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Final Thesis Report

Private Equity Home Bias in the Nordics

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Abstract

Our study analyzes the home bias in private equity deals conducted in the Nordics. We find that Nordic private equity companies outperform their non-Nordic peers when investing in the Nordics by delivering a 17% higher IRR which is both statistically and economically significant.

Nordic Private equity firms fit the profile of more profitable PE companies. They are significantly smaller, exit deals faster, have more women on the board, are more often niche players, and have closer office proximity to their portfolio companies. These factors contribute to a higher achieved IRR by Nordic private equity companies.

Knowing the existence of the private equity home bias can help private equity companies significantly in how they approach fundraising, expand into new geographies, and manage existing portfolio companies.

Acknowledgments

We would like to express our appreciation and sincerest gratitude to our supervisor, Janis Berzins, for his guidance, patience, generous support, and input throughout the last year, particularly considering his demanding schedule.

We would also like to thank our industry experts from leading private equity companies and advisors for lending their time and expertise by sharing their knowledge about private equity and discussing our findings and their economic significance.

Contents

Abbreviations

Abbreviation	Full Name
bilNOK	Billion Norwegian Krone
bilSEK	Billion Swedish Krona
BLUE	Best linear unbiased estimator
e.g	For example
EMPL	Employee
ESG	Environmental, social, & governance
FTE	Full-time equivalent
GDP	Gross domestic product
IPO	Initial public offering
IRR	Internal rate of return
km	Kilometer
KPI	Key performance indicator
milEUR	Million Euro
PE	Private equity
Q1	Quarter one (01.01-31.03)
tn	Trillion
UK	United Kingdom
US	United States

1. Introduction and Motivation

Our research topic is within the private equity industry in the Nordics. We present two closely related questions: is there a private equity home bias when investing in the Nordic market, and what factors contribute to this home bias.

Last year, the overall size of the global private capital industry rose to above $10tn, and data provider preqin predicts that the private capital industry will grow to about $18tn by 2026. In their blue-sky scenario, Goldman Sachs forecasts it could swell to as big as $30tn by 2026 (Wigglesworth, 2022). Moreover, according to McKinsey's annual private market review (2022), private equity, part of the private capital industry, has experienced less volatility than other asset classes and has simultaneously outperformed those since 2008.

The Nordic private equity market has steadily grown over the last decade. According to the annual report from ABG Sundal Collier (2022), the Nordics have seen record-breaking landmark deals and deal activity in 2021. This activity is coherent with Nordic private equity companies, since the sector's emergence at the beginning of the 1990s, have raised increasingly more significant funds attracting new international investors (Spliid, 2013). The Nordics have raised 25% and 28% of all private equity funds raised in Europe for 2019 and 2020, respectively (Invest Europe, 2020). Comparing this to the Nordic country's contribution to the total European GDP, which was approximately 12% for both years, shows the significant impact Nordic private equity companies have on the continent.

In 1989, Jensen predicted that the PE industry or leveraged buyout industry would eventually become the dominant form of corporate organization. Despite this significant increase in investments in private equity both globally and locally over the last decades, the historical performance of PE remains ambiguous as research in the field is still sparse, inconclusive, and sometimes even controversial (Harris et al., 2014).

Moreover, there is almost no literature analyzing and describing private equity in the Nordic Region (Spliid, 2013), as most PE research focuses on the North American market (Sharma et al., 2021).

Industry professionals in the Nordic market believe there can be a home bias for Nordic private equity transactions. Nordic PE companies know and understand the local market best, leading to superior returns over non-Nordic private equity firms. However, no previous research has covered this area in the Nordics yet.

We contribute in two ways. Firstly, we add to existing research by dissecting the link between performance and characteristics of Nordic private equity companies. Secondly, no previous study has evaluated a private equity home bias. Due to information asymmetry and agency theories, a potential home bias in private equity may be significantly more substantial than previous research on public markets. The results of this study can potentially change the way private equity companies operate within the Nordic market and internationally.

In Q1 2022, we conducted interviews with PE companies and advisors. We have spoken to the top management of ten PE companies and four advisors. Among them are top wall-street banks with a significant presence in the Nordics, three of the five largest, based on raised capital over the last 20 years, PE companies in the Nordics, and two of the four most prominent private equity deal advisors for the Nordics based on deal volume. These interviews helped finetune our hypotheses, find additional significant variables, and interpret statistically significant results for their economic significance.

We find a private equity home bias within our examined data. When investing in the Nordic market, Nordic private equity companies significantly outperform non-Nordic private equity companies.

Moreover, this home bias is proxying for other variables. It becomes insignificant/less significant once we add additional variables explaining the difference between Nordic and non-Nordic PE companies to the model. We find that the percentage of women on the board for the private equity company, size of the private equity company, holding periods, and distances to the target company if below 800km, statistically and economically significantly explain part of the private equity home bias. Unlike previous research, cultural differences between the Nordics and other countries are insignificant in explaining the bias.

2. Literature review and theory

We start our analysis by presenting the significant factors of private equity companies, their objectives, funds & their lifecycle, transactions, and an overview of the Nordic private equity market.

