INTRODUCING AN ALTERNATIVE IPO PEER MULTIPLE VALUATION RESEARCH METHOD

Analysis utilising equity analyst coverage in Nasdaq Nordic 2010-2021

ABSTRACT

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INTRODUCING AN ALTERNATIVE IPO PEER MULTIPLE VALUATION RESEARCH METHOD

Analysis utilizing equity analyst coverage in Nasdaq Nordic 2010-2021

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The thesis examines the relationship between the initial relative valuation level and the after-market performance of Nordic IPOs in 2010-2021. The after-market performance is measured with BHARs on short and long run. The purpose of the thesis is to compare the comparable company method and equity research approach in determining the peer companies. Equity research approach utilises relative valuations conducted by analysts, in the company reports, as an alternative method offered to contribute to the discussion of the peer determination research methods.

The study sample consists of 200 IPOs undertaken in Nasdaq Nordic markets in 2010-2021. The data including the prices, financials, and listing information is collected from Refinitiv Eikon supplemented by the listing prospectuses and Bureau van Dijk Orbis. Peer groups for equity research method are obtained from company reports published by service providers. In comparable company method, peers are matched based on industry, size, and profitability. Valuation levels are compared by using sales and EBITDA-based multiples relative to enterprise value. OLS regressions are used to determine factors affecting the initial relative valuation level and the after-market performance in different timeframes.

Nordic IPOs are found to be overvalued relative to their peers, but the magnitude of the overvaluation being conditional to the peer selection approach. The overvaluation ranges from 62% to 73% with comparable company method depending on the multiple used, while the corresponding figures are 11% and 16% for the equity research approach. The empirical evidence shows no statistically significant relationship between the initial relative valuation level and the after-market performance in any of the studied timeframes with comparable company method whereas equity research approach identifies IPOs with P/V ratio approaching 1 to significantly outperform others on longer timeframes. Smaller companies with lower profitability and stronger growth are identified to be valued higher at the offer price. High-tech companies with strong growth are found to perform better on the short run while smaller size and higher profitability promote the long-run performance.

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VAIHTOEHTOINEN TUTKIMUSMENETELMÄ LISTAUTUMISANTIEN KERROINVALUAATION TUTKIMUKSEEN

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Tutkimuksessa tarkastellaan pohjoismaisten listautumisantien suhteellista arvostustasoa verrattuna verrokkiyrityksiin, sekä suhteellisen arvostustason yhteyttä yhtiön markkina-arvon kehitykseen lyhyellä ja pitkällä aikavälillä. Markkina-arvon kehitystä mitataan BHAR-tuotoilla. Tutkimuksen tarkoituksena on verrata tunnettua yrityksen toimialaan, kokoon ja kannattavuuteen pohjautuvaa verrokkiyhtiön määrittämiseen käytettyä algoritmia osakeanalyyseissä analyytikkojen valitsemiin verrokkiyhtiöihin. Tavoitteena on tarjota vaihtoehtoinen lähestymistapa verrokkiyhtiöiden määrittämiseen käytetyille menetelmille.

Tutkimusotos koostuu 200 listautumisannista Pohjoismaiden Nasdaq-markkinapaikoilla aikavälillä 2010–2021. Jälkimarkkinahinnat, taloudelliset tiedot, sekä listautumisantien tiedot ovat kerätty Refinitiv Eikon ja Bureau van Dijk Orbis -tietokannoista, sekä listalleottoesitteistä. Analyytikkojen määrittämät verrokkiryhmät ovat kerätty julkaistuista yritysraporteista. Suhteellinen arvostustaso on laskettu liikevaihtoon ja käyttökatteeseen perustuvilla kertoimilla suhteessa yritysarvoon. OLS-regressioita käytetään arvostustasoon ja eri aikavälien markkina-arvon kehitykseen vaikuttavien tekijöiden määrityksessä.

Pohjoismaiset listautumisannit ovat yliarvostettuja verrattuna verrokkiyhtiöihin, mutta yliarvostuksen suuruus riippuu verrokkiyhtiöiden määrittämiseen käytetystä menetelmästä. Yliarvostus vaihtelee 62% ja 73% välillä algoritmilla määritetyillä verrokkiyhtiöillä laskettuna käytetystä kertoimesta riippuen, kun taas osakeanalyysien pohjalta määritetyillä verrokkijoukoilla välillä 11% ja 16%. Tulokset osoittavat, että suhteellisella arvostustasolla ei ole vaikutusta markkina-arvon kehitykseen tutkituilla aikaväleillä, jos algoritmipohjaisia verrokkeja käytetään. Osakeanalyysipohjaiset verrokit osoittavat yhtiöiden suoriutuvan paremmin pidemmällä aikavälillä, jos niiden suhteellinen arvostustaso vastaa verrokkeja. Pieni koko, voimakas kasvu, sekä heikompi kannattavuus vaikuttavat positiivisesti yliarvostukseen. Voimakkaasti kasvavat teknologiayritykset menestyvät paremmin lyhyellä aikavälillä, kun taas pienempi koko ja korkeampi kannattavuus edistävät pitkän aikavälin menestystä pörssissä.

LIST OF ABBREVIATIONS

BHAR	Buy-and-hold abnormal return
DCF	Discounted cash flow
DDM	Dividend discount model
EBIT	Earnings before interests and taxes
EBITDA	Earnings before interests, taxes, depreciation, and amortization
ESG	Environmental, social, and governance
EV	Enterprise value
EV/EBITDA	Enterprise value-to-EBITDA ratio
EV/Sales	Enterprise value-to-Sales ratio
IPO	Initial public offering
OLS	Ordinary least squares
P/E	Price-to-earnings ratio
P/V	Price-to-value ratio
RIV	Residual income valuation
SEO	Seasoned equity offering
SIC	Standard industry classification
SPAC	Special purpose acquisition company

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1 Introduction

"The world of value is the real world", Mercer and Harms (2007) said while introducing the concept of the world of value. This world is shaped by the investment decisions, supported by valuations and other analyses, of companies, individuals, and institutional and governmental entities when seeking debt and equity financing from capital markets (Mercer & Harms 2007). The value determination of an investment forms the basis of economic analysis, and the significance of reliable valuation cannot be exaggerated as it will set the foundation for the costs of the investments, defining whether the value of the shareholders is created or destroyed (Katramo, Lauriala, Matinlauri, Niemelä, Svennas & Wilkman 2013).

> "No activity in the investment profession is practiced by more participants with more fervor than equity analysis and valuation. The techniques and methods for valuing equity instruments - from earnings to cash flows, from simple multiples to incredibly complex models, from the dividend discount model to the capital asset pricing model and beyond - have an equally rich past and have become part of the everyday investment landscape." (Squires 1997)

Initial public offerings (IPO) have begun to receive increasing attention from researchers that is unlike to diminish as the recent developments have brought unprecedented events to the fore. As investors have easier access to corporate information than 50 years ago, when IPO regulation was designed, the risks associated with direct listings should lessen (Skates 2022). Yet, the recent hot equity capital markets have been depicted by several companies listed, through an IPO or a SPAC merger, coming under investigation by federal agencies about potentially misleading investors (Potter 2022). Furthermore, the traditional established nature of a listing company has underwent a radical transformation during the recent wave of listings, as several companies have reached soaring valuations even without a cash flow or reporting hundreds of millions of losses, for example Nikola, Rivian, Robinhood, and Palantir (Mackintosh 2022; Levy 2021). Consequently, questioning the valuation fundamentals in the capital markets with prodigiously optimistic future expectations. This thesis sets the emphasis on the fundamentals by examining the IPO valuation with focus on multiples method and its relation to the after-market performance of companies in four Nordic markets.

1.1 Background and motivation

Within the last five years IPOs have increased tremendously, as in 2021 nearly 2,700 listings were underwritten globally with a total deal value exceeding 600 billion dollars, growing over 330% (PwC 2022). The public equity capital markets are crucial for funding company investments and growth, while at the same time facilitating efficient capital allocation and exit options for entrepreneurs and supporting the financial systems by connecting both retail and institutional investors and the companies (de Jong & Legierse 2022). The IPO markets are also characterised by high cyclicity, as the listings cluster in time (Lowry 2003).

Several anomalous events have been universally perceived to be connected to IPOs, of which the underpricing, or initial returns, and the long-run underperformance are the most infamous ones (Ritter & Welch 2002). Academic literature has not reached consensus regarding these recurring phenomena although IPOs have been a popular research topic for several decades (Ljungqvist, Nanda & Singh 2006). Reflecting the efficient market hypothesis, these instances seem conflicting, and the variety of the explanatory theories offered only further increase the attraction of the puzzling embodiments of information asymmetry in IPOs.

The long-run underperformance has been recorded already in the early 1990s (Ritter 1991). Yet, the reasons behind the underperformance are still under debate as for example Brav and Gombers (2000) argue small companies with high book-to-market ratios to be the cause, whereas Daniel and Titman (1999) conclude the investor overconfidence being the reason for the declining long-run performance of IPOs.

Knüpfer and Puttonen (2018) portray the valuation itself being a process incorporating a substantial amount of subjectivity, while McCarthy (2017) notes the situation-specificity with simplifications and assumptions making IPO valuation partly art whilst the foundations are in the economic theory. However, Yee (2004) states that any valuation approach leads to imprecise answer, while Kaplan and Ruback (1996) conclude that analysts are forced to use multiple models in valuation. The pricing has been studied from the aspect of underpricing that has also been recorded to vary over time and differ between markets (Ritter & Welch 2002). Recent research has also started to shift more towards the valuation of IPOs, especially with relative valuation methods. However, with some practical contradictions, as for example Purnanandam and Swaminathan (2004) separate the pricing and valuing of an IPO company, that has led into increased research and debate over the methods and theory.

1.2 Contribution to existing literature

The study contributes to the existing literature by being one of the very first, if not the first, academic research paper utilising equity research reports instead of comparable company algorithms in selecting peers for relative valuation in IPOs. The equity research peers are obtained from the analyst reports including a relative valuation conducted on an appropriate company. Prior research has focused on larger markets such as The United Kingdom, The United States, or Continental Europe. However, Nordic capital markets are depicted by an outstanding ability to raise risk capital, funds through equity capital and high yield bonds, and financing for small and medium-sized enterprises, differing significantly from other European markets relative to the size of the market (NSA 2022). Thus, the conclusions of previous studies may not be generalisable for Nordic markets.

More recent studies have adopted the theory of Purnanandam and Swaminathan (2004) that has separated the valuation and pricing of IPOs enabling simultaneous relative overvaluation and underpricing. Such a practical contradiction is enabled by the susceptibility of multiples to incorrect implementation and even manipulation (Henschke & Homburg 2009). The greatest subjectivity lies in the selection of the peer companies, that has also gained substantial debate among the scholars in the field as academic research faces significant processual limitations compared to practice (Meitner 2006). This thesis sheds light on two different peer matching methods, the previously used comparable company method and a more novel one based on equity research reports written by analysts, with the aim of proving the pragmatic differences of the methods and producing more robust results for practice.

1.3 Research objectives and questions

This thesis focuses on the IPO relative valuation, different methods applied in peer company selection, and the connections to the market performance of IPO companies. The study can be divided into three main categories. First, the relative valuation levels compared between Nordic IPOs and their peers are analysed. Second, the effect of comparative valuation level of Nordic IPOs on the after-market performance is tested. Third, the differences between relative valuation levels of IPOs and peer companies defined with two different methods, comparable company method and equity research method, are examined.

IPO relative valuation has gained an increasing attention of scholars in the field during 2000s. Studies have been conducted from a variety of different angles and geographies. However, Nordics as the geography of interest in research stands out from others by its absence. This is the motivation for the first research question:

I. *"What is the relationship between the valuation levels of Nordic IPOs and their peer companies?"*

IPOs have been studied for decades, and several recurring and generally acknowledged phenomena, the underpricing and long-run underperformance of IPOs, have been highlighted as repetitive study topics. The implications of relative valuation levels of IPOs on the company after-market performance, including the underpricing measured with the return on the first trading day, have been an integral part of the studies in the field. Hence, the second research question is defined as follows:

II. *"What effect does the relative valuation level have on Nordic IPOs after-market performance?"*

While the asset valuation as a broader topic has been characterized by subjectivity, the research of IPO relative valuation has also generated controversy regarding the methods used to select the peer companies used in the determination of the valuation multiples. As the study proposes a novel peer selection method, with the aim of stabilizing the effects of subjectivity, comparing it to an already established method, the last research question is:

III. *"How does the valuation level and after-market performance vary between comparative company method and equity research method applied in determining the peer valuation multiples?"*

1.4 Structure of the thesis

The thesis is organised in the following way. In Section 2, the relevant literature is discussed and reviewed to form a basis for the formulation of hypotheses that is presented in Section 3. The data and methodology used in the study are described in Section 4. The empirical results of the study are presented and discussed in Section 5 ending to a review of the limitations of the study. Lastly, Section 6 concludes the thesis with presenting suggestions for further research.

2 Literature review

This section discusses literature related to the study. The key concepts are introduced starting from IPO valuation, followed by underpricing and long-run underperformance as phenomena. Finally, equity research is reviewed from the theoretical point of view of the study.

2.1 IPO valuation

This chapter starts with the introduction of IPO valuation focusing on the relative valuation methods. After this, relevant papers focusing on IPO overvaluation, a recurring observation in the studies, are presented.

2.1.1 Relative valuation

Relative, comparable, or multiple valuation refers to company value determination with the multiplication of a value driver and corresponding valuation multiple (Lessambo 2022). Commonly used value drivers include financial items such as sales, EBITDA, EBIT, and net income (Ross 2003). Valuation multiples are derived from selected peer companies whose value can be appropriately determined e.g. from M&A deal values or, especially in the case of IPOs, from the quotes of publicly traded companies (Meitner 2006). In relative valuation, bankers select the peer group based on the size and future growth prospects, riskiness, product offering scope, customer base, geographic reach, as well as current and future profitability of the comparable companies (Ross 2003). A more comprehensive list is provided by Meitner (2006) noting that the variable universe is limitless in practice.

Compared to absolute valuation models (e.g. DCF, DDM, RIV) relative valuation has its easiness and simplicity without detailed multi-year forecasts comprising profitability, growth and risk. It is also noted that analysts may infer these implied market expectations from market prices and multiples. (Sommer, Rose & Wöhrmann 2014) Yet, even considering the sensitivity to various assumptions and the onerousness of absolute valuation models, relative valuation bears multiple disadvantages that cannot be ignored (Rossi & Forte 2016).

The first drawback is the fact that relative valuation yields the target company value in cases where perfect substitutes exist in capital markets thus making case-specific adjustments necessary in the real world (Meitner 2006). Second disadvantage derives from the incomparability of peers with negative value drivers that are usually eliminated from the process generating potential distortions to the valuation (Sommer et al. 2014). Third drawback arises from the assumption of linear proportionality of the value driver and company value that should hold for the entire peer group. Meitner (2006) notes that this implies that market prices reflect the intrinsic company value which may be questioned owing to the effect of speculation and large price fluctuations (e.g. market bubbles and financial crises). Fourth disadvantage emphasized by Rossi and Forte (2016) is the reality that different denominators, fundamental value drivers, may imply different valuation results enabling analysts to utilize multiples best suited for the specific purpose, even with a conflict of interest. Rossi and Forte (2016) also point out that relative valuation suffers from circularity as often peer group companies are valued relative to each other.

Despite the problems depicted, relative valuation is among the most popular valuation techniques in practice (Sommer et al. 2014; Kaplan & Ruback 1996; Liu, Nissim & Thomas 2007). Also, Kim and Ritter (1999) find that comparable method is one of the most frequently cited, while DCF method may have firmer theoretical basis. In the case of IPO companies, Ritter and Welch (2002) claim the multiples of comparable companies being the most common valuation method. This is also backed by findings of Roosenboom (2012), in a study of French IPOs, concluding that over 87% underwriters use multiples in valuing IPO companies in contrast to only 59% using DCF or DDM.

