Lisbon School of Economics & Management
Universidade de Lisboa

MASTER

MASTER'S IN FINANCE

MASTER´S FINAL WORK

DISSERTATION

FIRM-LEVEL DETERMINANTS OF EV/SALES AND EV/EBITDA VALUATION MULTIPLES IN EUROPEAN LISTED TECHNOLOGY, MEDIA AND TELECOMMUNICATIONS COMPANIES

FELIX WIESE

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SUPERVISION:
PEDRO RINO VIEIRA

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Glossary

CAGR – Compound Annual Growth Rate.

Capex – Capital Expenditures.

COVID-19 – Coronavirus Disease 2019.

DCF – Discounted Cash Flow.

EBIT – Earnings Before Interest and Taxes.

EBITDA – Earnings Before Interest, Taxes, Depreciation and Amortization.

EMH – Efficient Market Hypothesis.

EUR – Euro.

EV/EBIT – Enterprise Value to Earnings Before Interest and Taxes.

EV/EBITDA – Enterprise Value to Earnings Before Interest, Taxes, Depreciation and Amortization.

EV/Sales – Enterprise Value to Sales.

M&A – Mergers and Acquisitions.

OLS – Ordinary Least Squares.

P/E – Price to Earnings.

R&D – Research and Development.

R^2 – R-squared / Coefficient of Determination.

ROA – Return on Assets.

SG&A – Selling, General, and Administrative Expenses.

SIC – Standard Industrial Classification.

TMT – Technology, Media and Telecommunications.

U.S. – United States.

USD – United States Dollar.

VIF – Variance Inflation Factor.

ABSTRACT

This dissertation studies the firm-level characteristics that explain the EV/Sales and EV/EBITDA valuation multiples of European listed companies in the Technology, Media and Telecommunications sectors. Even though enterprise-value multiples are widely used, they are theoretically incomplete, as the two multiples are linked by the identity EV/Sales = EBITDA margin × EV/EBITDA, meaning that profitability is mechanically embedded in the revenue multiple. The study is based on an unbalanced panel from the Bloomberg Equity Screener, comprising the constituents of the three STOXX Europe Total Market sector indices from 2010 to 2025. The study focuses on the natural logarithms of EV/Sales and EV/EBITDA as dependent variables, which are explained by profitability, revenue growth, risk, and intangible investment, along with subsector, country, and year fixed effects, with firm-clustered standard errors. Economic factors are isolated from mere definition by decomposing the EBITDA-margin coefficient using the identity that links the two multiples. The EBITDA margin is the main correlate of EV/Sales, but it is quite mechanical. The total association is attributed 132.6% to the mechanical part and minus 32.6% to the residual economic part, which is a conservative bound consistent with zero, so no positive economic premium for the margin can be established beyond the mechanical link. Revenue growth is well correlated with both multiples, but the correlation is stronger when growth is based on the trailing three-year rate. R&D intensity is positively correlated with both multiples, although its association with EV/EBITDA partly reflects a depressed denominator rather than a high value driver. The effective tax rate is negatively correlated with EV/Sales but not with EV/EBITDA, and leverage and stock-return volatility do not display the expected negative association. The determinants of the two multiples differ in strength and economic significance, and the link between profitability and the revenue multiple is more mechanical than it appears.

KEYWORDS: Relative valuation; Enterprise-value multiples; Technology, Media and Telecommunications; Panel data; European equity markets.

JEL CODES: G12; G32; M41; C23; L86; L96.

RESUMO

Esta dissertação estuda as características das empresas que explicam os múltiplos de avaliação EV/Sales e EV/EBITDA das empresas europeias cotadas dos setores da Tecnologia, Media e Telecomunicações. Embora os múltiplos baseados no valor da empresa sejam amplamente utilizados, são teoricamente incompletos, uma vez que os dois múltiplos estão relacionados pela identidade EV/Sales = margem EBITDA × EV/EBITDA, o que significa que a rendibilidade está mecanicamente incorporada no múltiplo das vendas. O estudo baseia-se num painel não equilibrado, obtido através do Bloomberg Equity Screener, constituído pelas empresas que integram os três índices setoriais STOXX Europe Total Market entre 2010 e 2025. O estudo utiliza os logaritmos naturais do EV/Sales e do EV/EBITDA como variáveis dependentes, explicadas pela rendibilidade, pelo crescimento das vendas, pelo risco e pelo investimento em ativos intangíveis. Os fatores económicos são separados dos que decorrem da mera definição dos múltiplos através da decomposição do coeficiente da margem EBITDA, recorrendo à identidade que relaciona os dois múltiplos. A margem EBITDA apresenta a correlação mais forte com o EV/Sales, embora esta seja, em grande medida, de natureza mecânica. Da correlação total, 132,6% é atribuível à componente mecânica e menos 32,6% à componente económica residual, o que constitui um limite conservador compatível com zero. Assim, não é possível estabelecer a existência de um prémio económico positivo associado à margem EBITDA para além da relação mecânica. O crescimento das vendas apresenta uma correlação positiva com ambos os múltiplos, sendo esta mais forte quando o crescimento é medido com base na taxa dos três anos anteriores. A intensidade de I&D está positivamente correlacionada com ambos os múltiplos, embora a sua correlação com o EV/EBITDA reflita, em parte, um denominador reduzido e não um fator de valorização elevado. A taxa efetiva de imposto está negativamente correlacionada com o EV/Sales, mas não com o EV/EBITDA, enquanto o endividamento e a volatilidade da rendibilidade das ações não apresentam a correlação negativa esperada. Os determinantes dos dois múltiplos diferem na intensidade e na relevância económica, e a relação entre a rendibilidade e o múltiplo das vendas é mais mecânica do que aparenta.

Palavras-chave: Avaliação relativa; Múltiplos de enterprise value; Tecnologia, Média e Telecomunicações; Dados em painel; Mercados acionistas europeus.

Códigos JEL: G12; G32; M41; C23; L86; L96.

TABLE OF CONTENTS

LIST OF TABLES

Acknowledgments

I would like to thank my supervisor, Pedro Rino Vieira, for the guidance and feedback throughout this dissertation. I am also grateful to my family for their support throughout my academic and professional career.

1. Introduction

Valuation is central to corporate finance, investment analysis, and mergers and acquisitions (M&A) (Damodaran, 2007). Although discounted cash flow (DCF) analysis is, in theory, the most comprehensive method, practitioners make extensive use of relative valuation based on market multiples. Damodaran (2007), for instance, reports that nearly ninety percent of equity research valuations and around half of acquisition valuations use some combination of multiples and comparable companies. Shaffer (2024) examines 13,019 advisor valuation multiples from 2,300 unique merger and acquisition deals. Accounting multiples appear in all merger-filing fairness opinions (Bartell & Janssen, 2017). The findings indicate that accounting multiples are a key valuation method. Of particular importance are enterprise-value multiples, which constitute about sixty percent of the multiples used. Specifically, earnings before interest, taxes, depreciation and amortization (EBITDA) is the most common value driver, accounting for 32.01%, while revenue multiples are the third most common at 22.44% (Shaffer, 2024). Although this evidence comes solely from mergers and acquisitions, it shows how heavily practitioners rely on revenue- and EBITDA-based enterprise multiples. Multiples are favored because they rely on fewer assumptions that must be stated explicitly and are simpler to communicate than a full DCF model. This simplicity, however, has a downside. When differences in growth, risk, and cash-flow potential are ignored, the resulting estimates can become inconsistent (Damodaran, 2007).

Multiples come in many forms, but enterprise value to sales (EV/Sales) and enterprise value to earnings before interest, taxes, depreciation and amortization (EV/EBITDA) are two of the most important enterprise-value multiples. They are particularly central to the valuation of European listed Technology, Media and Telecommunications (TMT) firms, where revenue and operating profitability often diverge widely across business models. The advantage of EV/Sales is that it relies on a measure that is typically positive, less volatile than earnings, and largely insensitive to accounting choices such as depreciation and amortization, research and development (R&D), and extraordinary items, which makes it suitable for young or temporarily loss-making firms (Damodaran, 2007). EV/EBITDA, in turn, reflects operating performance before the effects of financing and depreciation and amortization accounting, which improves comparability among companies with different capital structures or asset bases (Fazzini, 2018); it is also widely used in capital-intensive industries such as cable and telecommunications (Damodaran, 2007; Fazzini, 2018). Nevertheless, both multiples are theoretically incomplete. EV/Sales multiples do not incorporate a company's cost structure (Fazzini, 2018), and

EV/EBITDA multiples do not account for capital intensity or reinvestment requirements (Morgan Stanley, 2024; Fazzini, 2018). In practical terms, the two are linked by the identity EV/Sales = EBITDA margin × EV/EBITDA, so profitability is mechanically embedded in the revenue multiple (Morgan Stanley, 2024).

These limitations are highly relevant for European listed Technology, Media and Telecommunications firms, whose business models rest heavily on intangibles such as R&D. In addition, accounting rules that require the upfront expensing of R&D cause reported earnings and EBITDA to be lower, even when the investment is value-creating (Morgan Stanley, 2024; Joshi & Chauhan, 2024). This suggests that other firm-level determinants should be analyzed when using multiples. Media and internet-based firms have also evolved, from a focus on growth potential in the early 2000s to a stronger focus on profitability, with the EBITDA margin gaining importance relative to revenue growth for large internet-enabled firms from around mid-2012 onwards (Trusculescu et al, 2020). Besides Technology and Media companies, Telecommunications companies are also usually valued primarily on the basis of EV/EBITDA because they rely heavily on capital investments and are capital-intensive (Damodaran, 2007; Kumar, 2019). The three TMT subsectors show both substantial firm-level heterogeneity and sensitivity to market-wide cycles, an effect well established in the European multiples literature (Damodaran, 2007; Dittmann & Weiner, 2005).

Although valuation multiples and their drivers have been studied extensively, and although a broad literature shows that industry classification alone does not identify economically comparable firms (Eaton et al, 2022; Bhojraj & Lee, 2002; Dittmann & Weiner, 2005; Holthausen & Zmijewski, 2012), this body of work leaves a specific gap. Furthermore, no existing empirical paper analyzes EV/Sales and EV/EBITDA multiples for European listed TMT companies in a multi-country panel using firm-level determinants, while conducting robustness checks for subsector and time variation. Harbula (2009) covers European multiples but focuses on a broader market rather than TMT. In addition, Codau (2013) focuses on EV/Sales but does not analyze EV/EBITDA multiples. Kumar (2019) includes TMT but is not restricted to Europe, whereas Joshi and Chauhan (2024) rely on equity-based price multiples for a global sample of Technology firms.

This thesis addresses the following research question: Which firm-level factors explain EV/Sales and EV/EBITDA valuation multiples of European listed Technology, Media and Telecommunications companies? The thesis will examine how profitability, revenue growth, risk, and intangible investments influence enterprise-value multiples EV/Sales and

EV/EBITDA. These factors are measured by the EBITDA margin, revenue growth, leverage together with stock-return volatility, and R&D intensity. The profitability channel is examined primarily through EV/Sales, since the EBITDA margin cannot enter the EV/EBITDA model without mechanically inverting the dependent variable, and a decomposition based on the identity that links the two multiples separates the mechanical part of the margin association from its residual economic part. The analysis uses an unbalanced panel of European listed TMT firms, built from Bloomberg Equity Screener and augmented with members of three STOXX Europe Total Market sector indices (Technology, Media and Telecommunications). The natural logarithms of EV/Sales and EV/EBITDA serve as the dependent variables, while a concise set of operational and financial firm characteristics act as explanatory variables. Subsector, country, and year fixed effects absorb differences in business models, institutional frameworks, and market cycles.

This thesis makes three key contributions. First, the thesis focuses primarily on European listed TMT companies. Second, EV/Sales and EV/EBITDA are analyzed jointly within a unified framework. This addresses a setting where multiples are economically important, firm-level heterogeneity is substantial, and a revenue-based multiple can be compared with an operating-profitability multiple. The joint framework also makes it possible to exploit the identity that links the two multiples, so that the part of the EBITDA margin association with EV/Sales that is purely mechanical can be separated from any residual economic component. Third, multiples are explained by firm-level determinants rather than by industry averages, consistent with the argument that industry membership alone does not fully capture economic comparability (Herrmann & Richter, 2003; Bhojraj & Lee, 2002; Dittmann & Weiner, 2005; Holthausen & Zmijewski, 2012; Eaton et al, 2022).

The thesis comprises seven chapters. Chapter 2 reviews the literature on relative valuation, covering the logic of multiples, their accuracy and limitations, the determinants of EV/Sales and EV/EBITDA, peer selection and comparability, and TMT-specific issues related to intangibles, R&D, and subsector heterogeneity. Chapter 3 outlines the theoretical framework and the hypotheses. Chapter 4 describes the data, sample construction, and the empirical methodology. Chapter 5 discusses the empirical findings, while Chapter 6 presents robustness checks and explores subsector heterogeneity. Finally, Chapter 7 interprets the results and offers a perspective on future research directions.

