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Private Equity vs. Venture Capital: IPO Underpricing and Long-Run Stock Performance

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TIIVISTELMÄ:

Tässä tutkielmassa tarkastellaan pääomasijoittajien omistuksen vaikutusta osakkeiden alihinnoitteluun listautumisannissa sekä osakkeen pitkän aikavälin tuottoihin listautumisen jälkeen. Tutkimuksen kohteena ovat Ruotsin, Norjan, Suomen ja Tanskan suurimpien pörssien listatut yritykset, jotka ovat listautuneet vuosina 2010–2020. Tutkielman tavoitteena on selvittää listautumista edeltävän omistusrakenteen vaikutus alihinnoitteluun listautumishetkellä sekä osakkeen pitkän aikavälin tuottoihin. Tutkimuksessa vertaillaan kolmea erilaista omistusrakennetta: Private equity -omisteisia, Venture capital -omisteisia ja ei-pääomasijoitusomisteisia (Non-backed) yrityksiä.

Tutkimusaineisto koostuu 282 listautumisannista Ruotsissa, Norjassa, Suomessa ja Tanskassa vuosina 2010–2020. Aineistossa 230 listautumisannilla ei ole pääomasijoitusrahastojen rahoitusta (Non-backed), 40 on saanut Private equity -rahoitusta ja 12 Venture capital -rahoitusta. Listautumisantien alihinnoittelua mitataan vertaamalla ensimmäisen päivän päätöskurssia listautumisannin merkintähintaan. Pitkän aikavälin osaketuottoja mitataan buy-and-hold abnormal returns (BHAR) -menetelmällä, jonka tarkastelujaksoksi on valittu 36 kuukautta. Epänormaalit tuotot lasketaan vertaamalla listautumisantien tuottoja OMX Nordic 120 -indeksin tuottoihin. Tutkimuksen tavoitteena on tuottaa tietoa Pohjoismaiden listautumisanneista ja erityisesti Venture capital -omisteisten yritysten pitkän aikavälin tuotoista. Lopullinen tutkimusaineisto on suhteellisen pieni, sillä Private equity ja Venture capital -markkinat ovat vasta kehittymässä Pohjoismaissa, minkä vuoksi aiempia akateemisia tutkimuksia tältä markkina-alueelta on rajoitetusti saatavilla.

Tutkimuksen tulokset osoittavat, että listautumisantien merkintähinnat ovat keskimäärin alihinnoiteltuja ja pääomasijoittajien omistuksella on vaikutus alihinnoitteluun. Empiirinen tutkimus osoittaa, että Private equity -omisteisten yritysten merkintähinnat ovat vähemmän alihinnoiteltuja verrattuna sekä Venture capital -omisteisiin että ei-pääomasijoitusomisteisiin yrityksiin. Pääomasijoittajien omistus vaikuttaa myös pitkän aikavälin osaketuottoihin: Private equity -omisteisten yritysten listautumisannit tuottavat keskimäärin paremmin kuin Venture capital -omisteisten ja ei-pääomasijoitusomisteisten yritysten listautumisannit pitkällä aikavälillä. Tutkimuksen tulokset ovat linjassa aiempien akateemisten tutkimusten kanssa.

AVAINSANAT: Buy-and-hold abnormal return, initial public offering, private equity, underpricing, venture capital

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1 Introduction

The initial public offering (IPO) is one of the most remarkable milestones in a company's growth process, transitioning the company from private to public ownership. Going public allows companies to access new capital, attract investors in the public stock exchange, gain visibility, and expand in the competitive market. However, it also comes with new challenges, such as regulatory requirements from stock exchanges and increased transparency and corporate responsibility (Bancel & Mittoo, 2009). For venture capital-backed companies, an IPO can also serve as validation for their business model and potential for value creation. The IPO process is one of the most studied concepts in the field of corporate finance, where Pagano et al. (1998) are among the first to study why companies go public by testing several IPO theories in the Italian market. Since then, numerous studies have explored various aspects of IPOs, including underpricing, long-run performance, and the influence of ownership structure, across different markets and economic conditions.

In recent years, private equity (PE) and venture capital (VC) financing have transformed the capital markets in the Nordic countries. As a result, academic institutions and researchers have shown their interest in understanding the impact of different ownership structures on companies' performance. The effect of ownership structure on a firm's long- and short-term stock performance and level of IPO underpricing, where the issue price is set below the market price on the first trading day, has been widely studied in the past academic literature in different markets. However, most of these studies focus on the US market, which has been thoroughly analysed, and where IPOs are often divided into only two groups based on whether the company received private equity financing. This paper aims to address this gap in the research and answer the growing interest in private equity and venture capital financing in the Nordics by studying the Nordic IPO market and the relationship between PE-backed, VC-backed, and non-backed (NB) IPOs in different market conditions.

Private equity and venture capital investors target non-listed companies but look for different company characteristics. Private equity investors look for mature companies in their later stages, with strong governance structures and stable cash flows. On the other hand, venture capital investors look for young, innovative, early-stage ventures with high growth expectations and risk. Thus, we can agree that IPOs financed by private equity and venture capital investors have different characteristics, which have an impact on the IPO underpricing and long-term stock performance.

This study focuses on the IPOs in the Nordic markets: Denmark, Finland, Norway, and Sweden. The study covers a period of ten years, from 2010 to 2020. The aim is to study the effects of PE and VC ownership on the long-run post-IPO stock performance and IPO underpricing. The underpricing of IPOs is studied because it is one of the main research topics in the field of finance, and the majority of studies have proven that IPOs tend to be underpriced, and the offer price tends to be lower than the price in the aftermarket (Hahl et al., 2014). Similarly, the long-run performance of IPOs is impacted by various factors such as ownership structure, company characteristics, market conditions, and country of issue.

1.1 Purpose of the study

The purpose of the study is to examine the influence of pre-IPO ownership structure on IPO underpricing and long-term stock performance when companies enter the public markets via initial public offering in the Nordic countries. This study focuses on the Nordic IPO market because it is a relatively small market and has not received a lot of academic interest, and therefore is not widely studied yet. The majority of the previous studies focus on the US and UK markets, where private equity and venture capital are common forms of financing. PE and VC financing have emerged in the past years in the Nordics, and thus, it is beneficial to broaden the research to the Nordic markets. This study aims to offer new insights into the Nordic IPO markets and the influence of pre-

IPO ownership structure on underpricing and long-run performance in the post-IPO period.

In addition, this study examines the impact of different market conditions on underpricing and performance against the benchmark index. The IPO market can be separated into hot and cold cycles, where the number of IPOs increases, and valuations are more optimistic during hot cycles, and vice versa. The hot cycles tend to take place in bullish markets, and the cold cycles in bearish markets. The timing of the listing is a factor that affects the underpricing and post-performance of the IPO, and this study aims to explain the interdependence between these variables.

1.2 Hypotheses

The hypotheses focus on the underpricing of IPOs and long-run performance after the IPO. The first hypothesis focuses on the first-day returns and the influence that pre-IPO ownership structure has on the underpricing of the IPO. The second hypothesis focuses on the effect that ownership structure has on the long-run performance after the IPO, looking at the buy-and-hold abnormal returns for 36 months. The third hypothesis extends the research and evaluates the performance of IPOs with different ownership structures compared to the benchmark index and in hot and cold cycles.

The first hypothesis is formed based on the study by Levis (2011), who finds that private equity-backed IPOs are less underpriced than venture capital-backed IPOs in the UK market. This study follows a similar approach to Elston and Yang (2010), who studied the relationship between VC-backed and non-backed IPOs, and Vu et al. (2008), who include three ownership structures in their comparison: PE-backed, VC-backed, and non-backed IPOs. There is a standard method for measuring underpricing that has been well established by academic literature, and thus, this paper follows a similar approach. The first hypothesis is formed based on the previously mentioned studies and includes PE-

backed and VC-backed IPOs, which are compared in the Nordic market context. The first hypothesis is presented as follows:

H_1: Private equity-backed IPOs are less underpriced when going public in the Nordics than venture capital-backed IPOs.

The second and third hypotheses are related to the long-run stock performance of the IPOs. The second hypothesis follows studies by Matanova et al. (2022) and Levis (2011), who find that PE-backed IPOs perform better in the long run than VC-backed and non-backed IPOs in the US and UK markets. Based on their findings, the second hypothesis is formed as follows:

H_2: Private equity-backed IPOs outperform venture capital-backed and non-backed IPOs in the long run in the Nordic market.

The third hypothesis follows the study by Levis (2011), who finds that regardless of the continuous positive performance and outperformance of VC-backed and non-backed IPOs, PE-backed IPOs underperform the benchmark. Few issues managed to outperform the index in a 12-month period in 2008 when the market performance was low due to the financial crisis (Levis, 2011, p. 268). The third hypothesis is formulated as follows:

H_3: Private equity-backed, venture capital-backed, and non-backed IPOs in the Nordics underperform the benchmark index in the long run.

1.3 Structure of the study

This thesis consists of seven main chapters. The first chapter is the introduction, which includes the purpose of the study, hypotheses, and the structure of the study. This chapter aims to present the hypotheses and justify the relevance and scope of the research topic. The introduction is followed by the theoretical part, including an

overview of private equity, venture capital, initial public offerings, and related theories. In the next chapter, previous academic studies on IPO underpricing, the long-run performance of IPOs, and ownership structure in the IPO context are discussed. The empirical part covers the data, methodology, and regression models used in this study. Next, the empirical results of the study are presented, and finally, a conclusion is presented to summarize the findings and suggest future research questions.

2 Private Equity

A company's financing options can be divided into two categories: financing with equity or debt. In the stock exchange, companies can get financing by selling a part of their equity or by taking more debt in the form of a bank loan (Demaria, 2013, p. 9). However, the stock exchange only serves as a financing solution for medium- or large-sized companies that fulfill the criteria regarding, e.g., the financial figures. To be eligible for a bank loan, the company must meet the criteria set out by the bank and prove its financial stability and health. The need for collateral and stable cash flows might limit the possibilities of small companies to take out loans (Demaria, 2013, p. 9). Private equity provides an alternative financing solution for companies that are not listed on the stock exchange or do not qualify for a bank loan.

2.1 Introduction to private equity

Private equity can be defined as financing for equity that is non-listed and not regulated or traded in the public stock exchange. Private equity investors have high return expectations for the high risk they are taking, and they mentor and consult the entrepreneur or owner of the firm in the process of growing the business (Demaria, 2013, pp. 24–25). Private equity investors target later-stage companies with strong performance and aim to buy out the founder by acquiring a major stake in the company.

A private equity fund is an ecosystem that consists of limited partners and general partners. Limited partners are institutional investors such as banks, insurance companies, and pension funds that provide most of the capital. General partners are private banks, family offices, or private equity firms managing the funds (Demaria, 2013, p. 73; Kaplan & Strömberg, 2009, p. 123). The funds for private equity come from institutional investors, companies, individuals, and organizations, and these funds are allocated to different asset classes to balance the risk and return of the investment (Demaria, 2013,

p. 73). In Figure 1, the structure of the private equity ecosystem is presented in more detail.