The accuracy of relative valuation has been widely studied. Kim and Ritter (1999) studied several multiples concluding that the predictive ability is only modest if historical financials are applied as, especially in the case of immature companies, the accounting figures may not capture the future prospects. On the contrary, Berkman, Bradbury and Ferguson (2000) find in their study of IPOs in New Zealand that DCF and P/E multiple methods have similar precision in estimating market prices. Nonetheless, Kaplan and Ruback (1995) recommend practitioners to use both absolute and relative valuation methods if possible.

Research has not found an outperforming multiple. For example, Lie and Lie (2002) study market capitalization, enterprise value, and book value multiples with sales, EBITDA, EBIT figures finding no combination performing significantly better than others. Multiple

performance has also been studied from the perspective of timeframe of the value drivers and for example both Lie and Lie (2002) and Keun Yoo (2006) conclude that forward-based multiples outperform the trailing multiples. Additionally, several papers have studied combined multiples in a more complex setting (see e.g. Cheng & McNamara 2000; Penman 1998; Keun Yoo 2006) all finding combined multiples decreasing valuation errors. In spite of the higher accuracy, Demirakos, Strong and Walker (2004) note that these combined multiples are unestablished in practical use.

2.1.2 Relative valuation in equity research

Whereas IPO valuation is subject to deviations from the fundamentals, equity research is to determine the intrinsic value of the target. Analysts are assigned to determine the fair value of a company, and possible price recommendations, through selecting appropriate valuation methods and conducting analyses comprising the target itself, operating market dynamics, and general economic conditions (Stowe, Robinson, Pinto & McLeavey 2007). Listed companies sponsor sell-side research coverage to increase awareness and to publish a financial model, and support analysts to assure the accuracy through investor relation activities such as capital markets events, analyst calls, and several obliged guidance publications (Filbeck, Baker & Kiymaz 2020). Noted by Degeorge, Patel and Zeckhauser (1999), companies often target to meet the analyst expectations on earnings as most stocks meet the forecasts where only a few fails them, questioning the occurrence to be by chance.

Equity research provides in-depth analyses of companies, including overviews of the industries and markets the companies are operating in, with the objective of producing complete analyses of the targets (Ryan & Jacobs 2004). These reports produced can include varying levels of details, for example depending on the recent events affecting the target company or industry, but there are common elements although no standard format exists. The essential components include basic information of the company, business description including products and services conveying the key drivers behind the business, competitive positioning referring to industry dynamics analysis, valuation presenting the outputs and methods used, financial analysis showing the historical performance with forecasted figures, risks posed to the proposed investment thesis, and a review of the ESG performance (CFA Institute 2020).

Equity analysts are seen as highly credible third-party vendors acting as a source for unbiased views with an effect on the share visibility, liquidity, price, and valuation (Ryan & Jacobs 2004). Given the expertise and objectives of equity research, combined with the extensive list of variables considered in selecting the peers, and the exhaustive due diligence made in the analyses, analysts are supposed to select the most accurate comparable companies for the valuation. Reflecting this, several caveats of the comparable company method used in peer selection can be identified. The use of industry as a peer selection criterion rests on the notion that companies of same industry share the fundamental value drivers but in fact the characteristics in terms of the drivers may differ significantly, justifying unequal trading multiples (Knudsen, Kold & Plenborg 2017). Also, industry classifications alone have significant disadvantages that are further discussed in Section 5.3, and its usage as a proxy for risk and growth prospects is questionable as these characteristics are broad and often company specific (Bhoraj, Lee & Oler 2003). Furthermore, comparable company method does not capture most of the analyst-used variables listed in Section 2.1.1, and it lacks the control for the stock exchange of the peers as market-specific risks also affect the valuation levels of assets (see e.g. Bruner, Conroy, Estrada, Krizman & Li 2002).

2.1.3 Evidence of overvaluation

Relative overvaluation of IPOs has gained more attention in later research (see e.g. Purnanandam & Swaminathan 2004, Pöyhönen 2009, Zörgiebel 2016, Hämäläinen 2017). In their study of 2,288 IPOs in 1987-1997, Purmanandam and Swaminathan (2004) find that depending on the peer selection criteria IPOs are relatively overvalued by 14% to 50% with price-based multiples. They also argue the overvaluation being consistent with IPO underpricing by making a practically contradictory distinction between price and value, that enables IPOs being simultaneously underpriced but still overvalued relative to their peers. Zheng (2007) criticises the results noting that the growth prospects and financial structure of IPO companies have been ignored in the methodology. By using EV-based multiples and same sample restrictions as Purmanandam and Swaminathan (2004) the results of Zheng (2007) indicate IPOs no significant overvaluation at the offer price.

Despite the criticism shown towards the novel methodology of Purmanandam and Swaminathan (2004), alike results have been proven in several other studies. For example,

Zörgiebel (2016) studied 2,655 more recent IPOs in US, in 1994-2013, discovering companies being relatively overvalued on average with a variety of techniques including both EV and price-based multiples. With similar methods, Pöyhönen (2009) examines European IPOs in 1990-2008 finding an overvaluation up to 60% in relation to industry-matched peers, including a robustness check with EV-based multiples that exhibits a minor decrease in the magnitude of overvaluation, however still settling to a significant positive level. Also, the study of Hämäläinen (2017) focusing on penny stocks, that have previously been excluded in the methodology of IPO studies examining relative valuation, results in an overvaluation ranging from 37% to 57%, robust with EV-based multiples.

Purnanandam and Swaminathan (2004) argue that the overvaluation of IPOs stems from the excessively optimistic expectations regarding the company growth that fails to realize in the long run causing the underperformance to occur especially with overvalued companies. Likewise, Aggarwal, Bhagat and Rangan (2009) indicate that high valuation levels are promoted by growth expectations. Consistent with the arguments, the behavioural model introduced by Daniel, Hirshleifer and Subrahmanyam (1998) suggests that the overconfidence of investors leads to the initial overvaluation which remains for a shorter period due to the underreactions to new public information. Furthermore, Miller's (1977) theory of heterogeneous beliefs supports the arguments of Purmanandam and Swaminathan (2004). The theory presented by Miller (1977) claims that the prices do not reflect the views of typical investors but of the most optimistic ones actively purchasing shares of IPOs undertaken in a market with diverged opinions and less short selling. Miller (1977) thus indicates that the fluctuations between valuation levels and the intrinsic values of companies are larger when a higher amount of uncertainty is present. As extensions to the theory, Derrien (2005) claims bullish noise traders causing higher valuation in IPOs and Ljungqvist, Nanda and Singh (2006) present that the presence of sentiment investors enable issuing companies to extract value from them.

Purmanandam and Swaminathan (2004) also theorize that the role of IPO marketing in generating higher valuation is significant. This relation has gained the attention of scholars (see e.g. Butler, Keefe & Kieschnick 2014; Pollock & Rindova 2003). In their study, Cook, Kieschnick and Van Ness (2006) discover successful marketing campaigns to promote IPO valuation level. Also, Liu, Sherman and Zhang (2014) prove that ex ante media coverage affects the long-run value of IPO positively. Additionally, Chanine, Mansi and Mazboudi

(2015) show that even uninformative company news raises positive sentiment amongst investors on the first trading day. From another viewpoint, several studies of the effect of retail investors on IPO valuation have been conducted (see e.g. Clarke, Khurshed, Pande & Singh 2016; Cook et al. 2006; Cornelli, Goldreich & Ljungqvist 2006). As a relevant example, Neupane and Poshakwale (2012) conclude that favourable demand and aggressive bidding of retail investors have a positive impact on IPO valuation even after the participation of institutional investors has been controlled for.

2.2 IPO underpricing and long-run performance

This chapter begins by introducing IPO underpricing as a universally recognized phenomenon and discussing the explanatory theories proposed by studies. After this, research regarding the long-run underperformance of IPO companies is reviewed.

2.2.1 Underpricing phenomenon and explanatory theories

The underpricing of an IPO refers to the appreciation of the share price of the issuing firm from the offer price during the first trading day (Ritter & Welch 2002). Even the early studies of underpricing unanimously conclude that the companies undertaking an IPO are not raising the maximum amount of equity leaving money on the table, based on the ex-ante valuation levels (see e.g. Stoll & Curley 1970; Logue 1973; Reilly 1973; Ibbotson 1975; Ritter 1984). In their study with 6,249 US IPOs in 1980-2001 Ritter and Welch (2002) find an average first trading day return of 18.8%. Similarly, Coakley, Hadass and Wood (2009) discover average underpricing equalling to 10.5% with a sample of 591 IPOs in the UK between 1985 and 2003. In a different timeframe from 1995 to 2000, Loughran and Ritter (2004) observed average underpricing of 33% in the US market. Notable studies from the Finnish market include papers by Keloharju (1993) recording an average underpricing of 8.7% with a sample of 80 companies undertaken an IPO in 1984-1989 and Kaustia and Knüpfer (2008) finding 22.3% average underpricing in 57 IPOs during 1995-2000. Appropriately, Ibbotson and Ritter (1995) claim that the level of underpricing fluctuates between countries and time.

Even though underpricing has been a widely studied topic for the past fifty years, no dominant theory explaining the underlying cause for the phenomenon has been agreed on

(Ritter & Welch 2002). A variety of explanations have been developed from different viewpoints still all being consistent with statement of Beatty and Ritter (1985) that the uncertainty related to the fundamental value of the IPO company results in the underpricing phenomenon. One of the most well-known, and debated, model explaining the underpricing is the winner's curse introduced by Rock (1986). Simply, winner's curse refers to the tendency to bid over the intrinsic value of the target in order to win the auction. Rock (1986) assumes that the amount of information differs between investors creating a vantage for better informed investors thus leading uninformed investors to withdraw from the market as they would get only a partial allocation in underpriced and a full allocation in overpriced IPOs. Accordingly, the IPOs are underpriced on average to ensure the participance of all investors and to compensate the trading of uninformed investors in an inferior position.

Another proposed solution for the puzzle is the signalling model, a category of explanations theorised by Grinblatt and Hwang (1989), Allen and Faulhaber (1989) and Welch (1989). The common assumption behind these models is that the quality of the company is revealed ex post the IPO, and that high-quality firms will bear a costly signal to differentiate from the low-quality companies while simultaneously ensure more favourable market reaction for example for seasoned equity offerings.

Underpricing motives of managers as well as underwriters have also been contemplated. Aggarwal, Krigman and Womack (2002) introduce the information momentum that refers to the value maximisation during the lock-up period expiration, through a first underpriced IPO having an upward demand curve after an increased research coverage following the offering. Titman and Trueman (1986) propose that even the underwriters are in a disadvantageous informational position compared to the company management, leading to the underpricing. In connection with this, Sherman and Titman (2002) propose that the bookbuilding method authorizing underwriters to allocate the IPO shares in the considered best way, enables them to obtain additional market information regarding the suitable valuation level, and to favour their regular investors with underpriced IPOs. Nevertheless, among the countless theories relating to uncertainty and asymmetric information, additionally for example behavioural (see e.g. Brau, Cicon & McQueen 2016), ownership (see e.g. Brennan & Franks 1997), and institutional theories (see e.g. Tinic 1988), it is noted by Ritter and Welch (2002) that there are also other explanatory factors outside the theories.

2.2.2 Long-run underperformance

Another phenomenon, the long-run underperformance, is a well-documented and widely studied topic in IPO literature (see e.g. Loughran 1993; Loughran & Ritter 1995; Ritter & Welch 2002). A famous study by Ritter (1991) analysed 1,526 US IPOs in 1975-1984 and discovered the IPOs underperforming several indices and companies matched by size and industry, eventually destroying the shareholders' value by 17% on a three-year holding period starting from the first trading day. In another US-based study, Loughran and Ritter (1995), with larger data sets of IPOs and SEOs between 1970 and 1990, find that both equity issues have been poor investments on the long-run.

Similar results have been recorded in a European market setting. A study by Gandolfi, Regalli, Soana and Arcuri (2018) with 437 IPOs over the period 1997-2011 undertaken in Italy, France, and Germany confirmed the anomaly of long-run underperformance, however varying slightly between the countries. Berk and Peterle (2015), with 172 IPOs across 6 Central and Eastern Europe countries during 2000-2009, find the underperformance starting already three years after the listing. Similar results have been captured in Finland with timeframes between 1984 and 2006 by Keloharju (1993), Westerholm (2006), and Hahl, Vähämaa and Äijö (2014).

Multiple theories have been offered to explain the long-run underperformance. Several scholars including Ritter (1991) and Rajan and Sarvaes (1997) have argued that the companies undertaking an IPO have opted the timing to exploit the optimistic growth expectations of investors. These expectations yield the initial overvaluation that decreases towards the intrinsic value of the company as the amount of information increases by time, explaining the long-run underperformance. A different view, introduced by Schultz (2003), relies on efficient market prices and managers being unable to anticipate the market valuation peaks. The model argues that price level increases and successful listings eventually form a process where more IPOs are supplied until the prices fall and the supply decreases significantly. Thus, as the IPOs usually carry an equal weight in the studies, the period of high volume and excess valuations yields the average underperformance.

2.3 IPO valuation from the perspective of the underwriters and analysts

The listing company, its shareholders, and investors are the main parties of interest in an IPO process, in which the underwriter is to ensure that a balance of interests is maintained, as for example inherent conflicts between the issuer and investor sides do exist (Espinasse 2011). Underwriters must strive to achieve the objectives of the three main parties to complete a successful offering, that can be measured with indicators such as reasonable first day premium, broad distribution, stable core holdings, minimal flowback, strong aftermarket performance, and healthy trading volume (Geddes 2003). Equity research among other services possibly provided by the underwriter, for example trading and sales, play a different yet integral part in serving the clients, often bundled with the IPO underwriting service. However, the coexistence of these multidisciplinary operations is only enabled by mechanisms, so called Chinese Walls, including procedures, systems, and restrictions to prevent confidential information obtained by the corporate finance team, to penetrate other parts of the company, as it would potentially affect the share prices (Espinasse 2011).

The role of equity research analysts in an IPO process is integrated but highly regulated due to the multifaceted role posing conflicts of interest regarding the party that the analysts are representing, as the share price analyses and recommendations can serve one party at the expense of others (Geddes 2003). Pre-deal sell-side research is used in pitching the IPO as an investment to the institutional investors and is often restricted from being published to retail investors (Espinasse 2011). Also, a market-specific research blackout, followed by the listing, remains in force for a certain period for the underwriting banks, postponing the initiation of the coverage including price targets and recommendations (Geddes 2003).

The initial valuation made by the underwriter is adjusted during the allocation and pricing that can be done with bookbuilding, fixed price, or through an auction. Bookbuilding enables a complete flexibility over the number of issued shares and price that is adjusted based on the investor opinions on the initial range provided to facilitate the discussions (Gregoriou 2006). Fixed price refers to offering a fixed number of shares with a price set beforehand, however, still enabling the allocation and discussions with the cornerstone, or anchor, investors before publishing the IPO and the offering specifications (Geddes 2003). In an auction, a clearing price for all the offered shares is determined based on the bids by investors for the amounts of shares they want (Espinasse 2011). As noted by Ritter (2003), the auction

method has been out of favour for several decades while bookbuilding, with its American origins, has gained popularity also in European markets and especially in larger offerings.

