

Private Equity-Backed Initial Public Offerings

– Share Allocation and Secondary Distribution Overhang

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Abstract

We examine short-run underpricing and long-run performance differences between private equity-backed and non-private equity-backed initial public offerings by evaluating 101 transactions between 2000 and 2014 in the Nordic countries (Sweden, Denmark, Norway and Finland), whereby 45 offerings were private equity-backed. Initially, we explore the mere existence of short-run underpricing and long-run underperformance for all initial public offerings. Subsequently, we investigate the actuality of any short-run underpricing and long-run performance dissimilarities between private equity-backed and non-private equity-backed offerings and explain the documented performance difference by examining how secondary distribution overhang affects the long-run performance of private equity-backed offerings. Furthermore, we explore share allocation differences between private equity-backed and non-private equity-backed offerings. We employ shareholder return focus throughout the research, which instigates equal weighted and value weighted buy-and-hold abnormal returns with event time convention. We document that private equity-backed offerings are less underpriced than non-private equity-backed offerings and institutional investors receive higher share allocation for private equity-backed offerings. Initial public offerings exhibit long-run underperformance, whereas private equity-backed offerings demonstrate lower long-run underperformance than non-private equity-backed offerings, with positive abnormal returns over five years. Private equity-backed offerings underperform non-private equity-backed offerings before first secondary distribution and outperform non-private equity-backed offerings after the final secondary distribution, which suggests secondary distribution overhang.

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Keywords: Initial Public Offerings, Private Equity-Backed Initial Public Offerings, Share Allocation, Secondary Distribution, Overhang

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Presentation: 27 May, 2014

Location: Stockholm School of Economics, Sveavägen 65, Stockholm, Sweden

We want to express our gratitude towards our tutor, Assistant Professor Cristina Cella, for valuable guidance and support, and Assistant Professor Michael Halling, for helpful assistance regarding econometrics.

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1. Introduction

The Nordic markets are currently experiencing extraordinary initial public offering (“IPO”) volumes, with more offerings during the last twelve months than the previous two years. Investors will encounter numerous investment decisions regarding offering participation going forward, since offering advisors predict dramatic volume increases over the coming years (PwC, 2014). Media has been critical towards private equity-backed offerings (Affärsvärlden, 2012), whereas academic consensus has been positive. Previous research on short-run underpricing and long-run performance regarding private equity-backed offerings has been extensive, though prevailing academic literature exhibits scarcity concerning the share price performance effect from the exit process by private equity vendors.

Our research integrates the previous literature on short-run underpricing and long-run performance of private equity-backed offerings through the analysis of share allocation at initial public offering and share performance effects from secondary distributions. The short-run underpricing research has been complemented with analysis regarding share allocation differences between private equity-backed and non-private equity-backed offerings, since previous research suggests that institutional investors rationally support aftermarket share prices, which should be desired by private equity vendors who generally divest substantial ownership through secondary distributions. The long-run performance analysis has been supplemented with examinations concerning share price performance before first secondary distribution and after final secondary distribution. The study enables conclusions regarding the long-run performance impact from share overhang due to ownership retained by the private equity vendors, since market participants should anticipate additional secondary distributions through the aftermarket.

Our dataset comprises 101 main list offerings between January 2000 and April 2014 in the Nordic countries (excluding Iceland), whereof 45 offerings were private equity-backed. The average pre-offering private equity ownership was 70 per cent, while the average post-offering private equity ownership was 36 per cent. Approximately 58 per cent of the private equity-backed offerings have been entirely divested by the private equity vendor.

We have utilized group pair matching for the short-run underpricing and long-run performance analysis where we control for sector, country, timing, size and leverage. Additionally, we have employed multivariate regressions, since group matching procedures

generally exclude many observations due to absence from relevant control observations. The multivariate regressions control for equivalent factors, while allowing for fewer exclusions. We have utilized buy-and-hold abnormal returns, since shareholder return focus has been employed throughout the research. Furthermore, the overhang analysis requires event time convention, which has been employed exclusively for consistency and comparability.

The analysis regarding share price performance before first secondary distribution and after final secondary distribution requires event time matching between each private equity-backed offering with secondary distributions and non-private equity-backed offerings. Event time windows diverge considerably, since secondary distribution dates relative to offering dates differ substantially between the private equity-backed offerings. Moreover, the absence from relevant control observations has been insignificant for the overhang study. Therefore, we performed univariate pair matching analysis only.

The prevailing literature within private equity-backed initial public offerings demonstrates scarcity, particularly within our geographical concentration. Previous research partially ignores the explanation for diverse performance between private equity-backed and non-private equity-backed offerings, and merely demonstrates dissimilar performance without offering further justified explanations. We explain diverse returns between private equity-backed and non-private equity-backed offerings by unique features that distinguish private equity-backed offerings. The most distinctive characteristic of private equity-backed offerings are the uniform purpose for the transaction, namely the intended ownership transfer. Consequently, our research contribution emphasizes the explanatory power of secondary distributions for long-run performance of private equity-backed offerings. The strong divestment indications implicitly conveyed through private equity-backed initial public offerings, coupled with clear ownership expiration through fund durations, should cause dissimilar long-run performance for private equity-backed offerings, which has not been examined by previous research.

We document systematic short-run underpricing of initial public offerings in the Nordic countries, consistent with previous research. The underpricing levels are considerably lower compared to prevailing literature, likely caused by higher attention from the investor community for main list offerings. Higher investor attention would mean greater demand and lower valuation uncertainty, which should cause lower risk compensation and underpricing.

We record lower underpricing for private equity-backed offerings compared to non-private equity-backed offerings, consistent with previous research. Furthermore, private equity-backed offerings receive higher institutional share allocation, likely because institutional investors rationally support aftermarket share prices, as suggested by previous research, and generally are regarded long-term owners, which should be desired by private equity vendors. Therefore, private equity-backed offerings are likely allocated to institutional investors for share price support until secondary distributions.

We document long-run underperformance of initial public offerings, consistent with previous research. Moreover, private equity-backed offerings exhibit superior long-run performance relative to non-private equity-backed offerings, consistent with prevailing literature regarding Nordic private equity-backed offerings. Abnormal returns have been positive for all offerings over six months, primarily attributed to non-private equity-backed offerings. Private equity-backed offerings experience substantial performance declines between 6 and 12 months, which coincides with lock-up expiration and subsequent commencement of secondary distributions. Furthermore, private equity-backed offerings exhibit positive abnormal returns after five years.

We argue that secondary distribution overhang has been prevalent among private equity-backed offerings, since we document positive abnormal returns for private equity-backed offerings after the final secondary distribution coupled with negative abnormal return before the first secondary distribution. Our results suggest that secondary distribution overhang effects outweigh the certification role effect through private equity ownership, as proposed by previous literature.

Our conclusions have implications for both investors and vendors. Since private equity-backed offerings exhibit negative abnormal return prior to the first secondary distribution, investors should subscribe to offerings and divest during the first six months, when abnormal returns are still positive. However, the investment strategy has limitations, especially for ordinary individuals, as retail investors cannot easily obtain share allocation in initial public offerings. Since we document outperformance for private equity-backed offerings after final secondary distribution, investors that cannot obtain share allocation for private equity-backed offerings should instead acquire shares after the final secondary distribution when the overhang has disappeared.

Our results suggest that private equity vendors recover some money left on the table through secondary distributions. Therefore, the optimal divestment strategy for private equity vendors might not be maximal divestment through the offering. However, vendors should divest remaining shares quickly to avoid depressed share prices, since the investor community will anticipate secondary distributions following lock-up expiration. Furthermore, vendors should divest shares at lock-up expiration, since managers and investors have incentives to support the share price until then.

2. Previous Research

2.1 Background

2.1.1 Secondary Distributions

The share listing process represents an exit opportunity for pre-offering shareholders, though full divestments are rarely observed for major shareholders. Complete divestitures are typically attained through the sale of secondary shares in the aftermarket (“secondary distributions”). Vending shareholders normally sign lock-up agreements, where they undertake not to sell additional shares without the prior consent of the manager(s). Naturally, private equity-backed offerings should comprise more secondary shares, since the offering generally represents an exit route for the private equity owners.

Post-offering majority shareholders generally cannot sell their shares through the open market due to liquidity constraints. For example, illiquid stocks could turnover less than typical post-offering share blocks over several months of average trading volumes, which would require substantial execution durations and associated risks. The divestment of post-offering ownership will normally be made through bookbuilding procedures where investment banks, often the managers of the initial public offering, conduct the first secondary distribution. The transaction will typically be executed after market close and the shares are allocated before the market opens the subsequent day. In order to attract investor appeal, secondary distributions are normally made at discounts to the prevailing market share price. The discount generally varies depending on the size of the share block, although the average discount has been approximately five per cent since 2005 in the Nordic countries (Anonymous Investment Bank, 2014).

Since both the post-offering ownership and the length of the lock-up period are disclosed in prospectuses, the investor community will anticipate the announcement of additional divestments from major shareholders subsequent to lock-up expiration. The market anticipation of further divestments (“secondary distribution overhang”) tends to depress the share price. (Lilja, 1997)

2.2 Overview of Previous Research

Previous research within initial public offerings can be divided into (1) *decisions to go public*, (2) *pricing and allocation*, and (3) *long-run performance*. The focus of our research can be attributed to *pricing and allocation* (“short-run underpricing”) and *long-run performance*.

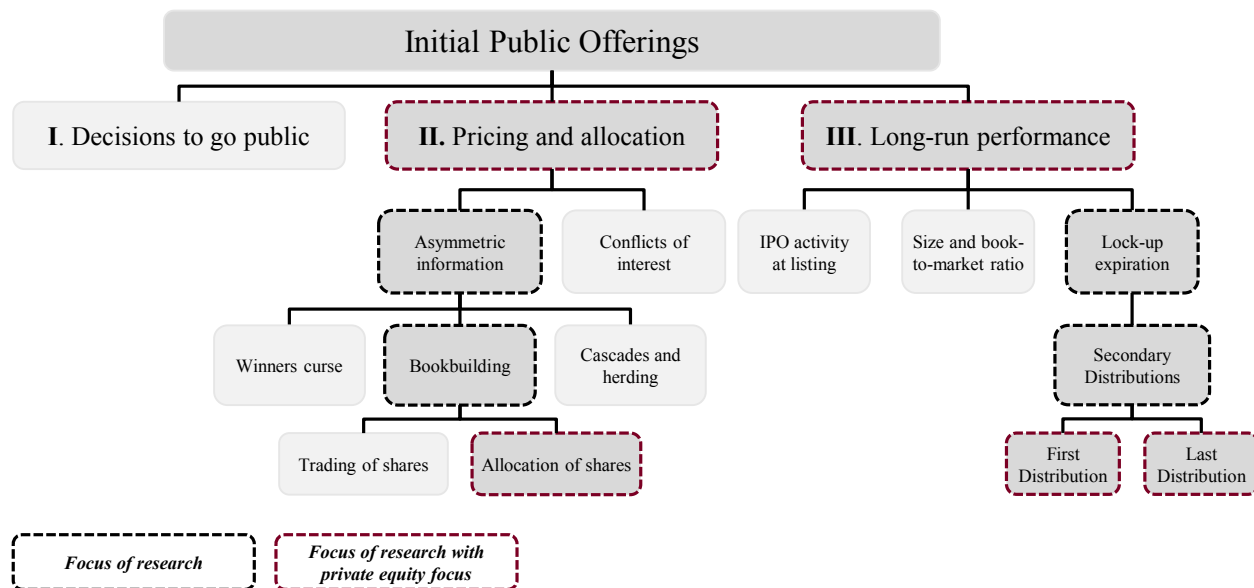


Figure 1. Overview of previous research and focus of study

2.3 Pricing and Allocation

2.3.1 Overview of Underpricing

Both early studies, such as Reilly and Hatfield (1969) and McDonald and Fisher (1972), and more recent research, such as Ritter and Welch (2002) and Loughran and Ritter (2004), suggest vast empirical evidence for underpricing (see Table 1). The average underpricing normally ranges between 15 per cent and 20 per cent for previous studies, although one should cautiously compare previous evidence, since different return calculations have been utilized. Recent research by Shi, Pukthuanthong and Walker (2013) examines underpricing in 34 countries and observes average underpricing of approximately 30 per cent, with notably lower average underpricing in the Nordic countries (excluding Iceland) of 7 per cent.

