INSTITUTO
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DE LISBOA

''The Role of Financial and Non-Financial Information in Private-Equity Backed Ventures''

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Master in Finance

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December 2024

BUSINESS SCHOOL

Department of Finance

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Acknowledgments

First and foremost, I would like to express my deepest gratitude to my professor and thesis advisor, Professor Mohamed Azzim Gulamhussen, for his support, guidance, and encouragement throughout this entire process. His dedication of time and willingness to help were invaluable, and his motivation kept me focused and inspired.

I am also profoundly grateful to my parents, whose continued motivation, unconditional support, and the freedom they provided me during this journey made this thesis possible. Their belief in me has been a constant source of strength.

Finally, I would like to thank all the people closest to me, whose care, encouragement, and genuine concern for both my wellbeing and the progress of this thesis were immensely appreciated.

Resumo

Este estudo visa reavaliar o impacto da informação financeira, não financeira e do mercado de capitais no processo de avaliação, com um foco específico nas empresas apoiadas por capital de risco no contexto atual. As informações financeiras utilizadas para este estudo são variáveis como a caixa, ativos não monetários, dívida de longo prazo, receita, custo de vendas, despesas administrativas, de vendas e gerais, despesas de investigação e desenvolvimento e total de ativos intangíveis. Informação não financeira, por exemplo, idade da empresa, número de rondas de financiamento, variação percentual do total de ações ordinárias em circulação e variáveis indicadoras para 2 e 3 anos após o IPO. Além disso, informações do mercado de capitais, como o índice NASDAQ. Com base no trabalho de Armstrong, Davila e Foster (2006), que examinaram dados de 1993 a 2003, este estudo alarga o horizonte temporal para cobrir o período de 2010 a 2019, empregando uma amostra de 565 empresas e uma metodologia semelhante ao estudo original para fornecer uma análise contemporânea.

As descobertas revelam continuidade e divergência em relação a pesquisas anteriores. Embora a análise descritiva mostre diferenças mínimas no tempo decorrido desde a fundação até ao IPO, com a avaliação de mercado a aumentar ao longo de sucessivas rondas de financiamento, a análise de regressão revela desvios notáveis. Contrariamente à crença convencional, verifica-se que as receitas e a idade da empresa diminuem o valor na fase pré-IPO, enquanto outras variáveis não financeiras o aumentam. Na fase pós-IPO, a receita continua a diminuir de valor, enquanto a idade da empresa se torna um fator positivo. As despesas com R&D e SMGA continuam a aumentar o valor, sugerindo que os investidores as vêem como investimentos a longo prazo. As *proxies* para a diluição patrimonial e para os pedidos de patente foram estatisticamente insignificantes, limitando o seu poder explicativo. Globalmente, as variáveis financeiras são cruciais para explicar a avaliação de mercado, enquanto os fatores não financeiros exercem uma influência moderada, mas importante, especialmente para as empresas apoiadas por capital privado.

Palavras-chave: Inital Public Offering (IPO), Informação Contabilística, Avaliação, Capital de Risco.

Classificação JEL: G24, M41, M13

Abstract in English

This study aims to reassess the impact of financial, non-financial, and capital market information on the valuation process, with a particular focus on venture-backed companies in the current landscape. The financial information used for this study are variables such as cash, non-cash assets, long term debt, revenue, cost of sales, sales, marketing & general administrative costs, research and development expenditures and total intangible assets. Non-financial information, for instance, firm age, number of funding rounds, percentage change on total common shares outstanding and indicator variables for 2 and 3 years after IPO. As well, capital market information such as the NASDAQ index composite. Building upon the work of Armstrong, Davila, and Foster (2006), which examined data from 1993 to 2003, this study expands the timeframe to cover the period from 2010 to 2019, employing a sample of 565 companies and a similar methodology to the original study to provide a contemporary analysis.

The findings reveal both continuity and divergence from earlier research. While the descriptive analysis shows minimal differences in the time taken from founding to IPO, with market valuation increasing across successive financing rounds, the regression analysis uncovers notable deviations. Contrary to conventional belief, revenue and company age are found to diminish value in the pre-IPO phase, while other non-financial variables enhance it. In the post-IPO phase, revenue continues to decrease value, while company age becomes a positive factor. R&D and SG&A expenditures remain value-enhancing, suggesting investors view them as long-term investments. The proxies for equity dilution and patent applications were statistically insignificant, limiting their explanatory power. Overall, financial variables are crucial for explaining market valuation, while non-financial factors exert moderate but important influence, especially for private equity-backed firms.

Keywords: Initial Public Offering (IPO), Accounting Information, Valuation, Venture Capital.

JEL Classification: G24, M41, M13

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Glossary of Acronyms

IPO	Initial Public Offering	PTA	Precedent Transaction Analysis
VC	Venture Capital	ROIC	Return on Invested Capital
DCF	Discounted Cash Flow	VCs	Venture Capitalists
FCFF	Free Cash Flow to the Firm	BA	Business Angels
FCFE	Free Cash Flow to Equity	VCM	Venture Capital Method
APV	Adjusted Present Value	NPV	Net Present Value
CCF	Capital Cash Flows	TMT	Top Management Team
DDM	Dividend Discount Model	GDP	Gross Domestic Product
EVA	Economic Value Added	ESG	Environmental, Social and Governance
PVED	Present Value of Expected Dividends	R&D	Research & Development
EBO	Edwards, Bell and Ohlson	IPOs	Initial Public Offerings
P/S	Price-to-Sale	ICB	Industry Classification Benchmark
P/B	Price-to-Book	COS	Cost of Sales
ROE	Return on Equity	SMGA	Sales, Marketing and General Administrative
ANAV	Adjusted Net Asset Value	OLS	Ordinary Least Square
CEEM	Capitalized Excess Earnings Method	VIF	Variance Inflation Factors
CCA	Comparable Company Analysis		

1. Introduction

In the current venture capital (VC) and private equity landscape, the importance of financial information remains a critical concern. As the global economy evolves at an unprecedented pace, driven by technological advancements and shifting market dynamics, there's an increasing need to reassess traditional perspectives on the role of financial statements and accounting data in valuing early-stage companies. As a result, this study aims to reevaluate the impact of financial, non-financial, and capital market information on the valuation process, with a particular focus on venture-backed firms in the present context, acknowledging the unique challenges and opportunities they face. [1]

Building upon the influential article of Armstrong, Davila, and Foster (2006), which analyzed data from 1993 to 2003, this research will instead cover the timeframe of 2010-2019, utilizing a sample of 565 companies The study deliberately excludes the period from 2020 to 2023 due to the pandemic's disruptive effects on markets and the economy, ensuring that the findings are not skewed by these exceptional circumstances. The study will employ regression models with time-series approaches, mirroring the methodology of the original article.

By applying established methodologies to contemporary data, the primary objective is to discern whether the conclusions drawn in the past still hold true in the current changing economic and market environment. It seeks to investigate whether financial information still retains its historical significance and holds the same weight in determining a company's value in today's context. By doing so, the study will identify which components of financial statements are most crucial in explaining a company's value, both before and after its initial public offering (IPO). Additionally, it will explore how financial and non-financial information, along with market characteristics, differently influences the valuation of traded and non-traded companies, highlighting potential disparities between these two categories and offering nuanced understanding of valuation across different stages of a company's lifecycle.

[1] The moderating effect of non-financial variables on financial outcomes is quite well documented (see, amongst others **Bhimani et al. (2009, 2013, 2014)**).

2. Literature Review

Business valuation has always been an extremely complex field characterized by subjectivity. Throughout history, many practitioners and academics have proposed diverse approaches to navigate this challenging area. As the business and financial landscapes have evolved, so too have the methodologies employed to determine accurate company valuations.

The evolution of company valuation reflects a continuous effort to refine and adapt valuation models, incorporating a broader understanding of economic dynamics, financial markets, and taking into account multiple factors influencing businesses in an ever-changing global landscape.

As a first approach, we will analyze various valuation models to understand academic findings, identify key variables for explaining valuation and how it is calculated, with a particular focus on early-stage companies. Therefore, we will present literature that defines what constitutes private equity backed companies, enabling us to delve into early-stage valuation models. Afterwards, we will explore literature that highlights the significance of financial, non-financial, and capital market information.

2.1. Overview of Valuation Models

Understanding the variety of valuation models present in current literature requires a systematic classification into theoretical and empirical approaches, a distinction also noted by **Abukari, K. et al. (2000).**

Theoretical underpinnings offer a structure grounded in financial principles. Among the well-known theoretical models are:

1. **Discounted Cash Flow (DCF) approaches** – which includes Free Cash Flow to the Firm (FCFF), Free Cash Flow to Equity (FCFE), Adjusted Present Value (APV) and Capital Cash Flows (CCF) models. These methods determine corporate valuation by discounting cash flows. Each method differs in the discounted cash flows and the applied discount rates **(Oded, J. and Michel, A., 2007; Berk, J. and DeMarzo, P. 2017).**

2. **Dividend Discount Model (DDM),** also known as Gordon Growth Model, calculates firm value based on the present value of expected dividends, assuming a constant growth rate (g), indefinitely (**Mc Lemore, P. et al. 2015**).According to this model, the firm's valuation depends on the dividend level for the forthcoming year, divided by the equity cost of capital, while incorporating the expected growth rate of dividends (**Berk, J. and DeMarzo, P. , 2017**)

3. **Economic Value Added (EVA)** models assess a company's value by measuring its generated economic profit, as explored by **Lee, C.M. (1996) and Edwards, E. and Bell, P. (1961).** EVA serves as a tool to evaluate a firm's financial performance beyond traditional accounting measures, providing a more comprehensive view of value creation or destruction.

4. **Present Value of Expected Dividends (PVED)** models focus on the present value of expected future dividends (**Donnelly, R., 2013**). **Feltham, G. and Ohlson, J. (1995)** demonstrate that under clean surplus accounting conditions, where changes in equity book value equate to retained earnings, market value can be expressed as the sum of book value and the present value of expected future abnormal earnings. This finding underscores the significance of financial statement variables in explaining company valuation.

Regarding empirical studies, **Abukari K., Jog V., and McConomy B. (2000)** categorize them into various groups:

1. Simplified and extended versions of Edwards, Bell and Ohlson (EBO) models express firm value using different financial variables. Some versions, such as those by **Collins et al. (1997)** and **Tiras et al. (1998),** use earnings and book value as key determinants. Others, such as **Hand, J. (1999)** and **Landsman, W. (1999),** incorporate dividends and capital expenditure variables to estimate firm value.

2. Models derived from economic value concepts, originating in **Miller and Modigliani's (1961**) work, states that a ʺfirm's value is linked to its current and expected future operating cash flowsʺ, **(e.g., see Sirower, M. and O'Byrne, S., 1998).**

3. Multiple approaches comprise **Damodaran's (1994 & 1996)** empirical studies. He tested a price-to-sales (P/S) regression model based on dividend payout, earnings growth, beta, and profit margin. Additionally, Damodaran examined price-to-book (P/B) multiples as a function of return on equity (ROE), dividend payout ratio, growth rate, and beta.

4. Ultimately, **algorithms employed by courts** in legal cases to determine the value of a firm **(e.g., Hickman, K. and Petry, G., 1990).** Courts utilize financial statement-based models for at least four decades, as evidenced by **Beatty, Riffe, and Thompson (1999).**

Additionally, there are two empirically recognized models within the finance domain not explicitly covered in the paper by **Abukari, K. et al. (2001)**. Firstly, the asset-based approach warrants attention.

Yannick, C.'s book (2022) explores this aspect by examining the adjusted net asset value method (ANAV) and the capitalized excess earnings method (CEEM) through case studies and illustrative examples. Secondly, the **Comparable Company Analysis (CCA)** involves comparing several valuation multiples of the company in scope with those of its peers. Thirdly, the **Precedent Transaction Analysis (PTA),** similar to CCA, requires comparing valuation multiples with those from similar transactions involving other companies.

In a video presentation by **McKinsey (2020),** Timothy Koller shared his insights on valuation. He argues that ''a core set of principles that have been around for more than 30, 50, 60 years, those principles don't change, what change is the economic environment". An exemplification of this enduring concept is that growth and Return on Invested Capital (ROIC) fundamentally drive cash flow and, consequently, determine value.

Appendixes 1 and 2 delineate the equations derived from the presented models. It is noteworthy to emphasize that a majority of these models incorporate accounting information. Subsequently, **Abukari K. et al. (2000)** undertake an empirical examination of ten aforementioned models. The objective is twofold: to access the performance of these models and to analyze the relative significance of financial statement variables in explaining equity valuation. The models subjected to this evaluation are: EBO models (both simple and extended versions), EVC model, ratio-type models, and two court-accepted models, as depicted in **Appendix 2**.

Employing Stein's Rank formula, the authors evaluate the relative performance of these models across different samples from 2090 Canadian firms spanning the years 1992 to 1996. The study finds that variables associated with book value and earnings are of utmost importance in explaining valuation. Furthermore, dividends exhibit higher valuation importance in companies characterized by a high degree of information asymmetry. The research suggests that valuations frequently leverage current performance as a strong indicator of future performance, thereby introducing complexity in valuing early-stage companies. Ultimately, the authors deduce that equity valuations are based on cumulative past investments (reflected in book value) and anticipated performance (represented by earnings-related variables).

It is pertinent to highlight that, in their study, **Abukari K. et al. (2000)**, by Stein's formula, rank the Extended EBO Models as the most robust, with an impressive R^2 of nearly 62% (refer to **Appendix 3**). Conversely, the extended P/B model is considered less explanatory, registering an R^2 of only 16%.

2.2. Valuation in Early-Stage Companies

Since our study has a deeper focus on private equity backed ventures, it is fundamental to understand the behaviors and characteristics of companies that have not yet undergone an exit.

Young companies are the foundation for creating economic value, generating jobs and driving innovation. These types of companies are characterized by the absence of a significant operating history, small or no revenues, operating losses, dependence on private equity, high susceptibility to failure, and multiple claims on equity. Additionally, investments in startups are often illiquid due to the early-stage nature of these companies (**Damodaran, A., 2009; Orlando, C., 2022).**

The developmental trajectories of startup companies reveal a considerable diversity, ranging from conceptual ideas as the pre-seed stage to entities with established markets and revenue streams. Some entities are in their early developmental phases, where founders conceptualize ideas aimed at addressing unmet consumer needs. Others have progressed to commercial product development but still lack substantial revenues or profitability. Yet, some have attained a stage wherein they possess a market for their products or services with the potential for profits, denoted as the growth stage **(Damodaran, A., 2009). Appendix 4** visually illustrates the various stages of a young company upon exit and **Appendix 5** demonstrates the development of earnings and revenues through each stage.

As the company expands and undergoes successive rounds of financing, it attracts diverse investor categories, resulting in a proliferation of financing mechanisms for the venture **(Orlando, C., 2022).** It is noteworthy that, on average, each successive round of financing tends to raise the firm's valuation, as evidenced in studies such as those by **Armstrong, C. et al. (2006).**

In the venture market context, achieving a fair valuation is essential for both entrepreneurs and investors, particularly venture capitalists (VCs) and business angels (BA). Entrepreneurs require a fair valuation not only for its influence on their motivation, underscoring the value assigned to their commitment and resources invested, but also to attract investments. Simultaneously, investors rely on accurate valuations to make informed decisions about acquiring a stake in the new ventures, anticipating high returns. Beyond these considerations, research also suggests that valuation is at the core of negotiation between founders and potential investors (**Miloud, T., Aspelund, A. and Cabrol, M., 2012).** A fair valuation is a crucial precondition for transparent and mutually beneficial agreements, fostering sustainable and prosperous partnerships while mitigating potential conflicts between involved parties.

Despite its significance, the valuation of startups is inherently challenging due to various factors. Many emergent enterprises operate as startups or idea-based businesses, characterized by lack of substantial revenues and recurrent operating losses. Even profitable startups typically possess short operating histories and heavily depend on private capital. Consequently, applying conventional valuation methodologies directly to venture capital-backed companies proves to be challenging, given the absence of consistent cash flows, growth patterns, and ascertainable discount rates. Moreover, the high failure rate among startups should also be considered, introducing an additional layer of complexity into the valuation process (**Damodaran, A., 2009**).

According to **Kohn, A. et al. (2018),** the existing body of literature on startup valuation within the VC market not only lacks depth but also exhibits fragmentation, lacking a consistent framework that integrates empirical research on the determinants influencing startup valuations. This observation is reinforced by **Miloud, T. et al. (2012),** who acknowledges the need for more rigorous research in VC investment and emphasizes certain studies that identify gaps in the existing literature regarding startup valuation and corporate finance. The subsequent section will display preferred studies for early-stage valuation.

2.3. Non-Traditional Studies for Early-Stage Valuation

Traditional valuation methodologies are theoretically proven, yet their applicability to early-stage startups is constrained by impractical assumptions. Moreover, these traditional approaches often demand data that is frequently either unavailable or lacks reliability for early-stage ventures. In response to these challenges, innovative valuation tools have emerged (**Orlando, C., 2022**). Business angels and venture capitalists predominantly employ these tools, designed with a primary emphasis on adapting assumptions and methodologies in valuation to effectively address the uncertainty inherent in the early stages of startup development. In his paper, **Orlando, C. (2022)** categorizes these innovative tools into two groups: Non-Traditional and Empirical Non-Traditional Valuation Methods.