2. LITERATURE REVIEW

This chapter reviews the literature on valuation multiples relevant for the determinants of EV/Sales and EV/EBITDA for European listed TMT firms. The review is organized thematically rather than paper by paper. Contributions overlap in scope but differ in sample, methodology, and the specific multiple they study.

2.1 Relative Valuation and the Fundamental Logic of Multiples

Relative valuation is commonly motivated by the Efficient Market Hypothesis (EMH) (Fama, 1970). While the market might misprice an individual company, it generally prices comparable firms accurately on average (Damodaran, 2007). More precisely, the EMH suggests that expected abnormal returns are zero given a certain information set, allowing for short-term and firm-specific mispricing as long as these average out across firms (Fama, 1970; Jensen, 1978). Similar principles apply to relative valuations. Instead of demanding complete informational efficiency, relative valuation assumes that prices of comparable firms remain reasonably aligned at a specific point in time (Damodaran, 2007). A market can therefore be wrong about an entire sector while relative valuation within that sector remains internally consistent, which is at once the strength of the approach and its blind spot (Damodaran, 2007). The multiple framework is conceptually linked to the DCF valuation and is a function of the same fundamental value drivers, namely cash-flow potential, expected growth, and risk (Damodaran, 2007). Firms with stronger cash-flow potential, higher expected growth, and lower risk should therefore trade at higher multiples. For enterprise-value multiples, Damodaran (2007) identifies expected growth, operating margin, tax rate, debt-to-capital, and reinvestment rate as fundamental determinants of EV/Sales, and expected growth, reinvestment rate, return on capital, and tax rate as fundamental determinants of EV/EBITDA.

This view is reinforced by practitioner-oriented contributions. Morgan Stanley (2024) distinguishes between pricing a firm using a multiple and valuing it using the present value of free cash flows, arguing that multiples are shortcuts that compress long-term expectations into a single ratio and can be misleading when investment needs or capital intensity are ignored or vary across firms. As mentioned before, Morgan Stanley (2024) states that EV/Sales is mathematically and economically tied to profitability. This establishes a theoretical link between the two dependent variables analyzed in this thesis and raises the question of whether the same firm-level determinants affect both multiples. Fazzini (2018) adds that the multiple method produces meaningful estimates only if peers are consistent across industry, geography, competitive positioning, size, performance, maturity, time, and tax rate. Bartram and Grinblatt

(2018) provide supporting asset-pricing evidence, estimating a peer-implied fair value from a broad set of accounting variables and finding that deviations from market capitalization predict future returns. This supports treating EV/Sales and EV/EBITDA as functions of firm-level fundamentals rather than as isolated market multiples.

2.2 Accuracy and Limitations of Multiples

Some empirical studies compare the accuracy of various multiples and assess how well they describe observed market values. Lie and Lie (2002) analyze ten multiples from 8,621 United States (U.S.) firms. They find that, among the main enterprise-value multiples, EV/Sales is the least accurate, with only 22.5% of estimates within 15% of the actual market value. The other enterprise-value multiples are somewhat more accurate, at 28.5% for EV/EBITDA, 26.9% for EV/EBIT, and 35.1% for enterprise value to book value. Furthermore, they find that the accuracy of multiples declines for companies with a high level of intangibles, such as R&D-intensive and dot-com companies (Lie & Lie, 2002). Liu et al (2002), in a canonical U.S. study from 1982 to 1999, find that forward earnings multiples are the most reliable predictors of stock prices, that sales-based multiples are less effective because sales alone ignore costs, and that transforming ratios into enterprise value does not materially improve their accuracy. They also note that within-industry peers yield better results than a broad cross-section. These findings support the use of profitability measures and subsector controls. In contrast, Schreiner and Spremann (2007), using a European sample drawn primarily from the Dow Jones STOXX 600 over 1996–2005, find that equity-value multiples such as price to earnings (P/E) and price to book value outperform enterprise-value multiples, which they attribute to the uncertainty in estimating enterprise value and net debt. They also find that knowledge-based multiples surpass traditional ones in science-oriented industries, which is notable because R&D-driven Technology firms belong to these industries. Harbula (2009) reports that, in contrast to Schreiner and Spremann (2007), EV/EBITDA is among the most relevant multiples for Technology, Media and Telecommunications, with enterprise value to earnings before interest and taxes (EV/EBIT) also relevant for Technology and Media, and P/E additionally relevant for Telecommunications, while stating similar subsector-specific conclusions. In conclusion, the literature emphasizes the importance of explaining the cross-sectional variation in enterprise-value multiples through firm-level fundamentals, despite their relative weakness.

2.3 Fundamental Determinants of EV/Sales and EV/EBITDA

A second strand examines empirically which firm characteristics explain the cross-sectional variation in valuation multiples. Damodaran's (2007) regression analysis for a European subsample explains EV/Sales using expected growth, operating margin, tax rate, and reinvestment rate, achieving an R-squared (R^2) of 73.4%. The regression analysis across various model specifications consistently indicates that operating margin and tax rate are significant predictors. Harbula (2009) offers the most directly comparable European evidence, drawing on data from roughly 400 firms, primarily from the Dow Jones STOXX 600. In the multifactor EV/Sales model the top three factors are EBITDA margin, sales compound annual growth rate (CAGR), and international reach, at a total R^2 of 87%, while the EV/EBITDA model is driven by EBITDA growth, earnings stability, relative return on capital employed, and tax rate, at an R^2 of 73%. Drawing on these results two points come to the fore. First, the huge role of EBITDA margin for EV/Sales aligns with the margin acting as a driver of EV/Sales (Damodaran, 2007). Second, since these multiples are influenced by different variables, analyzing them separately rather than as substitutes is warranted.

Codau (2013) extends the European evidence to EV/Sales with 1,853 listed companies and finds that the EBITDA margin is the most influential factor and is significant with a positive sign in most sectors, consistent with Damodaran (2007) and Morgan Stanley (2024). Capital structure and liquidity are significant in more than half of sectors but the signs vary across industries and country groups, and inflation and country risk matter mainly in less-developed European markets. Kumar (2019) studies 189 large firms in seven sectors and finds a companion variable for each multiple, the after-tax operating margin for EV/Sales and the reinvestment rate for EV/EBITDA. Higher after-tax operating margins in Technology companies are associated with higher revenue multiples, while in Telecommunications the higher net profit margin is associated with the multiples and beta shows a negative relationship. Revenue growth is sometimes negatively associated with the multiples (Morgan Stanley, 2024; Kumar, 2019).

Trusculescu et al (2020) note that by mid-2012 the EBITDA margin had become more important than growth for valuing large internet firms, pushing mature digital companies toward stricter profitability standards. Joshi and Chauhan (2024), using ordinary least squares (OLS) and Lasso regressions on 714 global tech firms, find that revenue multiples are positively associated with profit margins, cash reserves, and R&D emphasis, while size shows a negative correlation. Two further studies, though not focused on EV/Sales or EV/EBITDA, reinforce the role of profitability, leverage, size, and asset factors. Vasconcelos and Forte (2022) find that revenue, EBITDA, R&D, capital investment, return on assets (ROA), return on equity, tangible and intangible assets, and goodwill influence market value across England, France, and Germany, and Vuković et al (2024) find that ROA and firm size are positively associated with Tobin's Q while leverage and asset tangibility are negative and revenue growth is insignificant.

2.4 Peer Selection and Comparability

A related body of literature questions whether industry membership alone is sufficient to identify comparable firms. The findings from this literature underscore the importance of understanding firm-level determinants of valuation multiples, as well as the significance of this thesis. As previously noted, EV/Sales and EV/EBITDA multiples are influenced by different fundamentals. Damodaran (2007) further highlights that comparability depends on similarities in cash flows, growth, and risk, rather than sector classification. Alford (1992), in an early study of U.S. price-earnings valuation, finds that selecting peers by industry outperforms broad market comparisons, that risk and earnings-growth proxies are less accurate when used alone, and that larger firms have higher valuation accuracy. Although it concerns price-earnings multiples, it supports including subsector controls and firm size in empirical models. This view is supported by empirical evidence from Herrmann and Richter (2003). By analyzing large U.S. and European firms over 1997–1999, they find that fundamental-control selection generally produces lower prediction errors than industry-only selection. In particular, the revenue multiple is not very accurate when using simple market selections.

Building on these findings, Bhojraj and Lee (2002) developed a warranted-multiple approach aimed at selecting peer companies based on the specific determinants of each multiple. For EV/Sales, their model incorporates factors such as industry EV/Sales, industry-adjusted profit margin, effects of losing firms, industry-adjusted analyst growth forecasts, leverage, return on net operating assets, and R&D-to-sales ratio. This model achieves an average adjusted R^2 of 72.2% (ranging from 66.1% to 76.5%). A "new economy" subset that includes biotechnology, computers, electronics, and Telecommunications achieves an R^2 of 70.1%. The main drivers are profit margin, expected growth, and R&D, while leverage becomes insignificant once these factors are accounted for. Geertsema and Lu (2023) use machine learning on a large U.S. sample from 1980 to 2019 and find that profitability, growth, financial health, and efficiency ratios matter more for multiples than industry classification alone. Their focus is EV/Sales, driven mainly by efficiency, profitability, and growth, which supports selecting peers by fundamentals rather than generic industry terms and indicates that EV/Sales has firm-specific components. Furthermore, Dittmann and Weiner (2005) analyze 67,433 firm-year observations from 15 European Union countries and the United States over 1993–2002 using EV/EBIT and find that selecting comparables based on similar ROA outperforms industry-only or asset-based selection across all countries. Besides Damodaran (2007), Holthausen and Zmijewski (2012) reinforce these ideas by explaining that even direct competitors may not be comparable if they differ in growth, risk, capital structure, cost structure, capital expenditures (capex) needs, or working capital, and that various multiples respond differently to these factors. Eaton et al (2022) examine strategic peer selection in M&A across 3,907 deals from 1995 to 2017, finding that investment banks choose peers with stronger fundamentals than the target and that Standard Industrial Classification (SIC) codes only partially capture comparability, since nearly forty-nine percent of selected peers sit in a different four-digit SIC code. These findings support including firm-level operational and financial variables in the empirical analysis, alongside subsector controls.

2.5 Intangibles, R&D, and Subsector Heterogeneity

TMT firms' business models depend heavily on intangible assets like R&D, software, brand names, and customer relationships. This creates valuation challenges because, according to Morgan Stanley (2024), multiples are less meaningful as firms increasingly invest in intangibles. Since these assets are expensed via selling, general, and administrative expenses (SG&A) and R&D instead of being capitalized, they reduce reported earnings and EBITDA during periods of innovation. Although it appears that value is being destroyed, long-term value is still being generated. This suggests that EV/Sales may be more informative when profitability is affected by intangible investments, while EV/EBITDA should be interpreted carefully. Empirical data support this perspective. Peters and Taylor (2017) develop a measure of intangible capital that includes accumulated R&D and part of SG&A expenses, showing that it accounts for a significant share of total firm capital among U.S. companies from 1975 to 2011 and that a Tobin's Q measure incorporating it better explains investment than measures based mainly on physical assets. This supports using R&D intensity as a direct value-driver proxy rather than merely a control variable. According to Lie and Lie (2002), the accuracy of the valuation deteriorates for companies with high intangible value. Joshi and Chauhan (2024) have found that R&D intensity is a relevant determinant of sales-based multiples for Technology firms. Vasconcelos and Forte (2022) provide evidence that R&D, intangible assets, and goodwill contribute to market value creation in large European economies. Trusculescu et al (2020) notes that even intangible-intensive digital firms are eventually evaluated on profitability once they mature. The three subsectors also differ in valuation dynamics. Harbula (2009) finds EV/EBITDA to be the most relevant multiple across all three, with EV/EBIT relevant for Technology and Media and P/E for Telecommunications. Kumar (2019) shows that profitability correlates strongly with multiples in Technology, while Telecommunications shows a negative relationship between beta and multiples and possibly between growth and multiples. Joshi and Chauhan (2024) find an inverse relationship between size and multiples in Technology, suggesting smaller, innovation-driven firms attract higher multiples. The literature highlights numerous valuation differences within the TMT industry, which justify incorporating subsector fixed effects into the empirical model.

2.6 Synthesis and Research Gap

There are four solid propositions in the literature review. First, EV/Sales and EV/EBITDA are generalizations of key value drivers, namely cash-flow potential, growth, and risk (Damodaran, 2007; Morgan Stanley, 2024). Second, EV/Sales has the strongest relationship with profitability and margins, whereas EV/EBITDA is further dependent on reinvestment, tax effects, capital intensity, asset utilization, and earnings stability (Harbula, 2009; Morgan Stanley, 2024; Kumar, 2019; Codau, 2013). Third, industry classification in isolation is insufficient, and firm-level operational and financial characteristics must be controlled for (Herrmann & Richter, 2003; Bhojraj & Lee, 2002; Dittmann & Weiner, 2005; Holthausen & Zmijewski, 2012; Eaton et al, 2022). Fourth, TMT companies pose further obstacles through intangible investment, evolving valuation regimes, and subsector heterogeneity (Lie & Lie, 2002; Morgan Stanley, 2024; Trusculescu et al, 2020; Joshi & Chauhan, 2024).