The length of the aftermarket period following the offering frequently differs, where older research generally employs longer aftermarket periods. Some authors utilize calendar time, while others employ event time, which implies varying time periods within the sample. Most previous research analyzes unadjusted initial returns, whereas some examine abnormal returns relative to stock market indices. Academic consensus has not prevailed regarding aftermarket stock prices since some authors utilize closing prices while others employ bid prices or the average between bid and ask prices.

Table 1 – Previous Research Overview – Underpricing

Selected previous research on underpricing of initial public offerings. Underpricing refers to mean values.

Author(s)	Year	Obs.	Market	Period	Underpricing	Comments
Reilly & Hatfield	1969	53	U.S	1963 – 1966	9.9%	–
McDonald & Fischer	1972	142	U.S	Q1 1969	28.5%	–
Ritter & Welch	2002	6,249	U.S	1980 – 2001	18.8%	–
Loughran & Ritter	2004	6,391	U.S	1980 – 2003	18.7%	–
Shi, Pukthuanthong & Walker	2013	6,025	34 Countries	1995 – 2002	29.33%	Nordic Underpricing: 7.48% Swedish Underpricing: 6.62%

Although the research regarding underpricing has been extensive, the conundrum still puzzles academics since consensus has not prevailed regarding the “money left on the table” from systematic underpricing. One interesting explanation for underpricing, especially relevant for our research, comprises the overhang theory presented by Bradley and Jordan (2002). They suggest that initial public offerings with higher degrees of overhang, defined as the ratio of pre-offering shares retained by owners relative to the number of shares filed for sale, are more underpriced than issues with smaller degrees of overhang. The other prevalent theories regarding underpricing can be divided into two categories – underpricing due to *asymmetric information* and underpricing due to *conflicts of interest*.

2.4 Long-Run Performance of Initial Public Offerings

2.4.1 Overview of Long-Run Performance

Previous research within long-run performance appears less structured compared to short-run underpricing. The empirical evidence diverges within long-run performance, mainly due to differences regarding methodology (see Table 2). Analysis undoubtedly becomes complicated for long-run performance, as uncertainty arises regarding appropriate test statistics depending on methodology, since different performance metrics exhibits dissimilar distributional properties.

Previous literature suggests that long-run performance analysis significantly depends on several methodology decisions. To begin with, the metric utilized to calculate abnormal return substantially alters results. The most frequently employed performance metrics are cumulative abnormal returns (“CARs”), buy-and-hold abnormal returns (“BHAR”), and wealth relatives (“WRs”). Furthermore, the abnormal return benchmarks also affect results substantially. The outcome also depends on cross-sectional aggregation methodologies, where equal-weighted abnormal returns, value-weighted abnormal returns, and median abnormal returns dominate

previous research. Additionally, time regimes significantly affect results, where event time and calendar time can be employed. Finally, contingent on methodology decision, test statistics must be carefully selected.

Ritter (1991) suggests that initial public offerings significantly underperform compared to companies with similar market capitalization over several years following the offering. Boissin and Sentis (2014) document that offerings display positive abnormal returns over the first year, while exhibiting negative abnormal returns over three and five years. Brav and Gompers (1997), Brav, Geczy and Gompers (2000) and Eckbo and Norli (2005) propose that returns do not diverge significantly from other companies when the matching method ensures similarity between the initial public offering-company and the non-initial public offering company matched regarding size and book-to-market ratio. Their research rejects the existence of an initial public offering effect.

Previous research offers several explanations for the long-run performance of initial public offerings. For example, Ritter (1991) and Brav and Gompers (1997) suggest relationships between long-run performance and the offering activity level during the listing year. Furthermore, Brav and Gompers (1997) and Gompers and Lerner (2003) propose that the size and book-to-market ratio explain the long-run performance.

Table 2 – Previous Research Overview – Long-Run Performance

Selected previous research on long-run performance of initial public offerings.

Author(s)	Year	Obs.	Market	Period	Conventions	Benchmark(s)
Ritter	1991	1,526	U.S	1975 – 1984	CAR BHAR WR	Value weights Matching
Brav & Gompers	1997	4,341	U.S	1975 – 1992	BHAR WR	Value and equal weights FF model Matching
Brav, Geczy & Gompers	2000	4,622	U.S	1975 – 1992	CAR BHAR WR	Value and equal weights Matching
Gompers & Lerner	2003	3,661	U.S	1935 – 1972	CAR BHAR	Value weights Matching
Eckbo & Norli	2005	6,139	U.S	1972 – 1998	BHAR	Matching
Boissin & Sentis	2012	270	France	1991 – 2005	BHAR	FF model

2.4.2 Performance around Lock-Up Expiration

Another possible explanation for long-run performance studied by several researchers has been the effect of lock-up expirations. Bradley, Jordan, Roten and Yi (2001) and Field and Hanka (2001) suggest that share prices deteriorate when the lock-up period expires, since more shares

become available. Bradley, Jordan, Roten and Yi (2001) demonstrate that the share price effect appears more prominent for venture capital-backed offerings, since venture capital funds typically distribute shares to limited partners at lock-up and they usually divest immediately. Bergström, Nilsson and Wahlberg (2006) suggest that manager(s) may stimulate the price of private equity-backed offerings during possible lock-up periods to ensure subsequent profitable business. Furthermore, institutional investors desire share allocation for succeeding private equity-backed offerings, which may encourage share price support during longer periods than for non-private equity-backed offerings. Their research concludes that private equity-backed offerings may exhibit share price appreciation shortly after the offering, with subsequent deterioration approximately six months after the offering.

2.4.3 Performance around Secondary Distributions

Previous literature on long-run performance primarily examines performance after lock-up expiration, though we argue the date of interest should be (1) when the major pre-offering shareholders actually initiate their secondary distributions, and (2) when the major pre-offering shareholders has divested their entire post-offering ownership stake.

Previous research regarding secondary distributions has been scarce, since the literature within the area examines follow-on offerings generally, without distinguishing between the sale of secondary shares and the sale of primary shares. Furthermore, the sparse previous research generally investigates secondary offerings exclusively, without any contextual relation to initial public offerings.

Clarke, Dunbar and Kahle (2004) examine long-run share and operating performance following pure secondary equity offerings. For a subsample, where the sellers are insiders, both three year and five year post-distribution abnormal stock returns are significantly negative. Private equity investors were not defined as insiders.

Mikkelsen and Partch (1984) study pure secondary distributions between 1972 and 1981 in the United States and document significant share price deterioration at share distribution announcement, with the largest negative effect for insider distributions.

Harper, Johnston and Madura (2004) conclude that previous research has ascertained that lock-up provisions essentially defer distributions by insiders, which would cause pronounced share price decreases at lock-up expiration. Their research suggests that the cumulative effects

for initial public offerings complemented by follow-on offerings are approximately 7.0 per cent weaker compared to initial public offerings not complemented by follow-on offerings.

Conclusively, previous research partially ignores the share price impact from secondary distributions after lock-up expiration along with the potential explanatory ability with regards to long-run performance of initial public offerings. Previous literature merely studies the impact of lock-up expiration on share prices intrinsically and effects from secondary distributions exclusively. Seemingly, previous research does not examine the connection between secondary distributions and the impact on the long-run performance of the initial public offerings.

2.5 Private Equity-Backed Initial Public Offerings

2.5.1 Underpricing of Private Equity-Backed Initial Public Offerings

We have identified seven relevant academic studies that report underpricing of private equity-backed initial public offerings (see Table 3). Muscarella and Vetsuypens (1989), Fall and Mohan (1991), Hogan, Olson and Kish (2001), Ang and Brau (2002), Cao and Lerner (2006), Schöber (2008) and Ferretti and Meles (2010) document lower underpricing for private equity-backed initial public offerings compared to control transactions. The offerings are moderately underpriced, ranging from 1.9 per cent to 9.9 per cent, except for Cao and Lerner (2006) that report underpricing of 15.4 per cent.

Schöber (2008) tests several explanations for lower underpricing of buyout-backed offerings. One explanation relates to inferior information asymmetry of reverse leveraged buyouts (“RLBOs”), an ample subdivision of leveraged buyouts. Reverse leveraged buyouts had been listed previously, as independent entities or subsidiaries to public companies, which decreases information asymmetry and the accompanied risk premium. Consequently, reverse leveraged buyouts are less underpriced than stock exchange debutantes. Another explanation could be that buyout-backed offerings are less underpriced because the firm value has been certified by financial sponsors who risk their reputation. Furthermore, the post-offering ownership structure affects underpricing, since underpricing increase with the ownership stake held by financial sponsors after the offering. Schöber suggests that the effect may be due to share overhang – offerings where financial sponsors retain large ownership after the offering may be more underpriced to compensate investors for the downward pressure on the share price due to future divestments by financial sponsors. However, the primary support for lower buyout-backed

underpricing is that the initial price range implies only minimal discount to fair value. Financial sponsors are expected to actively participate in pricing discussions with the manager(s) to avoid lower initial price ranges and consequential discounts to fair value.

Table 3 – Previous Research Overview – Underpricing of Private Equity-Backed Offerings

Selected previous research on underpricing of private equity-backed initial public offerings. Underpricing refers to mean values.

Author(s)	Year	Obs.	Market	Period	Underpricing	Underpricing Control Group	Comment
Muscarella & Vetsuypens	1989	74	U.S	1983 – 1987	2.0%	8.0%	Only RLBOs
Fall & Mohan	1991	92	U.S	1983 – 1987	2.1%	2.8%	Only RLBOs
Hogan, Olson & Kish	2001	232	U.S	1986 – 1998	7.6%	13.0%	Only RLBOs
Ang & Brau	2002	334	U.S	1981 – 1996	5.5%	8.0%	–
Cao & Lerner	2006	468	U.S	1986 – 2002	15.4%	32.8%	–
Schöber	2008	701	U.S	1990 – 2006	9.9%	14.2% – 31.4%	6 control groups
Ferretti & Meles	2010	66	Italy	1998 – 2008	1.9%	6.6%	–

2.5.2 Long-Run Performance of Private Equity-Backed Initial Public Offerings

Most previous studies that analyze long-run performance of buyout-backed initial public offerings, such as Chou, Gambola and Liu (2006), Cao and Lerner (2006) and Schöber (2008), document outperformance tendencies for buyout-backed offerings (see Table 4). However, most studies do not provide any explanations for the outperformance. One should be critical towards the previous empirical evidence, since the literature on buyout-backed offerings utilized less advanced statistical analysis and fewer performance metrics compared to the general literature on initial public offerings. The obstacles that previous research has encountered suggest that the subdivision of buyout-backed offerings that are acquired during the measurement period distorts the results to great extents.

Björcke and Menzel (2006) study 271 offerings between 1992 and 2005 in Sweden and document that Swedish private equity-backed offerings outperform non-private equity-backed offerings when returns are value weighted, although they cannot draw similar conclusions when returns are equal weighted. Moreover, the results are more distinguished when measured over five year periods rather than three year periods.

Schöber (2008) finds that buyout-backed offerings exhibit positive abnormal returns over the first trading year. Furthermore, Schöber documents that the share price performance deteriorates sharply between 8 to 32 months after the initial public offering and suggests that the decline could be explained by financial sponsor divestments during the period. The buyout-backed offering sample should be characterized by significant share overhang, since financial sponsors

retain 47.6 per cent post-offering ownership on average. Since private equity vendors desire exits within several years, one should expect large share divestments by the financial sponsors over a period of several quarters up to a few years after the initial public offering.

Levis (2011) compares the aftermarket performance of buyout-backed offerings, venture capital-backed offerings, and non-private equity-backed offerings between 1992 and 2005 on the London Stock Exchange and attempts to explain the outperformance of buyout-backed offerings. The study suggest discernible differences across the three groups regarding market size, industry classification, underpricing, and key operating characteristics at the time of listing. The research documents that buyout-backed offerings comprise larger companies concerning revenues and assets, with stronger profitability and relatively low underpricing. Three years after the offering, the buyout-backed companies display both superior operating performance and share price development compared to other offerings and the market collectively. The superior share price performance has been positively related to leverage ratios and the proportion of shares that financial sponsors own after the initial public offering.

Table 4 – Previous Research Overview – Long-Run Performance of Private Equity-Backed Offerings

Selected previous research on long-run performance of private equity-backed initial public offerings.