Among the Non-Traditional Valuation Methods, the venture capital method (VCM) stands out as the first approach, made to accommodate the uncertainty of startup companies by changing how the discount factor is calculated and adjusting the forecasting period. The second method is the First Chicago Method, an improvement of the VCM that considers a broader array of scenarios, as opposed to the VCM's singular scenario. The third approach, Damodaran's Method, applies the DCF method with modifications regarding cash flows, the calculation of the company beta, and terminal value. This model also takes into consideration survival probability and illiquidity challenges faced by young companies **(Damodaran, A., 2009**). The fourth method, real option valuation, applies financial theory on options pricing and proves effective for young, high-growth companies by taking into consideration several complexities of start-ups **(Damodaran, A., 2009**). Lastly, intangible assets valuation estimates the company's value considering intangible assets, a crucial aspect often overlooked by other valuation methods. **Appendix 6** provides an overview of these methods along with relevant formulas and descriptions.

Turning to the Empirical Non-Traditional Methods, since most of the approaches heavily rely on financial information, empirical methods have been developed to facilitate fair valuation when financial information is scarce or uninformative, as is often the case with early-stage firms. **Orlando, C. (2022)** defines these methods as follows: First, Berkus Method, developed by **Berkus, D. (1996),** derives valuation by segmenting risk into different components. Second, the Scorecard Method, created by **Payne, B (2011)**, compares the value of comparable companies to obtain a pre-money average value, subsequently adjusted using a scorecard. The third method, the Risk Factor Summation Method, developed by OhioTech Angels (**Rahardjo, D. and Sugiarto, M., 2019**), similarly to the first two methods, accesses the value of a company through risk determinants and adjusts the average pre-money valuation of comparable companies considering several risk factors. Lastly, the Rule of Thirds, typically employed in initial valuation rounds by VCs, where valuation depends on the capital negotiated between founders and investors (**Mothersill, W. et al., 2009**).

In his work, **Orlando, C. (2022**) states that start-ups encounter several challenges when employing traditional valuation methods, primarily stemming from a lack of data for comparable companies, insufficient or uninformative financial data for the selected company, higher uncertainty compared to mature companies, multiple claims on equity (arising from multiple rounds of financing), high rate of development, and issues of illiquidity. Therefore, he concludes that no single method addresses all issues with evaluating early-stage companies. Considering this, he affirms that no single valuation tool can be identified as the most suitable. However, among the methods discussed earlier, he argues that Damodaran's Method and Real Options Valuation are the most comprehensive in adopting the aforementioned problems. This perspective is consistent with **Damodaran, A. (2009),** who, in his paper, also suggests that these two methods offer the most explanatory power.

Orlando, C. (2022) further presents two potential solutions for valuation challenges. One solution involves combining the DCF/Net Present Value (NPV) method from Damodaran with Real Option Valuation, aiming to mitigate their individual limitations. He implies that investigating this combination could produce valuable insights. Another proposed solution suggests employing multiple valuation methods alongside to derive an 'average valuation.' This approach seeks to leverage the strengths of various methods collectively to arrive at a more complete valuation outcome.

2.4. Financial Information

Many of these approaches, as noted by **Orlando, C. (2022),** are significantly in need of financial information. Despite efforts by researchers to develop and implement empirical tools to address the absence of financial information, these methods often fall short in explanatory power as they overlook several other pertinent issues. This underlines the critical importance of financial information and the significant role its variables play in the valuation of a company. This viewpoint is also emphasized in other undermentioned research papers that highlight the crucial nature of financial information.

For instance, **Cumming, D. et al. (2009a),** in a study involving 39 countries, demonstrates a bias in the valuation of private equity funds due to the substantial impact of accounting standards and the legal systems of countries. Less stringent accounting rules and weak legal systems are shown to facilitate overvaluation. Another example is found in the work of **Crain, N. et al. (2018),** which presents evidence indicating that fair value accounting increases valuation accuracy across a broad sample of private equity managers' valuation records. The study reveals an 18% reduction in valuation bias when fair value accounting is applied, particularly in high-growth companies, and a 37% increase in valuation accuracy. This strong evidence suggests that the benefits of using fair value accounting are likely to outweigh concerns about the reliability of measurements, even in challenging environments. **Easton, Larocque, and Stevens (2018)** explore the impact of fair value accounting on private equity valuations at the fund level and find that fair value accounting also leads to improved valuation outcomes. Additionally, **Hand, J. (2005),** in a study concerning 204 biotechnology companies in the period from 1992 to 2003, concludes that financial statements are value-relevant in the private equity venture capital market for high-growth companies as biotech. Finally, **Davila, A. and Foster, G. (2005),** using a sample of 78 private companies, report a positive correlation between changes in revenue and changes in valuation, further reinforcing the idea that financial statements play a crucial role in the valuation process.

2.5. Non-Financial Information

Accounting information, as stated before, despite being considered of great importance, there are instances when it may be insufficiently available. Addressing this gap, **Miloud, T. et al (2012**), present an empirical study introducing alternative variables that may possibly be considered when accounting information is missing. Employing a quantitative research approach, the study analyses 184 rounds of early-stage venture capital investments in 102 new ventures in France. Focusing on the hypothesis related to the effects of industry structure, founders, top management team (TMT) and external relationships, the findings suggests that these factors, derived from strategic management theories, could serve as a complementary valuation method for new ventures.

In addition to that study, the journal from **Bhimani, A et al. (2010)** presents insights regarding firm size and age. In private equity-backed ventures, default can significantly lower valuations due to their dependence on high leverage. Default signals potential failures in achieving growth targets, increasing perceived risk and discouraging additional funding. In public companies, default typically results in credit rating downgrades and higher borrowing costs, leading to stock price declines as investor confidence declines. Therefore, since default lowers valuation and non-financial factors such as firm size and age influence the likelihood of default, we can infer that these factors negatively affect valuation. While larger and older firms might have more established operations, their increased complexity can increase the default risk, consequently negatively affecting valuation by enhancing perceived risk and financial instability.

Nevertheless, according with another study by **Bhimani, A et al. (2013),** incorporating non-financial information and macroeconomic indicators alongside traditional financial accounting data greatly improves the accuracy of default prediction models. Moreover, macroeconomic indicators such as Gross Domestic Product (GDP), contribute to reducing the likelihood of default and positively influence market valuation. In contrast, higher benchmark interest rates increase the likelihood of default and tend to decrease market valuation. Additionally, non-financial factors such as operational assets, partners and support help mitigate default risk, thereby contributing positively to a firm's valuation.

Geographical location is another significant determinant, especially elements such as the country's legal system, cultural context, and level of innovativeness that can result in varying valuations—either higher or lower. For example, formal institutions, such as legal systems and regulatory frameworks, are crucial for both entrepreneurs and venture capitalists. These institutions help reassure venture capitalists that new venture valuations are fair and justified, while also reducing transaction costs and mitigating information asymmetry **(see Engelen, P. and van Essen, M., 2010; Li, Y. and Zahra, S., 2012).** On the other hand, formal institutions safeguard against entrepreneurs yielding too much control due to low valuations and encourage founders to focus on productive innovation **(Lerner, J. and Schoar, A., 2005; Baumol, W., 1996).** Overall, empirical studies have demonstrated that formal institutions that effectively protect VCs, thereby reducing investor uncertainty, contribute to higher start-up valuation across different countries (**see Lerner, J. and Schoar, A., 2005; Aggarwal and Goodell, 2014; Cumming, D. et al. 2009b; Nahata, R. et al. 2014).**

Social norms, customs and traditions are examples of the so-called informal institutions. Many researchers assert the impact of informal institutions on VC activities (**Lerner, J. and Tåg, J., 2013; Hofstede, G., 2001**). For example, considering only cultural dimensions of **Hofstede (2001),** uncertainty avoidance and collectivism affect VC activity as they are closely related to the uncertainty and information asymmetry inherent in investing in early-stage companies (**Li, Y. and Zahra, S., 2012; Antonczyk, R. and Salzmann, A., 2012).**

Higher levels of uncertainty avoidance tend to result in lower startup valuations, since VCs investors who prefer to avoid uncertainty are likely to demand a higher risk premium as a compensation from the risks taken by their investments (**see Fidrmuc, J. and Jacob, M., 2010; Li, Y. and Zahra, S., 2012; Antonczyk, R. and Salzmann, A., 2014).** Collectivism, typically seen as negative for valuation, can sometimes result in higher valuations in collectivistic countries due to trust and cooperation **(see Ding, Z. et al., 2014; Hsee, C. and Weber, E., 1999; Tiessen, J., 1997).** Trust and cooperation are the key for a successful negotiation that might lead VCs to voluntarily accept higher valuations for the prioritization of group goals (**Shepherd, D. and Zacharakis, A., 2001; Cai, D. et al., 2000**).

Innovation emerges as a pivotal factor in early-stage valuation, contributing to its increase. **Schertler, A. and Tykvová, T. (2011)** suggest that investments stimulate innovation and vice-versa. The interplay of innovation with both formal and informal institutions play a significant role in determining why certain countries exhibit higher valuations for startups.

Another important factor influencing daily business operations and overall firm valuation is Environmental, Social, and Governance (ESG) practices. Generally, strong ESG performance enhances firm value, leading to higher market valuations **(Yoon, B. et al., 2018; Zhou, G. et al., 2022; Chang, Y. et al., 2022**). However, the impact of ESG can vary by sector. For example, in the palm oil industry, ESG practices may negatively impact firm valuation due to lower scores in the environmental aspect (**Chong, T. et al., 2023).**

2.6. Valuation and its Correlation with Financial and Non-Financial Variables

Armstrong, C., Davila, A., and Foster, G. (2006) conducted the first empirical study investigating the correlation between financial, non-financial statement information and capital market information with valuation during both pre- and post-IPO periods. Employing a sample of 502 venture capital-backed companies over the period from 1993 to 2003, their primary findings underscored that financial information explains a significant portion of the levels in valuation during both periods. **Appendix 7** shows the description of the variables used in article. Notably, in the pre-IPO phase, research and development (R&D) costs are found to be value-enhancing. This finding aligns with the rationale that, for emerging companies, continuous development contributes positively to valuation. **Formula 1** was employed for pre-IPO analysis, while **Formula 2** was applied for post-IPO assessment.

$$MV - PRIV_{i,t} = \alpha + \beta_1 \Delta CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \beta_4 REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \sum_{j=2-6} \phi_j SERIES_{i,t} + \phi_7 DILUTE_{i,t} + \phi_8 PAT_{i,t} + \theta_1 \Delta NASDAQ_t + \varepsilon_{i,t} \quad (1)$$

$$MV - PUB_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \beta_4 REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \left[\sum_{j=2-3} \phi_j YEAR + j_{i,t}\right] + \phi_4 PAT_{i,t} + \theta_1 NASDAQ_t + \varepsilon_{i,t} \quad (2)$$

Employing the matching method and the interpolation method to verify their hypothesis, **Armstrong, C. et al. (2006)** reported a total adjusted R^2 averaging 66.71% for the Pre-IPO models and 61.42% for the post-IPO models (see **Table 1**). Generally, both equations 1 and 2 returned similar outcomes for their non-financial statement variables. Revenues and R&D expenses, characterized by positive coefficients, were identified as value-enhancing in both periods. Nevertheless, other costs such as SMGA expenses and COS demonstrate a change between the Pre-and Post-IPO phases, displaying a positive effect in the pre-IPO scenario and a negative impact in the post-IPO.

[Table 1 Here]

Building upon prior research regarding the significance of financial information and other non-financial variables, the objective of this thesis is to reaffirm the latest findings. Specifically, it aims to reevaluate whether financial, non-financial and capital market information remains explanatory and influential in valuation.

Furthermore, the study seeks to determine whether the same variables continue to have a value-enhancing or diminishing effect. Specifically noting investor perspectives both pre- and post-IPO compared with **Armstrong, C. et al (2006).** It will assess whether, in the Pre-IPO phase, costs related to R&D expenditures, SMGA expenses, and COS alongside revenue continue to enhance value as perceived investments by private equity investors. Similarly, in the post-IPO context, the research will examine if revenue and R&D maintain their role in enhancing value, whereas COS and SMGA potentially have significant negative effects, consistent with the market's treatment of these costs as operational rather than investment expenditures.

To achieve this, the research paper by **Armstrong, C., Davila, A. & Foster, G. (2006)** will serve as a guiding reference for testing these hypotheses in the present day. Their approach and robust methodology will provide a valuable basis for our analysis, allowing us to adapt and refine their techniques accommodating the characteristics of our sample.

3. Data & Methodology

In this empirical study, the primary objective is to investigate the factors influencing equity valuation both preceding and following Initial Public Offerings (IPOs), with a specific emphasis on the pre-IPO phase, aligning with the framework presented by **Armstrong, C. et al (2006)** in their academic paper. The dataset comprises 565 companies that successfully went public between 2013 and 2016, with data spanning from 2010 to 2019 in the United States. The data collection process was facilitated through EIKON, a renowned financial information platform, ensuring a rich and reliable information pool. The data will be conducted on an annual basis to ensure a consistent and comparable analysis.

To arrive at the final sample of 565 companies, an initial primary dataset of 894 companies was extracted from EIKON, based on the forementioned assumptions. Subsequently, any company lacking data across all variables or missing data between IPO-3 and IPO+3 was excluded, resulting in the elimination of 329 companies. The remaining dataset provided almost all necessary variables from both financial and non-financial information.

To complement the primary data from EIKON and address gaps in pre-IPO information, Crunchbase was utilized to expand the dataset with early-stage information of the selected companies. This additional data included the number of funding rounds, investors, acquisitions, and last funding type prior to the IPO. This supplementary information facilitates analysis and comparison of each sector's readiness for public listing, strategic direction, and growth potential. Furthermore, NASDAQ records were consulted to obtain capital market information.

Therefore, the integration of these sources enhances reliability of the study, contributing to a more delicate understanding of the factors influencing and shaping company valuation in the pre- and post-IPO phases.

To validate and extend the findings of **Armstrong et al. (2006),** this study employs two analytical approaches. First, a descriptive analysis is conducted to completely examine the sample and its characteristics. Following the descriptive analysis, a quantitative method is applied, utilizing time-series econometrics to test and verify the robustness of the model and the effects of variables explaining a company's market value at each event time. This approach differs from the original study in that no matching or interpolation methods are employed, primarily due to the unavailability of data on financing rounds. Instead, this study adopts a simplified method using rank regressions based on the IPO event timeline.

3.1. Overview of Data Characteristics

As stated before, a descriptive analysis is initially conducted to provide an essential overview of the dataset's key characteristics. This step offers insights into the distribution of variables, identifies potential patterns, and detects any anomalies in the data. This approach is the foundation for a more robust examination of factors influencing equity valuation in the IPO process.

Analyzing the dataset from a sector perspective, according to the Industry Classification Benchmark[2] (ICB), the distribution is as follows: 3.52% basic materials, 14.07% consumer discretionary, 3.69% consumer staples, 5.36% energy, 12.06% financials, 9.88% industrials, 6.03% real estate, 8.38% technology, 2.35% telecommunications, 1.68% utilities, and 33% healthcare. The significant representation of the healthcare sector aligns with the notable boom experienced in the U.S. healthcare sector from 2013 to 2016, particularly in 2014 and 2015, driven by the Affordable Care Act's coverage expansions, biotech advancements, and accelerated economic growth **(Sisko et al., 2014).** The substantial presence of technology and industrials sectors was anticipated given the growth of IoT and e-commerce during this period. The underrepresentation of sectors such as telecommunications and utilities are consistent with their relatively mature and stable nature.

For the descriptive analysis, the following financial information and valuation metrics were incorporated, including company market capitalization, total assets, book value per share (total equity), revenue, cost of revenue, total operating expenses, EBITDA, EBIT, net income before and after taxes, goodwill, number of funding rounds and number of investors. Total expenses were also included, calculated by considering revenue and net income before taxes.

Following the data analysis, the second phase of the study focuses on constructing and testing the most unbiased and consistent model for the dataset. The empirical analysis covers a variety set of variables involving financial, non-financial, and capital market information. Our primary objective is to determine whether the impact of these variables aligns with the findings presented in **Armstrong et al. (2006).** By systematically examining these scenarios, we aim to validate and extend their results, contributing to the robustness and generalizability of our understanding of valuation.

Both regression models will include the following financial variables: revenues - $REV_{i,t}$, cost of sales (COS) - $COS_{i,t}$, R&D expenditures - $RD_{i,t}$, cash - $CASH_{i,t}$, non-cash assets - $NCA_{i,t}$, long-term debt - $LTD_{i,t}$, and sales, marketing and general administrative expenses (SMGA) - $SMGA_{i,t}$. Non-financial variables will include the age of the company - $AGE_{i,t}$, and the total intangible assets - $TIA_{i,t}$, with the

[2] ICB's universal adoption and detailed framework make it a more suitable choice compared to NAICS, which is primarily used in North America, and GICS, which is more focused on sector classification. ICB's provide a clearer classification system, ensuring accurate categorization of companies with diverse business operations.

latter serving as a proxy for the number of patent applications. Capital market information will be represented by the level of the NASDAQ composite index - $NASDAQ_t$.

Specific to each regression model, there are additional non-financial statement variables. For the pre-IPO analysis, the number of funding rounds – $ROUNDS_{i,t}$ (data available for 400 companies) and the percentage change in total common outstanding shares - $TCOS_{i,t}$ - were included. In comparison to Amstrong, C. et al (2006), number of funding rounds will provide a proxy for the series $(B, C, \dots, G+)$ of funding of companies, while the percentage change in total common outstanding shares acts as a proxy for equity dilution.