2.1 Private equity overview

2.1.1 Private equity companies

The typical private equity company organizes as a limited liability corporation or partnership (Strömberg & Kaplan, 2009). The most prominent private equity houses globally are Blackstone, KKR, and Carlyle, whereas major Nordic private equity firms are EQT, Nordic Capital, and Altor. Jensen (1989) describes private equity companies as decentralized and lean organizations with, relative to their size, few investment professionals and employees. Private equity firms now seem to employ professionals with a wider variety of prior experience and skills (Strömberg & Kaplan, 2009).

One of the most popular definitions of private equity is by Cendrowski et al. (2012): "PE is a medium or long-term equity investment that is not publicly traded on an exchange." (p. 4). Their book highlights that private equity mainly consists of buyout transactions and venture capital but that debt securities, hedge funds, funds of funds, and other securities can also be considered PE. The main part of our sample consists of buyout transactions and a few venture capital transactions with majority ownership. According to the Cambridge dictionary (2022), majority ownership is "a situation in which a person or organization owns more shares in a company than any other shareholder, and enough to control it." PE firms usually take majority positions in the portfolio company and get actively involved in the firm with the fundamental aim of influencing management, as Barry et al. (1990) describe. Their study focuses on the venture capital part of private equity.

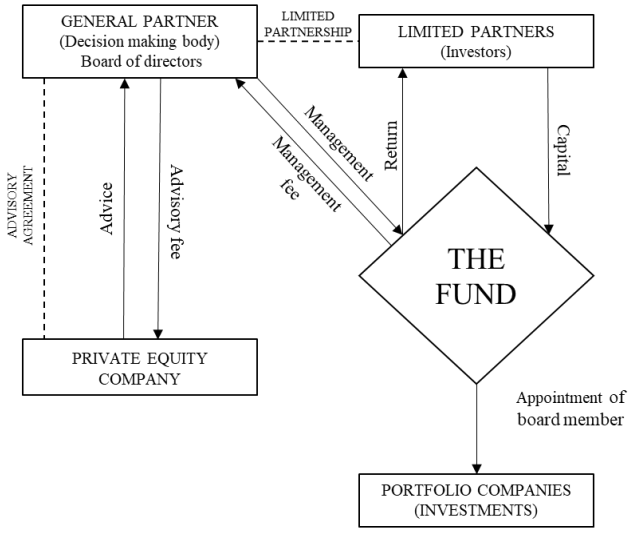
2.1.2 Main objectives of private equity firms

The main objective of private equity firms is to grow and restructure the portfolio firm to improve its future value (Osborne et al., 2012). According to Black and Gilson (1998), the restructuring involves both stewardship and an injection of finance. At the end of the investment horizon, the ultimate goal for the PE investor is to divest the firm at a higher value and generate wealth for the employees and the various stakeholders of the restructured portfolio firm (Cendrowski et al., 2012). Strömberg and Kaplan (2009) describe five main ways of exiting investments for PE companies. We have focused on PE-to-PE, financial and strategic exits. Especially PE-to-PE exits have increasingly gained popularity within the PE industry (Strömberg & Kaplan, 2009).

2.1.3 Private Equity Funds

Private equity firms raise finance through private equity funds with a limited lifetime (Cendrowski et al., 2012). Those funds are "closed-end" vehicles in which investors (limited partners) commit to providing funds for investments into portfolio companies and paying management fees. The general partner manages the fund, whereas the limited partner provides most of the capital (Strömberg & Kaplan, 2009). Examples of limited partners are wealthy individuals, institutional investors such as public and corporate pension funds, endowments and insurance companies. Figure one presents a simplified structure below.

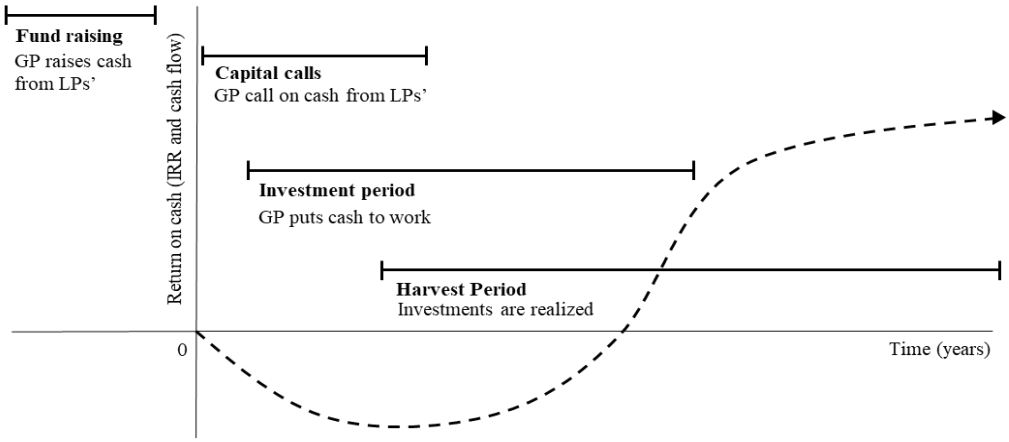
Figure 1: Typical structure of a private equity fund



