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Master Thesis

Performance in Private Equity and Strategic Acquisitions: Evidence from the United Kingdom

by

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Under the supervision of

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Abstract

We conducted an analysis of the UK's Merger and Acquisition (M&A) market, comparing the performance of Private Equity (PE) acquired firms and strategically acquired firms. This comparison involved a dataset consisting of 134 PE-acquired firms and 283 strategically acquired firms from the period of 2013 to 2017, with financial data extending from 2012 to 2021. We compare and analyse performance measure ratios, regression on Total Factor Productivity (TFP), and regression on Return on Assets (ROA). PE acquirers prefer high-performing firms, but these firms show a marked performance dip compared to strategically acquired firms one year post-acquisition in the performance measures ROIC (-0.066), ROA (-0.052), EBIT/Assets (-0.047), EBITDA margin (-0.045), and net profit margin (-0.049). The ROA regression showed evidence that PE-acquired targets perform 3.2% worse from the pre-acquisition period to the post-acquisition period regarding ROA. These findings indicate that the acquirer type's short-term strategies of financial efficiency and operational restructuring propagate into performance, but there is no evidence of superior performance between them in the long run. It is imperative to acknowledge that the research timeline corresponds with momentous macroeconomic episodes such as Brexit and the COVID pandemic.

Keywords: private equity, PE, financial acquisitions, strategic acquisitions, performance, value creation, private markets, propensity score matching, total factor productivity, TFP, return on assets, ROA, Brexit, COVID

Contents

1 Introduction

The global M&A market has grown remarkably from 2013 to 2017, with a 45% increase in the number of deals and a 320% growth in total value (Institute of Mergers, Acquisitions and Alliances, 2023)[39]. The major industries involved were financials, energy, power, consumer products, high technology, and industrials (Institute of Mergers, Acquisitions and Alliances, 2023)[39].

In 2019, M&A activities fell by 6.9% due to weak Eurozone growth and Brexit, with PE deals forming 27.5% of the total UK acquisitions (Mergermarket, 2020). Despite the COVID pandemic and Brexit, there were no significant delays in the UK acquisition market in 2020, although the value of acquisitions was lower (Office for National Statistics, 2022)[53]. However, both inward and domestic M&A values increased in 2021, peaking in March but declining again by December 2022 (Office for National Statistics, 2023)[52]. Domestic and inward acquisitions made up about 85% of all acquisitions from 2019-2022 (Office for National Statistics, 2023)[52].

Challenging financial conditions, lower confidence, and increased volatility impacted M&A activity, with rising costs inducing market uncertainty and a slowdown (Bank of England, 2023)[23]. Despite this, PE funds in the UK have a record level of ”dry powder”, i.e. unallocated capital (Zerdin, 2023; Gillen et al., 2022). The UK market underperformed the global average in Q1 2023 due to a lower growth forecast (Deloitte, 2023)[22]. The volume of UK mergers and acquisitions decreased by 30%, with future trends leaning toward all-equity transactions and limiting deal sizes (Deloitte, 2023)[22]. However, there is no scarcity of liquidity, and with ample ”dry powder,” MA market activity could increase, which bodes well for future value creation.

This thesis advances research on the comparative performance of Private Equity (PE) and strategically acquired targets in the United Kingdom's M&A market. By examining a sample of 134 PE-acquired and 283 strategically acquired targets between 2013 and 2017 and using comprehensive data sources available from 2012 to 2021, this study offers novel insights into the performance dynamics of these two types of acquisitions. While academic discourse has extensively explored the strategies and performance of PE and strategic acquirers, this study differentiates from previous literature by investigating the impact of these strategies on post-acquisition performance in terms of three distinct models. We evaluate the average change in financial performance ratios as well as an regression of TFP and ROA. These three models combined provide a unique approach to capturing the characteristics

and performance of the two target types, pre- and post-acquisition. In addition, our study fills a research gap by investigating post-acquisition performance specifically within the context of private equity transactions during the COVID pandemic as well as the period encompassing the Brexit referendum and its aftermath. This unique focus makes our research a valuable contribution to the existing academic literature, particularly in the contrasting of private equity and strategic transactions.

Our study found that in the short-term, PE-acquired firms experienced reduced performance as evidenced by decreases in ROIC (-0.066), ROA (-0.052), EBIT/Assets (-0.047), and EBITDA margin (-0.045). In our ROA regression, we found that PE acquired targets had a 3.2% lower ROA than strategically acquired targets in the post-acquisition period. We argue that this dip in performance and ROA is likely due to initial restructuring costs, strategic changes, and one-off expenses. These strategies are outlined by Barber (2008)[7], Guo et al. (2011)[34], Holloway et al. (2016)[37], and McKinsey and Company et al. (2020)[43], among others, and some find them to lead to superior performance (Feldman, 2016[24]; McKinsey and Company et al., 2020[43]) for PE-acquired firms. However, as the observed dip wasn't sustained for any of the models, we find no evidence for superior performance of neither PE nor strategic acquired targets in the longer term. While previous studies find that PE prefers targets with higher operating income, our findings suggest they tend to acquire higher performing targets than strategic firms in terms of the aforementioned performance measures. Using the methods of Field and Mkrtchyan (2017)[27] and Chang and Tang (2021)[18], we find no evidence on whether the acquirer type significantly impacts the target's TFP. Still, the ROA variable seems to be the primary determinant of TFP having both economical and statistical significance through its regression coefficient of 0.60 at a 1% significance level. Interestingly, older firms may be less productive as the variable age negatively affects TFP. Thus, age should be a consideration in the acquirer's target selection. In the ROA regression, we observe that leverage and liquidity emerge as primary determinants for an acquired company's ROA in the post-acquisition period, having regression coefficients of -0.257 and 0.178, respectively.

The unique economic and regulatory environment of the UK M&A market restricts this research to that country. Consequently, the findings may not be directly applicable to other jurisdictions with differing economic climates or business regulations. In addition, given the the economic events that occurred during this time period, the 2012 to 2021 time frame may restrict the applicability of the results. Another limitation of our research lies in the quality and availability of the data

for private acquisitions. While we utilized credible data sources, the accessibility and precision of certain data elements could be improved. For instance, private equity firms frequently withhold information regarding their strategies and post-acquisition operations, introducing an element of uncertainty into our analysis. Also, the categorization of firms as 'strategically acquired' could encompass a broad array of acquisition types and strategies, adding a further layer of complexity to our analysis.

This study could be extended to other markets to develop a more comprehensive comprehension of the performance dynamics between private equity firms and strategically acquired firms. Comparative analyses across multiple regions could provide more robust insights into the influence of different economic and regulatory environments on acquisition performance. In addition, future studies could delve deeper into the role of individual PE and strategic acquisition strategies in the performance of acquired firms. It would also be worthwhile to further investigate the impact of external economic shocks, like Brexit and the COVID-19 pandemic, on the performance dynamics of acquisitions.

This study advances knowledge of the performance dynamics of privately held and strategically purchased businesses in the UK MA market, particularly in times of economic downturns. The implication of our findings is that PE firms need to consider the timing and structure of acquisitions since we observe the initial performance dip one year after the acquisition for their acquired firms. Furthermore, PE firms should take into account whether they or their targets have the ability to manage restructuring costs and capital optimization. Strategic acquirers may use our findings when evaluating potential targets, knowing that this study finds no evidence suggesting that the nature of the acquirer impacts long-term performance. Targets can use these insights to comprehend what to anticipate post-acquisition, either from a PE or strategic acquirer's perspective. Furthermore, investors and stakeholders can implement this understanding to make more optimal investment decisions, such as anticipating a short-term performance dip in targets acquired by PE firms. Lastly, policymakers can use this study to better understand the impact acquirers and acquisitions have on targets and the economy, thus having a greater possibility of making better decisions on policies. Our contribution to the literature is outlined in Section 2.9, which addresses present knowledge gaps.

2 Literature Review

To provide readers with an overview of the current research that serves as the basis for our own data establishment and evaluations, the following sections (2.1 through 2.6) present this foundation. The key findings from these sections are summarized in Section 2.7, where we also introduce our research model and explain how it aligns with the literature. In Section 2.8, we outline the methodological differences between our study and the literature. Finally, Section 2.9 delineates our contribution to the literature by addressing existing knowledge gaps.

2.1 Prior studies on private company acquisitions

Previous scholarly works have provided an in-depth examination of the distinctive characteristics and implications of private company acquisitions. A seminal study by Capron and Shen (2007)[17] highlights that acquirers tend to prefer private targets that align with their core business or industry of expertise. Due to limited transparency, which is primarily attributable to the lower quality and quantity of available information, the acquisition process for private firms often comes with complications (Capron & Shen, 2007)[17]. This lack of transparency can result in higher search costs and may negatively impact the acquirer's performance post-acquisition, subjecting them to a classic case of adverse selection, according to by Akerlof's (1970)[3] theory.

Private firms typically exhibit less market liquidity compared to their public counterparts, which can constrain their financial flexibility, and ability to service debts, invest in opportunities, and maintain solvency during challenging times (Fuller et al., 2002)[28]. Yet, paradoxically, Fuller, Netter, and Stegemoller (2002)[28] argue that this apparent liquidity constraint can be desirable for acquirers, as it may generate higher returns on investment.

2.2 Prior studies on PE vs strategic acquisitions

The distinction between financial acquirers, predominantly PE firms, and strategic acquirers, typically corporate entities, is underscored by their unique business models, acquisition strategies, objectives, and channels for profit and growth (Barber, 2008[7]; Bargeron et al., 2008[8]; Gemson & Annamalai, 2015[30]; Gorbenko & Malenko, 2014[31]; Holloway et al., 2016[37]). PE firms devote considerable resources to gathering data on potential targets, thereby optimizing their valuation and selection processes (Bottazzi et al., 2008[14]). On the other hand, corporate acquirers aim

for the integration of acquired firms into their existing operations with a long-term retention strategy in mind. Typically, this strategy demands a comprehensive transformation of the target company in order to increase sales growth and revenue streams (Barber, 2008[7]).

