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HOW BUYOUT LEVERAGE AFFECTS POST-DEAL OPERATING PERFORMANCE - A
QUANTITATIVE ANALYSIS OF FIRST-TIME PRIVATE EQUITY DEALS

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Abstract

This study examines how leverage in private equity buyouts affects post-deal performance. Using data on 295 first-time buyouts in Italy from 2000-2019, I track performance changes for five years post-deal across profitability, revenue, and productivity. My findings reveal nuanced effects across leverage metrics: the D/A ratio is linked negatively to EBITDA margin and revenue, yet positively to ROA, where long-term debt relates more to profitability and short-term debt more to revenue growth. D/EBITDA shows a positive influence on productivity. This research advances the understanding of leverage in PE and offers insights on capital structure decisions for both practitioners and academia.

Keywords

agency theory, capital structure, corporate finance, debt, leverage, leveraged buyout, operating performance, post-deal performance, private equity

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1 Introduction

Private equity (PE) firms are known for acquiring companies using a substantial amount of debt in leveraged buyouts (LBOs). This leverage can increase equity returns and mitigate agency costs, albeit at the expense of added risk (Axelson, Strömberg, and Weisbach 2009). Despite the PE industry's ebbs and flows along various trends throughout the years, the basic mechanics of LBOs have remained the same (Shourun, Hotchkiss, and Song 2008). Ever since the first large buyout wave of the 1980's, the impact they have on the target companies has been a popular subject of academic research. Prior studies often find that they increase operational discipline and drive performance (Kaplan and Strömberg 2009).

Understanding the role that leverage plays in an LBO is crucial, since it forms its very definition, directly influences risk and return, and deciding on a suitable level of debt is one of the key issues a general partner (GP; private equity firm) faces in every deal. However, the evidence on the specific impact of the substantial amount of leverage that is typical for LBOs is still inconclusive. While some publications find that higher leverage can enhance efficiency and profitability (Kaplan 1989; Guo, Hotchkiss, and Song 2011), others argue that excessive debt can harm firm performance (Akhtar, et al. 2021; Coricelli, et al. 2012).

To address this ongoing debate, this study assesses how the amount of company-level debt at acquisition influences post-deal performance across profitability, revenue, and productivity. I create a new panel data set of 295 first-time buyouts in Italy between 2000 and 2019 using Preqin and Orbis that captures performance changes up to five years after the deal year. Unlike other studies, this is distinct from commonly used U.S.-focused samples and usually shorter-term views on post-deal periods. Additionally, the effects of multiple different leverage metrics are examined using two-way fixed effect models with two-way clustered standard errors.

The results are differentiated by the way debt is measured, where I find a negative relation of the Debt-to-assets (D/A) ratio on the EBITDA margin and revenue growth, yet a positive link

with return on assets (ROA). Furthermore, the relation with profitability is better explained by long-term debt (LTD), while revenue growth is captured better by short-term debt (STD). The leverage ratio (D/EBITDA) shows a positive influence on productivity and revenue growth. These results are robust to extended and reduced samples as well as variations in winsorization level.

This difference in results underscores the importance of considering multiple measures when evaluating LBO performance and warrants further research. Brown, Harris, and Munday (2021) point out that these differences could be explained by lifecycle stages of companies such as “value” versus “growth” with distinct leverage dynamics and characteristics. The influence of the D/EBITDA ratio indicates that the pressure of higher leverage relative to cash flows could drive management to pursue more aggressive operational improvements and growth strategies. Meanwhile, I propose that debt relative to assets could be viewed as a negative motivator that harms growth and profitability.

This research contributes to the ongoing debate on the effects of leverage in private equity and private equity value creation by providing findings on the nuanced effects of deal leverage on post-deal firm performance. The results add to the understanding of the determinants of firm performance in the private equity context. To my knowledge, very few publications cover post-deal firm performance with a similar width of analysis with eight variables across three key performance areas, allowing for a relatively complete picture of the analyzed effects. The novelty of the dataset expands and once more tests prior academic findings on new data. Furthermore, the results extend the available evidence on capital structure implications.

Next, this thesis works towards bridging the gap between observational research and private equity practitioners by combining theoretical and practical views, debt and performance measures, and adding to a holistic understanding of debt in private equity. As far as I am aware, it is among the first studies specific to the PE context that directly compares the effects of both

the research- and practice-standard measures of debt apart from Brown, Harris and Munday (2021). Notably, multiple studies such as Guo, Hotchkis and Song (2011) and Engel, Braun, and Achleitner (2012) include measures of both kinds. The insights provided are also relevant for PE practitioners and regulators in gauging an optimal leverage tradeoff in competitive markets. Lastly, widely accepted financial theory is tested with real-world evidence.

2 Existing literature and hypotheses

With their two most famous publications, Modigliani and Miller brought the essential notion of the tax advantage of debt financing to the forefront of corporate finance theory (Modigliani and Miller 1958; Modigliani and Miller 1963). With agency costs on the other side of the scale, an optimally balanced level of debt exists for each business (Mello and Parsons 1992). In theory, higher debt levels can solve issues such as the free cash flow problem, where managers employ excess cash for inefficient purposes and, according to the control hypothesis, can introduce regular oversight and evaluation by lenders to help steer funds only to economically beneficial projects (Jensen 1986). This is exactly what Private Equity uses to its advantage, along with the stringent alignment of interests through incentives. Specifically, the alignment between owners and management, as well as between the General Partner and their Limited Partners through the construction of funds and the need to approach capital markets for debt financing on a deal-by-deal basis (Wright, et al. 2009; Axelson, Strömberg, and Weisbach 2009).

Usually, buyout investments focus on businesses that are strong in cash generation and therefore prone to free cash flow agency problems (Jensen 1986). Despite Jensen (1986) framing debt use in LBO's as a solution for agency problems, another view sees the level of leverage as primarily driven by current market conditions, with GPs essentially trying to consistently maximize leverage (Axelson, et al. 2013). Finally, the empirical evidence specific to the private equity context on the relation between leverage and profitability remains inconclusive, as is the

case for other portfolio company performance measures (Eckbo and Kisser 2021). Still, theory and existing publications allow me to derive several hypotheses.

2.1 Debt levels, effects of leverage in LBOs, and current state of research

According to the trade-off theory, firms seek to strike an equilibrium between costs of potential bankruptcy and the financial- and agency benefits of debt (Myers 2001). Similarly, when general partners choose a level of debt for an investment, they weigh enhanced investment returns against the risk of a potential write-off (Axelson, et al. 2013). Arising from information asymmetry, pecking order theory suggests that debt is only raised if funds from retained earnings are not sufficient, contradicting the view of leverage maximization that Axelson, et al. (2013) presented. Together with the free cash flow problem that private equity promises to resolve, three differing, non-exhaustive expectations for optimal debt levels are formed. Notably, even much broader considerations, such as national culture, are found to influence firm behavior around debt decisions (Orlova and Harper 2022).

LBO leverage levels have been shown to be determined by different factors than those of comparable public companies, attributable to dynamics such as the differing permanence, purpose, and boldness behind the financing decision. Empirically and anecdotally, the view of GPs maximizing debt capacity utilization finds more support, with the availability and affordability of credit financing in turn heavily depending on the current credit market condition, valuation levels, and the general economic environment (Axelson, et al. 2013; Rizzi 2016). Supporting this argument, private equity firms are demonstrated to be efficient in timing credit markets (Engel, Braun, and Achleitner 2012).

Looking beyond factors determining debt levels, their impact following LBOs has been a popular subject of research, especially in the context of agency costs and its impact on the acquired companies' operating performance. Older studies find more positive effects of leverage on operating performance (Kaplan 1989; Smith 1990; Opler 1992), whereas more

recent publications struggle to find similarly large effects (Guo, Hotchkiss, and Song 2011; Cohn, Mills, and Towery 2014). In recent years, publications specific to operating performance still range from negative to positive relationships and are mostly smaller-scale studies (Asci 2019; Hæstad 2022; Liu 2014). With operational value creation as a main driver of private equity investment success, the current state of our understanding of this relation warrants the need for further research using new evidence (Achleitner, et al. 2010).

2.2 Expected effects of leverage on post-deal performance

Multiple studies analyzing the leverage-profitability relationship find a positive effect using the debt to total assets ratio (Abor 2005; Gill, Bigger, and Mathur 2011). Despite there being no known relation between the financial structures of LBOs and public companies, the same effect is found for LBO's, highlighting the similar consequences of leverage (Axelson, et al. 2013; Roden and Lewellen 1995). Some publications observe a negative relationship, where Wald (1999) notably finds differences across countries, limiting the generalization of this thesis (Mendell, Sydor, and Mishra 2006). Generally, findings can be interpreted as in favor of a positive relationship. As proposed by Brown, Harris, and Munday (2021), the denomination of leverage as Net Debt divided by EBITDA bears significant differences to the notion as debt to firm value. Notably, this thesis follows Abor (2005) and Gill, Bigger, and Mathur (2011) in their notion for profitability. Both debt over total assets and Debt over EBITDA are analyzed for comparability. The latter is examined in section 4.3, as in Engel, Braun, and Achleitner (2012), where Brown, Harris, and Munday (2021) suggest different dynamics and firm characteristics are at play. They propose that high debt-to-value ratios, which resemble D/A , are more typical in mature 'value' companies, while high net-debt-to-EBITDA ratios, similar to $D/EBITDA$, are more prevalent in 'growth' companies (Brown, Harris, and Munday 2021, 57). Based on the well-established disciplining effect of debt stemming from agency costs, a company can be significantly motivated to increase its profitability when facing larger than

before interest and principal payments (Jensen 1986). As Jensen (1989, 12) observed, “debt is a powerful agent for change”. Importantly, this thesis makes the same implicit assumption as most publications: a larger amount of debt means larger fixed interest payments, even though this is not strictly true in practice (Kaplan and Strömberg 2009). This increased financial strain represents a new challenge for managers, with the survival of their company and job depending on their ability to continuously service the debt payments. Suddenly enlarged fixed costs could renew managers’ focus on rational spending, therefore mitigating the free cash flow problem and motivating managers to increase profitability above prior levels. Consequently, the expectation of a positive relationship between the amount of leverage in the acquisition year and post-LBO profitability stands to be tested in the sample, similar to the results of Engel, Braun and Achleitner (2012) and Guo, Hotchkiss, and Song (2011).