The studies differ in the directness of their evidence. Harbula (2009) summarizes direct evidence focusing on EV/Sales and EV/EBITDA in Europe, Damodaran (2007) offers regression evidence, Codau (2013) explores European EV/Sales, and Kumar (2019) examines cross-sector enterprise multiples including TMT. Evidence on other valuation multiples, such as EV/EBIT (Dittmann & Weiner, 2005), price-to-sales (Joshi & Chauhan, 2024), Tobin's Q (Vuković et al, 2024), and market value (Vasconcelos & Forte, 2022), is indirect. Existing literature (Damodaran, 2007; Morgan Stanley, 2024; Fazzini, 2018) offers a theoretical framework. To the author's knowledge, no studies analyze joint determinants of EV/Sales and EV/EBITDA for European listed TMT companies within a single panel-based framework that considers firm-level operating and financial factors across subsectors, countries, and time. This gap is what this thesis aims to fill.

3. Theoretical Background and Hypotheses

3.1 Conceptual Framework

This thesis builds on the idea that each valuation multiple is affected by firm-specific fundamentals such as cash-flow potential, expected growth, and risk, much like a DCF analysis, so that firms with stronger fundamentals trade at higher multiples (Damodaran, 2007). As set out in Sections 2.1 and 2.3, the main determinants of EV/Sales and EV/EBITDA differ, and each multiple has a distinct companion variable (Damodaran, 2007; Kumar, 2019). In addition, because the EBITDA margin is mathematically embedded in EV/Sales conditional on EV/EBITDA, profitability is a particularly strong expected driver of the revenue multiple (Morgan Stanley, 2024).

Two qualifications must be recognized. First, growth is not in itself value-creating, because it creates value only if the return on invested capital exceeds the cost of capital (Morgan Stanley, 2024). The expected positive association between growth and multiples is therefore an average effect across firms with different return profiles (Kumar, 2019; Vuković et al, 2024). Second, accounting factors may underrepresent economic value, since R&D and other intangible expenditures are typically expensed rather than capitalized, which can temporarily depress reported earnings and EBITDA while the underlying activity supports a higher valuation (Morgan Stanley, 2024). For TMT companies, this means that R&D intensity should be included in the model not solely as a control for distortions in the profitability variables, but as a direct value-driver proxy.

3.2 Hypotheses

Based on the insights from the empirical review in Chapter 2, four hypotheses are formulated concerning the firm-level factors that influence EV/Sales and EV/EBITDA. These hypotheses are driven by the economically and theoretically central factors. The empirical model outlined in Chapter 4 includes size, cash holdings, and capex intensity as control variables but does not specify formal hypotheses for them, because the literature suggests ambiguous or sector-specific expectations for their effects (Codau, 2013; Vuković et al, 2024; Joshi & Chauhan, 2024; Holthausen & Zmijewski, 2012). Heterogeneity across subsector, country, and year is treated as a methodological choice for identification, discussed in Chapter 4, rather than as a hypothesis, although the subsector dimension is examined empirically in Chapter 6.

H1 – Profitability. Profitability indicates how much revenue a company converts into operating profit, so that higher operating profit per unit of sales means more value is derived from each unit of revenue. The positive association for EV/Sales is intuitive and rests on the identity expressing EV/Sales as the EBITDA margin times EV/EBITDA (Morgan Stanley, 2024). This relationship is not random, so part of the EBITDA-margin coefficient in the EV/Sales regression is definitional rather than informative, which raises the question of whether the margin explains EV/Sales beyond this mechanical link. This thesis does not simply take the strong coefficient as proof, but examines this question through a decomposition based on the identity, reported in the results. This positive association is the leading empirical regularity for EV/Sales in the European evidence reviewed in Section 2.3, where the EBITDA margin is the dominant driver in both Codau (2013) and Harbula (2009). In principle, a positive effect is expected for EV/EBITDA, but this is conceptually weaker and is assessed only indirectly, since EBITDA margin and EV/EBITDA are not linked by an analogous identity, although the decomposition introduced in the methodology isolates the residual association of the margin with EV/EBITDA. This is the reasoning for the first hypothesis, namely that the EBITDA margin is positively associated with EV/Sales, while for EV/EBITDA the margin is assessed only indirectly to avoid mechanically inverting the dependent variable.

H2 – Growth. Improved expected growth leads to larger future cash flows, and consequently a higher present value of every unit of current revenue or EBITDA (Damodaran, 2007). This is not a given, however, as growth makes a firm more valuable only if returns surpass its cost of capital. This favorable baseline and its qualification are both grounded in the evidence reviewed in Sections 2.3 and 2.4, where Harbula (2009) identifies the sales CAGR as the primary European EV/Sales driver, while Morgan Stanley (2024) and Kumar (2019) show that growth adds value only when returns exceed the cost of capital. That is, revenue growth is expected to be positively associated with EV/Sales and EV/EBITDA on average, though this relationship is expected to weaken or reverse when growth does not generate returns above the cost of capital. The second hypothesis states that there exists a positive average effect across the dataset, with subsector heterogeneity assessed in the robustness checks.

H3 – Risk. Greater firm risk decreases the market value of revenue streams or operating earnings, because it raises the discount rate for future cash flows. The regression captures this mechanism through two risk variables that reflect it. One is financial leverage, as it brings about a higher probability of distress and hence a greater cost of capital. The second is stock-return volatility, which measures overall firm risk (Damodaran, 2007; Morgan Stanley, 2024).

Evidence of a negative association, and of its uneven strength across sectors, is reviewed in Sections 2.3 to 2.5, where higher debt is negatively related to firm value (Vuković et al, 2024; Holthausen & Zmijewski, 2012) while leverage effects are not uniform across sectors (Bhojraj & Lee, 2002; Codau, 2013). In other words, the third hypothesis holds that higher levels of risk are negatively associated with EV/Sales and EV/EBITDA.

H4 – Intangible Investment. Since R&D costs are paid upfront, they reduce reported earnings and EBITDA during periods of strong innovation while contributing to long-term value creation (Morgan Stanley, 2024). The two valuation multiples interpret value differently because a company with high R&D intensity tends to have a lower EBITDA margin but a higher EV/Sales multiple, since the return on intangible investments is included in the revenue-based multiple. Evidence that intangible investments are associated with revenue multiples is discussed in Sections 2.3 and 2.5. R&D is incorporated into the warranted EV/Sales model of Bhojraj and Lee (2002) and is a key factor in revenue multiples in studies by Joshi and Chauhan (2024) and Vasconcelos and Forte (2022). Conversely, the EV/EBITDA outlook is more conservative. R&D lowers EBITDA, potentially resulting in higher EV/EBITDA multiples that partly reflect a depressed denominator rather than a stronger value driver. The fourth hypothesis suggests that higher R&D intensity correlates positively with EV/Sales but more cautiously with EV/EBITDA.

4. Data and Methodology

This chapter details the sample construction and the empirical approach. Section 4.1 covers the data sources and sample selection, Section 4.2 the dependent and explanatory variables including the treatment of outliers and loss firms, Section 4.3 the regression model and fixed-effects framework, Section 4.4 the estimation and inference, and Section 4.5 the descriptive statistics. A full variable table with the related Bloomberg fields is provided in Appendix *Table II*.

4.1 Data Source

This empirical study analyzes an unbalanced panel of European listed companies in the Technology, Media and Telecommunications sectors from 2010 to 2025, covering sixteen fiscal years. The sample is assembled using the Bloomberg Equity Screener and includes constituents from the three STOXX Europe Total Market sector indices for Technology, Media and Telecommunications. The firm-level financial and market data are obtained from Bloomberg (Bloomberg L.P., 2026). Since these companies operate in various currencies, all monetary figures are expressed in millions of euros to avoid distortions in enterprise value in a cross-border context (Copeland et al, 2000).

Firms are assigned to the TMT universe according to the Global Industry Classification Standard. A firm is classified as Technology when it belongs to the Information Technology sector, as Media when it belongs to the Communication Services sector and the Media and Entertainment industry group, and as Telecommunications when it belongs to the Communication Services sector and the Telecommunication Services industry group. Financial firms are excluded from this analysis due to their different capital structure and accounting practices, which could distort enterprise-value multiples.

The estimation sample is obtained from a sequential funnel. The raw panel is for a total of 644 firms and consists of 10,304 firm-years. Limiting the sample to the three TMT subsectors reduces it to 525 firms and 8,400 firm-years. Applying a positive revenue requirement decreases the panel to 6,575 firm-years for 524 firms. Setting a size cutoff allowing only for companies with at least EUR 50 million in market capitalization in at least one year results in 4,884 firm-years for 359 firms. This also excludes micro-capitalization firms, whose valuation multiples are noisy and whose coverage is thin. A comparable combination of a market-capitalization floor and a positive-earnings filter is used by Kim and Ritter (1999), who limit their sample to firms with at least USD 50 million in expected market capitalization and positive trailing earnings. Requiring a positive EV/Sales ratio, which is necessary for the log transformation of the first dependent variable, leaves 4,300 firm-years across 356 firms. Requiring a positive EBITDA, which is necessary for the log transformation and the economic interpretation of the second dependent variable, reduces the sample to 3,665 firm-years across 339 firms. After accounting for the missing observations concerning explanatory variables, the baseline EV/Sales model is estimated on 3,851 firm-years while the baseline EV/EBITDA model is estimated on 3,322 firm-years. With about forty-four percent of firm-years without a reported R&D figure, the specifications that add R&D intensity use smaller sample sizes (3,142 firm-years for EV/Sales and 2,729 firm-years for EV/EBITDA). A missing R&D value reflects the absence of a separately reported R&D expense in Bloomberg and cannot be reliably interpreted as either a genuine zero or a lack of disclosure, so these firm-years are treated as missing rather than set to zero and therefore drop out of the R&D specifications. The seventeen European countries are unevenly represented, with most firms in the United Kingdom, France, Germany, Sweden, and Italy. This matters for the fixed effects in Section 4.3, since a country represented by a single firm has a fixed effect almost collinear with that firm, so country and year effects capture broad institutional and cyclical factors rather than precisely estimated parameters in low-density cells.

One limitation must be made explicit. The base universe is constructed from the Bloomberg Equity Screener, augmented with the current constituents of the three indices, rather than from their historical membership, which underrepresents firms that were delisted, acquired, or declared insolvent and overrepresents survivors. This generates a survivorship bias, so the results should be read as describing the cross-section of remaining listed and index-eligible firms, and the direction of this bias is addressed in the interpretation.

4.2 Variable Construction

The regression model uses two dependent variables. The first is the natural logarithm of EV/Sales, defined as enterprise value divided by revenue. The second is the natural logarithm of EV/EBITDA, defined as enterprise value divided by earnings before interest, taxes, depreciation and amortization, computed only for firms with positive EBITDA. Enterprise value is taken directly from Bloomberg, defined as market capitalization plus total debt minus cash and short-term investments, in line with standard practice (Dittmann & Weiner, 2005). Both multiples are right-skewed and cannot take negative values, since a few firms trade at very high values (Damodaran, 2007), which can let outliers skew the results. Applying a logarithmic transformation brings the distribution closer to normal, allows the coefficients to be interpreted approximately as proportional effects, and reduces the influence of extreme observations. The positivity requirement of the transformation underpins the positivity restrictions in the sample funnel.

The explanatory variables draw from the literature discussed in Chapter 2 and the hypotheses outlined in Chapter 3. Revenue growth is the year-on-year change in revenue. Profitability is measured by the EBITDA margin, calculated as EBITDA divided by revenue. Financial leverage is defined as net debt divided by total assets, with net debt preferred over gross debt because subtracting cash and other financial assets from the balance sheet offers a more accurate picture of a firm's financial risk (Copeland et al, 2000). Company size is measured as the natural logarithm of total assets, chosen because total assets are highly right-skewed and firm size is expected to relate to valuation in proportional rather than absolute terms. Cash is the cash-to-assets ratio, defined as cash plus cash equivalents divided by total assets. Since net debt is measured net of cash, the cash position enters both leverage and this ratio, which may create a negative mechanical relationship. Both are retained because they capture distinct aspects, financial risk and liquidity, and the variance inflation factors (VIF) in Appendix *Table V* confirm that the overlap does not distort the results. Capital intensity is measured as the ratio of capital expenditures to revenue. Stock-return volatility is the 360-day volatility from Bloomberg, divided by 100 to convert it into a decimal. Lastly, intangible investment reflects R&D intensity, computed as R&D expenditure divided by revenue.