McKinsey and Company et al. (2020)[43] assert that PE firms often achieve superior performance through effective governance, which arguably plays a more pivotal role than financial leverage and clever investment timing—factors traditionally associated with the success of PE firms. This governance is manifested through a high-performance culture and quick management changes. Moreover, PE firms have a competitive edge in providing robust managerial incentives. According to Guo et al. (2011)[34], PE firms are better positioned to offer long-term incentives, which Feldman (2016)[24] suggests fosters a stronger alignment with the standalone business. Furthermore, the success-centric focus of PE firms motivates them more strongly as owners, particularly in ensuring the success of their deals (Wiersema & Liebeskind, 1995[67]). Feldman (2016)[24] further explains that this focus grants PE firms a competitive advantage over corporate acquirers, as even aggressive stock incentives for managers may still fall short in effectiveness compared to a PE-owned post-acquisition company.

There may be a difference between corporate buyers and PE investors in terms of the elements they prioritize within a target company's financial statements and balance sheet. This discrepancy could stem from corporate acquirers potentially lacking the valuation expertise that PE firms characteristically have (Holloway et al., 2016[37]). Instead, PE firms focus on improving the acquired company's processes and enhancing its value within a set investment period before selling it (Gemson & Annamalai, 2015[30]).

Gemson (2021)[29] discovered that targets with higher operating income and assets were more attractive for PE acquirers, while targets with higher revenues were more attractive for corporate acquirers. This indicates that PE tends to lean towards companies with profitability prospects in terms of revenue, while corporate buyers typically favor companies already producing high revenues. However, a PE firm was more likely to acquire targets with strong performance metrics than a corporate buyer.

2.3 Prior studies on acquisitions after Brexit

The Brexit referendum, marking the UK's decision to exit the European Union, introduced a wave of economic and political turbulence laden with deep uncertainty (Lavery et al., 2023)[45]. As Bernstein et al. (2019)[12] find in their study, PE is highly cyclical. Thus, we can expect a decline in PE activity. Furthermore, a study of Brexit-related uncertainty by Kellard et al. (2022)[41] concluded that PE activity in the UK had a drop in activity when there were high levels of Brexit uncertainty. Wright et al. (2017)[70] found an overall decline in the market after the referendum. According to Wilson et al. (2012)[69] and Wilson et al. (2013)[68], PE firms have given the impression of resilience during recessionary periods such as financial crises regarding financial distress, productivity, profitability, and growth. Additionally, Ivashina and Kovner (2011)[40] attribute the resilience of PE firms in part to their robust relationships within the banking industry.

2.4 Propensity Score Matching and ATT

Propensity Score Matching (PSM) has been widely used in previous studies when comparing two distinct groups of companies. Alexandridis et al. (2017)[4] use PSM to study the acquisition performance of post-2009 deals compared to pre-2010 transactions. To capture the difference between the two company types, studies have used Average Treatment Effect on the Treated (ATT) to find the significance in means concerning the performance. Arvanitis and Stucki (2015)[6] use ATT to capture the effect of acquiring firms on the performance of small and medium-sized firms. Weche Geluebcke (2015)[66] uses PSM with ATT to capture the impact of foreign takeovers in Germany. Furthermore, according to Kundhi and Voia (2019)[44], using bootstrapping with average treatment effects reduces bias effectively in samples.

2.5 Prior studies on post-acquisition performance

Regarding timing the deals concerning the economy, Fich et al. (2018)[25] find no evidence of a difference in value creation regardless of the strength of the economy at the time of deal execution. it is easier to improve a company's performance with low margins and a low ROIC McKinsey and Company et al., (2020)[43].

Several studies have defined acquisition performance using accounting-based performance measures. In a study on the M&A performance of acquiring firms, Aggarwal and Garg (2022)[2] use the measures ROE, ROCE, ROA, D/E, current ratio, and liquid ratio to establish the obtained performance. NBIM (2015)[54]

defines quality using the financial ratios ROA, ROE, ROIC, and ROCE. A study of buyouts in Sweden by Bergström et al. (2007)[10] bases their performance measures on the financial ratios EBITDA margin, CAGR, and ROIC. Novy-Marx (2013)[55] defines profitability by using gross profit. to represent the other side of value.

Despite some earlier research stating that accounting information can be suspected of manipulation through changing accounting policies and earnings management, several researchers prefer using accounts since any benefits arising from acquisitions will ultimately appear in the accounting records. In their study, Alexandridis et al. (2017)[4] find that value creation in M&As is only documented for public acquisitions, not private ones. Concerning the acquirer's perspective, a UK study on short-term performance finds that only a third of the acquirers experienced wealth gains (Sudarsanam & Mahate*, 2003)[63]. This is consistent with another UK study (Holl, P., & Kyriazis, D., 1997)[36]. Several UK studies report negative returns to acquirers (Limmack, 1991[49]; Kennedy & Limmack, 1996[42]; Gregory, 1997[33]; Sudarsanam & Mahate, 2006[62]; Conn et al., 2005[**conn2005**]). On the other hand, some other UK studies find clear improvements in profitability (Wright et al., 1992)[**wright1992**] and significant improvements in efficiency up to four years after the buyout (Amess, 2003)[5].

2.6 Prior studies on total factor productivity

There have been numerous research studies on total factor productivity (TFP) over the past decade. Multiple studies (Barth et al., 2005[9]; Chiang & Lin, 2007[20]; Schoar, 2002[58]) finds that TFP is a key measure of production efficiency. TFP is a requirement for economic development and growth (Chen, 1997[19]; Hulten et al., 2001[38]; Solow, 1957[60];Wu, 2011[71])

A study conducted by Tian and Twite (2011)[64] found TFP to be a critical determinant of a firm's value. A UK study by Harris et al. (2005)[35] found that productivity gains after acquisitions had a significant increase. A study supporting this finds that TFP increases up to three years after the acquisition under PE ownership compared to industry benchmarks (Lichtenberg & Siegel, 1990[48]). A study with a more modest result finds that PE-acquired targets only outperform other companies 46% of the time concerning TFP growth (Cumming, 2012[21]). Research on the UK buyout market shows that TFP developments are typically even more pronounced during financial slowdowns (Wilson et al., 2012[69]).

Chang and Tang (2021)[18] implement a TFP regression when analyzing

how corporate cash holdings affect productivity. In their approach, the TFP is calculated as the residuals from a regression of the number of employees, COGS, and total assets on operating income, reflecting a Cobb Douglas. Variables such as ROA and leverage are consequently regressed on the residuals (TFP). The method of using the residuals from the Cobb-Douglas function aligns with Field and Mkrtchyan's (2017)[27] study on director experience in acquisition performance, where TFP is used as a measure of productivity.

2.7 Prior studies on return on assets

A study by Wilson et al. (2012)[69] finds a positive profitability differential of between 2,7% and 4,7% for PE firms compared to other company types. Their findings also support the fact that PE-acquired targets maintain profitability higher than non-acquired companies in recessionary periods. Aggarwal and Garg (2022)[2] found that ROA increased for 29% of firms in their sample three years after a merger, and 66% improved ROA five years after the merger.

Berzins et al. (2022)[13] implement a ROA regression to capture the effect family firms have on ROA compared to comparable non-family firms. The researchers of this study use age, size, risk, growth opportunities, asset liquidity, leverage, and capital intensity with year-fixed effects in the ROA regression to capture the family firm's significance on ROA.

2.8 Key findings

The literature review presents a number of key findings that serve as cornerstones for both the structure and interpretation of our models. These key findings provide an understanding of the relationship and interplay between private acquisitions, PE- and strategic acquirer's different strategies, Brexit, performance measures model, TFP model, and ROA model.

The unique and different strategies of PE- and strategic acquirers play a critical role in the performance of their acquired targets through the acquirer's business model, acquisition strategy, and channels for profit and growth (Barber, 2008[7]; Guo et al., 2011[34]; Holloway et al., 2016[37]; McKinsey and Company et al., 2020[43]). These differences will probably propagate into the performance measures, ROA regression, and TFP regression results by creating different trends in performance between targets acquired by PE and strategic firms. It will be interesting to determine the impact of acquirer type on performance, particularly in light of the

findings by McKinsey and Company et al. (2020)[43], which indicate that PE firms typically deliver superior performance. Moreover, Feldman (2016)[24] assert that private equity firms appear to have a competitive advantage over strategic acquirers. In addition, Acharya et al. (2013)[1] finds that PE firms generate a higher gross profit. Given these studies, we could anticipate superior performance from PE in our models.

According to Wilson et al. (2012)[69] and Wilson et al. (2013)[68], PE firms tend to have high resilience during recessionary periods, like Brexit and COVID. Therefore, we might expect this to be reflected in better performance in the targets of PE firms compared to the targets of strategic firms. However, Fich et al. (2012)[25] finds no evidence for difference in value creation regarding market timing, but does not specifically control for PE acquired firms, and Alexandridis et al. (2017)[4] proposed, in their study, no documentation of value creation for private acquisitions.

In spite of the fact that our models have the potential to add substantial value to the discussion surrounding acquisition performance, particularly during economically tumultuous times, the variation of findings introduces an element of unpredictability.

Regarding pre-acquisition performance, previous studies find that there is a higher probability of targets being acquired by a PE firm than a strategic firm if the target has strong performance measures (Gemson, 2021)[29]. Therefore, we would expect that the performance measures one year before the acquisition are initially stronger for the PE acquired firms in our sample.

TFP, which is a vital production efficiency indicator, is expected to increase post-acquisition and particularly under PE ownership, according to previous studies (Barth et al., 2005[9]; Cumming, 2012[21]; Harris et al., 2005[35]; Wilson et al., 2012[69]). We expect to observe such results in our TFP regression by looking at whether one of the target types has a significantly different TFP. Further, given Brexit and COVID's potential impact on productivity, our TFP results will be especially interesting.

While some studies indicate a positive profitability differential for PE firms (Wilson et al., 2012)[69], other present less definitive trends (Aggarwal & Garg, 2022)[2]. The performance measures in our model will highlight this profitability differential by looking at the significance of the performance measure improvements post-acquisition for both PE and strategic acquisitions. In addition, the ROA regression will highlight whether there is a significant difference between PE and strategically acquired firms from the pre-acquisition period to the post-acquisition

period.

In summary, these key findings establish a comprehensive context for our study, which shapes our expectations and highlights the nuanced dynamics of acquisitions in a difficult economic environment.

2.9 Methodological differences and similarities

Our research's methodology is based mainly on the methods of Berzins et al. (2022)[13], Alexandridis et al. (2017)[4], Aggarwal and Garg (2022)[2], Chang and Tang (2021)[18], and Wilson et al. (2012)[69]. These papers are chosen for our methodological framework because we need research papers covering each step in our methodology. By using these research papers, we establish a clear methodological framework to match acquired companies, create performance measures, and establish TFP and ROA regressions. Similar to the study by Alexandridis et al. (2017)[4] on deals before and after 2010, we use PSM to match acquired targets across the two groups of acquirers.