H1: Positive effect of buyout leverage on post-deal company profitability

Following on the argumentation of having to reduce costs, LBOs have been found to increase firm productivity (Lichtenberg and Siegel 1990). Lichtenberg and Siegel (1990) observe that the total factor productivity, i.e. outputs, increase more for LBO companies, while the inputs grow slower than for non-LBO companies. Combined with the line of reasoning Jensen (1989) made, it can be further argued that this increase in productivity can at least partially be attributed to the disciplining effects of leverage that motivate a company to increase its efficiency and streamline its operations. Particularly labor and capital productivity are analyzed, since both a company’s employees and its fixed assets are likely among the first things to be reviewed by a GP throughout an LBO. With potential layoffs and asset sales as known cash generation tools of private equity, a positive relationship between the debt level in an LBO and post-deal productivity can be expected (Kaplan and Strömberg 2009; Guo, Hotchkiss, and Song 2011).

H2: Positive relationship between buyout leverage and post-deal firm productivity

Following on the notion of labor productivity gains after LBOs through faster output and slower input growth, expectations about employment growth and leverage can be formed. Multiple publications have found LBOs to be associated with slower employee growth (Kaplan 1989; Lichtenberg and Siegel 1990; Smith 1990). Despite this, some newer papers, especially by Kevin Amess and Mike Wright struggle to find this relationship (Amess and Wright 2012; Amess and Wright 2007a; Amess and Wright 2007b). Tipping the scales on the topic, Davis, et al. (2014) find a negative relation between LBOs and gross employment in an extensive study. Critically, Davis, et al. (2014) find that these differences are partly offset by job reallocation within a target entity. Combined with the argument made prior by Jensen (1989), it can be argued that the higher the leverage, the greater the motivation and need to restructure an organization. This restructuring could benefit long-term growth and viability of the organization. However, at least in the short- to medium term regarded in this thesis, it is much more likely that larger reorganizations hurt growth instead of boosting it. Notably, follow-on acquisitions in a buy-and-build strategy can provide a sudden boost to employment growth.

H3.1: Negative relationship between buyout leverage and post-deal employment growth

Using a sample of the first buyout wave of the 1980's, Wiersema and Liebeskind (1995) found a negative relation for LBOs on both sales and employee growth. To develop a hypothesis, the assumption can be made that GPs invest in firms with good investment opportunities and growth potential (Cohn, Hotchkiss, and Towery 2022). Then, the negative impact of LBOs observed by Lang, Ofek, and Stulz (1996) is not applicable, as their findings are only valid for firms with low Tobin's q ratio values. More recent publications largely find a positive effect of LBOs on revenue growth (Axelson, et al. 2009; Cohn, Hotchkiss, and Towery 2022; Boucly, Sraer, and Thesmar 2011). Notably, the findings of Boucly, Sraer, and Thesmar (2011) suggest that GPs can alleviate financing constraints for growth opportunities and are concentrated

among private-to-private deals, coinciding with the sample I use. Although LBOs have a positive effect on revenue growth, the role of leverage in buyouts must be further examined.

Engel, Braun, and Achleitner (2012) argued that companies burdened with high debt levels after an LBO see their focus consumed by servicing debt payments. Subsequently, little financial and managerial capacity remains for growth initiatives, with greater pressure from more debt causing a stronger effect. Consistent with Hypotheses 1 and 2 as well as evidence for a tradeoff between growth and profitability, large obligations to creditors could tilt this focus towards profitability (Jang and Park 2011; Ramezani, Soenen, and Jung 2002).

H3.2: Negative effect of buyout leverage on post-deal revenue growth

3 Data and methodology

The methodology focuses on analyzing the effects of leverage levels on post-deal profitability, productivity, and growth in the sample of first-time private equity buyouts. Due to varying definitions and use in existing literature, I compare different measurements of debt. Similar to Abor (2005), I use the popular debt to total assets notion, but also divide debt into short-term and long-term debt to total asset ratios. Following Guo, Hotchkiss, and Song (2011), a total debt to EBITDA leverage ratio is analyzed as well. Two-way fixed effects models with two-way clustered standard errors are estimated on eight dependent variables to test the hypotheses.

3.1 Data sources and sample construction

I construct a panel data set using the Orbis and Preqin platforms as sources. In total, 691 first-time private equity deals with Italian target companies between 1998 and 2020 are recorded. It contains information on deal metrics, the relevant parties, and financial data matched to the respective companies from Orbis for up to five years after the deal. Observations of the same company are numbered with the relative number of years to the deal from -5 to +5. Relative year 0 refers to the year of the deal for every company, irrespective of the calendar year the deal occurred in.

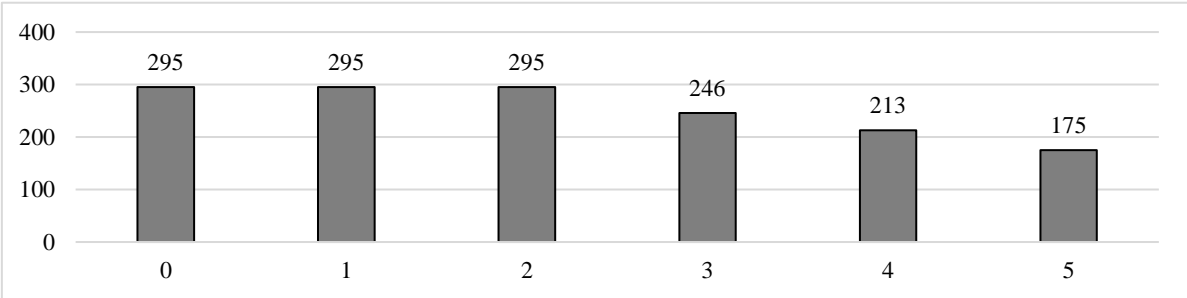
I excluded unusable deals where at least one of the dependent variables had missing values or obvious faulty entries, leaving 553 deals with data available for at least one post-deal period. As shown in Appendix 2, the number of observations significantly declines with each year relative to the deals. This is likely due to GP’s often preferring not to disclose investment details wherever possible, and the sample only reaching up to reporting years ending in 2021. Then, 28 firms were excluded that were involved in liquidation proceedings. Furthermore, the sample was restricted to only contain buyouts, excluding 149 add-on deals, as well as four public-to-private and one PIPE deal. Then, only firms with reported financials for at least two post-deal years were retained. Lastly, one delisted and four listed companies were excluded to focus solely on private companies, leaving 295 deals and 1224 observations in the main sample. The distribution of observations in the main sample is shown in Figure 1, where a noticeable, but less dramatic downward trend is observed. Approximately 59% of the firms remaining in the sample are recorded for the full five-year post-deal period.

Some data points still appear unlikely to be accurate, therefore I winsorize all leverage and dependent variables at the mild 1st and 99th percentiles. Control variables remain unwinsorized.

3.2 Variable construction

Most importantly, a notion of leverage must be defined. In the practice of private equity, leverage is most often defined as Net Debt divided by EBITDA. Despite its widespread use in practice, most publications apply the ratio of the book value of total debt to total assets (Achleitner, et al. 2010; Cohn, Mills, and Towery 2014). This thesis incorporates both, similar

Figure 1: Distribution of observations in the main sample over relative post-deal periods



to Guo, Hotchkiss, and Song (2011), though additionally including the division between the long-term debt and short-term debt to total assets ratios, as Gill, Bigger, and Mathur (2011) and Abor (2005) have done. The focus of analysis lies on the acquisition leverage determined by GPs at the time of the LBO, for which year 0 leverage serves as a proxy. These values are per definition constant over time for each company.

The dependent variables are constructed on the firm level as the relative changes with respect to the underlying indicator's year 0 value, calculated as the year t value divided by the year 0 value minus one. This also serves to make values more comparable between firms, as they are reflective of a firm's performance relative to itself. Distinctly, all profitability variables denote the absolute difference to the year 0 baseline since they are already expressed as ratios.

Productivity changes are measured across three variables, with labor productivity calculated as revenue per average number of employees for current and prior year. Value-added per employee (VAPE) is calculated as EBIT plus the cost of employees, divided by the same average number of employees and capital productivity equals sales divided by likewise averaged tangible fixed assets. The latter is chosen as to exclude intangible fixed assets such as goodwill, which can be subject to large changes following LBOs and subsequent transactions. Revenue and employee growth reflect the percentage change between year t and the absolute year 0 values for revenue and the number of employees. ROA describes year t EBIT divided by average total assets of years t and t-1, while the EBITDA and EBIT margins are the respective figures divided by sales for the same period. As mentioned, the simple difference to the baseline year 0 is used for the latter three variables in the regressions.