Author(s)	Year	Obs.	Period	Conventions	Benchmark	Comments
Björcke & Menzel	2006	89	1992 – 2005	CAR BHAR	Equal weighted Value weighted FF industry port.	– Private equity-backed offerings outperform with CAR and value weights – Private equity-backed offerings underperform with BHAR
Chou, Gambola & Liu	2006	247	1981 – 1999	CAR BHAR	Equal weighted Value weighted Matching	– RLBOs outperform size and book-to-market matched firms over 3 and 6 months – RLBOs outperform size and book-to-market matched firms over 3 and 4 years
Cao & Lerner	2006	496	1980 – 2002	CAR BHAR	Equal weighted Value weighted FF industry port. Matching	– Buyout-backed offerings outperform with BHAR and value weights over 1 year – Buyout-backed offerings underperform with BHAR and value weights over 3, 4 and 5 years
Schöber	2008	484	1990 – 2006	BHAR	Equal weighted Value weighted Matching	– Buyout-backed offerings outperform indices over 1 year but performance deteriorates sharply after 8 to 32 months
Levis	2011	454	1995 – 2002	BHAR	Equal weighted Value weighted FF model	– Private equity-backed offerings outperforms with equal and value weights over three years

3. Hypotheses

3.1 Hypotheses Background

The most distinctive characteristics of private equity-backed initial public offerings are the intended ownership transfer executed through secondary share offerings, and subsequent divestments attained through aftermarket secondary distributions. Furthermore, private equity vendors generally hold majority ownership prior to the offering, with considerable post-offering ownership, while fund durations reveal clear ownership expiration. We argue that the investor community should recognize the strong divestment indication implicitly conveyed through the initial public offering. Therefore, investors should also anticipate subsequent secondary distributions, which would create share price overhang. Academic support for the overhang theory has been proposed by Schöber (2008), who suggests that buyout-backed offerings are characterized by significant secondary distribution overhang, since financial sponsors generally divest within several years after the initial public offering.

Moreover, the aftermarket performance should be crucial for private equity-backed offerings, since private equity funds sometimes divest more shares through secondary distributions than initial public offerings. Consequently, private equity funds desire strong aftermarket performance, which should advocate greater share allocation to institutional investors that rationally support aftermarket share prices, as suggested by Bergström, Nilsson and Wahlberg (2006), while generally being considered long-term owners.

Although previous research has examined share price development around lock-up expiration, prevailing literature has not focused on actual secondary distributions that follow lock-up expiration. By studying secondary distributions, instead of the lock-up expiration, one should capture two relevant effects for long-run performance – (1) the share price effect before the majority shareholder reinstate divestment, and (2) the share price effect when the majority shareholder has completed the divestment, which should eliminate the overhang.

3.2 Short-Run Underpricing and Allocation

Long-run performance analysis should be made through contextual association with underpricing, which affects long-run performance. To disentangle divergences regarding underpricing between private equity-backed and non-private equity-backed initial public offerings, one should investigate underpricing generally for more insightful analysis.

Hypothesis I (a): Private equity-backed initial public offerings exhibit lower underpricing than non-private equity-backed initial public offerings

Hypothesis I (b): Private equity-backed initial public offerings exhibit higher institutional share allocation than non-private equity-backed initial public offerings

3.3 Long-Run Performance and Secondary Distributions

Long-run performance analysis regarding overhang should be made through conjunctional investigations concerning long-run performance generally, along with distinct analysis for private equity-backed and non-private equity-backed initial public offerings separately. Furthermore, overhang has been examined through comparisons between the performance prior to first secondary distributions and subsequent to final secondary distributions.

Hypothesis II (a): Private equity-backed initial public offerings exhibit lower long-run underperformance than non-private equity-backed initial public offerings

Hypothesis II (b): Private equity-backed initial public offerings underperform non-private equity-backed initial public offerings before first secondary distribution

Hypothesis II (c): Private equity-backed initial public offerings do not underperform non-private equity-backed initial public offerings after final secondary distribution

4. Dataset

4.1 Sample Identification

Identifying buyout-backed offerings can be challenging, which has been evident from the dissimilarities between datasets of reverse leveraged buyouts throughout previous research. No market database delivers reliable offering documentation that fulfills our sample selection criteria, especially regarding the identification of private equity-backed offerings.

Since our research examines both initial public offerings generally and private equity-backed offerings particularly, we commenced by collecting data for all initial public offerings between January 2000 and April 2014 in Sweden, Denmark, Norway and Finland – the Nordic countries excluding Iceland. Consistent with previous research, such as Fjellaker and Pedro (2012) and Shi, Pukthuanthong and Walker (2013), we excluded Iceland from our dataset since the stock exchange comprises only 15 companies on the main list. In order to conduct initial data assessments, we utilized Thomson Reuters, which generated gross data for approximately 500 offerings during the selected time frame. The gross dataset was examined with manual scrutiny regarding each individual transaction. Most transactions were excluded due to duplications, list transfers and non-main list offerings. The included offerings met the following criteria:

- i) Initial public offerings in Stockholm, Helsinki, Oslo and Copenhagen on main lists

The criterion ensures elimination of initial public offerings on Oslo Axess and First North, among others, which guarantees the mere inclusion of companies that satisfy the higher requirements on the main lists regarding size and accounting standards. Therefore, potential biases within the dataset concerning offering size, market capitalization and accounting standards would be partially mitigated.

In order to ensure inclusion of only genuine initial public offerings, which we define as offerings with traditional bookbuilding procedures, we inspected each individual transaction. Our analysis consequently caused exclusion of offerings where the bookbuilding procedure could have been distorted. The same reasoning was applied regarding the long-run performance analysis, which instigated omission of transactions where long-run comparisons could have been distorted. The criteria for exclusion typically included:

- ii) Listing transfers into main lists from smaller exchanges or lists
- iii) Offerings with over-the-counter trading prior the initial public offerings

- iv) Subsidiary spin-outs from public companies without bookbuilding
- v) Offerings with subsequent backdoor listings or substantial mergers

Initial public offerings where the companies only made list transfers were omitted, since the transactions did not involve bookbuilding procedures. Offerings that included over-the-counter trading before bookbuilding would likely entail distorted underpricing due to established indicative market prices. Offerings for spin-outs where the subsidiary shares are distributed to parent shareholders only do not involve bookbuilding procedures and were consequently excluded. Furthermore, offerings with subsequent mergers whereby the listed entity legally acquires an even larger company, while economically being the target, with the intention of reversely listing the larger entity, distort the long-run performance analysis.

Since our research examines allocation divergences between private equity-backed and non-private equity-backed offerings, the bookbuilding procedure must not include any distortions. Therefore, we adhere to previous research, such as Schöber (2008), and make the additional exclusions:

- vi) Closed-end investment funds and real estate investment trusts
- vii) Special purpose vehicles and special purpose acquisition vehicles

Offerings that raise capital for special purpose vehicles, investment funds, and investment trusts cannot compare to offerings for ordinary companies regarding underpricing. The aftermarket performance for such companies depends on subsequent investments, rather than prevailing prospects when shares are allocated.

Furthermore, offerings made within the technology sector during the dotcom bubble were omitted, since previous research documents considerable distortion from including such transactions. Ljungqvist and Wilhelm (2002) suggest that high-technology companies are more challenging to value, which induces higher initial returns. Moreover, prevailing literature normally employs dummy variables to account for distortions formed by high-technology companies, though mostly for regressions explaining underpricing. Since our research design diverges from previous research, including such transactions would create considerable distortion and prevent generalizations regarding our results.

After the gross dataset was manually scrutinized according to aforementioned criteria, the qualifying observations were reduced substantially. The final dataset comprised 101 initial public offerings, whereby 45 were private equity-backed. Each individual transaction was cross-

examined against additional data sources and listing data from the stock exchanges was utilized to verify the gross dataset.

4.2 Identification of Private Equity-Backed Offerings

In order to identify private equity-backed initial public offerings within the final dataset we studied each prospectus and analyzed the pre-offering ownership structure. We followed previous research, such as Schöber (2008), regarding minimum pre-offering private equity ownership to capture transactions where private equity funds were active pre-offering owners. Transactions that did not obey the following criteria were omitted:

- i) Combined pre-offering private equity ownership exceeding 10 per cent

The final dataset comprised 45 private equity-backed offerings, whereby separation was made between venture capital-backed and buyout-backed offerings according to definitions established by the Swedish Private Equity & Venture Capital Association, using information from private equity fund websites. The isolation efforts implied 40 buyout-backed offerings and 5 venture capital-backed offerings. As previously discussed, venture capital-backed offerings generally exhibit higher underpricing compared to buyout-backed offerings. However, since we exclusively study offerings on main lists, we argue that the main difference between buyout-backed offerings and venture capital-backed offerings disappears. Due to the higher requirements stipulated for main list offerings regarding size and accounting standards, complying companies generally are more mature than typical venture capital-backed companies. Therefore, we have chosen to evaluate our main hypotheses utilizing the separation between private equity-backed offerings and non-private equity-backed offerings only, consistent with more recent literature, such as Ferretti and Meles (2010).

4.3 Data Collection for Short-Run Underpricing

In order to calculate underpricing, we have used offering prices, retrieved through prospectuses, and unadjusted first day closing prices, obtained from Bloomberg. The data acquired from Bloomberg was manually cross-examined against data from the stock exchanges and press releases. To calculate underpricing adjusted for sector returns, we obtained industry codes from Capital IQ and made individual assessments for dubious classifications. The industry codes were matched against relevant sector indices and returns were calculated for matching time periods.

The index data comprised daily observations for 24 different Nordic value weighted total return sector indices.

Information regarding share allocation, namely retail investor versus institutional investor share allocation, was manually obtained using press releases and news articles, primarily from the International Financing Review. We obtained data concerning allocation for 72 out of 101 offerings. In order to control for factors that could explain share allocation, other than being private equity-backed, we utilized information regarding the offering available throughout the bookbuilding process. To control for strong pre-market demand, defined as offer price divided by the offering price range midpoint, we manually obtained data from prospectuses and press releases. Furthermore, the same data was employed to control for pricing uncertainty, defined as the offering price range divided by the offering range midpoint. Further data was obtained from Thomson Reuters and prospectuses regarding offer size and number of secondary and primary shares offered, in order to control for offering size and the proportion of secondary shares offered. The proportion of secondary shares offered was defined as the number of secondary shares offered divided by the total number of shares offered. Offer size was defined as the deflated offering size, calculated as the number of shares offered multiplied by the final offer price. Monthly inflation data was obtained from Statistics Sweden, Statistics Norway, Statistics Denmark and Statistics Finland. Leverage was obtained from Capital IQ and defined as total interest bearing debt divided by total assets at the latest capital structure preceding the initial public offering.

4.4 Data Collection for Long-Run Performance

4.4.1 Long-Run Performance

To consistently comply with the shareholder abnormal return focus throughout our performance analysis, we obtained closing prices for each offering, adjusted for normal cash dividends, abnormal cash dividends and stock splits from Bloomberg. Thereafter, we calculated returns consistent with the actual returns for investors. The unadjusted offering returns were matched against the corresponding sector index returns to obtain abnormal returns. Furthermore, leverage was defined as total interest bearing debt divided by total assets for the entire listing period.

4.4.2 Performance before First Secondary Distribution

To study the share price performance before first secondary distribution, we initially obtained information on lock-up expirations from prospectuses manually, since many first secondary distributions are made around lock-up expiration. We conducted searches with Factiva and International Financial Review and utilized ownership information from SIS Ownership Service to uncover the dates of first secondary distribution. The dates employed for return calculations after first secondary distributions were manually adjusted to capture the share price that was unaffected by transaction announcement. For example, when the first secondary distribution date was specified, but the transaction was announced during market hours, we used the unaffected closing price of the previous day for return calculations.

In order to better understand the exit process for private equity investors, we manually gathered data regarding pre-offering ownership and post-offering ownership for the private equity-backed initial public offerings. We obtained information concerning ownership through prospectuses and manually adjusted the post-offering ownership for over-allotment options (“greenshoes”), which are announced through press releases when the stabilization period ends.

4.4.3 Performance after Final Secondary Distribution

To calculate performance after the pre-offering private equity owner made the final secondary distribution, we utilized similar methods to uncover the dates of final secondary distribution as for the dates of first secondary distribution. We defined the final private equity secondary distribution date as when the pre-offering private equity owner(s) controlled less than five per cent of the share capital. We employed the five per cent limit, instead of complete divestment, because shareholders with less than five per cent ownership are difficult to monitor due to rules on disclosure stipulated by the Swedish Financial Supervisory Authority (2014).