Berzins et al. (2022)[13] studied the difference in the return on assets of family-controlled firms versus non-family-controlled firms by applying a ROA regression to analyze the effect. In our approach, we use all the same variables in the regression, with the exception of the risk variable. The risk variable is calculated using three previous years of accounting figures, which we were unable to provide adequately for all acquisition years, namely acquisitions in 2013, 2014, and 2015.

We adopted the procedure for analyzing performance measures from the other research papers mentioned earlier (Aggarwal and Garg, 2022[2]; Bergström et al., 2007[10]; NBIM, 2015[54]; Novy-Marx, 2013[55]). Like Aggarwal and Garg (2022)[2], we establish performance sections that we define as profitability, growth, and insolvency. We include growth as a section and do not use efficiency as a separate section, following the procedure used by Aggarwal and Garg (2022)[2].

The two papers by Wilson et al. (2012)[69] and Chang and Tang (2021)[18] investigated TFP as a measure of productivity in their studies. The former researched the effect of the global recession after the 2008 financial crisis on PE-backed buyouts' productivity. The latter research studied how cash holdings, crises, financial constraints, and financial development affected TFP in companies globally. We implement the same method for calculating TFP while controlling for the same variables as Chang and Tang (2021)[18].

2.10 Knowledge gap

Current research in the field of private equity acquisitions is expansive, yet there are notable areas of insufficient understanding, which our investigation addresses. The first issue pertains to the lack of distinction made between PE and strategic acquired targets within the context of acquisition performance. This is particularly in relation to the acquired target's performance metrics, post-acquisition productivity (TFP), and where ROA is measured in conjunction with control variables in a regression. Our research comprehensively assesses these targets by employing methodologies derived from earlier studies.

The second area where current literature can be extended is in examining the performance of private acquisitions in the UK in the context of Brexit and COVID. While some studies have predicted the referendum's potential impact on acquisition activities within the country, a detailed evaluation or evidence of acquired company performance has not been sufficiently carried out, which our study aims to rectify.

By applying relevant previous research to our analysis, our study aims to fill these knowledge gaps. The results yielded will enhance our understanding of UK acquisition activity during 2012–2017 and shed light on acquisition performance during this period. Moreover, we hope that our study will shed light on the anticipated outcomes of various types of acquisitions.

3 Data

This section details the sample created by exploring possible acquisition databases and their limitations. The foundation for the database is considering information on acquisitions from the Orbis database, which is the most reliable source. The Orbis database has two portals that we merged concerning accounting and acquisition data. The different phases of the data collection procedure are summarized in Table 1.

3.1 Data collection

The Orbis database served as the primary data source for this study. Originally, our approach relied on Pitchbook, but we redirected our focus toward Orbis due to the recurring challenge of obtaining error-free financial statements and balance sheets. The integrated system within Orbis provided a more efficient method for identifying companies, thus streamlining our data-gathering process.

The initial data filtering concentrated on privately held British companies acquired between 2013 and 2017. This temporal boundary was established due to the lack of comprehensive data in the Orbis database preceding 2012 and proceeding into 2021. According to Lewis (2017)[47], the average holding time in years for PE companies has been between 5 and 6 for each of these acquisition years, This observation leads to our selection of using accounts up to 4 years after acquisition. Having filtered the preliminary dataset, we re-input the acquisition samples into the database, permitting the extraction of the correct accounts and additional data for subsequent analysis.

To ensure that our acquisition data sampling was thorough and accurate, we cross-referenced our dataset with Pitchbook and Preqin. However, it's important to note that due to the nature of private acquisitions and their associated data gaps, not every transaction could be incorporated into our dataset. Consequently, our data may be skewed toward businesses with accessible accounts. We use Python for the remaining parts of data administration and analysis.. We derived two distinct files from the initial data: one containing acquisition data and another containing accounts. These files were subsequently merged into one single dataset, which was then partitioned according to the year of acquisition. This classification approach was adopted to prevent the excessive exclusion of valuable accounting data and to aid in the ensuing process of pairing companies based on their respective years of acquisition.

At this stage, we eliminated companies with inadequate accounting data,

iterated the filtering process to ensure the targets were within the UK, and removed acquisitions representing minority stakes. Acquisitions where the acquirer already held ownership or where the ownership stake was undefined were also omitted. Next, we formulated new columns for the target NACE section based on the pre-existing 'Target NACE code' column. Then, we created new columns for each company containing all needed ratios and performance metrics. This established the necessary variables for subsequent analysis while simplifying the task of data cleaning.

The distrubution of acquistions by industry, year and acquiror type is shown in Table 2 and Table 3. We observe that the manufacturing industry has been the industry with the most acquisitions in our data. In addition, we observe that the year 2014 had the most acquisitions for both acquirers.

The resulting database provided a valuable resource for studying private company acquisitions during the period of interest and allowed us to analyze the data rigorously and systematically.

Table 1: Data collection and Filtering Process

Procedure	**All Deals**	
	Effect	*Sample size*
M&A Portal		7615
Sum		
Adjustments		
Removed all deals without completed date	-694	
		6921
Removed all target names with PLC	-254	
		6667
Removed all targets being either listed or delisted	-51	
		6616
Removed all targets missing both orbis id or bvd id	-19	
		6597
Sum M&A Portal with adjustments		6597
Company portal		
Left after batch search in Orbis	-2311	4286
Sum batch search		4286
Further adjustments		
Companies containing relevant data for matching	-3136	
		1150
Final stake equal to acquired stake, majority and know final stake	-187	
		963
Removed management buyouts and removed financial which is not PE	-206	
		757
Removed companies within matching criteria under PE	-340	
Final sample		417
Financial acquirer		134
Strategic acquirer		283

3.2 Merging and cleaning data

The final dataset had extreme observations in accounting values that yielded high kurtosis, which presented a challenge. Trimming the dataset by generating a winsorized distribution is suggested by Tukey (1962)[65]. This is also consistent with a new study on value creation where the top and bottom 1% of accounting ratios are winsorized (Alexandridis et al., 2017)[4]. Winsorizing means that the values of data points outside a predefined quantile are assigned to that quantile. We implemented a conservative winsorization of 1% (Leone et al. 2014)[46].

Identifying and rectifying anomalies was done after the company matching process, as this stage intrinsically led to eliminating numerous outliers. We implemented an outlier test predicated on Z-values. For this test, we employed a substantial threshold of three standard deviations, with the examination rooted in company ratios. The logic behind this approach is to anticipate a degree of normalization across the sample when using ratios. Upon identifying outliers, each was assessed in detail, comparing the outlier value with the company's data from other years. This step was essential in detecting typing errors or other data entry inaccuracies that could skew the analysis. We were able to identify and eradicate four such instances through this procedure. This relatively low count of errors underscores high data integrity within our selected company sample.

In the ensuing phase, we differentiated between financial and strategic companies based on the detailed descriptions provided in the Orbis database. We isolated companies identified as "private equity" in the "Acquirer primary business" column to discern private equity acquirers. In addition, we elected to exclude "management buyouts" from our sample, as a significant proportion of these transactions couldn't be classified as strategic acquisitions under our definitional framework. To further mitigate bias, we removed acquisitions where: 1. the acquirer wasn't identified as a PE company but; 2. The deal was financed by PE funds.

To compensate for the potential omission of PE acquisitions during the initial filtering process, we identified and incorporated any remaining "leveraged buyouts" into the PE group. We examined each added PE acquirer to confirm that they conformed to the established criteria of a PE company. This resulted in 134 PE companies and 283 strategic companies after matching. Out of the 417 acquired companies left in the sample, 15 have been dissolved, and 8 have become liquidated. Thus the remaining, defined as active companies, amount to 394 companies, whereas 4 are currently dormant and 3 are in insolvency proceedings.

Table 2: PE and strategic activity by acquisition year and sector

Acquisition year and sector overview after matching with PSM. The NACE section variable identifies all NACE section present in final dataset. The year variables identifies the number of companies within the corresponding NACE section.

Stategic and Financial Targets						
NACE Section	***Total***	***2013***	***2014***	***2015***	***2016***	***2017***
Manufacturing	**157**	36	53	25	34	9
Electricity, Gas, Steam and Air Conditioning Supply	**2**				2	
Water Supply; Sewerage, Waste Management and Remediatio	**2**			2		
Construction	**6**	1			2	3
Wholesale and Retail Trade; Repair of Motor Vehicles and Mc	**46**	8	11	13	10	4
Transportation and Storage	**14**	6	5		3	
Accommodation and Food Service Activities	**12**	3		3	4	2
Information and Communication	**54**	12	18	4	13	7
Financial and Insurance Activities	**30**	10	8	2	6	4
Professional, Scientific and Technical Activities	**42**	6	11	7	16	2
Administrative and Support Service Activities	**33**	7	10	2	12	2
Human Health and Social Work Activities	**9**	3	4	2		
Arts, Entertainment and Recreation	**8**	4			2	2
Other Service Activities	**2**			2		
Total	***417***	***96***	***120***	***62***	***104***	***35***

Table 3: Acquisition activity by acqusition year and acquirer type

Overview of type of acquirer by investment year after matching with PSM. The table coincides with the economic period 2011-2021.

Type of acquiror by investemnt year						
Type	***Total***	***2013***	***2014***	***2015***	***2016***	***2017***
PE	134	28	36	21	34	15
Startegic	283	70	86	38	72	17
Total	***417***	***98***	***122***	***59***	***106***	***32***

3.3 Strengths and weaknesses of the sample

The final sample has potential weaknesses that can impact the conclusions' validity. Firstly, selection bias can occur if the sample of firms being compared does not represent the general population. In addition, buyouts are expected not to follow a normal distribution in the population. These omitted observations may result in an overestimation of the true effect of PE ownership. Small companies do not file P&L and balance sheets to Company House; hence, smaller transactions may be omitted from the dataset, leading to an incomplete representation of the full range of transactions in the market and an overemphasis on the impact of larger transactions. This selection bias is to some extent controlled by using propensity score matching (Bryson et al., 2002)[15]. In addition, we might expect survivorship biases as the targets that went bankrupt during the period might not be included. Moreover, industry bias can occur due to a general partner's industry specialists, and some industries may be more vulnerable to PE investments than others (Cumming, 2012)[21].