3.3 Sample characteristics

Table 1 shows the distribution of deals in the sample across industries and deal years. The majority of deals involved companies active in the manufacturing industry (62.4%), followed

by Services (13.9%) and Wholesale trade (8.5%). This concentration in the manufacturing industry is somewhat typical for samples used in LBO literature though slightly stronger.

Table 2 shows common descriptive statistics for the main sample of all variables used in the regressions. Appendix 4 shows descriptive statistics for the leverage variables, where the mean target company in the sample has a D/A ratio of 21.5% shortly after its acquisition at the end of year 0, with slightly more long-term than short-term obligations. The average company has an LTD/A ratio of 12.2% and an STD/A ratio of 9.3%. Regarding the D/EBITDA multiple, a very large standard deviation and disparity between mean and median indicates the presence of noticeable outliers, with the mean company being levered at 4.71x EBITDA opposed to the median of 1.58x. Compared to the samples used by Guo, Hotchkiss, and Song (2011) and

Table 1: Distribution of deals in the main sample across industry and deal calendar year

Year (20')	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	Sum	%
Construction	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	2	1	0	7	2.4%
Fin., Ins. & RE	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	2	1	0	0	0	6	2.0%
Manufacturing	1	0	1	0	1	7	12	7	14	2	1	6	8	9	22	23	21	19	27	3	184	62.4%
Retail trade	0	0	0	0	1	1	2	1	0	0	1	2	2	2	0	0	1	2	2	0	17	5.8%
Services	1	0	1	0	0	0	2	2	2	3	1	2	2	2	4	2	5	5	7	0	41	13.9%
Transportation	0	0	0	0	0	0	1	1	2	0	0	3	1	2	0	1	1	3	0	0	15	5.1%
Wholesale trade	0	0	0	0	2	0	2	1	0	0	0	2	4	0	1	3	3	3	4	0	25	8.5%
Sum	2	0	2	1	4	9	19	12	18	5	4	15	17	16	27	31	35	34	41	3	295	100%

Table 2: Descriptive statistics of regression variables, 2%-winsorized

	N	Mean	St. Dev	Pctl(25)	Median	Pctl(75)
D/A	1867	0.195	0.175	0.021	0.159	0.343
LTD/A	1867	0.104	0.134	0.000	0.043	0.162
STD/A	1867	0.089	0.108	0.004	0.048	0.136
D/EBITDA	1867	3.040	9.796	0.003	1.022	3.581
Δ EBITDA margin	1867	-0.005	0.183	-0.048	-0.005	0.035
Δ EBIT margin	1867	-0.034	0.221	-0.073	-0.015	0.028
Δ ROA	1867	-0.036	0.149	-0.081	-0.023	0.021
Δ Labor productivity	1799	-0.006	0.434	-0.231	-0.050	0.136
Δ VAPE	1799	-0.024	1.460	-0.368	-0.075	0.186
Δ Capital productivity	1837	0.117	0.961	-0.352	-0.041	0.290
Δ Revenue	1867	0.222	0.740	-0.103	0.089	0.328
Δ Employees	1812	0.323	0.930	-0.019	0.089	0.350
ln(revenue)	1867	16.939	1.533	16.186	17.030	17.835
Revenue growth	1857	0.218	5.174	-0.090	0.031	0.144
EBITDA margin	1859	0.076	0.249	0.040	0.095	0.167

Kaplan (1989), the deals in this sample use much lower leverage, especially compared to those in the first buyout wave of the 1980s. Leverage ratios in this sample are also lower than for most data used in LBO literature.

Appendix 5 shows the Pearson's correlation matrix for all variables used in the regression models. Bold coefficients denote absolute values larger than 0.5. These large correlations only appear among dependent variables and are mostly grouped among those of the same hypothesis. No multicollinearity issues appear present, as these variables mostly assess the same hypothesis or never appear in the same regression and all control variables never show concerning levels of correlation among the others included in the same models. Noteworthy observations include the large correlations between the relative changes in revenue and VAPE as well as labor productivity and ROA and the very low correlation between VAPE and labor productivity. The latter may partly be explained by a similarly low correlation between the change in revenue and the change in EBIT margin, which are parts of the two productivity measures, respectively.

3.4 Empirical methods

To achieve the goal of this thesis by investigating a causal link between year 0 leverage and different performance indicators of the companies in post-deal periods, the exogeneity assumption must be fulfilled. Since observational data is used, true exogeneity is unrealistic and the issue of endogeneity must be effectively managed. Therefore, mainly the omitted variable bias (OVB), reverse causality, and measurement error issues must be addressed.

Beginning with the least controllable problem, measurement errors are both hard to detect and resolve in the used sample. It is deemed most appropriate to trust the data sources enough for general accuracy and preemptively account for outliers arising from inaccurate data using winsorization, as described above. Reverse causality can be handled quite elegantly by effectively isolating the main independent variable year 0 leverage in time. Since its values are constant over time for each company, removing observations from year 0 and before logically

resolves reverse causality. Standard errors are adjusted for the remaining within-firm correlation. Only data points from years 1 through 5 remain in the sample, creating a strict successive time structure for the analyzed relationship and preventing reverse causality. OVB, the most complex issue to resolve in a satisfactory way, is discussed in the following.

Generally, OVB occurs when the error term is correlated with the dependent variable, indicating that a relevant independent variable is omitted in the error term, instead of being specified in the model itself. Since the existence of these so-called confounders cannot be fully ruled out, fixed effects estimators are used, and standard errors are adjusted to best account for the existence of industry- and time effects. The individual specific heterogeneity arising from the panel structure of the sample is likely to be correlated with the explanatory variables, ruling out the use of random effects models.

To capture variable relations present in the panel data sample, a two-way fixed effects regression using individual and time effects is the most suitable. Then, for example, common time-specific shocks such as macroeconomic crises and unobserved, firm-specific time-invariant factors such as management quality are in effect removed from the estimators. However, since the variable of interest in this paper, year 0 leverage, is constant over time for each company, firm fixed effects would absorb this effect. Therefore, industry is used as a second dimension to supplement time effects and standard errors are adjusted through two-way clustering along the same variables. The standard HC0 heteroskedasticity-consistent estimator is chosen, since higher-order robust estimators are generally only required to adjust for small sample sizes and one-dimensional clustering. This way, robustness against within-firm correlation over time and common shocks within each calendar year are also accounted for as best as possible given the sample and variable constraints. Hybrid models with separated estimation of the effects of year 0 leverage and time-varying factors on the different firm

performance variables were deemed impractical and problematic to interpret. Section 5.2 discusses alternative estimations on an extended sample and sub-samples.

With the main regression model design laid out, control variables are added. Following most publications, size effects are controlled for with the natural logarithm of revenue alongside the SIC industry classification and calendar year as fixed effects (Gill, Biger, and Mathur 2011). Additionally, EBITDA margin, revenue growth, and VAPE are added to regressions testing the two hypotheses where they are not regressands themselves. Moreover, the deal type is included in the regression models run on the extended sample.

4 Results

Multiple groups of regression models are estimated on the dependent variables for different notions of leverage as the main independent variable. First, for the most widely used in literature with the debt to assets ratio, second, this ratio is split into long-term and short-term debt and third, the notion of debt to EBITDA is tested.

4.1 Leverage as the debt to assets ratio

Table 3 shows the outputs for the regression models estimating leverage as the D/A ratio. A very significant negative coefficient of the debt to total assets ratio on the EBITDA margin is shown. On average, a one standard deviation (SD) increase in the D/A ratio in year 0 is associated with a 1.65 ppts lower EBITDA margin in the observed post-deal periods. Contrarily,

Table 3: Regression outputs for models estimating firm performance using the total debt to assets ratio as leverage

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.094*** (0.025)	-0.043 (0.030)	0.077*** (0.020)	-0.139* (0.076)	-0.188 (0.185)	-0.206 (0.168)	-0.334** (0.141)	-0.205 (0.251)
log(Revenue)	0.002 (0.003)	0.005 (0.004)	0.007*** (0.003)	0.015 (0.011)	0.046* (0.026)	-0.074*** (0.022)	0.040** (0.019)	0.042 (0.035)
Revenue growth	0.006* (0.003)	0.007 (0.004)	0.000 (0.003)	0.087*** (0.010)	0.275*** (0.024)	0.101*** (0.021)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.032 (0.034)	0.334*** (0.082)	0.091 (0.072)	-0.037 (0.062)	0.036 (0.111)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	no	no
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.091	0.092	0.040	0.063	0.123	0.040	0.035	0.015

Note:

*p<0.1; **p<0.05; ***p<0.01

the same relative debt level shows a strong significant relation with a 1.35 ppts higher ROA. Notably, the effect on the EBIT margin is also negative, yet only significant at the 10% -level. The coefficients on productivity are only slightly significant in a negative effect on labor productivity, with a 2.43% lower revenue to the number of employees ratio in post-deal periods for a one SD higher D/A ratio. Though not significant, the estimates for VAPE and capital productivity are also negative. With a similar sign and very significant coefficient, revenue levels are on average 5.85% lower than their year 0 reference points for a comparable D/A ratio change. With a noteworthy effect size, this represents a key finding alongside those for the profitability measures. The effect on the number of employees is not significant.