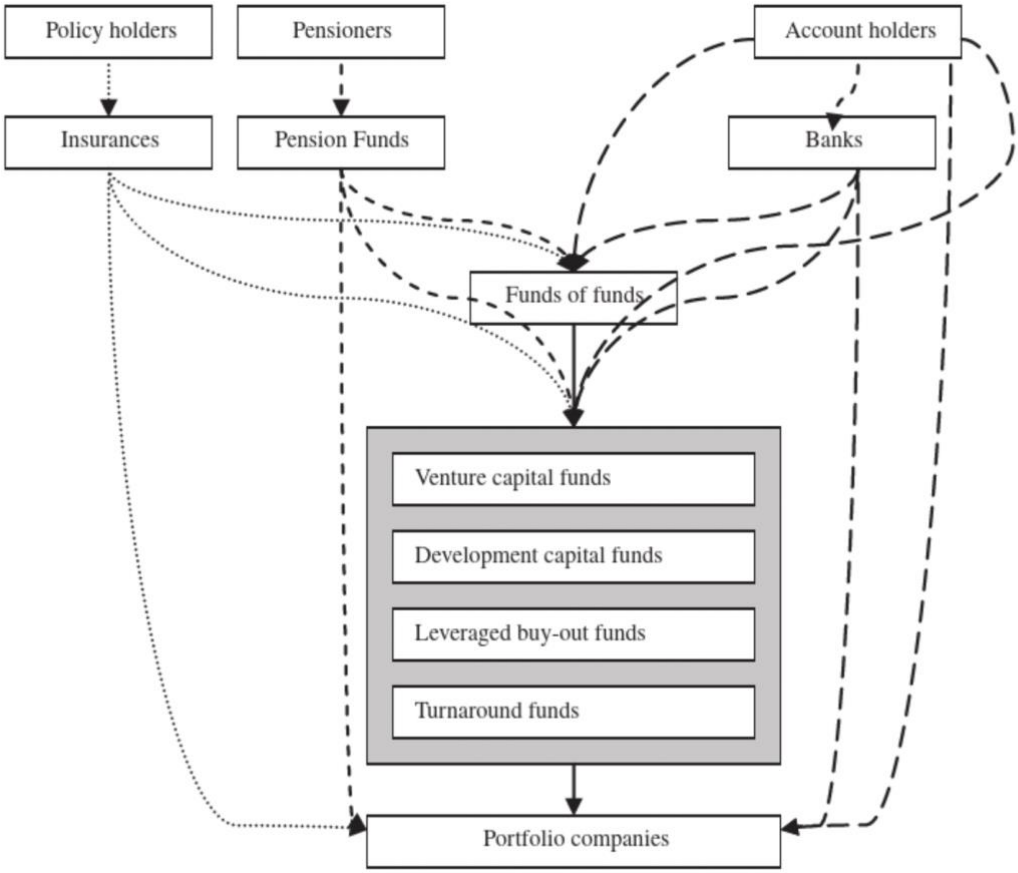

Figure 1. Private equity ecosystem structure (Demaria, 2013, p. 75).

2.2 Introduction to venture capital

Venture capital funds invest in early growth-stage companies or start-ups that are unable to finance their operations with debt financing. Typical industries for venture capital financing are technology and healthcare, which are innovative fields with high starting costs (Hudson, 2014). Offering guidance and help to develop the start-up is typical for venture funds, depending on the stage of the start-up. Mentoring can add value significantly, and for the entrepreneur, finding the right investor can be crucial for the company's future development (Zeisberger et al., 2017, p. 20). According to Zeisberger

et al. (2017), one-third of venture-backed companies fail, and two-thirds lose money, making venture capital a high-risk investment.

Venture capitalists look for innovations that have the potential to disrupt the current market and create wealth (Haislip, 2011, pp. 2–11). In addition to providing capital and funding, venture capital investors add value by bringing knowledge, executives, and customers. Venture capitalists are professional investors who invest money raised from institutional investors, unlike “angel investors”, who invest their own money. All venture capital investments are unique, and there is no strict and formal definition for these investments (Haislip, 2011, pp. 2–11). What makes venture capital funds different from private equity funds is high-risk investments, investing in early-stage start-ups, and providing consulting and guidance. Compared to private equity funds, the investments are smaller in monetary terms as only a minority stake is acquired (Metrick & Yasuda, 2011, pp. 646–647). Venture capitalists are general partners who invest limited partners’ money through a fund. A standard venture fund agreement is 10 to 12 years, and investments are made during the first five to seven years. The investments accumulate returns that are distributed back to the limited partners (Haislip, 2011, pp. 2–11).

2.3 Other sub-categories

Private equity investors look for companies of different sizes and stages depending on their investment style and portfolio focus. Private equity can be divided into three main sub-categories, as there are three key types of funds, the first one being the previously introduced venture capital fund. The two other funds are growth capital and leveraged buy-outs (LBOs), which are introduced briefly in the following chapter.

Growth capital funds target companies that are looking to grow and expand and have grown past the start-up stage. Unlike in venture capital investments, only a minority stake may be acquired (Hudson, 2014). Thus, trust and partnership have a crucial role, and growth is dependent on funding and expertise brought by the fund. The difference

between growth capital and buy-out is that in growth equity, the owners and management remain active in the company (Zeisberger et al., 2017, pp. 33–34).

A leveraged buy-out is an investment of both private capital and debt financing. In theory, the greater the amount of debt in comparison to equity, the greater the returns are for investors. Target companies of LBOs tend to be more mature and larger than target companies of venture capital and growth capital (Hudson, 2014). In an LBO, the investors acquire a major stake in the company to be able to make all decisions regarding finances and the business independently (Zeisberger et al., 2017, pp. 45–54).

2.4 Value creation

Private equity investors can create value through several actions. Firstly, value can be created by improving operational performance by setting long-term goals, incentives for management, and performance-driven bonuses (Leleux et al., 2015, p. 70). Secondly, value can be created by setting higher growth expectations for the company. Thirdly, by scheduling purchases in low periods and sales in high periods, investors might benefit from the changes in the market. The last option is to use the bank debt as a form of financing due to its tax benefits, as leverage on the investment, or to keep discipline since the bank debt is strictly controlled by the bank, and covenants might be required (Leleux et al., 2015, p. 70).

The improvement of operational value can be seen as an increase in earnings before interest and taxes (EBIT) as expected earnings grow and the risk related to those earnings decreases. When setting higher growth expectations for the company, the idea is to get a higher valuation multiple from the market, which is used to discount the EBIT (Leleux et al., 2015, pp. 78–79). Thus, the multiple arbitrage, which means timing asset purchases and sales according to the cycle, and multiple engineering, which means actively proving to the market the accuracy of the higher multiple, repositioning the company in the market, and creating value (Leleux et al., 2015, pp. 85–86). Financial

leverage uses debt to grow returns because it can lower taxes, as interest charges tend to be tax-deductible, unlike dividends. In addition, it improves the return on equity and forces the company to have enough cash to cover the interest and principal costs (Leleux et al., 2015, p. 86).

2.5 Divestment and exit strategies

Private equity funds are illiquid, which separates them from the traditional asset classes, as investors' funds are tied to the fund for an entire term without the possibility of withdrawing the capital (Zeisberger et al., 2017, pp. 5–18). Exits are an important final step for PE investors, and there are several exit routes. The exit is the only possibility for the investor to realize the capital gains, and thus, the exit strategy is an important part of the return realization process and can be conducted as a full or partial exit. PE investments tend to last for 3 to 7 years, and the investment is valid for a finite period (Uddin & Chowdhury, 2021). According to Gompers et al., (2008) there are three successful and profitable exit routes for PE companies, which are a trade sale, initial public offering, and a secondary buyout. In Figure 2, Invest Europe (2023) has identified seven different exit routes, including a trade sale, public offering, write-off, repayment of preference shares or loans, sale to another private equity firm, sale to a financial institution, and management or owner buyback. In the following chapters, these exit methods are described in more detail, focusing on the three main exit routes: trade sale, initial public offering, and secondary buyout.

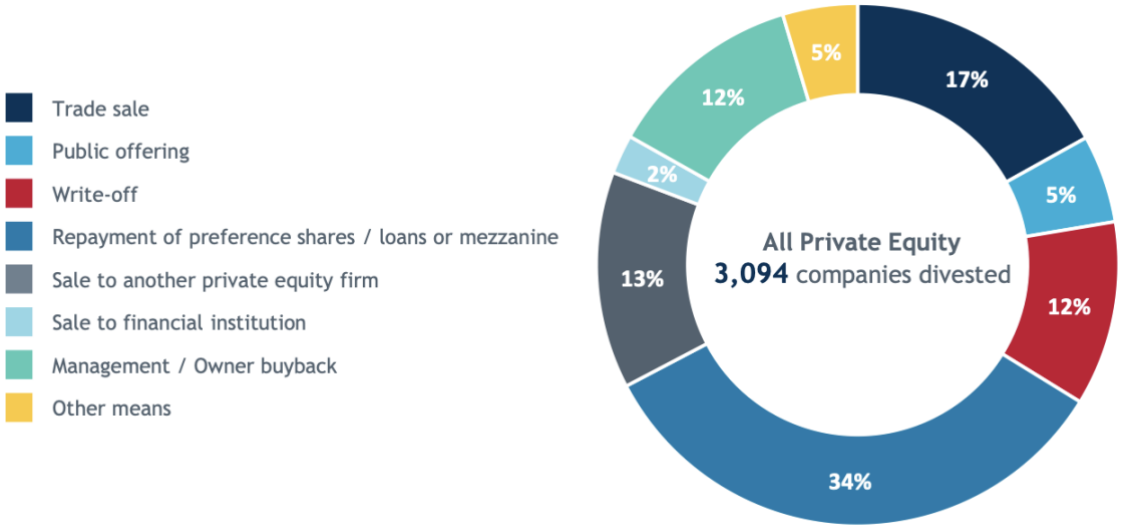

Figure 2. Divestments by exit route in Europe 2023 (Invest Europe, 2023, p. 66).

2.5.1 Trade sale

Trade buyers are acquirers who make purchases for strategic reasons, e.g., to achieve market growth or secure innovative products and patents. Trade buyers are non-PE firms or non-financial buyers (Baker, 2015, p. 220). The firms are typically large companies in the same or similar business field as the acquired company that aim to grow and develop their own business via a merger within the industry. The advantage of this exit route is that it can yield high valuations due to the synergies (Rigamonti et al., 2016, p. 1423). In 2023, trade sale was the second most common exit route in Europe, measured by divestment at cost (Invest Europe, 2023, p. 66).

2.5.2 Initial public offering

In an initial public offering, the company's shares are listed on the stock market for public sale for the first time, which allows the PE firm to exit by selling its shares of the company. IPO is a popular exit method suitable for large and high-performing companies due to its high transaction costs and multiple legal and regulatory restrictions (Baker, 2015, p. 221).

For a PE firm, an IPO is generally considered the best exit route when considering the returns and the effect the exit can have on the reputation of the PE firm. An IPO can provide a high valuation and liquidity if the market conditions are favorable. However, this strategy also requires knowledge of the industry and competitive environment from the PE firm (Rigamonti et al., 2016, pp. 1423–1424).

2.5.3 Sale to another private equity firm

Sale to another private equity firm was the most common divestment method in Europe in 2023, covering 35% of the total exits (Invest Europe, 2023, p. 66). A PE company can sell a company from its portfolio to another in a secondary buyout. This exit method can be considered when the PE company and the management team of the portfolio company agree that selling to a larger PE company can add value or boost growth. A PE company can sell its portfolio company when the minimum investment time has been reached, and if the investment has already generated high returns, the PE company might benefit from selling (Baker, 2015, p. 221). A secondary buyout can be considered if the private equity firm cannot finance the portfolio company anymore, and the company is not ready for an IPO or a trade sale and needs more financing from another financial sponsor to develop. Sale to another private equity firm can also act as a solution in a conflict between the PE investor and the management team since it is a fast exit route that offers flexibility in the structure of the sale and enables other special arrangements, e.g., partial ownership (Baker, 2015, p. 221).

2.5.4 Write-off

If the investment does not generate the expected returns, the private equity company might have to write off the investment if the other exit routes are not viable (Cumming & MacIntosh, 2003, p. 514). The portfolio company does not have to fail for a write-off to occur if the recovery from financial distress is unlikely. When the portfolio company is

marginally profitable but does not have upside potential, the PE firm can decide to keep it in its portfolio to receive smaller, stable returns or eliminate the investment by a write-off (Cumming & MacIntosh, 2003, pp. 524–525).

2.5.5 Repayment of preference shares, loans, or mezzanine

The PE firm might have provided financing in the form of debt and equity, called mezzanine financing (Invest Europe, 2023). This is typical in a leveraged buyout deal where a PE firm gives the portfolio company financing in mezzanine debt, which will be repaid by the portfolio company. When the portfolio company repays all preference shares, loans, or mezzanine it has received from the PE firm, this allows the PE firm to exit (Invest Europe, 2023).