Profitability poses particular challenges in the treatment because the distribution of the EBITDA margin is heavily influenced by loss-making firms, which have large, widely dispersed margins in absolute value. When the EBITDA margin is used as a single continuous variable, a few deeply negative observations dominate the slope, causing the coefficient to be mechanically distorted. To distinguish the level shift associated with losses from the profitability slope, the EV/Sales specifications adopt the approach of Bhojraj and Lee (2002). The EBITDA margin is included only for profitable firms and set to zero for loss-making firms, while a binary loss-firm dummy equals 1 when EBITDA is negative and 0 otherwise. As a dummy variable, the loss-firm indicator takes only the values zero and one and is therefore not winsorized. This approach is applied only in the EV/Sales models, where the EBITDA margin is used as a regressor. In the EV/EBITDA models, the margin is excluded to avoid mechanically inverting the dependent variable, and the sample contains no loss firms since it is restricted to firms with positive EBITDA. A decomposition that isolates the mechanical component of this link, described in Section 4.4 and reported in Section 5.1, regresses the logarithm of EV/EBITDA on the margin only to recover the residual component of the identity, and does not reintroduce the margin as a valuation driver for EV/EBITDA.

All continuous variables are winsorized at the 1st and 99th percentiles, since a few extreme outliers can strongly influence the results, especially for variables with a lower bound but no upper bound. Winsorizing retains all observations while limiting the influence of extreme values, which is preferable to deleting genuine high-value companies and aligns with standard practice (Bhojraj & Lee, 2002; Codau, 2013). As mentioned before, the loss-firm indicator is binary and is not winsorized. The robustness of the results to this choice is examined in Chapter 6.

Two further explanatory variables address factors ignored in the baseline model. The first is the effective tax rate. Since EBITDA is measured before tax, the same EBITDA can translate into different cash flows depending on the tax rate, and the tax rate is one of the fundamental determinants of EV/Sales identified by Damodaran (2007), because a higher tax burden lowers the after-tax cash flow per unit of revenue. Even though the country fixed effects included in

Section 4.3 capture average differences in tax treatment across countries, they do not account for how taxes are applied at the firm level. The effective tax rate sourced from Bloomberg is a percentage divided by 100 to convert it into a decimal. Values above 100 percent, which generally arise from mechanical effects when pre-tax income is near zero, are treated as missing, and the remaining data are then winsorized along with other continuous variables.

The second added variable is growth expectations. High-explanatory-power studies, in particular Harbula (2009), rely partly on richer growth measures such as the sales CAGR and forward-looking expectations, whereas the baseline revenue growth used here is backward-looking, itself a recognized limitation of multiple-based analysis (Schreiner & Spremann, 2007). A forward-looking measure based on Bloomberg consensus cannot be used, because the point-in-time consensus is not available with sufficient depth in the early years and using current estimates for past years would introduce a look-ahead bias, so this is treated as a data limitation. Instead of one-year revenue growth, the trailing three-year sales compound annual growth rate is specified for both multiples as a fully available backward-looking alternative, defined in Appendix *Table II.*

A three-year horizon cuts through the noise of a one-year measure, since a single strong or weak year can distort the underlying growth trend. Because the trailing compound annual growth rate and one-year revenue growth measure the same underlying construct and are highly collinear, they are never included together. They are compared as alternatives on identical samples, as described in Section 4.4.

4.3 Empirical Model and Fixed Effects

The dependent variables are explained by the firm characteristics together with a structure of fixed effects. The baseline EV/Sales specification is given in Equation (1), where i indexes firms, t indexes years, s indexes subsectors, and c indexes countries.

$$
\begin{aligned}
(1)\ ln\left(\frac{EV}{Sales}\right)(i,t) \\
&= \beta 0 + \beta 1\ RevGrowth(i,t) + \beta 2\ EBITDAMarginPos(i,t) \\
&+ \beta 3\ LossFirm(i,t) + \beta 4\ Leverage(i,t) + \beta 5\ Size(i,t) \\
&+ \beta 6\ CashToAssets(i,t) + \beta 7\ CapexToSales(i,t) + \beta 8\ StockVol(i,t) \\
&+ Subsector(s) + Country(c) + Year(t) + e(i,t)
\end{aligned}
$$

The baseline EV/EBITDA specification is given in Equation (2). It omits the EBITDA margin and the loss-firm indicator for the reasons set out in Section 4.2.

$$(2)\ ln\left(\frac{EV}{EBITDA}\right)(i,t) = \beta 0 + \beta 1\ RevGrowth(i,t) + \beta 2\ Leverage(i,t) + \beta 3\ Size(i,t) + \beta 4\ CashToAssets(i,t) + \beta 5\ CapexToSales(i,t) + \beta 6\ StockVol(i,t) + Subsector(s) + Country(c) + Year(t) + e(i,t)$$

Two additional versions of each specification include R&D intensity, denoted RDToSales(i,t), as an explanatory variable to test the intangible-investment hypothesis on the subsample of firms that report R&D. The effective tax rate is included in both specifications as an additional term, β EffTaxRate(i,t), and trailing three-year sales growth replaces one-year revenue growth in the corresponding alternative specifications.

The model includes three sets of fixed effects with distinct purposes. The subsector fixed effects capture systematic valuation differences across the TMT sectors, so the coefficients are not driven by one subsector trading at a higher multiple than another. The country fixed effects account for institutional differences among the seventeen countries, which vary in taxation, regulation, accounting practices, and investor base. The year fixed effects account for market-wide valuation cycles, the interest rate environment, and sector rotation, such as elevated Technology valuations and disruptions like the Coronavirus Disease 2019 (COVID-19) pandemic in 2020. The importance of year fixed effects and the relevance of time controls are also supported by the literature. Dittmann and Weiner (2005) find that valuation errors rise sharply during market-wide episodes such as the Technology boom around the turn of the millennium. Without these controls, the estimated coefficients would absorb variation that is unrelated to the firm-level factors of interest, for example, the tendency of firms in a given country or year to trade at particular multiples. Firm fixed effects are deliberately not included. They would absorb the cross-sectional variation in firm characteristics that is constant or slowly evolving within the firm, such as size, leverage, and R&D intensity, which is precisely the variation the analysis seeks to explain.

4.4 Estimation and Inference

The models are estimated by ordinary least squares with fixed effects partialled out, the within estimator applied across subsector, country, and year, with standard errors clustered at the firm level. In panel data the residuals of a single firm across years are correlated through heteroskedasticity and serial correlation, which ordinary standard errors ignore, and Petersen (2009) shows that neglecting this within-firm dependence understates standard errors and overstates significance. Firm clustering treats each firm as an independent unit while allowing its residuals to be correlated in any way.

Apart from within-firm correlation, two-way clustering by firm and year is reported in Chapter 6 as a robustness check, following Gow et al (2010), who recommend accounting for the cross-sectional correlation of residuals within a year in addition to within-firm correlation. Since the panel is just sixteen years, two-way clustering is not used in the main specification, because reliable inference along a clustering dimension usually needs many more clusters than is available with the time dimension.

These fixed effects absorb a large share of the variation in the multiples, so the overall coefficient of determination is dominated by them and is not informative about the firm-level variables. The within coefficient of determination measures the variation explained by the firm characteristics after the fixed effects are removed, and is therefore used as the relevant measure of fit. Multicollinearity between the explanatory variables is a further concern in this case, as operational and financial characteristics are interdependent (Damodaran, 2007). It is assessed using variance inflation factors based on O'Brien's (2007) conventional thresholds, reported in Appendix *Table V*, and the correlation structure of the regressors, reported in Appendix *Table IV*, is examined before estimation.

The EBITDA margin enters EV/Sales partly through the identity EV/Sales = EBITDA margin × EV/EBITDA. A separate decomposition therefore isolates the mechanical component of the margin coefficient from the residual component that operates through the EV/EBITDA multiple, with the construction and the results reported in Section 5.1 and Appendix *Table VI.*

The two extension variables are available for only part of each estimation sample, since the effective tax rate is missing for some firm-years. Additionally, the trailing three-year growth rate needs three prior years of revenue. Comparing a full-sample model with a smaller-subsample model would confound the effect of the variable with changes in sample composition, as the firms with available data are generally larger and more profitable. Each augmented model is therefore paired with a baseline re-estimated on the same reduced sample, so that comparing the augmented model with the same-sample baseline isolates the variable while comparing the same-sample baseline with the full-sample baseline captures the composition effect.

4.5 Descriptive Statistics

The descriptive statistics for the estimation sample are reported in Appendix *Table III*. After winsorizing, the median EV/Sales is close to 1.7 and the median EV/EBITDA is close to 9.0. The corresponding means are substantially higher, with the mean EV/Sales close to 3.8 and the mean EV/EBITDA close to 15.5. This indicates that the multiples are right-skewed and furthermore motivates the logarithmic transformation in the regression model. Without winsorizing, the right-skew would be even more pronounced. Additionally, median revenue growth is positive and moderate, and the dispersion of the EBITDA margin is wide, reflecting the coexistence of highly profitable firms and loss-making firms within the sample.

The three TMT subsectors differ systematically. Technology firms exhibit the highest EV/EBITDA values and the highest R&D intensity. Media companies occupy a middle ground, while Telecommunications firms have lower multiples, slower growth, larger size, and higher capital intensity, consistent with their capital-intensive business model. These differences may reflect the subsectors occupying different stages of their market life cycle, with Technology resembling a growth market and Telecommunications a more mature one, which is consistent with their contrasting growth, investment, and size profiles. Loss firms represent a modest but non-negligible fraction of the EV/Sales sample, which is why the loss-firm treatment discussed in Section 4.2 is required. R&D is missing for a substantial share of firm-years, which explains the smaller sample sizes for specifications that include R&D intensity. These descriptive patterns motivate the subsector, country, and year fixed effects as well as the separate treatment of loss firms, and they form the background against which the regression results described in Chapter 5 are interpreted.

5. Empirical Results

This chapter builds on the hypotheses introduced in Chapter 3 and follows the model described above. Section 5.1 discusses profitability and the treatment of loss firms, Section 5.2 revenue growth, Section 5.3 risk, Section 5.4 intangible investment, and Section 5.5 the control variables. Sections 5.6 and 5.7 present the two extension specifications, the effective tax rate and the trailing three-year sales growth rate, reported in Appendix Table VII and Appendix Table VIII. Section 5.8 considers the model fit and the fixed-effects contribution, and Section 5.9 provides the interpretation. The four baseline specifications are reported in Table I, and the identity-based decomposition of the EBITDA margin coefficient in Appendix Table VI.

TABLE I: FIRM-LEVEL DETERMINANTS OF EV/SALES AND EV/EBITDA MULTIPLES, BASELINE SPECIFICATIONS.

	(1) EV/Sales	(2) EV/EBITDA	(1b) EV/Sales + R&D	(2b) EV/EBITDA + R&D
Revenue Growth	0.311*** (0.057)	0.160** (0.075)	0.302*** (0.062)	0.198** (0.077)
EBITDA Margin (profitable only)	3.007*** (0.241)		3.290*** (0.238)	
Loss Firm (EBITDA < 0)	1.018*** (0.098)		0.896*** (0.099)	
Leverage (Net Debt/Assets)	0.232 (0.165)	0.087 (0.180)	0.172 (0.157)	0.079 (0.184)
Firm Size (ln Total Assets)	0.042** (0.018)	-0.000 (0.015)	0.044** (0.019)	0.000 (0.016)
Cash / Assets	1.471*** (0.316)	0.406 (0.329)	1.018*** (0.301)	0.150 (0.322)
Capex / Sales	1.066*** (0.277)	0.036 (0.340)	0.388 (0.256)	-0.117 (0.349)
Stock Volatility (360d, decimal)	-0.051 (0.172)	0.195 (0.175)	-0.220 (0.158)	0.005 (0.190)
R&D / Sales			0.999*** (0.120)	1.364*** (0.480)
Observations	3,851	3,322	3,142	2,729
R^2	0.455	0.154	0.514	0.181
Within-R^2	0.356	0.011	0.424	0.027

Note: Main regression results. EBITDA Margin in EV/Sales models (1 and 1b) uses the 'profitable only' specification with a separate Loss Firm dummy. EBITDA Margin omitted in EV/EBITDA models to avoid mechanical inversion. All models include subsector, country, and year fixed effects. Continuous variables winsorized at 1st/99th percentile. Firm-clustered standard errors in parentheses. Models 1b/2b estimated on subsample with non-missing R&D. * p<0.1, ** p<0.05, *** p<0.01.