4.2 Leverage as long-term and short-term debt to assets ratios

The regression of the debt to total asset ratio split into long-term and short-term debt, similar results are found, as shown in Table 4. Again, a very significant negative effect on the EBITDA margin is found, countered with a very significant positive effect on the ROA. Notably, the effects of short-term debt on the EBITDA margin and ROA are slightly larger than those of long-term debt. The coefficients on productivity are mostly not significant and negative. Short-term debt shows a large, very significant negative effect on revenue growth. On average, a one SD higher short-term debt over total assets predicts 11.67% lower revenues than those in year

Table 4: Regression output for models estimating firm performance using split short-term and long-term debt to asset ratios as leverage

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.090*** (0.031)	-0.056 (0.036)	0.076*** (0.024)	-0.144 (0.093)	-0.401* (0.225)	-0.167 (0.204)	0.048 (0.171)	-0.013 (0.306)
STD/A	-0.102** (0.048)	-0.018 (0.050)	0.084** (0.033)	-0.107 (0.130)	0.269 (0.315)	-0.238 (0.278)	-1.081*** (0.232)	-0.672 (0.424)
log(Revenue)	0.002 (0.010)	0.005 (0.004)	0.007*** (0.003)	0.014 (0.011)	0.044* (0.026)	-0.074*** (0.022)	0.043** (0.019)	0.044 (0.035)
Revenue growth	0.006 (0.005)	0.007* (0.004)	0.000 (0.003)	0.087*** (0.010)	0.277*** (0.024)	0.101*** (0.021)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.032 (0.034)	0.337*** (0.082)	0.090 (0.073)	-0.040 (0.061)	0.036 (0.111)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.090	0.091	0.040	0.062	0.124	0.039	0.048	0.016

Note:

*p<0.1; **p<0.05; ***p<0.01

0 for the post-deal periods. Contrarily, the coefficients for long-term debt are not significant. Notably, the regression models for this split debt measurement exhibit little difference in adjusted R squared. This suggests a similar model fit when dividing total debt up into long-term and short-term debt.

4.3 Leverage as the debt to EBITDA ratio

As presented in Table 5, the leverage ratio shows a small, but positive significant effect on ROA as the only profitability variable, with only an estimated 0.98 ppts higher ROA for every one SD higher D/EBITDA. In stark contrast to the results of section 4.1 and 4.2, leverage as the Debt to EBITDA ratio shows a uniformly positive and very significant estimator for all productivity measures. The largest effect is on VAPE at 21.55% higher productivity per one SD higher D/EBITDA, accompanied by the highest adjusted R squared value of 14.6% within this group of regressions. For similar leverage changes, an 8.82% higher labor productivity and 12.73% higher capital productivity is estimated. Regarding the growth variables, I find a similar positive and very significant coefficient for revenue at 12.73% growth per one SD higher leverage ratio. Given the wider range of D/EBITDA values in the sample, these estimators represent larger effect sizes than those for sections 4.1 and 4.2.

Table 5: Regression output for models estimating firm performance using the Debt to EBITDA ratio as leverage

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	-0.001 (0.001)	0.000 (0.001)	0.001** (0.000)	0.009*** (0.002)	0.022*** (0.004)	0.013*** (0.003)	0.013*** (0.003)	0.007 (0.005)
log(Revenue)	0.001 (0.003)	0.004 (0.004)	0.008*** (0.003)	0.010 (0.011)	0.037 (0.025)	-0.082*** (0.022)	0.030 (0.019)	0.038 (0.035)
Revenue growth	0.007** (0.003)	0.007* (0.004)	-0.001 (0.003)	0.080*** (0.010)	0.258*** (0.024)	0.092*** (0.021)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.029 (0.033)	0.330*** (0.081)	0.085 (0.072)	-0.052 (0.061)	0.028 (0.111)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.081	0.090	0.032	0.088	0.146	0.050	0.048	0.016

Note:

*p<0.1; **p<0.05; ***p<0.01

5 Discussion of results

The regression models in the previous section suggest a negative relation of the D/A ratio with the EBITDA margin and revenue growth, the latter especially for short-term debt, yet a positive effect on ROA. At the same time, I observe a positive influence of D/EBITDA on productivity and sales growth. In the following, these results are discussed and placed in the context of prior studies, the theoretical background, and the hypotheses from section 2. Additionally, the findings are tested for robustness before discussing limiting factors and giving an outlook on potential future research.

5.1 Evaluation of results and review of hypotheses

The results of section 4.3 are consistent with Engel, Braun, and Achleitner (2012), as well as Guo, Hotchkiss, and Song (2011), confirming a positive relationship between the leverage ratio and EBITDA margin expected in hypothesis H1. At the same time, the negative relation found between the Debt to assets ratio and the EBITDA margin in sections 4.1 and 4.2 highlights an apparent meaningful difference rooted in the definition of profitability. Wald (1999), the study closest in variable definitions, finds a negative relation of D/A ratio and ROA yet while predicting leverage with profitability. Overall, the results suggest a positive effect on ROA when leveraging a firm more with regards to both their total assets and EBITDA, yet the inverse for the EBITDA margin when increasing debt with regards to its total assets. This leaves the evaluation of H1 contingent on the definition of profitability.

This difference in the sign of the relation of leverage with profitability margins and ROA could be due to conflicting consequences of leverage on different reference points, i.e., revenues and total assets. As Kaplan (1991) noted, asset sales often play a role in leveraged buyouts. Especially, larger leverage pressures could increase motivation to sell off assets, which could lead to a stronger post-deal decrease in total assets for higher-levered companies, allowing ROA to rise, even though the EBITDA margin could decline. Additionally, PE investors are usually

focused on EBITDA as a proxy for the cashflow a company produces (Sherman and Young 2016). Furthermore, EBITDA and EBITDA-based measures are commonly used for covenants in loan contracts, further shifting focus on the monitoring and improvement of this specific metric (Li 2016). Taken together, this could explain the difference in the ways of measuring profitability and favor the observed clarity of the relation between D/A and the EBITDA margin over the EBIT margin. An integrated rationale is formed later in this section.

Regarding productivity, the results of section 4 show a largely insignificant impact of the D/A ratio on productivity, although the coefficients are negative. Contrarily, the leverage ratio exhibits a very significant, positive, and sizeable effect on all three post-deal productivity measures. The results at hand only allow speculations about the difference in effect sign and significance similar to those made for the discussion on profitability regarding differing denominators and value ranges. Overall, the results suggest an increase in productivity with higher year 0 leverage, consistent with hypothesis H2 and most literature.

Taking together the results of section 4.1 and 4.2, the regressions suggest a considerable negative effect of leverage on revenue growth, especially stemming from short-term debt. This suggests that while the impact of long-term debt is unclear, short-term debt can significantly harm firm growth. A tendency towards higher interest rates in conjunction with pressure from the shorter time until repayment is due could force companies to create liquidity. Losing sight of growth or even being forced to downsize could be a plausible consequence. Notably, a very significant positive effect of the leverage ratio on revenue growth was found. Therefore, hypothesis 3.2 can be considered as contingent on the measure of debt, albeit with a negative impact of short-term debt. This is still in line with Boucly, Sraer, and Thesmar (2011) who argue that their results point towards GPs alleviating financing constraints, assuming that long-term rather than short-term debt serves to solve these underinvestment issues. The evidence does not allow for a conclusion on hypothesis H3.1.

To link the results, I propose a nuanced view of the two ways to measure leverage. I hypothesize that the effects of leverage are generally more positive in firms with a lower EBITDA to total assets ratio, building on the notion of “value” vs. “growth” firms of Brown, Harris, and Munday (2021). For example, at a fixed debt level, firms with high assets and low profitability margins could be able to service debt more easily through more profitability improvement potential and could have potentially cheaper, more collateralized debt. Overall, these “value” companies could have larger debt service safety margins and safer, although lower EBITDA. Contrarily, a relatively higher EBITDA and lower assets would mean higher D/A, yet lower D/EBITDA. Although the company’s cashflows could service the debt more easily, less collateral is available, meaning that the ability to repay debt is more contingent on uncertain future cashflows. In the case of lower-than-expected EBITDA, a high D/A ratio in these firms could shift managerial focus away from profitability and growth towards survival. Companies could be forced to sell assets to service debt, with potentially negative effects on the EBITDA margin and revenue growth. At the same time, ROA could improve through the reduction in total assets. I theorize that, since the sample solely includes private equity deals, the rationale above for growth firms explains the observed negative effect of leverage as D/A on EBITDA margins. While high D/EBITDA may signal a strong outlook for future cashflows, a high D/A may signal a weak balance sheet. Often, leverage is employed rather aggressively in PE buyouts and usually calculated with regards to EBITDA. The lower a company’s assets are compared to its EBITDA, the more vulnerable it is to financial distress and the subsequent loss of profitability based on revenues. Yet, it could increase the profitability of its potentially lower assets.

In summary, I find a negative relation of the D/A ratio with profitability margins and sales growth, while at the same time discovering a positive relation of the D/EBITDA ratio with productivity, ROA, and revenue growth. These differences could be explained by distinct firm reactions dependent on their EBITDA/A ratio, which relates the two leverage definitions.

5.2 Robustness

To further verify results, the same regressions were run again on a less restricted sample, additionally including add-on, public-to-private and PIPE deals, as well as firms that were involved in liquidation, previously listed firms and those with less than two years of post-deal data is available. For these regressions, shown in Appendix 6-8, the direction and size of the effect are similar, yet the significance of the coefficients is overall lower. Largely, the same conclusions from the reduced sample still apply in the full sample, though the coefficients for LTD on the EBITDA margin and STD on ROA become insignificant. A notable exception is the more significant effect of short-term debt on employment growth in the full sample, which is also observed for the leverage ratio. This could imply that these effects are more general PE-induced relationships that are not specifically present in buyouts, but across different deal types. Additionally, a subsample of the main sample used is constructed observing only relative year 3, i.e., three years after the deal. Only one observation per firm remains, allowing for a simpler interpretation. The regression results for the subsample, shown in Appendix 9-11, are again in line with the results from sections 4.1-4.3, although noticeable decreases in the significance of estimators can be noted. This is most likely due to the large decrease in the number of observations. Remarkably, the coefficient for the change in EBITDA margin remains very significant and negative for the D/A and LTD/A ratios.