2.5.6 Sale to a financial institution

The PE firm can sell its shares of the portfolio company to a financial institution to exit the investment. The financial institution can be a bank, pension fund, or insurance company looking for long-term returns and investment (Invest Europe, 2023). A sale to a financial institution can also be referred to as a secondary buyout, similar to a sale to another private equity firm (Baker, 2015, p. 221).

2.5.7 Management or owner buyback

Buyback exit occurs when the company or the owner of the company buys back the shares from the PE firm (Cumming & MacIntosh, 2003, p. 514). An owner buyback can be considered when the original owner wants to manage the company after expanding and improving the company and strategy with the help of a PE firm. It is typical for a buyback exit to be a partial exit due to limited cash resources, as the entrepreneur might

not be able to buy back the company in full due to high valuations (Cumming & MacIntosh, 2003, p. 524).

3 Initial public offerings

This chapter explains the concept of initial public offerings and the reasons why some companies choose to go public while others prefer to stay unlisted. The introduction part is followed by a cross-section of the going public process and a description of different anomalies that aim to explain the valuation of IPOs. Lastly, the Nordic IPO market is discussed to understand the relevance of venture capital- and private equity-backed IPOs in the Nordic context and the characteristics of the Nordic IPO market.

3.1 Introduction to IPOs

An initial public offering can be defined as a process where a private company is listed on a public stock exchange and sells its shares for the first time to the public, transitioning the company from private to public ownership (Ritter & Welch, 2002). The decision to go public and enter the public equity market is one of the key stages in the lifespan of a company. However, some large companies still choose to stay private. Several factors affect the decisions to go public, including the role of the stock market in the economy and how developed the equity market is compared to the economy.

One of the main reasons to go public is the need for financing. By listing on the stock exchange, the firm can raise equity capital, and the founders get a chance to realize their gains for cash or exit the company at a later stage. Nonfinancial reasons could be to gain increased publicity and a better reputation for the firm, which can lower the cost of bank debt or boost sales (Ritter & Welch, 2002). Pagano et al. (1998) studied the IPO market in Italy and found that the market-to-book ratio at which companies in the industry trade is the biggest factor affecting the decision to go public. The higher the ratio, the more likely the companies are to go public. Another important factor is the size of the company, as larger companies are more likely to go public than smaller companies, similar to fast-growing and highly profitable companies (Pagano et al., 1998). Ritter and Welch (2002) agree that market conditions and the current stage of the company in its lifespan are the

two most important factors affecting the decision to go public. The company must be at a stage where it fulfills the criteria for listing and can afford the costly and complex process.

3.2 IPO process

In simple words, an IPO takes place when a company sells its shares to a third-party investor. Depending on the country and stock exchange the company has chosen to list, there are different requirements and steps in the process. In this chapter, the structure of a typical IPO process is explained in a European context since this study is focused on the Nordic market.

When a company has decided to go public, it begins to prepare for the process by choosing an underwriter, which is the managing bank or investment bank, and legal advisors and consultants to advise them in the process. Before the listing, which is also called a primary offering, the company must follow the accounting standards, and audit and due diligence must be completed (Espinasse, 2014, pp. 63–67). When it is ensured that the company complies with regulatory requirements, the company decides on the structure of the IPO. This includes deciding the stock exchange where they will list, the number of shares distributed, and the voting rights of the shares. The shares are valued based on the company's financials and the demand. When the regulators have approved the company for the IPO, the investment is marketed to investors in "road shows" (Certo et al., 2001, p. 35). The investors are chosen based on the allocation plan and are often institutional investors. Finally, the shares will be traded on the stock market on the listing day. After the IPO, the company must take care of continued compliance with regulations and accounting standards and might consider conducting secondary offerings (Espinasse, 2014, pp. 1–2).

3.3 Theoretical background of IPO underpricing and performance

When companies go public, they tend to underprice the equity, which leads to a rapid increase in the price on the first trading day. Because of underpricing, the company is missing an opportunity to create more money since the shares are sold at a price that is too low (Eckbo, 2007). The IPO first-day returns tend to show better performance than the long-term returns. The IPOs show underperformance on average in 3 years after the listing (Ritter, 1991, p. 3). There are several explanations for the underperformance, including window of opportunity theory, investors' overoptimistic expectations on post-IPO earnings, and fads. The fads are mainly caused by investors trying to benefit from IPO underpricing and companies timing the issues to "hot markets" to benefit from a market upturn. This will lead to overvaluation due to investor speculation, which will eventually end in price fall as the fads begin to weaken and the prices revert to their fundamental value. The fads can also be caused by investors' overoptimistic expectations and irrational behavior. The window of opportunity hypothesis is linked to the market timing theories, as by timing the IPO, the issuer can take advantage of the "window of opportunity" (Ritter, 1991).

The private equity or venture capital financial backing can impact the underpricing and stock performance after the IPO, as the reputation of the financial sponsor can increase or decrease the firm's value. According to the certification hypothesis, a financial sponsor with a good reputation signals high quality, reduces information asymmetry, and can have a decreasing impact on the underpricing (Megginson & Weiss, 1991). Another theory is the value-adding theory, which suggests that a financial sponsor can have a positive impact on the firm value by offering support for the company and by enhancing the monitoring and corporate governance of the company (Jensen, 1986). In previous studies, several theories have been presented to explain the underpricing and why firms underperform in the long run. The underpricing theories can be divided into four categories: asymmetric information, institutional, control, and behavioral theories. The following chapters present the most relevant and well-known theories under these categories.

3.3.1 Asymmetric information models

The parties in the IPO process are the selling firm, the underwriting bank, and the investor buying the stock. If one of the parties in the IPO process has more information than the others, the asymmetric information model applies. The most famous asymmetric information model is the winner's curse by Rock (1986), which assumes that some investors know the actual value of the shares better than other investors, the issuing firm, or the underwriting bank. Thus, well-informed investors only buy correctly priced IPOs, putting a winner's curse on the uninformed investors. The uninformed investors are the only ones bidding on the overpriced shares and, therefore, win all of them, resulting in negative average returns. Rock (1986) also assumes that the participation of uninformed investors is crucial for the primary market to keep the demand high, and thus, all IPOs must be underpriced because the expected returns cannot be negative for uninformed investors to participate. Another assumption of the winner's curse is that firms that are going public benefit from the underpricing because it ensures high demand and enough investor capital. However, as mentioned previously, underpricing also costs the firm, which sets an incentive for investment banks to underprice the shares only to the extent that it boosts the sale of the shares and does not cause reputational damage for the underwriter (Rock, 1986).

Another well-known theory is the principal-agent theory. The agency relationship forms as the principal delegates work to another party, the agent. The agency problem arises if the principal and agent have different goals, or the principal cannot supervise the agent's actions to their desired level (Eisenhardt, 1989, p. 58). Another problem that agency theory aims to solve is the problem of risk sharing that arises if the principal and agent have different risk preferences, which might cause inconsistency in their actions and decisions. In the field of finance, the agency theory has been studied and developed by Jensen and Meckling (1976), and Fama (1980), who studied the relationship between owners and managers of the firm and incentive problems. The agency theory aims to

create the most suitable contract to manage the principal-agent relationship while considering, e.g., the irrationality of people, conflicts among the parties, and information as a commodity that can be traded. One of the important questions that the agency theory considers is the best executive remuneration model (Eisenhardt, 1989, p. 58).

Signaling theory was introduced by Spence (1973), and according to the theory, if the company has more information than the investor on the present value, the future cash flows, and the risk level, the underpricing can be used to signal the high value of the company (Ljungqvist, 2004, pp. 36–37). This theory can be used to build an image of a high-quality firm and leave a good impression on the investor, allowing the issuer to sell equity later on the market on better terms.

3.3.2 Institutional theories

Institutional theory by Tinic (1988) states that intentional underpricing can be used as insurance to avoid litigation. The theory is based on the assumption that the more overpriced issues are, the more prone to litigation they are. Similarly, underpricing reduces the risk of litigation, the probability of a lawsuit and adverse ruling, and the amount of damages in case of an adverse ruling (Ljungqvist, 2004, p. 41). Another institutional explanation for underpricing is price stabilization. Price stabilization is used to stabilize the offerings whose prices fall below the offer price, and it takes place in after-market trading. Stabilization leads to a positive jump in the average price and eliminates the negative returns of the IPO (Ljungqvist, 2004, p. 45).

The last institutional explanation is the tax advantages for IPO companies' employees. Underpricing can lead to tax benefits as stock option holders pay tax when exercising the option on the difference between the strike price and the fair market value. When selling the stock, capital gains tax is paid on the difference between the sale price and fair market value. Therefore, the holder of the stock option benefits when the fair market

value is as low as possible. This may set an incentive for managers to underprice the IPOs (Ljungqvist, 2004, pp. 49–50).

3.3.3 Control theories

According to Brennan and Franks (1997), underpricing can be used to retain control and secure managers' benefits by making strategic share allocations. Underpricing is used to generate excess demand for the stock, which leads to greater ownership dispersion. Managers may avoid allocating large stakes to investors to reduce the external monitoring and risk of being replaced in a takeover (Ljungqvist, 2004, pp. 51–52). Underpricing can also be used to reduce agency costs. When managers own large stakes of the company, the agency costs might be higher than the private benefits, and in this case, it is beneficial for them to aim to reduce the agency costs. Contrary to the previously discussed theory by Brennan and Frank (1997), the theory by Stoughton and Zenner (1998) presents that allocating large stakes to outside investors can lead to increased monitoring, leading to reduced agency costs (Ljungqvist, 2004, pp. 54–55).

3.3.4 Behavioral theories

One of the behavioral theories is the informational cascades theory by Welch (1992). Informational cascades form as investors make their decisions at different times, and the later investors base their bids on the earlier investors' bids. Cascades may affect the underpricing of the IPO, as the early investors have the power to demand higher underpricing in return for their early investment, long commitment, and the act of creating a positive cascade (Brennan & Franks, 1997, pp. 57–58). Another behavioral explanation is the investor sentiment or irrational investor. An irrational investor has overly optimistic expectations of the future returns of the IPO company, causing excess valuation. Eventually, the stock price will revert to the fundamental value. As IPO

companies are young companies that are hard to value, they are prone to the investor sentiment effect (Ljungqvist, 2004, pp. 59–60).

3.3.5 Market-timing theories

Hot markets, defined by Ibbotson and Jaffe (1975, p. 1027), are periods when the average of the first-month performance of new issues is abnormally high. Similarly, the number of IPOs is higher during hot than cold markets. Loughran and Ritter (2004) study the IPO underpricing during the dot-com bubble, defined as a hot period, and during the following cold periods. Their findings support the study by Ibbotson and Jaffe (1975), as they find that the average first-day returns on IPOs and the level of underpricing were the highest during hot markets. They explain this phenomenon by irrational investor behavior during the hot markets, where investors are overoptimistic and push money into the markets, which results in high first-day returns (Loughran & Ritter, 2004). In line with Loughan and Ritter (2004), investor optimism and the number of firms going public are the main reasons explaining the IPO market's hot and cold cycles, according to Helwege and Liang (2004). Therefore, timing the IPO to the hot cycle can allow the firm to collect more equity, but can also lead to lower long-term returns as overvaluation and overoptimistic behavior are detected and the market begins to turn to a cold period (Westerholm, 2006; Zingales, 1995).

3.4 Nordic IPO market

The listing requirements in the Nordic markets are stricter compared to the rest of Europe. Finland, Norway, and Sweden also have a separate list for smaller companies with lower listing requirements (Westerholm, 2006). The requirements for listing on the main list are higher, especially regarding company size and financial performance. However, the average size of listing companies is still lower in the Nordics than in Europe. Norway has the fastest-growing IPO market in the Nordics, which can be explained by

the most IPO listings in Norway's official stock exchange, as well as the most active small list in the Nordics. Regardless, Sweden currently holds the largest IPO market in the Nordics (Westerholm, 2006). In Figure 3 below, the number of investments is compared between different regions in Europe. Nordics hold the second-lowest number of venture capital investments in 2023, but are not necessarily far from Germany, Austria, and Switzerland, also known as the DACH countries, with 677 venture capital investments. The CEE countries, standing for central and eastern European countries, have the least venture capital investments, with 358 investments made in 2023. France and the Benelux countries hold the highest number of investments, with 1266 VC investments.