For the post-IPO regression, indicator variables for the second and third years following the IPO were incorporated ($\sum_{j=2-3} \phi_j YEAR + \ j_{i,t}$). This inclusion allows for the consideration of information beyond the initial valuation, considering the company's trajectory and growth potential in the public markets. This improvement provides a more accurate assessment of the long-term value of a public company and may increase the predictive power of the regression model.

3.1.1. Adjustments to Regression Models: Adapting to Data Constraints

As previously stated, this study introduces several modifications to the models employed in the previous paper. These changes primarily involve the substitution of certain variables that were unavailable or difficult to obtain in our dataset. Specifically, three key variables from the original study have been replaced with suitable proxies. The number of patent applications ($PAT_{i,t}$), equity dilution that occurred for company i at the first funding after time t ($DILUTE_{i,t}$) and the series of funding of company i at the first funding after time t ($\sum_{j=2-6} \phi_j SERIES_{i,t}$).

This study employs financial variables as proxies for non-financial variables for research purposes, based on the premise that financial metrics can serve as indicative measures of underlying economic and social factors.

1. As for the financial information, instead of using the number of patent applications filed by a company, this study uses the amount of total intangible assets of a given company as a proxy ($TIA_{i,t}$). This serves as an indicator of innovation (often reflected in patent applications) and might be correlated with patent applications, as companies with more intangible assets are likely to hold a higher number of patents. However, there are some limitations to this approach. Substituting the number of patents with total intangible assets can lead to omitted variable bias. Additionally, intangible assets include items beyond patents, which might not be directly related to patent

applications. In general, while there is no definitive research confirming the use of total intangible assets as a proxy for the number of patents, it is reasonable due to data constraints.

2. Additionally, there was significant difficulty in obtaining information about the series of funding for companies, which was used in the previous thesis for regression analysis on private equity market value, due to a scarcity of available information regarding this topic. The number of funding rounds ($ROUNDS_{i,t}$) can serve as a proxy for the series of funding of company at the first funding after time t, capturing a company's ability to attract investors and secure funding, which is likely to be correlated with the $SERIES_{i,t}$ variable. This substitution is a reasonable alternative, considering the data availability. However, it is essential to acknowledge the limitations of this approach. By using the number of funding rounds, some granularity in capturing the specific effects of each specific capital raising round ($e.g., B, C, \ldots, G+, etc.$) on private market capitalization may be lost, potentially leading to omitted variable bias.
3. Furthermore, due to the lack of available data on equity dilution, the percentage change in total common outstanding shares ($TCOS_{i,t}$) is used as a proxy for the equity dilution that occurred for companies at the first funding after time t. While this measure is readily available and generally correlated with equity dilution, it presents certain limitations when used as a proxy for the $DILUTE_{i,t}$ variable. This approach may not fully capture the complexities of financing structures, such as the issuance of different share classes or the existence of convertible securities. Additionally, the percentage change could be influenced by factors unrelated to equity dilution, such as stock splits or share repurchases, potentially introducing bias into the regression model. Despite these limitations, the percentage change in outstanding shares is employed as a proxy variable, given the potential significant correlation with equity dilution.

Formulas 3 and **4** represent the modified regression models employed in this analysis, incorporating the additional variables. When compared to **formulas 1** and **2** from the original study, it becomes evident that the variables $SERIES_{i,t}$, $DILUTE_{i,t}$, and $PAT_{i,t}$, have been replaced with $ROUNDS_{i,t}$, $TCOS_{i,t}$, and $TIA_{i,t}$, respectively. These substitutions were required by data availability constraints. While these proxies may not perfectly replicate the original variables, they have been carefully selected to maintain the integrity of the model and provide meaningful insights into the factors influencing equity valuation in the IPO process.

$$MV - PRIV_{i,t} = \alpha + \beta_1 \Delta CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \beta_4 REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \phi_2 ROUNDS_{i,t} + \phi_3 TCOS_{i,t} + \phi_4 TIA_{i,t} + \theta_1 \Delta NASDAQ_t + \varepsilon_{i,t} \quad (3)$$

$$MV - PUB_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \beta_4 REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \left[\sum_{j=2-3} \phi_j YEAR + j_{i,t}\right] + \phi_4 TIA_{i,t} + \theta_1 NASDAQ_t + \varepsilon_{i,t} \quad (4)$$

3.2. Quantitative Analysis of Variable Correlations

Figure 1 and 2 illustrates the correlations between variables using Spearman's Correlation Heatmap for the pre-IPO and post-IPO phases, respectively.

[Figure 1 and Figure 2 Here]

In the pre-IPO phase, financial variables exhibit the strongest correlations. Revenue shows a strong correlation with the COS (0.73 – Spearman's and 0.99 – Pearson's) and SMGA (0.81- Spearman's and 0.94 – Pearson's). Aligned with **Armstrong et al. (2006)** findings where COS and revenue have a Spearman's correlation of 0.83 (Pearson's correlation of 0.97). Additionally, the cost of sales and SMGA have a strong correlation 0.66. Cash is an exception, displaying a weak correlation with the other financial statement variables, ranging from 0.13 to 0.28. Non-financial and capital market information variables generally exhibit minimal correlation with other variables. Although total intangible assets serve as a proxy for a non-financial statement information variable, their origin is still rooted as a part of financial information and thus show medium correlation with most of the financial variables.

For the post-IPO phase, the correlations between variables remain largely consistent with the pre-IPO scenario, with most financial variables maintaining their strong correlations. Non-financial variables, including indicator variables for the second- and third-years post-IPO, generally show low correlations with other variables. An exception is the moderate correlation (0.56) between the third-year post-IPO indicator and the NASDAQ composite index.

4. Descriptive Statistics & Observations

Before conducting and analyzing the regressions, it is essential to first perform a descriptive analysis of the dataset and compare our findings with those presented in **Armstrong et al. (2006).** In their study, two-time formats are utilized: calendar time, which analyzes financial and non-financial information throughout each round of financing, and event time – years before and after IPO. However, due to the unavailability of data concerning financial, non-financial, and capital market information during each round of financing, our focus will be solely on event time, specifically from three years prior to the IPO until three years post-IPO.

4.1. Years from Company Founding Until IPO

The initial analysis will involve evaluating whether there are differences in the time it takes for a company to go public following its founding. To facilitate comparison between the findings of **Armstrong et al. (2006)** and our own results, **Table 2** has been constructed to provide an overview and support our conclusions. A more detailed presentation of our findings is available in **Appendix 8**.

In the original thesis, the classification of industry sectors differs significantly. **Armstrong et al. (2006)** categorize the sample into Software, Telco/Network, Services, Biotechnology, Medical Equipment, and Computer Hardware. In contrast, our study uses the ICB[3] to divide the sample into eleven distinct industry sectors.

It is important to note that the industry divisions in the previous thesis correspond to specific sectors within the ICB. For instance, the Software and Computer Hardware sub-sectors are classified within the Technology Sector, while the Telco/Network sub-sector falls under the Telecommunications Sector. Both Biotechnology and Medical Equipment are part of the Health Care Sector. The Services sub-sector can span multiple sectors, typically associated with Consumer Discretionary or Consumer Staples, depending on the nature of the services provided.

According to **Table 2**, during the 1993-2003 period, the pooled sample shows a mean (median) time to IPO of 5.36 (3.00) years. For the 2010-2019 period, the mean (median) time extends to 6.05 (3.00) years, reflecting a difference of 0.69 years. This increase is primarily driven by industries such as the Energy and Consumer Discretionary sectors, which average 7.19 and 6.52 years, respectively, to complete an IPO from founding. However, when considering only the comparable sectors, the mean time to IPO during the earlier period is nearly identical to that of the later period, at 5.38 years. Overall,

[3] The data set is divided into the following sectors: Basic Materials, Consumer Discretionary, Consumer Staples, Energy, Financials, Healthcare, Industrials, Real Estate, Technology, Telecommunications and Utilities.

we can conclude that, for comparable industries, there is little to no difference in the time taken to complete an IPO across the different time ranges.

In comparing Software and Computer Hardware, as well as Telco/Network, with their corresponding ICB industries—Technology and Telecommunications—during the earlier period, it is evident that companies are, on average, reaching maturity and opting for an IPO at an earlier stage. This trend could be attributed to factors such as increased investor demand, and improved access to funding. Additionally, the overall data may reflect the impact of other sub-sectors within the Technology and Telecommunications industries that typically require less time to go public, thereby reducing the average time to IPO in the earlier period.

On the other hand, Biotechnology and Medical Equipment firms reached the IPO stage more quickly during the 1993-2003 period than the Healthcare sector, with a mean (median) time to IPO of 6.70 (6.00) years—a difference of 0.58 years. The Healthcare sector includes a diverse range of companies, such as pharmaceuticals and healthcare services, which often face stringent regulatory requirements and extensive clinical trial processes, leading to delays in going public. In contrast, Biotechnology and Medical Equipment firms may have more streamlined pathways to commercialization, enabling a quicker transition to the public market.

From **Table 2**, we can also take other assumptions. The Energy sector shows a relatively higher mean time to IPO (7.19 years) compared to the overall sectors, indicating that the sector's longer timelines may result from complex project requirements and regulatory approvals[4]. Real Estate (4.00 years) and Utilities (4.10 years) sectors have the shortest mean times, suggesting simpler pathways to public offerings. **Honjo, Y. (2020)** suggests that less complex sectors are likely to go public earlier than other sectors.

[Table 2 Here]

4.2. Market Capitalization Through Event Time

Differently from the original paper - **Figure 1 of Armstrong, C. et al. (2006),** our paper analyses the median valuation of each sector by event time instead of by each round of financing. As shown in **Figure 3**, market valuations tend to increase over time, with a significant rise occurring after the IPO.

[4]Energy projects often require significant infrastructure investments and involve extensive implementation processes, contributing to increased complexity. The sector faces stringent regulatory scrutiny, including extensive environmental assessments and safety compliance, which can delay the readiness for an IPO **(IRENA, 2023).**

This finding aligns with the results of the original paper, which concluded that median private equity market valuations generally increase with successive rounds of financing.

[Figure 3 Here]

Figure 4 breaks down the data by sector, revealing that the trend of increasing market valuation is consistent across all sectors. However, a slight decline in valuation is observed from IPO+1 to IPO+3 in the Basic Materials, Consumer Staples, and Energy sectors. The sectors with the highest market capitalizations in the sample are Consumer Discretionary, Consumer Staples, Healthcare, and Industrials, driven by strong consumer demand and significant growth potential. Conversely, Basic Materials, Telecommunications, and Utilities exhibit the lowest market capitalizations, likely due to their cyclical nature, capital intensity, and regulatory challenges. Additionally, investor sentiment tends to favor high-growth sectors such as Technology and Healthcare, resulting in higher valuations in these areas compared to more traditional sectors.

[Figure 4 Here]

4.3. Pooled Revenue & Expense Deciles

By examining the distribution of revenue and expenses across the sample firms over the event time, we can identify patterns, trends and potential outliers that may not be apparent through other analytical methods.

Our analysis, represented by **Figure 5,** reveals several key observations regarding the pooled revenue and expense deciles. Firstly, the 90th decile exhibits significantly higher values for both revenue and expenses, ranging from 3.5 billion to over 4 billion, whereas the remaining deciles range from 0 to less than 1 billion. This suggests that a small proportion of firms in our sample are driving the overall trends, with revenues and expenses that are substantially higher than the rest. Secondly, we observe a positive trend for revenues and a negative trend for expenses across all deciles, indicating that firms are generally experiencing growth in revenue and a corresponding increase in expenses. This trend is consistent with the expectation that firms would invest in operations, expansion, or research and development as they grow. Thirdly, we note a strong correlation between revenue and expense deciles, with similar magnitude of changes in both metrics. This suggests that firms are managing their expenses in line with their revenue growth, or that expenses are driving revenue growth. Finally, we observe a deviation in the 90th decile for IPO+1 and IPO+2, where both revenue and expense values are lower than expected.

[Figure 5 Here]

Our findings can be compared to those of **Armstrong et al. (2006),** who also examined the financial performance of firms during the pre- and post-IPO periods. While our study finds a positive trend for revenues and a negative trend for expenses - consistent with the original article-, there are notable differences in the magnitude of revenue and expense values. Their article reports lower values, ranging from -600 million to 600 million, whereas our study shows values ranging from -4 to 4 billion. This discrepancy may be due to differences in sample selection and industry.

Furthermore, **Armstrong et al. (2006)** found that expenses exceeded revenues at every event time and decile. In contrast, our study shows that revenues are greater than expenses at the 70th and 90th deciles, as illustrated in **Figure 6**. This difference may indicate that the firms in our sample are more efficient in managing their expenses or have business models that enhance growth potential.

[Figure 6 Here]

4.4. Median Revenues & Expenses by Sector

Considering **Figure 7**, our analysis reveals that the Basic Materials sector consistently demonstrates the highest median revenue values across all event times, peaking at approximately 1.9 billion at IPO-3. Notably, this sector exhibits a negative trend in revenues, contrasting with the positive trends observed in all other industries. The Healthcare sector, on the other hand, shows the lowest median revenue values, remaining below 200 million throughout all event times.

These findings contrast with **Armstrong et al. (2006),** who reported that the Telecommunications and Services sectors had the highest median revenues, peaking at around 70 million in IPO+3. The difference in industry classification makes direct comparisons challenging, but it is notable that Telecommunications sector, which would include the Telco/Network category, does not show the same prominence in revenue. While both studies agree on the relatively lower revenue values in the Healthcare sector (which includes their Biotechnology and Medical Equipment categories), our results indicate a significantly larger scale of revenues across all industries. Interestingly, our analysis shows that the pooled median revenue values are lower than most individual industries, exceeding only Technology, Telecommunications, and Healthcare. This is consistent with **Armstrong et al.'s (2006)** findings, where they also reported that the pooled median revenue was higher than the Biotech and Medical Equipment sectors (which correspond to our Healthcare sector).

[Figure 7 Here]

In terms of expenses, represented by **figure 8**, our study finds that the Basic Materials sector incurs the highest median expenses, reaching approximately -1.6 billion at IPO-2. Conversely, the Healthcare sector consistently shows the lowest median expenses, remaining above -200 million across all event times. While most industries in our study exhibit a decreasing trend in expenses, we identified two notable exceptions. The Utilities sector demonstrates a unique pattern, with expenses decreasing substantially from -800 million to -200 million at IPO, followed by an increase to -1 billion post-IPO. Additionally, the Basic Materials sector shows a positive trend, with expenses diminishing over time.

These findings differ from **Armstrong et al. (2006),** who reported a consistent negative trend in expenses across all industries, with Telecommunications showing the highest expense values. Notably, our Technology sector, which includes their Software and Computer Hardware categories, shows lower expenses relative to other industries, contrasting with their findings.

[Figure 8 Here]

From **figure 9**, it is possible to observe that the Basic Materials sector achieves the highest median net income values, exceeding 150 million at IPO-3, while the Technology sector consistently shows the lowest, approximately -50 million throughout all event times. Most industries demonstrate an increasing net income trend, with exceptions in Basic Materials - showing a decreasing trend with a positive increase from IPO to IPO+2 -, and Utilities - displaying a notably volatile trend. These results differ from **Armstrong et al. (2006),** who reported a generally negative trend until IPO+1, followed by a positive trend until IPO+3 across all industries. Our findings suggest a more varied landscape of net income trends, with significant inter-industry differences.

[Figure 9 Here]

4.5. Industry Trends in Funding Rounds and Investor Activity

To enhance our descriptive analysis, specifically for the Pre-IPO phase, we examined the number of funding rounds and investors across different industry sectors. **Figure 10** presents this data, with columns showing total funding rounds and investors and lines illustrating the ratios per company. The Healthcare sector leads with an average of 9.04 funding rounds and 8.92 investors per company, while the Technology sector follows closely with 6.45 funding rounds and 6.53 investors. In contrast, the overall sample averages 4.21 funding rounds and 3.70 investors.

These figures suggest that companies in the Healthcare sector may be more attractive to investors or that the stage of innovation and development within this industry requires more extensive funding efforts. Another perspective, as previously noted, is that this sector typically takes longer to reach an IPO, necessitating more funding rounds. Similarly, the Technology sector suggests significant investor confidence driven by innovation and scalability, reflecting a market trend towards digital transformation. Overall, these findings highlight both sectors as attractive opportunities for investors seeking growth potential prior to IPOs.

[Figure 10 Here]

Overall, we can conclude several key aspects: the Healthcare sector stands out by taking the most time to reach an IPO and having a higher number of funding rounds and investors compared to the average across other sectors. When comparing both studies, the healthcare and technology sectors exhibit similar times to IPO. Revenues, expenses and, consequently, net income tend to increase over time, with significant growth occurring after the IPO. Market capitalization follows the same trend, which may indicate a correlation between these variables. Generally, the results from both studies have remained stable over time, indicating reliable and applicable findings across different economic cycles.

Ultimately, our study provides a more granular view of industry-specific financial trends around IPOs compared to previous research. The use of the ICB classification system allows for a more comprehensive analysis of market trends, revealing industry-specific behaviors that may have been obscured in previous studies.