When running the regressions on the broader sample, yet only on year 3 observations, the core findings persist again. The regression results are shown in Appendix 12-14, with a negative relation present between D/A and the EBITDA margin, especially for LTD, and a negative coefficient for STD/A on revenue growth. For D/EBITDA, a positive effect on VAPE and capital productivity remains. These results indicate that the effects are applicable to a broader set of PE deals, including prior ownership and more short-term biased observations.

Altering the degree of winsorization within the main sample used between 0%-5% did not change results unusually. When not winsorizing, coefficients and standard errors in the regression models generally increase, while significance decreases, as shown in Appendix 15-17. The most notable differences include increased significance and positive coefficients for D/A on productivity, mostly by LTD. The effects on profitability remain similar in size and across leverage definitions. The coefficients for D/EBITDA particularly see the smallest changes in their significance, though with most coefficients doubling in effect size.

For 5%-winsorization results remain very close to those of section 4, with overall higher statistical significance but slightly lower effect sizes. The only notable difference shown in Appendix 18-20 is again an increased significance in the effect of the D/A ratio, especially the LTD/A ratio, on VAPE and labor productivity. Therefore, it can be concluded that the results generally hold for different levels of winsorization.

5.3 Limitations

A number of different factors may affect the results of these analyses. Some biases may be present stemming from the sample construction. First, factors specific to Italy could distinguish the results from those for other countries. Second, the limitations and fluctuations in the availability of financial data are unknown and not realistically traceable. Third, bankruptcies could introduce significant skews into the data set yet are also not reliably detectable and controllable in the data set. Solely the 28 firms where the indication “In Liquidazione” was displayed were excluded. Fourth, some companies were possibly involved in further inorganic growth, either expanding through subsequent acquisitions they made or being acquired by others. Lastly, the distribution of data points across post-deal periods presented in Figure 1 could skew results to more prominently reflect short-term outcomes of leverage. Notably, some of the transaction types could exhibit different dynamics to the buyouts in focus here, although some indication of possible differences is given in section 5.2. Additionally, the composition

of industries included in the sample could differentiate these results from those in other countries and timeframes. Lastly, leverage could be placed on the company through special purpose vehicles (SPVs) that only exist to issue debt or other securities. It is possible that the latter are not detected and recorded by the sources used. However, the interest rates implied in the data suggest that at least 90% of observations appear very plausible without SPV debt.

5.4 Outlook

The better understanding of the different definitions of leverage is a key question opened up by the results of this thesis. These nuances could be further analyzed both with theoretical explanations and additional observational works. A focus could be on understanding the relation between D/A and $D/EBITDA$ through $EBITDA/A$ or even additional measures of leverage. Notably, although industry dummies often present significant coefficients in the results and could be a proxy for differences in EBITDA to total assets, the presented results are still observable and thus remain to be further examined.

Possible further analyses could also be conducted by testing for a higher-dimensional relation between leverage and the dependent variables, similar to Akhtar, et al. (2021). The authors detect an inverted U-shaped relationship, with leverage only harming growth and profitability after a certain optimal level. Alternatively, leverage levels could be divided into buckets and classified into low, moderate, and high, for example. This segmented analysis could also provide more nuanced insights into firm performance and its link to leverage. Similarly, the relationship between leverage and productivity could be further tested for thresholds, as Coricelli, et al. (2012) have done.

Furthermore, conducting similar regression analysis on larger data sets could reveal more generalizable conclusions. For example, appending PE deals from other countries in Europe or other continents, including secondary PE deals, or expanding the range of calendar years. As

Wald (1999) found significant differences between countries in the factors determining long-term debt to asset ratios, differentiated findings seem viable.

6 Conclusion

Using a sample of 295 first-time private equity backed buyouts of private Italian firms, I find a nuanced effect of leverage on post-buyout company performance. The deals between 2000 and 2019 are analyzed using a broad set of performance indicators and regression models separated in their definition of leverage. For the Debt to total assets ratio, I find a generally negative link with operating performance. Most notably, a negative relation with the EBITDA margin and revenue growth, especially linked to short-term debt, yet a positive relation with ROA, more linked to long-term debt. When defining leverage as the Debt over EBITDA ratio, a positive effect on firm performance is found, where particularly its positive influence on various productivity measures and revenue growth stands out. These results are robust to extended- and subsamples, including additional deal types, liquidations, and firms with shorter coverage periods, as well as changes in the degree of winsorization. For real-world applications of the results, this highlights the careful consideration of different leverage definitions and their implicit interrelation. Overall, the results suggest a positive effect of leverage on operational performance, the higher total assets yet lower EBITDA are compared to total debt.

The results confirm the conclusions of some studies with the same variable definitions, such as Guo, Hotchkiss, and Song (2011), yet disagree with findings on other, only similarly defined leverage notions, for example Abor (2005) and Gill, Bigger, and Mathur (2011).

This thesis contributes to existing literature by presenting different notions of leverage and their different relations with post-deal firm performance. It provides evidence to the ongoing debate on the effects of leverage, its understanding in the private equity context, and value creation in a new sample of buyouts from Europe. At the same time, further questions unfold about the nuanced effects of leverage in the private equity context.

References

- Abor, Joshua. 2005. "The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana." *The journal of risk finance* 6 (5): 438-445.
- Achleitner, Ann-Kristin, Reiner Braun, Nico Engel, Christian Figge, and Florian Tappeiner. 2010. "Value Creation Drivers in Private Equity Buyouts: Empirical Evidence from Europe." *The Journal of Private Equity* 13 (2): 14-27.
- Akhtar, Muhammad, Kong Yusheng, Muhammad Haris, Qurat Ul Ain, and Hafiz Mustansar Javaid. 2021. "Impact of financial leverage on sustainable growth, market performance, and profitability." *Economic Change and Restructuring* 737-774.
- Amess, Kevin, and Mike Wright. 2007b. "Barbarians at the Gate? Leveraged Buyouts, Private Equity and Jobs." doi:10.2139/ssrn.1034178.
- Amess, Kevin, and Mike Wright. 2007a. "The Wage and Employment Effects of Leveraged Buyouts in the UK." *International Journal of the Economics of Business* 14 (2): 179-195.
- Amess, Kevin, and Mike Wright. 2012. "Leveraged buyouts, private equity and jobs." *Small Business Economics* 38: 419-430.
- Asci, Ceylan Cemre. 2019. "Do Public-to-Private Leveraged Buyouts Result in Improved Operating Performance? Evidence from the United Kingdom." Master Thesis, Department of Finance and Tax, University of Cape Town. doi:http://hdl.handle.net/11427/31560.
- Axelson, Ulf, Per Strömberg, and Michael S. Weisbach. 2009. "Why Are Buyouts Levered? The Financial Structure of Private Equity Funds." *The Journal of Finance* 64: 1549-1582.

- Axelson, Ulf, Per Strömberg, Tim Jenkinson, and Michael S. Weisbach. 2009. "Leverage and pricing in buyouts: An empirical analysis." *EFA 2009 Bergen Meetings Paper*. 1-51. doi:10.2139/ssrn.1344023.
- Axelson, Ulf, Tim Jenkinson, Per Strömberg, and Michael S. Weisbach. 2013. "Borrow Cheap, Buy High? The Determinants of Leverage and Pricing in Buyouts." *The Journal of Finance* 68: 2223-2267.
- Boucly, Quentin, David Sraer, and David Thesmar. 2011. "Growth LBOs." *Journal of Financial Economics* 102 (2): 432-453.
- Brown, Greg, Robert Harris, and Shawn Munday. 2021. "Capital Structure and Leverage in Private Equity Buyouts." *Journal of Applied Corporate Finance* 33 (3): 42-58.
- Cohn, Jonathan B., Edith S. Hotchkiss, and Erin M. Towery. 2022. "Sources of Value Creation in Private Equity Buyouts of Private Firms." *Review of Finance* 26 (2): 257-285.
- Cohn, Jonathan B., Lillian F. Mills, and Erin M. Towery. 2014. "The evolution of capital structure and operating performance after leveraged buyouts: Evidence from U.S. corporate tax returns." *Journal of Financial Economics* 111 (2): 469-494.
- Coricelli, Fabrizio, Nigel Driffield, Sarmistha Pal, and Isabelle Roland. 2012. "When does leverage hurt productivity growth? A firm-level analysis." *Journal of International Money and Finance* 31 (6): 1674-1694.
- Davis, Steven J, John Haltiwanger, Kyle Handley, Ron Jarmin, Josh Lerner, and Javier Miranda. 2014. "Private equity, jobs, and productivity." *American Economic Review* 104 (12): 3956-3990.
- Eckbo, B. Espen, and Michael Kisser. 2021. "The Leverage–Profitability Puzzle Resurrected." *Review of Finance* 25 (4): 1089-1128.
- Engel, Nico, Reiner Braun, and Ann-Kristin Achleitner. 2012. "Leverage and the performance of buyouts." *Zeitschrift für Betriebswirtschaft* 82: 451-490.