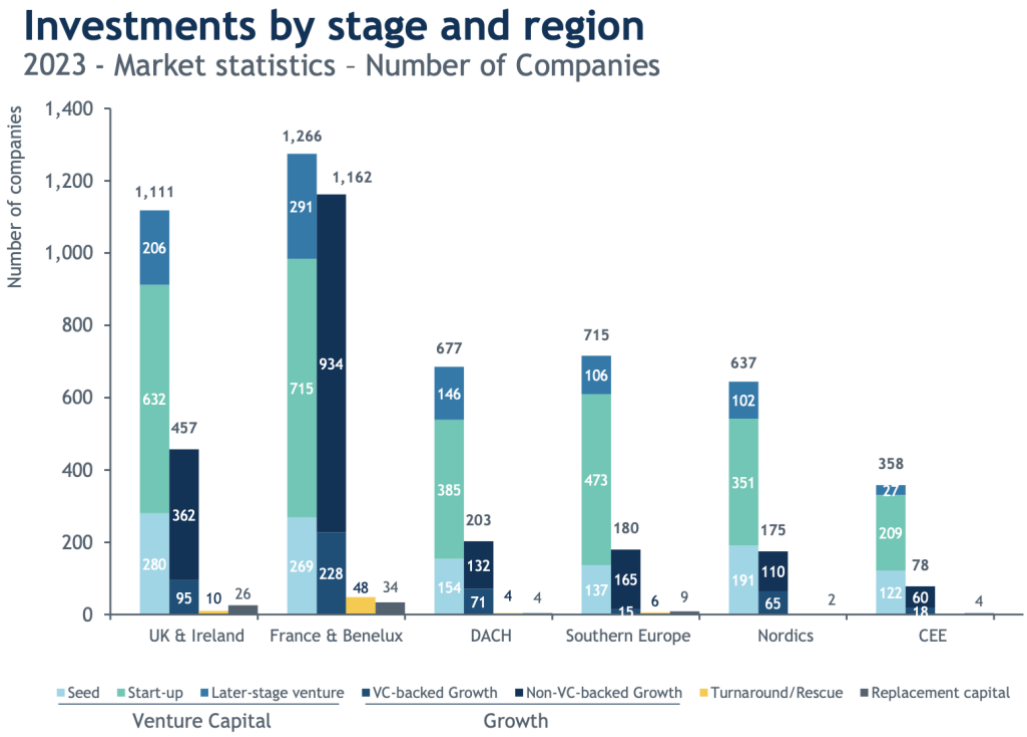

Figure 3. Investments in Europe by stage and region (Invest Europe, 2023, p. 49).

4 Literature review

In this chapter, the relevant previous academic studies on how private equity and venture capital ownership affect the level of IPO underpricing and firms' long-run performance after going public are presented. This is followed by the empirical part, which includes the data and methodologies used, which are chosen based on the studies presented in this chapter.

4.1 IPO underpricing

Levis (2011, p. 254) measures the underpricing of IPOs and compares the results in PE-backed, VC-backed, and non-backed IPOs in his study. He finds that PE-backed IPOs are the least underpriced and explains the low underpricing with the size and maturity of the companies in the data set. Since the company characteristics indicate low risk on the issues, the findings are consistent. According to Levis (2011, p. 264), the low underpricing is a result of low risk and aggressive pricing. Additionally, if a company holds a PE group certification, it can lower the level of underpricing.

In line with previous literature by Purnanandam and Swaminathan (2004), Levis (2011, pp. 274–275) finds that the price of overvalued IPOs tends to go up in the aftermarket and, eventually, settle down to a fair price in the long run. Thus, Purnanandam and Swaminathan (2004), and Levis (2011) argue that at the same time, IPOs can be overvalued and underpriced. Levis (2011, pp. 274–275) finds evidence supporting this view as PE-backed IPOs are generally fairly valued, but there is a general perception in the market of PE sponsors' aggressive pricing methods and IPOs' high debt levels at the time of the issuance. This leads to IPOs generating modest first-day returns as the investors are surprised by the stable performance, active PE sponsors, and the reduction of debt, which eventually encourages positive aftermarket performance.

Bergström et al. (2006) measure the underpricing of PE-backed and non-PE-backed companies in the European market in 1994–2004. They measure the underpricing by calculating the IPO abnormal returns in the initial return period and then subtracting the benchmark return. They calculate equally weighted abnormal returns for different portfolios based on the stock exchange, year, PE-backing, and non-PE-backing, further calculating value-weighted abnormal returns for all portfolios. Bergström et al. (2006) find that on average, PE-backed IPOs are underpriced by 9,33% and non-PE-backed IPOs by 12,87%. The level of underpricing varies in different years, but the trend remains the same: in most years, PE-backed IPOs are less underpriced. They also find that the level of underpricing is higher within the IPOs in the growth markets, which could be explained by low levels of transparency and little information on companies' past performance. Lack of transparency and information could lead to information asymmetries, causing adverse selection bias. Consistent with the hot-issue market theory by Ibbotson and Jaffe (1975), Bergström et al. (2006, p. 41) find that the timing of the IPO and the amount of raised capital have the greatest impact on underpricing instead of the ownership.

Consistent with Bergström et al. (2006), Ferretti and Meles (2011) study the IPO underpricing in the Italian market. They focus on a sample of 160 IPOs in the Milan Stock Exchange from 1998–2008 and divide their sample into PE-backed and non-PE-backed IPOs. They measure underpricing by simple and adjusted-underpricing models. Their findings are consistent with Bergström et al. (2006), Kirschbaum et al. (2023), and Levis (2011), who find evidence that private equity backing reduces IPO underpricing. They find that the underpricing of PE-backed IPOs is 1,67% using the mean simple underpricing model and 1,92% using mean beta-adjusted underpricing. The equivalent values for non-PE-backed IPOs are 6,21% and 6,57%, resulting in a lower level of underpricing in PE-backed IPOs. Ferretti and Meles (2011, p. 43) explain their findings by assuming that private equity syndication reduces underpricing because it is a sign of high-quality PE investors.

Elston and Yang (2010) study the effects that ownership structure has on IPO underpricing in Germany, focusing on the effects of VC ownership. They aim to examine whether VC ownership and high insider ownership after going public will cause lower underpricing. In addition to standard underpricing measures, they use a modified measure for robustness. The data includes 320 companies from the Hoppenstedt GmbH and Deutsche Börse AG from the period of 1996–2001.

Elston and Yang (2010) find that the median underpricing of non-VC-backed listings is higher than the underpricing of VC-backed listings. However, the difference is not statistically significant. They state that because the difference is not significant, the role of VCs in Germany is minimal, unlike in the US and UK. They base this finding on the fact that in Germany, the use of venture capital became popular during the later stages of the development of the financial markets and highlight that their finding is in line with previous studies on similar countries, where VC has a minor role in the markets. Underpricing is often studied using asymmetric information models in the finance literature, but Elston and Yang (2010, pp. 534–535) provide empirical evidence that asymmetric information models are not suitable for all institutional environments. For example, Germany is a bank-based country, unlike the UK or the US, and problems caused by asymmetric information might not be affected or solved by venture capitalists or other market forces.

Kirschbaum et al. (2023) study the underpricing of Brazilian IPOs and find similar results to Levis (2011), regardless of differences in the sample countries' market environment and geographical factors. They find that PE-backing reduce underpricing, whereas non-backed IPOs tend to be more underpriced, and higher underpricing is related to higher abnormal returns of the company (Kirschbaum et al., 2023, p. 483). However, their study does not provide the exact values of underpricing to allow better comparison of their findings to other studies.

Vu et al. (2008) study the pricing of initial public offerings in Australia in 1996–2007. They study a sample of 306 IPOs and divide them into three types of issues: PE-backed, VC-backed, and non-backed. They use four different measures for underpricing, which are headline underpricing, underpricing issuer loss, underpricing loss by market value, and underpricing loss by issue price. The findings of the traditional method for measuring underpricing, headline underpricing, show that VC-backed IPOs are the least underpriced by 32,1%, PE-backed IPOs are underpriced by 39,6%, and non-backed IPOs by 70,7%. This finding differs from Levis (2011), who finds that PE-backed IPOs are less underpriced at 9,10% compared to VC-backed IPOs by 14,90%. Previous studies are consistent with the finding that non-backed IPOs are more underpriced than VC- and PE-backed issues, as can be seen from Table 1 below.

Table 1. Summary of previous literature on IPO underpricing.

Author	Market	Time	Sample size (IPOs)	PE-backed underpricing	VC-backed underpricing	Non-backed underpricing
Levis (2011)	UK	1992–2005	1595	9,10 %	14,90 %	21,10 %
Bergström et al. (2006)	UK & France	1994–2004	1522	9,33 %	-	12,87 %
Ferretti & Meles (2011)	Italy	1998–2008	160	1,92 %	-	6,57 %
Elston & Yang (2010)	Germany	1996–2001	320	-	9,68 %	15,79 %
Kirschbaum et al. (2023)	Brasil	2004–2013	120	PE-backing reduces underpricing	-	Higher underpricing compared to PE-backed
Vu et al. (2008)	Austalia	1996–2007	306	39,60 %	32,10 %	70,70 %

4.2 IPOs long-run underperformance

Previous studies have found that IPOs tend to underperform after going public in the long- and short-term, regardless of the ownership structure. The IPO performance after going public is a well-studied topic, and several studies have similar findings regarding the IPO underperformance. This study focuses on examining the long-term post-IPO performance, and therefore, studies focusing on long-term returns are discussed in this chapter.

Studies by Ritter (1991), Loughran and Ritter (1995), and Chen et al. (2013) have all received similar results and find that in the long term, IPOs have not been able to beat the benchmark indexes. All three studies use a holding period of 36 months and find that benchmark indexes outperform the average IPO returns during that period. However, there are studies with opposing findings. Studies by Brav and Gompers (1997) and Gompers and Lerner (2003) find that IPOs can beat the benchmark indexes and generate higher returns in the long run.

4.3 IPOs ownership structure: Private equity and venture capital

Levis (2011) studies the post-IPO performance of IPOs with different ownership structures on the London Stock Exchange in 1992–2005. He uses the buy-and-hold abnormal returns (BHAR) and compares the BHAR of PE-backed, VC-backed, and non-sponsored IPOs. According to Levis, there is not much reliable evidence on the IPO performance of PE-backed firms outside the US, and he aims to fill this research gap. The data sample consists of 1595 IPOs in the UK market, and the methodology consists of the BHAR and Fama and French Three-Factor model. Levis (2011) finds that PE-backed IPOs outperform VC-backed and non-backed IPOs and all benchmarks. VC-backed and non-backed IPOs show weak performance, and non-backed IPOs perform the weakest. The worst performance is found in small non-backed IPOs, as larger IPOs performed

slightly better. A noticeable finding is that large VC-backed IPOs perform worse than large non-backed IPOs.

Bergström et al. (2006) use the cumulative abnormal return (CAR) method to study the long-run performance of PE-backed and non-PE-backed IPOs in the European markets. The purpose of the study is to find out if private equity-backed IPOs underperform non-backed IPOs in the long run. Bergström et al. (2006) study a data set of 152 private-equity-backed IPOs and 1370 non-private-equity-backed IPOs in the London and Paris stock exchanges from 1994–2004. They measure the long-run performance over six months, three years, and five years using the CAR36 method. Their findings suggest that PE-backed IPOs outperform non-PE-backed IPOs, similar to the findings of Matanova et al. (2022), Kirschbaum et al. (2023), and Levis (2011). PE-backed IPOs outperform in all time horizons but manage to accumulate the same level of return as the benchmark only in the first six months. In line with the windows-of-opportunity theory, they find that the IPOs are more likely to underperform in high-volume years (Bergström et al., 2006, p. 34).