All the pricing methods facilitate the reduction of the uncertainty and information asymmetry concerning the pricing, and thus the overall success potential of the offering, by enabling information exchange between different parties, steered by the underwriter (Bajo, Chemmanur, Simonyan & Tehranian 2016). However, the pricing process embodies the subjectivity concerning the valuation and creates motives for the price to deviate from the intrinsic value of the company. Consequently, Espinasse (2011) notes that an approximate opening premium of 10-15% usually represents a balance between the money left on the table and expectations of the investors on the initial return, leaving both vendors and investors happy. Also, Geddes (2003) provides an actual example of a prospectus disclaimer stating that the market price following the offering is not reflected by the initial offering price, as the latter is based on negotiations between the vendors and the underwriter. Furthermore, Geddes (2003) raises another prospectus excerpt stating the initial offering price being based on the information available to the underwriter, general and IPO market conditions, industry history and prospects, past and present operations and financials, ability of the management, and the prices and demand for generally comparable public companies. Geddes (2003) concludes that while the intrinsic value of the company sets the basis for the valuation, supply and demand have the largest effect on the offering price.

In addition to the issues tackled with regulation, the prevailing subjective nature of the valuation enables several questionable phenomena. Concluded by Vismara, Signori and Paleari (2015), investment banks select different peers as underwriters and afterwards as analysts to make the shares of the issuer to look conservatively priced at the IPO. Paleari, Signori and Vismara (2014) state that underwriters systematically exclude peers signalling overvaluation for the IPO. Doukas, Kim and Pantzalis (2008) find that excessive analyst coverage, driven by investment banking incentives and analyst self-interests, drives investor optimism and overvaluation. Chemmanur and Krishnan (2012) conclude that the reputation of the underwrites promotes the IPO valuation. Furthermore, Vithanage, Neupane and Chung (2016) find that multiple lead underwriting syndicates do price the IPO closer to the intrinsic value of the target compared to single lead managers.

3 Hypotheses

This section outlines the hypotheses that are tested with the empirical methods selected for the study. The hypotheses are formulated based on prior research and literature that is briefly discussed with every hypothesis in this chapter. In addition to the empirical testing of the hypotheses, several analyses are conducted to obtain a comprehensive picture of studied phenomena to contribute to the existing literature and support the future research.

Purnanandam and Swaminathan (2004) among other consequent studies focusing on the relative valuation of IPOs with comparable company method find that IPOs are valued with significantly higher multiples at the offer price than their peers. Academics have offered several mutually consistent theories supporting the arguments of overvaluation. Purnanandam and Swaminathan (2004) suggest that the higher valuation levels are driven by the optimistic growth expectations of investors. Accordingly, Lowry (2003) argues that companies time the IPO by maximizing the additional financing raised through the offering. For this, Lerner (1994) defines the concept of window of opportunity referring to optimal market conditions including positive market sentiment and high valuations that companies strive to exploit. Thus, it is assumed that Nordic IPOs are valued with higher multiples than their peers.

H1: Nordic IPOs are overvalued compared to their global peers

Cornelli, Goldreich and Ljungqvist (2006) suggest that post-IPO prices are driven above the fundamental value of the company by the actions taken by small retail investors. The data set of the study shows that the mean ownership share of cornerstone, or anchor, investors agreements on the publication date of prospectuses is 44%, implying that the retail investors are allocated with a substantial stake of the shares on average. Also, several IPO relative valuation studies find that the most overvalued listings have higher initial returns than IPOs with lower valuation levels at the offer price (see e.g. Purnanandam & Swaminathan 2004; Pöyhönen 2009; Hämäläinen 2017). In line with these, it is presumed that higher IPO valuation drives higher initial returns.

H2: Nordic IPOs with the highest relative valuation level have higher returns on the first trading day

The behavioural model of Daniel et al. (1998) proposes that the initial overvaluation is driven by the overconfidence of investors that is reflected as an underreaction to new post-IPO information allowing higher valuation to persist for a while. This model is supported by the findings of the aforementioned IPO studies focusing on the relative valuation. Additionally, the argument of Baker and Wurgler (2007), suggesting younger, volatile, and low-profit growth companies to be particularly sensitive to the investor sentiment, could be linked to the IPOs with higher valuation multiples. As the typical lock-up period in Nordic IPOs is 180 days, it could be expected that the market sustains the initially higher valuation levels until the lock-up expiration allowing insiders to further distribute the ownership thus signal superior information to the market.

H3: Nordic IPOs with the highest relative valuation level have higher abnormal returns compared to other IPOs during the first six months after the IPO

Prior research commonly accepts the phenomenon of IPOs underperforming on the long run. Miller (1977) argues that as the uncertainty regarding the future prospects of the IPOs declines by time, the share prices will converge towards the fundamental value offsetting the overvaluation driven by the most optimistic investors. This effect has been recorded in several studies as the most overvalued companies underperforming IPOs with lower valuation differences to their peers on the long run (see e.g. Purnanandam & Swaminathan 2004; Pöyhönen 2009; Hämäläinen 2017). According to the theory validated by the results, it is expected that the overvaluation of Nordic IPOs would correlate with the long run underperformance of the shares.

H4: Nordic IPOs with the highest relative valuation underperform the most in the long run

Roosenboom and Thomas (2007) conclude in their study that the practical discount made in IPO valuation is distinct from the widely researched underpricing. Deloof, De Maeseneire and Inghelbrecht (2009) state that underwriters are consciously applying a discount to their value estimates, regardless of the valuation method used, thus implying that the share price and company value are not to be separated in practice. Reflecting this and the recorded overvaluation in former IPO peer valuation studies with comparable company method, it is supposed that the equity research peers would result in lower valuation differences.

H5: Equity research approach yields lower relative valuation levels compared to the comparable company method applied in the peer selection

4 Data and methodology

This section presents the data and methodology used in the study. First, the selection criteria of the IPO sample are introduced followed by the different peer company matching method review. Lastly, the possible limitations of the study regarding the data and methodology are covered.

4.1 Data collection

This chapter focuses on the data used in the study. First, IPO sample selection process is elaborated. Second, both peer matching methods for the IPOs are detailed. Third, descriptive statistics of the sample are presented.

4.1.1 Selection of the IPO sample

The selected sample applied in the study consists of companies listed on Nasdaq Nordic First North and main markets in Stockholm, Helsinki, Copenhagen, and Iceland between 1 January 2010 and 31 December 2021. The initial listing data including companies, dates, and prices is collected from Refinitiv Eikon supplemented by data collected from Nasdaq OMX Nordic, and IPOhub (Thomson Reutern 2022; Nasdaq OMX Nordic 2022a, 2022b; IPOhub 2022). The company financial data and further information regarding the IPOs are collected from Orbis and company prospectuses published on the website of the Financial Supervisory Authority of each country (Bureau van Dijk 2022; Finanssivalvonta 2022; Finanstilsynet 2022; Finansinspektionen 2022; Fjármálaeftirlit Seðlabanka Íslands 2022).

The sample selection criteria are similar to Purnanandam and Swaminathan (2004) apart from few restrictions mainly related to the equity research matching method. The method requires the IPO companies to have defined peers in equity research reports with positive EBITDA one year prior. Also, while many IPO relative valuation studies using similar criteria (see e.g. Zörgiebel 2016; Zheng 2007; Purnanandam & Swaminathan 2004) have excluded IPOs with offer price less than one dollar, euro, or pound, Hämäläinen (2017) found that the results of previous studies apply to small-priced issues also. Thus, the offer

price criterion is not used for the sample as it would also be a significant restriction in a smaller market geography as Nordics. Additionally, the availability of financial information of the IPO companies has been used as a criterion in previous studies but is ignored in this as the prospectuses are used as a source. The criteria IPOs must fulfil to be included in the sample is as follows:

a) The shares issued in the IPO should be ordinary common shares and the offering should not be a unit offering, closed-end fund, a real estate investment trust or global depository receipt

b) The IPO company should not be a financial firm (SIC codes 6000-6999 excluded)

c) The IPO company should have reported a positive EBITDA one year prior the listing

d) The IPO company should have equity research coverage including a peer valuation conducted by the analyst(s)

e) The peers defined in the equity research report should have reported a positive EBITDA one year prior the listing of the company being valued

The criteria result in a final sample of 200 IPOs for which the annual breakdown of inclusion and exclusion is presented in Table 1. 630 IPOs have been undertaken in Nasdaq Nordic during 2010-2021. 113 of these have been financial companies including banks, investment companies, real estate companies, and from other financial industries, with SIC code between 6000-6999, decreasing the sample to 517 companies. Out of these, 274 companies have reported a positive EBITDA one year prior the IPO. The requirement of equity research analyst defined peers reduces the sample size to 215 companies of which 200 have had peers with positive EBITDA one year prior the listing of the IPO company, or in other words, assessable multiples for the purpose. Thus, the final sample includes 32% (excludes 68%) of the IPOs.

Table 1. Annual breakdown of the IPO inclusion and exclusion in the sample

The table shows the selection criteria used with the breakdown of the exclusion of each criterion. All refers to all IPOs identified, followed by the exclusion of financial companies with a SIC code between 6000-6999, companies reporting negative EBITDA one year prior the listing, and companies with no relative valuation applied by the analyst(s) in the research report or all the identified peers reporting negative EBITDA one year prior the IPO. This arrives in the final sample which is used to derive the overall exclusion percentage from all identified listings.

	All	Financial companies	Negative EBITDA	No equity research peers	Negative EBITDA peers	Final sample	Excluded %
2010	9	1	3	1	1	3	67 %
2011	14	1	8	1	0	4	71 %
2012	13	5	5	0	0	3	77 %
2013	23	9	7	3	1	3	87 %
2014	50	8	23	7	1	11	78 %
2015	79	21	22	9	1	26	67 %
2016	68	7	28	8	2	23	66 %
2017	81	4	42	3	1	31	62 %
2018	55	9	21	3	1	21	62 %
2019	35	4	15	2	2	12	66 %
2020	49	9	24	4	2	10	80 %
2021	154	35	45	18	3	53	66 %
Total	630	113	243	59	15	200	68 %

The criteria used prevents several biases that have appeared in most of the previous studies. Prior studies have included the availability of prior year financials to the criteria exposing the results to biases as the data unavailability usually occur in the case of smaller companies (see e.g. Purnanandam & Swaminathan 2004; Zheng 2007; Pöyhönen 2009; Hämäläinen 2017). And, as for example Ritter and Welch (2002) have noted that small IPOs are more likely to exhibit long-run underperformance, the estimates of the study are not influenced by this phenomenon. Also, as mentioned before, the peer multiple valuation is not a suitable method for valuing all companies due to its restrictions and disadvantages. Thus, using the definition of peers by equity research analysts as a criterion prevents the sample inclusion of companies that should be valued with different methods, or in other words, supports more robust results for peer multiple valuation research.

However, Zörgiebel (2016) found that IPO companies reporting negative profitability numbers are valued higher than the ones with positive profitability figures. Consequently, excluding companies with negative EBITDA may lead to the results presenting more

conservative estimates of the valuation levels. Also, the study excludes 68% of the IPOs for which the results could be questioned. However, the high exclusion percentages have been common in similar studies, for example 81.0% in the study of Hämäläinen (2017), 76.5% in the paper of Purnanandam and Swaminathan (2004), and 64.8% in the research of Pöyhönen (2009). Thus, the percentage of the study is not alerting as it represents the lower end of exclusion appeared in research.

4.1.2 Matching companies using comparable company method

A comparable company is defined for each IPO company using all data available in Refinitiv Eikon. The matching process is similar to previous studies (see e.g. Purnanandam & Swaminathan 2004; Zheng 2007) and as defined in the prior research, it aims to match companies of same fundamentals: industry, size, and profitability. Also, the matching companies are restricted not to be undertaken an IPO within last three years.

First, an industry classification by Fama and French (1997) is used to group the appropriate companies to match the industry as presented in Appendix 1. Second, the industry group of every IPO company is divided into three portfolios based on the sales one year prior to the listing of the corresponding IPO companies. Third, the sales portfolios are further divided into three portfolios, if available, based on previous year EBITDA margin. Lastly, and to summarize, from the maximum of 9 portfolios for every IPO company the peer closest in sales is selected from the appropriate portfolio.

As in previous studies following similar process, the industry matching aims to ensure the IPO companies and peers sharing similar operating risk, and profitability and growth prospects. Matching the sales is to control for size of operations whereas EBITDA margin controls for the profitability level. EBITDA margin is used as it is perceived as more stable measure for profitability given that it removes the effect of non-operating items.

4.1.3 Matching companies using equity research

As a novel method for defining matching companies and multiples for IPO companies, equity research reports are utilized. For every IPO company, a report written by an equity research service provider covering the corresponding company is searched. The usage of the

report also necessitates that the analyst(s) have defined peer multiples as a suitable method for valuing the company and conducted the analysis. This should reflect the reality of IPO valuation better as the peers are defined by specialists. Accordingly, the selection is not affected by the database limitations imposed to the characteristics matching for peer companies, for example product offering scope and customer base as noted by Ross (2003), that academic studies usually face.

The reports used in the study are from 21 different equity research service providers listed in Appendix 2. The reports used are aimed to be as close as possible to the IPO date of the company, usually the coverage initiation reports, to have the original peers that depict the IPO valuation level accurately. The total sample size of the equity research peers consisted of 1,381 companies of which 144 had reported negative EBITDA one year prior the listing of the corresponding IPO company, leading to the final sample of 1,237 equity research peer companies. To note circularity of peers raised by Rossi and Forte (2016), 804 companies out of the final sample of 1,237 were unique. Given the IPO sample of 200 companies, this means that for each company there is a defined peer group of 6 companies of which 4 are unique, on average. However, as a remark, none of the companies sharing peers were listed on the same day implying that the multiples are derived from unique factors for every IPO.

Meitner (2006) defines the aggregation methods for peer group multiples to four possible: arithmetic mean, median, harmonic mean, and regression approach. However, Meitner (2006) also lists several disadvantages related to most of the methods. Arithmetic mean is prone to outliers, whereas harmonic mean overweights the low-priced companies, and regression approach is a reasonable method only if the peer group is large enough. He also notes that the median is the most common method among the practitioners. Thus, the comparable multipliers for IPO companies are calculated as the median of the corresponding peer group.