- Gill, Amarjit, Nahum Biger, and Neil Mathur. 2011. "The Effect of Capital Structure on Profitability: Evidence from the United States." *International Journal of Management* 28 (4): 3-15.
- Guo, Shouron, Edith S. Hotchkiss, and Weihong Song. 2011. "Do Buyouts (Still) Create Value?" *The Journal of Finance* 66 (2): 479-517.
- Hæstad, Theodor. 2022. "Leverage Buyout - Success or failure? Investigating the impact of excessive leverage on operating efficiency for US. companies." Master Thesis, Department of Finance, Norwegian School Of Economics.
- Jang, Soocheong (Shawn), and Kwangmin Park. 2011. "Inter-relationship between firm growth and profitability." *International Journal of Hospitality Management* 30 (4): 1027-1035.
- Jensen, Michael C. 1986. "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." *The American Economic Review* 76: 323-329.
- Jensen, Michael C. 1989. "Eclipse of the public corporation." *Harvard Business Review*. <https://hbr.org/1989/09/eclipse-of-the-public-corporation>.
- Kalantonis, Petros, Christos Kallandranis, and Marios Sotiropoulos. 2021. "Leverage and firm performance: new evidence on the role of economic sentiment using accounting information." *Journal of Capital Markets Studies* 5 (1): 96-107.
- Kaplan, Steven N. 1989. "The effect of managements buyouts on operating performance and value." *Journal of financial economics* 24 (2): 217-254.
- Kaplan, Steven N. 1991. "The staying power of leveraged buyouts." *Journal of Financial Economics* 29 (2): 287-313.
- Kaplan, Steven N., and Per Strömberg. 2009. "Leveraged Buyouts and Private Equity." *Journal of Economic Perspectives* 23: 121-146.
- Lang, Larry, Eli Ofek, and René M. Stulz. 1996. "Leverage, investment, and firm growth." *Journal of Financial Economics* 40 (1): 3-29.

- Li, Ningzhong. 2016. "Performance Measures in Earnings-Based Financial Covenants in Debt Contracts." *Journal of Accounting Research* 54: 1149-1186.
- Lichtenberg, Frank R., and Donald Siegel. 1990. "The effects of leveraged buyouts on productivity and related aspects of firm behavior." *Journal of financial economics* 27 (1): 165-194.
- Liu, Chen. 2014. "Debt Structure, Private Equity Reputation, and Performance in Leveraged Buyouts." doi:<http://dx.doi.org/10.2139/ssrn.2312150>.
- Mello, Antonio S., and John E. Parsons. 1992. "Measuring the Agency Cost of Debt." *The Journal of Finance* 47: 1887-1904.
- Mendell, Brooks C., Tymur Sydor, and Neena Mishra. 2006. "Capital structure in the United States forest products industry: The influence of debt and taxes." *Forest Science* 52 (5): 540-548.
- Modigliani, Franco, and Merton H. Miller. 1963. "Corporate Income Taxes and the Cost of Capital: A Correction." *The American Economic Review* 53: 433-443.
- Modigliani, Franco, and Merton H. Miller. 1958. "The Cost of Capital, Corporation Finance and the Theory of Investment." *The American Economic Review* 48: 261-297.
- Myers, Stewart C. 2001. "Capital Structure." *Journal of Economic Perspectives* 15 (2): 81-102.
- Opler, Tim C. 1992. "Operating performance in leveraged buyouts: Evidence from 1985-1989." *Financial Management* 27-34.
- Orlova, Svetlana, and Grant Harper. 2022. "National culture and leverage adjustments." *Review of Behavioral Finance* 14 (3): 410-435.
- Ramezani, Cyrus A., Luc Soenen, and Alan Jung. 2002. "Growth, Corporate Profitability, and Value Creation." *Financial Analysts Journal* 58 (6): 56-67.

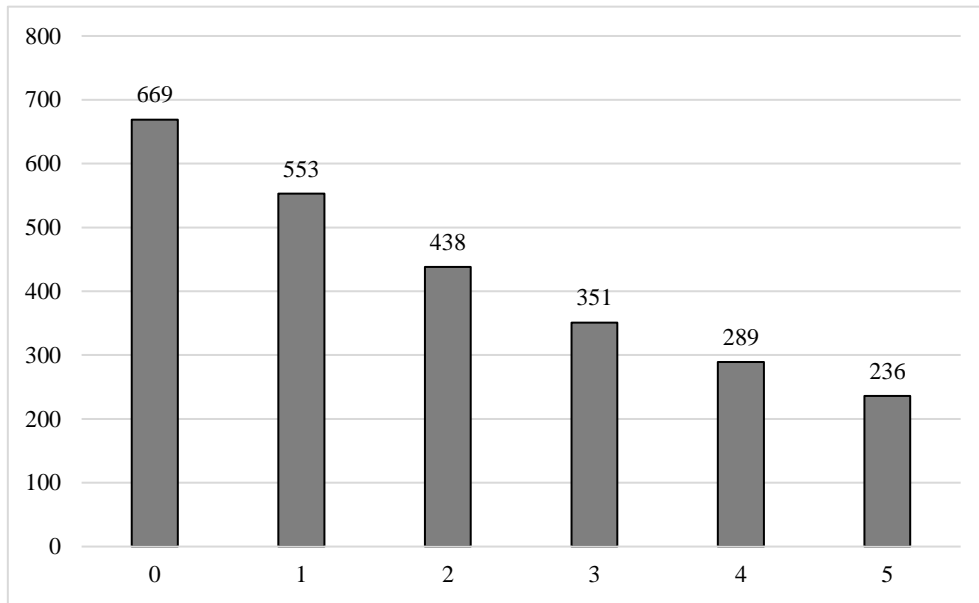
- Rizzi, Joseph V. 2016. "The Capital Structure of PE-Funded Companies (and How New Debt Instruments and Investors Are Expanding Their Debt Capacity)." *Journal of Applied Corporate Finance* 28 (4): 60-67.
- Roden, Dianne M., and Wilbur G. Lewellen. 1995. "Corporate capital structure decisions: evidence from leveraged buyouts." *Financial Management* 24 (2): 76-87.
- Sherman, H. David, and S. David Young. 2016. "Where financial reporting still falls short." *Harvard business review* 94 (7). <https://hbr.org/2016/07/where-financial-reporting-still-falls-short>.
- Shourun, Guo, Edie S. Hotchkiss, and Weihong Song. 2008. "Do Buyouts (Still) Create Value?" *The Journal of Finance* (66): 479-517.
- Smith, Abbie J. 1990. "Corporate ownership structure and performance: The case of management buyouts." *Journal of financial Economics* 27 (1): 143-164.
- Wald, John K. 1999. "How firm characteristics affect capital structure: an international comparison." *Journal of Financial research* 22 (2): 161-187.
- Wiersema, Margarethe F., and Julia Porter Liebeskind. 1995. "The effects of leveraged buyouts on corporate growth and diversification in large firms." *Strategic Management Journal* 16 (6): 447-460.
- Wright, Mike, Kevin Amess, Charlie Weir, and Sourafel Girma. 2009. "Private Equity and Corporate Governance: Retrospect and Prospect." *Corporate Governance: An International Review* 17 (3): 353-375.

Appendix

Appendix 1: Definition of variables

Variable	Definition
D/A	The book value of total debt (long-term debt plus short-term debt) divided by the book value of total assets, both values of relative year 0
LTD/A	The book value of long-term debt divided by the book value of total assets, both values of relative year 0
STD/A	The book value of short-term debt divided by the book value of total assets, both values of relative year 0
D/EBITDA	The book value of total debt (long-term debt plus short-term debt) divided by EBITDA (Earnings before interest, tax, depreciation and amortization), both values of relative year 0
Δ EBITDA margin	The absolute change in EBITDA margin (EBITDA / revenues) between the observation year and relative year 0 of a given firm
Δ EBIT margin	The absolute change in EBIT margin (Earnings before interest and tax / revenues) between the observation year and relative year 0 of a given firm
Δ ROA	The absolute change in return on assets (Earnings before interest and tax / average total assets of the current and prior year) between the observation year and relative year 0 of a given firm
Δ Labor productivity	The relative change between the observation year and relative year 0 for labor productivity (Revenues / average number of employees of the current and prior year)
Δ VAPE	The relative change between the observation year and relative year 0 for the value-added per employee (EBIT + costs of employees / average number of employees of the current and prior year)
Δ Capital productivity	The relative change between the observation year and relative year 0 for the asset turnover (revenues / average fixed tangible assets of the current and prior year)
Δ Revenue	The relative change between the observation year and relative year 0 for revenues
Δ Employees	The relative change between the observation year and relative year 0 for the number of employees
$\ln(\text{revenue})$	The natural logarithm of revenues of the current period
Revenue growth	The current year revenue divided by the prior year revenue minus 1
EBITDA margin	The current period's EBITDA / revenues

Appendix 2: Distribution of data points across relative post-deal periods, prior to filtering



Appendix 3: Descriptive statistics of regression variables, unwinsorized

	N	Mean	St. Dev	Pctl(25)	Median	Pctl(75)
D/A	1867	0.195	0.176	0.021	0.159	0.343
LTD/A	1867	0.105	0.137	0.000	0.043	0.162
STD/A	1867	0.090	0.109	0.004	0.048	0.136
D/EBITDA	1867	3.571	21.549	0.003	1.022	3.581
Δ EBITDA margin	1867	0.033	2.859	-0.048	-0.005	0.035
Δ EBIT margin	1867	-0.001	3.032	-0.073	-0.015	0.028
Δ ROA	1867	-0.043	0.277	-0.081	-0.023	0.021
Δ Labor productivity	1799	0.134	3.502	-231.000	-0.050	0.136
Δ VAPE	1799	0.073	7.232	-0.368	-0.075	0.186
Δ Capital productivity	1837	0.145	1.178	-0.352	-0.041	0.290
Δ Revenue	1867	0.417	5.321	-0.103	0.089	0.328
Δ Employees	1812	0.540	3.837	-0.019	0.089	0.350
Revenue	1867	63,292,124	140,232,958	10,698,275	24,892,000	55,680,362
Revenue growth	1857	0.218	5.174	-0.090	0.031	0.144
EBITDA margin	1859	0.047	0.807	0.04	0.095	0.167