4.5 Additional Data Treatment

Additional adjustments were made before the final dataset could be utilized. The returns were adjusted for the 25 companies that delisted, with particular attention for the 20 companies that were acquired during the period. By manually retrieving the acquisition announcements and closing announcements, we adjusted the return calculations for the acquired companies to incorporate the effect from the acquisitions, consistent with the shareholder abnormal return focus of our research. The remaining 5 companies were either delisted due to bankruptcy or by

request from the company, whereby the closing date of the delisting was utilized for adherence to the shareholder return focus.

4.6 Potential Data Issues

4.6.1 Sampling Problem within Share Allocation

Our dataset could demonstrate sampling problems concerning the information on share allocation, as data was not available for all transactions. Since disclosures on share allocation are not mandatory, one could assume that successful transactions exhibit higher degrees of disclosure. The sampling problem causes non-random data collection, though the statistical impact should be relatively small, since share allocation data was gathered for 71.3 per cent of all transactions. Furthermore, the sampling problem should not produce any significant bias, since private equity-backed offerings likely exhibit similar degrees of disclosure for unsuccessful transactions compared to non-private equity-backed transactions.

4.6.2 Endogeneity between Offer Pricing and Share Allocation

Since share allocation and offer pricing are determined after preliminary orders have been collected from potential investors, one could suspect endogeneity between the offer price and share allocation through potential reverse causality. However, offer pricing will be determined by manager(s) after the marketing period has concluded, and share allocations will be decided subsequently, which could limit the endogeneity. Nonetheless, offer pricing will be determined with consideration regarding share allocation and vice versa. Therefore, endogeneity has been tested using the Durbin-Wu-Hausman test. The reduced form share allocation model, which excludes the endogenous variable, has been regressed against the endogenous variable. Residuals have then replaced the endogenous variable for the main model. Subsequently, an f-test has been employed to assess whether the residuals are significantly different from zero, which would imply endogeneity issues. Since the residuals were not significantly different from zero at five per cent confidence levels, the endogeneity problem was disregarded.

4.7 Descriptive Statistics

The final dataset comprised 101 initial public offerings, whereof 45 were private equity-backed (see Table 5). The sample encompassed 40 offerings in Sweden, 36 in Norway, 15 in Denmark, and 10 in Finland. The market with the most private equity-backed offerings was undoubtedly

Sweden, where approximately 60 per cent of all offerings were private equity-backed. The most active private equity managers were EQT, Nordic Capital and IK Investment Partners.

Table 5 – Geographical Distribution

The table reports the geographical distribution of the initial public offerings in our dataset.

	Sweden	Norway	Denmark	Finland	Total
Non-Private-Equity-Backed	14	27	7	8	56
Private-Equity-Backed	23	9	8	2	45
Total	40	36	15	10	101
% of Total	40	36	15	10	100

The most frequent industry inherency was the Oil and Gas sector, which predominantly originates from companies in Norway with exposure to natural resources (see Table 6). Other offering intensive sectors were Industrials, Healthcare, Consumer Goods, and Retail. In Sweden, most offerings have been made within the Industrial and Healthcare sectors, while Denmark and Finland have been dominated by the Healthcare and Industrial sectors, respectively.

Table 6 – Sector Distribution

The table reports the sector distribution of the initial public offerings in our dataset.

Sector	Sweden	Norway	Denmark	Finland	Total	% of Total
Automobiles and Parts	1	1	0	0	2	2
Basic materials	0	1	1	0	2	2
Chemicals	0	0	0	1	1	1
Construction and Materials	1	0	0	0	1	1
Consumer Goods	5	5	0	0	10	10
Consumer Services	2	0	0	0	2	2
Financials	1	2	1	1	5	5
Food and Beverage	0	0	0	1	1	1
Healthcare	7	2	4	1	14	14
Industrial Goods and Services	0	0	1	0	1	1
Industrials	8	2	2	4	16	16
Media	0	1	0	0	1	1
Oil and Gas	0	16	1	1	18	18
Real Estate	2	3	0	0	5	5
Retail	6	1	2	0	9	9
Technology	3	1	1	1	6	6
Telecommunications	3	1	2	0	6	6
Utilities	1	0	0	0	1	1
Total	40	36	15	10	101	100

Private equity-backed offerings were dispersedly distributed among many different sectors, though none were made within the Chemicals, Consumer Services, Financials, Food and Beverage, and Utilities sectors (see Table 7). Many private equity fund managers are prohibited

from acquiring financial institutions due to investment constraints frequently stipulated within fund agreements, while the other absent sectors are likely underrepresented owing to the limited sample size. Moreover, the private equity-backed offerings were concentrated to the Industrial, Retail, Oil and Gas, and Technology sectors.

Table 7 – Private Equity-Backed Sector Distribution

The table reports the sector distribution of the private equity-backed initial public offerings in our dataset.

Sector	Sweden	Norway	Denmark	Finland	Total	% of Total
Automobiles and Parts	1	1	0	0	2	4
Basic materials	0	0	1	0	1	2
Construction and Materials	1	0	0	0	1	2
Consumer Goods	4	0	0	0	4	9
Healthcare	3	1	1	0	5	11
Industrial Goods and Services	0	0	1	0	1	2
Industrials	7	1	0	1	9	20
Media	0	1	0	0	1	2
Oil and Gas	0	5	1	0	6	13
Real Estate	1	0	0	0	1	2
Retail	4	0	2	0	6	13
Technology	3	0	1	1	5	11
Telecommunications	2	0	1	0	3	7
Total	26	9	8	2	45	100
% of Total	59	20	18	4	100	

The average offer price relative to the offer range midpoint was (0.42) per cent for the entire sample (see Table 8). The private equity-backed offerings exhibited slightly lower pricing relative to the initial price range, though not statistically significant at conventional confidence levels. The average proportion of secondary shares offered was 55 per cent for the total sample. Unsurprisingly, private equity-backed offerings displayed higher average proportion of secondary shares offered, namely 68 per cent, and the difference was significant at conventional confidence levels. The average proportion of institutional offering subscribers was 89 per cent, with marginally higher subscription from institutional investors in private equity-backed offerings, though not statistically significant at conventional confidence levels. The average share of domestic offering subscribers was 46 per cent for the full sample, with essentially identical proportions for private equity-backed and non-private equity-backed offerings. The average offering size was substantially lower for private equity-backed offerings, although not statistically significant at standard confidence levels.

Table 8 – Offering Data

The table reports descriptive statistics for selected variables. Pricing has been defined as the final offering price divided by the offering price range midpoint. Secondary has been defined as the secondary shares offered divided by the total number of shares offered. Institutional has been defined as the proportion of shares allocated to institutions. Domestic has been defined as the proportion of shares allocated to domestic investors. Size (USDm) has been defined as the deflated offering size calculated as total number of shares offered multiplied by the offering price.

	Pricing	Secondary	Institutional	Domestic	Size (USDm)
Non-Private Equity-Backed	(0.11%)	44.15%	88.76%	46.83%	548.45
Private Equity-Backed	(0.79%)	67.91%	89.67%	44.01%	342.74
Total	(0.42%)	54.74%	89.16%	45.55%	456.80

Approximately 90 per cent of the transactions had lock-up agreements for the vending shareholders, and the average length of the lock-up agreements was approximately 230 days (see Table 9). Pre-offering ownership was approximately 70 per cent for the private equity-backed transactions, while the post-offering ownership was approximately 35 per cent. Consequently, the final divestments, through final secondary distributions, are generally not made at initial public offerings, but rather after lock-up expiration. The median number of days between lock-up expiration and first post-offering secondary distributions was 200 days.

Table 9 – Ownership, Distributions and Offering Terms

The table reports descriptive statistics for selected variables. Pre-Ownership represents the average private equity vendor pre-offering ownership. Post-Ownership represents the average private equity vendor post-offering ownership. Divested represents the proportion of private equity-backed offerings where the private equity vendor has divested the entire ownership. Lock-Up represents the proportion of offerings that have lock-up agreements. Lock-Up days represents the average number of lock-up days. Secondary Days represents the average number of days between the initial public offering and the first secondary distribution by private equity vendors.

	Pre-Owners.	Post-Owners.	Divested	Lock-Up	Lock-Up Days	Secondary Days
Non-Private Equity-Backed	–	–	–	83.9%	251.7	–
Private Equity-Backed	69.9%	36.0%	57.8%	97.8%	211.8	418.1
Total	–	–	–	90.1%	232.4	–

5. Methodology

5.1 Short-Run Underpricing and Allocation

Previous research on short-run underpricing for private equity-backed initial public offerings has utilized non-private equity-backed offerings to control for distinctive features of private equity-backed offerings related to underpricing, other than being private equity-backed. Potential biases include offering size, offering period, company size, country and industry. Several studies have employed pair matching, whereby one control offering was selected for each private equity-backed offering, while other studies used group pair matching, whereby many control offerings were selected for each private equity-backed offering. Both matching procedures discard many observations due to the scarcity of relevant control observations. Numerous studies have instead utilized abnormal returns to reduce eliminations, while still obtaining relatively unbiased observations. Control return observations were obtained from the capital asset pricing model and the three factor model, while some employed market index returns. The asset pricing models are theoretically relevant, though market index returns prove more realistic with abnormal shareholder return focus. However, the offering period, offering size, company size and industry biases remain, while leverage differences must be considered separately.

Previous research exhibits diminutive consideration and transparency regarding the definition of what characteristics constitute relevant offerings. Since the initial dataset was substantially reduced, large additional exclusions could have impacted the statistical power of our research. Therefore, we employed both abnormal returns and group pair matching simultaneously, whereby many non-private equity-backed offerings were matched against each private equity-backed offering using abnormal returns. The optimal return benchmark would have been sector indices for each country, which control for both industry bias and country bias. However, only country indices and sector indices for the entire region were available for the complete time period. Since the dataset contains fewer countries than sectors, the sector indices for the region were employed. Furthermore, the company size bias was reduced by only including main list offerings, while all statistical tests were performed using equally weighted returns and value weighted returns based on the deflated offering size, for adherence to abnormal shareholder return emphasis with control for the offering size bias and the company size bias, since larger companies should have larger offerings generally. Moreover, the offering period bias was

managed through the group pair matching procedure, whereby the entire time period was divided into three different initial public offering windows. The offering windows comprised 2000 through 2002, 2004 through 2007, and 2009 through 2014, respectively. Our dataset did not contain any offerings during 2003 and 2008, which marks two years with substantial uncertainty for financial markets generally. Leverage differences were also managed through the group pair matching procedure, whereby offerings were matched when the absolute leverage difference remained below 20 per cent. The leverage variable was defined as total interest bearing debt divided by total assets using the latest capital structure preceding the offering.

Furthermore, the analysis was complemented with multivariate regressions that control for the same biases as the group pair matching procedure. The multivariate analysis excludes fewer observations from our final dataset, since matching can be avoided, which has advantages considering the sample size. The country bias was controlled for through dummy variables for Sweden, Norway and Denmark, since dummy variables for all countries would create perfect collinearity. The timing bias was controlled for through one dummy variable for the second offering window, since some countries were unrepresented for some offering windows, which creates additional collinearity.

The underpricing of initial public offerings was calculated using the unadjusted first day closing price and the final offer price communicated by the company.

$$First\ Day\ Return_{0,1} = \frac{(First\ Day\ Close\ Price_1 - Offer\ Price_0)}{Offer\ Price_0}$$

The first day closing prices were not adjusted for splits, normal cash dividends, and abnormal cash dividends, which enabled comparability. The relevant sector index was identified through industry codes and company research, where the main determinant was the earnings generation. For example, companies that provide services and equipment to certain industries occasionally had industry codes consistent with the industrial goods and services sector, while their revenues and earnings were apparently related to the industry of customers. To ensure relevant industry identification, such companies were considered constituents of the customers' sector. The short-run return of the relevant sector index was calculated using matched dates for the offering and the previous trading day. The abnormal return of each offering was calculated by subtracting the return of the relevant industry index from the offering.

$$Abnormal\ Return_{0,1} = Offering\ Return_{0,1} - Index\ Return_{0,1}$$

Previous research has utilized either t-tests or non-parametric equivalents to statistically prove dissimilar average returns between private equity-backed offerings and non-private equity-backed offerings. Assumptions regarding statistical distribution are not required for non-parametric tests, with the disadvantage of lower statistical power. Conversely, compliance with the student t-distribution offers higher statistical power, while the central limit theorem enables the assumption of normal distribution, given sample sizes with more than 30 observations. The paired mean-comparison test was employed to statistically verify diverse average returns between private equity-backed and non-private equity-backed offerings, while Wilcoxon matched pairs signed rank tests were utilized for robustness assessments.