The distribution of PE investments is skewed towards established and traditional industries, such as chemical, industrial, electrical, textile, pulp & paper, and machinery & equipment sectors (Bernstein et al., 2013)[11]. This is controlled by using industry-fixed effects. Additionally, time bias can occur since PE transactions can come in waves, and different phases of competitive pressure between bidders and acquirers have been identified (Martos-Vila, 2011)[50]. This is controlled by using year-fixed effects. Firms are bought at different times of the year. This affects to what degree the acquirers have managed to start the process of acquiring the acquired companies, which can lead to some bias in the accounting in the acquisition year.

Because our economic period coincides with Brexit complications, we can expect "Brexit bias" in reduced capital, fewer acquisitions, and more outward acquisitions. Bernstein et al. (2019)[12] find that PE is highly cyclical, thus, we can expect a decline in PE activity. Furthermore, Kellard et al. (2022)[41] concluded that PE activity in the UK had a drop when there were high levels of Brexit uncertainty. In addition, as some of the accounting years coincide with COVID, we would also expect a COVID bias in our results. Furthermore, other microeconomic or macroeconomic factors may have influenced private acquisitions upward or downward during our economic period.

Missing accounting data in some years makes a direct comparison of pre-

and post-acquisition for each individual firm not feasible. Finally, the database does not contain information on stepwise investments in the target firm, making it difficult to distinguish the degree of influence the acquirers have on the target. Only including new investments and selecting acquisitions where the acquired majority stake is equal to the final stake (total holdings) mitigates this.

We also observe another potential bias in our dataset. Typically, PE firms acquire targets using leverage through an SPV, where the target is used as collateral for the borrowed money. However, the target often does not assume this debt; instead, the target and the SPV have specific agreements for servicing it. Hence, the estimation of leverage and debt may be underrepresented in the data. There may be instances in our data sample where the acquirer isn't a private equity firm but the acquisition is financed with private equity funding. This will reveal the issue of whether the PE firm has any influence over the acquired company and whether the acquirer is PE or a strategic firm. Therefore, we removed companies where this was established from the dataset.

4 Methodology

4.1 Propensity Score Matching

General partners often specialize in specific industries, which means that certain sectors may see more Private Equity (PE) activity than others (Cumming, 2012)[21]. This suggests that the selection process for PE firms is not entirely random. In addition, the timing of PE investments frequently coincides with market cycles, introducing an additional non-random element. As a consequence, companies targeted for acquisition may differ systematically from those that are not, leading to the possibility of sample selection bias if portfolio companies are compared to a random group of companies. However, this selection problem can be addressed through the use of matching, which allows us to create a well-suited control group that takes into account market timing and individual industry and firm characteristics (Rosenbaum & Rubin, 1983)[56].

Using propensity scoring is effective for matching in this context. Based on its observed characteristics, it involves calculating the likelihood that a company will participate in a program or, in this case, that a strategic firm will acquire a PE-acquired company. This method helps us define the probability of a company being targeted for a PE acquisition, thus enabling a more balanced comparison.

Propensity Score Matching (PSM) is primarily founded on two fundamental assumptions. The first is the assumption of ignorability, which posits that the assignment of treatment is independent of the potential outcomes given the covariates. The second assumption is that the probability of receiving treatment is positive for all covariates (Rosenbaum & Rubin, 1983)[56]. In instances where an assumption of overlap exists, this can be avoided by limiting matched samples to a common support region.

Given the potential limitations of PSM, it's crucial to carefully manage the matching process. This can be achieved through a four-step procedure: 1. defining closeness; 2. implementing the matching method; 3. evaluating the quality of samples; and 4. analyzing the outcome and estimating treatment effects.

The first step involves deciding on which variables to include when to observe the variables, and the choice of distance measure. Along with the third step, which involves evaluating the caliber of the model-specified control group, comes the subsequent step of choosing the matching method. The final stage, involving analysis of the result and estimation of treatment effects, is elaborated upon in a separate chapter

4.1.1 Closeness

For the assumption of strong ignorability to hold, it is crucial to include all variables that are related to both the treatment and the outcome. In our study, we selected the NACE section, year of investment, turnover, EBITDA, log of total assets, log-age, number of employees, and long-term debt to total assets for matching purposes. Some variables, such as revenue CAGR and cash, were excluded due to incomplete data sets. To avoid a significant decrease in the matched sample and a possible loss of validity in our results, we chose to omit these variables. Nonetheless, we used revenue CAGR in the analysis section for robustness checks. Therefore, we believe that the variables we used provide a reasonable justification for the assumption of strong ignorability. We use accounts from the year prior to investment for covariates. To ensure that the treatment won't have an impact on any variables, matching is best done prior to the treatment (Caliendo & Kopeinig, 2008)[16].

In terms of the matching methods, we used exact and linear propensity scores as distance measures (Stuart, 2010)[61]. Exact matching requires a control company to have the same covariate value as the treatment. Given that economic conditions can vary dramatically from year to year, we applied exact time matching. We also applied exact matching to the NACE section, considering the significant differences that could exist between industry groups. Once we narrowed down the sample of potential comparison companies using exact matching, we then used linear propensity score matching for the rest of the covariates as a distance measure. This approach condenses the score for all these covariates into a probability measure of being acquired by a PE firm, and strategically acquired companies with the highest probability are selected.

4.1.2 Implementing matching technique

Various matching techniques are available when applying Propensity Score Matching (PSM), each with its own impact on the size of the matched sample and the weight assigned to each observation (J. A. Smith & Todd, 2005)[59]. Many experts, including Rosenbaum & Rubin (1983)[56], suggest that nearest-neighbor matching is the easiest to use and interpret. For this reason, we've chosen this approach for our study, noting that more complex techniques might introduce an extra risk of bias to the model.

Smith and Todd (2005)[59] also note that choosing the number of firms for the control group involves a trade-off between bias and model variance. Including more companies will lower variance but increase bias due to the inclusion of less

similar companies. To mitigate the risk of matching too many control firms to each treatment firm, we start with a large number of firms matched and reiterate until we have a satisfactory variance. This approach should help us decrease variance without introducing significant bias.

We've also assumed common support, meaning that there's a positive chance that the sample companies will appear in both the treated and untreated groups. It is possible, however, that this is not always the case. So, we've restricted the propensity matching to only include companies within a common support region with a propensity score sufficiently similar to the treated score. Moreover, we've implemented matching with replacement to improve the quality of samples (Caliendo & Kopeinig, 2008)[16].

4.1.3 Matching quality

There are numerous ways to assess the quality of a matched sample. We use a two-sample t-test to see if there are any significant differences between the average covariates of the two groups, following Rubin's method (2001)[57]. Ideally, the difference between the two groups' means of the propensity score should be minimal and the variance ratio should approximate one.

In the Appendix, Table 8 shows the results of the quality matching. Stuart (2010)[61] suggests that the choosing of the PSM method has less of an impact as the sample size increases. Considering this, we matched the largest number of strategically acquired companies per PE acquired company, achieving 283 strategically acquired firms matched on 134 PE acquired firms while maintaining a satisfactory score.

4.2 Post-acquisition performance

To measure the performance of the target companies, the performance is based on the sections of profitability, growth, and insolvency, in accordance with previous studies (Aggarwal & Garg, 2022)[2]. Accordingly, we focus on specific performance measures within each section. After the acquisition, the target's profitability and efficiency position in the coming years is essential in establishing whether the acquisition has succeeded. In terms of liquidity, this can be seen as a more critical factor for the acquirer than the target. Still, the target's liquidity position can give indices of profitability and efficiency. The same goes for solvency, which changes immediately after the acquisition. Therefore, all three sections are important to measure success in acquiring targets.

To measure each section, we use the same measures as previous studies (Aggarwal & Garg, 2022[2]; NBIM, 2015[54]; Bergström et al., 2007[10]). This results in the following performance measures: gross profit margin, ROCE, ROIC, ROA, EBIT to assets, EBITDA margin, net profit margin, CAGR, long-term debt to assets, revenue to assets, current ratio, current assets to assets, and current liabilities to assets. According to Novy-Marx (2013)[55], gross profit is the purest accounting measure of actual economic profitability because it is largely unaffected by accounting estimates for accruals and noncash expenses such as depreciation and amortization. Implementing these measures in the analysis yields results that can be directly connected to the actual performance of the targets since these measures omit gearing effects.

In alignment with previous research efforts (Arvanitis & Stucki, 2015[6]; Kundhi & Voia, 2019[44]; Weche Geluebcke, 2015[66]), we adopt the methodology of Average Treatment Effect on the Treated (ATT) in conjunction with a bootstrapping technique to establish the significance of mean disparities between PE-acquired firms and strategically acquired firms. This method is especially useful when dealing with small sample sizes or when fewer assumptions about the shape of the population distribution are desired. For each specified metric within each period, the change from the preceding period is individually computed for both PE-acquired firms and strategically acquired firms. Then the ATT is calculated, which is the difference between the average change in the treated group (PE-acquired firms) and the control group (strategically acquired firms), respectively.

Following this, we perform bootstrapping, which is a resampling technique used to estimate statistics on a population by sampling a dataset with replacement. This technique is particularly beneficial when dealing with small sample sizes or if you want to make fewer assumptions about the shape of the population distribution.

The standard error of the ATT is subsequently determined, and calculated as the standard deviation of the bootstrap ATTs. From this derived standard error, we compute the z-score, which provides an indication of how many standard deviations the ATT deviates from the mean. Finally, we derive the p-value from the calculated z-score. A distribution of the ATT estimator is generated through bootstrap resampling of variations in the treated and control groups.

To measure whether PE and strategic owners buy companies based on different characteristics, we perform a Mann-Whitney U test on the variables in the year prior to the investment. This is a non-parametric statistical test used for assessing two independent groups based on a continuous or ordinal dependent variable.

It's often used as an alternative to the independent t-test when the assumption of normality is violated (McKnight & Najab, 2010)[51].

