18	2,73	1,91	1,29	3,57	3,74
Western Europe	1.593	686	3,29	2,97	1,48	1,22	4,43	4,38

Source: prepared by the authors.

Table 7 – LN EV/EBITDA Regressions

	Linear Regression	Quantile regression				
	LN EV/EBITDA	**LN EV/EBITDA**	**LN EV/EBITDA**	**LN EV/EBITDA**	**LN EV/EBITDA**	**LN EV/EBITDA**
	Winsorized	*10% quantile*	*25% quantile*	*50% quantile*	*75% quantile*	*90% quantile*
Target Private	-0,218 (***)	-0,385 (***)	-0,229 (**)	-0,158 (**)	-0,117	-0,237 (**)
Interaction: Target Europe x Target private	-0,053	-0,361	-0,130	-0,051	0,023	0,126
Target Europe	-0,121 (***)	-0,184 (***)	-0,135 (***)	-0,089 (***)	-0,073	-0,078
Target EBITDA (or EBIT) Margin	-0,568 (***)	-0,308 (**)	-0,123	-0,130	-0,025	-0,045
Target ROA	0,554 (***)	0,244	0,012	0,198	-0,228	-0,372
Target Total Debt to EBITDA	0,084 (***)	0,016 (*)	0,033 (***)	0,039 (***)	0,038 (***)	0,033 (***)
Target EBITDA (or EBIT) 3-year growth rate	-0,001 (***)	-0,003 (***)	-0,002 (**)	-0,001 (**)	-0,001	0
Acquiror Private	-0,022	-0,100	-0,132 (*)	-0,111	-0,020	-0,145
Different sector	-0,002	-0,007	0,003	0,004	0,007	0,055
Different country	0,092 (***)	0,076 (*)	0,05	0,078 (**)	0,136 (***)	0,134 (**)
Cash Acquisition	-0,083 (***)	0,008	0,033	-0,026	-0,1 (***)	-0,18 (***)
Relative size sales	0,003 (***)	0,000	0,000	0 (*)	0,001 (*)	0,001
Crisis year	-0,015	-0,063	-0,037	-0,016	0,011	0,053
Sector fixed effects	0,229 (***)	0,187 (***)	0,179 (***)	0,219 (***)	0,281 (***)	0,309 (***)
Size (Ln Net Sales)	-0,044 (***)	-0,006	-0,018 (***)	-0,034 (***)	-0,07 (***)	-0,117 (***)
Intercept	2,571 (***)	1,892 (***)	2,147 (***)	2,528 (***)	3,105 (***)	3,815 (***)
Multiple R-Squared / Pseudo R-Squared	0,2454	0,6211	0,6303	0,6367	0,6387	0,6534
Adjusted R-Squared	0,2418					
F-statistic:	78,4 on 15 and 3115 DF					
p-value:	< 2,2e-16					

Note: significance codes: 0.01 '***' 0.05 '**' 0.1 '*'.

Source: elaborated by the authors.

Table 8 – LN EV/EBIT Regressions

	Linear Regression	Quantile regression				
	LN EV/EBIT	**LN EV/EBIT**	**LN EV/EBIT**	**LN EV/EBIT**	**LN EV/EBIT**	**LN EV/EBIT**
	Winsorized	*10% quantile*	*25% quantile*	*50% quantile*	*75% quantile*	*90% quantile*
Target Private	-0,327 (***)	-0,507 (***)	-0,301 (***)	-0,242 (***)	-0,269 (**)	-0,349 (**)
Interaction: Target Europe x Target private	-0,027	-0,511 (**)	-0,141	-0,001	0,091	-0,096
Target Europe	-0,086 (***)	-0,089 (*)	-0,038	-0,05	-0,106 (**)	0,059
Target EBITDA (or EBIT) Margin	-1,624 (***)	-0,125	-0,017	-0,018	-0,019	-0,02
Target ROA	-1,748 (***)	-1,12 (***)	-1,655 (***)	-1,967 (***)	-1,983 (***)	-1,559
Target Total Debt to EBITDA	0,086 (***)	0,019 (***)	0,029 (***)	0,037 (***)	0,046 (***)	0,062 (***)
Target EBITDA (or EBIT) 3-year growth rate	-0,002 (***)	-0,002 (***)	-0,001 (***)	-0,001 (***)	-0,001 (**)	0
Acquiror Private	-0,048	-0,217 (*)	-0,015	-0,092	-0,055	0,05
Different sector	-0,05 (**)	-0,039	-0,029	-0,032	0,02	-0,035
Different country	0,125 (***)	0,094 (**)	0,089 (***)	0,142 (***)	0,184 (***)	0,191 (**)
Cash Acquisition	-0,097 (***)	0,005	0,013	-0,016	-0,076 (**)	-0,099
Relative size sales	0,003 (***)	0,000	0 (**)	0 (***)	0 (*)	0,000
Crisis year	-0,014	-0,045	-0,054	-0,063 (**)	-0,033	0,030
Sector fixed effects	0,167 (***)	0,151 (***)	0,139 (***)	0,179 (***)	0,219 (***)	0,274 (***)
Size (Ln Net Sales)	-0,085 (***)	-0,018	-0,031 (***)	-0,058 (***)	-0,102 (***)	-0,189 (***)
Intercept	3,643 (***)	2,438 (***)	2,768 (***)	3,308 (***)	3,991 (***)	4,988 (***)
Multiple R-Squared / Pseudo R-Squared	0,3423	0,5098	0,5180	0,5226	0,5282	0,5285
Adjusted R-Squared	0,3398					
F-statistic:	121,2 on 15 and 3923 DF					
p-value:	< 2,2e-16					