5.1 Profitability and Loss Firms

As expected, the EBITDA margin shows the strongest correlation with the EV/Sales multiple. In the baseline regression (1), the coefficient is 3.007 with a standard error of 0.241. When R&D is included in model (1b), the coefficient increases to 3.290, with a standard error of 0.238. Both coefficients are significant at the one percent level. That means the coefficient is approximately a semi-elasticity. Among profitable firms, a ten-percentage-point increase in the EBITDA margin is associated with an EV/Sales multiple roughly thirty-five percent higher, holding all other variables and fixed effects constant. The dominant role of the EBITDA margin aligns with the literature reviewed in Chapter 2 and with the practitioner view that EV/Sales is tied to profitability (Codau, 2013; Harbula, 2009; Damodaran, 2007; Morgan Stanley, 2024).

However, as set out in Chapter 3, this high correlation partly stems from the identity EV/Sales = EBITDA margin × EV/EBITDA, so part of the association is definitional rather than informative. The size of this definitional component is assessed on the subsample of profitable firms, for which the identity is defined, by estimating the margin coefficient across three regressions that share the same sample, controls, and fixed effects, with the logarithm of EV/Sales, of the EBITDA margin, and of EV/EBITDA as the respective dependent variables. Since the logarithm of EV/Sales is the exact sum of the other two dependent variables, the margin coefficient in the first regression equals the sum of the margin coefficients in the other two, so that the first measures the total association, the second the mechanical component, and the third the residual component that operates through the EV/EBITDA multiple. In a subsample of 3,322 profit-making firm-years, which by construction excludes loss firms, the total margin coefficient is 3.312 (0.234), slightly higher than the full-sample value of 3.007, and it separates into a mechanical component of 4.393 (0.181) and a residual component of minus 1.081 (0.293), both significant at the one percent level. The mechanical component therefore accounts for the entire positive association, at 132.6% of the total, while the residual economic component is negative, at minus 32.6%. These results are reported in Appendix *Table VI*.

That is, the negative residual implies that a higher EBITDA margin, after adjusting for the definitional link, is not associated with an additional EV/EBITDA premium. Since the residual portion is downward biased by measurement error in EBITDA, the estimate should be considered as a conservative bound and, given this bias, as consistent with zero, such that no positive economic premium for the margin beyond the mechanical link can be established for this subsample. The thesis, therefore, shows that the EBITDA margin is the main correlate of EV/Sales, notes that the coefficient is largely mechanical, and examines the effect of the margin across the three subsectors further in Chapter 6.

The loss-firm indicator is positive and significant at the one percent level, with a coefficient of 1.018 (0.098) in the baseline EV/Sales model and 0.896 (0.099) when R&D intensity is added. Thus, conditional on the profitability spline and the remaining controls, loss-making firms do trade at a high EV/Sales premium, since the baseline coefficient corresponds to approximately 2.8 times the value of an equivalent break-even company, falling to about 2.4 times in the specification with R&D. This premium is consistent with the treatment suggested by Bhojraj and Lee (2002) and with data suggesting that loss-making TMT firms are young, rapidly expanding, research-intensive firms whose high market price reflects revenue potential rather than current earnings. This also backs up the reasoning in Section 4.2 about what should be treated as the loss-related level shift versus the profitability slope. Because the margin is not included within the EV/EBITDA models and the sample does not include any loss firms, the first hypothesis is assessed only indirectly for that multiple. However, the first hypothesis is supported for EV/Sales as a descriptive association.

5.2 Revenue Growth

Revenue growth is positively and significantly associated with both multiples in all four baseline specifications. The coefficient is 0.311 (0.057) in the EV/Sales baseline and 0.302 (0.062) once R&D intensity is added, both significant at the one percent level. For EV/EBITDA the coefficient is 0.160 (0.075) and 0.198 (0.077), significant at the five percent level. The effect is economically modest, since a ten-percentage-point increase in revenue growth is associated with an EV/Sales multiple that is approximately three percent higher. The positive average association is consistent with the second hypothesis and with the role of the sales compound annual growth rate in the European model of Harbula (2009). The relationship is expected to be an average across firms with different return profiles, and Kumar (2019) documents a negative growth association in Telecommunications examined in Chapter 6. On average across the sample, the second hypothesis is supported, and Section 5.7 shows that a smoothed multi-year growth measure strengthens this finding further.

5.3 Risk

On these baseline specifications, neither risk variable is statistically significant in any of the analyzed cases. Financial leverage, defined as net debt to total assets, has coefficients of 0.232 (0.165) and 0.172 (0.157) in the EV/Sales models, and 0.087 (0.180) and 0.079 (0.184) in the EV/EBITDA models, none of which are significant under conventional levels. In terms of stock-return volatility, it is also statistically insignificant, exhibiting coefficients near zero and of inconsistent sign. Therefore, in the baseline analysis, the third hypothesis, which predicted a negative association between risk and the multiples, is not supported.

Several factors are consistent with this. The leverage variable is measured net of cash and the enterprise-value numerator already abstracts from the financing mix, so the discount-rate channel may be only weakly reflected in cross-sectional leverage. The finding echoes Bhojraj and Lee (2002), who report that leverage becomes insignificant once profitability, growth, and R&D are controlled for. The restriction to surviving and index-eligible firms may also understate financial distress and attenuate any negative leverage effect. The result contrasts with the negative debt association for European Tobin's Q in Vuković et al (2024), which may reflect the different dependent variable and enterprise-value framing.

5.4 Intangible Investment

Both multiples have significant and positive R&D intensity at the one percent level. The EV/Sales model returns a coefficient of 0.999 (0.120), while the EV/EBITDA model has a coefficient of 1.364 (0.480). This positive result is consistent with the fourth hypothesis for EV/Sales and with the view that the value of intangible investment enters the revenue-based multiple (Bhojraj & Lee, 2002; Joshi & Chauhan, 2024; Vasconcelos & Forte, 2022). Adding R&D intensity also raises the explanatory power of the EV/Sales model, with the within R^2 increasing from 0.356 to 0.424, although the sample decreases from 3,851 to 3,142 firm-years because many firms do not report R&D.

However, the positive coefficient for EV/EBITDA should be interpreted with the caution outlined in Chapter 3. Since R&D is expensed rather than capitalized, it directly lowers EBITDA, causing research-heavy companies to display higher EV/EBITDA multiples that reflect a depressed denominator rather than a stronger value driver. The significant positive coefficient aligns with this view and does not necessarily imply that R&D boosts a higher operating-profitability multiple through a different valuation route. With this consideration, the fourth hypothesis is supported for EV/Sales and, in a more cautious sense, is consistent with the evidence from EV/EBITDA.

5.5 Control Variables

The control variables did not have formal hypotheses in Section 3.2 due to the literature indicating ambiguous or sector-specific expectations. Firm size, calculated as the natural logarithm of total assets, shows a significant positive association at the five percent level for EV/Sales, with coefficients of 0.042 (0.018) and 0.044 (0.019), respectively. However, it is negligible and insignificant for EV/EBITDA. The positive correlation with EV/Sales suggests that larger firms tend to have a slightly higher revenue multiple than smaller firms. In contrast, Joshi and Chauhan (2024) report a negative size effect for equity-based price multiples of Technology companies, possibly due to the different multiple and the size threshold used in Section 4.1.

The cash-to-assets ratio has a strong positive association with EV/Sales at the one percent significance level, with coefficients of 1.471 (0.316) and 1.018 (0.301). In contrast, EV/EBITDA shows no significant relationship. This positive link with the revenue multiple may indicate the liquidity and flexibility of cash-rich companies, many of which are younger Technology firms. Capital intensity, calculated as capital expenditures divided by revenue, is significantly and positively related to EV/Sales, with a coefficient of 1.066 (0.277). However, its significance diminishes when R&D intensity is accounted for, with the coefficient falling to 0.388. This suggests that capital intensity partly acts as a proxy for investment also measured by R&D, and its effect is absorbed once intangible investment is included. For EV/EBITDA, neither cash nor capital intensity is significant.

5.6 Effective Tax Rate

The first extension adds the effective tax rate to both specifications, and the results are reported in Appendix *Table VII*. In accordance with the design mentioned in Section 4.4, each augmented column is matched with an equivalent baseline re-estimated on the same sample of firm-years for which the effective tax rate is available. The two multiples behave in very different manners. For EV/Sales, at the one percent level, the effective tax rate is negative and significant, with a coefficient of minus 0.491 (0.143) without R&D and minus 0.463 (0.144) with R&D. Therefore, an increase in the effective tax rate of ten percentage points is associated with an EV/Sales multiple that is approximately five percent lower. This result is consistent with the inclusion of the tax rate among the fundamental determinants of EV/Sales by Damodaran (2007), since a higher tax burden lowers the after-tax cash flow generated per unit of revenue. However, for EV/EBITDA, the effective tax rate is negative but insignificant, with coefficients of minus 0.177 (0.146) and minus 0.130 (0.147).

This asymmetry is evident in the within R^2 values. Notably, the tax rate has increased the within R^2 of the EV/Sales models from 0.453 to 0.458 and from 0.491 to 0.496. Meanwhile, the EV/EBITDA within R^2 remains mostly unchanged, moving from 0.028 to 0.030 and staying at 0.044. A likely reason for this minimal change in EV/EBITDA is that country fixed effects already account for average differences in tax treatment, so the remaining firm-level variation in the effective tax rate has little impact when profitability is not included. Furthermore, this also clarifies why a same-sample approach is essential, as the baseline fit for the reduced EV/Sales sample (0.453) exceeds that of the full sample (0.356). This difference does not imply that the tax variable itself is the explanatory factor, but rather reflects sample composition, since firms reporting an effective tax rate tend to be larger and more profitable, which makes them easier to explain. The same selection explains the larger loss-firm coefficient in this subsample, which rises to 1.899 without R&D and 2.113 with R&D, compared with 1.018 and 0.896 in the full-sample baseline. Requiring a valid effective tax rate removes observations with near-zero pre-tax income, which fall disproportionately among loss firms, so the remaining loss firms form a smaller and more selected group, and the higher coefficient should not be read as a stronger loss-firm premium.

5.7 Trailing Three-Year Sales Growth

Extension 2 replaces the one-year revenue growth rate with the trailing three-year sales compound annual growth rate in both specifications, as shown in Appendix *Table VIII*. Because the two growth measures are highly collinear, they are compared on identical samples and never enter together. The trailing three-year measure shows a stronger correlation with the two multiples than the one-year measure. It has a coefficient of 0.595 (0.093) for EV/Sales without R&D and 0.627 (0.101) with R&D, both significant at the one percent level. In comparison, the one-year rate has coefficients of 0.279 and 0.280 on the same samples. For EV/EBITDA, the trailing measure has coefficients of 0.430 (0.120) and 0.532 (0.133), against 0.148 and 0.178 for the one-year measure.

The smoothed measure shows an increase in the within R^2 in every pairing, rising from 0.342 to 0.350 and from 0.417 to 0.427 for EV/Sales, and from 0.013 to 0.021 and from 0.031 to 0.043 for EV/EBITDA. This indicates a substantial increase in the explanatory power of growth, nearly doubling for EV/EBITDA. It also supports the second hypothesis and is consistent with the prominence of the sales compound annual growth rate in Harbula (2009). Additionally, the multi-year growth measure offers a more reliable representation of the underlying growth trend than single-year measures, being less affected by short-term fluctuations. A forward-looking growth measure based on point-in-time consensus estimates, as noted in Section 4.2, could not be sourced for the early years of the panel and is documented as a limitation of the data rather than estimated.

5.8 Model Fit and the Role of the Fixed Effects

The within R^2 is the relevant measure of fit, as set out in Section 4.4, since the fixed effects absorb a large share of the variation and dominate the overall coefficient of determination. In the baseline it is 0.356 for EV/Sales and 0.011 for EV/EBITDA, rising to 0.424 and 0.027 once R&D intensity is added. This large contrast requires the qualification from Section 5.1, since the decomposition shows that the EBITDA margin enters EV/Sales largely through the identity rather than an independent valuation channel, so a substantial part of the EV/Sales within R^2 reflects this mechanical link. For EV/EBITDA the firm characteristics explain only a small part of the residual variation, consistent with the broader and less easily measured set of determinants the literature associates with the operating-profitability multiple. The within R^2

gap therefore overstates how far EV/Sales is better explained by fundamentals independent of the multiple, although revenue growth, R&D intensity, the effective tax rate, and the cash position remain genuine correlates of EV/Sales beyond the margin. The overall coefficient of determination, at 0.455 and 0.514 for EV/Sales and 0.154 and 0.181 for EV/EBITDA, is higher but largely reflects the fixed effects, and these magnitudes are consistent with Damodaran (2007) that relative-valuation fit is frequently well below seventy percent and often around thirty to thirty-five percent, rather than a sign of misspecification.