5. Primary Results

In a regression analysis, testing different types of regression models is essential to ensure that the selected model best captures the data structure, follows the necessary assumptions, and aligns with the specific objectives of the study. Various regression techniques, such as Ordinary Least Squares (OLS), has unique assumptions and capabilities, making them suitable for different dataset characteristics. For instance, while OLS may provide unbiased estimates under ideal conditions, it can encounter issues as multicollinearity or overfitting in high-dimensional data. In such cases, alternative models such as rank regression may offer more robust solutions by incorporating regularization **(Yuan, X. et al., 2023)**. Therefore, evaluating multiple regression approaches is crucial to identify the model that not only fits the data well but also meets the study's requirements for interpretability, prediction accuracy, and the handling of specific data features, thereby ensuring the validity and reliability of the analysis.

In our analysis, we tested various OLS regression models, including $lin - lin$, $log - lin$, $lin - log$, and $log - log$ models. However, these models failed to satisfy several key assumptions required by OLS regression. OLS relies on assumptions such as linearity in the parameters, strict exogeneity of explanatory variables, no perfect collinearity – none of the independent variables is constant and there is no exact linear relationship among them -, homoskedasticity – the conditional variance of the errors is constant, absence of autocorrelation - no correlation between errors of different observations, and normality of the error terms **(Curto, J., 2021)**.

Our model violated multiple assumptions. Ramsey's test indicated issues with linearity while high variance inflation factors (VIF) for variables such as the constant, revenue, COS, and SMGA suggested the presence of perfect collinearity. Moreover, the Breusch-Pagan test revealed heteroskedasticity in the regression. Autocorrelation was present in both scenarios, as highlighted by Durbin's Watson statistic, which placed them in region I[5]. Additionally, the test for normality of residuals shows a p-value of zero, indicating with confidence that the residuals are not normally distributed (**Appendix 9**). Given these violations, we opted to use rank regression—consistent with the original study—to more appropriately test the model.

Rank regression, also known as non-parametric or rank transformation regression, is a preferred model when strict assumptions of OLS regression cannot be met. In this approach, both the dependent and independent variables are transformed into their ranks before performing ordinary

[5] For the Pre-IPO scenario, the values of $dL \approx 1.77$ and $dU \approx 1.89$. For the post-IPO scenario, the values are $dL \approx 1.90$ and $dU \approx 1.94$. Region I is defined as the range from 0 to dL. If values fall within this region, it indicates that the errors are positively correlated **(Curto, J., 2021)**.

least squares regression. This method is particularly useful when the dependent variable demonstrates a non-linear, monotonic relationship with the independent variables (**Iman, R.L., Conover, W.J., 1979**). The monotonicity between the dependent and independent variables are illustrated in **Appendix 10** by interpreting Spearman's Rank Correlation[6]. It can be observed that there is one non monotonic variable in the pre-IPO scenario and three in the post-IPO. While rank regression does not strictly require all variables to have monotonic relationships with the dependent variable, it is important to understand how these variables can affect model performance, especially if they significantly contribute to the model's explanatory power.

Rank regression is more robust to outliers and does not require the normality of residuals (**Fu, L., Wang, Y., Liu, C., 2012**). As a result, whether outliers are included or excluded, the results remain consistent[7]. It also handles non-linear relationships better than standard OLS. However, it is less intuitive to interpret, as coefficients reflect changes in ranks rather than in actual values.[8]

5.1. Predicted Results

Based on the literature review, it is anticipated that both financial and non-financial information will be critical predictors in our regression analyses. Research indicates that financial data, including fair value accounting, substantially enhances valuation accuracy and addresses biases, particularly in the context of private equity (**Cumming et al., 2009; Crain et al., 2018**). Meanwhile, non-financial factors and capital market information also emerge as significant determinants of valuation **(Miloud et al., 2012; Engelen & van Essen, 2010; Armstrong, C., et al., 2006; Hand, 2005**).

Revenue is widely recognized as having a positive influence on company valuation, with studies demonstrating a significant positive correlation between revenue and market capitalization, particularly within firms employing digital platform business models (**Pomykalski, P., 2019; Uday Chandra, U. et al., 2008**). In relation to R&D expenditures, most literature suggests that R&D investments positively affect market value (**Ehie, I. C. et al., 2010**). Specially in early-stage companies, innovation is a pivotal factor that contributes to its increase (**Schertler, A. and Tykvová, T., 2011)**. Similarly, SMGA costs are shown to significantly impact on a firm's market value. Specifically, marketing expenditures, especially in advertising and customer-related assets, have a direct and favorable effect on firm value (**Joshi, A. et al., 2010**). The effects of long-term debt on corporate valuation present a

[6] A strong Spearman correlation close to 1 or -1 suggests a strong monotonic relationship while close to zero indicates weak or no monotonic relationship.

[7] Rank regression is utilized, assuming that outliers have a negligible influence and are given equal weight as the rest of the data, thereby preserving the robustness of the regression model.

[8] For the model construction, missing values (NaNs) were imputed using the median of each variable's respective column.

dichotomy among researchers. While some studies indicate that long-term debt has a positive and statistically significant impact on company value (**Desai, R. et al., 2021; D'Mello, R. et al., 2010**), others argue that both long-term and short-term borrowings can negatively affect market value, with a stronger effect on smaller firms compared to their medium and large counterparts (**Desai, R. et al., 2021**).

Furthermore, research indicates that a higher number of funding rounds prior to an IPO tends to boost valuation. For instance, **Gornall, W. et al. (2021)** highlight that "post-money valuations of venture capital-backed companies with multiple financing rounds exceed fair values by 39%." Patents are also generally recognized for their '' large, positive, and statistically significant effect on firm market values'' (**Connolly, R. A et al., 1988**). Moreover, the age of a company has generated mixed views in the academic community. Some researchers agree that age negatively impacts firm value (**see Bhimani, A (2010); Chay, J. et al., 2015; Harsono, S. et al., 2023; A. D'Amato, A. et al., 2019**), while others affirm that, despite not being statistically significant, company age has a favorable influence on market value (**Lambey, R. et al., 2021**). Ultimately, according to **Gompers, P. and Lerner, J. (2000)** the level of the NASDAQ composite index should be positive and highly significant.

5.2. Empirical Findings & Interpretations

In the Pre-IPO analysis, as illustrated in **Table 3** and **formula 5**, revenue, and age negatively impact a company's private market value. For example, the coefficient β_4 for revenue is -0.1510, indicating that for each one-rank increase in revenue, the rank of the private market value is expected to decrease by 0.1510 ranks on average, assuming other variables remain constant. Notably, most variables in this regression have a relatively modest effect on private market value, with coefficients ranging between 0.03 and 0.51, while the constant has a much larger coefficient of 71.55.

Comparing our results with those of **Armstrong et al. (2006)** and the predicted results, several notable differences emerge. The original report illustrated negative coefficients for long-term debt, equity dilution, and company age, also aligned with the researchers' beliefs. In contrast, our analysis found revenue and age to have a negative effect. Revenue, as indicated in the predicted results, is recognized in other studies to have a positive effect on a company valuation. The negative coefficient for revenue in our study could suggest that investors are focusing more on growth potential rather than current revenue figures.

Furthermore, **Table 3** presents the p-values for all explanatory variables in the regression model. These p-values are crucial for assessing the statistical significance [9]of each variable within the model. In the pre-IPO scenario, generally almost explanatory variables demonstrate p-values lower than the common significance level of 0.05, except for the variables $TIA_{i,t}$ and $TCOS_{i,t}$, the proxies included in the model. This finding is noteworthy as it indicates that most variables in the model are statistically significant, suggesting they contribute meaningfully to explaining the variation in private equity value and strengthening the model's reliability. However, it is particularly notable that variables from the original study in the pre-IPO phase, such as equity dilution and the number of patent applications, could have been omitted variables rather than using proxies that are not significant to the model.

In our analysis, long-term debt was found to be statistically significant, contrary to the findings of **Armstrong et al (2006),** however aligned with the predicted results from researchers. Notably, the original study found equity dilution and the NASDAQ composite index to be highly significant, whereas in our case, non-cash assets and SMGA are found to be highly significant. Overall, it is notable that although equity dilution was expected to have high statistical significance in the model, its proxy was unable to capture this effect. Due to data limitations, this crucial aspect was not included in the model, impacting its explanatory power.

The adjusted R-squared [10]value of the regression is 65.2%, suggesting that the model explains approximately 65.2% of the variation in private market valuation. This explanatory power is higher than that of the interpolation method models and lower than that of the matching method models reported in the original study.

$$MV - PRIV_{i,t} = \boldsymbol{\alpha} + \beta_1 CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \boldsymbol{\beta_4} REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \boldsymbol{\phi_1} AGE_{i,t} + \phi_2 ROUNDS_{i,t} + \phi_3 TCOS_{i,t} + \phi_4 TIA_{i,t} + \theta_1 NASDAQ_t + \varepsilon_{i,t} \quad (5)$$

In the post-IPO analysis, as shown in **Table 3** and **formula 6**, the financial variable revenue maintained a negative coefficient, as did the indicator variables for 2 and 3 years after IPO. In this case, assuming all other variables remain constant, for each one-rank increase in revenue, the rank of the market value is expected to decrease 0.0671 ranks on average. This counterintuitive relationship

[9] Statistical significance in regression indicates that a predictor likely affects the dependent variable. At a 5% confidence level, a p-value less than 0.05 suggests the relationship is unlikely by random chance.

[10] Adjusted R-Squared is a refined version of R-Squared that assesses how much of the dependent variable's total variation is explained by the model's independent variables, while accounting for the number of predictors. This adjustment makes it more suitable for comparing models with differing numbers of variables, offering a more balanced evaluation metric.

between revenue and market value could suggest that investors prioritize other financial metrics or growth potential over current revenue in the years following an IPO. Non-cash assets, R&D and SMGA costs demonstrate the most substantial effects on valuation in this regression. Their coefficients range between 0.12 and 0.42 for the explanatory variables mentioned. This indicates that these factors play a particularly crucial role in determining a company's market value post-IPO.

In the original article, both revenue and R&D expenses maintained positive coefficients in both pre- and post-IPO phases. However, the authors observed that SMGA expenses and COS coefficients shifted to negative from pre- to post-IPO phase. These results are consistent with the prediction that on early-stage companies, costs are seen as ''investments''. In contrast, our results reveal a different trend: revenue continues to exhibit a negative coefficient in both phases, while other costs remain positive. This suggests that the perception of costs as investments persists even after the IPO.

Furthermore, the variable age changed to a positive coefficient, which contrasts with the findings of the original study where the predictor had a negative coefficient. This discrepancy is also reflected in the literature review, where researchers provide arguments for both positive and negative impacts of age on valuation.

Table 3 presents the p-values for the explanatory variables in this scenario. Nearly all variables are statistically significant at the 0.05 level of confidence, except for $COS_{i,t}$ and $NASDAQ_t$. Notably, the cost of sales was also found to be statistically insignificant in the results of **Armstrong et al. (2006).** In contrast, NASDAQ composite index was seen has highly significant, which aligns with expectations based on the literature review. This change may be attributed to differences in industry composition among the samples or shifts in investor sentiment regarding the index's predictive relevance.

In general, our results show a different pattern regarding the significance of the variables for the different event time. While, in the original article, the findings were notably consistent with the pre-IPO scenario, where all variables were statistically significant except for long-term debt. Cost of sales was considered insignificant only after IPO.

Remarkably, our findings show that R&D and SMGA expenses are highly significant in the post-IPO phase. The high significance of these costs, underscores its importance in valuation models, possibly reflecting investor attention to innovation and future growth potential.

The adjusted R-squared value for this regression is 69%, which is higher to the results obtained by **Armstrong et al. (2006)** - approximately 61%. The result indicates that the model accounts for a significant amount of market value variation, supporting its explanatory capabilities and lending credence to its effectiveness in predicting market value.

$$MV - PUB_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \boldsymbol{\beta_4} REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \left[\sum_{j=2-3} \boldsymbol{\phi_j} YEAR + j_{i,t}\right] + \phi_4 TIA_{i,t} + \theta_1 NASDAQ_t + \varepsilon_{i,t} \quad (6)$$

[Table 3 Here]

From the analysis, notable conclusions emerge about the factors affecting company valuation pre- and post-IPO. The negative impact of revenue on market value suggests that investors may prioritize growth potential and other metrics over current revenue. This implies a shift in focus for early-stage towards long-term strategic growth rather than immediate revenue generation.

Unlike **Armstrong et al. (2006),** which identified cost seen as ʹʹinvestmentsʹʹ specifically for private-equity backed ventures, our findings emphasize the long-term significance of innovation-related expenses like R&D and SMGA. In other words, costs are seen as ʹʹinvestmentsʹʹ during the pre- and post-IPO phases. This reflects a broader market trend where intangible assets and strategic investments are increasingly valued for their potential to drive future growth.

Finally, the adjusted R-squared values demonstrate that while the model effectively explains a substantial portion of the variation in market value, certain variables—such as the introduction of proxies for equity dilution and number of patents applications —did not capture expected effects. This highlights potential areas for improvement in data collection, mostly due to the lack of available data.

5.2.1. Effects of Variable Transformations and Sector Exclusion

In addition to the regression analysis that includes all sectors, a regression excluding the financial sector was conducted. This approach was taken to better understand the relationships among non-financial industries without the potential distortive effects of financial entities that often exhibit unique financial dynamics. The analysis revealed that for the pre-IPO model, the overall significance decreased by one point. While the effects of the variables remained consistent, their significance within the model diminished, which resulted in the proxy for patents becoming non-significant. Conversely, for the post-IPO model, the results closely aligned with those shown in **Table 3**, although the significance of the variables and the adjusted R-squared also exhibited a decrease.

Another scenario where the effects should be considered is the incorporation of age squared into the regression model. This addition allows for a better understanding of the relationship between age and market value, capturing the non-linear effects that a linear age variable might overlook. The age and age-squared variables are not statistically significant at the 5% level in both phases (see **Table 4**), indicating a linear relationship with market value, as the addition of age-squared did not enhance significance. Additionally, the pre-IPO model shows a 0.02% increase in overall significance, indicating improved model fit, while the explanatory power of the post-IPO model remained unchanged at 69.2%.

[Table 4 Here]

5.2.2. Four Scenario Analysis

To further examine the relationship between financial metrics and market value, we conducted additional analyses across four scenarios, as presented in **Table 4**. These scenarios were designed to complement the findings from **Table 3** and to examine how specific financial statement information contributes to explaining market value when excluded from the regression. Additionally, for the pre-IPO regression, we introduced a model that accounts for the timing relative to the IPO event[11], enabling us to evaluate how temporal factors influence valuation (**Formula 7**).

$$MV - PRIV_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 NCA_{i,t} + \beta_3 LTD_{i,t} + \beta_4 REV_{i,t} + \beta_5 COS_{i,t} + \beta_6 SMGA_{i,t} + \beta_7 RD_{i,t} + \phi_1 AGE_{i,t} + \phi_2 ROUNDS_{i,t} + \phi_3 TCOS_{i,t} + \phi_4 TIA_{i,t} + \left[\sum_{j=-3,-2,-1} \phi_j YEAR + j_{i,t}\right] + \theta_1 NASDAQ_t + \varepsilon_{i,t} \quad (7)$$

Our analysis revealed several key findings. Firstly, as aforementioned, revenue displayed an unexpected statistically significant negative relationship with market value when all variables were included, contrasting with **Armstrong et al. (2006)** findings. However, this relationship became positive when discretionary expenses (SMGA and R&D) were excluded, highlighting the significant impact of these expenses on valuation models. Nonetheless, in this situation, revenue was not significant to the model. Secondly, COS consistently showed a positive and significant relationship with market value across all scenarios, except for the first scenario. This aligns with **Armstrong et al.'s (2006)** post-IPO

[11] Different years leading up to an IPO may have distinct financial characteristics or strategic changes as a company prepares for public offering—dummy variables such as $\sum_{j=0-3} \boldsymbol{\phi_j} YEAR + j_{i,t}$ can capture these effects.

results, where COS ceased to be significant after the IPO. Thirdly, in scenario 3, revenues were expected to have a greater effect with the removal of a collinear independent variable such as cost of sales, a prediction made in the original study as well.

We also observed an increase in the explanatory power of financial metrics from pre-IPO to post-IPO periods, as indicated by rising Adjusted R-squared values. However, this trend should be interpreted cautiously due to the larger sample size in the post-IPO period. Notably, for each type of regression, the scenario including all variables consistently demonstrated the highest explanatory underscoring the collective importance of the financial variables in determining market value. Furthermore, in the pre-IPO phase, incorporating time sensitivity into the model further increased the adjusted R-squared, highlighting its significance.

[Table 5 Here]

6. Conclusion

This research provides an analysis of the factors influencing market valuation, particularly in the pre-IPO and post-IPO contexts. The descriptive analysis reveals that, despite sector-specific variations across different studies, the pooled results indicate a mean difference of only 0.69 years in the time taken from company founding to IPO when comparing datasets from this study (2010–2019) with those from **Armstrong et al. (2006)** (1993–2003). Moreover, both studies converge on the observation that market valuation tends to increase with successive rounds of financing, a trend consistent across all sectors examined.

The regression analysis, however, diverges in some respects from the existing literature. Contrary to the widely held belief that revenue has a significant positive correlation with market value—as well as R&D, and SMGA expenditures—this study finds that, in the pre-IPO phase, both revenue and company age operate as value-diminishing factors. All other non-financial variables, except for company age, display value-enhancing characteristics. However, the proxies for equity dilution and number of patent applications are not statistically significant, thereby did not capture expected effects due to lack of data, contributing to the decrease of explanatory power of non-financial variables.