Previous research has suggested several factors interrelated with underpricing, including share allocation. To control for other factors that affect share allocation, multivariate regressions have been employed with variables that could affect share allocation throughout the bookbuilding process. Initially, the offering price range and the number of secondary shares offered are determined by the manager(s) and the vendor(s) jointly. Subsequently, the manager(s) and the vendor(s) determine the offering price and share allocation almost simultaneously when the bookbuilding process has concluded. Therefore, we have employed three control variables that could affect share allocation, other than being private equity-backed. The control variables have been proxies for pre-market demand and valuation uncertainty, together with the proportion of secondary shares offered. Offerings with strong pre-market demand are typically priced above the midpoint of the offer range, as explained earlier. Therefore, the proxy for pre-market demand has been calculated as the offer price divided by the offering price range midpoint. Offerings with valuation uncertainty generally have wider offering price ranges. Consequently, the proxy for valuation uncertainty has been calculated as the offering price range divided by the offering price range midpoint. Large proportions of secondary shares are generally considered negative, as suggested by Schöber (2008). Therefore, the proportion of secondary shares offered has been calculated as the number of secondary shares offered divided by the total number of shares offered. The fourth variable classifies the offering as private equity-backed or non-private equity-backed. Furthermore, the offering size has been accounted for through value weighted multivariate regressions and an offering size variable for the equal weighted regressions.

5.2 Long-Run Performance and Secondary Distributions

The potential biases within underpricing of private equity-backed initial public offerings regarding offering size, offering period, company size, country and industry affect the long-run return of private equity-backed offerings and have been managed equivalently. However, the leverage variable was defined as average total interest bearing debt to total assets over the entire listing period, while the capital structure at initial public offering was used for short-run analysis.

Furthermore, previous research recommends attentiveness regarding time regime and return convention, as long-run returns are substantially affected by methodology, while academic consensus has not prevailed. The analysis can be conducted using either event time or calendar time concerning time regime, and most previous research has utilized event time. The event time regime calculates returns relative to the offering date, while the calendar time regime computes returns in calendar time. Since average returns across the sample are calculated for the event time regime, the offerings are implicitly assumed to be independent. However, previous research has recorded cross-sectional dependence among offerings, since offerings cluster over certain time periods. Therefore, common market movements affect the returns of several offerings, which create cross-sectional dependence. Consequently, traditional t-tests may overstate the statistical significance. The calendar time regime eliminates cross-sectional dependence through the calculation of returns in calendar time.

Performance tests concerning secondary distribution overhang must be performed using the event time regime, with regards to offering date, first secondary distribution date, and last secondary distribution date. Therefore, the event time regime has been employed for comparability and consistency, with robustness assessments to ensure statistical significance. Some transactions were disqualified for longer event time periods, since recent offerings had not been listed for five years, our longest event time period for example.

When companies delist before the end of the event time period, the abnormal return has been set to zero after the delisting closing announcement. Similar methodology has been applied to companies with insufficient trading history for the entire event time period, and the abnormal returns have been set to zero following the last event listing day, while the transactions have been excluded from analysis for longer event time periods. The methodology implies the proceeds from companies that delist or have insufficient trading history are reinvested in the relevant sector index, as proposed by previous research, such as Schöber (2008).

The analysis can be performed using cumulative abnormal returns, buy-and-hold abnormal returns, or wealth relatives. The abnormal return conventions have different merits, though previous research has employed CAR and BHAR frequently. The most prominent advantage of BHAR can be attributed to the replication of investor returns, while results can be skewed due to compounding. The distributional property of CAR proves advantageous for statistical verification. However, previous research has recorded positive biases due to additive accumulation. The abnormal shareholder return focus has dictated our research, which promotes the BHAR convention. However, non-parametric tests and have been employed to ensure robustness. The BHAR has been calculated as follows:

$$BHAR_{0,T}^{IPO} = \prod_{t=1}^T (1 + R_t^{IPO}) - \prod_{t=1}^T (1 + R_t^{SECTOR})$$

The secondary distribution overhang has been tested through the identification of first secondary distribution dates and final secondary distribution dates of the private equity-backed offerings. The number of days between the offering and the first secondary distribution has been calculated, which established the event time period. The return between the offering and the first secondary distribution has also been computed, along with the return between the final secondary distribution and the trading day that corresponds to the date of final secondary distribution plus the number of days between the offering and the first secondary distribution. The same calculations were made for non-private equity-backed offerings, where the return prior to the first secondary distribution was calculated between the offering date of each non-private equity-backed offering and the number of days between the offering and the corresponding first secondary distribution of the investigated private equity-backed offering. The private equity-backed offerings were then matched against non-private equity-backed offerings regarding country, offering window and leverage.

The same procedure was applied to obtain the return after the final secondary distribution of the private equity owner, where the date of final secondary distribution corresponded to the offering date plus the number of days between the offering and the date of final secondary distribution of the investigated private equity-backed offering. Naturally, the event time period after the final secondary distribution corresponded to the number of days between the offering and the first secondary distribution of the investigated private equity-backed offering.

The equal weighted and value weighted abnormal returns were compared between the private equity-backed offerings and non-private equity-backed offerings for the return prior to the first secondary distribution and the date of final secondary distribution using paired mean-comparison test, with equivalent non-parametric tests for robustness assessments. Event time windows diverge considerably, since secondary distribution dates relative to offering dates differ substantially between the private equity-backed offerings. Moreover, the absence from relevant control observations has been insignificant for the overhang study. Therefore, we performed univariate pair matching analysis only.

6. Results and Analysis

6.1 Short-Run Underpricing and Allocation

6.1.1 Results

6.1.1.1 Short-Run Underpricing

In Table 10, our results exhibit statistically significant underpricing for all initial public offerings with average first day returns of 6.20 per cent for equal weighted returns and 4.75 per cent for value weighted abnormal returns, consistent with previous research. The underpricing for private equity-backed offerings was 5.06 per cent for equal weighted abnormal returns and 3.00 per cent for value weighted abnormal returns, whereas non-private equity-backed offerings exhibit average underpricing of 7.33 per cent for equal weighted abnormal returns and 6.51 per cent for value weighted abnormal returns.

The differences between private equity-backed and non-private equity-backed offerings are statistically significant for equal weighted and value weighted abnormal returns and indicate that private equity-backed offerings are less underpriced than non-private equity-backed offerings when group pair matching has been applied. Furthermore, the difference between equal weighted and value weighted abnormal returns indicate that larger offerings are less underpriced than smaller offerings. However, the difference has not been statistically verified.

Table 10 – Short-Run Underpricing Univariate Analysis

The table presents the results of matched pair t-tests on underpricing of private equity-backed offerings compared to non-private equity-backed offerings. The equal weighted and value weighted return difference has been tested using a one-tailed t-test, where the hypothesis that private equity-backed offerings are less underpriced than non-private equity-backed offerings has been tested. The table also depicts the results of t-tests on statistical difference from zero for all initial public offerings, non-private equity-backed offerings and private equity-backed offerings separately.

	Equal Weighted			Value Weighted		
	Observations	Average	P-Value	Observations	Average	P-Value
Non-Private Equity-Backed	35	7.33%	0.0000	35	6.51%	0.0000
Private Equity-Backed	35	5.06%	0.0002	35	3.00%	0.0060
Difference	–	(2.27%)	0.0912	–	(3.51%)	0.0195
All	70	6.20%	0.0000	70	4.75%	0.0000

In Table 11, our results exhibit statistically insignificant negative coefficients for being private equity-backed using both equal weighted and value weighted abnormal return multivariate regressions. The multivariate analysis excludes fewer observations from our final dataset. The coefficient for being private equity-backed was (0.0195) for the equal weighted abnormal return

regression, which suggests underpricing decreased by 1.95 per cent when the offering was private equity-backed. The coefficient for being private equity-backed was (0.0035) for the value weighted abnormal return regression, which proposes underpricing decreased by 0.35 per cent when the offering was private equity-backed. However, the coefficients were not significant at conventional confidence levels.

Table 11 – Short-Run Underpricing Multivariate Analysis

The table presents multivariate regressions with underpricing as the dependent variable and being private equity-backed as the independent variable of interest. Several variables have been used to control for country, timing and leverage. Sweden, Norway and Denmark represent dummy variables for the offerings listing domicile. Window represents the second initial public offering window, comprising 2004 through 2007. Leverage represents interest bearing debt divided by total assets at the initial public offering. Private Equity represents the dummy variable for being private equity-backed or non-private equity-backed.

	Equal Weighted			Value Weighted		
	Coefficient	Standard Error	P-Value	Coefficient	Standard Error	P-Value
Underpricing						
Sweden	0.0266	0.0348	0.4460	0.0159	0.0398	0.6900
Norway	(0.0089)	0.0331	0.7870	(0.0151)	0.0387	0.6960
Denmark	0.0565	0.0400	0.1610	0.0575	0.0457	0.2110
Window	0.0331	0.0200	0.1010	0.0266	0.0195	0.1770
Leverage	0.0256	0.0355	0.4730	0.0717	0.0377	0.0600
Private Equity	(0.0195)	0.0205	0.3440	(0.0035)	0.0223	0.8730
Constant	0.0174	0.0370	0.6390	0.0086	0.0416	0.8360
Observations	101			101		
R²	0.0648			0.0977		

6.1.1.2 Allocation

In Table 12, our results exhibit marginally higher equal weighted institutional share allocation for private equity-backed offerings, though not statistically significant at conventional confidence levels. However, the dissimilarity becomes significant when value weighted, with higher institutional share allocation for private equity-backed offerings. Furthermore, the difference between value weighted and equal weighted allocations indicate that larger private equity-backed offerings are more allocated to institutional investors than smaller offerings. Larger non-private equity-backed offerings are less allocated to institutional investors than smaller offerings. However, the differences have not been statistically verified.

Table 12 – Institutional Share Allocation

The table presents the results of the t-tests on private equity-backed institutional allocation compared to non-private equity-backed institutional allocation. The equal weighted and value weighted institutional share allocation has been tested using a one-tailed t-test, where the hypothesis that private equity-backed offerings have larger institutional share allocation than non-private equity-backed offerings has been tested. The table also depicts the results of t-tests on statistical difference from zero for all initial public offerings, non-private equity-backed offerings and private equity-backed offerings separately.

	Equal Weighted			Value Weighted		
	Observations	Mean	P-Value	Observations	Mean	P-Value
Non-Private Equity-Backed	40	88.76%	0.0000	40	85.42%	0.0000
Private Equity-Backed	32	89.67%	0.0000	32	90.41%	0.0000
Difference	–	(0.91%)	0.7176	–	(4.99%)	0.0025
All	72	89.16%	0.0000	72	86.95%	0.0000

In Table 13, our results exhibit consistency with our equal weighted mean comparison test, since our equal weighted multivariate regression exhibits an insignificant coefficient for the dummy variable representing private equity-backed offerings. Similarly, our value weighted multivariate regression reveals significantly positive return contribution from being private equity-backed, consistent with our value weighted group mean matched mean comparison test.

Table 13 – Institutional Share Allocation Regressions

The table presents the results of multivariate regressions on institutional share allocation. The value weighted regression excludes the offering size variable. Pricing has been defined as the final offering price divided by the offering price range midpoint and represents the proxy for pre-market demand. Secondary has been defined as the secondary shares offered divided by the total number of shares offered. Range has been defined as the offering price range divided by the offering range midpoint and represents the proxy for valuation uncertainty. Size has been defined as the deflated offering size calculated as total number of shares offered multiplied by the final offering price. Private equity represents the dummy variable that classifies the offering as private equity-backed or non-private equity-backed.