4.1.4 Descriptive statistics

The final sample consists of 200 IPOs undertaken in Nasdaq Nordic markets in Stockholm, Helsinki, Copenhagen, and Iceland between 2010 and 2021. Figure 1 illustrates the annual IPO sample breakdown by country. The cyclicity of equity capital markets can be seen from the graph as the listing volume in the aftermath of the 2008 financial crisis is remarkably

low. Afterwards, the market activity has increased significantly peaking in 2021 presenting the phenomenon of so-called hot IPO markets that is a well-known subject in the field (see e.g. Lowry 2003; Yung, Colak & Wang 2008). Also, Figure 1 shows Swedish market being the most active, followed by Finnish and Danish markets, and lastly Icelandic market as the smallest in terms of IPO volume.
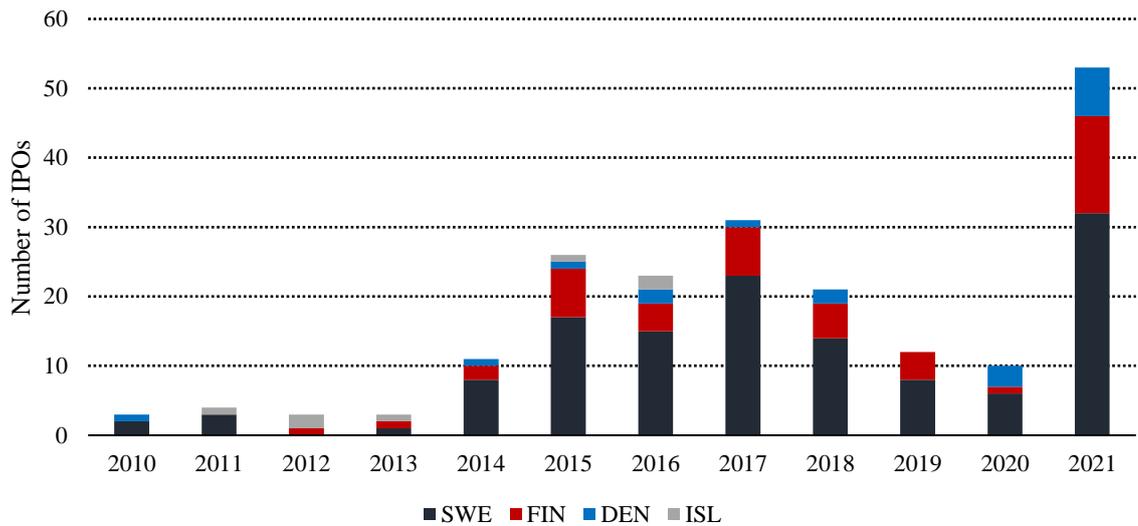
Figure 1. IPO sample breakdown by year and country

Descriptive statistics of the IPO companies and peer companies by selection method can be found from Table 2. The offer prices show that Nordic IPOs are offered at lower share price compared to European (see e.g. Pöyhönen 2009) or US IPOs (see e.g. Purnanandam & Swaminathan 2004). The proceeds depict the total sum of capital raised from the markets including the gross proceeds of the listing company, and the possible share of selling shareholders. All the prices and financials are converted into euro by using the currency rates of Refinitiv Eikon on the figures reported in the original currency on the corresponding date and timeframe in other data sources used, that are specified in Section 4.1.1.

Table 2. Sample description

The table provides descriptive statistics of the IPO sample of 200 companies, the corresponding peer companies selected with comparable company method, and the equity research peer sample of 1237 companies. Panel A shows the IPO offer price in euros, and total proceeds in millions of euros. Total proceeds include both gross proceeds of the listing company, and the possible proceeds of the selling shareholders. Financials, net sales, and EBITDA, one year prior the listing, are presented in Panel B in millions of euros for IPO companies and for the peers selected with both methods.

Panel A: IPO characteristics				
n = 200	Mean	25 %	Median	75 %
Offer price (€)	5.32	2.41	4.61	6.66
Proceeds (in millions of €)	116.15	6.77	31.14	88.26

Panel B: IPO and peer company statistics					
	IPO companies		Peer companies		Equity research peers	
in millions of €	Mean	Median	Mean	Median	Mean	Median
Net sales	513.16	51.71	472.23	55.58	4098.93	527.08
EBITDA	63.50	6.82	60.66	7.96	624.16	65.02

The accuracy of the comparable company matching method can be also noted from Table 2. The difference between the median sales of IPO companies and peers is 7.5% whereas in similar studies these figures have been 21.1% in the study of Hämäläinen (2017) and 17.1% in the paper of Purnanandam and Swaminathan (2004). On the other hand, it can be observed that the peers used by equity research analysts are approximately ten times larger than the IPO companies in terms of median sales and EBITDA. This reveals that analysts prioritize other peer characteristics more than size when choosing comparable companies for the valuation.

4.2 Methods

This chapter focuses on the methodology of the study. First, IPO price multiple valuation and the tests conducted are detailed. Second, the buy-and-hold abnormal return calculation and the use in empirical testing are elaborated.

4.2.1 IPO valuation with price multiples

The valuation ratios used in the study are enterprise value-based relative to the sales and EBITDA figures reported. Many of the previous studies, for example Purnanandam and Swaminathan (2004), use market capitalisation or price-based ratios despite their weaknesses. As mentioned, Zheng (2007) criticised the study of Purnanandam and Swaminathan (2004) because price-based ratios do not account for the capital structure and excess cash holdings of the companies. Also, the shareholders are entitled only to the market capitalization, the equity of the company, and the sales and EBITDA figures accrue to both creditors and shareholders. Thus, the use of enterprise value-based ratios is justified. The enterprise value is calculated by adding net debt, cash and equivalents subtracted from the total debt to the market capitalisation measured with multiplying price by the number of shares outstanding. Furthermore, only sales and EBITDA figures are used as denominators in the ratios leaving out earnings, the net income, for the sake of stability of the measures. The rationale for this is the fact that earnings is subject to fluctuations and several studies have concluded that IPO issuers make discretionary accruals among other actions to mislead stakeholders with increased income figures (see e.g. Miloud 2014; Healy & Wahlen 1999; Friedlan 1994).

Following the logic of Zheng (2007) the IPO company valuation multiples are calculated as follows. All financial items used in the multiples, sales, EBITDA, and net debt are reported figures one year prior to the listing. Shares outstanding refers to the total number of shares confirmed to form the equity after the listing, including the new shares possibly offered and the original shares outstanding.

$$\left(\frac{EV}{S}\right)_{IPO} = \frac{Offer\ price \times Shares\ outstanding + Net\ debt}{Sales} \tag{1}$$

$$\left(\frac{EV}{EBITDA}\right)_{IPO} = \frac{Offer\ price \times Shares\ outstanding + Net\ debt}{EBITDA} \tag{2}$$

Similarly, the valuation multiples of peers are calculated with the market closing price and number of shares outstanding immediately prior to the IPO offer date and prior fiscal year financials, as follows.

$$\left(\frac{EV}{S}\right)_{PEER} = \frac{Market\ price \times Shares\ outstanding + Net\ debt}{Sales} \tag{3}$$

$$\left(\frac{EV}{EBITDA}\right)_{PEER} = \frac{Market\ price \times Shares\ outstanding + Net\ debt}{EBITDA} \tag{4}$$

The EV-to-value (P/V) ratios are calculated with the previously explained multiples of IPO companies and peers as follows.

$$\left(\frac{P}{V}\right)_{SALES} = \frac{(EV/S)_{IPO}}{(EV/S)_{PEER}} \tag{5}$$

$$\left(\frac{P}{V}\right)_{EBITDA} = \frac{(EV/EBITDA)_{IPO}}{(EV/EBITDA)_{PEER}} \tag{6}$$

The ratios are calculated with respect to peers defined with both comparable company method and equity research method. The ratios are to be interpreted so that the differences from one determine the relative valuation level to the peer or peer group (above one is considered as overvalued and vice versa). The *p*-values for Wilcoxon rank sum test with the hypothesis of median P/V ratio equalling to one are calculated to test the hypothesis of IPOs being fairly valued in comparison to the respective peer or peer group, similarly with Purnanandam and Swaminathan (2004). Also, the factors affecting the valuation ratio based on former literature are studied with OLS regression explained in more detail in Section 5.1.3.

4.2.2 Buy-and-hold abnormal returns

The aftermarket performance of the IPO companies is studied using BHARs by dividing the sample into three portfolios based on the relative valuation level to test the correlation. Also, OLS regressions are conducted to test the explanatory power of selected factors on the performance in different timeframes elaborated further in Sections 5.2.3 and 5.2.4. BHAR approach is favoured in IPO research (see e.g. Loughran & Ritter 1995; Purnanandam & Swaminathan 2004; Brav & Gompers 1997; Michaely & Womack 1999; Yung, Colak &

Wang 2008). Moreover, several studies have shown that the alternative method, CAR, is prone to positive bias and ignores the compounding effect of returns (see e.g. Kothari & Warner 1997; Barber & Lyon 1997). Thus, the selection of BHAR approach is valid.

Buy-and-hold returns (R) for period T are calculated for IPO companies (i) and benchmark (b) as defined below.

$$R_{iT} = \prod_{t=D+1}^{T} (i + r_{it}) - 1 \tag{7}$$

$$R_{bT} = \prod_{t=D+1}^{T} (i + r_{bt}) - 1 \tag{8}$$

where r_{it} and r_{bt} represent the daily returns of the IPO company i and benchmark b on date t. D means the offer date of the IPO and T is the ending date of the calculation period. Following Barber and Lyon (1997), BHAR, equally weighted portfolio BHAR, and t-statistic under the assumption of independence are calculated as follows.

$$BHAR_{iT} = R_{iT} - R_{bT} \tag{9}$$

$$\overline{BHAR}_T = \frac{1}{N} \times \sum_{i=1}^{N} BHAR_{iT} \tag{10}$$

$$t(BHAR) = \sqrt{N} \times \sqrt{\overline{BHAR_T}}/\sigma(BHAR_{iT}) \tag{11}$$

where the number of IPOs in the sample is represented by N and $\sigma(BHAR_{iT})$ constitutes for the sample standard deviation under the assumption of independence.

5 Analysis and results

The empirical results of the study are presented and discussed in this section. The valuation analysis is conducted first, followed by the review of after-market performance of the IPOs. To end the section, the limitations of the study are presented and discussed.

5.1 Valuation of the IPOs

This chapter focuses on the valuation results of the study by starting from the comparable company method results, followed by a similar analysis with equity research approach. As the sample size is rather limited, mean figures are prone to outliers making them unreliable to indicate valuation differences which is why median figures are preferred as they present more conservative, and comparable, estimates. Lastly, the multivariate OLS regression models testing the factors affecting the initial valuation differences are viewed.

5.1.1 Comparable firm multiple method

Figure 2 shows the annual median P/V ratios based on EV/Sales and EV/EBITDA multiples using the comparable company method in selecting the peers. It can be seen from the graph that the median P/V ratio indicates systematic overvaluation for the entire sample period. The EBITDA-based ratios can be seen to weakly correlate with the annual IPO volume in the later years. However, the statistical significance of median P/V ratios (both sales and EBITDA) differing from one is not reached in some individual years, as later elucidated. Nevertheless, the results support the first research hypothesis of Nordic IPOs being overvalued compared to their peers, at least for comparable company method. This confirms the results of Hämäläinen (2017) and Pöyhönen (2009) also being applicable to Nordics whereas it contradicts the results of Zheng (2007) concluding that EV-based multiples remove the overvaluation found by Purnanandam and Swaminathan (2004) with price-based multiples.
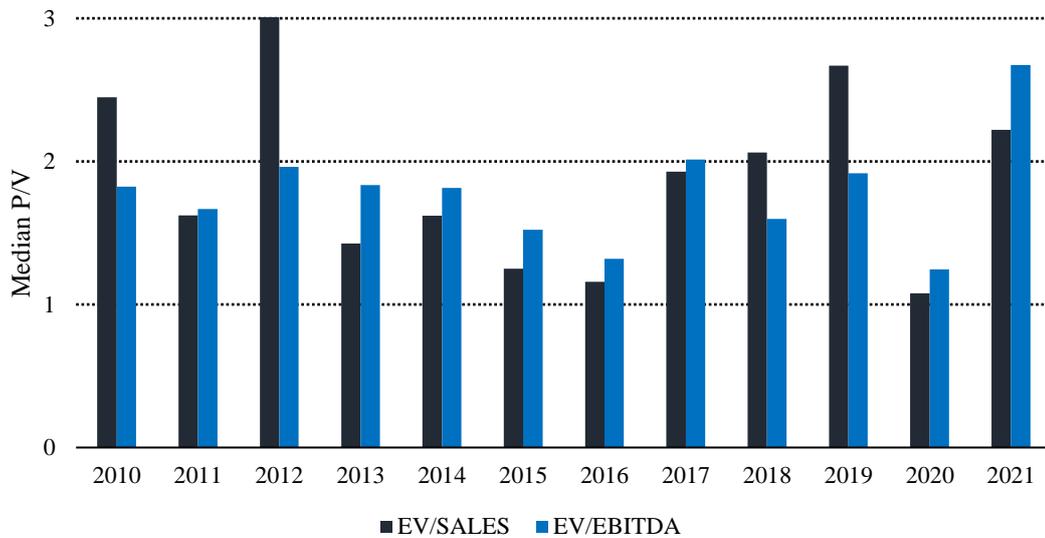
Figure 2. Annual median P/V ratios by comparable company method

Table 3 presents the annual breakdown of P/V ratios based on both EV/Sales and EV/EBITDA including the skewness of the ratios with first and third quartiles. It can be seen from the quartiles that the multiples are slightly positively skewed. As mentioned, the overvaluation is not statistically significant for some individual years. However, the results of the entire sample indicate that IPO companies are systematically overvalued by 62% and 73%, measured with EV/Sales and EV/EBITDA, respectively. The overvaluation of the entire sample is statistically significant at 1% level for both multiples.

Table 3. IPO valuation with comparable company method

The table provides an annual breakdown of both sales and EBITDA-based P/V ratios calculated with peers selected with the comparable company method. The table includes the number of issues in each year and the 25th, 50th, and 75th percentiles of the P/V ratios. Overall numbers represent the statistics for the entire sample. *p* refers to p-value of Wilcoxon rank sum test for testing the corresponding median to equal one. ***, **, and * show the statistical significance on 1%, 5%, and 10% level, respectively.

| | | P/V based on EV/Sales | | | | P/V based on EV/EBITDA | | | |
Year	Issues	25 %	Median	75 %	*p*	25 %	Median	75 %	*p*
2010	3	1.72	2.45	4.54	0.100*	1.63	1.82	6.06	0.100*
2011	4	1.05	1.62	2.70	0.314	1.44	1.67	3.23	0.029**
2012	3	1.18	2.99	10.63	0.100*	1.10	1.96	5.71	0.100*
2013	3	0.73	1.43	3.28	0.700	0.85	1.83	1.86	0.700
2014	11	0.69	1.62	6.00	0.266	1.01	1.82	3.19	0.005***
2015	26	0.78	1.25	2.09	0.041**	0.77	1.52	2.37	0.129
2016	23	0.75	1.16	1.90	0.1831	0.70	1.32	2.30	0.0597*
2017	31	1.12	1.93	4.45	0.000***	1.09	2.01	6.02	0.000***
2018	21	0.82	2.06	4.20	0.102**	1.12	1.60	6.55	0.000***
2019	12	1.06	2.67	4.07	0.002***	0.95	1.92	3.53	0.026**
2020	10	0.64	1.08	2.19	0.445	0.95	1.24	2.22	0.014**
2021	53	1.21	2.22	7.08	0.000***	0.97	2.67	6.98	0.000***
Overall	200	1.04	1.62	3.98	0.000***	1.01	1.73	3.92	0.000***

As mentioned, the overvaluation is not statistically significant for some years, and this should be acknowledged especially in the case of 2010-2013 as the IPO volume is remarkably low during the period. Nonetheless, the statistical insignificance does not exhibit any kind of pattern indicating that the overvaluation is present in every cycle in the market.