4.3 Total factor productivity regression

In alignment with methodologies proposed in earlier research, we evaluate Total Factor Productivity (TFP), focusing particularly on the improvement in the target company's productivity. We use the one-step augmented Cobb-Douglas production function as our main analytical tool, which has received support from studies like those by Harris et al. (2005)[35] and Wilson et al. (2012)[69]. In addition, we combine the approaches of Wilson et al. (2012)[69] and Chang and Tang (2021)[18] to define the parameters and implement procedures. Both the initial investment and subsequent performance are evaluated using this methodology when comparing PE-owned companies to their corresponding control companies. The general Cobb Douglas production function can be described as follows:

$$Q_{it} = L_{it}^{\alpha} * K_{it}^{\beta} \tag{1}$$

Qit is defined as the output for target i at time t, defined as turnover. *Kit* is denoted as the capital base input for each target in the sample, defined as fixed assets, while *Lit* is denoted as each target's labor input through the number of employees. We can rearrange the production function (1) by including control variables and taking its natural logarithm.

$$\begin{aligned} q_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + \beta_3 \ln(COGS)_{it} + \beta_4 \ln(Age)_{it} \\ + \sum_{l=1}^{21} \theta_l \text{section}_{it} + \sum_{l=1}^{9} \theta_l \text{Year}_{it} + u_{it} \end{aligned} \tag{2}$$

To control for potential differences in competition within industries, we use the control variable *Section* for each industry section. To establish each section, we first use the first two-digit NACE code for industry, which results in 21 different sections. The *Year* control variable contains each accounting year. *LnAge* is another control variable and is defined as the natural logarithm of the company's age at the acquisition date, computed as the acquisition date minus the date of incorporation.

According to Field & Mkrtchyan (2017)[27], the TPF of a firm is calculated as the residuals from a regression of sales on assets, employees, and materials, having both industry and year-fixed effects. The cost of goods sold is used as a proxy for materials. Applying this, we can run the regression equation (2) and obtain its residuals, which we call *TFPit* (3).

$$TFP_{it} = q_{it} - \hat{q}_{it} \tag{3}$$

Subsequently, we regress the variables proposed by Chang and Tang (2021)[18] on TFP, including a PE dummy variable, obtaining the regression below (4).

$$\begin{aligned} TFP_{it} = \beta_0 &+ \beta_1 PE_{it} + \beta_2 \ln(Assets)_{it} + \beta_3 LIQ_{it} + \beta_4 LEV_{it} \\ &+ \beta_5 ROA_{it} + \beta_6 \ln(Age)_{it} \\ &+ \sum_{l=1}^{21} \theta_l \text{section}_{it} + \sum_{l=1}^{9} \theta_l \text{Year}_{it} + u_{it} \end{aligned} \tag{4}$$

The dummy variable *PE* is established to distinguish the acquirers. The variable assumes a value of one when the target firm is acquired by a private equity firm and zero when the acquisition is conducted by a strategic firm. The control variables are calculated for each target firm: *LIQ* is liquidity defined as cash and cash equivalents divided by total assets; *LnAssets* is used as a variable for firm size and is defined as the natural logarithm of total assets; *LEV* is the debt ratio, which is defined as total debt divided by total assets; and *ROA* is Return on Assets defined as the net profit after tax divided by total assets. Lastly, we control for the industry (*Section*) and time-fixed (*Year*) effects.

4.4 Return on assets regression

In addition to measuring ROA separately, we want to explore which variables affect the target's ROA. We use previous research for the regression procedure. We implemented the method of regression based on the study by Berzins et al. (2022)[13]. The regression function can be described as follows:

$$\begin{aligned} ROA_{it} = \beta_0 &+ \beta_1 PE_{it} \\ &+ \beta_2 \ln(Age)_{it} + \beta_3 Size_{it} + \beta_4 \text{Growth Opportunities}_{it} \\ &+ \beta_5 \text{Asset Liquidity}_{it} + \beta_6 \text{Leverage}_{it} + \beta_7 \text{Capital Intensity}_{it} \\ &+ \sum_{l=1}^{21} \theta_l \text{section}_{it} + \sum_{l=1}^{9} \theta_l \text{Year}_{it} + u_{it} \end{aligned} \tag{1}$$

PE is a dummy that assumes the value one if the target's acquirer is a private equity firm, and zero if it is a strategic acquirer. *LnAge* is the log of the target's age in years, which is calculated by subtracting the acquisition year from the target's incorporation year. *Size* is denoted as the log of inflation-adjusted revenue. Logically, firms with higher revenue-to-asset ratios should have less slack and a higher probability of expanding their future asset base. This ratio is incorporated into *Growth Opportunities*. *Asset liquidity* is the ratio of cash holdings to total assets of the target firm, while *Leverage* is debt less cash to total assets less cash. The

last variable, *Capital Intensity*, is calculated as the log of assets per employee. This variable controls for possible measurement errors in ROA, which can come from unusually small physical assets and large intangible assets. Lastly, we control for the industry (*Section*) and time-fixed (*Year*) effects.

4.5 Robustness of the results

We perform additional robustness checks for the TFP and ROA regressions. We expect there may be heteroskedasticity in our model due to three factors. Firstly, as there are differences in firm sizes within each acquirer group, we may predict differences in the error term variances, as larger firms may have more variability in their performance than smaller firms. Secondly, financially acquired firms may focus more on short-term gains than long-term growth compared to strategically acquired firms, which would create differences in the variances of the error term. Thirdly, discrepancies in industry or market conditions may also contribute to the error term variances. This is somewhat controlled by including time and industry-fixed effects.

Using White's test, we regress the squared residuals in the regression model on the independent variables. Our null hypothesis is that the error term has homoskedasticity, while the alternative hypothesis is that the error term has heteroskedasticity. The test statistic is calculated as n*R-squared from the regression of the squared residuals on the independent variables. n is the sample size, and R-squared is the regression's coefficient of determination.. We estimate the regression using ordinary least squares (OLS) and obtain the squared residuals regressed on the independent variables. Finally, the test statistic is calculated and compared to the critical values of the chi-squared distribution to conclude whether the null is rejected. To address the issue of heteroscedastic residuals, we utilize the HC3 standard error type, as recommended for smaller sample sizes by David Cribari-Neto.

Prior research underscores the necessity of accurately adjusting for potential bias, as observed in PE-related studies that have employed random effects models (Wilson et al., 2012)[69]. If consistent, random effects models are favored owing to their superior efficiency compared to fixed effects models, and vice versa. We use the Durbin-Wu-Hausman test in accordance with the Greene (2012)[32] methodology to assess the consistency of the estimators.

5 Results

In this study, we measure the consequences of Private Equity (PE) and strategic ownership by analyzing the differences in the average performance of PE-acquired and strategically acquired firms after acquisition. The study covers acquisitions in the UK taking place during the time period of 2013 until and including 2017, and our performance evaluation takes into account company performance both 1 year prior to each acquisition and 4 years after, thus covering the accounting period of 2012 to 2021.

In the sections that follow, we present our findings regarding the post-acquisition performance measures, the Total Factor Productivity (TFP) regression, and the Return On Asset (ROA) regression, respectively. To measure the consequence of the type of acquirer on the subsequent target performance, we analyze the differences in development between average performance for financially acquired and strategically acquired targets when using a solid data foundation of these taken from the Orbis database. In addition, we evaluate what type of companies tends to be acquired by PE and strategic respectively based on the pre-acquisition performance state of the acquired targets. The economic period of 2012-2021 coincides with significant political and economic events in the UK, such as the Brexit referendum in 2016 and COVID. These are events that potentially have implications for our analyses. Our analyses of the outcomes are supported by statistical and economic data.

5.1 Post-acquisition performance

Using the Average Treatment Effect on the Treated (ATT), we assess the significance of the average change difference in performance measures over individual years for firms acquired by PE and strategic acquirers. Table 4 below presents performance measure results. The ATT is calculated as the difference in the average year-over-year change of each performance metric for firms acquired by PE versus those acquired by strategic acquisition.

The performance measures Gross profit, ROCE, ROIC, ROA, EBITDA/assets, EBITDA-margin, and Net Profit margin are measures of different aspects of a firm's performance, which are influenced by the acquirer's strategies. Thus, the different strategies characterized by the acquirer types will expectedly propagate into the performance measure trends. PE companies often aim to improve the profitability of their acquired targets before selling them, and strategic companies typically acquire

targets to integrate them into their own existing operations.

Table 4: Comparison of Private Equity and Startegic Target's Performance - Average

Matched on period T=-1. Changes in mean performance values from 1 year before acquisition (T=-1). The numbers, ranging from -1 to 4, represents the periods before and after the acquisiton, where period 0 is the acquisition year. Variables are defined in detail in TABLE 7 in the appendix. Part 1. reports changes in measures of profitability. Part 2. reports changes of growth. Part 3. measures of the groups' solvency, using current ratio, current assets ratio and current liabilities ratio are also included to highlight which affect current ratio the most. Δ is the change in the average from the previous period. ATT is the Average is the Average Treatment effect on the Treated, which is the difference between PE targets and Strategic targets average changes from T=-1. Significance in period -1 is derived from a U-mann test. Significance is reported based on the null hypothesis of no difference between PE targets and Strategic targets. Significance levels of 1%, 5% and 10% are denoted as ***, **, and * respectively. Significance is also highlighted in bold text.