Viviani et al. (2008) study the long-run stock performance of Italian firms, focusing on the effects of private equity ownership and family ownership. In Italy, family ownership accounts for a significant number of companies, but the effect of ownership structure in the IPO context has not been widely studied. Viviani et al. (2008) aim to contribute to the existing literature by studying the relationship between private equity ownership and family ownership in post-IPO performance. Their data consists of 168 IPOs during PE-backed, and the rest are non-PE-backed. They use the same methodology as Levis (2011), as BHAR for 36 months is applied to measure the post-IPO long-run market performance. The results show that the total sample underperformed by -11,9% the benchmark index MIBTEL (Viviani et al., 2008, p. 54). Private equity ownership shows a statistically significant negative impact on the IPO's long-run performance, whereas family ownership does not show a significant impact on the performance. Viviani et al. (2008, pp. 56–57) conclude that private equity investors do not provide their target firms

with enough value through certification and monitoring to increase the performance of the firm.

Matanova et al. (2022) study the effect of private equity and venture capital ownership on post-IPO performance of newly-public acquirers in the US IPOs in 1997–2010, and their final sample consists of 1975 IPOs. The purpose of the study is to shed light on the effects that PE and VC investors have on merger activity after the company goes public. This is an important topic because the investors have a significant impact on the value of the firm, but their influence on merger decisions is unclear. Matanova et al. (2022) examine the effect of financial backing in the post-IPO period by BHAR, similar to Levis (2011) and Viviani et al. (2008). The BHARs are adjusted for two benchmarks, style-matched portfolio returns and market-adjusted returns, by using the value-weighted CRSP index. They use dummy variables to analyze the impact that PE and VC ownership have on the long-run performance and to control for first-year acquirers because these firms tend to perform well in their first year, but compared to other firms, their performance is weaker in the following years. Additionally, Matanova et al. (2022) use the Fama-French Three-Factor model to analyze the aftermarket performance in more detail.

The results show weak aftermarket returns varying between -17,61% and -14,27% depending on whether market-adjusted or style-matched BHAR is used. PE-backed IPOs outperform VC-backed and non-backed IPOs, but overall, the whole sample shows a long-run underperformance. The multivariate regression analysis shows that VC-backed firms perform significantly better in the long run than non-backed firms, and VC backing has a significant positive impact on the long-run performance of first-year acquirers. On the contrary, VC backing in the second and third years after going public harms the long-run performance. According to Matanova et al. (2022) their finding could indicate that VC investors aim to plan their exit in the first year and are not that interested in acquisitions happening in the following years when their stake in the firm is already

smaller. On the other hand, PE-backing has a positive impact on the long-run performance of the firm and tends to benefit the firm even in the second and third years.

Kirschbaum et al. (2023) focus on studying the impact of private equity ownership and board centrality on IPO performance. They study the Brazilian market and test a sample of 120 IPOs during 2004–2013. They aim to study the impact of institutional ties and association with private equity firms on IPO performance in emerging economies. Their study is based on the signaling theory, and they analyze whether companies can use an association with PE firms to signal steady performance and trust for investors. They follow previous studies and use a one-year CAR to measure the performance of the IPOs. They use dummy variables to indicate if the company is PE-backed or non-PE-backed, and OLS-regression with CAR to test the hypotheses. Several models are estimated with control variables, independent variables, and dummy variables that indicate PE ownership. The robust standard error is used for heteroscedasticity. The results of the OLS regression indicate that PE ownership increases the firms' CAR by 17,3% compared to non-PE-backed firms. The study does not provide exact returns for non-PE-backed firms, but they find that the average CAR of non-PE-backed firms is significantly lower than the CAR of PE-backed firms. This finding supports the theory that PE ownership significantly improves long-term post-IPO performance.

Table 2. Summary of previous literature on post-IPO long-run performance.

Author	Market	Time	Sample size (IPOs)	Method	PE-backed long run	VC-backed long run	Non-backed long run
Levis (2011)	UK	1992–2005	1595	BHAR36	13,84 %	-3,92 %	-20,20 %
Bergström et al. (2006)	UK & France	1994–2004	1522	CAR36	-28,61 %	-	-72,94 %
Viviani et al. (2008)	Italy	1995–2005	143	BHAR36	-28,20 %	-	0,80 %
Matanova et al. (2022)	US	1997–2010	1975	BHAR36	-1,19 %	-18,21 %	-36,40 %
Kirschbaum et al. (2023)	Brasil	2004–2013	120	CAR12	17,3% higher compared to non-backed	-	lower than PE-backed

5 Empirical part

The empirical part includes the description of the data and methodology used in the study. The hypothesis regarding underpricing assumes that private equity-backed companies are less underpriced at the time of the IPO than venture capital-backed companies. Regarding long-run performance, this study has two hypotheses. The first hypothesis assumes that private equity-backed IPOs outperform venture capital-backed and non-backed IPOs in the long run. The second hypothesis is that IPOs under all ownership structures underperform the benchmark in the long run.

5.1 Data

The data for this study is collected from the LSEG database. The sample is drawn from the population of IPOs in the Nordic countries from January 2010 to December 2020. The data includes Danish, Finnish, Norwegian, and Swedish stock listings from the countries' main stock exchanges: OMX Nordic Helsinki, Nasdaq OMX Stockholm, OMX Nordic Copenhagen, Oslo Bors, First North Finland, First North Sweden, First North Denmark, and Oslo Axess.

Iceland is excluded due to its small IPO market and data unavailability, which makes it challenging to compare the market to other Nordic markets. Over-the-counter exchanges and several smaller, specialized exchanges are excluded from the sample: Oslo-OTC, Stockholm-OTC, Copenhagen-OTC, Nordic MTF, NGM, and Spotlight Stock Market Sweden. Companies whose financial statement variables are unavailable at LSEG Datastream and IPOs with missing stock price or ownership information are excluded to minimize the risk of errors in data from manually searching and matching variables.

The final sample consists of 282 IPOs; 12 of the companies are VC-backed, 40 PE-backed, and 230 non-backed. The ownership type is identified using the data retrieved from LSEG Datastream, which has a filtering function that allows for the collection of the backing

type information, whether the IPO is venture capital-, private equity-, or non-backed. Similarly, the variables used in this study have been retrieved from company-specific numbers from Datastream. The benchmark index used is the OMX Nordic 120 Index, which tracks the 120 most traded companies in Denmark, Finland, Norway, and Sweden. The index was chosen because it covers large-, mid-, and small-cap firms, giving a broad representation of the market and making the index a good fit for a sample consisting of smaller VC-backed IPOs and larger non-backed IPOs. The data period begins after the financial crisis of 2008 and, thus, reflects the market environment after the crisis. The COVID-19 pandemic and its effects on the market can be expected to be reflected in last year's numbers of data set.

In Table 3, the initial public offerings are distributed by the issue year and issuing country. The effects of the financial crisis and the European debt crisis can be seen in the table as a low number of IPOs in the years 2010–2013 following the crises. An increase in the number of IPOs can be detected from 2014 to 2017, as the number of issues began to decrease again in 2018. The years 2017 and 2020 have been the most active in the IPO sector, with 51 IPOs issued in each year. Denmark and Finland have issued the fewest IPOs in the past 10 years, with 36 and 43 IPOs. Sweden has issued the most IPOs, with 142, and Norway comes second with 61 IPOs.

Table 3. IPO volumes by issue year and country.

Year	Denmark	Finland	Norway	Sweden	Total
2010	0	0	0	0	0
2011	0	0	4	5	9
2012	1	1	2	0	4
2013	3	3	4	0	10
2014	2	5	8	14	29
2015	2	7	4	27	40
2016	4	5	3	24	36
2017	3	8	7	33	51
2018	5	9	3	14	31
2019	3	3	6	9	21
2020	13	2	20	16	51
Total	**36**	**43**	**61**	**142**	**282**

In Table 4, the IPOs are distributed by the ownership structure to venture capital-backed (VC), private equity-backed (PE), and non-backed (NB). It can be seen from the table that most companies did not have any financial backing at the time of the initial public offering. The number of venture capital-backed companies varies from zero to three companies per year, which reflects the weak status of venture capital financing in the Nordics.

Table 4. IPO volumes by ownership.

Year	VC	PE	NB	Total
2010	0	0	0	0
2011	1	2	6	9
2012	1	0	3	4
2013	2	2	6	10
2014	3	7	19	29
2015	1	12	27	40
2016	1	6	29	36
2017	2	5	44	51
2018	1	2	28	31
2019	0	1	20	21
2020	0	3	48	51
Total	**12**	**40**	**230**	**282**

IPOs are more common in industries like technology, industrials, and healthcare, where 60% of the IPOs were issued, as can be seen from Table 5 below. Investors tend to favour fast-growing and innovative industries, and consumer cyclicals and industrials were the most attractive industries for private equity investors, with 20 and 11 backed IPOs. Venture capital investors focus on technology and healthcare companies, as 75% of the venture capital investments are placed in these industries, according to the data.

Table 5. IPO distribution by industry.

Industry	VC	PE	NB	Total
Technology	5	2	65	72
Industrials	2	11	40	53
Healthcare	4	3	43	50
Consumer Cyclicals	0	20	23	43
Real Estate	0	0	16	16
Consumer Non-Cyclicals	1	3	11	15
Basic Materials	0	0	10	10
Financials	0	1	9	10
Utilities	0	0	6	6
Energy	0	0	5	5
Academic & Educational Services	0	0	1	1
Government Activity	0	0	1	1
Total	**12**	**40**	**230**	**282**

Table 6 presents the annual average underpricing of IPOs in the data sample. In this study, the market is considered hot when the underpricing is above the average underpricing of the sample, 9,42%, and the count of IPOs is above the average count of IPOs in the sample, 25,64. Therefore, the years 2014 and 2016 are considered hot periods. In 2011, the count of IPOs is below the average, but the underpricing is over twice the average, and therefore, 2011 is also considered a hot period in this study. Vice versa, the market is considered cold when the underpricing is below the average underpricing and the count of IPOs is below the average count. Following this method, 2013 and 2019 are cold periods. The rest of the sample is considered a neutral period with moderate underpricing.

Table 6. Average underpricing of IPOs distributed by year.

Year	Underpricing	IPO amount
2010	0,00 %	0
2011	20,49 %	9
2012	17,61 %	4
2013	-2,11 %	10
2014	41,30 %	29
2015	1,72 %	40
2016	16,37 %	36
2017	7,71 %	51
2018	0,19 %	31
2019	-0,46 %	21
2020	0,78 %	51
Average	**9,42 %**	**25,64**

Table 7 includes the summary statistics of the whole data sample divided by the ownership structure of VC, PE, and NB. The table includes seven variables: total assets, total debt, revenue, price to book, asset turnover, EBITDA, and leverage. The first variable shows a clear difference between the ownership groups, as PE-backed companies have significantly higher total assets with 453,85 than VC-backed with 78,73 or non-backed with 51,61. A similar trend can be detected in other variables: total debt, revenue, EBITDA, and leverage, which get notably the highest values for PE-backed companies. Asset turnover rate shows a similar trend, but the difference between PE-backed companies and the rest of the sample is not as dramatic. Price to Book value, on the contrary, is highest for non-backed companies with a value of 2,92, and VC-backed companies get a similar result with 2,75.

Table 7. Summary statistics of the IPOs.

Variable	Measure	VC (12)	PE (40)	NB (230)	All (282)	Unit
Total Assets	Median	78,73	453,85	51,61	71,83	M EUR
Total Debt	Median	1,81	120,64	3,05	6,41	M EUR
Revenue	Median	51,96	411,43	20,26	29,30	M EUR
Price to Book	Median	2,75	2,01	2,92	2,74	
Asset Turnover	Median	0,75	1,05	0,38	0,55	
EBITDA	Median	4,07	40,57	2,18	4,81	M EUR
Leverage	Median	3,36 %	24,43 %	9,63 %	13,28 %	%

5.2 Methodology

This study focuses on examining how the pre-IPO ownership structure impacts the company's underpricing at the time of the IPO and the performance after the listing. The underpricing is studied by comparing the first-day return to the IPO offer price. The underpricing, also known as the initial return of private equity, venture capital, and non-backed companies, is compared to answer the first hypothesis.