5.1.2 Equity research peer method

Figure 3 shows the annual median P/V ratios based on EV/Sales and EV/EBITDA multiples using the equity research approach in selecting the peers. It can be seen from the graph that IPOs are not consistently valued under or over throughout the sample period. The sales-based ratios are exhibiting weak correlation with the IPO volume in the later years. Also, it can be noted that the equity research ratios vary significantly less than the ones based on comparable company method except the sales-based ratio in 2010. This could be explained by the fact that the years 2010-2013 are prone to outliers due to significantly low IPO volume.
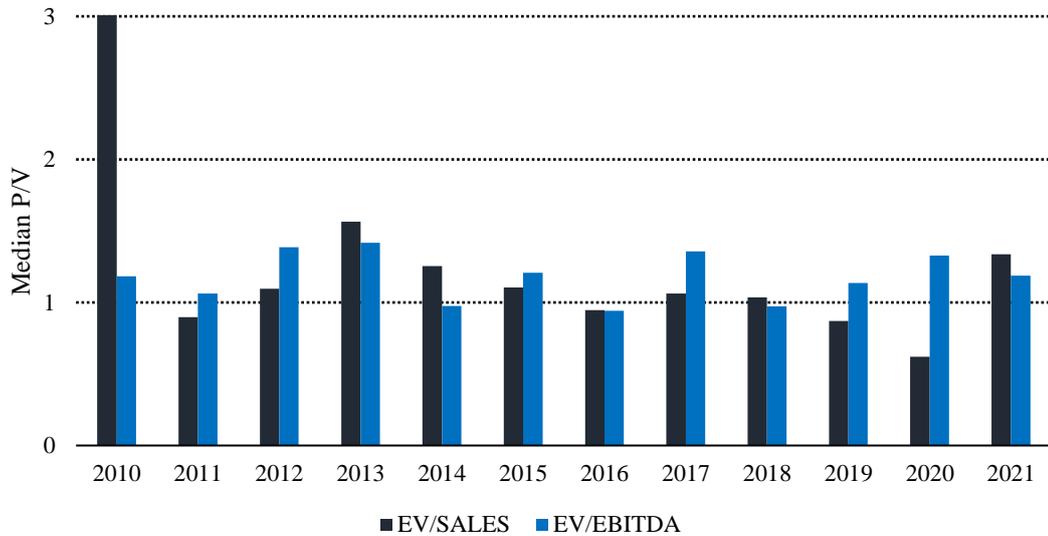
Figure 3. Annual median P/V ratios by equity research method

Table 4 shows the annual P/V ratios based on both EV/Sales and EV/EBITDA including the skewness of the ratios with first and third quartiles. It can be seen from the quartiles that the multiples are less skewed than the ratios based on comparable company method. In this case, the only statistically significant individual differences are shown by 2021 ratios and 2017 EBITDA-based ratio. Nonetheless, the results of the entire sample are statistically significant at 1% level and indicate that IPOs are systematically overvalued by 11% and 16%, based on EV/Sales and EV/EBITDA multiples, respectively. The results provide evidence for the fifth study hypothesis of equity research peers yielding lower relative initial valuation levels than the comparable company method, and further support the first hypothesis of general overvaluation of Nordic IPOs.

Table 4. IPO valuation with equity research method

The table provides an annual breakdown of both sales and EBITDA-based P/V ratios calculated with peers selected with the equity research method. The table shows the number of issues in each year with the 25th, 50th, and 75th percentiles of the P/V ratios. Overall numbers represent the statistics for the entire sample. *p* refers to p-value of Wilcoxon rank sum test for testing the corresponding median to equal one. ***, **, and * show the statistical significance on 1%, 5%, and 10% level, respectively.

		P/V based on EV/Sales				P/V based on EV/EBITDA			
Year	Issues	25 %	Median	75 %	*p*	25 %	Median	75 %	*p*
2010	3	0.83	2.99	5.78	0.700	0.35	1.18	2.39	0.700
2011	4	0.56	0.90	1.98	1.000	0.87	1.06	2.18	0.314
2012	3	0.59	1.10	1.40	0.700	0.83	1.39	2.22	0.700
2013	3	0.73	1.57	4.87	0.700	0.61	1.42	5.51	0.700
2014	11	0.44	1.26	1.45	0.728	0.82	0.98	1.48	0.728
2015	26	0.55	1.10	1.78	0.619	0.67	1.21	1.67	0.619
2016	23	0.58	0.95	1.60	0.798	0.71	0.94	1.25	0.798
2017	31	0.61	1.06	1.77	0.249	0.91	1.36	2.09	0.002***
2018	21	0.80	1.04	1.83	0.164	0.69	0.97	1.67	0.790
2019	12	0.60	0.87	1.60	0.480	0.71	1.14	1.57	0.480
2020	10	0.50	0.62	3.41	0.445	0.54	1.33	2.03	0.445
2021	53	0.75	1.34	1.88	0.002***	0.78	1.19	2.22	0.049**
Overall	200	0.64	1.11	1.76	0.01***	0.75	1.16	1.74	0.003***

However, there are several implications and questions to be raised based on the rather low overvaluation indicated by the approach utilising equity research. Could this be explained by the method limitations or variables omitted in the study? Prior research focusing on the comparable company method has stated that the high overvaluation figures found cannot be reasoned with the impracticalities of the study methods. These conclusions of high systematic relative overvaluation disprove the facts that IPOs are generally valued at a discount, and the relative valuation is the most popular method for underwriters to determine the company value. Thus, the implications of comparable company peer selection method controlling for the size, profitability, and industry of the IPOs should be separated from the valuation conducted in practice. These implications and limitations are further discussed in Chapter 5.3.

5.1.3 IPO Valuation regressions

The initial overvaluation of IPOs is further investigated with multiple regression analysis. The early research focusing on IPO relative valuation with comparable company method by Purnanandam and Swaminathan (2004) and Zheng (2007) does not include P/V regression

analysis into the studies. The regressions aim to identify the factors affecting the initial relative valuation level.

The P/V ratios calculated with EV/EBITDA and EV/Sales multiples with both peer selection methods are used as dependent variables. For both comparable company method, and equity research method the regression model is as follows:

$$
\begin{aligned}
\frac{P}{V} ratio_i = a &+ b \times ln(Sales_i) + c \times EBITDA\ margin_i \\
&+ d \times Net\ income_i + e \times Growth_i + f \times Anchored_i \\
&+ g \times PE\ dummy_i + h \times Tech\ dummy_i + u_i
\end{aligned}
\tag{12}
$$

Baker and Wurgler (2007) find that companies of smaller size and lower profitability are more affected by the investor sentiment. As the larger companies with steady cash flows are perceived to be more easily valued, the size of the IPO company, proxied by the *sales*, and *EBITDA margin* have been controlled for in the regression. Also, *earnings*, the net income, is included in the model as it has been widely recorded that manipulative accrual management is a means to deceive investors in order to maximize the initial company value and proceeds (DuCharme, Malatesta & Sefcik 2001). The financial figures are from one year prior the listing and the natural logarithm of sales is used as the data is skewed.

Ross (2003) notes the growth prospects of the companies being an integral part of the valuation and often linked to significantly high after-market valuation levels as Aggarwal et al. (2009) indicated. The *growth* used in the regression is calculated as the change in the sales of the company from two years to one year prior the listing, due to the scarcity of the data. The role of both institutional and retail investors in IPOs has been widely studied. The effect of retail investors promoting higher initial valuation, captured by for example Neupane and Poshakwale (2012), has been controlled for and proxied by the percentage of the shares that have been *anchored* to the cornerstone investors, in accordance with their agreements stated in the prospectuses. This can also be interpreted as a signal for a quality listing with early demand from professional investor entities.

It has also been argued that the private equity (including venture capital) backed IPOs are priced differently as these investment companies are assumed to time the listings to get excess valuations (see e.g. Lee & Wahal 2004; Barry & Mihov 2015). The ownership of an

investment company is accounted for by using a dummy variable in the regression. The *PE dummy* equals one for companies that have received funding from an investment company prior the IPO, and zero otherwise. Also, the challenges in the company valuation posed by intangible growth options, often associated with technology companies, have been acknowledged in the regression model. Fazzini (2018) notes that the development prospects of technology companies may be altered by sudden changes creating instability to the business, thus hampering the valuation and generation of accurate estimates. The *tech dummy* used in the regression equals to one if the company is defined as a high-tech company according to the classification by Kile and Phillips (2009), and otherwise zero. This SIC code-based categorisation can be found in Appendix 3. Also, as the number of listings and the generic valuation levels have varied between exchanges and years, these effects are controlled for with appropriate *country* and *year dummy* variables.

The pair-wise correlations between the independent variables do not exceed 0.5, thus no multicollinearity problems affect the models. The P/V regression results are presented in Table 5. It can be observed that the coefficients of determination, r-squared values, are higher for models using EBITDA-based valuation ratios, and significantly higher for the model using equity research peers instead of comparable company method. However, all the values are rather low indicating that there are several other factors affecting the initial relative valuation level.

In line with the results of earlier studies, sales and EBITDA-margin have an inverse correlation to the relative valuation level, statistically significant at 1% level, except sales only for equity research method at 10% and 1% level for sales and EBITDA-based multiples, respectively. This implies that small and unprofitable companies are valued higher, in accordance with the conclusions of Baker and Wurgler (2007). Growth has a positive effect on the relative valuation level, significant at 1% and 10% levels for equity research and comparable company models, respectively. This supports the arguments of Aggarwal, Bhagat and Rangan (2009) and Purnanandam and Swaminathan (2004) regarding the linkages between optimistic growth expectations and initial valuation level as the recent growth figures usually form the basis for future projections and expectations.

Surprisingly and paradoxically, sales-based models show EBITDA-margin having a positive correlation with the initial valuation level, significant at 1% level for both peer selection methods. A rationalisation for this could be that as the sales-based multiples are often seen

inferior to EBITDA-based ones, in a situation where sales-based multiples are more suitable, higher profitability drives the valuation level higher. Also, on the contrary to previous studies, the ownership of an investment company has mixed effects and the industrial classification as a high-tech company has a slight negative effect to the initial relative valuation level, both with no statistical significance.

Table 5. IPO valuation regressions for different peer selection methods

The table shows the OLS regression results for the sales and EBITDA-based P/V ratios calculated with the corresponding peer selection method. Ln(Sales) is the natural logarithm of the prior fiscal year sales. EBITDA margin and net income refer to the prior fiscal year financials where EBITDA margin is calculated by dividing the EBITDA by the sales. Growth is calculated as the change in sales within two years prior the listing. Anchored is the share of the equity that the cornerstone investors have agreed to mark in the IPO, according to the agreements noted in the prospectus. PE dummy is a dummy variable that equals one if the company was backed by an investment company prior the IPO. Tech dummy is a dummy variable that equals one for high-tech companies defined by Kile and Phillips (2009). Numbers in brackets refer to p-values and the significance of each coefficient is shown by ***, **, and * at 1%, 5%, and 10% level, respectively.

| | Dependent variables | | | |
| Peer selection method | Comparable company | | Equity research | |
Independent variables	$P/V_{[EBITDA]}$	$P/V_{[Sales]}$	$P/V_{[EBITDA]}$	$P/V_{[Sales]}$
Intercept	8.41** [0.040]	2.24 [0.816]	7.26*** [0.000]	2.58* [0.066]
Ln(Sales)	-0.34 [0.119]	-0.05 [0.899]	-0.52*** [0.000]	-0.22* [0.066]
EBITDA margin	-8.26*** [0.004]	15.86*** [0.001]	-5.80*** [0.001]	5.62*** [0.000]
Net income	-0.00 [0.481]	-0.00 [0.520]	-0.00 [0.926]	-0.00 [0.576]
Growth	1.66* [0.066]	0.10 [0.947]	2.34*** [0.000]	0.17 [0.718]
Anchored	-0.88 [0.563]	2.31 [0.366]	0.25 [0.778]	-0.62 [0.441]
PE dummy	-0.14 [0.856]	0.82 [0.523]	-0.26 [0.561]	0.53 [0.190]
Tech dummy	-0.08 [0.926]	-0.56 [0.698]	-0.76 [0.126]	-0.03 [0.941]
Country dummies	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
p	0.039	0.082	0.000	0.093
r^2	0.166**	0.118*	0.242***	0.148*

The r-squared values of comparable company method models are lower than equity research, however only the model of the EBITDA-based equity research ratio having significantly higher value of 0.242, that is still rather modest. Also, the comparable company method

models are only statistically significant at 5% and 10% level for EBITDA and sales-based valuation ratios, respectively, whereas the equity research method models are statistically significant at 1% and 10% level for the EBITDA and sales-based ratios, respectively. In the end, it can be concluded that the models presented do not exhaustively cover the factors affecting the initial relative valuation level. Furthermore, it can be pointed out that the coefficients of the intercepts for EBITDA-based valuation ratios differ significantly from the mean P/V values as the population parameters of the models make it appear higher.

5.2 After-market performance

This chapter focuses on the analyses conducted on the after-market performance of the IPOs. Initially, the first trading day returns, or underpricing as perceived in IPO literature, are examined. Then, the after-market performance in different periods is analysed by dividing the IPO sample into three portfolios based on the relative valuation ratios. After this, multivariate OLS regression models testing the factors affecting both long and short-run aftermarket performance are viewed. Finally, the limitations of the study are considered reflecting the existing literature and future research opportunities.

5.2.1 First trading day returns

The IPO sample is divided into three portfolios based on the EV/EBITDA multiple as it enables the comparison of the results to the prior research. Following the methodology used by Purnanandam and Swaminathan (2004) and Hämäläinen (2017), the sample is divided to high, medium, and low equal-weighted portfolios by forming equal groups using 33rd and 66th percentiles of the P/V distribution during the last two years of each IPO. The division procedure is repeated for every month starting from 2013 as the first two years form the initial distribution. This method has multiple advantageous characteristics, including the prevention of look-ahead bias and calendar-time clustering, compared to simply using the whole sample to calculate the P/V percentiles used in the portfolio division. Also, splits and other capital changes are considered by using adjusted offer and daily closing prices.

Figure 4 illustrates the yearly median valuation ratios based on EV/EBITDA multiples by peer matching method and average annual underpricing measured with the first trading day

returns. The graph shows no evidence of relationship between underpricing and valuation ratios. Also, it can be observed from the graph that the IPOs in the sample have yielded negative first trading day returns on average in 2011 and 2014. This can be explained by the fact that the sample criteria exclude companies with negative EBITDA that is often associated with higher uncertainty in the valuation, thus needing higher underpricing to secure the market acceptance.
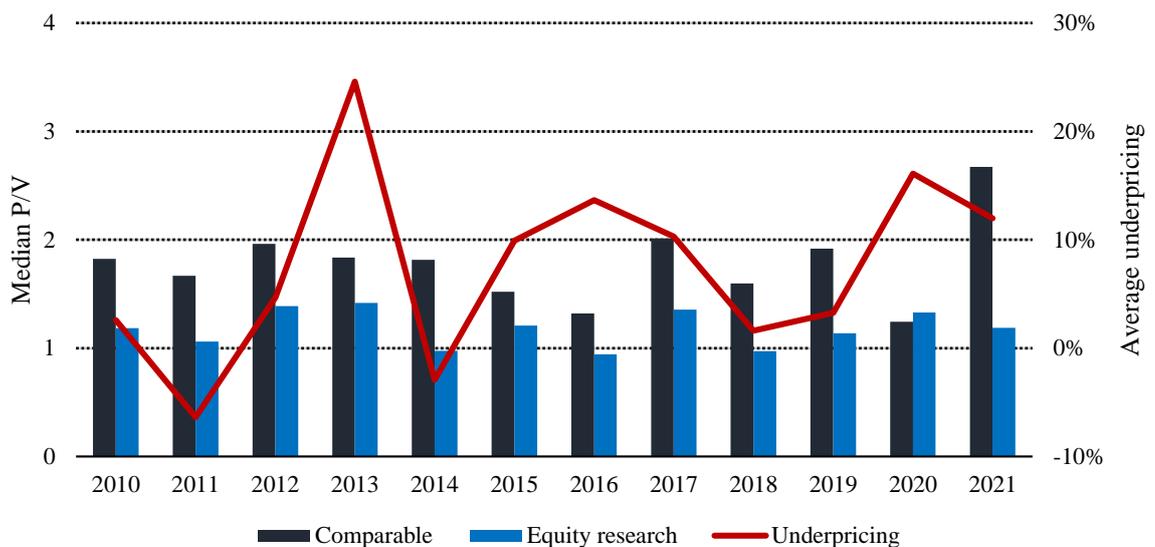

Figure 4. Annual IPO underpricing and P/V ratios based on EV/EBITDA

Table 6 reports the first trading day returns and other comparable company method portfolio characteristics. Interestingly, the results regarding underpricing are contradictory to the results of comparable studies from other markets (see e.g. Purnanandam & Swaminathan (2004); Hämäläinen (2017). The mean first trading day returns show that the there is no relationship between higher underpricing and higher relative valuation. On the contrary, mean first trading day returns are highest for the low portfolio. The relationship is logical if it is assumed that the market also perceives the valuation similarly, thus the lower the relative valuation the higher the increase towards the hypothetical maximum value of the company as in the theory of Purnanandam and Swaminathand (2004) of separate valuation and pricing. Nevertheless, the underpricing differences between high and low portfolio are not statistically significant. However, there are notable differences between the recorded characteristics of the portfolios. For example, the high portfolio companies are significantly smaller in terms of the median sales as the difference between high and low portfolio is 36.2 million euros that is statistically significant at 1% level. Also, the difference between high and low portfolios in the median EBITDA is 1.9% and is statistically significant at 10%

level. This indicating that smaller companies with lower profitability are more overvalued at the offer price that is often linked to the investor sentiment driven by high future expectations of smaller growth companies.