Appendix 4: Descriptive statistics for year 0 leverage

	N	Mean	St. Dev	Pctl(25)	Median	Pctl(75)
D/A	295	0.215	0.175	0.035	0.193	0.362
LTD/A	295	0.122	0.143	0.000	0.067	0.193
STD/A	295	0.093	0.104	0.013	0.056	0.145
D/EBITDA	295	4.71x	24.11x	0.07x	1.58x	4.14x

Appendix 5: Pearson's correlation matrix for regression variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) D/A year 0	1.000													
(2) LTD/A year 0	0.868	1.000												
(3) STD/A year 0	0.540	0.672	1.000											
(4) D/EBITDA year 0	0.209	0.246	0.202	1.000										
(5) Δ EBITDA margin	0.385	0.402	0.253	0.382	1.000									
(6) Δ EBIT margin	0.126	0.155	0.054	0.219	0.381	1.000								
(7) Δ ROA	0.335	0.330	0.169	0.299	0.500	0.273	1.000							
(8) Δ Labor productivity (rel.)	0.022	0.039	0.036	0.078	-0.166	-0.025	0.534	1.000						
(9) Δ VAPE (rel.)	-0.087	-0.042	0.051	0.020	-0.047	-0.022	-0.033	0.010	1.000					
(10) Δ Capital productivity (rel.)	-0.022	-0.001	0.071	0.027	-0.024	-0.005	0.057	0.057	0.786	1.000				
(11) Δ Revenue (rel.)	-0.115	-0.067	-0.004	-0.001	-0.044	-0.032	-0.124	-0.057	0.645	0.037	1.000			
(12) Δ Employees (rel.)	-0.053	-0.040	0.012	0.128	0.107	0.059	0.091	0.065	0.215	0.211	0.086	1.000		
(13) ln(revenue)	0.338	0.335	0.184	0.154	0.063	0.000	0.063	0.000	0.033	0.095	-0.063	-0.021	1.000	
(14) EBITDA margin	0.054	0.071	0.018	0.076	0.100	-0.019	0.176	0.108	0.192	0.186	0.080	0.071	0.273	1.000

Note: Values >0.5 or <-0.5 are marked as bold

Appendix 6: Regression output for models estimating firm performance using the total debt to assets ratio on the expanded sample

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.061** (0.024)	-0.014 (0.029)	0.059*** (0.021)	-0.093 (0.059)	0.151 (0.201)	-0.027 (0.137)	-0.301*** (0.102)	-0.135 (0.135)
log(revenue)	0.005* (0.003)	0.008** (0.004)	0.001 (0.003)	0.030*** (0.008)	0.039 (0.027)	-0.023 (0.018)	0.070*** (0.013)	0.053*** (0.018)
revenue growth	0.011*** (0.004)	0.012*** (0.005)	0.002 (0.003)	0.097*** (0.009)	0.363*** (0.030)	0.126*** (0.020)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.051* (0.028)	0.381*** (0.095)	0.055 (0.062)	-0.011 (0.048)	-0.044 (0.064)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal type FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1823	1823	1823	1793	1793	1832	1817	1777
R2 Adj.	0.082	0.106	0.020	0.084	0.089	0.023	0.054	0.021

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 7: Regression output for models estimating firm performance using the split long-term and short-term debt to assets ratios on the expanded sample

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.019 (0.033)	0.023 (0.037)	0.092*** (0.027)	-0.067 (0.076)	0.131 (0.258)	0.026 (0.174)	0.136 (0.131)	0.147 (0.173)
STD/A	-0.124* (0.067)	-0.069 (0.046)	0.012 (0.033)	-0.125 (0.095)	0.191 (0.322)	-0.122 (0.220)	-0.955*** (0.161)	-0.599*** (0.216)
log(revenue)	0.005 (0.007)	0.007** (0.004)	0.001 (0.003)	0.030*** (0.008)	0.039 (0.027)	-0.023 (0.018)	0.068*** (0.013)	0.051*** (0.018)
revenue growth	0.010* (0.005)	0.012** (0.005)	0.002 (0.003)	0.097*** (0.009)	0.363*** (0.030)	0.125*** (0.020)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.050* (0.028)	0.381*** (0.095)	0.053 (0.062)	-0.021 (0.048)	-0.05 (0.064)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal type FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1823	1823	1823	1793	1793	1832	1817	1777
R2 Adj.	0.084	0.107	0.022	0.083	0.088	0.022	0.068	0.025

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 8: Regression output for models estimating firm performance using the total debt to EBITDA ratio on the expanded sample

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	-0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.003*** (0.001)	0.017*** (0.004)	0.008*** (0.002)	0.006*** (0.002)	0.005** (0.002)
log(revenue)	0.004 (0.007)	0.007** (0.004)	0.002 (0.003)	0.028*** (0.008)	0.039 (0.026)	-0.026 (0.018)	0.066*** (0.013)	0.051*** (0.018)
revenue growth	0.011** (0.006)	0.012*** (0.005)	0.001 (0.003)	0.095*** (0.009)	0.348*** (0.030)	0.119*** (0.020)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.051* (0.028)	0.391*** (0.094)	0.057 (0.062)	-0.021 (0.048)	-0.047 (0.064)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal type FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1823	1823	1823	1793	1793	1832	1817	1777
R2 Adj.	0.080	0.106	0.017	0.088	0.100	0.029	0.057	0.023

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 9: Regression output for models estimating firm performance using the total debt to assets ratio on the reduced single year sample for relative post-deal year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.135*** (0.039)	-0.073 (0.066)	0.051 (0.045)	-0.196 (0.174)	-0.411 (0.433)	-0.163 (0.312)	-0.362 (0.359)	-0.091 (0.616)
log(revenue)	-0.012 (0.009)	-0.006 (0.009)	-0.001 (0.006)	0.015 (0.024)	0.031 (0.060)	-0.070* (0.042)	0.004 (0.049)	-0.037 (0.087)
revenue growth	0.012* (0.006)	0.013 (0.009)	0.001 (0.006)	0.031 (0.025)	0.441*** (0.061)	-0.008 (0.044)		
VAPE	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)				0.000** (0.000)	0.000 (0.000)
EBITDA margin				-0.191 (0.187)	-0.361 (0.466)	0.662** (0.291)	-1.361*** (0.394)	-0.69 (0.741)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	243	243	243	238	238	243	242	237
R2 Adj.	0.020	-0.008	-0.061	-0.057	0.146	-0.001	0.021	-0.036

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 10: Regression output for models estimating firm performance using the split long-term and short-term debt to assets ratio on the reduced single year sample for relative year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.128*** (0.025)	-0.079 (0.081)	0.043 (0.055)	-0.270 (0.212)	-0.719 (0.528)	-0.219 (0.382)	0.191 (0.440)	0.000 (0.760)
STD/A	-0.153* (0.082)	-0.063 (0.111)	0.075 (0.075)	-0.019 (0.296)	0.255 (0.737)	0.010 (0.515)	-1.392*** (0.590)	-0.320 (1.052)
log(revenue)	-0.012 (0.009)	-0.006 (0.009)	-0.001 (0.006)	0.013 (0.024)	0.025 (0.060)	-0.072* (0.042)	0.01 (0.049)	-0.036 (0.087)
revenue growth	0.012* (0.006)	0.013 (0.009)	0.001 (0.006)	0.031 (0.025)	0.441*** (0.061)	-0.008 (0.044)		
VAPE	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)				0.000*** (0.000)	0.000 (0.000)
EBITDA margin				-0.180 (0.188)	-0.320 (0.468)	0.674** (0.294)	-1.474*** (0.394)	-0.712 (0.748)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	243	243	243	238	238	243	242	237
R2 Adj.	0.016	-0.013	-0.065	-0.06	0.147	-0.006	0.038	-0.041

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 11: Regression output for models estimating firm performance using the total debt to EBITDA ratio on the reduced single year sample for relative post-deal year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	-0.002* (0.001)	-0.001 (0.002)	0.000 (0.001)	0.007* (0.004)	0.024** (0.010)	0.010 (0.008)	0.010 (0.009)	0.004 (0.015)
log(revenue)	-0.014 (0.009)	-0.007 (0.009)	0.000 (0.006)	0.011 (0.024)	0.021 (0.059)	-0.074* (0.041)	-0.004 (0.049)	-0.039 (0.087)
revenue growth	0.013** (0.006)	0.013 (0.009)	0.000 (0.006)	0.038 (0.024)	0.459*** (0.060)	-0.001 (0.044)		
VAPE	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)				0.000*** (0.000)	0.000 (0.000)
EBITDA margin				-0.189 (0.186)	-0.338 (0.461)	0.663** (0.290)	-1.420*** (0.391)	-0.701 (0.737)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	243	243	243	238	238	243	242	237
R2 Adj.	-0.003	-0.010	-0.067	-0.050	0.164	0.005	0.022	-0.036