Institutional Share Allocation	Equal Weighted			Value Weighted		
	Coefficient	Standard Error	P-Value	Coefficient	Standard Error	P-Value
Pricing	(0.1338)	0.0681	0.0540	(0.1611)	0.0820	0.0540
Secondary	0.0034	0.0213	0.8720	(0.0575)	0.0256	0.0280
Range	0.0780	0.0930	0.4050	(0.1829)	0.1289	0.1610
Size	(8.89E-06)	6.54E-06	0.1790	–	–	–
Private Equity	0.0043	0.0169	0.7980	0.0510	0.0185	0.0080
Constant	0.8768	0.0248	0.0000	0.9350	0.0357	0.0000
Observations	72			72		
R ²	0.0994			0.2419		

6.1.2 Robustness

The equal weighted difference between private equity-backed and non-private equity-backed offerings regarding underpricing and allocation has been assessed using Wilcoxon signed rank

tests for additional robustness. Moreover, the multivariate regressions for short-run underpricing provide significant robustness. The non-parametric equal weighted matched pair comparison test exhibits an insignificant difference regarding underpricing between private equity-backed offerings and non-private equity-backed offerings, inconsistent with our mean comparison t-test. Similarly, the non-parametric Wilcoxon-Mann-Whitney mean comparison test reveals an insignificant difference for institutional share allocation between private equity-backed offerings and non-private equity-backed offerings.

6.1.3 Analysis

We document support for the established phenomenon of systematic underpricing for initial public offerings in the Nordic countries, consistent with previous research. Furthermore, the level of underpricing has been considerably lower than prevailing literature for other countries and regions. Naturally, lower underpricing could be related to distinctive characteristics of Nordic offerings, though the dissimilarities are likely associated with methodological variations. Our research only comprises offerings on Nordic main lists, which implies larger companies with higher attention from the investor community. Consequently, investor demand and valuation uncertainty could have been mitigated during the bookbuilding process, since the manager(s) would receive more information from potential investors. Therefore, one could expect lower compensation for risk and consequently lower underpricing, as suggested by Habib and Ljungqvist (2001).

We record lower value weighted underpricing for private equity-backed initial public offerings than non-private equity-backed offerings. Consequently, the private equity-backed offerings leave less money on the table when actual shareholder abnormal returns are emphasized. Our results are consistent with previous research, such as Schöber (2008), that suggest support for lower underpricing of buyout-backed offerings because they file an initial price range that implies only minimal discount to fair value. However, our results should be interpreted cautiously, since they were not statistically significant with non-parametric tests or multivariate analysis.

We document higher value weighted institutional share allocation for private equity-backed offerings, both for simple mean comparison t-tests and multivariate regressions that control for other factors that could affect share allocation, consistent with our hypothesis. We argue that private equity-backed offerings receive higher institutional share allocation, since institutional

investors rationally support aftermarket share prices, as suggested by Bergström, Nilsson and Wahlberg (2006), and generally are regarded long-term owners. Therefore, private equity-backed offerings are likely allocated to institutional investors to support the share price until the private equity owner divests more shares through secondary distributions, whereas institutional investors could be compensated through discounts.

6.2 Long-Run Performance and Overhang

6.2.1 Results

6.2.1.1 Long-Run Performance

In Table 14, we document statistically significant value weighted abnormal outperformance over six months for non-private equity-backed offerings and all offerings. Since the private equity-backed offerings exhibit insignificant value weighted outperformance over six months, the overall offering outperformance can mainly be attributed to non-private equity-backed offerings. The value weighted abnormal returns deteriorate over one and three years for all offerings. However, the value weighted abnormal returns rebound for all offerings over five years, primarily attributed to statistically significant value weighted abnormal outperformance for private equity-backed offerings.

We record positive equal weighted abnormal outperformance for all offerings over six months, with similar return development over one and three years compared to value weighted abnormal returns. However, the equal weighted abnormal returns are negative and statistically significant merely over three years for private equity-backed, non-private equity-backed and all offerings. Similarly, the equal weighted abnormal returns are negative and statistically significant over five years for private equity-backed, non-private equity-backed and all offerings. Conversely, the value weighted abnormal returns are positive and statistically significant for private equity-backed offerings over five years, which suggests that larger private equity-backed offerings exhibit superior performance compared to smaller private equity-backed offerings. Our results support the hypothesis that all offerings underperform the market, though only using equal weighted abnormal returns for three years and five years.

The abnormal return difference between private equity-backed and non-private equity-backed offerings displays significant value weighted outperformance for private equity-backed offerings over five years at conventional confidence levels, which often defines long-run

performance for previous research. However, the value weighted abnormal returns differences are insignificant for one, three and five years. Furthermore, the equal weighted abnormal return differences are not significant over any event time period. Our results support the hypothesis that private equity-backed initial public offerings exhibit lower long-run underperformance than non-private equity-backed offerings, since value weighted returns are emphasized.

Table 14 – Long Run Performance

The table presents the results of t-tests on long-run performance of private equity-backed initial public offerings compared to non-private equity-backed initial public offerings. The equal weighted and value weighted abnormal return differences have been tested using one-tailed t-tests, where the hypothesis that private equity-backed offerings outperform non-private equity-backed offerings has been tested. The table also depicts the results of t-tests on statistical difference below zero for all initial public offerings, non-private equity-backed offerings and private equity-backed offerings separately.

	Obs.	Equal Weighted			Value Weighted		
		Mean	Standard Error	P-Value	Mean	Standard Error	P-Value
6 Month BHAR							
Non-Private Equity-Backed	31	4.21%	0.0598	0.8476	11.89%	0.0312	1.0000
Private Equity-Backed	31	2.79%	0.0403	0.6784	6.63%	0.0569	0.8760
Difference	—	1.41%	0.0772	0.5720	5.25%	0.0649	0.7890
All	62	3.50%	0.0358	0.8344	9.26%	0.0323	0.9970
12 Month BHAR							
Non-Private Equity-Backed	30	0.25%	0.0419	0.5240	9.05%	0.0402	0.9860
Private Equity-Backed	30	(3.13%)	0.0728	0.3352	(0.24%)	0.0638	0.4850
Difference	—	3.39%	0.0841	0.6550	9.29%	0.0754	0.1115
All	60	(1.44%)	0.0417	0.3657	4.40%	0.0379	0.8750
36 Month BHAR							
Non-Private Equity-Backed	23	(34.90%)	0.0849	0.0002	(11.40%)	0.1108	0.1545
Private Equity-Backed	23	(56.32%)	0.1276	0.0001	(12.13%)	0.1702	0.2400
Difference	—	21.41%	0.1184	0.9579	0.72%	0.2031	0.5140
All	46	(45.61%)	0.0774	0.0000	(11.76%)	0.1004	0.1240
60 Month BHAR							
Non-Private Equity-backed	19	(58.08%)	0.1476	0.0005	(16.47%)	0.1931	0.1995
Private Equity-Backed	19	(57.05%)	0.3389	0.0548	55.27%	0.4043	0.0900
Difference	—	(1.02%)	0.2580	0.4844	(71.75%)	0.4481	0.0590
All	38	(57.56%)	0.1823	0.0016	19.40%	0.2287	0.2010

In Table 15, our multivariate analysis records similar results compared to the univariate analysis with group pair matching. However, the variable for being private equity-backed exhibits significant negative coefficients over six months, one year and three years using value weighted multivariate regressions, which suggests underperformance of private equity-backed offerings. Therefore, we document negative contribution from being private equity-backed also over six months using multivariate regressions. Furthermore, the variable for being private equity-backed displays significant positive contribution to long-run performance at conventional confidence levels over five years using value weighted multivariate regressions. Consequently, our results

also support the hypothesis that private equity-backed initial public offerings exhibit lower long-run underperformance than non-private equity-backed offerings using multivariate analysis. The improved significance could be attributed to fewer observation omissions for the multivariate regressions, which do not require group pair matching.

Table 15 – Long Run Performance Regressions

The table presents multivariate regressions with long-run performance as the dependent variables and being private equity-backed as the independent variables of interest. Several variables have been used to control for country, timing and leverage. Sweden, Norway and Denmark represent dummy variables for the offerings listing domicile. Window represents the second initial public offering window, comprising 2004 through 2007. Leverage represents interest bearing debt divided by total assets at the initial public offering. Private Equity represents the dummy variable for being private equity-backed or non-private equity-backed.

	Equal Weighted			Value Weighted		
	Coefficient	Standard Error	P-Value	Coefficient	Standard Error	P-Value
6 Month BHAR						
Sweden	0.1769	0.1628	0.2800	(0.2056)	0.1326	0.1250
Norway	0.1344	0.1534	0.3840	(0.2171)	0.1288	0.0960
Denmark	0.1785	0.1891	0.3480	(0.1429)	0.1551	0.3590
Window	0.0590	0.0908	0.5180	(0.0908)	0.0659	0.1720
Leverage	(0.0404)	0.2057	0.8450	(0.0370)	0.1752	0.8330
Private Equity	(0.1983)	0.0931	0.0360	(0.2017)	0.0741	0.0080
Constant	0.0174	0.1772	0.9220	0.4573	0.1436	0.0020
12 Month BHAR						
Sweden	(0.0057)	0.2128	0.9780	(0.4621)	0.2208	0.0400
Norway	0.0481	0.2017	0.8120	(0.4037)	0.2146	0.0640
Denmark	(0.2887)	0.2492	0.2500	(0.6394)	0.2586	0.0160
Window	0.0013	0.1210	0.9910	(0.0498)	0.1102	0.6520
Leverage	(0.2873)	0.2712	0.2930	(0.1352)	0.2946	0.6470
Private Equity	(0.1665)	0.1229	0.1790	(0.3789)	0.1235	0.0030
Constant	0.2291	0.2314	0.3250	0.7890	0.2390	0.0010
36 Month BHAR						
Sweden	(0.5688)	0.3448	0.1040	(0.4843)	0.2748	0.0830
Norway	(0.3339)	0.3322	0.3190	(0.1378)	0.2688	0.6100
Denmark	(0.7851)	0.3955	0.0520	(0.1130)	0.3212	0.7260
Window	(0.9198)	0.1876	0.0000	(0.8758)	0.1364	0.0000
Leverage	(0.1902)	0.4663	0.6850	0.0666	0.4085	0.8710
Private Equity	(0.1045)	0.1983	0.6000	(0.3172)	0.1554	0.0460
Constant	0.8106	0.3916	0.0430	0.6558	0.3056	0.0360
60 Month BHAR						
Sweden	(0.4486)	0.6207	0.4740	(1.0439)	0.5029	0.0440
Norway	0.0685	0.6030	0.9100	(0.2724)	0.4863	0.5780
Denmark	(1.6831)	0.7274	0.0260	(0.5444)	0.6175	0.3830
Window	(2.2112)	0.3794	0.0000	(1.9906)	0.2963	0.0000
Leverage	(2.0280)	0.8978	0.0290	(1.6870)	0.8760	0.0610
Private Equity	0.3152	0.4112	0.4480	0.6455	0.3525	0.0740
Constant	2.0355	0.7210	0.0070	1.9399	0.5960	0.0020

6.2.1.2 Overhang

In Table 16, we document statistically significant equal weighted and value weighted underperformance for private equity-backed initial public offerings prior to first secondary distribution. During the same time period, we record statistically significant value weighted outperformance for non-private equity-backed offerings, while the equal weighted abnormal returns are significantly negative. The abnormal return difference between value weighted and equal weighted non-private equity-backed offerings suggests that larger offerings perform better. Furthermore, the value weighted abnormal return difference between private equity-backed and non-private equity-backed offerings proposes stronger performance for non-private equity-backed offerings before the first secondary distribution at conventional confidence levels.

After the final secondary distribution, value weighted private equity-backed offerings significantly outperform the market at conventional confidence levels. Conversely, non-private equity-backed offerings underperform, though not statistically significant at conventional confidence levels. Furthermore, the equal weighted and value weighted difference between private equity-backed and non-private equity-backed offerings become negatively significant after the final secondary distribution, which suggests private equity-backed offerings significantly outperform non-private equity-backed offerings. Consequently, our results support the hypothesis that private equity-backed initial public offerings underperform non-private equity-backed initial public offerings before first secondary distributions. Moreover, our results support the hypothesis that underperformance diminishes after the final secondary distribution, since private equity-backed offerings outperform non-private equity-backed offerings after the final secondary distribution.

Between the first secondary distribution and the final secondary distribution we cannot statistically verify any performance difference between private equity-backed and non-private equity-backed offerings. However, the average performance of non-private equity-backed offerings exceeds the average performance of private equity-backed offerings. Furthermore, private equity-backed offerings exhibit negative abnormal returns, though statistically insignificant at conventional confidence levels.