5.9 Summary of Findings

The baseline results support three of the four hypotheses, with qualifications, and do not support the hypothesis on risk. The EBITDA margin is the main correlate of EV/Sales, so the first hypothesis is supported for EV/Sales as a descriptive association. The decomposition in Section 5.1 qualifies this result substantially, because the mechanical component implied by the identity accounts for the whole of the positive association, while the residual component that operates through EV/EBITDA is negative and significant rather than positive. Once the definitional link is removed, no positive economic premium for the margin can be established on the subsample of profitable firms, and this estimate is itself a conservative bound given measurement error in EBITDA. For EV/EBITDA the margin is excluded, so the first hypothesis is assessed only indirectly for that multiple. Revenue growth is positively associated with both multiples on average, which supports the second hypothesis, and the trailing three-year growth measure strengthens this finding for both multiples. The third hypothesis is not supported, since neither leverage nor stock-return volatility is significant for either multiple. R&D intensity is positively associated with both multiples, which supports the fourth hypothesis for EV/Sales and is consistent, in the more cautious sense, with the depressed-denominator interpretation for EV/EBITDA. Among the extension variables, the effective tax rate is negatively and significantly associated with EV/Sales, consistent with its role as a fundamental determinant of the revenue multiple, but is insignificant for EV/EBITDA once the country fixed effects are included. Taken together with the model-fit results in Section 5.8, these findings imply that a substantial part of the larger explanatory power of the EV/Sales specification reflects the mechanical margin link rather than evidence that the revenue multiple is, in general, more closely tied to independent firm fundamentals than the operating-profitability multiple, even though growth, intangible investment, the effective tax rate, and the cash position remain genuine firm-level correlates of EV/Sales.

These findings should be read in light of the survivorship limitation discussed in Section 4.1. Since this sample is based on the Bloomberg Equity Screener, augmented with the current rather than the historical constituents of the three STOXX Europe Total Market sector indices, it underrepresents firms that were delisted, acquired, or became insolvent, and overrepresents firms that survived and remained listed. The estimated relationships therefore describe the cross-section of surviving and index-eligible firms. The most likely direction of the resulting bias is a conservative one for the risk hypothesis, because the firms most exposed to financial distress are least likely to remain in the sample. This may contribute to the absence of a significant leverage effect.

The loss-firm premium and the growth associations may likewise be affected, since failed firms are absent from the estimation. The robustness of the baseline findings to alternative inference, to the winsorization choice, and to subsector heterogeneity is examined in Chapter 6.

6. Robustness and Subsector Heterogeneity

This chapter assesses whether the baseline findings of Chapter 5 remain consistent when alternative inference and specification choices are applied. It further examines whether the determinants differ across the three TMT subsectors and extends the EV/EBITDA model with additional operating measures. The robustness checks for the EV/Sales specification are reported in Appendix *Table IX*, the subsector regressions are reported in Appendix *Table X*, and the extended EV/EBITDA specifications are reported in Appendix *Table XI*.

6.1 Robustness of the EV/Sales Specification

The baseline EV/Sales specification with R&D intensity is re-estimated by changing one element at a time while keeping others constant. The profitability measure shifts from the EBITDA margin to the earnings before interest and taxes (EBIT) margin, and leverage moves from net debt to total debt. Additionally, size is now calculated using the natural logarithm of market capitalization instead of total assets. The years 2020 and 2025 are excluded, 2020 due to an extreme COVID-19 market shock, and 2025 as the final, incomplete year of the sample. The profitability coefficient remains positive and significant at the one percent level, at 3.270 with total-debt leverage, 2.685 when using the market-capitalization size measure, and both 3.266 when 2020 or 2025 are excluded. Replacing the EBITDA margin with the EBIT margin increases this coefficient to 4.964. The market-capitalization size measure raises the within R^2 from 0.424 to 0.508, partly for mechanical reasons, since market capitalization enters the enterprise-value numerator of the dependent variable. The risk measures are only significant in specific columns, and when they are, their signs are positive, contrary to the third hypothesis's prediction. Leverage is positive and significant at the one percent level, at 0.438 for the EBIT-margin specification and 0.297 without winsorization. Stock-return volatility is positive and significant at the five percent level at 0.319 under the market-capitalization size measure. None of the risk variables show the negative association predicted, indicating the third hypothesis is not supported across different specifications. Inference uses two-way clustering by firm and year, following Gow et al (2010). Since this clustering only affects standard errors, the coefficients remain unchanged, and the significance of the EBITDA margin, revenue growth, and R&D intensity is unaffected. Given the panel has only sixteen years, the year dimension has few clusters, so the standard errors should be interpreted cautiously. Firm clustering remains the main approach.

A more consequential sensitivity concerns the winsorization of the continuous variables described in Section 4.2. When the winsorization is removed, the EBITDA-margin coefficient falls from 3.290 to 0.559 and loses significance, while the within R^2 declines from 0.424 to 0.184. This shows that the strong positive margin association in the baseline model is sensitive to a small number of extreme observations, since unwinsorized margins among profitable firms include values close to the loss boundary that flatten the estimated slope. The sensitivity does not overturn the central message of the thesis, but it reinforces the cautious reading established by the decomposition in Section 5.1. The total margin association is both substantially mechanical and sensitive to outlier treatment, so the conservative conclusion that no positive economic premium for the margin can be established beyond the mechanical link is appropriate rather than overstated.

6.2 Subsector Heterogeneity

The baseline specification is re-estimated separately for Technology, Media and Telecommunications, omitting subsector fixed effects by construction and retaining country and year fixed effects where the sample size allows. Regarding EV/Sales, the EBITDA-margin coefficient is highest in Technology at 4.164, followed by Media at 2.927, and Telecommunications at 2.536, with all being statistically significant at the one percent level. Since the identity that links the two multiples holds within each subsector, each margin coefficient contains a mechanical component, allowing the decomposition in Section 5.1 to be repeated for each subsector. Therefore, the cross-subsector ordering is partly mechanical and should not be interpreted as direct evidence that the market awards a greater economic profitability premium to Technology than to Telecommunications. The loss-firm premium also differs markedly, at 1.926 for Telecommunications, 1.146 for Technology, and 0.834 for Media, with Telecommunications showing the highest EV/Sales within R^2 at 0.530. These estimates, based on a smaller sample of 475 firm-years, are indicative rather than precise.

Revenue growth differs between subsectors. For EV/Sales, it is positive and significant for Technology (0.472) and Telecommunications (0.386), but not for Media (0.130), with similar results for EV/EBITDA. The positive growth association in Telecommunications contrasts with the negative relationship reported by Kumar (2019), confirming that the conditional growth effect discussed in Chapter 3 does not resolve into a uniform sign across subsectors. The within R^2 of the EV/EBITDA regressions remains low, at 0.019 for Technology, 0.022 for Media, and 0.125 for Telecommunications. Even the higher Telecommunications value of 0.125, rather than the overall 0.372 that is inflated by the country and year fixed effects, confirms that observable firm characteristics explain only a small share of the operating-profitability multiple within each subsector.

6.3 Extended Specifications for EV/EBITDA

In adherence to the companion-variable logic of Kumar (2019) and to the multifactor EV/EBITDA model of Harbula (2009), return on assets, asset turnover, EBITDA growth, and earnings stability have been added. These additions raise the within R^2 only modestly, from 0.011 in the baseline to 0.069 in the full model. The low within R^2 is a substantive finding rather than a model shortcoming, since it shows that observable accounting fundamentals explain very little of the operating-profitability multiple once subsector, country, and year are held fixed. The thirty to thirty-five percent reported by Damodaran (2007) refers to cross-sectional fit and not to a within-fixed-effects measure, so it is not directly comparable to the within R^2 used here. This is consistent with the diagnosis of Section 5.8 that the operating-profitability multiple is associated with a broader and less easily measured set of determinants than the observable accounting measures used here. Return on assets and earnings stability are insignificant throughout. R&D intensity remains positive and significant in the extension columns, at 1.161 and 1.062, while revenue growth goes up to 0.286 and 0.354, both significant at the one percent level, when EBITDA growth and earnings stability are added. This stronger growth association is consistent with the finding in Section 5.7 that growth is a more reliable correlate of the operating-profitability multiple than the low baseline coefficient implies.

The two coefficients are both negative and statistically significant, and they merit discussion beyond mere presentation in the table. The coefficient for asset turnover ranges from minus 0.233 to minus 0.311 across various models and is significant at the one percent level. This aligns with the well-established inverse relationship between asset turnover and operating margin across different business contexts. Similarly, the EBITDA growth coefficient varies from minus 0.112 to minus 0.108 in the models where it appears and is also significant at the one percent level. Its negative sign can be explained by two non-exclusive mechanisms. First, strong recent EBITDA growth increases the denominator, reducing the trailing multiple. Second, mean reversion suggests this growth is not projected into a higher multiple. Both explanations are consistent with Chapter 3's finding that growth only adds value when returns exceed the cost of capital. These coefficients do not influence the primary hypotheses because they fall outside the four tested factors, indicating that these operating measures enter the multiple mainly through mechanical effects rather than pure economic premiums.

6.4 Multicollinearity Diagnostics

The variance inflation factors in Appendix *Table V* and the correlations in Appendix *Table IV* confirm the absence of multicollinearity issues affecting the results. All values remain below three, with the highest being 2.67 in the baseline EV/Sales model and 2.72 when R&D intensity is included, both well below O'Brien's (2007) thresholds. The strong negative correlation of minus 0.74 between cash and leverage is expected, as net debt is calculated net of cash. Nonetheless, both variables are retained for their distinct economic significance, as explained in Section 4.2.

7. CONCLUSION

The central result concerns profitability. The EBITDA margin is the main correlate of EV/Sales, but this link is substantially mechanical. Among profitable companies, the mechanical component accounts for the entire positive association at 132.6%, while the EV/EBITDA component is negative at minus 32.6%. Since this negative part is biased downward by measurement error in EBITDA, it should be considered a conservative bound consistent with zero. Hence, there is no evidence of a positive economic premium for the margin beyond this mechanical effect. The other hypotheses are generally supported, with some qualifications, except for risk. Revenue growth correlates positively with both valuation multiples, and the association strengthens when growth is measured as a trailing three-year rate. Higher R&D intensity is associated with a higher EV/Sales, and its positive EV/EBITDA coefficient mainly reflects a depressed denominator. The effective tax rate shows a negative relationship with EV/Sales but not with EV/EBITDA. The risk hypothesis is not supported since leverage and stock-return volatility do not display the expected negative signs.

This decomposition is the primary contribution for research because it converts a strong but partly definitional coefficient into a clear and interpretable outcome. It is not solely about the margin. It directly addresses whether that margin helps explain EV/Sales beyond a purely mechanical perspective. As shown, the greater explanatory power of the EV/Sales specification is largely mechanical. The revenue multiple should not be regarded as more closely linked to independent fundamentals than the operating-profitability multiple. In practical terms, a high EBITDA margin alone does not justify a higher EV/Sales multiple. However, factors like revenue growth, R&D intensity, the effective tax rate, and cash holdings are genuine firm-level correlates of EV/Sales. These factors are valuable for relative valuation and also serve as a map of the levers that drive the revenue multiple.

There are three limitations affecting these findings, which also point to future research avenues. First, the sample is based on the Bloomberg Equity Screener, augmented with the current rather than the historical membership of three sector indices, leading to a survivorship bias that is likely conservative for the risk hypothesis. Adopting a snapshot approach to index membership could reduce this bias and offer a more comprehensive view of the relationships. Second, the growth measure uses historical data, whereas a forward-looking measure based on point-in-time consensus estimates would be preferable but was not available in enough detail for the early years. This contributes to the low within R^2 in the EV/EBITDA model, and using forecasts could determine whether expectations help explain this gap. Third, the decomposition could be applied to each subsector separately to distinguish how much of the cross-subsector ordering in Chapter 6 is definitional rather than economic. Overall, the thesis highlights that the determinants of EV/Sales and EV/EBITDA differ in strength and economic significance. Furthermore, the observed link between profitability and the revenue multiple, once examined through the identity that connects the two multiples, appears more mechanical than it initially seems.