This trend persists into the post-IPO analysis, where similarly, revenue is recognized as value-diminishing factor, a finding that remains inconsistent with the literature review and does not align with the observations from Armstrong's earlier study. However, company age emerges as a statistically significant positive factor post-IPO. Additionally, cost of sales and the NASDAQ composite index are not statistically significant, while R&D and SGMA expenditures continue to be seen as value-enhancing in the post-IPO phase, suggesting that investors perceive these costs as long-term investments.

An important improvement in this study is the increased accuracy of the models compared to earlier research. Furthermore, with the four-scenario analysis, it was discovered that for the pre-IPO scenario, imputing the dummy variables that accounts for the timing relative to the IPO event increases the explanatory power of the model.

In general, and in line with the literature review, this study confirms that financial statement variables remain crucial in explaining market valuation, although their impacts and interactions have evolved over time. Non-financial and capital market information, while retaining a more moderate influence, remain important factors. Specifically, for private equity-backed companies, the results provide valuable insights into how this type of firm’s valuation is shaped.

6.1. Recommendations

Based on the findings of this study, several recommendations are proposed for practitioners, investors, and companies preparing for an IPO, with particular emphasis on the outcomes observed in the pre-IPO phase. First and foremost, investors should reconsider their valuation strategies by placing greater emphasis on financial and non-financial information that reflects a company's growth potential. Given the current trend indicating that factors such as revenue may not substantially influence market value as previously thought and that R&D and SMGA are seen as long-term investments, investors should prioritize understanding a firm's strategic vision, alongside traditional financial metrics.

For companies on the brink of an IPO, it is crucial to redefine their messaging by focusing on the narrative surrounding their growth journey rather than solely emphasizing revenue figures. Providing a comprehensive overview of the company's strategic initiatives, including its plans for innovation, customer engagement, ESG, and competitive advantages, will help build investor confidence and may ultimately lead to higher valuations.

Furthermore, companies should prioritize enhancing their financial reporting practices, ensuring that stakeholders have access to transparent and detailed information regarding their financial health and operational strategies. This approach can facilitate informed decision-making among investors, fostering a positive perception of the company prior to its public offering.

Finally, future research should continue to explore the characteristics of successful pre-IPO firms and the impact of evolving investor expectations. Investigations into sector-specific trends and the relationship of various financial and non-financial information will enrich understanding and provide further insight into maintaining firm value.

6.2. Limitations

Despite the valuable insights collected from this study, several limitations warrant consideration. Firstly, the research is subject to survivorship bias, as it primarily focuses on successful companies that have undergone IPOs. This approach risks excluding a broader spectrum of firms, including those that may have failed or been unsuccessful in market processes, potentially leading to biased conclusions that may not be universally applicable.

Moreover, the analysis also encountered challenges related to data availability and uneven distribution across sectors, which limited the robustness and generalizability of the findings. The unevenly distributed data could delay a comprehensive understanding of the factors influencing firm valuation across various industries.

Omitted variable bias is another critical limitation noted in this study. Certain relevant variables, such as the number of funding rounds, equity dilution and number of patent applications were substituted for other metrics, which could have provided further context for assessing firm valuation. Specifically, equity dilution was considered through the percentage change in total common outstanding shares, and the analysis included total intangible assets instead of the specific number of patents. Notably, equity dilution was highly significant in the original study, whereas its proxy in this analysis proved to be insignificant. Therefore, these omissions potentially obscure critical elements that could contribute to a richer understanding of the market value.

Additionally, the differences in sector classification between this study and that of **Armstrong et al. (2006)** highlight the need for caution in making direct comparisons. While Armstrong's study categorized firms into broader industry groups, this research employed the Industry Classification Benchmark, which divides the sample into eleven distinct sectors. These differences necessitate careful interpretation of the results and suggest that findings may not be directly translatable across different sector classifications. Furthermore, the sample distribution in this study was heavily influenced by the healthcare sector, which accounted for 33% of the total sample.

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8. List of Figures

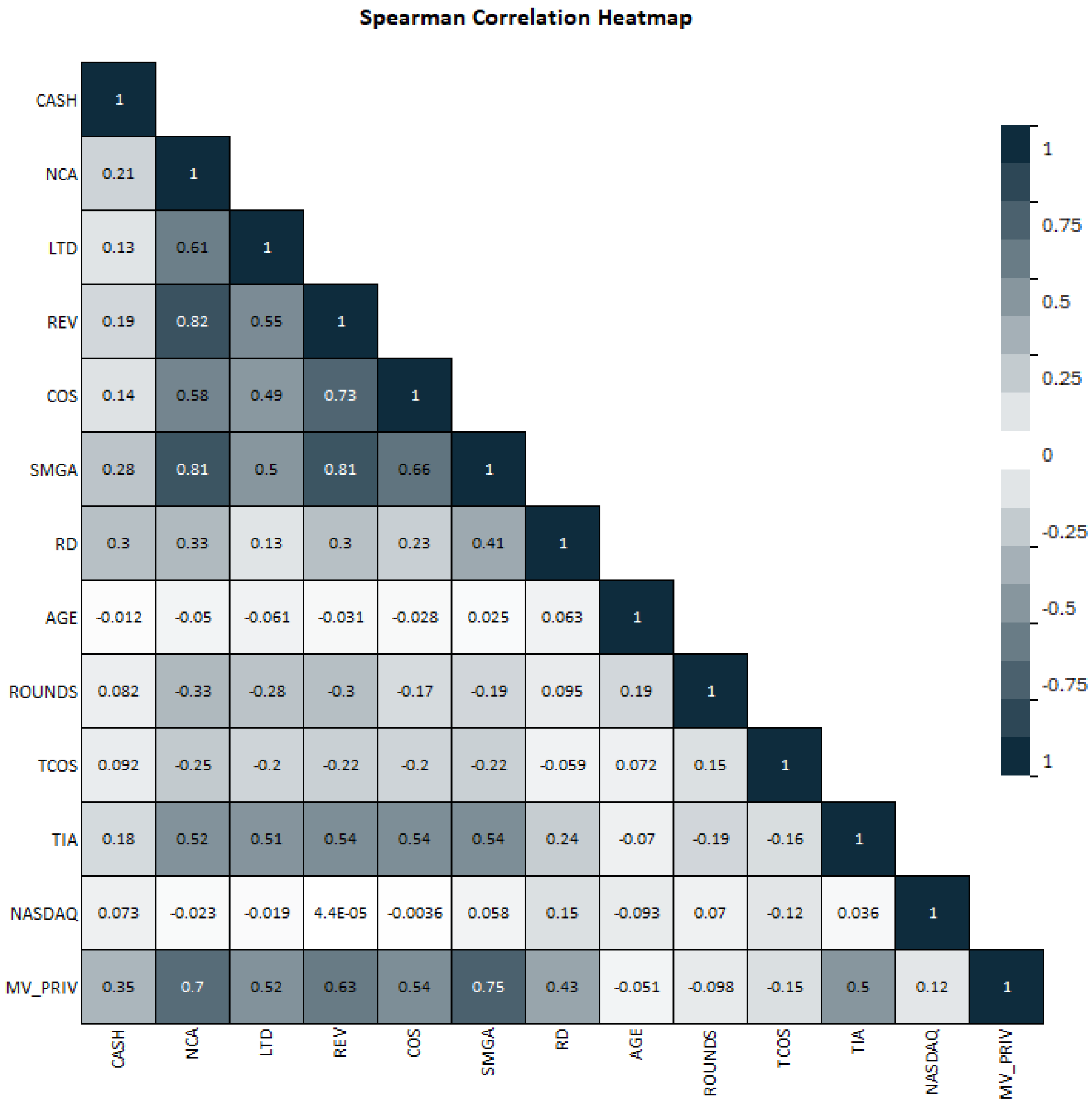


Figure 1. Pre-IPO Spearman Correlation Heatmap. **Source:** *Own Results.*

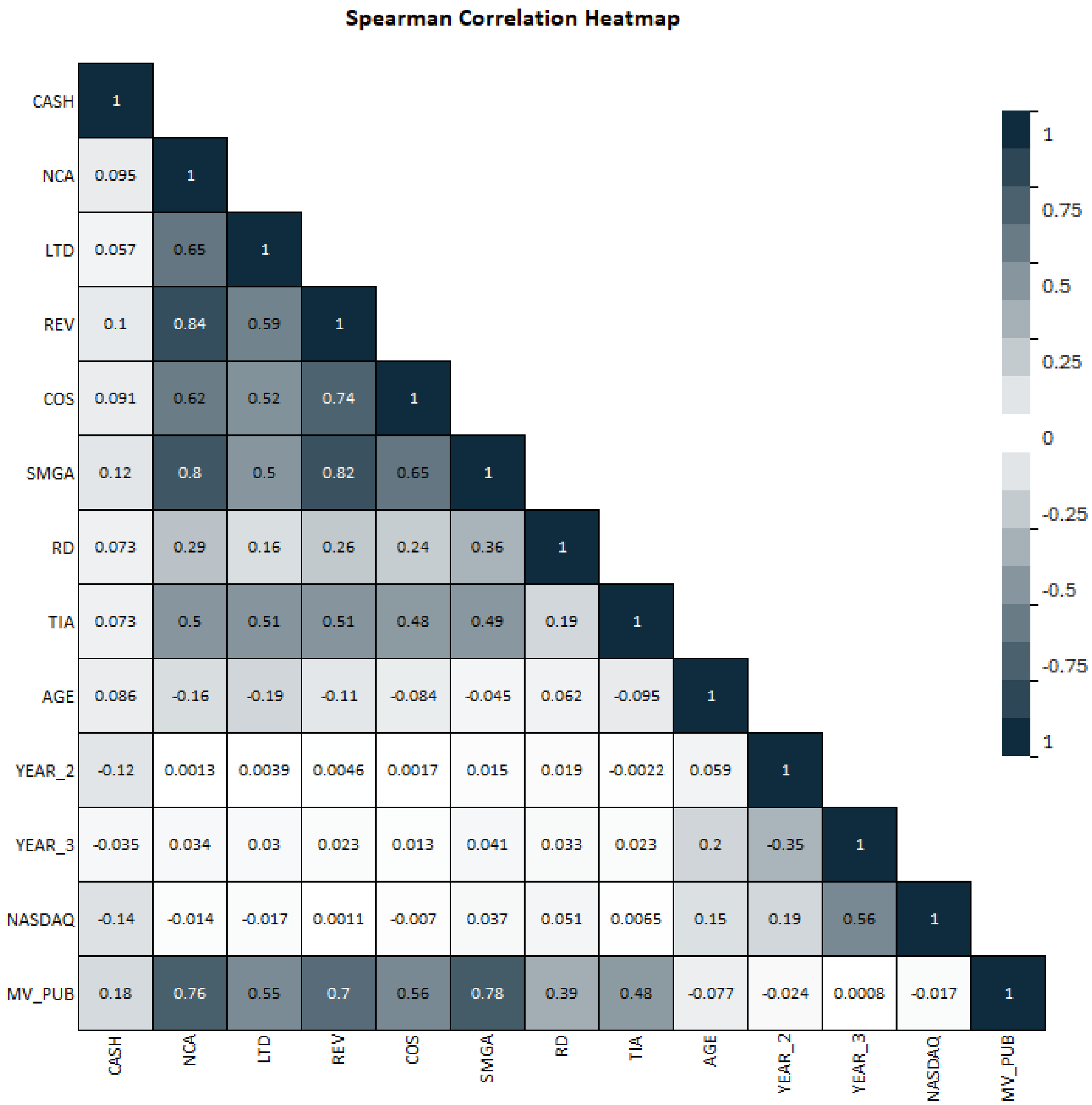


Figure 2. Post-IPO Spearman Correlation Heatmap. **Source:** *Own Results.*

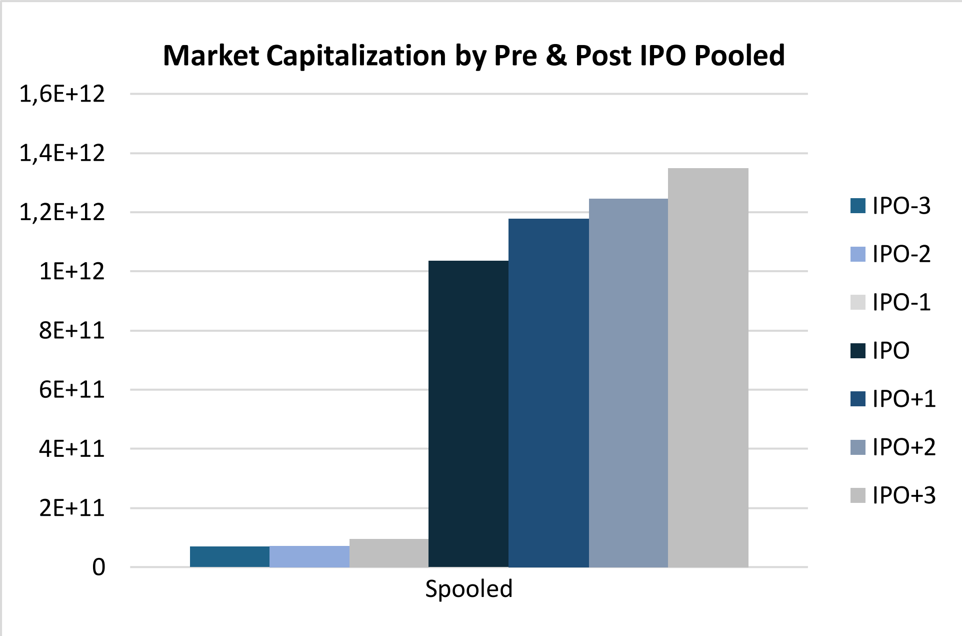


Figure 3. Pooled Market Capitalization by Pre- and Post-IPO phase. **Source:** *Own Results.*

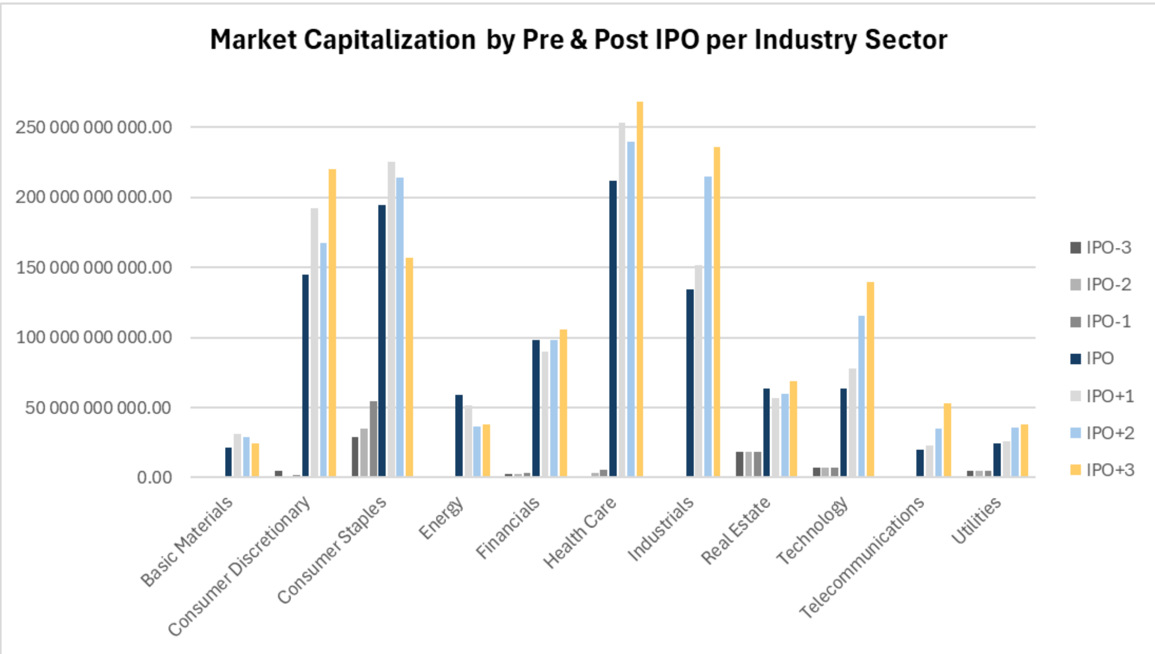


Figure 4. Market Capitalization by Pre- and Post-IPO phase by Industry Sector. **Source:** *Own Results.*