The long-term performance of IPOs is studied using the buy-and-hold abnormal returns (BHAR). Following previous studies by Levis (2011), Matanova et al. (2022), and Viviani et al. (2008), a multivariate regression model is applied to measure the returns. Levis (2011) and Matanova et al. (2022) use a Fama and French Three-Factor model to further analyze the performance. On the other hand, Viviani et al. (2008) use BHAR as a dependent variable in a multivariate regression analysis.

5.2.1 Underpricing

The underpricing of an IPO, also referred to as initial return in the previous studies, is calculated using equation 1 below. The standard formula for underpricing has been used in the previous literature by Elston and Yang (2010). In equation 1, P_c is the first-day closing price, and P_0 is the offer price. The offer price is the price at which the asset is sold, decided by the company. The initial return is the offer price subtracted from the first-day closing price, and the difference is divided by the offer price. The equation is presented below:

$$\text{Underpricing} = \frac{(P_c - P_o)}{P_o}, \quad (1)$$

where the underpricing is the offer price subtracted from the first-day closing price and divided by the offer price.

5.2.2 The long-run performance of the IPOs

The long-run performance of IPOs has been measured by a buy-and-hold abnormal return BHAR and cumulative abnormal return CAR in the previous studies. Matanova et al. (2022), Levis (2011), and Viviani et al. (2008) have used BHAR for three years, and Kirschbaum et al. (2023) CAR of one year to measure the IPO performance. In this study, BHAR is used to measure the returns and performance. The benchmark index OMX Nordic 120 is used to calculate the BHAR. The equation is formulated as below:

$$\text{BHAR} = \frac{1}{N}\sum_{i=1}^{N}\left[\left(\prod_{t=1}^{T}(1+r_{it})\right) - \left(\prod_{t=1}^{T}(1+r_{bt})\right)\right], \quad (2)$$

where the return of the index r_{bt} is subtracted from the return of an IPO r_{it}.

5.2.3 Variables

Dummy variables are used to differentiate the sample by ownership structure into three different categories. Firms with private equity backing are marked with a dummy variable PE equal to one if the company has private equity ownership. The dummy variable VC refers to venture capital ownership and equals one if the company has venture capital ownership. The PE and VC dummy variables equal zero if the company does not have private equity or venture capital ownership. These companies with a dummy variable equal to zero are considered non-backed. Another dummy variable separates the data into hot and cold markets based on market sentiment. Listings made during the hot period are marked with a dummy variable Hot equal to one. The dummy Cold refers to listings in the cold period and equals one if the IPO was listed in the cold period. The IPOs with a dummy equal to zero were listed in the neutral period. Average underpricing relative to average initial returns for a year determines the hot and cold periods.

The first-day return variable is the underpricing of the IPO, which is used as a variable in the multivariate regression because it can act as an indicator of the long-run performance. IPOs with high first-day returns tend to get lower returns in the long term, which causes them to revert to their fair value over time, leading to underperformance (Purnanandam & Swaminathan, 2004). The logarithm of total assets is used to measure the size of the company. This variable allows the comparison of small and big companies inside the sample, which is important because bigger companies have a stronger impact on the results than smaller companies.

Price to book describes the company value and whether it is a value or growth company. This study includes this variable following previous studies by Levis (2011) and Bergström et al. (2006) , who use the P/B value as a variable when studying IPO's long-term performance. Asset turnover tells about the company's efficiency and ability to generate

revenue with its assets, and it was used in a previous study Levis (2011) The asset turnover ratio is calculated by dividing revenue by assets.

Leverage is introduced to measure the company's financial risk by comparing the amount of total debt to the amount of capital. The leverage ratio is calculated by dividing total debt by the sum of total debt and capital. Levis (2011) presented that higher leverage is beneficial for shareholders as it equals the company's high ability to generate returns. However, Cao and Lerner (2008) made an opposite finding in their study, as their results show a negative relationship between leverage and IPO performance. The last variable of the regression model is earnings before interest, taxes, depreciation, and amortization, also known as EBITDA. EBITDA is used to measure the company's overall performance and profitability.

5.3 Regression models

The long-run performance of the IPO is measured using regression models. The multivariate regression model consists of several variables presented previously. The model is formulated by following the previous study by Levis (2011). In the regression models, the BHAR of 36 months is used as a dependent variable, and it is calculated by subtracting the returns of the benchmark index, OMX Nordic 120, from the abnormal returns of the IPOs. The dummy variables for ownership and market sentiment are used in every regression. Similarly, first-day return, log of total assets, and price-to-book value are included in all regression models.

The regression models can be seen below:

$$BHAR = \alpha + \beta_1 PE + \beta_2 \mathrm{VC} + \beta_3 Hot + \beta_4 Cold + \beta_5 First\ day\ return +$$

$$\beta_6 \log(total\ \ assets) + \beta_7 Price\ to\ Book + \varepsilon, \qquad (3)$$

In the second regression, asset turnover is added to consider the company's efficiency while other variables remain unchanged.

$$BHAR = \alpha + \beta_1 PE + \beta_2 \text{VC} + \beta_3 Hot + \beta_4 Cold + \beta_5 First\ day\ return + \beta_6 \log(total\ \ assets) + \beta_7 Price\ to\ Book + \beta_8 Asset\ turnover + \varepsilon, \quad (4)$$

In the third regression, leverage is added to consider the company's financial risk and dependency on debt while other variables remain unchanged.

$$BHAR = \alpha + \beta_1 PE + \beta_2 \text{VC} + \beta_3 Hot + \beta_4 Cold + \beta_5 First\ day\ return + \beta_6 \log(total\ \ assets) + \beta_7 Price\ to\ Book + \beta_8 Asset\ turnover + \beta_9 Leverage + \varepsilon, \quad (5)$$

In the fourth regression, EBITDA is added to consider company profitability while other variables remain unchanged.

$$BHAR = \alpha + \beta_1 PE + \beta_2 \text{VC} + \beta_3 Hot + \beta_4 Cold + \beta_5 First\ day\ return + \beta_6 \log(total\ \ assets) + \beta_7 Price\ to\ Book + \beta_8 Asset\ turnover + \beta_9 Leverage + \beta_{10} EBITDA + \varepsilon, \quad (6)$$

6 Results

This chapter presents the results of the empirical part of the study. First, the results of the IPO underpricing are presented for all groups with different ownership structures and all market periods based on the IPO volumes. Secondly, stock returns are presented for several holding periods using the BHAR method and F-test to further examine the difference in performance between the different ownership structure groups. Lastly, the results of the multivariate regression model for long-term performance are presented to answer all the hypotheses of this study.

6.1 Underpricing

Table 8 shows the results for underpricing categorized by backing type and market conditions. Underpricing is measured using equally- and value-weighted averages. In panel A, results for the entire period are presented. During the entire period, VC-backed IPOs exhibit the highest equally-weighted underpricing at 17,21%. VC-backed IPOs have statistically significant results at a 10% level, similar to non-backed IPOs at 8,87% underpricing. PE-backed IPOs have the lowest underpricing level at 6,79%, which indicates that PE-backed companies price the IPOs closer to market value than others. The value-weighted average for PE-backed IPOs is 12,09%, which is statistically significant at a 10% level and suggests that larger PE-backed companies have higher underpricing levels than smaller companies. The equally-weighted average underpricing of the whole sample is significant at the 5% level.

The results for the hot period are presented in panel B. Non-backed IPOs show the highest equally-weighted underpricing at 30,58%, followed by PE-backed IPOs at 18,41%. VC-backed IPOs show a moderate level of underpricing at 8,78%. The overall underpricing in the hot period is statistically significant at 10%. The value-weighted underpricing for PE-backed IPOs is 22,24%, for non-backed IPOs 4,83%, and for VC-backed IPOs 0,89%. The results indicate that PE- and non-backed IPOs are prone to

higher underpricing in hot periods. However, strong statistical significance is not shown between different ownership groups.

In panel C, the results for the cold period are presented. VC-backed IPOs exhibit the lowest equally-weighted underpricing at -6,73%, and PE-backed IPOs the highest at 0,41%. Value-weighted averages follow this trend as VC-backed IPOs show the lowest underpricing at -6,36%, followed by NB IPOs at -0,9% and PE-backed at 0,43%. The VC and PE-backed IPOs have statistically significant values at the 1% level, suggesting that these groups experience lower underpricing in cold periods than non-backed IPOs.

The results of underpricing indicate that market conditions and backing type affect the underpricing levels. PE-backed IPOs have the lowest equally-weighted average underpricing in the entire period. On the other hand, PE-backed IPOs have a high level of underpricing in hot markets similar to non-backed IPOs. According to the results, H1 can be confirmed as private equity-backed IPOs have lower equally-weighted underpricing than venture capital-backed IPOs in the entire period.

Table 8. IPO Underpricing.

Underpricing	**VC**	**PE**	**NB**	**ALL**
		Panel A. Entire Period		
Equal-weighted average	17,21 %*	6,79 %	8,87 %*	8,93 %**
	(1,65)	(1,01)	(1,87)	(2,23)
Value-weighted average	3,72 %	12,09 %*	2,12 %	4,78 %
	(0,36)	(1,79)	(0,45)	(1,19)
N	12	40	230	282
		Panel B. Hot Period		
Equal-weighted average	8,78 %	18,41 %	30,58 %	26,64 %*
	(1,36)	(1,03)	(1,59)	(1,84)
Value-weighted average	0,89 %	22,24 %	4,83 %	9,55 %
	(0,14)	(1,24)	(0,25)	(0,66)
N	5	15	54	74
		Panel C. Cold Period		
Equal-weighted average	-6,73 %***	0,41 %***	-0,72 %	-0,99 %*
	(-5,07)	(4,62)	(-1,37)	(-1,90)
Value-weighted average	-6,36 %***	0,43 %***	-0,90 %*	-0,57 %
	(-4,79)	(4,84)	(-1,72)	(-1,08)
N	2	3	26	31

The data sample consists of 282 Nordic IPOs between 2010 and 2020 in Denmark, Finland, Norway, and Sweden. Of the IPOs, 12 are venture capital-backed, 40 are private equity-backed, and 230 are non-backed. An asterisk refers to statistical significance. * at 10 % level, ** at 5 %, and *** at 1 %. T-statistics are reported in the parentheses.

6.2 Long-run performance

The results of the buy-and-hold abnormal returns for Nordic IPOs are presented in Table 9 for holding periods of 1, 12, 24, and 36 months. Two calculation methods are used for BHAR: equal-weighted average and value-weighted average, where inflation-adjusted market capitalization on the IPO date is used. The results show the long-term performance of IPOs based on the backing type: venture capital (VC), private equity (PE), and non-backed (NB). The BHAR results are biased to skewness, and to eliminate the bias, t-statistics have been calculated and are presented in parentheses.

The 1-month value-weighted returns are positive and statistically significant for all ownership structures, which indicates that IPOs outperform the benchmark index. However, equal-weighted averages do not show statistical significance, which indicates that large firms have a bigger effect on short-term returns. The 12-month holding period shows positive returns for value-weighted BHARs, especially for VC-backed IPOs at 4,4% and for PE-backed at 3,7%. These returns indicate that IPOs with financial backing from institutions continue to generate abnormal returns during the first 12 months after going public.

The trend changes for VC-backed IPOs as 24 months is reached. The value-weighted BHAR for VC-backed IPOs decreases from 4,4% at 12 months to 2,11% with 1% statistical significance. Similarly, equal-weighted averages begin to decrease for VC- and non-backed IPOs, and non-backed IPOs' equal-weighted returns turn negative at -0,18%. This indicates that non-backed IPOs underperform the market, unlike the financially backed IPOs. Value-weighted returns keep the positive trend for PE-backed and non-backed IPOs, and the returns stay statistically significant. At the 36-month holding period, the trend keeps on reversing. The value-weighted BHARs stay positive but receive lower returns on VC-backed IPOs at 0,89% and PE-backed IPOs at 3,56%, which indicates that larger IPOs with financial backing can keep generating returns, but smaller IPOs start to lose their initial gains. The equal-weighted BHARs receive negative returns with non-backed

IPOs at -0,2% and VC-backed IPOs at -0,18%, which indicates underperforming the benchmark index in the long term.