Signif. codes: '***' p < 0.01; '**' p < 0.05; '*' p < 0.1

Source: elaborated by the authors.

Table 9 – LN EV/Sales Regressions

	Linear Regression	Quantile regression				
	LN EV/Sales	**LN EV/Sales**	**LN EV/Sales**	**LN EV/Sales**	**LN EV/Sales**	**LN EV/Sales**
	Winsorized	*10% quantile*	*25% quantile*	*50% quantile*	*75% quantile*	*90% quantile*
Target Private	-0,449 (***)	-0,773 (***)	-0,747 (***)	-0,44 (***)	-0,37 (***)	-0,48 (***)
Interaction: Target Europe x Target private	0,012	-0,018	0,058	0,095	0,068	0,195
Target Europe	-0,192 (***)	-0,268 (***)	-0,239 (***)	-0,216 (***)	-0,148 (***)	-0,175 (***)
Target EBITDA (or EBIT) Margin	3,469 (***)	0,127	1,32	2,685 (***)	3,037 (***)	2,912 (***)
Target ROA	1,637 (***)	1,632 (***)	1,522 (***)	1,207 (***)	1,08 (***)	0,952 (***)
Target Total Debt to EBITDA	0,08 (***)	0,007	0,019 (*)	0,04 (***)	0,046 (***)	0,039 (***)
Target EBITDA (or EBIT) 3-year growth rate	-0,001 (**)	0,001	0	0,000	0	0
Acquiror Private	0,016	0,185	0,06	-0,045	0,13	-0,053
Different sector	0,001	-0,119 (*)	-0,036	0,006	-0,003	0,065
Different country	0,11 (***)	0,148 (*)	0,092 (*)	0,101 (**)	0,196 (***)	0,174 (***)
Cash Acquisition	-0,1 (***)	-0,116 (*)	-0,194 (**)	-0,117 (*)	-0,161 (***)	-0,214 (***)
Relative size sales	0,003 (***)	0,000	0,000	0,001	0,001 (**)	0,001
Crisis year	0,009	0,095	0,075	0,018	0,079 (*)	0,11 (*)
Sector fixed effects	0,291 (***)	0,199 (***)	0,096	0,15 (**)	0,256 (***)	0,371 (***)
Size (Ln Net Sales)	-0,044 (***)	-0,103 (***)	-0,081 (***)	-0,045 (***)	-0,063 (***)	-0,096 (***)
Intercept	-0,182 (***)	0,039	0,288	0,187	0,589 (***)	1,218 (***)
Multiple R-Squared / Pseudo R-Squared	0,5147	0,5098	0,518	0,5226	0,5282	0,5285
Adjusted R-Squared	0,5124					
F-statistic:	216,3 on 15 and 3115 DF					
p-value:	< 2,2e-16					
Signif. codes: '***' p < 0.01; '**' p < 0.05; '*' p < 0.1						

Source: elaborated by the authors.

Table 10 - Private Company Discount – before PSM

Valuation Multiple	**W. Europe - Country**			**W. Europe - Region**		
	Overall	*USA*	*W. Europe*	*Overall*	*USA*	*W. Europe*
EV/EBITDA	16,9%	16,1%	28,3%	22,1%	16,1%	30,6%
EV/EBIT	33,3%	33,3%	32,1%	41,3%	33,3%	50,8%
EV/SALES	12,3%	10,0%	21,8%	8,9%	10,0%	6,7%