	-1		**0**		**1**				**2**				**3**				**4**			
Profitability	**PE Avg**	**Strat Avg**	**ΔPE**	**ΔStrat**	**ΔPE**	**ΔStrat**	**ATT**		**SE**	**ΔPE**	**ΔStrat**	**ATT**	**SE**	**ΔPE**	**ΔStrat**	**ATT**	**SE**	**ΔPE**	**ΔStrat**	**ATT**	**SE**
Gross Profit Margin	0.37	0.37	0.00	0.00	-0.006	0.001	-0.003		0.01	0.01	-0.01	**0.016** *	0.01	0.00	0.00	0.005	0.01	-0.01	0.00	-0.004	0.01
ROCE	0.16	0.11	-0.01	0.01	-0.035	-0.009	-0.012		0.05	-0.06	-0.01	-0.053	0.04	0.03	-0.05	**0.065** *	0.04	0.04	0.04	-0.004	0.04
ROIC	0.18	**0.13** **	-0.02	-0.04	-0.047	0.019	**-0.066**	**	0.03	-0.02	-0.03	0.015	0.03	-0.01	-0.02	0.001	0.02	-0.02	0.00	-0.015	0.02
ROA	0.10	**0.07** **	0.00	-0.01	-0.041	0.011	**-0.052**	***	0.02	-0.01	-0.02	0.012	0.02	0.00	-0.01	0.013	0.02	0.00	0.00	0.004	0.02
EBIT / Assets	0.14	**0.10** **	-0.02	-0.03	-0.037	0.010	**-0.047**	**	0.02	-0.02	-0.02	0.008	0.02	0.00	-0.02	0.013	0.02	-0.01	-0.01	0.000	0.02
EBITDA margin	0.13	**0.10** **	-0.01	-0.03	-0.028	0.017	**-0.045**	***	0.02	-0.01	0.00	-0.013	0.01	0.00	-0.01	0.011	0.01	-0.01	0.00	0.001	0.01
Net Profit Margin	0.08	**0.05** **	0.01	-0.01	-0.032	0.017	**-0.049**	***	0.02	-0.01	-0.01	-0.005	0.01	0.01	-0.02	0.021	0.02	-0.01	0.00	0.001	0.02
Growth																					
CAGR			0.06	0.03	0.10	0.06	0.012		0.04	0.09	0.06	-0.014	0.02	0.06	0.04	-0.008	0.02	0.07	0.03	0.018	0.01
Long-term Debt / Assets	0.15	0.14	-0.03	-0.01	-0.02	-0.01	-0.008		0.03	-0.01	0.00	-0.006	0.02	0.02	0.00	0.012	0.02	-0.02	0.00	-0.012	0.01
Revenue / Assets	1.81	1.90	-0.14	0.02	-0.06	0.01	-0.070		0.09	-0.06	-0.20	0.064	0.06	-0.19	-0.04	-0.069	0.06	0.00	0.02	-0.008	0.07
Solvency																					
Current Ratio	2.23	**1.91** **	-0.03	0.14	-0.11	0.25	**-0.195**	**	0.10	-0.10	0.07	-0.166	0.10	0.10	-0.08	**0.164** *	0.09	-0.04	0.08	-0.096	0.14
Current Assets / Assets	0.76	0.74	0.00	0.02	-0.02	0.02	**-0.018**	*	0.01	-0.01	-0.01	0.000	0.01	0.01	0.00	**0.020** **	0.01	0.02	0.01	0.007	0.01
Current Liabilities / Assets	0.52	0.52	-0.02	0.02	-0.01	0.03	-0.003		0.04	0.00	0.00	0.004	0.02	-0.02	0.03	**-0.040***	0.03	0.05	0.04	-0.005	0.03

Our study observes inferior performance across most metrics, with the exception of Gross Profit and Return on Capital Employed (ROCE), for PE acquired firms one-year post-acquisition as compared to strategic acquired firms. As shown in Table 4, these findings are significant at a 5% level or higher. The corresponding ATT for these measures is economically significant, shown by an initial dip in the performance measures ROIC (-0.066), ROA (-0.052), EBIT/Assets (-0.047), and EBITDA margin (-0.045). Despite this dip, the periods 2, 3, and 4 show no clear evidence that the decrease in performance measures is contained in the long-term.

This observed dip could be attributed to the contrasting strategies and management practices employed by PE and strategic acquirers. PE firms frequently employ a leveraged buyout (LBO) strategy, wherein a significant portion of the acquisition price is financed via debt, which the acquired firm is then tasked with repaying. This strategy can have a significant impact on the firm's financial performance metrics in the short term. The ratios of current liabilities to assets and long-term debt to assets are insignificant, so we do not observe evidence of elevated leverage nor a relative increase in financial burden in the first year following the acquisition, see Table 4. This suggests that private equity firms may opt for other relatively aggressive early-stage modifications to the acquired company in order to increase its long-term profitability

While we find no statistical difference in the gross profit margins between the target types in the first year after acquisition, this doesn't rule out possible differences between the target types elsewhere in the income statement. A typical PE investment strategy often involves significant initial restructuring costs, strategic changes, and one-off expenses, which can temporarily reduce profitability. These expenses, while not limited to, can encompass severance payments, asset write-offs, costs associated with business integration, staff retraining, technology investments, and capital expenditures. Such factors can negatively impact EBIT and net income, leading to a subsequent adverse effect on profitability ratios like ROA and ROCE. These expectations aligns with presented observations established from our data in Table 4. Thus, it's likely that these PE-specific strategies are contributing to the observed early stage performance measures dips for their targets compared to strategic targets. While these explanations align with the observed data, it's crucial to consider that there may be other factors not included in our analysis that could explain these performance differences.

Our study finds a substantial initial decrease in the current ratio for firms acquired by private equity in the first year, with an ATT coefficient of -0.195 at a 5%

significance level. This reduction, possibly linked to enhanced operational efficiency, is supported by a concurrent decrease in the current assets to assets ratio (-0.018), which is significant at the 10% level. The reduction in the current assets to total assets may be part of the PE acquirer's strategy for short-term financial optimization. Despite the dip in some performance measures during the early restructuring phase in year one, these findings suggest that PE-acquired firms may be successfully managing their current assets, thereby improving financial efficiency. Moreover, the optimization can be the result of a more streamlined firm that may be better positioned to achieve increased long-term operational performance.

By year three, this trend reverses. At the 10% significance level, the current ratio of PE-acquired firms exhibits a significant improvement with a significant ATT coefficient of 0.164. Concurrently, the ATT for the current assets ratio exhibits a rising trend where the ATT coefficient of 0.02 is significant at the 5% level. In contrast, the current liabilities component exhibits a markedly declining trend (-0.04) at the 10% significance level. Our analysis reveals that, in year three, changes in current liabilities have twice the economic impact on the current ratio compared to changes in current assets, highlighting its strong influence on the current ratio's development. This suggests that PE-acquired firms are efficient in decreasing liabilities and enhancing assets compared to strategically-acquired firms.

Across the four post-acquisition years, PE-acquired firms generally decrease their current ratio, while strategically acquired targets exhibit a rising trend. There are however no significant differences in ATT development between the two groups by the fourth year. This pattern implies that despite different short-term strategies, there's no substantive evidence to suggest a significant long-term difference in the impact on the current ratio between PE and strategically acquired firms.

The gross profit margin measure is statistically significant only two years into post-acquisition, with a 10% significance level favoring PE-acquired firms with a 1.6% higher gross profit margin on average. This isolated increase precludes a definitive conclusion regarding a long-term upward trend in private equity acquisitions. The rise could be attributed to operational improvements stemming from the leaner, more financially efficient structure established in the first year. Consequently, the initial profitability dip seems to support an advantageous development for gross profit in the second post-acquisition year for PE-acquired targets. Three years into post-acquisition, ROCE displays a 10% significance level in ATT, suggesting restructuring efforts might be leading to more efficient capital utilization in PE-acquired targets. The ATT for ROCE is also economically significant, showing a 6.5% higher ROCE for

PE-acquired firms than strategically acquired firms. By the fourth year, the absence of significant ATT coefficients indicates that we cannot definitively differentiate between the performance of PE-acquired and strategically acquired firms in the longer term.

Pre acquisition, the difference in performance metrics (ROIC, ROA, EBIT/Assets, EBITDA margin, and net profit margin) was statistically significant at the 5% level, indicating that PE typically acquire companies with strong initial performance in order to improve them further. The initial performance of PE-acquired targets is, on average, more than 35% higher than that of the previously mentioned measures. Notably, PE targets have 60% higher net profit margin averages. Additionally, PE firms purchase targets with a current ratio that is about 35% higher than that of strategic firms, which is a significant difference at the 5% level. Fidrmuc et al. (2012)[26] and Gemson (2021)[29] both reported findings that are consistent with these observations.

Looking solely at the average changes for PE and strategic acquired targets, both target types show their lowest values in the fourth year for all profitability measures except ROCE. This could suggest a general decline in performance over time for both acquisition types, potentially influenced by external factors such as Brexit and COVID. However, verifying this connection would necessitate further research. Interestingly, both PE and strategic acquisitions have a notably higher ROCE in year 4. Despite other profitability measures being at their lowest, acquired targets may be enhancing their capital utilization efficiency. But given the insignificant ATT, these interpretation should be taken with caution due to the lack of robust statistical support.

5.2 Total factor productivity

The objective of the Total Factor Productivity (TFP) regression is to analyze productivity trends and show whether there is a significant difference between PE acquired targets and strategically acquired targets in terms of productivity throughout the period. This is done by examining whether one of the two types of acquired firms has a significant relationship to the residuals of the modified Cobb-Douglas function, reported in Table 9 in the appendix. Table 5 displays the TFP regression results for the pre-acquisition period (t-1) and the post- acquisition period (t+1 to t+4), as well as the DiD regressions for all years and years 0 to 1.

Our findings may provide valuable insight for potential acquirers in their target selection process and highlight the benefits of leverage, liquidity, and ROA and the disadvantages of age on an acquired company's productivity. The uncertainty and economic effects concerning Brexit and COVID may have influenced the results. Future research might investigate Brexit or COVID's specific impact on the findings.

Table 5: Comparison of Private Equity and Strategic Target's Total Factor Productivty - Regression

Total Factor Productivity for PE targets compared to Strategic targets, matched at 1 year before acquisition. The regression is estimated using year and industry fixed effects. "Total Assets" is the log of the target's adjusted revenue, "Liquidity" is the ratio of cash to assets, "Leverage" is the ratio of liabilities less cash to total assets less cash, "ROA" is the return onn assets, and "Age" is the log of date of acquisition minus date of target's incorporation of the targets. PE is the dummy variable that measures the TFP difference between PE targets and Strategic targets. Output for pre-acquisition are measured using T=-1 and T=0, while post-acquisition are measured using T=1 to T=4. All Years (T=-1 to T=4) is a DiD regression which are measured as the total difference within the respective periods. Period 0 to 1 is another DiD regression which are measures as the difference between year 0 and year 1. The standard error of each variable is listed to the right of their respective value. Significance levels of 1%, 5% and 10% are denoted as ***, **, and * respectively. We implemented a Durbin-Wu-Hausman's chi-squared test to establish the consistency and efficiency of the coefficients in the model, and a White's test to indicate the presence of heteroskedasticity in the model residuals. We found correlation between the effects and the regressors, as well as heteroskedasticity in the residuals. Hence, we determined to use robust standard errors type HC3, and a fixed effects model.