The value-weighted returns are substantially higher than equal-weighted and remain positive for single groups throughout all holding periods. The trend for value-weighted returns for the whole sample is negative, as returns decrease and turn negative over time. On the contrary, the value-weighted returns for non-backed IPOs show a positive trend as the returns increase over time, and the largest returns are reported in BHAR36. Similarly, the equal-weighted returns show a negative trend as the returns decrease and turn negative over time. Private equity-backed IPOs outperform all groups in all holding periods and with both methods, with the only exception being that in a 12-month holding period, VC-backed IPOs generated larger returns than PE-backed IPOs by a 0,71% difference. This finding is in line with previous studies by Matanova et al. (2022) and Levis (2011), who used the BHAR36 method in their studies.

Based on the results reported in Table 9, the H2 can be confirmed. The private equity-backed IPOs outperform venture capital-backed and non-backed IPOs in the 36-month period with an equal-weighted average of 1,15%, compared to VC-backed at -0,18% and non-backed at -0,20%. The value-weighted BHAR36 confirms the hypothesis, as PE-backed IPOs exhibit the largest returns. This finding is supported by previous academic literature by Matanova et al. (2022), Levis (2011), Kirschbaum et al. (2023), and Bergström et al. (2006).

According to the findings, the H3 that private equity-backed, venture capital-backed, and non-backed IPOs in the Nordics underperform the benchmark index in the long run can be confirmed to hold. Table 9 shows that the whole sample receives a negative result for equal-weighted average on BHAR36. Similarly, in Table 10, the t-test confirms that the results of BHAR36 are generally low. The findings are also supported by previous literature, which states that IPOs tend to underperform the benchmark in the long run.

Table 9. BHAR calculated with holding periods of 1-, 12-, 24-, and 36-months.

Window	Equal-weighted average %				Value-weighted average %			
	VC	**PE**	**NB**	**ALL**	**VC**	**PE**	**NB**	**ALL**
N	12	40	230	282	12	40	230	282
1M	0,42	0,86	0,18	0,29	2,06***	3,02***	0,94**	0,11
	(1,03)	(1,13)	(0,44)	(0,82)	(5,11)	(3,96)	(2,32)	(0,31)
12M	0,47	1,19	0,18	0,34	4,40***	3,70***	1,13***	-0,24
	(0,75)	(1,33)	(0,43)	(0,91)	(6,91)	(4,13)	(2,67)	(-0,66)
24M	0,03	1,46	-0,15	0,08	2,11***	4,84***	1,45***	-0,25
	(0,06)	(1,15)	(-1,62)	(0,42)	(5,11)	(3,81)	(15,24)	(-1,28)
36M	-0,18	1,15	-0,20*	-0,01	0,89***	3,56***	2,20***	-0,16
	(-0,57)	(1,23)	(-1,65)	(-0,06)	(2,79)	(3,83)	(17,92)	(-0,96)

The data sample consists of 282 Nordic IPOs between 2010 and 2020 in Denmark, Finland, Norway, and Sweden. Of the IPOs, 12 are venture capital-backed, 40 are private equity-backed, and 230 are non-backed. The benchmark index OMX Nordic 120 is used to calculate the BHARs. An asterisk refers to statistical significance. * at 10 % level, ** at 5 %, and *** at 1 %. T-statistics are reported in the parentheses.

Table 10 supports the findings through an F-test where long-term BHARs for a 36-month holding period are compared. The results of the F-test show statistically significant differences between VC- and PE-backed IPOs and non- and PE-backed IPOs. This finding indicates that PE-backed firms generate higher post-IPO returns in the long term. In Table 11, the PE variable shows a positive coefficient, which further supports the second hypothesis.

Table 10. F-test to compare the long-term returns of BHAR36.

	VC	PE	VC	NB	NB	PE
Mean	-0,18 %	1,15 %	-0,18 %	-0,20 %	-0,20 %	1,15 %
Listings	12	40	12	230	230	40
F	5,31***		0,25		3,72***	
p-value	0,00		0,62		0,00	

An asterisk refers to statistical significance. * at 10 % level, ** at 5 %, and *** at 1 %.

6.3 Multivariate regression model

The multivariate regression model is used to analyze the results of BHAR36 and follows the previous study by Levis (2011). The results are presented in Table 11 below, and four regression models are used. All regression models include dummy variables for ownership, PE and VC, and market sentiment, Hot and Cold. Other variables included in the first regression are the first-day return, the logarithmic value of total assets, and the price-to-book ratio, which is used to analyze the company's financial efficiency. In the second regression, the asset turnover variable is included, and in the third regression, the leverage ratio is included. In the fourth regression, the EBITDA variable is included.

The PE dummy variable has a statistically significant coefficient at a 10% or 5% level to the dependent variable of BHAR36 across all models. The coefficient ranges between 0,921 and 0,985, which indicates the robustness of the finding. Therefore, the results suggest that PE-backed IPOs have higher long-term returns than non-PE-backed IPOs. On the contrary, the VC dummy variable does not show statistical significance in any regression model. The coefficients are negative, and t-statistics are close to zero, indicating that VC-backed IPOs do not outperform or underperform the non-backed IPOs, and VC backing does not have a significant impact on the returns.

The first-day return and the logarithmic value of total assets have positive and statistically significant coefficients at a 1% level in all regressions. The coefficient of the first-day return is stable and ranges between 1,129 and 1,143 across the models. The

results suggest that high underpricing at the time of the IPO is related to higher long-run returns. The coefficient of the logarithmic value of total assets ranges from 0,525 to 0,699, indicating that larger firms have higher long-term returns.

The Hot and Cold dummy variables do not show statistical significance, indicating that the long-term performance is not necessarily affected by the market conditions. The coefficient for hot periods receives positive values, indicating slightly higher BHARs, and the coefficient for cold periods receives negative values, indicating lower BHARs. However, these findings are not considered to be significant.

A negative coefficient to the dependent variable is found in the leverage variable. A negative relationship between leverage and long-term performance was also found in the study by Cao and Lerner (2008). However, Levis (2011) received the opposite results in his study regarding the leverage variable. Therefore, there are no coherent findings regarding the effects of leverage on BHAR returns. The leverage variable is statistically insignificant and therefore cannot be used to explain the long-run performance. Similarly, Price to Book has a positive coefficient to the dependent variable but is missing statistical significance and therefore may not have a strong effect on the long-term IPO performance. Asset Turnover and EBITDA have coefficients of 0,000 with low t-statistics and therefore these variables cannot be used to explain the long-run performance.

The R-squared values range from 0,133 to 0,139, which suggests that while these variables explain the results of BHAR, there may be other factors that impact the results. The results show that PE-backing, first-day return, and firm size are significant predictors and contribute to higher long-term returns. In conclusion, the results of the regression models support the second hypothesis, that PE-backed IPOs outperform the rest of the groups.

Table 11. Multivariate regression model on BHAR36.

Variable	Regression 1	Regression 2	Regression 3	Regression 4
Intercept	-2,133***	-2,907***	-3,486***	-3,485***
	(-2,912)	(-2,870)	(-3,181)	(-3,175)
PE	0,921*	0,921*	0,984**	0,985**
	(1,900)	(1,898)	(2,022)	(2,019)
VC	-0,201	-0,200	-0,275	-0,212
	(-0,254)	(-0,253)	(-0,347)	(-0,258)
Hot	0,404	0,405	0,444	0,457
	(1,069)	(1,069)	(1,172)	(1,195)
Cold	-0,382	-0,383	-0,319	-0,322
	(-0,733)	(-0,733)	(-0,610)	(-0,614)
First-Day Return	1,130***	1,129***	1,143***	1,139***
	(4,720)	(4,706)	(4,767)	(4,737)
Log Total Assets	0,526***	0,525***	0,699***	0,699***
	(2,601)	(2,565)	(2,906)	(2,903)
Price to Book	0,011	0,110	0,014	0,013
	(0,621)	(0,621)	(0,769)	(0,748)
Asset Turnover		0,000	0,000	0,000
		(-0,047)	(0,004)	(0,095)
Leverage			-2,148	-2,128
			(-1,371)	(-1,356)
EBITDA				0,000
				(-0,290)
R2	0,133	0,133	0,139	0,139
Observations	282	282	282	282

The data sample consists of 282 Nordic IPOs between 2010 and 2020 in Denmark, Finland, Norway, and Sweden. 12 of the IPOs are venture capital-backed, 40 are private equity-backed, and 230 are non-backed. The dependent variable is BHAR36, calculated using the benchmark index OMX Nordic 120. An asterisk refers to statistical significance. * at 10 % level, ** at 5 %, and *** at 1 %. T-statistics are reported in the parentheses.

7 Conclusions

Newly issued firms have been widely studied in the past literature, and it is well-known that these issues tend to be underpriced at the time of the listing compared to their actual value. Another well-studied topic is the long-term performance of IPOs, which are proven to underperform in the after-market. Several studies have noted the impact the pre-IPO ownership structure of the company has, and multiple studies have been carried out using data on different markets and continents. As venture capital financing has emerged in the Nordics only in the past few years, the amount of research and literature is limited. Therefore, this study includes the venture capital-backed issues in the study, regardless of the small number of issues in the final data.

This study aims to examine the influence of pre-IPO ownership structure on IPO underpricing and long-term stock performance when companies enter the public markets via initial public offering in the Nordic markets. In the final sample, 282 Nordic IPOs are included, where 12 IPOs are identified as VC-backed, 40 as PE-backed, and the rest of the sample, 230, as non-backed. Another factor included in the study is the effect of market conditions, which is considered in the regressions. The countries included in the study are Denmark, Finland, Norway, and Sweden, and the IPOs included are listings from the countries' main stock exchanges.

The findings of this study confirm that Nordic IPOs experience underpricing, which is affected by the pre-IPO ownership structure. Private equity-backed IPOs experience lower underpricing than venture capital-backed IPOs at the time of the IPO, which is aligned with the previous research where more mature PE-backed firms are less underpriced due to a low level of asymmetric information, which allows them to price the issues more accurately. VC-backed firms tend to be in the earlier stages, where information asymmetry is higher and can lead to higher underpricing.

The results regarding the long-term performance suggest that IPOs underperform the benchmark index over 36 months. Private equity-backed IPOs show better performance

than VC-backed and non-backed IPOs, confirming the hypothesis that PE-backed IPOs outperform their peers in the long run in the Nordic market. The results are in line with the previous studies. The multivariate regression model shows that PE-backing, first-day return, and firm size have a significant influence on the performance. The regression model also supports the hypothesis that IPOs tend to underperform the benchmark index in the long run, following the findings of previous studies in the UK and US markets.

This study extends the previous research on IPO underpricing and performance by including VC-backed issues in the Nordic market context and thus offers valuable insights, especially in the field of venture capital financing. The results of the study provide valuable information for investors, as the IPO investment should be assessed beyond the initial underpricing period, as the long-term returns might differ from the expectations made based on the underpricing. For other financial intermediaries, the results highlight the importance of pricing mechanisms and post-IPO strategies to generate long-term returns.

The findings of this paper should be interpreted with caution for several reasons. Firstly, the data used in this paper has been retrieved from the LSEG database, and companies with missing data or unavailable data in LSEG Datastream were excluded. Therefore, the final dataset is limited, and especially the sample of VC-backed companies is small, and results are dominated by a few companies and may not give an accurate representation of the entire Nordic market. Secondly, the results are dependent on the method used, and this paper uses the BHAR to measure the long-run performance. Studies by Bergström et al. (2006) and Kirschbaum et al. (2023) use another measure, CAR, for long-run performance, and this study could be extended by including another measure. Future research could expand the study by extending the timeline over different economic conditions, e.g., to include the time during and after the COVID-19 pandemic and the Russian invasion of Ukraine, to explore the effects. This would also extend the number of IPOs in the dataset and allow for a better representation of the whole Nordic market.

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Appendices

Appendix 1. Data sample of IPOs in 2010–2020.