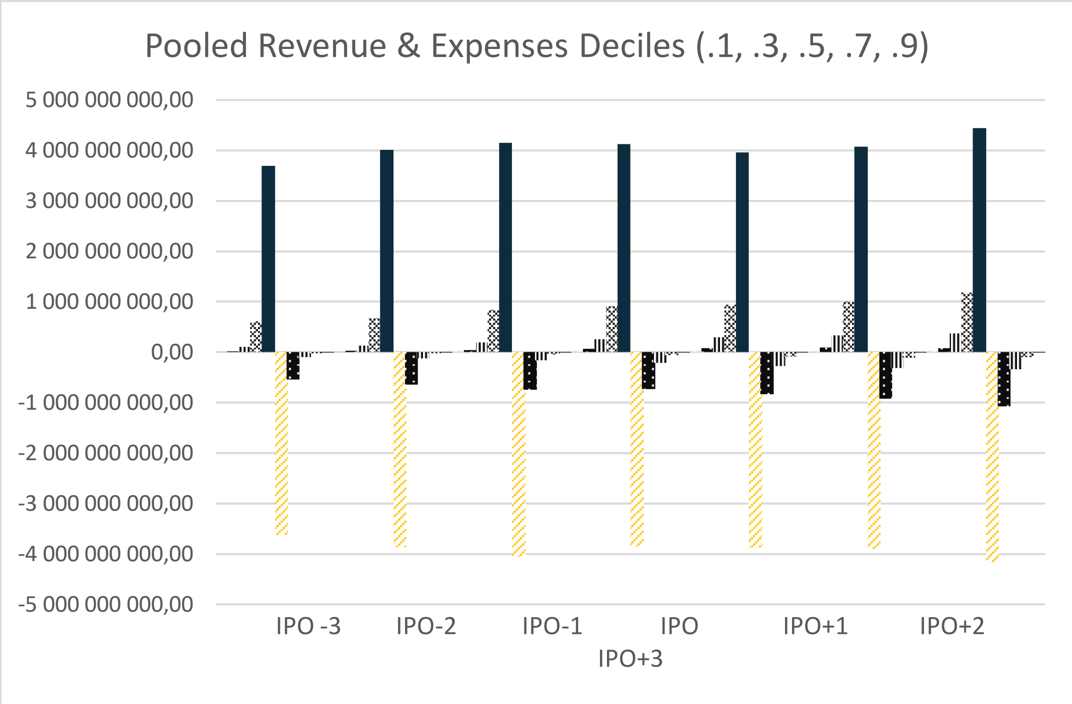


Figure 5. Pooled Revenue & Expenses from 10th to 90th Deciles. **Source:** *Own Results.*

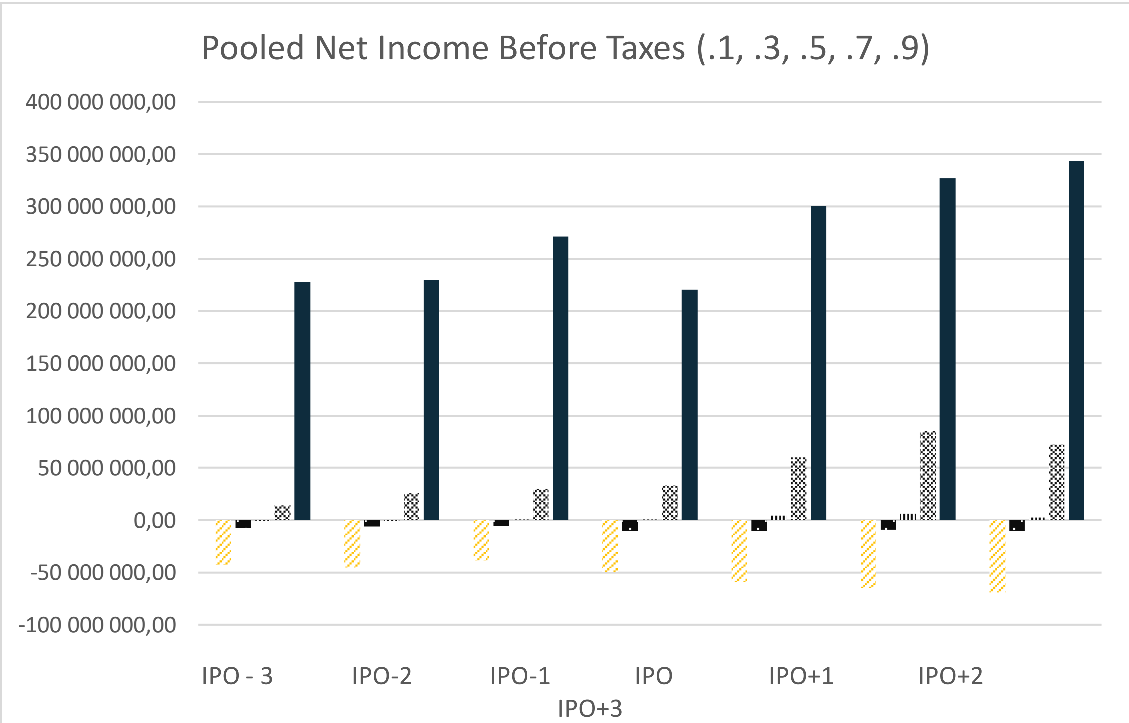


Figure 6. Pooled Net Income from 10th to 90th Deciles. **Source:** *Own Results.*

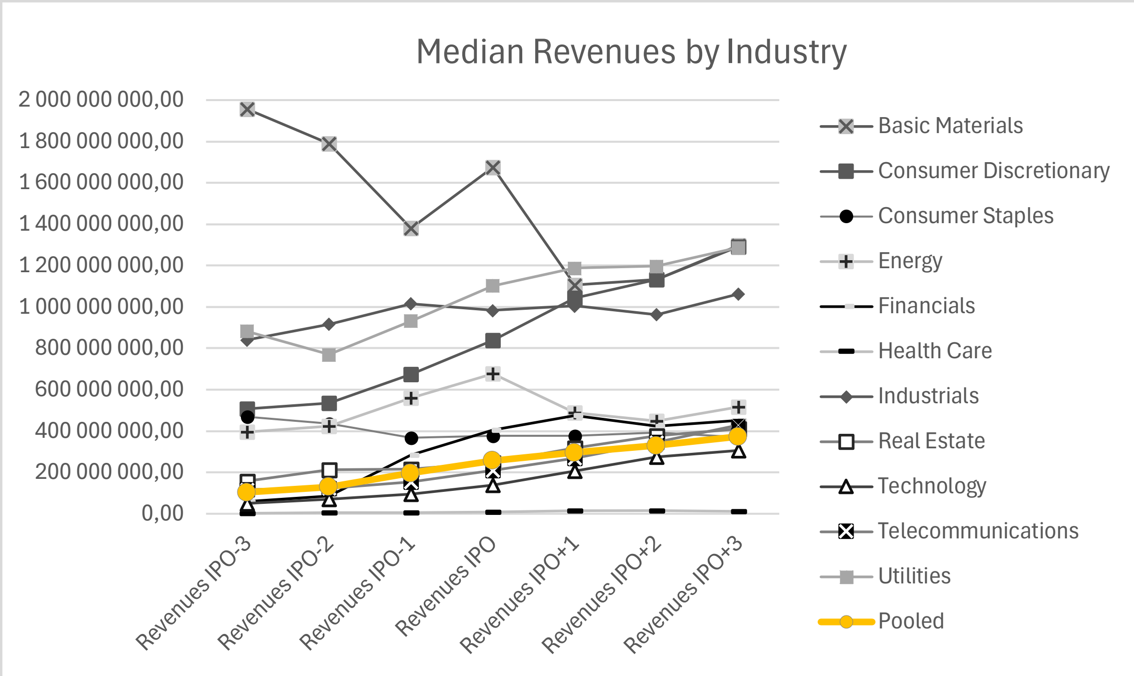


Figure 7. Median Revenues by Industry. **Source:** *Own Results.*

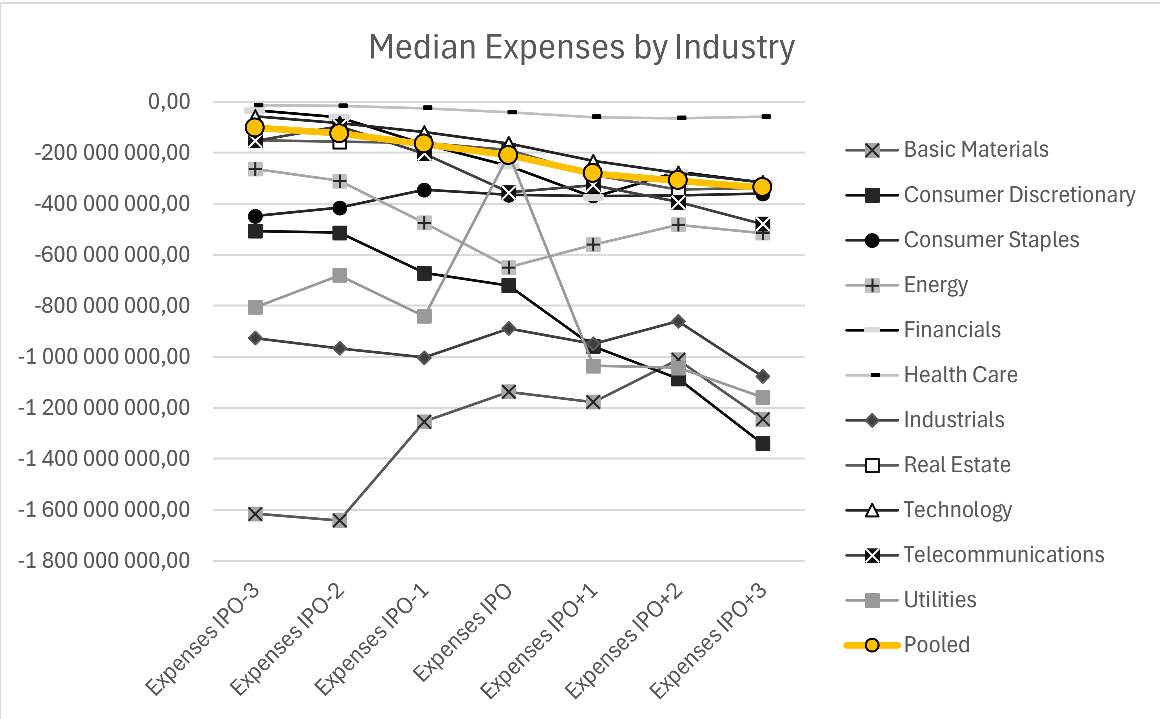


Figure 8. Median Expenses by Industry. **Source:** *Own Results.*

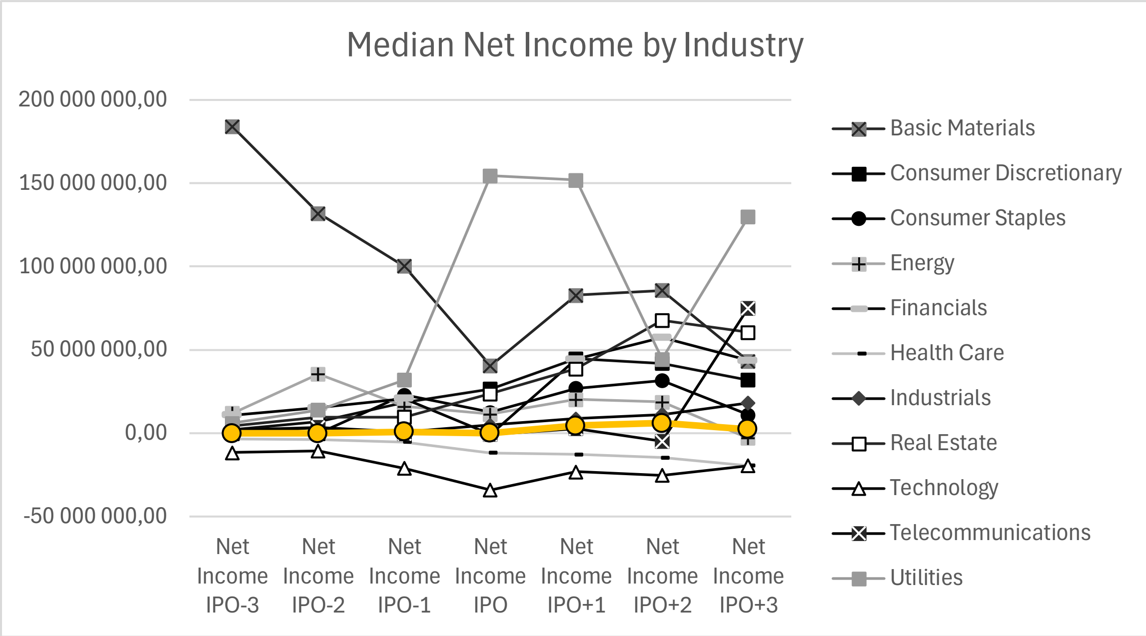


Figure 9. Median Net Income by Industry. **Source:** *Own Results.*

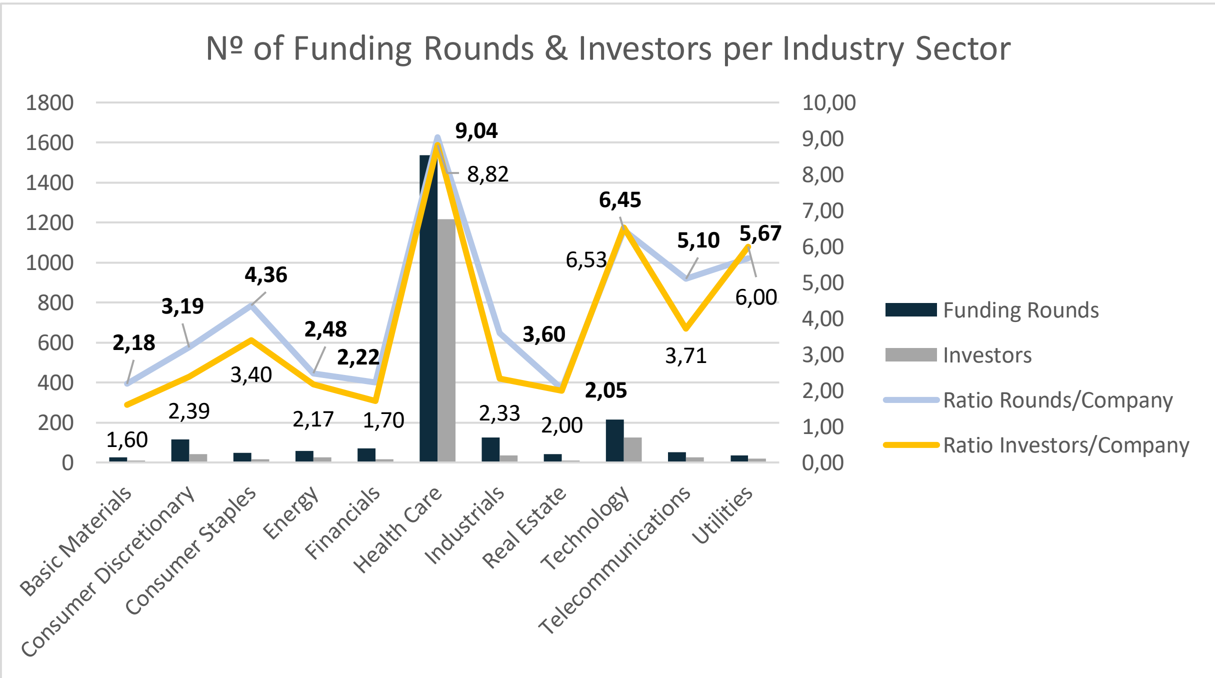


Figure 10. Number of Funding Rounds & Investors per Industry Sector.

Source: *CrunchBase & Own Results*

9. List of Tables

***Table 1**. Adjusted R-squared for Pre- and Post-IPO Models.*

	Models[12]	Matching Method	Interpolation Method	Sample
Pre-IPO	Model 1(A)	69.83%	63.60%	898(M)/879(I)
	Model 1 (B)	69.79%	63.60%	898(M)/879(I)
Post-IPO	Model 2 (A)	61.82%	-	1231
	Model 2(B)	61.02%	-	1231

Source: Adapted from Armstrong, C. et al. (2006).

***Table 2.** Mean and Median of years from company founding until IPO from 1993-2003 and 2010-2019 periods.*

Years from company founding to IPO – Mean (Median)	1993-2003 (Panel A, Table 1, Armstrong, C. et al (2006))	2010-2019 Own dataset	Differences in Years
Pooled	5.36 (3.00)	6.05 (3.00)	0.69
Energy	-	7.19 (3.00)	-
Financials	-	5.9 (3.00)	-
Healthcare[13]	Biotechnology: 6.07 (4.00) Medical Equip.: 6.17 (6.00)	6.70 (6.00)	0.58 [14]
Industrials	-	5.58 (2.00)	-
Real Estate	-	4.00 (1.00)	-
Technology[15]	Software: 5.84 (5.00) Computer Hardware: 6.53 (5.00)	5.51 (4.00)	-0.68

[12] Models (A) represents a regression model that includes all four income statement variables ($REV_{i,t}, COS_{i,t}, SMGA_{i,t}\& RD_{i,t}$). Models (B), on the other hand, includes only three of these variables ($REV_{i,t},\ SMGA_{i,t}\& RD_{i,t}$) since $COS_{i,t}$ was not statistically significant.
[13]Biotechnology & Medical Equipment will be categorized under the broader ''Healthcare'' sector for a more comprehensive analysis.
[14]Difference in years calculated by comparing the average time to IPO for Biotechnology and Medical Equipment during the 1993-2003 period with the average time to IPO for the Healthcare sector in the 2010-2019 period.
[15] Software and Computer Hardware will be categorized under ''Technology'' sector for a more comprehensive analysis.

Telecommunications[16]	5.01 (4.00)	3.92 (2.00)	-1.09
Utilities	-	4.10 (1.00)	-
Basic Materials	-	5.00 (2.50)	-
Consumer Discretionary	-	6.52 (3.00)	-
Consumer Staples	-	5.81 (2.00)	-
Services	5.84 (5.00)	-	-

Source: Adapted from Armstrong, C. et al. (2006) & Own Results.