Regression on TFP	**PRE ACQUISITION**		**POST ACQUISITION**		**ALL YEARS**		**PERIOD 0 TO 1**	
Independent Variables	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**	**Coefficient**	**SE**
PE	**-0.02**	**0.04**	**-0.04**	**0.02**	**-0.01**	0.05	**-0.06**	0.05
PE * Post					**-0.03**	0.05	**0.06**	0.08
Post					**0.03**	0.04	**0.00**	0.05
Constant	0.09	0.24	-0.18	0.14	-0.06	0.12	0.06	0.19
Ln Total Assets	0.00	0.02	0.02 **	0.01	0.02 *	0.01	0.00	0.02
Liquidity	0.18 *	0.11	0.28 ***	0.09	0.22 ***	0.07	0.18 *	0.12
Leverage	0.18 ***	0.05	0.21 ***	0.03	0.20 ***	0.03	0.17 ***	0.05
ROA	0.61 ***	0.16	0.60 ***	0.08	0.61 ***	0.08	0.54 ***	0.15
Ln Age	-0.06 *	0.02	-0.09 ***	0.02	-0.08 ***	0.01	-0.07 ***	0.02
Industry fixed effects	*Yes*		*Yes*		*Yes*		*Yes*	
Year fixed effects	*Yes*		*Yes*		*Yes*		*Yes*	
Statistics								
R - squared	0.139		0.102		0.101		0.153	
Number of obervations	792		1553		2345		763	
Numbe of firms	396		388		390		361	
Covariance type	HC3		HC3		HC3		HC3	

The regression analysis, controlling for total assets, liquidity, leverage, Return on Assets (ROA), and age, yields no statistically significant difference in TFP between PE-acquired and strategically acquired firms within the observed period, shown in the dummy variable "PE" in Table 5. This suggests insufficient evidence to assert a significant differential impact based on the type of acquirer on the target firm's TFP levels. The lack of significance for the "PE" dummy from year 0 to year 1 implies that a change in productivity does not appear to be the primary driver behind the observed dip in performance measures in the first post-acquisition year.

Regarding the "Ln Total Assets" variable, we observe a coefficient of 0.02 at the 5% significance level. Although the coefficient has a relatively small economic significance, it implies that the target's assets have a positive relationship with productivity in the post-acquisition period. A consistently positive and significant correlation is seen between TFP and both liquidity and leverage, highlighting the role robust cash flows and financial strength have in enhancing productivity. In addition, the high significance and coefficient size (0.6) of ROA indicate that a firm's ability to generate profits from its assets significantly influences TFP, highlighting the significance of asset efficiency in overall productivity improvement. Other studies have used other methods for calculating TFP, and while ROA has such a strong influence on TFP, it might be that in other research where ROA isn't controlled for, we would see a decrease in the PE dummy. The coefficients obtained in our analysis are consistent with previous studies (Chang & Tang, 2021)[18].

Age has a consistently negative and significant impact on TFP, implying that characteristics associated with older targets, such as potential inefficiencies, can hinder productivity. This impact becomes even more pronounced post-acquisition, with a coefficient of -0.09 at the 1% significance level. While age has not traditionally been a primary consideration in target selection, our findings suggest that acquirers may benefit from considering it given its influence on productivity.

5.3 Return on assets

The goal of the Return On Assets (ROA) analysis is to examine whether the type of acquirer significantly affects the ROA of the targets, providing a deeper understanding of governing effects on the performance measure ROA. This analysis takes into account the same regression periods as used for the TFP regression analysis, including regressions for pre-acquisition, post-acquisition, and one DiD regression spanning all years and one for year 0 to year 1. The regression output is shown in Table 6 below.

Our research on ROA provides interesting insights for acquirers for their target selection process and for targets on what to prioritize post-acquisition to develop ROA. The research underscores the positive effects of firm size, capital intensity, and liquidity on ROA, and the negative impact of leverage. As our study coincides with Brexit and COVID, we expect some implications on the results due to the extra layer of complexity. Further research into the specific impact of these events is a potential avenue for future research.

Table 6: Comparison of Private Equity and Strategic Target's Return on Assets - Regression

Return on assets for PE targets compared Strategic targets, matched at 1 year before acquisition. This table shows the results of a regression of ROA on a PE dummy while accounting for firm characteristics. The regression is estimated using year and industry fixed effects. "Firm Size" is the log of the acquirer's adjusted revenue, "Capital Intensity" is the log of the ratios of the assets to employees, "Growth Opportunities" is the ratio of revenue to assets, "Leverage" is the ratio of liabilities less cash to total assets less cash, "Liquidity" is the ratio of cash to assets and "Age" is the log of date of acquisition minus date of target's incorporation of the targets. PE is the dummy variable measuring the ROA difference between PE and Strategic targets. Pre-acquisition outputs are measured using T=-1 and T=0, while post-acquisition are measured using T=1 to T=4. All Years (T=-1 to T=4) is a DiD regression which are measured as the total difference within the respective periods. Period 0 to 1 is another DiD regression which are measures as the difference between year 0 and year 1.The standard error of each variable is listed to the right of their respective value. Significance levels of 1%, 5%, and 10% are denoted as ***, **, and * respectively. The "SE" column is the standard error of the coefficent. We implemented a Durbin-Wu-Hausman's chi-squared test to establish the consistency and efficiency of the coefficients in the model, and a White's test to indicate the presence of heteroskedasticity in the model residuals. We found correlation between the effects and the regressors, as well as heteroskedasticity in the residuals. Hence, we determined to use robust standard errors type HC3, and a fixed effects model.

Regression on ROA	**PRE ACQUISITION**			**POST ACQUISITION**			**ALL YEARS**			**PERIOD 0 TO 1**		
Independent Variables	**Coefficient**		**SE**	**Coefficient**		**SE**	**Coefficient**		**SE**	**Coefficient**		**SE**
PE	**0.036**	***	**0.014**	**0.004**		**0.008**	**0.036**	***	**0.013**	**0.039**	**	**0.018**
PE * Post							**-0.032**	**	**0.015**	**-0.053**	**	**0.025**
Post							**-0.011**		**0.011**	**0.011**		**0.016**
Constant	-0.104		0.079	-0.1098	**	0.0439	-0.106	***	0.038	-0.165	***	0.069
Firm Size	0.015	**	0.008	0.016	***	0.004	0.015	***	0.004	0.022	***	0.007
Capital Intensity	0.012	*	0.008	0.022	***	0.005	0.019	***	0.004	0.016	**	0.007
Growth Opportunities	0.043	***	0.009	0.030	***	0.006	0.035	***	0.005	0.032	***	0.008
Leverage	-0.275	***	0.030	-0.257	***	0.017	-0.263	***	0.015	-0.264	***	0.029
Liquidity	0.087	**	0.050	0.178	***	0.032	0.139	***	0.028	0.169	***	0.050
Age	0.002		0.009	0.004		0.005	0.004	***	0.004	0.005		0.008
								**				
Industry fixed effects	*Yes*			*Yes*			*Yes*			*Yes*		
Year fixed effects	*Yes*			*Yes*			*Yes*	***		*Yes*		
Statistics												
R - squared	0.229			0.102			0.325			0.318		
Number of obervations	697			1553			2250			763		
Numbe of firms	349			388			375			380		
Covariance type	HC3			HC3			HC3			HC3		

In the pre-acquisition phase, the regression results indicate a positive coefficient that is statistically significant (0.036) for the ”PE” dummy variable. This implies that, on average, companies acquired by PE are associated with a 3.6% higher ROA pre-acquisition compared to those acquired by strategic acquirers, holding the other variables constant. This result aligns with our previous results on the tendency of PE acquiring targets with higher ROA. In contrast, the PE variable did not yield a significant result in the post-acquisition regression. The interaction term ”PE*Post” for the “all years” regression is significant at the 5% significance level with a coefficient of -0.032, which suggests a 3.2% decrease in ROA for PE acquired targets compared to strategically acquired targets. Further, as the post-acquisition regression do not show neither a economical nor a statistical significant difference in ROA between PE and strategically-acquired firms, it suggests that the observed decrease in the ”PE*Post” variable in the “all years” regression was a temporal shift from the pre to the post-acquisition period rather than an enduring performance gap. This is further indicated by the DiD regression from year 0 to year 1, which revealed a interaction term (PE*Post) with a coefficient of -0.053 at the 5% significance level. These results confirms our previous results on the performance measure trend of ROA as we observe the dip in the measure one year after the acquisition for PE acquired firms compared to strategically acquired firms. This observed reduction in ROA for PE-acquired firms suggests the influence of additional factors than those controlled in our model, likely including restructuring costs, one-off acquisition costs, and other disruptive events, such as Brexit and COVID.

”Firm size” consistently displays a positive, statistically significant relationship with ROA across all periods, indicating larger firms generally enjoy higher ROA, likely due to economies of scale and market positioning. Similarly, the ”capital intensity” and ”growth opportunities” variables have a positive relationship with ROA across all time periods, indicating that companies with a higher asset-to-employee ratio and greater growth potential tend to enjoy a higher ROA. Post-acquisition, capital intensity appears to play a more significant role, while the importance of growth opportunities diminishes, indicating a transition toward asset optimization and operational efficiency.

The regression output shows a negative coefficient for the ”Leverage” variable which is both statistically and economically significant across all reported periods, with coefficients between -0.263 and -0.275. This supports the expectation that increased debt, through higher interest payments, reduces net income, which leads to a decrease in ROA. In addition, leverage is slightly less negative in the post-

acquisition period, indicating that the targets have become slightly more effective in utilizing their debt to generate returns.

We observe positive coefficients for the other variables in the regression, whereas all variables exhibit significant and more pronounced effects in the post-acquisition period as well as throughout the other reported periods. The observed positive coefficient (0.178) for the "Liquidity" variable in the post-acquisition regression, suggests that higher levels of liquidity come with increased ROA. A similar coefficient is seen in the study of Berzins et al. (2022)[13]. Our results highlight the growing economical significance of liquidity, as evidenced by the increase in the coefficient from 0.087 in the pre-acquisition regression to 0.178 in the post-acquisition regression. As liquidity is a measure of a company's ability to meet its short-term obligations, it can be concluded that higher liquidity corresponds to a more efficient use of assets, which results in greater profitability. Furthermore, we observe that the impact of liquidity on ROA becomes more statistical significant post-acquisition, i.e. developing from a 10% significance level to a 5% significance level. This is indicating that the acquired targets' ability to efficiently manage and maintain liquidity can be an important factor in increasing ROA. This can be line with that an acquirer's strategy to use liquidity effectively to maximize return on assets is being materialized.