Table 16 – Overhang Tests

The table presents the results of t-tests on the performance of private equity-backed initial public offerings compared to the performance of non-private equity-backed initial public offerings after, before and between the first and final secondary distribution. The equal weighted and value weighted return difference before the first secondary distribution has been tested using a one-tailed t-test, where the hypothesis that private equity-backed offerings underperform non-private equity-backed offerings before the first secondary distribution has been tested. The equal weighted and value weighted return difference between the first and final secondary distribution has been tested using a one-tailed t-test, where the hypothesis that private equity-backed offerings underperform non-private equity-backed offerings after the final secondary distribution has been tested. The equal weighted and value weighted return difference after the final secondary distribution has been tested using a one-tailed t-test, where the hypothesis that private equity-backed offerings do not underperform non-private equity-backed offerings after the final secondary distribution has been tested. The table depicts the results of t-tests on statistical difference below zero for all initial public offerings, non-private equity-backed offerings and private equity-backed offerings separately before first secondary distribution and between first and final secondary distributions. The table also depicts the results of t-tests on statistical difference above zero for all initial public offerings, non-private equity-backed offerings and private equity-backed offerings separately after final secondary distribution.

	Equal Weighted			Value Weighted		
	Obs.	Mean	P-Value	Obs.	Mean	P-Value
Before First Secondary Distribution BHAR						
Non-Private-Equity-Backed	28	(15.23%)	0.0497	28	23.13%	1.0000
Private-Equity-Backed	28	(17.17%)	0.0333	28	(24.31%)	0.0040
Difference	28	(1.93%)	0.4282	28	(47.44%)	0.0000
All	56	(16.20%)	0.0063	56	14.78%	0.9975
Between First and Final Secondary Distribution BHAR						
Non-Private-Equity-Backed	19	(12.99%)	0.0446	19	(4.77%)	0.1430
Private-Equity-Backed	19	(13.74%)	0.1753	19	(17.89%)	0.1070
Difference	19	(0.74%)	0.4827	19	(13.11%)	0.1910
All	38	(13.37%)	0.0499	38	(8.84%)	0.0795
After Final Secondary Distribution BHAR						
Non-Private-Equity-Backed	25	(13.18%)	0.9622	25	(3.62%)	0.8425
Private-Equity-Backed	25	6.75%	0.2257	25	13.72%	0.0780
Difference	25	19.93%	0.0059	25	17.35%	0.0470
All	50	(3.21%)	0.7095	50	(0.65%)	0.4300

6.2.2 Robustness

The equal weighted group pair matched abnormal return difference between private equity-backed and non-private equity-backed offerings regarding long-run performance has been assessed using Wilcoxon signed rank tests for additional robustness. Moreover, the multivariate regressions also provide significant robustness. The non-parametric equal weighted matched pair comparison tests exhibit significantly different abnormal returns between private equity-backed offerings and non-private equity-backed offerings over three years, consistent with our mean comparison t-test. However, non-parametric tests cannot statistically verify any other abnormal return differences.

Furthermore, the difference between private equity-backed and non-private equity-backed offerings regarding overhang has been evaluated using Wilcoxon-Mann-Whitney tests, which exhibit statistically significant equal weighted abnormal return differences after the final secondary distribution, consistent with our mean comparison t-tests. However, the non-parametric tests were not significant regarding performance difference between private equity-backed and non-private equity-backed offerings before the first secondary distribution and between the first and final secondary distributions.

6.2.3 Analysis

We document long-run underperformance for all initial public offerings, consistent with previous research such as Ritter (1991). We record support for the hypothesis that private equity-backed offerings exhibit lower long-run underperformance than non-private equity-backed offerings, consistent with previous research regarding Nordic private equity-backed offerings such as Björcke and Menzel (2006). Since prevailing research, such as Levis (2011), documents positive relationships between aftermarket performance and leverage, we have controlled for the factor throughout our research and still document outperformance of private equity-backed offerings. One explanation, which has been frequently suggested by previous research, could be that the private equity-backed companies are acquired during the event periods, which substantially affects abnormal returns. The effect could exist within our results, since the proportion of private-equity backed companies that are acquired over the longest event time period has been 26.7 per cent compared to 16.1 per cent for the non-private equity-backed companies. However, we deliberately include the effect from buyouts, since they affect abnormal shareholder returns, the main focus throughout our research.

The abnormal return has been positive over six months for all offerings using value weighted returns, primarily attributed to non-private equity-backed offerings. Over subsequent time periods, the abnormal return deteriorates for all offerings. Moreover, private equity-backed offerings display significantly negative contribution to value weighted abnormal returns over six months, one year, and three years using multivariate analysis. Over five years, private equity-backed offerings display positive abnormal return and significant outperformance relative to non-private equity-backed offerings, with equivalent results using multivariate analysis. Consequently, private equity-backed offerings outperform the market over six months when actual shareholder abnormal returns are emphasized, though not within conventional confidence

levels, while subsequently exhibiting negative abnormal returns over one and three years. The abnormal return becomes positive over five years, while significantly outperforming non-private equity-backed offerings.

The abnormal shareholder return difference could be related to secondary distribution overhang, which would imply lower shareholder return until the private equity owners have executed the final secondary distribution. Investor anticipation of secondary distributions should reasonably depress returns, since the investor community can identify the shares retained by private equity owners after the initial public offering, and should anticipate divestments after lock-up expiration.

The outperformance over six months for all offerings could be explained by the relatively large effect from underpricing for shorter time periods. Furthermore, the potential stabilization activities performed by managers naturally cause artificial share prices over the first month, which also have relatively larger effects for shorter time periods. As suggested by Bergström, Nilsson and Wahlberg (2006), managers and institutional investors may have additional incentives to support share prices over shorter time periods for private equity-backed offerings, since institutional investors desire share allocation in subsequent private equity-backed offerings. Therefore, we argue that stronger performance over six months compared to longer time periods for private equity-backed offerings can be explained by underpricing, potential stabilization activities during the first month, and incentives for managers and institutional investors to support the share price over shorter time periods for private equity-backed offerings. As previously explained, the potential secondary distribution overhang counteracts these positive effects, which attains partial support by comparing the substantial performance decline between 6 and 12 months for private equity-backed offerings compared to non-private equity-backed offerings, which coincides with the median lock-up expiration and subsequent initiation of secondary distributions. However, our arguments must be reinforced by the overhang analysis for stronger legitimacy.

We document support for the hypothesis that private equity-backed initial public offerings underperform non-private equity-backed offerings before the first secondary distribution. Furthermore, private equity-backed offerings outperform non-private equity-backed initial public offerings after the final secondary distribution. Therefore, we argue that secondary distribution overhang has been prevalent among private equity-backed offerings. Our results add new

perspective towards arguments from Bergström, Nilsson and Wahlberg (2006) that performance deterioration for private equity-backed offerings should be related to divestments of private equity owners through evaporated certification effects. We investigate the performance after the final divestment and capture effects that previous research partially has ignored – the secondary distribution overhang.

Since we document positive abnormal returns for private equity-backed offerings after the final secondary distribution along with negative abnormal returns before the first secondary distribution, we argue that the performance deterioration should be more related to the secondary distribution overhang than the certification role of private equity owners. The certification role could exist simultaneously through the offsetting of secondary distribution overhang. However, we argue that market participants should realize that private equity owners desire full divestments through the initial public offering. Furthermore, private equity fund durations reveal clear ownership expiration, which should be known to the investor community. Therefore, the vanished certification role should be recognized and incorporated at initial public offering.

7. Conclusions and implications

7.1 Main Findings

Initial public offerings are systematically underpriced in the Nordic countries, consistent with previous research. The level of underpricing has been considerably lower compared to prevailing literature, likely caused by higher attention from the investor community for main list offerings and consequential greater demand and lower valuation uncertainty, which should cause lower risk compensation and underpricing. Furthermore, private equity-backed offerings are less underpriced than non-private equity-backed offerings with actual shareholder abnormal return emphasis, consistent with previous research. Private equity owners retain substantial ownership after the offering, sometimes more than divested through the offering, which implies private equity owners recover some money left on the table.

Institutional share allocation has been higher for private equity-backed offerings with actual shareholder abnormal return emphasis, likely since institutional investors rationally support aftermarket share prices and generally are regarded long-term owners. Consequently, private equity-backed offerings are likely more allocated to institutional investors for share price support until secondary distributions.

Initial public offerings exhibit long-run underperformance, consistent with previous research. Moreover, private equity-backed offerings exhibit lower long-run underperformance than non-private equity-backed offerings, consistent with prevailing literature regarding Nordic private equity-backed offerings. However, abnormal returns have been positive over six months for all offerings, primarily attributed to non-private equity-backed offerings. The substantial performance decline between 6 and 12 months for private equity-backed offerings coincides with lock-up expiration and subsequent commencement of secondary distributions. We argue that secondary distribution overhang has been prevalent among private equity-backed offerings, since we document positive abnormal returns for private equity-backed offerings after the final secondary distribution along with negative abnormal return before the first secondary distribution. Our results suggest that secondary distribution overhang effect outweighs the certification role effect suggested by previous research.

Our results have implications for both investors and vendors. Since initial public offerings exhibit negative abnormal returns prior to the first secondary distribution, investors should

subscribe to offerings and divest during the first six months. However, the investment strategy has limitations, especially for ordinary individuals, as retail investors typically cannot easily obtain share allocation in initial public offerings. Since we document outperformance for private equity-backed offerings after final secondary distribution, investors that cannot obtain share allocation for private equity-backed offerings should acquire shares after the final secondary distribution has concluded and the overhang has disappeared.

Our results suggest that private equity vendors recover some money left on the table through secondary distributions. Therefore, the optimal divestment strategy for private equity vendors might not be maximal divestment through the offering. However, vendors should divest remaining shares quickly to avoid depressed share prices, since the investor community will anticipate secondary distributions following lock-up expiration. Furthermore, vendors should take advantage of the opportunity to divest shares at lock-up expiration, since managers and investors have incentives to support the share price until then.

7.2 Limitations and Suggested Future Research

One general limitation includes the restricted number of observations. Since the Nordic private equity markets and equity capital markets are relatively small, future research could extend the time period and the number of markets to enlarge the sample size. However, longer time periods would reduce the relevance and including more markets would limit the ability to ensure data quality, since many markets have different rules regarding initial public offerings.

Another limitation includes share allocation information, which could not be collected for the entire dataset. Ideally, proprietary share allocation information would be obtained from managers, which would enable more granular analysis. Short-run underpricing and long-run performance should be related to investor type, such as share allocation distribution between hedge funds and long-only funds, which could be an interesting research topic.

Another limitation includes secondary distribution overhang information, where one could investigate the abnormal return differences between private equity-backed offerings with and without full private equity divestment. Furthermore, one could examine the abnormal return differences between non-private equity-backed offerings with full founder divestment and private equity-backed offerings with full private equity owner divestment. However, such research would require considerably larger datasets, which would necessitate substantially larger time periods. As discussed above, longer time horizons would distort the relevance.

Furthermore, an intriguing research subject would be the recipient of potential long-run returns of private equity-backed offerings, when accounting for lower underpricing and secondary distribution discounts. Institutional investors in private equity-backed offerings could be compensated for secondary distribution overhang through subsequent discounts in secondary share distributions when private equity owners divest additional shares, which could imply the same institutional investors must subscribe for the initial offering and secondary distributions to profit from private equity-backed offerings.

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Appendix

Background

Initial Public Offerings

Initial public offerings are equity capital transactions whereby the shares of companies start trading publically. The offerings can constitute the sale of new shares to raise capital (primary offerings) and the sale of existing shares to transfer ownership (secondary offerings). The offerings are either privatizations or corporate transactions, whereby the vendors are private entities.