Issue Date	Issuer
25.3.2011	Norway Royal Salmon ASA
5.4.2011	Sevan Drilling ASA
13.4.2011	Karolinska Development AB
18.5.2011	Moberg Derma AB
20.5.2011	FinnvedenBulten AB
27.5.2011	Transmode Holding AB
16.6.2011	Boule Diagnostics AB
24.6.2011	Hoegh LNG Holdings Ltd
30.11.2011	Hofseth Biocare ASA
11.6.2012	Selvaag Bolig ASA
9.10.2012	Siili Solutions Oyj
18.10.2012	Borregaard ASA
5.11.2012	Veloxis Pharmaceuticals A/S
18.3.2013	Asetek A/S
19.3.2013	EAM Solar ASA
25.3.2013	Serodus ASA
27.6.2013	Ocean Yield AS
28.6.2013	Matas A/S.
4.10.2013	Orava Asuinkiinteistorahasto Oyj
21.10.2013	Western Bulk ASA
21.11.2013	Restamax Oyj
4.12.2013	Napatech A/S
9.12.2013	Sanitec Oy
20.2.2014	Bufab AB
12.3.2014	ISS A/S
19.3.2014	Hemfosa Fastigheter AB
2.4.2014	Recipharm AB
4.4.2014	Verkkokauppa.com Oyj
7.4.2014	Scanship Holding ASA
8.4.2014	D Carnegie & Co AB
30.5.2014	Herantis Pharma Oyj
11.6.2014	Besqab AB
11.6.2014	cXense AS
16.6.2014	Com Hem Holding AB
18.6.2014	Bactiguard Holding AB

18.6.2014	Zalaris ASA
24.6.2014	Havyard Group AS
26.6.2014	Scandi Standard AB
2.7.2014	Serendex Pharmaceuticals A/S
25.9.2014	Inwido AB
26.9.2014	Absolent Group AB
1.10.2014	Scatec Solar ASA
3.10.2014	XXL ASA
9.10.2014	Granges AB
16.10.2014	Entra ASA
3.11.2014	Nexstim Oyj
11.11.2014	United Bankers Oy
20.11.2014	Lifco AB
25.11.2014	Thule Group AB
2.12.2014	NP3 Fastigheter AB
4.12.2014	Nixu Oyj
12.12.2014	RenoNorden AS
5.2.2015	Eltel AB
10.2.2015	The Lexington Co AB
12.2.2015	Dustin Group AB
5.3.2015	NNIT A/S
11.3.2015	Savo-Solar Oy
13.3.2015	Detection Technology Oy
19.3.2015	Evolution Gaming Group AB
24.3.2015	Hoist Finance AB
26.3.2015	Asiakastieto Group OYJ
26.3.2015	Troax Group AB
22.4.2015	Tobii AB
20.5.2015	Robit Oyj
21.5.2015	Multiconsult AS
2.6.2015	Inission AB
4.6.2015	Magnolia Bostad AB
4.6.2015	Pihlajalinna Oy
9.6.2015	Collector AB
9.6.2015	Hovding Sverige AB
16.6.2015	Alimak Group AB
16.6.2015	Coor Service Management Holding AB
16.6.2015	Hugo Games A/S
16.6.2015	Nordax Group AB
17.6.2015	Nobina AB
18.6.2015	Pandox AB

19.6.2015	Europris ASA
26.6.2015	A Group Of Retail Assets Sweden AB
1.7.2015	Kotipizza Group Oyj
7.10.2015	CLX Communications AB
15.10.2015	Bravida Holding AB
29.10.2015	Kid ASA
30.10.2015	Skandiabanken ASA
13.11.2015	Maxkompetens Sverige AB
20.11.2015	A City Media AB
23.11.2015	Dometic Group AB
27.11.2015	Attendo AB
1.12.2015	Nilsson Special Vehicles AB
1.12.2015	Scandic Hotels Group AB
2.12.2015	Camurus AB
4.12.2015	Nuevolution AB
10.12.2015	Consti Yhtiot Oy
10.2.2016	Scandinavian Tobacco Group A/S
15.3.2016	Garo AB
16.3.2016	LeoVegas AB
18.3.2016	Suomen Hoivatilat Oyj
21.3.2016	Humana AB
25.4.2016	Lehto Group Oyj
25.4.2016	Nepa AB
28.4.2016	Resurs Holding AB
29.4.2016	Tokmanni Group Oyj
11.5.2016	Wilson Therapeutics AB
24.5.2016	Paradox Interactive AB
1.6.2016	GomSpace Group AB
7.6.2016	B2Holding ASA
9.6.2016	DONG Energy A/S
9.6.2016	Nordic Waterproofing Holding A/S
10.6.2016	B3IT Management AB
21.6.2016	Lauritz.com Group A/S
22.6.2016	ExpreS2ion Biotech Holding AB
23.9.2016	Nets A/S
27.9.2016	InDex Pharmaceuticals Holding AB
28.9.2016	Internationella Engelska Skolan i Sverige Holdings II AB
24.10.2016	Cellink AB
28.10.2016	Ahlsell AB
28.10.2016	Tobin Properties AB
4.11.2016	Heeros Oyj

18.11.2016	THQ Nordic AB
22.11.2016	Alligator Bioscience AB
22.11.2016	SERNEKE Group AB
29.11.2016	Arcus ASA
29.11.2016	DNA Oyj
29.11.2016	Smart Eye AB
30.11.2016	Bygg Partner i Dalarna Holding AB
7.12.2016	Acarix AB
7.12.2016	SeaTwirl AB
8.12.2016	Edgeware AB
28.12.2016	Unified Messaging Systems ASA
10.2.2017	IRLAB Therapeutics AB
22.2.2017	Oncopeptides AB
22.3.2017	Next Games Oy
23.3.2017	MIPS AB
24.3.2017	Fondia Oy
31.3.2017	Ambea AB
3.4.2017	Isofol Medical AB
6.4.2017	Actic Group AB
6.4.2017	BerGenBio ASA
6.4.2017	SSM Holding AB
7.4.2017	FM Mattsson Mora Group AB
25.4.2017	Bambuser AB
9.5.2017	Integrum AB
11.5.2017	Instalco Intressenter AB
11.5.2017	Kamux Oyj
18.5.2017	TerraNet Holding AB
19.5.2017	Munters Group AB
24.5.2017	Saferoad Holding ASA
26.5.2017	Nitro Games Oyj
30.5.2017	TC Connect AB
31.5.2017	Boozt AB
8.6.2017	Silmaasema Oyj
12.6.2017	SpareBank 1 Ostlandet
15.6.2017	Green Mobility A/S
19.6.2017	Sedana Medical AB
20.6.2017	Bonesupport Holding AB
20.6.2017	Fastighets AB Trianon
21.6.2017	Conferize A/S
14.7.2017	Seamless Distribution Systems AB
24.9.2017	Sparebank 1 Nordvest

27.9.2017	Infront ASA
28.9.2017	Rovio Entertainment Oy
5.10.2017	Balco Group AB
9.10.2017	Handicare Group AB
10.10.2017	Terveystalo Oy
11.10.2017	Climeon AB (publ)
11.10.2017	Global Gaming 555 AB
12.10.2017	BioArctic AB
20.10.2017	Indentive AB
25.10.2017	Self Storage Group ASA
27.10.2017	2cureX AB
6.11.2017	Crayon Group Holding ASA
21.11.2017	IRRAS AB
23.11.2017	TCM Group A/S
24.11.2017	Acconeer AB
30.11.2017	DevPort AB
5.12.2017	Tempest Security AB
7.12.2017	Efecte Oyj
8.12.2017	Hitech & Development Wireless Sweden Holding AB
8.12.2017	Mag Interactive AB
11.12.2017	Lyko Group AB
1.2.2018	Admicom Oyj
18.2.2018	BBS Bioactive Bone Substitutes Oy
5.3.2018	Zutec Holding Ab
20.3.2018	Fjordkraft Holding ASA
21.3.2018	Harvia Oyj
22.3.2018	Altia Oyj
22.3.2018	Elkem ASA
22.3.2018	Green Landscaping Holding AB
27.3.2018	Bygghemma Group First AB
29.3.2018	Fluicell AB
16.4.2018	Enersense International Oy
23.4.2018	Happy Helper A/S
17.5.2018	Ovzon AB
5.6.2018	NCAB Group AB
7.6.2018	NetCo Group A/S
14.6.2018	Kojamo Oyj
18.6.2018	VMP Oyj
19.6.2018	Projektengagemang Sweden AB
20.6.2018	ViroGates A/S
25.6.2018	Odico A/S

27.6.2018	Nordic Iron Ore AB
28.6.2018	Calliditas Therapeutics AB
27.9.2018	poLight AS
4.10.2018	Fellow Finance Oyj
12.11.2018	AROS Bostadsutveckling AB
21.11.2018	Scape Technologies A/S
29.11.2018	Oma Saastopankki Oy
4.12.2018	Jetpak Top Holding AB
5.12.2018	Azelio AB
6.12.2018	Lime Technologies AB
6.12.2018	Q-Linea AB
21.1.2019	Zwipe AS
28.2.2019	Ferroamp Elektronik AB
5.3.2019	Ascelia Pharma AB
11.4.2019	Karnov Group AB
6.5.2019	Konsolidator A/S
22.5.2019	Danish Aerospace Company A/S
29.5.2019	Ultimovacs ASA
5.6.2019	John Mattson Fastighetsforetagen AB
14.6.2019	Mentice AB
14.6.2019	OKEA ASA
18.6.2019	Norbit ASA
15.10.2019	Relais Group Oy
16.10.2019	Norske Skog ASA
23.10.2019	SATS ASA
19.11.2019	Fodelia Oyj
28.11.2019	K-Fast Holding AB
29.11.2019	Astralis Group A/S
4.12.2019	Optomed Oyj
9.12.2019	24Storage AB
10.12.2019	Kollect On Demand Holding AB
12.12.2019	Qleanair Holding AB
30.1.2020	Hudya AB
12.2.2020	Musti Group Oyj
12.2.2020	Train Alliance Sweden AB
12.5.2020	Pexip Holding AS
25.5.2020	Penneo A/S
28.5.2020	Ice Fish Farm AS
3.6.2020	Nanoform Finland Oyj
9.6.2020	LED iBond International A/S
18.6.2020	Shape Robotics ApS

19.6.2020	Fom Technologies A/S
24.6.2020	Aker Biomarine AS
26.8.2020	BEWi ASA
28.8.2020	Mdundo.com A/S
4.9.2020	Salmon Evolution Holding AS
8.9.2020	Exsitec Holding AB
11.9.2020	Audientes A/S
16.9.2020	LifeClean International AB
16.9.2020	Readly International AB
21.9.2020	GPX Medical AB
25.9.2020	Mintra Holding AS
28.9.2020	Play Magnus AS
30.9.2020	HydrogenPro AS
30.9.2020	Teco 2030 ASA
30.9.2020	Zaptec AS
5.10.2020	Norcod AS
6.10.2020	House of Control Group AS
7.10.2020	Volue AS
12.10.2020	Wastbygg Gruppen AB
16.10.2020	Ocean Sun AS
19.10.2020	PatientSky Group AS
19.10.2020	WindowMaster International A/S
21.10.2020	Everfuel A/S
21.10.2020	LINK Mobility Group Holding ASA
21.10.2020	Nordic Paper Holding AB
22.10.2020	Offentliga Hus i Norden AB
23.10.2020	Airthings AS
29.10.2020	Alefarm Brewing A/S
5.11.2020	Dataproces Group A/S
6.11.2020	Luxbright AB
11.11.2020	Stenhus Fastigheter i Norden AB
18.11.2020	HusCompagniet A/S
24.11.2020	Nordnet AB
25.11.2020	Renewcell AB
26.11.2020	Cadeler A/S
3.12.2020	Hexagon Purus AS
4.12.2020	Thunderful Group AB
8.12.2020	Fasadgruppen Group AB
9.12.2020	DecideAct A/S
11.12.2020	Cyviz AS
14.12.2020	Elektroimportoren AS

14.12.2020 Scandinavian Biogas Fuels International AB