Table 6. First day returns and descriptive statistics of comparable company portfolio

The table presents the first trading day returns with company characteristics of each portfolio assigned by the EBITDA-based valuation ratio determined with peers based on comparable company method. The first-day returns are calculated as the change between the closing price of the first trading day and the offer price. Sales and EBITDA margin refer to prior fiscal year financials that are also used in calculating the EV. Offer price, used to derive the EV, and the proceeds are as defined during the offering process. Sales, EV, and proceeds are expressed in millions of euros. *p*-values refer to Wilcoxon rank sum test and Student's t-test for the equality of median and mean figures, under the assumption of independence, respectively. ***, **, and * denote the statistical significance on 1%, 5%, and 10% level, respectively.

P/V Portfolio	Issues	Median P/V	First-day returns		Median Sales	Median EBITDA	Median EV	Median Proceeds
			Median	Mean				
Low	66	0.79	7.9 %	9.6 %	55.4	14.0 %	81.0	24.0
Medium	66	1.70	6.2 %	9.4 %	82.9	11.4 %	124.5	36.0
High	68	6.98	8.2 %	8.0 %	19.2	12.1 %	119.8	18.4
Low - High		-6.19	-0.3%	1.6%	36.2***	1.9%*	-38.8	5.6
p-value			0.750	0.611	0.001	0.080	0.487	0.630
All	200	1.73	7.4 %	9.0 %	51.7	12.3 %	109.4	31.1

Table 7 shows the first trading day returns and other fundamental characteristics of the portfolios based on valuation ratios formed with equity research peer selection. The results are similar to the ones obtained with comparable company method portfolios. The mean first trading day returns indicate that the lowest valued companies experience the highest increase in share prices. The results are similarly statistically insignificant. Furthermore, the median sales shows that the companies with higher relative valuation have 52.8 million euros lower sales than low portfolio companies with the difference being statistically significant at 1% level, in parallel with the results of comparable company method portfolios. Again, supporting the findings of high investor sentiment for smaller growth companies. However, the results provide contradictory evidence for the second research hypothesis of higher overvaluation yielding higher first trading day returns.

Table 7. First day returns and descriptive statistics of equity research portfolios

The table presents the first trading day returns with company characteristics of each portfolio assigned by the EBITDA-based valuation ratio determined with peers based on equity research method. The first-day returns are calculated as the change between the first trading day closing price and the offer price. Sales and EBITDA margin refer to prior fiscal year financials that are also used in calculating the EV. Offer price, used to derive the EV, and the proceeds are as defined during the offering process. Sales, EV, and proceeds are expressed in millions of euros. *p*-values refer to Wilcoxon rank sum test and Student's t-test for the equality of median and mean figures, under the assumption of independence, respectively. ***, **, and * denote the statistical significance on 1%, 5%, and 10% level, respectively.

P/V Portfolio	Issues	Median P/V	First-day returns		Median Sales	Median EBITDA	Median EV	Median Proceeds
			Median	Mean				
Low	66	1.00	6.8 %	9.4 %	72.5	11.8 %	87.0	30.8
Medium	66	1.86	9.2 %	9.0 %	74.8	13.3 %	120.0	37.8
High	68	3.74	6.3 %	8.6 %	19.7	12.3 %	108.4	19.7
Low - High		-2.74	0.5%	0.8%	52.8***	-0.5%	-21.4	11.1
p-value			0.783	0.800	0.002	0.274	0.423	0.447
All	200	1.16	7.4 %	9.0 %	51.7	12.3 %	109.4	31.1

Mean and median first day returns for the entire sample are 9.0% and 7.4%, respectively. The average underpricing for all the IPOs in the sample is lower than the figures reported in former studies focusing on the underpricing in Nordics (see e.g. Bask & Nätter 2021; Westerholm 2006). This can be explained by the sample selection criteria excluding the IPOs with negative EBITDA that often are more underpriced to ensure a successful IPO due to the uncertainty associated to negative profitability measures.

5.2.2 Portfolio performance

The portfolio performance is analysed with observing the daily BHAR development, based on EV/EBITDA multiple differences calculated with both peer selection methods, and with testing the statistical significance of the differences between high and low portfolio BHARs on certain time periods. The used timeframe is 0-1,800 days after the listing and the BAHRs are calculated using NASDAQ OMX Nordic 120 index as the benchmark. The analysis focuses on median BAHRs to reduce the effects of outliers as the sample size is rather low.

Figure 5 plots the daily median BHARs of the entire sample and P/V portfolios based on EV/EBITDA valuation differences calculated with comparable company method peers. It

can be seen from the graph that larger differences between the performance of the portfolios start to manifest after circa 900 days following the IPO. Since then, the high portfolio companies sustain higher valuation levels approximately 600 days after which the median BHAR declines rapidly yielding the lowest performance of the portfolios in the end of the timeframe. This supports the fourth study hypothesis of the companies with highest overvaluation underperforming the most in the long run. In addition, it can be observed from the graph that the median BHAR of all IPOs drops after roughly 1,500 days underperforming the benchmark index on the long run. This is in line with the prior research and embodies the long run underperformance of IPOs, however at later stages as the underperformance have often been recorded to emerge approximately three years (1,080 days) after the listing.
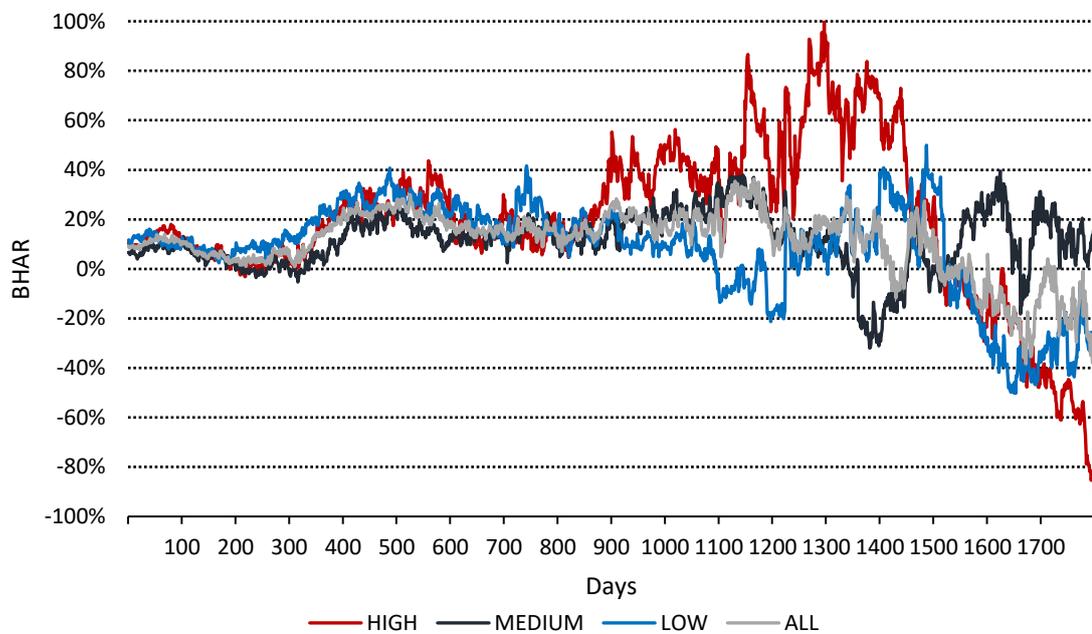
Figure 5. Daily median BHARs of P/V portfolios based on comparable company method

Figure 6 shows the comparable company P/V portfolio BHARs focusing on certain periods. The data shows that the BHARs fluctuate significantly between the portfolios, and the graph supports the observation that during the first six months of flotation, no single portfolio sustains higher valuation level than others. This is contradictory to the third research hypothesis of companies with higher initial valuation level having higher abnormal returns during the first six months after the IPO. Also, it can be noted that the medium portfolio outperforms the benchmark index on the five-year timeframe.
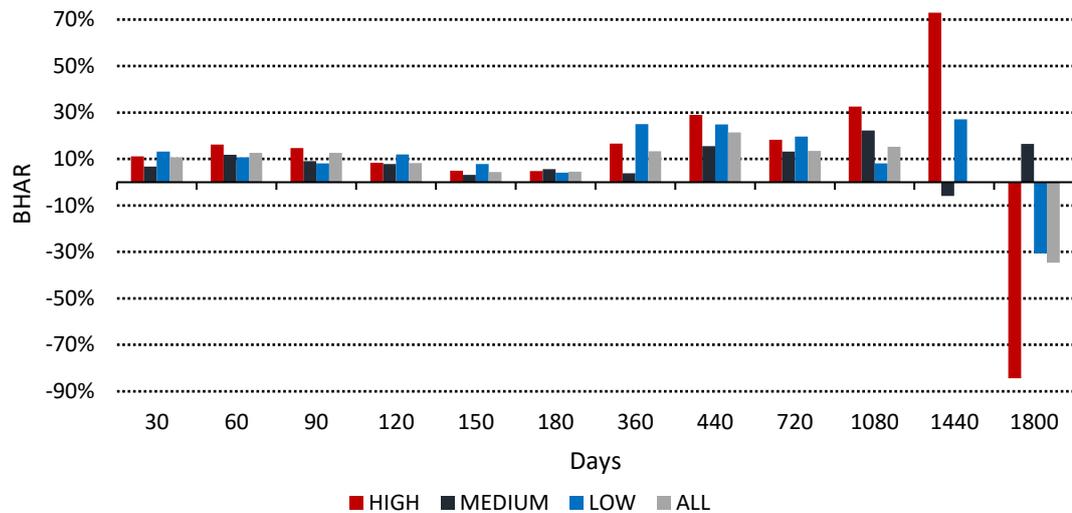
Figure 6. P/V portfolio BHARs based on comparable company method for selected periods

Figure 7 illustrates the daily median BHARs of the entire sample and P/V portfolios based on EV/EBITDA valuation differences calculated with equity research method peers. It can be observed from the graph that the performance of the portfolios does not differ significantly in the first approximate 1,200 days after the IPO. Thereafter, the BHARs of low and high portfolios start to decline to negative but the performance of the medium portfolio peaks ending to a significant overperformance. The low portfolio underperforms other portfolios in the last 600 days except the very last ones on which the high portfolio ends in the lowest performance supporting the fourth hypothesis of the study.
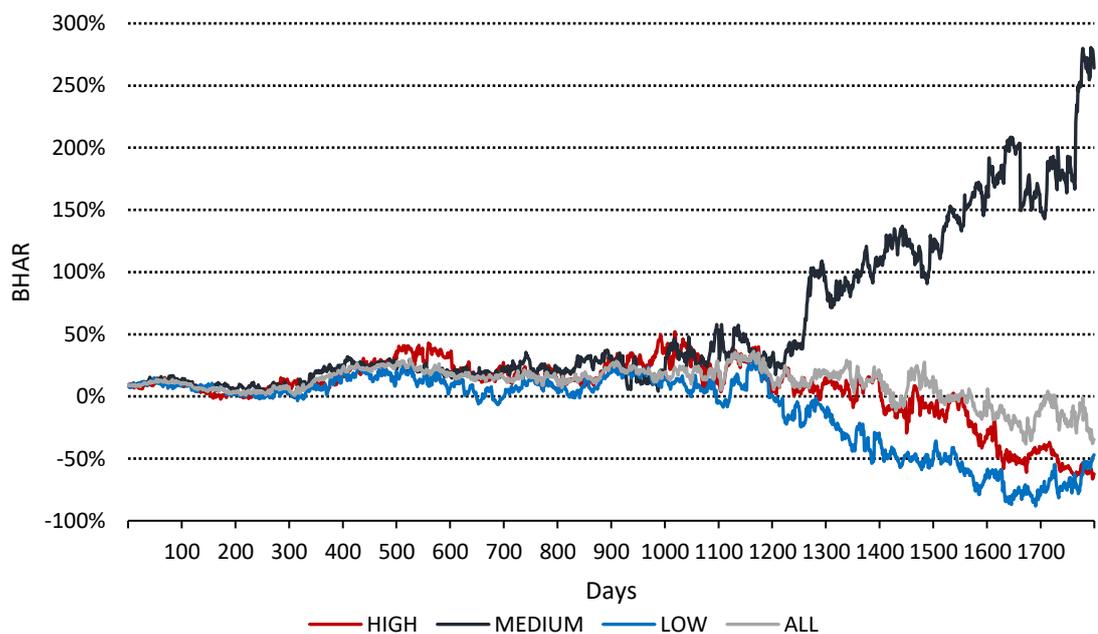
Figure 7. Daily median BHARs of P/V portfolios based on equity research method

Figure 8 illustrates the equity research P/V portfolio BHARs focusing on certain periods. Like the comparable company method, both the data and the graph show no relation between the initial valuation level and short run performance, contradicting the third hypothesis of the study.
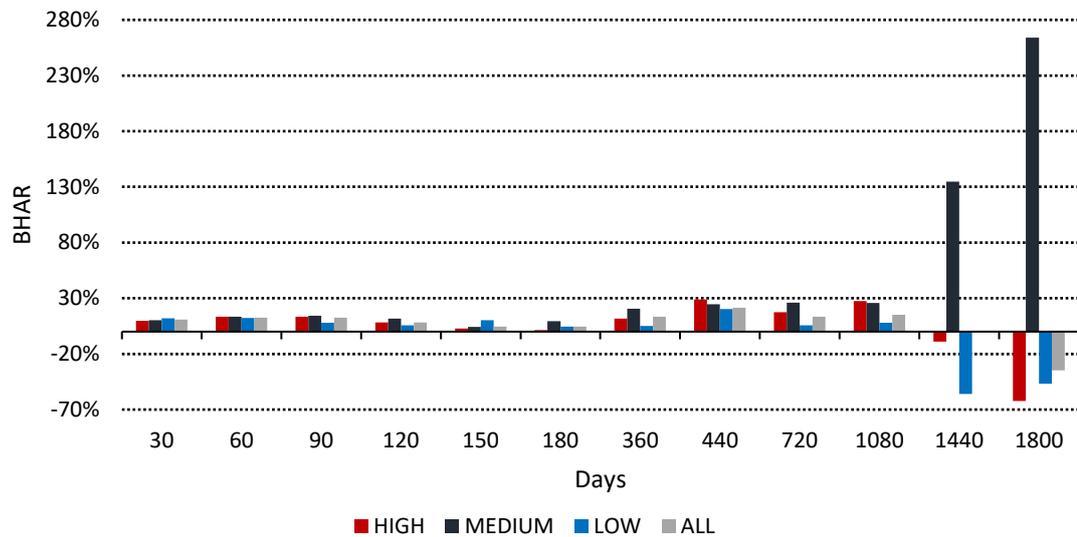
Figure 8. P/V portfolio BHARs based on equity research method for selected periods

Table 8 includes the comparable company P/V portfolio BHARs for the periods of interest. Although the analyses support the prior results of IPOs with the highest initial relative valuation exhibiting the worst performance on the long run, the results should be viewed with caution as none of the high and low portfolio differences are statistically significant. Appendix 4 presents the differences of medium portfolio BHARs that also exhibit statistical insignificance between both low and high portfolio returns on all timeframes. This implies that there exists no statistically significant relation between the initial relative valuation level and share performance in Nordic IPOs.