The transaction dynamics from primary offerings are significantly different from those that prevail under secondary offerings due to dissimilar proceeds recipients. For primary offerings and secondary offerings the proceeds accrue to the company and vendors, respectively. Should the offering proceeds accrue to the company, management are believed to be motivated to augment the due diligence quality, the prospectus and the investor presentations. The complicated relationship between the vendor and the company generally causes dependence on delicate negotiations between the parties for successful secondary offerings. (Lilja, 1997)

The listing process normally demands between 6 and 12 months, depending on the time required for financial audit compliance, the financial performance of the company, and the equity capital market conditions. During the majority of the listing process the offering manager(s) prepare marketing activities and compose the prospectus, an offer document provided for prospective investors with information regarding the securities and the company, while legal advisors and financial accounting advisors conduct rigorous due diligence. During the final stages of the listing process, the offering manager(s) hold investor conferences, organize marketing roadshows and write equity research reports to facilitate demand for the share offering. (Anonymous Investment Bank, 2014)

Throughout the process, the offering manager(s) collect indications of interest from investors at different prices within the offer range. The offering manager(s) and the vendor determine final offering price and share allocations after the marketing period has concluded.

When the company has been listed, the aftermarket share price performance will be the principal indicator of success for the investor community. Investors endeavor superior share price performance, although the optimal outcome for all parties will generally be considered

moderate and stable price appreciation following the issue, since vendors reluctantly divest at abnormally low offer prices. Furthermore, rapid share price appreciation may induce investors to liquidate immediate profits, which add limited value to the offering. Preferably, the share price should outperform the local market and comparable companies. In order to support the aftermarket share price performance, offering manager(s) employ an over-allotment option (greenshoe). (Lilja, 1997)

Should an offering generate investor demand beyond the number of shares offered, the unsatisfied demand creates aftermarket orders, strong share price performance and secondary market liquidity. The greenshoe enables manager(s) to over-allocate shares, which gives them the flexibility to acquire shares in the aftermarket to stabilize the share price. The greenshoe normally constitutes 15 per cent of the offering and gives manager(s) the option to purchase additional shares from the issuer at the offer price within 30 days following pricing of the offering. Should the aftermarket performance develop favorably, the greenshoe will normally be fully exercised, which implies an extended share offering. Weak aftermarket performance typically implies acquisitions of the over-allocated shares by the manager(s), which stabilizes the share price development.

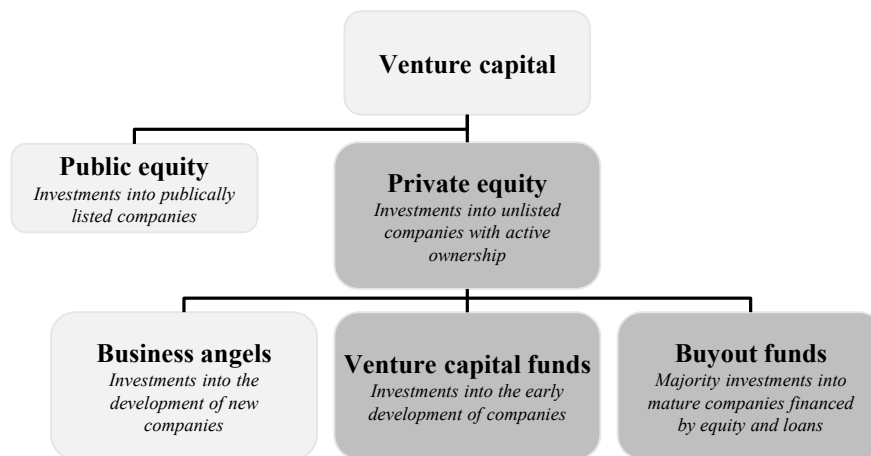
Another imperative success factor generally constitutes the allocation of shares between institutional investors and retail investors. The share distribution should preferably be sufficiently wide without being too dispersed – key institutional investors must be allocated enough shares to establish core ownership positions and the geographical allocation should avoid excessive share placement to individual investment regions, which can create significant share price volatility. Exemplary benchmarks are typically set by previous offers from the same country. (Lilja, 1997)

Share allocations for offerings are determined through the bookbuilding method. The bookbuilding method allows manager(s) to examine the strength of the institutional demand for the shares over different prices, by obtaining non-binding expressions of interest from potential investors. By the end of the bookbuilding period the price will be fixed, the prospectus finalized, and the shares allocated to investors.

Private Equity

Venture capital (Swedish: “riskkapital”) comprises all capital injections into companies not defined as debt. Venture capital investments are divided into *public equity* – investments into

publically listed companies, and *private equity* – investments into unlisted companies. Private equity can be divided into various forms of financing, whereof the three most common subdivisions are: *business angels* – individuals who invest into the development of new companies, *venture capital funds* – investment funds that make capital injections into the early development of companies, and *buyout funds* – investment funds that make capital injections into mature companies that demand active ownership with financial strength. (Swedish Private Equity & Venture Capital Association, 2014) Most private equity-backed offerings in our dataset are buyout fund investments.



Venture capital and subdivisions

Source: Swedish Private Equity & Venture Capital Association, *Private Equity på Tre Minuter*, (2014-03-02)

Typical venture capital-backed companies are high-risk ventures in technology-intensive industries that raise capital from numerous financial sponsors in multiple financing rounds, often to finance development and expansion. When venture capital-backed companies list, the ownerships of individual financial sponsors are generally much smaller compared to buyout-backed companies. Furthermore, the typical venture capital-backed company will be immature and unprofitable at listing, with brief operating history and limited tangible assets. (Schöber, 2008)

Conversely, buyout-backed companies are generally established enterprises with extensive operating history, predictable cash flows, and considerable tangible assets. When buyout funds acquire portfolio companies, they normally assume full ownership, though majority interests are also common. Occasionally, several buyout funds form consortiums for larger acquisitions. Approximately four to seven years after the acquisition, the portfolio company will be divested through industrial or financial acquirers, or an initial public offering. The equity offerings are

generally larger for buyout-backed companies compared to venture capital-backed companies. (Ernst & Young, 2014)

Previous research

Conflicts of Interest

One explanation for underpricing comprises conflicts of interest between vendors and manager(s) regarding distribution networks – manager(s) will more likely win future mandates if they have wide distribution networks. Underpricing will solidify relationships between institutional investors and the manager(s) and lead to widened distribution networks.

Another theory within conflicts of interest concerns aftermarket stabilization. Given the uncertainty surrounding the offering price, investors desire certainty regarding proper due diligence execution. The underwriter certifies offering quality by market stabilization efforts through greenshoes. Theory suggests that manager(s) pursue lower offering prices to limit the probability of stabilization.

Other theories within conflicts of interest concern “spinning” and trading commissions. The “spinning” theory suggests that manager(s) allocate shares to potential future clients. The investor subsequently flips the underpriced shares shortly after listing for immediate profits – quid pro quo. The trading commission theory can be elucidated through the Securities and Exchange Commission sentenced penalty charge for Credit Suisse First Boston in 2002, caused by the extraction of profits from customers through inflated commissions that represented profit sharing arrangements for share allocations in popular offerings. (Taylor, 2013)

Asymmetric Information

Rock (1986) presented the “winners curse theory”, where informed and uninformed investors both bid for initial public offerings. Informed investors will only invest into superior offerings, causing reduced average return for uninformed investors, since they hold more inferior offerings. In order to attract uninformed investors at fair prices, informed investors must extract abnormal returns.

Benveniste and Spindt (1989) have studied the explanation for underpricing offered by the bookbuilding procedure. The theory suggests that manager(s) have insufficient information to price the offering properly. Therefore, they gather indications of interest from institutional investors. In order to extract truthful revelations, the manager(s) must offer abnormal returns.

Welch (1992) has presented research within the “cascades and herding theory”, which adheres to the offering quality noise. With substantial noise regarding offering quality, investors will follow other investors when they evaluate offerings. Should the manager(s) capture prominent investors via underpricing, other investors will quickly follow, even though they might have negative opinions concerning the offering.

Bookbuilding

Previous research regarding underpricing can undoubtedly be considered academically embraced. However, one could argue that the least explored area within underpricing adheres to the bookbuilding theory, namely that share allocation should explain underpricing. The most plausible justification for the theory relates to information scarcity regarding share allocation in the bookbuilding process. Within the theory, the allocation of shares to institutional investors versus retail investors has interested academics. Ritter and Welch (2002) state that manager(s) often protect information regarding share allocations – something that has hampered research. Furthermore, empirical evidence has typically depended on sample period.

Hanley and Wilhelm (1995) suggest that institutional investors capture large proportions of the short-run profits associated with initial public offerings. However, the favored status enjoyed by institutional investors regarding underpriced offerings appears to comprise quid pro quo expectations that the institutional investors will participate in less attractive offerings also. Their findings coincide with Benveniste and Spindt (1989).

Aggarwal, Prabhala and Puri (2002) examine institutional allocation for offerings between 1997 and 1998 in the United States. Their research documents positive relationships between institutional allocation and underpricing, because institutions are allocated more shares in offerings with strong pre-market demand, consistent with bookbuilding theories. However, institutional allocation could also explain underpricing beyond the relation with pre-market demand, which suggests that manager(s) allocate more shares to institutional investors in offerings with strong pre-market demand to obtain favorable pre-market demand information or that institutional investors possess private information. Their evidence supports bookbuilding theories of underpricing. However, the share allocation to institutional investors for underpriced offerings cannot be explained by bookbuilding alone.

Ljungqvist and Wilhelm (2002) estimate the structural relations between share allocations, pre-market information production, and initial underpricing and suggest that (1) allocation

policies favor institutional investors; (2) increased institutional allocation yields offer prices that diverge more from the pre-marketing price range; (3) constraints on manager discretion reduce institutional allocation, which causes smaller price revisions, indicating reduced information production; and (4) initial returns are directly linked to information production and inversely related to institutional allocations.

Boehemer, Boehemer and Fishe (2006) made the most recent research on share allocation and underpricing. Their research suggests favorable underpricing for institutional investors, while institutions also obtain more shares in offerings with better long-run performance. Their research illustrates the importance of aftermarket relations between manager(s) and investors in addition to discretionary means that manager(s) possess to compensate investors beyond underpricing and price stabilization.

The latest master thesis regarding share allocation in the Nordic countries was written by Sevegran and Toft (2006). Their research studies initial public offerings between 1997 and 2006 in Sweden and suggests that institutional investors are not favored through higher share allocation in offerings with strong pre-market demand.

Glossary

Aftermarket

The market for trading shares subsequent to the pricing and allocation of an initial public offering. Market participants often define the aftermarket as the first few days of trading, but some define the aftermarket as the stabilization period, which includes the first 30 days of trading after the initial public offering. The period beyond the stabilization period is more commonly referred to as the secondary market.

Allocation

The process of fully or partially accepting investor bids by confirming the number of shares sold to each investor. Under the bookbuilding method allocations are entirely discretionary.

Bookbuilding

The pricing and underwriting method whereby the offer price is fixed and the offer underwritten after the book of preliminary orders has been built at the end of the marketing period.

Greenshoe

To enable over-allocation of shares and the flexibility for underwriters to buy back shares in the aftermarket to stabilize the share price in the aftermarket, issuers grant greenshoes, typically 15 per cent of the offer size, which gives the underwriter an option to purchase additional shares from the issuer at the offer price within 30 days following offering pricing.

Lock-up

The undertaking of the company and third party vendors not to sell additional shares without the prior consent of the managers. The lock-up period typically extends over 180 days, but can be considerably longer.

Managers

All members of syndicates with an underwriting responsibility, regardless of seniority and underwriting commitment. The international equivalent of “underwriters” for syndicates in the United States.

Overhang

The market expectation that large shareholders will announce further divestments. An overhang tends to depress the share price.

Pricing Date

The determination date for the fixed offer price. The pricing date coincides with the end of the marketing period in the bookbuilding method.

Prospectus

The name of the disclosure document provided to presumptive investors prior to their investment decision that contains information of the securities being offered, the issuers business, operations, prospects, capital structure and financial performance – also called offer circular or offer memorandum. Preliminary versions of prospectuses, referred to as preliminary prospectus or red herring, without specific information about the issue size and issue price are occasionally issued for marketing purposes.

Stabilization

Market activities conducted by the lead manager and possibly other syndicate members to ensure an orderly aftermarket.

Syndicates

Group of investment banks assembled to sell the shares in an equity offering. Syndicates have leaders, normally called the lead manager, and many varieties of investment banks and brokers that are more or less senior in the syndicate.

Underwriters

The equivalent of managers in the United States.

Underwriting

The commitment by the underwriter to purchase the shares that are not acquired by investors during the offering period.

Vendor

The seller of securities in initial public offerings. The vendor can be either the company (primary offerings) or selling third parties (secondary offerings) or both when new shares are issued and existing shares are sold.

(Lilja, 2014)