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APPENDICES

TABLE II: VARIABLE DEFINITIONS AND BLOOMBERG DATA SOURCES

Variable	Definition	Bloomberg Field
Dependent variables		
ln(EV/Sales)	Natural logarithm of EV/Sales, where EV/Sales = Enterprise Value / Revenue.	Derived
ln(EV/EBITDA)	Natural logarithm of EV/EBITDA, where EV/EBITDA = Enterprise Value / EBITDA; computed only for firms with positive EBITDA.	Derived
Components of enterprise value		
Enterprise Value	Market capitalization + total debt − cash and short-term investments; taken directly from Bloomberg.	ENTERPRISE_VALUE
Revenue	Total revenue (sales) for the fiscal year.	SALES_REV_TURN
EBITDA	Earnings before interest, taxes, depreciation and amortization.	EBITDA
Explanatory variables (baseline)		
Revenue Growth	Year-on-year change in revenue, (Revenue_t − Revenue_{t−1}) / Revenue_{t−1}.	Derived from SALES_REV_TURN
EBITDA Margin (profitable only)	EBITDA / Revenue for profitable firms; set to zero for loss-making firms (EBITDA < 0).	Derived
Loss Firm	Indicator equal to 1 if EBITDA < 0, and 0 otherwise; not winsorized.	Derived
Leverage (Net Debt / Assets)	Net debt / total assets, where net debt = total debt − cash and equivalents.	NET_DEBT, BS_TOT_ASSET
Firm Size (ln Total Assets)	Natural logarithm of total assets.	BS_TOT_ASSET
Cash / Assets	(Cash + cash equivalents) / total assets.	BS_CASH_NEAR_CASH_ITEM, BS_TOT_ASSET
Capex / Sales	Capital expenditures / revenue.	CF_CAP_EXPEND_PRPTY_ADD, SALES_REV_TURN
Stock Volatility	360-day price volatility from Bloomberg, divided by 100 to express it as a decimal.	VOLATILITY_360D
R&D / Sales	Research and development expenditure / revenue.	IS_RD_EXPEND, SALES_REV_TURN
Extension and robustness variables		
Effective Tax Rate	Bloomberg effective tax rate / 100; values above 100% set to missing, then winsorized.	EFF_TAX_RATE
Trailing 3-Year Sales CAGR	(Revenue_t / Revenue_{t−3})^(1/3) − 1; a smoothed backward-looking growth measure used as an alternative to one-year Revenue Growth.	Derived from SALES_REV_TURN
ROA	Net income / total assets.	NET_INCOME, BS_TOT_ASSET
Asset Turnover	Revenue / total assets.	SALES_REV_TURN, BS_TOT_ASSET
EBITDA Growth	Year-on-year change in EBITDA.	Derived from EBITDA
Earnings Stability	Rolling three-year standard deviation of the EBITDA margin within firm (requires three consecutive non-missing observations).	Derived
EBIT Margin (profitable only)	EBIT / Revenue for profitable firms; used in the robustness check.	EBIT, SALES_REV_TURN
Leverage (Total Debt / Assets)	Total debt / total assets; used in the robustness check.	SHORT_AND_LONG_TERM_DEBT, BS_TOT_ASSET
Firm Size (ln Market Cap)	Natural logarithm of market capitalization; used in the robustness check.	CUR_MKT_CAP

Note: Enterprise value is taken directly from Bloomberg. The Bloomberg Field column lists the standard mnemonics corresponding to each item; the exact fields should be read against the data dictionary used in the empirical work. The trailing three-year sales CAGR is defined as (Revenue_t / Revenue_{t−3})^(1/3) − 1.

TABLE III: DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE AND BY SUBSECTOR

	All TMT					Technology					Media					Telecom				
Variable	**Mean**	**Median**	**SD**	**P25**	**P75**	**Mean**	**Median**	**SD**	**P25**	**P75**	**Mean**	**Median**	**SD**	**P25**	**P75**	**Mean**	**Median**	**SD**	**P25**	**P75**
EV/Sales (w)	3.76	1.65	7.88	0.88	3.30	4.38	1.69	9.99	0.83	3.58	3.34	1.48	5.96	0.80	3.21	2.98	1.97	3.75	1.44	2.95
EV/EBITDA (w)	15.51	9.02	23.51	5.87	15.47	17.83	11.09	25.29	7.09	17.93	15.08	8.37	23.79	5.17	14.35	9.50	6.88	13.39	5.25	9.86
Revenue Growth	0.14	0.05	0.48	-0.04	0.17	0.15	0.07	0.48	-0.04	0.21	0.15	0.04	0.53	-0.06	0.17	0.05	0.02	0.23	-0.03	0.08
EBITDA Margin	-0.00	0.15	1.20	0.07	0.28	-0.18	0.12	1.60	0.05	0.21	0.11	0.16	0.78	0.07	0.29	0.29	0.31	0.18	0.19	0.38
Leverage	0.01	0.02	0.29	-0.17	0.21	-0.06	-0.05	0.26	-0.20	0.10	0.02	0.04	0.30	-0.18	0.22	0.25	0.28	0.21	0.16	0.40
Size (ln Assets)	5.72	5.28	2.32	4.06	7.42	5.34	5.03	2.06	3.87	6.61	5.41	5.19	2.12	3.98	6.89	8.24	8.75	2.36	7.09	9.88
Cash / Assets	0.16	0.11	0.15	0.05	0.22	0.19	0.15	0.16	0.08	0.25	0.16	0.10	0.16	0.05	0.23	0.07	0.05	0.09	0.02	0.09
Capex / Sales	0.07	0.02	0.15	0.01	0.07	0.06	0.02	0.14	0.01	0.05	0.07	0.01	0.16	0.01	0.04	0.15	0.13	0.14	0.07	0.18
R&D / Sales	0.10	0.00	0.31	0.00	0.10	0.17	0.08	0.40	0.01	0.15	0.04	0.00	0.19	0.00	0.00	0.01	0.00	0.01	0.00	0.00
Stock Volatility	0.44	0.38	0.22	0.29	0.52	0.46	0.41	0.21	0.32	0.53	0.46	0.40	0.24	0.29	0.54	0.31	0.27	0.15	0.22	0.34
Firms	356					158					158					40				
Firm-Years	4,300					1,930					1,856					514				

Note: Descriptive statistics for the final EV/Sales estimation sample after winsorising all continuous variables (including EV/Sales and EV/EBITDA) at the 1st and 99th percentiles. EV/EBITDA statistics computed on the EBITDA > 0 subsample. Firm and firm-year counts shown at the bottom. The 4,300 EV/Sales firm-years reported here exceed the 3,851 firm-years used in the baseline EV/Sales regression, which additionally requires non-missing values for all explanatory variables. Source: Bloomberg; own calculations.

TABLE IV: PAIRWISE CORRELATIONS OF THE CONTINUOUS REGRESSORS

Variable	**Rev. Growth**	**EBITDA Margin (pos.)**	**Loss Firm**	**Leverage**	**Size**	**Cash/Assets**	**Capex/Sales**	**R&D/Sales**	**Stock Vol.**
Rev. Growth	1.00	NA	NA	NA	NA	NA	NA	NA	NA
EBITDA Margin (pos.)	0.04	1.00	NA	NA	NA	NA	NA	NA	NA
Loss Firm	0.03	-0.44	1.00	NA	NA	NA	NA	NA	NA
Leverage	-0.18	0.16	-0.14	1.00	NA	NA	NA	NA	NA
Size	-0.17	0.28	-0.31	0.38	1.00	NA	NA	NA	NA
Cash/Assets	0.20	-0.09	0.21	-0.74	-0.38	1.00	NA	NA	NA
Capex/Sales	0.02	0.26	0.11	0.06	0.04	0.04	1.00	NA	NA
R&D/Sales	0.11	-0.17	0.36	-0.25	-0.21	0.35	0.26	1.00	NA
Stock Vol.	0.12	-0.24	0.38	-0.09	-0.46	0.20	0.02	0.32	1.00

Note: Pearson correlations among continuous regressors in the EV/Sales estimation sample. Upper triangle suppressed (symmetric). Correlations above |0.5| in absolute value warrant attention for multicollinearity. Source: Bloomberg; own calculations.

TABLE V: VARIANCE INFLATION FACTORS FOR THE EV/SALES REGRESSORS

Variable	VIF (Model 1)	VIF (Model 1b)
Revenue Growth	1.09	1.10
EBITDA Margin (profitable only)	1.71	1.73
Loss Firm (EBITDA < 0)	1.54	1.60
Leverage (Net Debt / Assets)	2.67	2.72
Firm Size (ln Total Assets)	1.80	1.81
Cash / Assets	2.47	2.58
Capex / Sales	1.27	1.40
Stock Volatility (360d)	1.58	1.65
R&D / Sales	NA	1.59

Note: Variance Inflation Factors for the EV/Sales regressors. VIFs computed from OLS replicas of Models 1 and 1b using lm(), since fixest does not interface with car::vif(). Fixed-effect dummies (subsector, country, year) omitted from the table. VIF > 5 indicates moderate multicollinearity; VIF > 10 indicates serious multicollinearity (O'Brien 2007). Source: own calculations.

TABLE VI: DECOMPOSITION OF THE EBITDA MARGIN COEFFICIENT INTO MECHANICAL AND ECONOMIC COMPONENTS

	(A) ln(EV/Sales)	(B) ln(EBITDA Margin), mechanical	(C) ln(EV/EBITDA), non-mechanical
EBITDA Margin (profitable only)	3.312*** (0.234)	4.393*** (0.181)	-1.081*** (0.293)
Observations	3,322	3,322	3,322
R^2	0.465	0.791	0.183
Within-R^2	0.380	0.753	0.046

*Note: Decomposition of the EBITDA-margin loading using the identity ln(EV/Sales) = ln(EBITDA Margin) + ln(EV/EBITDA), so the margin coefficient in column (A) equals the sum of columns (B) and (C): the mechanical part is 132.6% and the non-mechanical (economic) part is -32.6% of the total. All three models share the identical positive-EBITDA subsample of profitable firms, the same controls (the EV/Sales specification without the Loss Firm dummy, which is constant here) and subsector, country and year fixed effects, with firm-clustered standard errors. The non-mechanical part is conservatively biased downward by EBITDA measurement error. * p<0.1, ** p<0.05, *** p<0.01.*

TABLE VII: EFFECTIVE TAX RATE EXTENSION FOR EV/SALES AND EV/EBITDA

	(1) EV/Sales	(2) EV/Sales + Tax	(3) EV/Sales + R&D	(4) EV/Sales + R&D + Tax	(5) EV/EBITDA	(6) EV/EBITDA + Tax	(7) EV/EBITDA + R&D	(8) EV/EBITDA + R&D + Tax
Revenue Growth	0.249*** (0.092)	0.239*** (0.090)	0.274*** (0.097)	0.264*** (0.094)	0.281*** (0.093)	0.275*** (0.093)	0.342*** (0.101)	0.338*** (0.100)
EBITDA Margin (profitable only)	3.911*** (0.250)	3.828*** (0.250)	3.946*** (0.257)	3.866*** (0.258)				
Loss Firm (EBITDA < 0)	1.899*** (0.327)	1.851*** (0.333)	2.113*** (0.229)	2.041*** (0.228)				
Leverage (Net Debt / Assets)	-0.046 (0.197)	-0.016 (0.190)	0.022 (0.190)	0.048 (0.183)	-0.051 (0.202)	-0.041 (0.198)	-0.024 (0.206)	-0.018 (0.204)
Firm Size (ln Total Assets)	0.053*** (0.017)	0.056*** (0.017)	0.051*** (0.017)	0.053*** (0.017)	0.024 (0.016)	0.025 (0.016)	0.022 (0.016)	0.022 (0.016)
Cash / Assets	0.528 (0.349)	0.570* (0.342)	0.539 (0.334)	0.570* (0.326)	0.438 (0.356)	0.448 (0.351)	0.389 (0.346)	0.395 (0.343)
Capex / Sales	-0.058 (0.293)	-0.062 (0.290)	-0.172 (0.303)	-0.182 (0.299)	0.147 (0.285)	0.124 (0.285)	0.021 (0.314)	0.001 (0.313)
Stock Volatility (360d, decimal)	-0.109 (0.239)	-0.103 (0.234)	-0.175 (0.243)	-0.168 (0.240)	0.019 (0.233)	0.021 (0.232)	-0.161 (0.246)	-0.158 (0.246)
R&D / Sales			1.745*** (0.551)	1.717*** (0.534)			0.973* (0.523)	0.959* (0.519)
Effective Tax Rate		-0.491*** (0.143)		-0.463*** (0.144)		-0.177 (0.146)		-0.130 (0.147)
Observations	2,483	2,483	2,046	2,046	2,466	2,466	2,035	2,035
R^2	0.533	0.538	0.555	0.559	0.209	0.210	0.226	0.226
Within-R^2	0.453	0.458	0.491	0.496	0.028	0.030	0.044	0.044

*Note: Effective tax rate added to both the EV/Sales and EV/EBITDA baselines, EV/Sales columns first (Damodaran (2007): EBITDA and Sales are pre-tax, and country fixed effects absorb only average country-level tax differences, not firm-level variation). Effective tax rate = Bloomberg 'Tax Rate' / 100; raw values above 100% set to missing. Coverage is partial, so each '+ Tax' column is paired with the same-sample baseline immediately to its left, estimated on identical rows (column 2 with 1, 4 with 3, 6 with 5, 8 with 7). EV/Sales models retain the profitable-only EBITDA Margin and Loss Firm dummy; EBITDA Margin is excluded from all EV/EBITDA models to avoid mechanical inversion. All models include subsector, country, and year fixed effects. Continuous variables winsorized at 1st/99th percentile. Firm-clustered standard errors in parentheses. Within-R2 reported (FE absorb most overall variance). * p<0.1, ** p<0.05, *** p<0.01.*