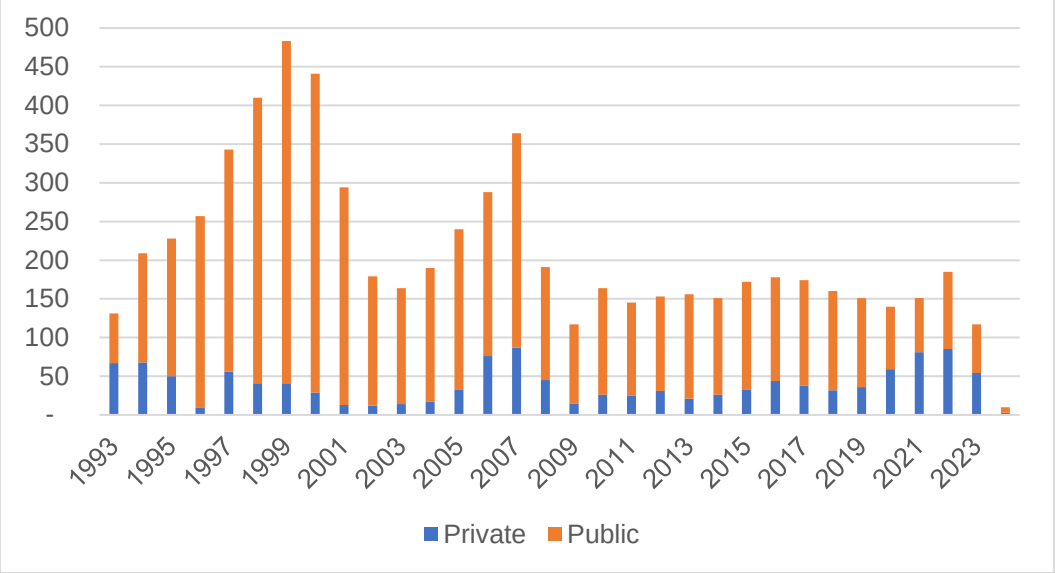
Source: prepared by the authors.

Table 11 - Private Company Discount – PSM without outliers

Valuation Multiple	**Overall**	**USA**	**Europe**
EV/EBITDA	26,5%	25,9%	33,2%
# of matches	*1110*	*964*	*146*
EV/EBIT	35,8%	36,5%	28,9%
# of matches	*1106*	*962*	*144*
EV/SALES	47,9%	46,5%	55,4%
# of matches	*1070*	*936*	*134*

Source: prepared by the authors.

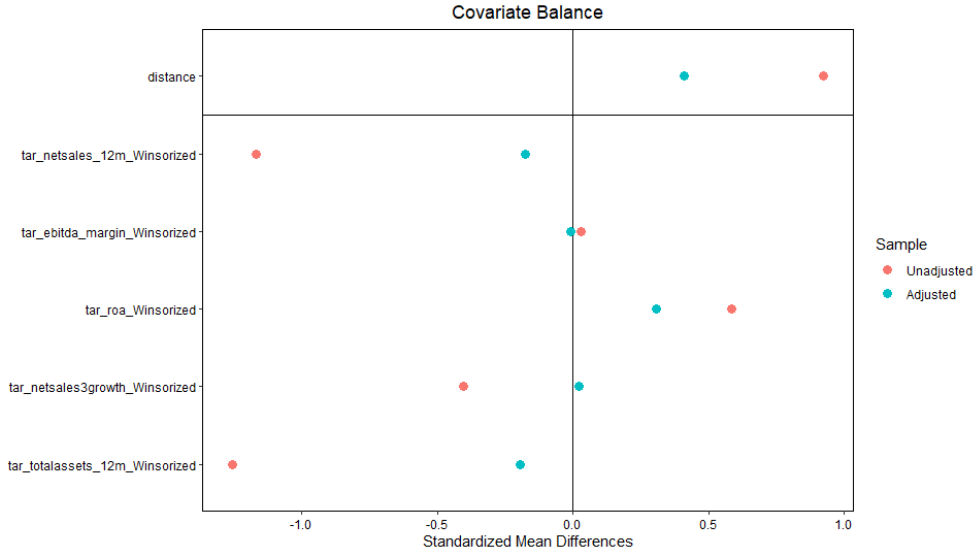
Chart 1 – Transactions per year



Source: prepared by the authors.