The regression model exhibits that the constant, which is negative, becomes statistically significant after the acquisition. Although the constant itself has no clear economic application, changes in its importance and value may point to a structural change in the total ROA in the years after an acquisition. This change may be the result of variables that our model could not account for, such as economic occurrences like Brexit and COVID.

Looking at the R-squared for the post-acquisition regression, we observe that the model explains less than half of the variance in ROA compared to the pre-acquisition model. This observation suggests that there are other influential factors in the post-acquisition period that might have a significant influence on ROA. Potential influences could be restructuring costs, strategy changes, or increased volatility related to external events such as Brexit and COVID. Furthermore, to fully understand the determinants of ROA post-acquisition, further research should explore these determinants.

6 Conclusion

This research, covering exploration of the comparative performance of Private Equity (PE) and strategically acquired targets, provides new insights into the nuances of post-acquisition performance through performance measure ratios, Total Factor Productivity (TFP), and Return on Assets (ROA) between the two target types. The sample consists of 134 PE acquisitions and 283 strategic acquisitions across the UK, spanning from 2013 to 2017 with financial data from 2012 to 2021.

A key finding of the study is that PE-acquired firms, on average, perform worse in the short-term with both statistical and economic significance compared to strategically acquired firms. This is shown by an initial dip in the performance measures ROIC (-0.066), ROA (-0.052), EBIT/Assets (-0.047), EBITDA margin (-0.045), and net profit margin (-0.049). This dip is most likely due to the aggressive business optimization and restructuring costs that are typical of the acquisition strategies of private equity firms. However, for the second, third and fourth year after acquisition, we find no clear evidence of PE acquired targets having superior performance measures in the long-term, contrasting Feldman (2016)[24] and McKinsey and Company et al. (2020)[43]. Interestingly, PE firms predominantly acquire targets with high performance, more so than strategic firms. While Gemson (2021)[29] finds that PE prefers targets with higher operating income and assets, we find that PE targets demonstrate an average of over 35% higher initial performance across most of the measures, and notably, a 60% superior net profit margin on average than those acquired by strategic firms.

Concerning current ratio, we observe a substantial decrease for PE acquired targets in the first year after acquisition, having a significant difference of -19.5% compared to strategically acquired targets. This decrease, likely due to PE firm's strategy of enhanced operational efficiency and financial optimization, is accompanied by a significant decrease in the current assets, suggesting effective management. However, three years after the acquisition we observe a reversal where PE acquired firms exhibit 16.4% higher current ratio than strategically acquired firms. This is due to an increase in the current asset ratio and a decrease in the current liability ratio, which demonstrates effective management of liabilities and assets for PE targets. Despite the different short-term strategies, there is no clear evidence to suggest a long-term difference in current ratio between PE and strategically acquired targets.

Regarding the observations from the TFP regression, our research does not find any evidence that the acquirer type significantly impacts the target's productivity

in either of the periods studied. Still, leverage, ROA, and liquidity have both an economically and statistically significant impact on TFP across all periods, regardless of acquirer type. While these variables are significant at the 1% level, ROA seems to be the primary determinant on TFP reporting a coefficient of 0.6. Intriguingly, the age of the target firms consistently shows a negative and significant relationship with TFP, yielding a negative coefficient of -0,09 in the post acquisition period. This result suggests that older firms may experience inefficiencies that slow productivity and highlights the importance of age being part of the target selection process for acquirers.

Surprisingly, the study found no evidence that PE-acquired targets tend to have higher ROA post-acquisition compared to strategically acquired targets. Still, from the pre-acquisition period to the post-acquisition period, targets acquired by private equity firms demonstrate, on average, a 3,2% poorer performance in terms of ROA compared to targets acquired by strategic firms. This gives a further indication that the acquirer type affects the performance of their targets through their different strategies, also regarding the target's ROA. These results are in contrast to the study of Wilson et al. (2012)[69] which finds PE firms being superior for this profitability differential ROA. Generally, the variables growth opportunities, leverage, and liquidity show a consistent statistically significant relationship with ROA for both target types, indicating the complex processes that affect targets' return on assets. Regarding economic significance, leverage and liquidity seems to be the primary determinants for ROA in the post-acquisition period reporting coefficients of -0,257 and 0,178, respectively.

This research serves as a stepping stone toward understanding the complex dynamics that influence the performance of PE and strategic acquisitions in the UK acquisition market. Our findings offer valuable insights for acquirers, emphasizing the need to consider the primary determinants of acquisition performance through performance measures, TFP, and ROA. Given the dip in performance after the acquisition, PE firms might need to consider the timing and structure of their acquisitions carefully. Furthermore, PE firms should consider their own and their target's ability to manage restructuring costs and the effect of aggressive capital optimization on performance. For strategic acquirers, the findings suggest no evidence of PE acquirers performing better in terms of performance measures, TFP, or ROA in the long-term. Strategic acquirers, knowing from our results that there is no evidence that the nature of the acquirer affects performance, could consider these results when evaluating potential targets. This study offers insight into the outcomes of

acquisitions to investors, stakeholders, potential acquisition targets, and policymakers. It can aid in optimal investment decisions, inform policies about acquisitions, and forecast post-acquisition expectations, especially concerning performance dips for PE-acquired firms. The study can also offer relevance for performance during other economic downturns.

Researchers may investigate acquisition performance by comparing our results with analysis on acquisitions pre- and post-financial crisis in 2008 and pre- and post-COVID. Furthermore, it is encouraged to explore other potentially influential factors, such as restructuring costs and strategic changes, to gain a more comprehensive understanding of the determinants of ROA and TFP post-acquisition. Lastly, it would be interesting to find a difference in the results concerning the ownership stake of the acquirer.

To conclude, while our analysis did not directly examine the causes of the different trends in performance between the target types, our findings are consistent with existing literature which suggests that the unique strategies employed by PE firms, involving substantial short-term costs, may propagate into the performance trends. Firstly, PE-acquired firms perform worse in the short-term, having an initial dip one year after the acquisition, likely due to restructuring costs and aggressive business optimization. Secondly, PE acquired firms have a significant decrease in their current ratio in the first year after acquisition, but reverse it in the third year after acquisition, highlighting the asset and liability management, and efficiency strategies of PE acquired firms. Thirdly, PE acquired targets performed, on average, poorer than strategic targets from the pre-acquisition period to the post acquisition period, further indicating that the acquirer's strategies propagate into the target's performance. Although we observe short-term changes, we cannot assert which acquirer has the most beneficial strategy in the long-term. Another interesting find is that PE firms tend to acquire targets with notably higher performance. The age of target firms also showed a consistent negative relationship with TFP, suggesting older firms might face inefficiencies. The study considers the impact of major economic events such as Brexit and COVID-19. However, it does not provide definitive evidence that PE acquired firms, compared to strategically acquired firms, demonstrate superior long-term performance or resilience during such downturns in terms of performance measres and TFP, as previous studies have found.

7 Appendix

Table 7: Variable definitions

Variable name	Definition
Performance Measures:	
ROA	Operating earnings after taxes divided by assets, winsorized at the 2.5% and 97.5% tails
ROIC	Operating earnings after taxes divided by assets net of cash and current debt, winsorized at the 2.5% and 97.5% tails
EBITDA-margin	Earnings before interests taxed depreciation and amortization divided by revenue
ROCE	Earnings before interests and taxes divided by assets less current liabilities
NOPAT/Assets	Net operating profit after tax divided by assets
Net profit margin	Revenue less costs divided by revenue
Current ratio	Current assets divided by current liabilities
CAGR	Revenue in year 4 divided by Revenue in year 0
Regression variables:	
Ln Age	Log of date of acquisition minus date of target's incorporation
Section	Control variable for industry, section based on NACE codes
Year	Control variable for each accounting year from 2012-2021
PE	1 if PE acquirer, 0 if strategic acquirer
Total Factor productivity (TFP):	
Q	Operating revenue (Turnover)
K	Fixed assets
L	Number of employees
k	Log of total assets
l	Log of number of employees
q	Log of operating revenue (Turnover)
COGS	Costs of goods sold
Leverage	Debt less cash to total assets less cash

Variable name	Definition
LIQ	Asset liquidity as ratio of cash holdings to total assets of target firm

Return on Assets (ROA) :

Size	The log of the target's adjusted revenue
Growth opportunities	The ratio of revenue to assets
Asset liquidity	The ratio of cash to assets
Leverage	The ratio of liabilities less cash to total assets less cash
Capital intensity	The log of the ratios of the assets to employees

Other variables:

PSM	Propensity Score Matching
ATT	Average Treatment Effects on Treated
PE	Private Equity
DiD	Difference in Difference

Table 8: Assessment of matching quality at year before acquisition

Propensity Score Matching (PSM) matched quality for nearest neighbor matching procedure with common support and replacement. The table shows Bias in terms of Average difference between the PE targets and Strategic targets.

Covariate	PE Mean	Startegic Mean	P Value
Log of Age	2.7	2.87	0.47
Operating Revenue	35279	30450	0.4
EBITDA	28003	2294	0.28
Log of Toal Assets	9.6	9.31	0.33
Number of employees	229.65	185.11	0.42
Long term Debt / Total Assets	0.15	0.12	0.65

Table 9: Modified Cobb-Douglas - Regression

Regression on Turnover using Cobb-Douglas explanatory variables. The regression is estimated using year and industry fixed effects. "Total Assets" is the log of the target's adjusted revenue, "Number of employees" log of the target's number of employees, "COGS" is the log of the target's cost of goods sold. All Years (T=-1 to T=4) is a regression on all the periods. The standard error of each variable is listed to the right of their respective value. Significance levels of 1%, 5% and 10% are denoted as ***, **, and * respectively. We implemented a Durbin-Wu-Hausman's chi-squared test to establish the consistency and efficiency of the coefficients in the model, and a White's test to indicate the presence of heteroskedasticity in the model residuals. We found correlation between the effects and the regressors, as well as heteroskedasticity in the residuals. Hence, we determined to use robust standard errors type HC3, and a fixed effects model.

Regression on Turnover	**ALL YEARS**		
Independent variables	**Coefficient**		**SE**
Constant	2.13	***	0.11
Ln Number of Emplyees	0.29	***	0.02
Ln Total Assets	0.36	***	0.02
Ln COGS	0.3159	***	0.017
Statistics			
R - squared	0.805		
Number of observations	2853		
Covariance type	HC3		
Fixed Effects			
Industry fixed effects	Yes		
Year fixed effects	Yes		

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