TABLE VIII: TRAILING THREE-YEAR SALES GROWTH EXTENSION FOR EV/SALES & EV/EBITDA

	(1) EV/Sales	(2) EV/Sales (CAGR)	(3) EV/Sales + R&D	(4) EV/Sales + R&D (CAGR)	(5) EV/EBITDA	(6) EV/EBITDA (CAGR)	(7) EV/EBITDA + R&D	(8) EV/EBITDA + R&D (CAGR)
Revenue Growth	0.279*** (0.063)		0.280*** (0.065)		0.148* (0.082)		0.178** (0.082)	
Trailing 3Y Sales CAGR		0.595*** (0.093)		0.627*** (0.101)		0.430*** (0.120)		0.532*** (0.133)
EBITDA Margin (profitable only)	2.966*** (0.242)	2.936*** (0.244)	3.238*** (0.246)	3.231*** (0.243)				
Loss Firm (EBITDA < 0)	0.998*** (0.103)	0.983*** (0.101)	0.858*** (0.102)	0.841*** (0.101)				
Leverage (Net Debt / Assets)	0.234 (0.174)	0.305* (0.183)	0.185 (0.167)	0.256 (0.174)	0.016 (0.196)	0.047 (0.196)	0.003 (0.202)	0.047 (0.201)
Firm Size (ln Total Assets)	0.042** (0.019)	0.044** (0.019)	0.046** (0.019)	0.049*** (0.019)	-0.001 (0.016)	0.001 (0.016)	0.001 (0.017)	0.003 (0.017)
Cash / Assets	1.522*** (0.323)	1.602*** (0.328)	1.037*** (0.304)	1.124*** (0.308)	0.449 (0.343)	0.475 (0.341)	0.187 (0.340)	0.246 (0.337)
Capex / Sales	1.025*** (0.281)	1.010*** (0.283)	0.238 (0.259)	0.183 (0.259)	-0.006 (0.345)	-0.022 (0.343)	-0.179 (0.347)	-0.206 (0.342)
Stock Volatility (360d, decimal)	-0.066 (0.183)	-0.038 (0.185)	-0.243 (0.168)	-0.209 (0.167)	0.189 (0.180)	0.169 (0.179)	-0.003 (0.195)	-0.031 (0.193)
R&D / Sales			1.073*** (0.110)	1.064*** (0.112)			1.465*** (0.479)	1.506*** (0.477)
Observations	3,393	3,393	2,777	2,777	2,922	2,922	2,409	2,409
R^2	0.431	0.437	0.498	0.506	0.141	0.148	0.173	0.183
Within-R^2	0.342	0.350	0.417	0.427	0.013	0.021	0.031	0.043

*Note: Trailing three-year sales CAGR = (Revenue_t / Revenue_{t-3})^(1/3) - 1, a smoothed backward-looking growth measure used as an ALTERNATIVE to one-year Revenue Growth (the two are highly collinear and never enter together), for both multiples with EV/Sales columns first. The base columns use one-year Revenue Growth; the columns marked (CAGR) replace it with the Trailing 3Y Sales CAGR on identical samples, so the two growth measures are compared on the same rows. Forward-looking expected growth could not be sourced (no historical point-in-time Bloomberg BEst consensus for the early panel) and is documented as a data limitation only. EV/Sales models retain the profitable-only EBITDA Margin and Loss Firm dummy; EBITDA Margin is excluded from all EV/EBITDA models to avoid mechanical inversion. All models include subsector, country, and year fixed effects. Continuous variables winsorized at 1st/99th percentile. Firm-clustered standard errors in parentheses. Within-R2 reported. * p<0.1, ** p<0.05, *** p<0.01.*

TABLE IX: ROBUSTNESS AND SENSITIVITY CHECKS FOR THE EV/SALES SPECIFICATION

	(A) Baseline	(B) Total Debt	(C) ln(Market Cap)	(D) EBIT Margin	(E) Excl. 2020	(F) Excl. 2025	(G) Two-Way SE	(H) No Winsor
Revenue Growth	0.302*** (0.062)	0.304*** (0.062)	0.284*** (0.055)	0.329*** (0.056)	0.281*** (0.066)	0.310*** (0.058)	0.302*** (0.069)	0.018*** (0.004)
EBITDA Margin (profitable only)	3.290*** (0.238)	3.270*** (0.238)	2.685*** (0.210)		3.266*** (0.241)	3.266*** (0.239)	3.290*** (0.220)	0.559 (0.428)
EBIT Margin (profitable only)				4.964*** (0.244)				
Loss Firm (EBITDA < 0)	0.896*** (0.099)	0.887*** (0.099)	0.901*** (0.093)		0.892*** (0.101)	0.876*** (0.101)	0.896*** (0.088)	0.546*** (0.137)
Loss Firm (EBIT < 0)				0.612*** (0.077)				
Leverage (Net Debt / Assets)	0.172 (0.157)		0.214 (0.144)	0.438*** (0.159)	0.204 (0.161)	0.208 (0.158)	0.172 (0.164)	0.297*** (0.108)
Leverage (Total Debt / Assets)		0.265 (0.163)						
Firm Size (ln Total Assets)	0.044** (0.019)	0.043** (0.019)		0.045** (0.018)	0.045** (0.019)	0.044** (0.019)	0.044** (0.018)	0.074*** (0.025)
Firm Size (ln Market Cap)			0.174*** (0.020)					
Cash / Assets	1.018*** (0.301)	0.880*** (0.239)	1.158*** (0.274)	1.137*** (0.303)	1.007*** (0.303)	1.139*** (0.306)	1.018*** (0.299)	1.915*** (0.349)
Capex / Sales	0.388 (0.256)	0.388 (0.255)	0.541*** (0.204)	1.116*** (0.176)	0.328 (0.250)	0.427* (0.256)	0.388 (0.244)	-0.016*** (0.002)
Stock Volatility (360d, decimal)	-0.220 (0.158)	-0.231 (0.156)	0.319** (0.152)	-0.024 (0.164)	-0.246 (0.159)	-0.181 (0.160)	-0.220 (0.164)	0.156 (0.217)
R&D / Sales	0.999*** (0.120)	0.999*** (0.120)	0.905*** (0.113)	1.017*** (0.131)	1.015*** (0.124)	0.968*** (0.122)	0.999*** (0.113)	0.026*** (0.004)
Observations	3,142	3,142	3,137	3,142	2,887	2,983	3,142	3,142
R^2	0.514	0.515	0.584	0.527	0.513	0.515	0.514	0.313
Within-R^2	0.424	0.425	0.508	0.440	0.423	0.426	0.424	0.184

*Note: Sensitivity analysis for EV/Sales baseline (Model 1b). Each column varies one element: (B) Total Debt leverage, (C) ln(Market Cap) as size, (D) EBIT Margin instead of EBITDA Margin, (E) excludes 2020, (F) excludes 2025, (G) two-way clustered SE (firm + year; 16 year-clusters — interpret with caution), (H) no winsorising. All other elements held constant across columns. Firm-clustered SE except column (G). * p<0.1, ** p<0.05, *** p<0.01.*

TABLE X: SUBSECTOR-SPECIFIC REGRESSIONS FOR EV/SALES AND EV/EBITDA

	EV/Sales Technology	EV/Sales Media	EV/Sales Telecom	EV/EBITDA Technology	EV/EBITDA Media	EV/EBITDA Telecom
Revenue Growth	0.472*** (0.058)	0.130 (0.083)	0.386** (0.176)	0.215** (0.108)	0.099 (0.097)	0.307* (0.180)
EBITDA Margin (profitable only)	4.164*** (0.436)	2.927*** (0.323)	2.536*** (0.410)			
Loss Firm (EBITDA < 0)	1.146*** (0.129)	0.834*** (0.150)	1.926*** (0.343)			
Leverage (Net Debt / Assets)	0.085 (0.287)	0.344* (0.204)	-0.515 (0.315)	0.182 (0.352)	0.048 (0.214)	-0.763 (0.537)
Firm Size (ln Total Assets)	0.019 (0.026)	0.070** (0.032)	0.048 (0.037)	-0.002 (0.025)	0.040 (0.028)	-0.008 (0.031)
Cash / Assets	1.126** (0.508)	1.323*** (0.392)	0.416 (0.569)	-0.163 (0.592)	0.927** (0.415)	-0.083 (0.671)
Capex / Sales	1.762*** (0.260)	0.546 (0.350)	0.878*** (0.219)	-0.252 (0.455)	0.289 (0.415)	0.731 (0.469)
Stock Volatility (360d, decimal)	-0.237 (0.284)	0.142 (0.209)	-0.101 (0.415)	0.403 (0.342)	0.110 (0.214)	0.111 (0.398)
Observations	1,751	1,625	475	1,453	1,410	459
R^2	0.555	0.430	0.667	0.154	0.197	0.372
Within-R^2	0.411	0.332	0.530	0.019	0.022	0.125

*Note: Subsector-specific regressions. The EV/Sales Technology, Media and Telecom columns estimate the EV/Sales specification separately for the Technology, Media, and Telecommunications subsamples. The EV/EBITDA Technology, Media and Telecom columns do the same for EV/EBITDA. Subsector fixed effects are omitted by construction. Country and year fixed effects are included where the subsample size allows. Firm-clustered SE in parentheses. Stars * p<0.1, ** p<0.05, *** p<0.01.*

TABLE XI: EXTENDED SPECIFICATIONS FOR THE EV/EBITDA MULTIPLE

	(2) Baseline	(2b) + R&D	(2c)+ ROA & Turnover	(2cb) + ROA, Turnover & R&D	(2d) + Growth & Stability	(2db) + Growth, Stability & R&D
Revenue Growth	0.160** (0.075)	0.198** (0.077)	0.168** (0.075)	0.200** (0.079)	0.286*** (0.086)	0.354*** (0.101)
Leverage (Net Debt / Assets)	0.087 (0.180)	0.079 (0.184)	0.069 (0.180)	0.075 (0.185)	0.087 (0.183)	0.139 (0.189)
Firm Size (ln Total Assets)	-0.000 (0.015)	0.000 (0.016)	-0.027 (0.017)	-0.022 (0.018)	-0.022 (0.017)	-0.015 (0.018)
Cash / Assets	0.406 (0.329)	0.150 (0.322)	0.391 (0.336)	0.141 (0.324)	0.406 (0.339)	0.239 (0.323)
Capex / Sales	0.036 (0.340)	-0.117 (0.349)	-0.252 (0.349)	-0.356 (0.353)	-0.400 (0.342)	-0.596* (0.333)
Stock Volatility (360d, decimal)	0.195 (0.175)	0.005 (0.190)	0.092 (0.175)	-0.047 (0.191)	0.090 (0.189)	-0.010 (0.210)
ROA (Net Income / Assets)			0.076 (0.370)	0.207 (0.403)	0.556 (0.356)	0.651 (0.396)
Asset Turnover (Revenue / Assets)			-0.275*** (0.080)	-0.233*** (0.084)	-0.311*** (0.081)	-0.279*** (0.085)
EBITDA Growth					-0.112*** (0.020)	-0.108*** (0.021)
Earnings Stability (3Y rolling SD of EBITDA Margin)					0.156 (0.282)	0.020 (0.325)
R&D / Sales		1.364*** (0.480)		1.161** (0.462)		1.062** (0.467)
Observations	3,322	2,729	3,322	2,729	2,937	2,411
R^2	0.154	0.181	0.169	0.191	0.191	0.213
Within-R^2	0.011	0.027	0.029	0.040	0.054	0.069

*Note: Extensions of the EV/EBITDA baseline. The '+ ROA & Turnover' columns add ROA and Asset Turnover (Damodaran 2007; Kumar 2019). The '+ Growth & Stability' columns additionally add EBITDA growth and earnings stability following Harbula (2009). Earnings stability is the rolling 3-year standard deviation of EBITDA margin within firm (requires 3 non-missing consecutive observations per firm). EBITDA Margin excluded from all EV/EBITDA models to avoid mechanical inversion. All models include subsector, country, and year fixed effects. Continuous variables winsorized at 1st/99th percentile. Firm-clustered standard errors in parentheses. Models 2b/2cb/2db estimated on sub-sample with non-missing R&D. * p<0.1, ** p<0.05, *** p<0.01.*

DISCLOSURES

I disclose that AI tools were used during the preparation of this MFW as follows:

- AI-based tools assisted with the literature search and the organization of references.
- AI was used to check and improve English language and grammar.
- A generative AI tool was used to help structure the research and writing process.
- AI was used to assist in writing and debugging the code for the empirical analysis.

All final writing, synthesis, interpretation, and critical analysis are my own work. Every source, whether conventional or AI-assisted, has been referenced in accordance with academic guidelines. The content and originality of this thesis are entirely my responsibility, and I have ensured that its integrity has not been compromised by the use of AI tools.

The number of characters without spaces, from the Introduction to the end of the Conclusion, is 72,218, which is within the limit of 75,000 set by the general rules for master's dissertations at ISEG. The References, Appendices, and Disclosures together contain 21,490 characters without spaces.