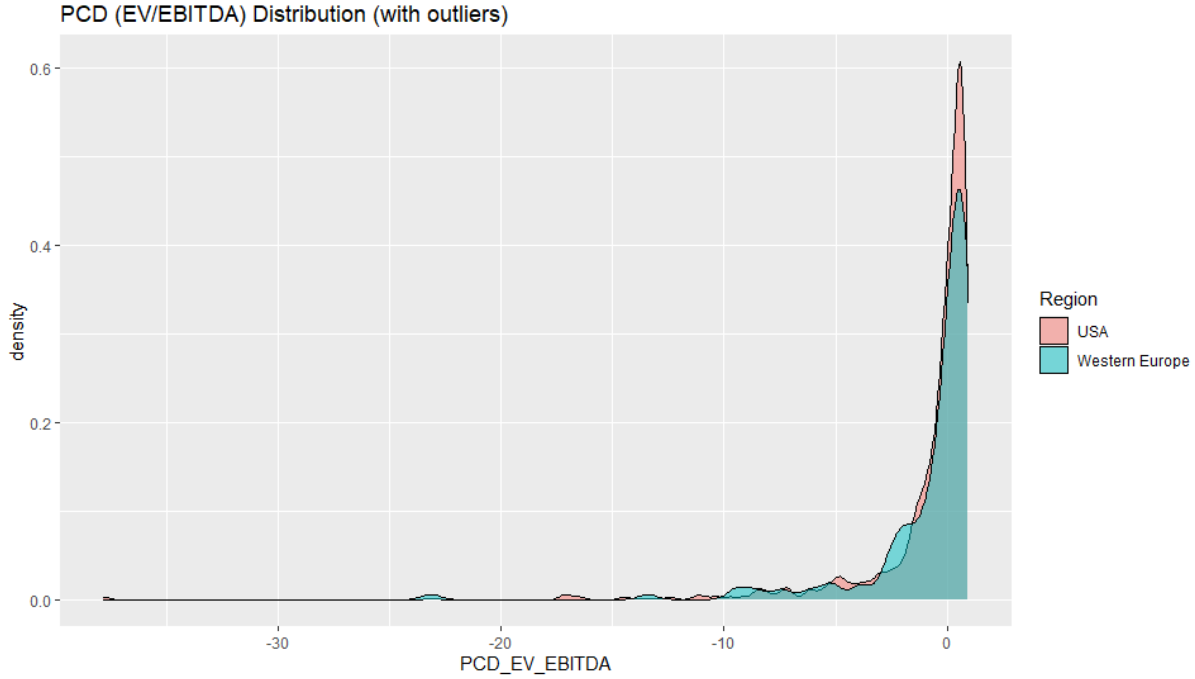
Appendix

Chart A1 – Covariate Balance Plot



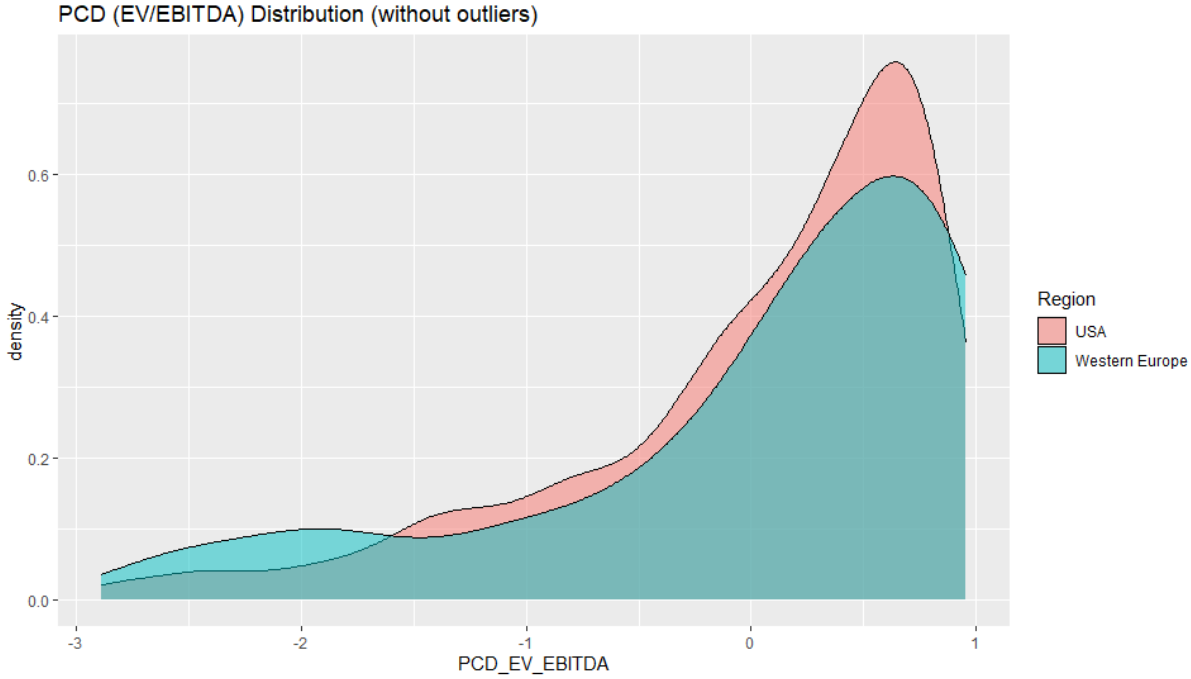
Source: prepared by the authors.

Chart A2 – PCD (EV/EBITDA) Distribution (with outliers)



Source: prepared by the authors.

Chart A3 – PCD (EV/EBITDA) Distribution (without outliers)



Source: prepared by the authors.