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 12: Regression output for models estimating firm performance using the total debt to assets ratio on the expanded single year sample for relative post-deal year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.129** (0.052)	-0.070 (0.068)	0.004 (0.054)	-0.198 (0.140)	-0.389 (0.458)	0.046 (0.256)	-0.394 (0.271)	0.044 (0.357)
log(revenue)	-0.003 (0.011)	-0.003 (0.008)	-0.004 (0.007)	0.033* (0.018)	-0.032 (0.058)	-0.005 (0.032)	0.033 (0.034)	-0.005 (0.047)
revenue growth	0.013* (0.008)	0.014 (0.011)	0.001 (0.009)	0.045** (0.023)	0.506*** (0.075)	-0.004 (0.042)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000*** (0.000)	0.000 (0.000)
EBITDA margin				0.036 (0.119)	1.100*** (0.391)	0.216 (0.201)	-0.692*** (0.256)	-0.233 (0.355)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	340	340	340	334	334	341	339	330
R2 Adj.	0.049	0.096	-0.011	-0.019	0.090	-0.050	0.021	-0.049

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 13: Regression output for models estimating firm performance using the long-term and short-term debt to assets ratios on the expanded single year sample for relative year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.076*** (0.025)	-0.018 (0.089)	0.047 (0.071)	-0.246 (0.183)	-0.696 (0.601)	-0.005 (0.333)	0.184 (0.354)	0.457 (0.469)
STD/A	-0.200* (0.116)	-0.136 (0.105)	-0.051 (0.084)	-0.118 (0.222)	0.076 (0.728)	0.148 (0.406)	-1.199*** (0.420)	-0.573 (0.568)
log(revenue)	-0.003 (0.012)	-0.003 (0.008)	-0.004 (0.007)	0.033* (0.018)	-0.033 (0.058)	-0.006 (0.032)	0.032 (0.034)	-0.006 (0.046)
revenue growth	0.013* (0.007)	0.014 (0.011)	0.001 (0.009)	0.045** (0.023)	0.507*** (0.075)	-0.004 (0.042)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000*** (0.000)	0.000 (0.000)
EBITDA margin				0.046 (0.121)	1.153*** (0.396)	0.227 (0.205)	-0.800*** (0.258)	-0.328 (0.361)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	340	340	340	334	334	341	339	330
R2	0.050	0.095	-0.011	-0.022	0.089	-0.053	0.037	-0.046

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 14: Regression output for models estimating firm performance using the total debt to EBITDA ratio on the expanded single year sample for relative post-deal year 3

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.004 (0.003)	0.022** (0.009)	0.011** (0.005)	0.005 (0.005)	0.007 (0.007)
log(revenue)	-0.005 (0.011)	-0.004 (0.008)	-0.004 (0.007)	0.028 (0.018)	-0.046 (0.057)	-0.008 (0.031)	0.024 (0.034)	-0.006 (0.046)
revenue growth	0.014* (0.007)	0.014 (0.011)	0.001 (0.009)	0.049** (0.023)	0.519*** (0.074)	-0.001 (0.042)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000*** (0.000)	0.000 (0.000)
EBITDA margin				0.057 (0.119)	1.187*** (0.388)	0.24 (0.199)	-0.678*** (0.257)	-0.223 (0.354)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	340	340	340	334	334	341	339	330
R2 Adj.	0.034	0.096	-0.007	-0.019	0.107	-0.031	0.018	-0.046

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 15: Regression output for models estimating firm performance using the total debt to assets ratio on the main sample, unwinsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.069 (0.066)	-0.040 (0.077)	0.117** (0.046)	0.845* (0.493)	2.014** (1.010)	-0.356* (0.208)	-0.413 (0.358)	-0.784 (0.840)
log(revenue)	0.015* (0.009)	0.008 (0.010)	0.001 (0.006)	0.07 (0.069)	0.198 (0.142)	-0.095*** (0.028)	0.091* (0.048)	0.121 (0.119)
revenue growth	0.008 (0.009)	0.011 (0.011)	-0.024*** (0.006)	2.462*** (0.063)	4.734*** (0.130)	0.136*** (0.027)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				-0.599*** (0.220)	3.191*** (0.451)	0.078 (0.090)	-0.145 (0.158)	-0.060 (0.373)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.070	0.045	0.114	0.556	0.547	0.053	-0.016	-0.019

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 16: Regression output for models estimating firm performance using the long-term and short-term debt to assets ratio on the main sample, unwinsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.102** (0.051)	-0.073 (0.093)	0.082 (0.056)	1.135* (0.597)	2.233* (1.222)	-0.283 (0.250)	0.676 (0.431)	-0.909 (1.018)
STD/A	-0.004 (0.125)	0.022 (0.128)	0.185** (0.077)	0.262 (0.835)	1.575 (1.710)	-0.498 (0.343)	-2.499*** (0.587)	-0.536 (1.413)
log(revenue)	0.015 (0.031)	0.007 (0.010)	0.001 (0.006)	0.072 (0.069)	0.199 (0.142)	-0.094*** (0.028)	0.097** (0.048)	0.121 (0.119)
revenue growth	0.008 (0.009)	0.011 (0.011)	-0.024*** (0.006)	2.459*** (0.064)	4.732*** (0.130)	0.135*** (0.027)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				-0.604*** (0.220)	3.188*** (0.451)	0.075 (0.090)	-0.155 (0.157)	-0.059 (0.373)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2	0.070	0.045	0.114	0.556	0.546	0.053	0.000	-0.020

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 17: Regression output for models estimating firm performance using the total debt to EBITDA ratio on the main sample, unwinsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)	0.028*** (0.004)	0.045*** (0.009)	0.003* (0.002)	0.029*** (0.003)	-0.005 (0.007)
log(revenue)	0.013 (0.009)	0.007 (0.010)	0.003 (0.006)	0.079 (0.068)	0.221 (0.140)	-0.101*** (0.027)	0.078* (0.046)	0.112 (0.118)
revenue growth	0.008 (0.009)	0.011 (0.011)	-0.026*** (0.007)	2.418*** (0.063)	4.659*** (0.129)	0.134*** (0.027)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				-0.566*** (0.216)	3.259*** (0.446)	0.070 (0.090)	-0.162 (0.152)	-0.082 (0.372)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.069	0.045	0.109	0.572	0.556	0.053	0.058	-0.019

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 18: Regression output for models estimating firm performance using the total debt to assets ratio on the main sample, 5%-winsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/A	-0.074*** (0.016)	-0.018 (0.021)	0.081*** (0.018)	-0.135** (0.065)	-0.162 (0.123)	-0.081 (0.124)	-0.235** (0.115)	0.019 (0.157)
log(revenue)	0.001 (0.002)	0.005** (0.003)	0.006** (0.002)	0.012 (0.009)	0.046*** (0.017)	-0.042** (0.016)	0.037** (0.015)	0.039* (0.022)
revenue growth	0.005** (0.002)	0.006** (0.003)	0.001 (0.003)	0.050*** (0.008)	0.119*** (0.016)	0.042*** (0.016)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.038 (0.029)	0.175*** (0.054)	0.108** (0.053)	0.000 (0.050)	0.028 (0.068)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.069	0.07	0.039	0.033	0.072	0.016	0.045	0.003

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 19: Regression output for models estimating firm performance using the long-term and short-term debt to assets ratio on the main sample, 5%-winsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
LTD/A	-0.073*** (0.023)	-0.03 (0.025)	0.082*** (0.022)	-0.153* (0.079)	-0.355** (0.149)	-0.122 (0.151)	0.091 (0.139)	0.253 (0.191)
STD/A	-0.084** (0.038)	0.000 (0.036)	0.086*** (0.032)	-0.084 (0.115)	0.273 (0.217)	0.031 (0.216)	-0.889*** (0.198)	-0.522* (0.275)
log(revenue)	0.001 (0.006)	0.005** (0.003)	0.006** (0.002)	0.012 (0.009)	0.044*** (0.017)	-0.043*** (0.016)	0.039** (0.015)	0.041* (0.022)
revenue growth	0.005 (0.004)	0.006** (0.003)	0.001 (0.003)	0.050*** (0.008)	0.121*** (0.016)	0.042*** (0.016)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.038 (0.029)	0.179*** (0.054)	0.110** (0.053)	-0.005 (0.049)	0.026 (0.068)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.069	0.069	0.039	0.032	0.076	0.015	0.058	0.007

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 20: Regression output for models estimating firm performance using the total debt to EBITDA ratio on the main sample, 5%-winsorized

Term	<i>Dependent variable:</i>							
	Δ EBITDA mg.	Δ EBIT mg.	Δ ROA	Δ Labor prod.	Δ VAPE	Δ Capital prod.	Δ Revenues	Δ Employees
D/EBITDA	-0.001 (0.001)	0.001 (0.001)	0.004*** (0.001)	0.009*** (0.002)	0.017*** (0.005)	0.017*** (0.005)	0.003 (0.004)	0.000 (0.006)
log(revenue)	0.000 (0.002)	0.005* (0.003)	0.006** (0.002)	0.008 (0.009)	0.039** (0.017)	-0.049*** (0.016)	0.032** (0.015)	0.040* (0.022)
revenue growth	0.006** (0.002)	0.006* (0.003)	0 (0.003)	0.049*** (0.008)	0.117*** (0.015)	0.039** (0.016)		
VAPE	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)				0.000 (0.000)	0.000 (0.000)
EBITDA margin				0.034 (0.028)	0.170*** (0.054)	0.104** (0.053)	-0.008 (0.050)	0.029 (0.068)
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes
Deal year FE	yes	yes	yes	yes	yes	yes	yes	yes
Num.Obs.	1206	1206	1206	1183	1183	1211	1202	1180
R2 Adj.	0.054	0.070	0.046	0.041	0.081	0.026	0.042	0.003

Note: *p<0.1; **p<0.05; ***p<0.01