Table 3. *Pre- and post-IPO association between equity valuations and explanatory variables.*

	Pre-IPO Regression		**Post-IPO Regression**	
	Coefficient[17]	**t-statistic**	**Coefficient**	**t-statistic**
Intercept	-71.5531***	-3.247	37.1793	0.874
Financial Statement Info.				
Cash ($CASH_{i,t}$)	0.1174***	4.801	0.0799***	6.815
Non-cash assets ($NCA_{i,t}$)	0.2924***	6.063	0.3399***	13.640
Long-term debt ($LTD_{i,t}$)	0.1483***	4.790	0.1216***	7.437
Revenue ($REV_{i,t}$)	-0.1510***	-3.038	-0.0671**	-2.519
COS ($COS_{i,t}$)	0.0773**	2.152	0.0128	0.714
SMGA ($SMGA_{i,t}$)	0.5103***	11.765	0.4219***	18.762
R&D ($RD_{i,t}$)	0.1129***	4.040	0.1289***	9.677
Non-Financial Statement Info.				
Total Intangible Assets ($TIA_{i,t}$)[18]	0.0504*	1.654	0.0425***	2.885
Firm age (in years) ($AGE_{i,t}$)	-0.0532**	-2.284	0.0281**	2.295
Nº of funding rounds ($ROUNDS_{i,t}$)	0.0809***	3.081	-	-

[16] Telco/Network will be categorized as ''Telecommunications'' sector for a comprehensive understanding of the data.
[17] The statistical significance of each variable will be analyzed using asterisks, with three asterisks (***) indicating significance at the 1% level ($p < 0.01$), two asterisks (**) indicating significance at the 5% level ($p < 0.05$), and one asterisk (*) indicating significance at the 10% level ($p < 0.10$)
[18] It is regarded as a non-financial statement, serving as a proxy for the number of patent applications.

Percentage change on total common shares outstanding ($TCOS_{i,t}$)[19]	0.0305	1.278	-	-
Indicator variable for 2 years after IPO ($\sum_{j=2} \phi_j YEAR + j_{i,t}$)	-	-	-0.0717***	-3.817
Indicator variable for 3 years after IPO ($\sum_{j=3} \phi_j YEAR + j_{i,t}$)	-	-	-0.0927***	-4.109
Capital Market Info.				
NASDAQ Index ($NASDAQ_t$)	0.0703***	2.949	0.0245	1.496
R-Squared	0.658		0.692	
Adjusted R^2	0.652		0.690	
F-statistic	109.1		441.5	
Number of observations	692		2375	

Source: Own Results.

Table 4. *Pre- and post-IPO association between equity valuations and explanatory variables with variable Age-squared.*

	Pre-IPO Regression		**Post-IPO Regression**	
	Coefficient[20]	**t-statistic**	**Coefficient**	**t-statistic**
Intercept	-66.11***	-2.968	38.7740	0.911
Financial Statement Info.				
Cash ($CASH_{i,t}$)	0.1162***	4.756	0.0800***	6.822
Non-cash assets ($NCA_{i,t}$)	0.2845***	5.876	0.3388***	13.588
Long-term debt ($LTD_{i,t}$)	0.1482***	4.793	0.1214***	7.428
Revenue ($REV_{i,t}$)	-0.1491***	-3.002	-0.0671**	-2.520
COS ($COS_{i,t}$)	0.0750**	2.089	0.0127	0.705
SMGA ($SMGA_{i,t}$)	0.4354***	9.352	0.4230***	18.794
R&D ($RD_{i,t}$)	0.1120***	4.010	0.1288***	9.672

[19] It is classified as a non-financial statement, as it serves as a proxy for equity dilution.

[20] The statistical significance of each variable will be analyzed using asterisks, with three asterisks (***) indicating significance at the 1% level ($p < 0.01$), two asterisks (**) indicating significance at the 5% level ($p < 0.05$), and one asterisk (*) indicating significance at the 10% level ($p < 0.10$)

Non-Financial Statement Info.				
Total Intangible Assets ($TIA_{i,t}$)[21]	0.0521*	1.713	0.0423***	2.869
Firm age (years) ($AGE_{i,t}$)	0.0272	0.489	0.0820*	1.668
Firm age - squared (years) ($AGE_{i,t}{}^2$)	-0.0896	-1.593	-0.0557	-1.132
Nº of funding rounds ($ROUNDS_{i,t}$)	0.0812***	3.094	-	-
Percentage change on total common shares outstanding ($TCOS_{i,t}$)[22]	0.0334	1.396	-	-
Indicator variable for 2 years after IPO ($\sum_{j=2} \phi_j YEAR + j_{i,t}$)	-	-	-0.0710***	-3.778
Indicator variable for 3 years after IPO ($\sum_{j=3} \phi_j YEAR + j_{i,t}$)	-	-	-0.0914***	-4.048
Capital Market Info.				
NASDAQ Index ($NASDAQ_t$)	0.0642***	2.661	0.0235	1.433
R-Squared	0.66		0.692	
Adjusted R^2	0.653		0.690	
F-statistic	101.1		407.7	
Number of observations	692		2375	

Source: Own Results.

Table 5. *Summary of the four scenarios in Static and Time-Sensitive Models for the Pre- and Post IPO*

	Pre-IPO Regression				**Post-IPO Regression**	
	Static Model		**Time-Sensitive Model**		**Time-Sensitive Model**	
	Coefficient[23]	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
Scenario 1						
Revenue ($REV_{i,t}$)	-0.1510***	-3.038	-0.1391***	-2.810	-0.0671**	-2.519
COS ($COS_{i,t}$)	0.0773**	2.152	0.0753**	2.107	0.0128	0.714

[21] It is regarded as a non-financial statement, serving as a proxy for the number of patent applications.
[22] It is classified as a non-financial statement, as it serves as a proxy for equity dilution.
[23] The statistical significance of each variable will be analyzed using asterisks, with three asterisks (***) indicating significance at the 1% level ($p < 0.01$), two asterisks (**) indicating significance at the 5% level ($p < 0.05$), and one asterisk (*) indicating significance at the 10% level ($p < 0.10$)

SMG&A ($SMGA_{i,t}$)	0.5103***	11.765	0.4283***	9.275	0.4219***	18.762
R&D ($RD_{i,t}$)	0.1129***	4.040	0.0984***	3.506	0.1289***	9.677
Adjusted R^2	0.652		0.658		0.690	
Scenario 2						
Revenue ($REV_{i,t}$)	-0.0068	-0.132	0.0055	0.107	0.0947***	3.417
COS ($COS_{i,t}$)	0.1446***	3.790	0.1423***	3.765	0.0683***	3.456
Adjusted R^2	0.593		0.602		0.618	
Scenario 3						
Revenue ($REV_{i,t}$)	0.0917**	2.051	0.1029**	2.321	0.1411***	5.810
Adjusted R^2	0.585		0.594		0.616	
Scenario 4						
COS ($COS_{i,t}$)	0.1421***	4.320	0.1444***	4.437	0.1011***	5.833
Adjusted R^2	0.593		0.602		0.616	

Source: Own Results.

10. Appendices

Appendix 1

Theoretical Equity Valuation Models

Theoretical Models	Formulas	Definition
Discounted Cash Flow Approaches	FCFF: $$EV = \left(\frac{FCFF_1}{(1+WACC)^n} + \cdots + \frac{FCFF_n}{(\text{WACC}-g)^n}\right) + cash - debt$$ FCFE: $$EV = \left(\frac{FCFE_1}{(1+r_E)} + \cdots + \frac{FCFE_n}{(r_E-g)^n}\right) + cash - debt$$	$FCFF_n$ = discounted free cash flow to the firm, for year n $WACC$ = weighted average cost of capital EV = enterprise value $FCFE_n$ = discounted free cash flow to equity, for year n
Dividend-Discount Model	$$P_0 = \frac{Div_1}{r_E - g}$$	P_0 = Price per share of the company in time (t) zero Div_1 = Dividend level for the coming year r_E = equity cost of capital g = expected constant growth rate of dividends
Economic Value Added	$$EVA = NOPAT - (WACC \times Cap_t)$$	EVA = economic value added $NOPAT$ = net operating profits after tax $WACC$ = weighted average cost of capital Cap = capital employed

Present Value of Expected Dividends (PVED)	$P_0 = BV_0 + \frac{RI_1}{1+r} + \frac{P_1 - B_1}{1+r}$	P_t = Price per share of the company in time (t) B_t = Book value in time (t) RI = Residual Income r = cost of capital

Appendix 2

Empirical Equity Valuation Models

Empirical Models	Formulas	Definition
Simplified versions EBO models	(Basic – Earnings & Book Value): $P_{it} = a_0 + a_1E_{it} + a_2BV_{it} + \varepsilon_{it}$ (Abnormal Earnings – Ohlson, 1995): $P_{it} = a_0 + a_1ABNEPS_{it} + a_2BV_{it} + \varepsilon_{it}$	P_{it} = Price per share of the company at the end of the fiscal year, t. E_{it} = Earnings per share at the end of fiscal year, t. BV_{it} = Book value per share at the end of the fiscal year, t. $ABNEPS_{it}$ = Abnormal earnings per share at the end of the fiscal year, t.
Extended versions of EBO models	(Earnings Retained (ER) & Dividend): $P_{it} = b_0 + b_1ER_{it} + b_2DV_{it} + b_3BV_{it} + \varepsilon_{it}$ (Capital Investment (CI)): $P_{it} = c_0 + c_1E_{it} + c_2CI_{it} + c_3BV_{it} + \varepsilon_{it}$ (ER, Dividend & CI): $P_{it} = d_0 + d_2ER_{it} + d_3DV_{it} + d_4CI_{it} + d_5BV_{it} + \varepsilon_{it}$	P_{it} = Price per share of the company at the end of the fiscal year, t. E_{it} = Earnings per share at the end of fiscal year, t. BV_{it} = Book value per share at the end of the fiscal year, t. CI_{it} = Capital Investment at the end of the fiscal year, t. ER_{it} = Expected Return at the end of the fiscal year, t.

		DV_{it} = Dividend at the end of the fiscal year, t.
Economic Value Created Models	Sirower and O'Byrne, 1998: $\frac{MV}{Cap} = a + b(\ln(Cap)) + d\left(\frac{\left(\frac{EVC^{+}}{c}\right)}{Cap}\right) + f\left(\frac{\left(\frac{EVC^{-}}{c}\right)}{Cap}\right) + e$	Cap = capital employed MV= market value EVC = Economic Value Created
Multiples Approach	P/B regression model: $\frac{P}{B}_{it} = g_0 + g_1\text{beta}_{it} + g_2\text{growth}_{it} + g_3\text{ROE}^{+}{}_{it} + g_4\text{ROE}^{-}{}_{it} + g_5 payout_{it} + \varepsilon_{it}$ P/S regression model: $\frac{P}{S} = f_0 + f_1\text{beta}_{it} + f_2\text{growth}_{it} + f_3 margin^{+}{}_{it} + f_4 margin^{-}{}_{it} + f_5 payout_{it} + \varepsilon_{it}$	P/B = Price to book value P/S = Price to sales beta_{it} = company's stock beta growth_{it} = geometric average growth rate in earnings over the previous 5 years $margin_{it}$ = earnings divided by sales ROE_{it} = earnings divided by book value (return on equity) $payout_{it}$ = dividend payout ratio
Algorithms applied by courts	Bader Case: $P_{it} = a_0 + a_1(EPS_{it})(PE_l) + a_2\frac{DV_{it}}{DVYLD_l} + a_3 BV_{it} + \varepsilon_{it}$ Central Trust: $P_{it} = b_0 + b_1(EPS_{it})(PE_l) + b_2\frac{DV_i}{DVYLD_l} + b_3(BV_{it})(BVM_l) + \varepsilon_{it}$	P_{it} = year-end price per share EPS_{it} = most recent earnings per share DV_{it} = most recent dividends per share BV_{it} = most recent book value per share PE_l = industry average price earnings ratio $DVYLD_l$ = industry average dividend yield BVM_l = market to book value multiple (on average) for the industry
Net Asset Value (NAV) Method	$NAV = \frac{Value\ of\ Assets_t - Value\ of\ Liabilities_t}{Total\ Shares\ Outstanding}$	$Value\ of\ Assets_t$ = value of all securities of the firm

		$Value\ of\ Liabilities_t$ = value of all liabilities and expenses
Capitalized Excess Earnings Method (CEEM)	$CEEM\ Value = \text{Tangible Asset Value} + (\text{Total Earnings} - \text{ROTA})$	ROTA = Return on Tangible Assets Tangible Asset Value = market value of the tangible assets of the firm

Appendix 3

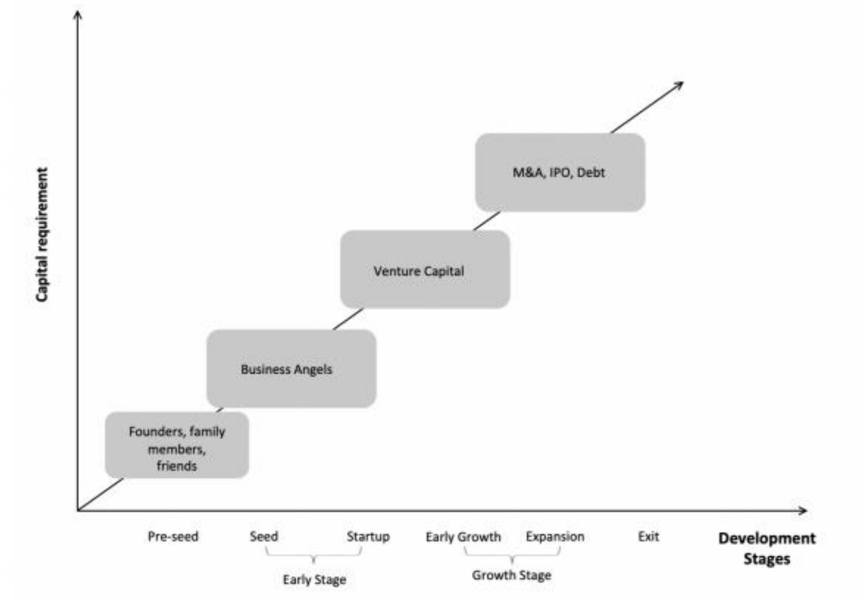
R-Squared for the Ten Models Tested in Abukari et al. (2000) Article

Models	R^2 Pooled Sample	Adj. R^2 Pooled Sample	Stein's Rank	Nº of Cases
Basic EBO Model – Earnings & Book Value	0.5718	0.5714	0.5708	2090
Basic EBO Model - Abnormal Earnings	0.6115	0.611	0.6098	1585
Extended EBO Models – ER & Dividend	0.5908	0.5902	0.5894	2080
Extended EBO Models – Capital Investment	0.6103	0.6097	0.6089	2022
Extended EBO Models – Capital Inv. & Dividend	0.6175	0.6167	0.6158	2021
Extended EVC Model	0.2964	0.2952	0.2935	1706
Extended P/S Model	0.5237	0.5205	0.5168	765
P/B Model	0.1764	0.1711	0.1646	774
Bader Case Court Model	0.5738	0.5732	0.5724	2079
Central Trust Court Model	0.5732	0.6048	0.6040	2079

Source: Abukari et al. (2000).

Appendix 4

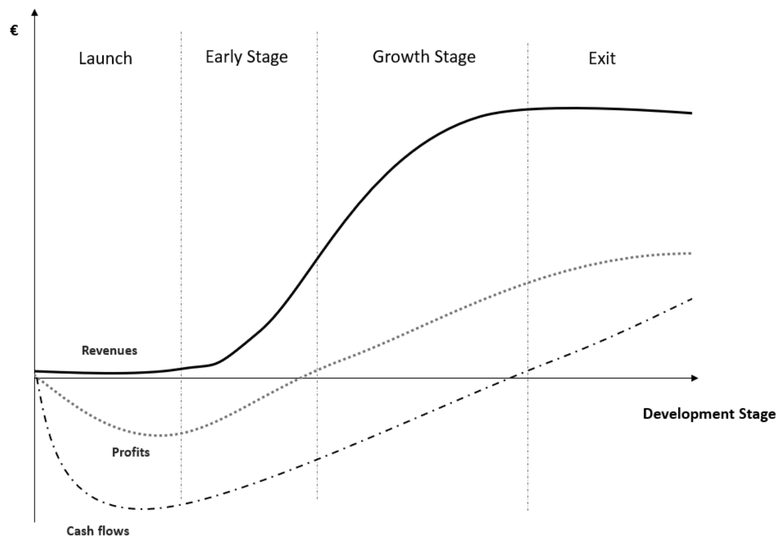
Development Stages of a Company Upon Exit



Source: Orlando, C. (2022).

Appendix 5

Revenues, Profits & Cashflows for Each Development Stage



Source: Bender, R. (2014). Corporate Financial Strategy, 4th Edition.