Table 8. BHARs of P/V portfolios based on comparable company method by timeframe

The table includes median and mean BHARs of each portfolio assigned by the EBITDA-based valuation ratio determined with peers based on comparable company method. The periods for the returns range from 6 to 60 months with closing prices adjusted for splits and other capital changes. BHARs are calculated using NASDAQ OMX Nordic 120 index as the benchmark. Panel A shows the median BHARs with *p*-values referring to Wilcoxon rank sum test of the equality of the medians and Panel B shows the mean BHARs with *p*-values referring to Student's t-test testing the equality of the means, both under the assumption of independence.

Panel A: Median BHARs of portfolios based on comparable company method						
	6 months	12 months	24 months	36 months	48 months	60 months
Low	4.1 %	25.0 %	19.6 %	8.1 %	27.0 %	-30.1 %
Medium	5.6 %	3.9 %	13.1 %	22.2 %	-5.9 %	16.4 %
High	4.8 %	16.7 %	18.3 %	32.5 %	73.0 %	-84.0 %
Low - High	-0.7%	8.3%	1.3%	-24.4%	-56.0%	53.9%
p-value	0.294	0.975	0.857	0.731	0.883	0.557
Panel B: Mean BHARs of portfolios based on comparable company method						
Low	37.0 %	52.7 %	69.6 %	216.5 %	183.6 %	50.8 %
Medium	16.3 %	24.0 %	46.9 %	107.3 %	198.5 %	144.4 %
High	36.5 %	57.9 %	106.9 %	154.6 %	206.2 %	39.6 %
Low - High	1.5%	-5.2%	-37.3%	61.9%	-22.6%	11.2%
p-value	0.190	0.983	0.491	0.638	0.911	0.912

Table 9 shows the equity research P/V portfolio BHARs for the selected periods. The results of the tests exhibit similar characteristics as the ones based on comparable company method. The *p*-values show no statistical significance in the differences between high and low portfolio performance. However, the significant overperformance of the medium portfolio is statistically significant on longer timeframes, as shown in Appendix 5. The differences between the medium portfolio four and five-year BHARs and both high and low portfolio returns are statistically significant at 5% level, except the difference of medium and high portfolios on a four-year period at 1% level. This implies that fairly or accurately valued IPOs with a P/V ratio approaching 1, based on analyst-selected peers, perform the best in the long run.

Table 9. BHARs of P/V portfolios based on equity research method by timeframe

The table includes median and mean BHARs of each portfolio assigned by the EBITDA-based valuation ratio determined with peers based on equity research method. The periods for the returns are ranging from 6 to 60 months with closing prices adjusted for splits and other capital changes. BHARs are calculated using NASDAQ OMX Nordic 120 index as the benchmark. Panel A shows the median BHARs with *p*-values referring to Wilcoxon rank sum test of the equality of the medians and Panel B shows the mean BHARs with *p*-values referring to Student's t-test testing the equality of the means, both under the assumption of independence.

Panel A: Median BHARs of portfolios based on equity research method						
	6 months	12 months	24 months	36 months	48 months	60 months
Low	4.5 %	5.0 %	5.7 %	8.1 %	-55.8 %	-46.8 %
Medium	9.4 %	20.5 %	26.1 %	25.8 %	134.8 %	263.9 %
High	13.2 %	11.6 %	17.3 %	27.4 %	-8.9 %	-62.4 %
Low - High	-8.7%	-6.6%	-11.6%	-19.3%	-46.9%	15.6%
p-value	0.608	0.565	0.975	0.526	0.352	0.977
Panel B: Mean BHARs of portfolios based on equity research method						
Low	14.0 %	21.2 %	69.2 %	228.7 %	194.2 %	-42.7 %
Medium	10.5 %	28.4 %	59.7 %	110.1 %	344.0 %	262.7 %
High	20.0 %	38.8 %	88.5 %	134.4 %	-2.2 %	-28.5 %
Low - High	-6.0%	-17.6%	-19.3%	94.3%	196.4%	-14.2%
p-value	0.627	0.364	0.716	0.471	0.148	0.733

The BHAR tables show significant deviations between mean and median figures indicating the presence of outliers. Also, it can be noted that the medium, or the fairly valued, portfolio outperforms others, and even the benchmark index, while the entire IPO sample exhibits the expected share underperformance on the long run.

5.2.3 BHAR regressions

The factors affecting the after-market performance are examined with OLS regressions using BHARs as the dependent variable. Multiple regressions are conducted for both short and long-run timeframes with returns ranging from three months to five years. The selection of independent variables is similar to Purnanandam and Swaminathan (2004) but also includes several additional characteristics, which are the same used in the P/V regression analyses, to examine whether they have an effect on the after-market valuation. Additionally, the initial EBITDA-based valuation ratio, *P/V ratio*, is added as an independent variable to study the relation between the IPO valuation and after-market performance. The natural logarithm of

the valuation ratio is used as the data is skewed. The regression models for both peer selection methods are as follows:

For short-run periods of three, six, and twelve months and long-run periods of two, three, four, and five years:

$$
\begin{aligned}
BHAR_i = a &+ b \times \ln{(P/V\ ratio_i)} + c \times ln(Sales_i) \\
&+ d \times EBITDA\ margin_i + e \times Earnings_i + f \times Growth_i \\
&+ g \times Anchored_i + h \times PE\ dummy_i + i \times Tech\ dummy_i \\
&+ u_i
\end{aligned}
\tag{13}
$$

No multicollinearity problems affect the models as the pair-wise correlations between the independent variables do not exceed 0.5. Table 10 presents the results of the short-run regressions. Previous studies have shown mixed results for the factors affecting the short-run BHARs. In line with Pöyhönen (2009), the P/V ratios, regardless of the peer selection method, have weak and mainly statistically insignificant effect on the short-run share performance. The growth has a higher, however modest, positive correlation with three-month and six-month BHARs, statistically significant on 5% level. Also, the high-tech industry classification has a positive effect on the twelve-month BHARs, statistically significant on 1% level. Additionally, EBITDA margin has more significant positive correlation with the twelve-month BHAR, however statistically significant on 10% level and only for the peer selection method based on equity research. In the end, the r-squared values are significantly low for the models implying that the pre-IPO factors are weak to explain the variance in short-run BHARs.

Table 10. Short-run BHAR regressions for different peer selection methods

The table shows the OLS regression results for the short-run BHARs on three, six, and twelve-month timeframes for both peer selection methods. Ln(P/V ratio) is the natural logarithm of the EBITDA-based initial relative valuation level calculated with the designated peer selection method. Ln(Sales) is the natural logarithm of the prior fiscal year sales. EBITDA margin and net income refer to the prior fiscal year financials reported where EBITDA margin is calculated by dividing the EBITDA by the sales. Growth is calculated as the change in sales within two years prior the listing. Anchored is the share of the stock that the cornerstone investors have agreed to mark in the IPO, according to the agreements listed in the prospectus. PE dummy is a dummy variable that equals one if the company was backed by an investment company prior the IPO. Tech dummy is a dummy variable that equals one for companies classified to high-tech sector defined by Kile and Phillips (2009). Numbers in brackets refer to p-values and the significance of each coefficient is shown by ***, **, and * at 1%, 5%, and 10% level, respectively.

	Dependent variables					
Peer selection method	Comparable company			Equity research		
Independent variables	$BHAR_{[3M]}$	$BHAR_{[6M]}$	$BHAR_{[12M]}$	$BHAR_{[3M]}$	$BHAR_{[6M]}$	$BHAR_{[12M]}$
Intercept	0.31 [0.417]	0.23 [0.661]	0.09 [0.908]	0.29 [0.436]	0.07 [0.900]	-0.10 [0.900]
Ln(P/V ratio)	-0.02 [0.511]	-0.07* [0.078]	-0.08 [0.211]	-0.02 [0.961]	-0.01 [0.903]	0.04 [0.648]
Ln(Sales)	-0.01 [0.647]	-0.00 [0.934]	0.00 [0.981]	-0.01 [0.649]	0.00 [0.888]	0.01 [0.850]
EBITDA margin	-0.21 [0.407]	-0.34 [0.347]	0.89 [0.137]	-0.21 [0.416]	-0.24 [0.503]	1.07* [0.075]
Net income	-0.00 [0.561]	-0.00 [0.629]	-0.00 [0.530]	-0.00 [0.554]	-0.00 [0.630]	-0.00 [0.545]
Growth	0.16** [0.044]	0.26** [0.022]	0.22 [0.220]	0.17** [0.042]	0.25** [0.035]	0.17 [0.375]
Anchored	-0.18 [0.139]	0.04 [0.822]	0.06 [0.811]	0.18 [0.140]	0.43 [0.807]	0.09 [0.743]
PE dummy	-0.10 [0.150]	-0.09 [0.324]	-0.19 [0.177]	-0.10 [0.156]	-0.10 [0.277]	-0.20 [0.162]
Tech dummy	0.07 [0.330]	0.12 [0.268]	0.50*** [0.002]	0.08 [0.325]	0.11 [0.302]	0.48*** [0.003]
Country dummies	yes	yes	yes	yes	yes	yes
r^2	0.068	0.058	0.135	0.067	0.042	0.127

Table 11 shows the long-run regression results. Prior research has shown differing results also for the factors affecting BHARs on the long run. The P/V ratios of both peer selection methods have higher coefficients for the long-run BHARs, however also statistically insignificant. Other factors show no statistically significant patterns but rather random effects on the BHARs. Sales has weak negative effects on the share performance converging to imperceptibly low positive correlation for the five-year BHARs. Also, the sales coefficients are statistically significant, on 10% level, only for the four-year BHARs.

EBITDA margins have higher positive coefficients until dropping significantly with five-year BHARs, however statistically significant only for two-year BHARs on 10% and 5% levels for comparable company and equity research peers, respectively. In addition, the coefficient of an investment company ownership drops significantly in the four-year BHAR model, where only they are also statistically significant on 10% level.

Table 11. Long-run BHAR regressions for different peer selection methods

The table shows the OLS regression results for the long-run BHARs on two, three, four, and five-year timeframes for both peer selection methods. Ln(P/V ratio) is the natural logarithm of the EBITDA-based initial relative valuation level calculated with the corresponding peer selection method. Ln(Sales), EBITDA margin, and net income refer to prior fiscal year financials where natural logarithm of sales is used and EBITDA margin is calculated by dividing the EBITDA by the sales. Growth is calculated as the change in sales within two years prior the listing. Anchored is the share of the stock that the cornerstone investors have agreed to mark in the IPO, according to the agreements listed in the prospectus. PE dummy is a dummy variable that equals one if the company was backed by an investment company prior the IPO. Tech dummy equals one for high-tech companies defined by Kile and Phillips (2009). Numbers in brackets refer to p-values and the significance of each coefficient is denoted by ***, **, and * at 1%, 5%, and 10% level, respectively.

	Dependent variables							
Peer selection method	Comparable company				Equity research			
Independent variables	$BHAR_{[2Y]}$	$BHAR_{[3Y]}$	$BHAR_{[4Y]}$	$BHAR_{[5Y]}$	$BHAR_{[2Y]}$	$BHAR_{[3Y]}$	$BHAR_{[4Y]}$	$BHAR_{[5Y]}$
Intercept	1.80 [0.374]	9.13* [0.070]	8.57 [0.254]	0.85 [0.888]	1.44 [0.475]	9.40* [0.063]	9.35 [0.210]	0.77 [0.899]
Ln(P/V ratio)	-0.09 [0.617]	-0.66 [0.123]	0.47 [0.503]	-0.12 [0.815]	0.18 [0.469]	-0.90 [0.115]	-1.28 [0.169]	0.17 [0.836]
Ln(Sales)	-0.10 [0.365]	-0.46* [0.080]	-0.42 [0.292]	0.02 [0.957]	-0.08 [0.442]	-0.50* [0.060]	-0.43 [0.273]	0.02 [0.962]
EBITDA margin	3.11* [0.068]	5.60 [0.154]	8.48 [0.154]	1.10 [0.848]	3.39** [0.045]	5.86 [0.133]	7.26 [0.215]	1.17 [0.839]
Net income	-0.00 [0.629]	-0.00 [0.764]	-0.00 [0.998]	-0.00 [0.694]	-0.00 [0.646]	-0.00 [0.612]	-0.00 [0.988]	-0.00 [0.738]
Growth	-0.31 [0.541]	-1.00 [0.394]	-0.52 [0.780]	1.43 [0.467]	-0.39 [0.456]	-0.65 [0.588]	-0.04 [0.981]	1.10 [0.613]
Anchored	0.29 [0.680]	2.14 [0.184]	3.42 [0.136]	-0.74 [0.682]	0.38 [0.588]	1.83 [0.263]	2.41 [0.297]	-0.68 [0.711]
PE dummy	0.03 [0.944]	-0.69 [0.457]	-2.57* [0.070]	-0.26 [0.820]	-0.01 [0.981]	-0.55 [0.552]	-2.44* [0.083]	-0.22 [0.847]
Tech dummy	0.62 [0.154]	0.94 [0.365]	0.06 [0.972]	-0.57 [0.671]	0.57 [0.187]	1.06 [0.310]	0.25 [0.880]	-0.49 [0.712]
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
r^2	0.078	0.128	0.143	0.033	0.080	0.129	0.162	0.033

However, a shortcoming of the portfolio sorting method used is the fact that the long-run performance may be diluted as the analysis focuses on the portfolios instead of the cross-sectional averages and medians of the IPO companies. Also, empirically, tests based on long-run returns are affected by a variety of measurement issues. Research has not found a consensus on whether to use event time or calendar time, or what is the best methodology for detecting abnormalities in the performance. (see e.g. Barber & Lyon 1997; Kothari & Warner 1997; Lyon, Barber & Tsai 1999; Brav 2000) Accordingly, the results concerning long-run share performance are to be interpreted with caution.

5.3 Limitations of the study

The research is subject to several limitations that need to be acknowledged. Although the inclusion rate of the data is higher, the sample size itself is rather small due to the size of the financial markets and the market share of Nasdaq in the Nordics. Also, the low r-squared values imply that the multivariate regressions omit several explanatory variables. However, as depicted in the literature review, the universe of theories offered to explain both the initial relative valuation level, and long-term performance is vast and purposeless to be attempted to fully capture in a single regression analysis study.

Also, several constraints apply to the methods used in the study. The relative valuation as a means to derive the value of a company has its disadvantages in itself that are described in Section 2.1.1. Related to the drawbacks, the aspect of valuation including multiple methods and the mandatory case-specific multiplier adjustments are omitted in the methodology of the study. After all, these multiplier adjustments can be related to any peer company characteristics discussed in Section 2.1.1.

Another limitation concerning the data is the timeframe of the datapoints. The company financials used in the study are from one fiscal year prior to the listing whereas in reality bankers may use trailing twelve-month figures, data from last four quarters or forward-looking numbers. However, the financials reported in prospectuses have no universal standard form as the quarterly reporting is mandatory only after the IPO, and the listing documents are usually restricted to not include forecasts or to express them only in a very conservative manner (see e.g. Espinasse 2011; Drobetz, Gounopoulos, Merika & Merikas 2017).

In view of the omitted timeframe and adjustment aspects, a question arises that whether the slight overvaluation indicated equity research peers method could show statistically significant undervaluation of IPOs, bridging the practical valuation and the share pricing discount, by using more recent financials as denominators and incorporating the adjustments to the ratios. The current research has not been able to link these but have contradictorily separated the (relative) valuation and share pricing (at a discount) as events. Contemporary research uses algorithms that are focusing on size, profitability, industry, and growth in selecting peer companies for relative valuation, for example the comparable company method. This omits several characteristics used by analysts, listed in Section 2.1.1, and in fact focuses on variables that analysts do not prioritize in selecting the peers for the valuation, as shown in the Section 4.1.4. Also, the traditional research uses industry classification to proxy several different peer characteristics, for example riskiness and growth, usually based on the SIC classification that is perceived as the most comprehensive industry classification standard. To point out, the SIC system was last revised in 1987 and several problems regarding the definitions, identification, the hierarchical structure, and its boundaries have still been noted (Schmitt & Rossetti 1987). Hence, it could be asked that what kind of value the research adds if it relies on factors that do not reflect the valuation in the real world?

6 Summary and conclusions

The thesis researched the initial relative valuation of IPOs and its relation to the after-market performance on both short and long run in Nasdaq Nordic markets with a sample of 200 listings in 2010-2021. In addition to the conventional industry-based peer matching algorithm, the comparable company method, a distinct approach to obtain the peers utilising equity research was proposed and compared with different common valuation multiples.

Most previous studies focusing on the relative valuation of IPOs have explicitly relied on the comparable company method or other aggregate algorithms including questionable proxies for peer matching (see e.g. Purnanandam & Swaminathan 2004; Pöyhönen 2009; Hämäläinen 2017). The study provides evidence of the significant differences between the peer matching method with the aim of linking the theoretical and practical aspects of relative valuation by using analyst-selected peers. Furthermore, the research broaches the Nordic markets that have received little attention in the relative valuation literature.

Table 12 presents a summary of the research hypotheses tested and the empirical evidence obtained. Surprisingly, the empirical evidence obtained supports only two of the hypotheses regarding the initial valuation of Nordic IPOs compared to their global peers, and the differences between the relative valuation levels obtained with comparable company method and equity research approach. The results give no evidence of the initial relative valuation level to affect the immediate or long-run after-market performance of the IPO companies.

Table 12. Hypotheses and empirical evidence

The table shows all the hypotheses tested in the study with empirical evidence obtained to either support or to not support the corresponding hypothesis.

Hypothesis	Empirical evidence
H1: Nordic IPOs are overvalued compared to their global peers	**Supported.** Peers obtained by the comparable company method indicate an initial overvaluation of 62% and 73% calculated with Sales and EBITDA-based multiples, respectively. However, peers determined with equity research method result in lower overvaluation of 11% and 16% with Sales and EBITDA-based multiples, respectively, that is statistically significant mainly only for the entire sample but not for individual years.
H2: Nordic IPOs with the highest relative valuation level have higher returns on the first trading day	**Not supported.** Both peer selection approaches yield either mixed or opposite results that are statistically insignificant. Based on the results it cannot be stated that the initial high valuation would follow to the market as immediate higher valuation levels after the listing.
H3: Nordic IPOs with the highest relative valuation level have higher abnormal returns compared to other IPOs during the first six months after the IPO	**Not supported.** Both methods used for the peer selection show no correlation between the initial valuation level and short-run BHARs. Furthermore, the results are statistically insignificant for both methods. To conclude, it cannot be stated that higher initial valuation level would hold in the markets for the first six months.
H4: Nordic IPOs with the highest relative valuation underperform the most in the long run	**Not supported.** Although the results of both peer selection approaches indicate the highest valued IPOs to underperform the most in the long run, however equity research barely, the results are statistically insignificant. Thus, the existence of an uncoincidental relationship between higher initial valuation level and the lowest performance on the long run cannot be supported. On the contrary, equity research method shows the accurately valued IPOs outperforming in the long run.
H5: Equity research approach yields lower relative valuation levels compared to the comparable company method applied in the peer selection	**Supported.** The equity research method indicates significantly lower initial valuation for the IPOs than the comparable company method. The differences between the obtained valuation levels for the entire sample are -51 and -57 percentage points for Sales and EBITDA-based multiples, respectively.

To answer the first research question *"What is the relationship between the valuation levels of Nordic IPOs and their peer companies?"* it can be concluded that Nordic IPOs are overvalued, however with the magnitude of overvaluation being conditional to the method of selecting peer companies. Comparable company method leads into prominent overvaluation versus lower and more stable relative valuation levels obtained with equity research method. The regression analysis results show that smaller companies with lower profitability and stronger growth are valued higher compared to their peers regardless of the peer matching method, being in line with prior literature (see e.g. Baker & Wurgler 2007).

Comparable company method yields similar results as obtained by previous research for both initial valuation and long-run after-market performance (see e.g. Pöyhönen 2009; Hämäläinen 2017). However, the results regarding market performance are statistically insignificant for every timeframe observed. Equity research method exhibits similar results except for the medium portfolio that overperforms high and low portfolios on the long run. The differences are statistically significant for four and five-year periods with the median differences of returns ranging from 143.7% to 326.3%. Thus, the answer for the second question of the study, *"What effect does the relative valuation level have on Nordic IPOs after-market performance?"*, can be formulated that there exists no statistically significant relationship between the initial relative valuation level and after-market performance in Nordic IPOs if comparable company method is applied. Additionally, equity research approach shows that the fairly valued IPOs with P/V ratio approaching 1 outperform IPOs with greater deviations in the relative valuation ratio compared to the peers. Furthermore, the results of the regression analyses show that high-tech companies with strong growth track perform better on short run whereas smaller and more profitable companies tend to show better performance on the long run. Also, the private equity-backed companies exhibit underperformance on longer timeframes.

Based on the empirical evidence, the answer for the third research question, *"How does the valuation level and after-market performance vary between comparative company method and equity research method applied in determining the peer valuation multiples?"*, is that the multiples calculated with peers selected utilizing equity research reports yield significantly lower relative valuation levels. Also, the market performance is different between shares with different initial relative valuation levels for the two studied methods of selecting peer companies. However, the differences in after-market performance are

statistically insignificant for both methods implying no advantage for investors using either of the peer selection approaches.

The results imply that different peer selection methods yield significantly different results leaving numerous opportunities for future research. The opportunity of equity research approach identifying wealth maximisation benefits with fairly valued IPOs should be tested in other markets. Also, given the consequentially lower, almost negligible, overvaluation shown by the multiples based on analyst-selected peers and the limitations relating to the timeframe of the financials and to adjustments on the multiples, a possibility to study the practical price discount with relative valuation exists. By obtaining more recent financials and simulating the differences between peers and targets, to incorporate the adjustments on the multiples, the differences between the practical price discount and the market perception of the intrinsic value of the company could be studied. Thus, the practical valuation and underpricing could be linked. Furthermore, these differences would reveal valuable information on the investors between markets and general economic conditions.

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Appendix 1. Industry classification by Fama and French (1997)

#	Industry	SIC codes
1.	Agriculture	0100-0799, 2048-2048
2.	Food Products	2000-2046, 2050-2063, 2070-2079, 2090-2095, 2098-2099
3.	Candy and Soda	2064-2068, 2086-2087, 2096-2097
4.	Alcohol Beverages	2080-2085
5.	Tobacco Products	2100-2199
6.	Recreational Products	0900-0999, 3650-3652, 3732-3732, 3930-3949
7.	Entertainment	7800-7841, 7900-7999
8.	Printing and Publishing	2700-2749, 2770-2799
9.	Consumer Goods	2047-2047, 2391-2392, 2510-2519, 2590-2599, 2840-2844, 3160-3199, 3229-3231, 3260-3260, 3262-3263, 3269-3269, 3630-3639, 3750-3751, 3800-3800, 3860-3879, 3910-3919, 3960-3961, 3991-3991, 3995-3995
10.	Apparel	2300-2390, 3020-3021, 3100-3111, 3130-3159
11.	Healthcare	8000-8099
12.	Medical Equipment	3693-3693, 3840-3851
13.	Pharmaceutical Products	2830-2836
14.	Chemicals	2800-2829, 2850-2899
15.	Rubber and Plastic Products	3000-3000, 3050-3099
16.	Textiles	2200-2295, 2297-2299, 2393-2395, 2397-2399
17.	Construction Materials	0800-0899, 2400-2439, 2450-2459, 2490-2499, 2950-2952, 3200-3219, 3240-3259, 3261-3261, 3264-3264, 3270-3299, 3996-3996
18.	Construction	1500-1549, 1600-1699, 1700-1799
19.	Steel Works, Etc.	3300-3369, 3390-3399
20.	Fabricated Products	3400-3400, 3443-3444, 3460-3479
21.	Machinery	3510-3536, 3540-3569, 3580-3599
22.	Electrical Equipment	3600-3621, 3623-3629, 3640-3646, 3648-3649, 3660-3660, 3691-3692, 3699-3699
23.	Miscellaneous	3900-3900, 3990-3990, 3999-3999, 9900-9999
24.	Automobiles and Trucks	2296-2296, 2396-2396, 3010-3011, 3537-3537, 3647-3647, 3694-3694, 3700-3716, 3790-3792, 3799-3799, 3720-3729
25.	Aircraft	3720-3729
26.	Shipbuilding, Railroad	3730-3731, 3740-3743
27.	Defense	3480-3489, 3760-3769, 3795-3795
28.	Precious Metals	1040-1049
29.	Nonmetallic Mining	1000-1039, 1060-1099, 1400-1499
30.	Coal	1200-1299

#	Industry	SIC codes
31.	Petroleum and Natural Gas	1310-1389, 2900-2911, 2990-2999
32.	Utilities	4900-4999
33.	Telecommunications	4800-4899
34.	Personal Services	7020-7021, 7030-7039, 7200-7212, 7215-7299, 7395-7395, 7500-7500, 7520-7549, 7600-7699, 8100-8199, 8200-8299, 8300-8399, 8400-8499, 8600-8699, 8800-8899
35.	Business Services	2750-2759, 3993-3993, 7300-7372, 7374-7394, 7397-7397, 7399-7399, 7510-7519, 8700-8748, 8900-8999
36.	Computers	3570-3579, 3680-3689, 3695-3695, 7373-7373
37.	Electronic Equipment	3622-3622, 3661-3679, 3810-3810, 3812-3812
38.	Measuring and Control Equipment	3811-3811, 3820-2830
39.	Business supplies	2520-2549, 2600-2639, 2670-2699, 2760-2761, 3950-3955
40.	Shipping Containers	2440-2449, 2640-2659, 3210-3221, 3410-3412
41.	Transportation	4000-4099, 4100-4199, 4200-4299, 4400-4499, 4500-4599, 4600-4699, 4700-4799
42.	Wholesale	5000-5099, 5100-5199
43.	Retail	5200-5299, 5300-5399, 5400-5499, 5500-5599, 5600-5699, 5700-5736, 5900-5999
44.	Restaurant, Hotel, Motel	5800-5813, 5890-5890, 7000-7019, 7040-7049, 7213-7213
45.	Banking	6000-6099, 6100-6199
46.	Insurance	6300-6399, 6400-6411
47.	Real Estate	6500-6553
48.	Trading	6200-6299, 6700-6799

Appendix 2. Equity research service providers

#	Service provider	Website
1.	ABG Sundal Collier	www.abgsc.com
2.	Analysguiden	www.aktiespararna.se/analysguiden
3.	Analyst Group	www.analystgroup.se
4.	Berenberg	www.berenberg.de
5.	Carlsquare	www.carlsquare.com
6.	Credit Suisse	www.credit-suisse.com
7.	DNB Markets	www.dnb.no
8.	Erik Penser Bank	www.penser.se
9.	Evli	www.evli.com/equity-research
10.	Goldman Sachs	www.goldmansachs.com
11.	HC Andersen Capital	www.hcandersencapital.dk
12.	Inderes	www.inderes.fi
13.	J.P. Morgan	www.jpmorgan.com
14.	Mangold Insight	www.mangold.se
15.	Nordea	www.research.nordea.com
16.	OP Equity Analysis	www.op.fi
17.	Redeye	www.redeye.se
18.	Remium	www.remium.com
19.	SEB	www.research.sebgroup.com
20.	UBS	www.ubs.com
21.	Wright Investor's Service	www.wrightinvestorsservice.com

Appendix 3. High-tech industry classification by Kile and Phillips (2009)

SIC Code	Industry Name
283	Drugs
357	Computer and Office Equipment
366	Communication Equipment
367	Electronic Components and Accessories
382	Surgical, Medical, Dental Equipment
384	Laboratory, Optic, Measure, Control Instruments
481	Telephone Communications
482	Miscellaneous Communication Services
489	Communication Services, NEC
737	Computer Programming, Data Processing, etc.
873	Research, Development, Testing Services

Appendix 4. BHAR differences of medium P/V comparable company method portfolio

The table includes median and mean differences in BHARs of medium portfolio and high and low portfolios by the EBITDA-based valuation ratio determined with peers based on comparable company method. The periods for the differences in returns range from 6 to 60 months with closing prices adjusted for splits and other capital changes. BHARs are calculated using NASDAQ OMX Nordic 120 index as the benchmark. Panel A shows the differences in medians with *p*-values referring to Wilcoxon rank sum test of the equality of the medians and Panel B shows the differences in means with *p*-values referring to Student's t-test testing the equality of the means, both under the assumption of independence.

Panel A: Median BHAR differences of medium P/V portfolio						
	6 months	12 months	24 months	36 months	48 months	60 months
Medium - Low	1.5%	-21.1%	-6.5%	14.1%	-32.9%	46.5%
p-value	0.458	0.247	0.503	0.867	0.646	0.403
Medium - High	0.8%	-12.8%	-5.2%	-10.3%	-78.9%	100.4%
p-value	0.831	0.214	0.500	0.829	0.990	0.382
Panel B: Mean BHAR differences of medium P/V portfolio						
Medium - Low	-20.7%	-28.7%	-22.7%	-109.2%	14.9%	93.6%
p-value	0.334	0.213	0.528	0.317	0.958	0.318
Medium - High	-20.2%	-33.9%	-60.0%	-47.3%	-7.7%	104.8%
p-value	0.753	0.197	0.190	0.517	0.931	0.456

Appendix 5. BHAR differences of medium P/V equity research method portfolio

The table includes median and mean differences in BHARs of medium portfolio and high and low portfolios by the EBITDA-based valuation ratio determined with peers based on equity research approach. The periods for the differences in returns range from 6 to 60 months with closing prices adjusted for splits and other capital changes. BHARs are calculated using NASDAQ OMX Nordic 120 index as the benchmark. Panel A shows the differences in medians with *p*-values referring to Wilcoxon rank sum test of the equality of the medians and Panel B shows the differences in means with *p*-values referring to Student's t-test testing the equality of the means, both under the assumption of independence.

	6 months	12 months	24 months	36 months	48 months	60 months
Panel A: Median BHAR differences of medium P/V portfolio						
Medium - Low	4.9%	15.5%	20.4%	17.7%	190.6%	310.7%
p-value	0.891	0.364	0.660	0.670	0.012**	0.012**
Medium - High	-3.8%	8.9%	8.8%	-1.6%	143.7%	326.3%
p-value	0.533	0.762	0.814	0.880	0.001***	0.015**
Panel B: Mean BHAR differences of medium P/V portfolio						
Medium - Low	-3.5%	7.2%	-9.5%	-118.6%	149.8%	305.4%
p-value	0.695	0.645	0.798	0.284	0.396	0.007***
Medium - High	-9.5%	-10.4%	-28.8%	-24.3%	346.2%	291.2%
p-value	0.400	0.545	0.521	0.731	0.018**	0.010***