Appendix 6

Non-Traditional Valuation Methods

Non-Traditional Valuation Methods	**Formulas**	**Description**
Venture Capital Method (Sahlman & Scherlis, 1987)	$(pre-money)NPV = \frac{P_{T,VC}}{\prod_{t=1}^{T}(1+R_{T,VC})} - \sum_{t=1}^{T}\frac{I_{T,VC}}{\prod_{t=1}^{T}(1+R_{T,VC})} - I_{0,VC}$	$P_{T,VC}$ = estimate of company value at T $I_{T,VC}$ = estimate of additional investment required in T $R_{T,VC}$ = one-year discount rate from t to t-1 $I_{0,VC}$ = net present value of initial investment
First Chicago Method (First Chicago Bank)	$Valuation = \sum_{s=1}^{N} p_s \times \left[\sum_{t=1}^{h}\frac{CF_t^s}{(1+r)^t} + \frac{TV_s}{(1+r)^h}\right]$	h = investment horizon CF_t^s = cash flow in period t, in scenario S r = required rate of return TV_s = terminal value in scenario S p_s = probability of scenario S realizing
Damodaran's Method (Modified DCF Method)	$EV = \left(\frac{FCFF_1}{(1+WACC)^n} + \cdots + \frac{FCFF_n}{(\mathrm{WACC}-g)^n}\right) + cash - debt$	$FCFF_n$ = discounted free cash flow to the firm, for year n $WACC$ = weighted average cost of capital EV = enterprise value
Real Option Valuation	$EV = Current\ value\ of\ existing\ operation + value\ of\ company\ portfolio\ of\ real\ option$ $(Through\ binomial\ model\ or\ Black-Scholes\ model)$	-
Intangible Assets Valuation	Market-based valuation, cost-based valuation & income-based valuation (**see Orlando, C., 2022**)	-

Appendix 7

Description of Variables Used in Armstrong et al. (2006)

Variable	Definition
$\boldsymbol{MV-PRIV_{i,t}}$	interpolated private equity market value of company i on date t (using the interpolation approach) or the private equity market value of company i at first funding date after time t (using the matching approach).
$\boldsymbol{MV-PUB_{i,t}}$	market value (i.e., market capitalization) of publicly traded company i 3 months after time t.
$\boldsymbol{CASH_{i,t}}$	cash balance of company i at time t.
$\boldsymbol{NCA_{i,t}}$	non-cash assets of company i at time t.
$\boldsymbol{LTD_{i,t}}$	long-term debt of company i at time t.
$\boldsymbol{REV_{i,t}}$	revenue of company i for the year ended at time t.
$\boldsymbol{COS_{i,t}}$	cost of sales expense of company i for the year ended at time t.
$\boldsymbol{SMGA_{i,t}}$	sales, marketing, general and administrative expense of company i for the year ended at time t.
$\boldsymbol{RD_{i,t}}$	research and development expense of company i for the year ended at time t.
$\boldsymbol{AGE_{i,t}}$	the age (in years) of company i at time t.
$\boldsymbol{SERIES_{i,t}}$	the series (B, C, ..., G+) of funding of company i at the first funding after time t.
$\boldsymbol{DILUTE_{i,t}}$	the equity dilution that occurred for company i at the first funding after time t.
$\boldsymbol{PAT_{i,t}}$	the number of patent applications filed by company i as of time t.
$\boldsymbol{NASDAQ_t}$	level of the NASDAQ composite index at time t.

Appendix 8

Years from company founding until IPO by Industry Sector

Years	Basic Materials			Consumer Discretionary			Consumer Staples			Energy			Financials			Health Care		
	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)
Years from company founding to IPO Date																		
0	5	25.0	25.0	10	12.3	12.3	4	19.0	19.0	7	23.3	23.3	8	12.5	12.5	12	6.3	6.3
1	4	20.0	45.0	18	22.2	34.6	3	14.3	33.3	8	26.7	50.0	12	18.8	31.3	22	11.6	18.0
2	1	5.0	50.0	10	12.3	46.9	4	19.0	52.4	4	13.3	63.3	6	9.4	40.6	20	10.6	28.6
3	5	25.0	75.0	9	11.1	58.0	1	4.8	57.1	3	10.0	73.3	7	10.9	51.6	14	7.4	36.0
4	1	5.0	80.0	4	4.9	63.0	1	4.8	61.9		0.0	73.3	3	4.7	56.3	8	4.2	40.2
5		0.0	80.0	7	8.6	71.6		0.0	61.9	2	6.7	80.0	2	3.1	59.4	11	5.8	46.0
6		0.0	80.0	4	4.9	76.5		0.0	61.9		0.0	80.0	2	3.1	62.5	11	5.8	51.9
7	1	5.0	85.0	3	3.7	80.2		0.0	61.9		0.0	80.0	4	6.3	68.8	18	9.5	61.4
8		0.0	85.0	2	2.5	82.7		0.0	61.9		0.0	80.0	3	4.7	73.4	17	9.0	70.4
9	1	5.0	90.0	2	2.5	85.2	2	9.5	71.4		0.0	80.0		0.0	73.4	5	2.6	73.0
10		0.0	90.0		0.0	85.2	1	4.8	76.2		0.0	80.0	1	1.6	75.0	13	6.9	79.9
11		0.0	90.0	2	2.5	87.7		0.0	76.2	2	6.7	86.7	3	4.7	79.7	10	5.3	85.2
12		0.0	90.0	1	1.2	88.9	1	4.8	81.0	1	3.3	90.0	1	1.6	81.3	3	1.6	86.8
13		0.0	90.0		0.0	88.9	1	4.8	85.7		0.0	90.0	2	3.1	84.4	5	2.6	89.4
14		0.0	90.0		0.0	88.9	1	4.8	90.5	1	3.3	93.3	1	1.6	85.9	2	1.1	90.5
15		0.0	90.0	1	1.2	90.1	1	4.8	95.2	1	3.3	96.7		0.0	85.9	6	3.2	93.7
16		0.0	90.0	1	1.2	91.4		0.0	95.2		0.0	96.7		0.0	85.9	2	1.1	94.7
17		0.0	90.0		0.0	91.4		0.0	95.2		0.0	96.7	1	1.6	87.5	3	1.6	96.3
18		0.0	90.0	1	1.2	92.6		0.0	95.2		0.0	96.7		0.0	87.5	3	1.6	97.9
20		0.0	90.0		0.0	92.6		0.0	95.2		0.0	96.7	3	4.7	92.2		0.0	97.9
21		0.0	90.0	1	1.2	93.8		0.0	95.2		0.0	96.7	1	1.6	93.8	2	1.1	98.9
22		0.0	90.0		0.0	93.8	1	4.8	100.0		0.0	96.7		0.0	93.8		0.0	98.9
23	1	5.0	95.0		0.0	93.8		0.0	100.0		0.0	96.7		0.0	93.8		0.0	98.9
25		0.0	95.0		0.0	93.8		0.0	100.0		0.0	96.7		0.0	93.8	1	0.5	99.5
27		0.0	95.0	1	1.2	95.1		0.0	100.0		0.0	96.7		0.0	93.8		0.0	99.5
29		0.0	95.0	1	1.2	96.3		0.0	100.0		0.0	96.7		0.0	93.8		0.0	99.5
30		0.0	95.0	1	1.2	97.5		0.0	100.0		0.0	96.7	1	1.6	95.3		0.0	99.5
31		0.0	95.0	1	1.2	98.8		0.0	100.0		0.0	96.7	1	1.6	96.9		0.0	99.5
32		0.0	95.0		0.0	98.8		0.0	100.0		0.0	96.7	1	1.6	98.4		0.0	99.5
36	1	5.0	100.0		0.0	98.8		0.0	100.0		0.0	96.7		0.0	98.4		0.0	99.5
40		0.0	100.0		0.0	98.8		0.0	100.0		0.0	96.7		0.0	98.4	1	0.5	100.0
43		0.0	100.0		0.0	98.8		0.0	100.0		0.0	96.7	1	1.6	100.0		0.0	100.0
45		0.0	100.0		0.0	98.8		0.0	100.0		0.0	96.7		0.0	100.0		0.0	100.0
47		0.0	100.0		0.0	98.8		0.0	100.0	1	3.3	100.0		0.0	100.0		0.0	100.0
48		0.0	100.0		0.0	98.8		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0
70		0.0	100.0		0.0	98.8		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0
112		0.0	100.0	1	1.2	100.0		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0
Total Obs.	20		100.0	81		100.0	21		100.0	30		100.0	64		100.0	189		100.0
Mean:			5.00			6.52			5.81			4.83			7.19			6.70
Median			2.50			3.00			2.00			1.50			3.00			6.00

Years	Health Care			Industrials			Real Estate			Technology			Telecommunications			Utilities			Pooled		
	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)	No.	Pctg. (%)	Cum Pctg (%)
Years from company founding to IPO Date																					
0	12	6.3	6.3	8	14.5	14.5	9	25.7	25.7	4	8.5	8.5	4	30.8	30.8	3	30.0	30.0	74	13.1	13.1
1	22	11.6	18.0	14	25.5	40.0	13	37.1	62.9	6	12.8	21.3	2	15.4	46.2	3	30.0	60.0	105	18.6	31.7
2	20	10.6	28.6	7	12.7	52.7	7	20.0	82.9	7	14.9	36.2	1	7.7	53.8		0.0	60.0	67	11.9	43.5
3	14	7.4	36.0	6	10.9	63.6		0.0	82.9	3	6.4	42.6	2	15.4	69.2		0.0	60.0	50	8.8	52.4
4	8	4.2	40.2	3	5.5	69.1	2	5.7	88.6	4	8.5	51.1	2	15.4	84.6		0.0	60.0	28	5.0	57.3
5	11	5.8	46.0	1	1.8	70.9		0.0	88.6		0.0	51.1		0.0	84.6	1	10.0	70.0	24	4.2	61.6
6	11	5.8	51.9	4	7.3	78.2		0.0	88.6	3	6.4	57.4		0.0	84.6		0.0	70.0	24	4.2	65.8
7	18	9.5	61.4	1	1.8	80.0		0.0	88.6	4	8.5	66.0		0.0	84.6	1	10.0	80.0	32	5.7	71.5
8	17	9.0	70.4	2	3.6	83.6	1	2.9	91.4	6	12.8	78.7		0.0	84.6	1	10.0	90.0	32	5.7	77.2
9	5	2.6	73.0		0.0	83.6		0.0	91.4	4	8.5	87.2		0.0	84.6		0.0	90.0	14	2.5	79.6
10	13	6.9	79.9		0.0	83.6	1	2.9	94.3	1	2.1	89.4		0.0	84.6		0.0	90.0	17	3.0	82.7
11	10	5.3	85.2	2	3.6	87.3		0.0	94.3		0.0	89.4		0.0	84.6		0.0	90.0	19	3.4	86.0
12	3	1.6	86.8	1	1.8	89.1		0.0	94.3		0.0	89.4	1	7.7	92.3		0.0	90.0	9	1.6	87.6
13	5	2.6	89.4		0.0	89.1		0.0	94.3	1	2.1	91.5		0.0	92.3		0.0	90.0	9	1.6	89.2
14	2	1.1	90.5	2	3.6	92.7		0.0	94.3	1	2.1	93.6		0.0	92.3		0.0	90.0	8	1.4	90.6
15	6	3.2	93.7		0.0	92.7		0.0	94.3	1	2.1	95.7		0.0	92.3		0.0	90.0	10	1.8	92.4
16	2	1.1	94.7		0.0	92.7		0.0	94.3	2	4.3	100.0		0.0	92.3		0.0	90.0	5	0.9	93.3
17	3	1.6	96.3	1	1.8	94.5	1	2.9	97.1		0.0	100.0		0.0	92.3		0.0	90.0	6	1.1	94.3
18	3	1.6	97.9		0.0	94.5		0.0	97.1		0.0	100.0		0.0	92.3	1	10.0	100.0	5	0.9	95.2
20		0.0	97.9		0.0	94.5		0.0	97.1		0.0	100.0		0.0	92.3		0.0	100.0	3	0.5	95.8
21	2	1.1	98.9		0.0	94.5		0.0	97.1		0.0	100.0	1	7.7	100.0		0.0	100.0	5	0.9	96.6
22		0.0	98.9		0.0	94.5		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	96.8
23		0.0	98.9		0.0	94.5		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	97.0
25	1	0.5	99.5	1	1.8	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	2	0.4	97.3
27		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	97.5
29		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	97.7
30		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	2	0.4	98.1
31		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	2	0.4	98.4
32		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	98.6
36		0.0	99.5		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	98.8
40	1	0.5	100.0		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	98.9
43		0.0	100.0		0.0	96.4		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	99.1
45		0.0	100.0	1	1.8	98.2		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	99.3
47		0.0	100.0		0.0	98.2		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	99.5
48		0.0	100.0	1	1.8	100.0		0.0	97.1		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	99.6
70		0.0	100.0		0.0	100.0	1	2.9	100.0		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	99.8
112		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0		0.0	100.0	1	0.2	100.0
Total Obs.	189		100.0	55		100.0	35		100.0	47		100.0	13		100.0	10		100.0	565		100.0
Mean:			6.70			5.58			4.00			5.51			3.92			4.10			6.05
Median			6.00			2.00			1.00			4.00			2.00			1.00			3.00

Source: Own Results

Appendix 9

OLS Assumptions Testing for Lin-Lin, Log-Lin, Lin-Log and Log-Log models

Appendix 9.1. OLS Linearity Assumption Through Ramsey's Reset Test

Ramsey's Reset Test

	Pre-IPO Scenario		Post-IPO Scenario	
	statistic	p-value	statistic	p-value
Lin-Lin Model	387.01	3.70	901.98	3.64
Lin-Log Model	126.27	2.69	1008.43	2.64
Log-Lin Model	64.58	9.46	242.25	2.50
Log-Log Model	43.84	3.03	112.65	3.45

Source: Own Results

Appendix 9.2. OLS No Perfect Collinearity Assumption Through Variance Inflation Factors[24]

Variance Inflation Factors

	Pre-IPO Scenario				Post-IPO Scenario			
	Lin-Lin Model	Lin-Log Model	Log-Lin Model	Log-Log Model	Lin-Lin Model	Lin-Log Model	Log-Lin Model	Log-Log Model
const	46.83	1176.68	46.83	1176..68	49.63	3384.58	49.47	3384.58
CASH	1.46	1.02	1.46	1.02	1.01	1.01	1.01	1.01
NCA	1.96	3.3	1.96	3.3	2.01	3.04	1.98	3.04
LTD	1.6	1.09	1.6	1.09	1.67	1.1	1.65	1.10
REV	76.35	2	76.35	2	98.16	2.29	58.35	2.28
COS	40.35	1.31	40.35	1.31	55.53	1.38	31.91	1.38
SMGA	13.11	3.14	13.11	3.14	12.41	3.04	10.51	3.04
RD	1.65	1.34	1.65	1.34	1.65	1.21	1.64	1.21
AGE	1.07	1.08	1.07	1.08	1.02	1.04	1.02	1.05
TIA	1.67	1.11	1.67	1.11	1.97	1.08	1.88	1.08
TCOS	1	1.24	1	1.24	-	-	-	-
ROUNDS	1.07	1.13	1.07	1.13	-	-	-	-
YEAR_2	-	-	-	-	1.38	1.28	1.38	1.28
YEAR_3	-	-	-	-	1.98	1.39	1.98	1.39
NASDAQ	1.09	1.29	1.09	1.29	1.76	1.23	1.75	1.23

Source: Own Results

[24] When the Variance Inflation Factor (VIF) is between 1 and 5, it is being considered that there is moderate to no correlation.

Appendix 9.3. OLS Heteroscedasticity Assumption Through Breusch-Pagan Test

Breusch-Pagan Test

	Pre-IPO Scenario	Post-IPO Scenario
	p-value	
Lin-Lin Model	0.00	0.00
Lin-Log Model	0.00	0.00
Log-Lin Model	0.998	0.6183
Log-Log Model	0.0014	0.00

Source: Own Results

Appendix 9.4. OLS Auto-Correlation Assumption Through Durbin-Watson Test

Durbin-Watson Test

	Pre-IPO Scenario	Post-IPO Scenario
	statistic	
Lin-Lin Model	1.7046	0.9349
Lin-Log Model	1.6310	0.8842
Log-Lin Model	1.5848	0.9578
Log-Log Model	1.6113	1.1169

Source: Own Results

Appendix 9.5. OLS Normality of the Error Term Assumption

Normality of Residuals Test

	Pre-IPO Scenario	Post-IPO Scenario
	p-value	
Lin-Lin Model	0.00	0.00
Lin-Log Model	0.00	0.00
Log-Lin Model	0.00	0.00
Log-Log Model	0.00	0.00

Source: Own Results

Appendix 10

Spearman's Rank Correlation Test to Monotonicity

Monotonicity Test

	Pre-IPO Scenario		Post-IPO Scenario	
	statistic	p-value	statistic	p-value
CASH	0.353**	0.000	0.179*	0.000
NCA	0.7***	0.000	0.761***	0.000
LTD	0.52**	0.000	0.555**	0.000
REV	0.626***	0.000	0.699***	0.000
COS	0.542**	0.000	0.562**	0.000
SMGA	0.749***	0.000	0.776***	0.000
RD	0.429**	0.000	0.389**	0.000
AGE	-0.051	0.180	-0.077*	0.0002
TIA	0.502**	0.000	0.475**	0.000
TCOS	-0.15*	0.000	-	-
ROUNDS	-0.098*	0.010	-	-
YEAR_2	-	-	-0.024	0.250
YEAR_3	-	-	0.001	0.969
NASDAQ	0.116*	0.002	-0.017	0.404

Note: A statistic marked with * indicates a weak monotonic relationship with market value, ** denotes a moderate monotonic relationship, and *** signifies a strong monotonic relationship with market value.

Source: Own Results