2.1.4 Life cycle of a private equity fund

The classical private equity fund usually has a life cycle of seven to ten years (Blackstone, 2020). However, it can be extended additionally for one year at a time, up to a maximum of 13 years. The private equity company divides the fund's life cycle into four stages: organization/fundraising, capital calls, investment period, and harvest period. During the fundraising, investors commit capital to the private equity fund. The general partner calls the capital from the limited partners during capital calls. During the investment period, the manager puts the cash to work. Finally, during the harvest period, the investments in portfolio companies are realized, and the fund returns capital to the investors. Axelson et al., (2013) provide a detailed description of capital structures for levered buyouts. Figure two displays a typical life cycle of a private equity fund and the return characteristics below.

Figure 2: Life cycle of a private equity fund



2.1.5 Private equity transactions

The private equity company agrees to buy a company in a typical private equity transaction through one of their funds. The buyout's financing consists of 60 to 90% debt (Strömberg & Kaplan, 2009). The debt includes a senior secured loan, and often an investment bank arranges it (Cendrowski et al., 2012). In a private equity transaction, debt usually includes an unsecured junior component, either mezzanine or high-yield debt (Demiroglu & James, 2010). However, more recently, institutional investors such as hedge funds and collateralized loan obligation managers have purchased a large part of the debt (Strömberg & Kaplan, 2009).

2.1.6 Overview of the Nordic private equity market

This thesis examines private equity in the Nordic region. This paper defines the Nordic Region as Norway, Sweden, Denmark, and Finland.

According to Spliid (2013), the Nordic private equity market emerged in the 1990s, and private equity funds have grown to be one of the most critical investor groups in the region. The high returns generated in the Nordic market have attracted big international investors, which have enabled PE firms to raise large funds and increase capital under management.

According to the Norwegian venture capital and private equity association with analysis from Menon Economics (2021), private equity companies contribute over 40bilNOK value creation per year for the Norwegian society alone through jobs, innovation, taxes, and other fees as well as the employment of over 70.000 people.

As specified by the Swedish Private Equity & Venture capital Association (2017), over 1000 companies have received financing from PE firms in Sweden from 2007 to 2017, accounting for more than 150bilSEK. This amount is equivalent to the capital raised by IPOs on Nasdaq's Stockholm exchange during the same period. Due to investments made by private equity firms, Sweden's GDP has increased by 6% since 2005 (SVCA, 2017). Sweden is one of the world's leading countries regarding private equity, with a long track record of performance. Some of Europe's most prominent and best-performing private equity companies, Altor, Nordic Capital, IK, and EQT, are from Sweden (PitchBook, 2022).

Figure 3: private equity deals in the Nordic market

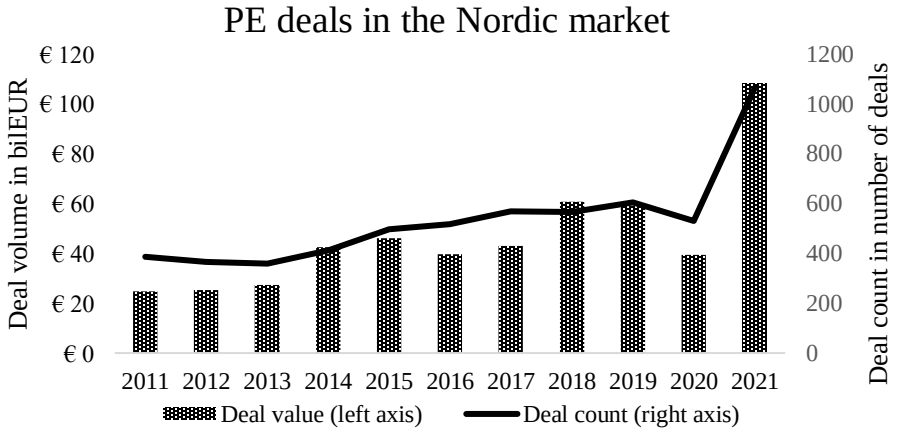


Figure three above shows that the total deal count has increased over the last ten years (PitchBook, 2022). After a pandemic-induced drop in total deal value in 2020, 2021 has seen record numbers for both total deal count and total deal value for the Nordic private equity market (Grant Thornton, 2022).

2.2 Equity home bias

After analyzing the main aspects of private equity companies and introducing the Nordic private equity market, we will examine previous literature about a public market equity home bias in the following paragraphs.

According to Warren (2010), The equity home bias is the examined phenomenon in which investors favor home market securities, which prior literature has branded a 'puzzle'. There is a geographically proximate preference within a radius of 100km for investments in publicly traded firms (Coval & Moskowitz, 2001). According to French and Poterba (1999), US, Japanese, and UK investors overweight their portfolios in their respective home markets. Besides that, according to Malloay (2005), geographically close analysts outperform their faraway counterparts. Shukla and van Inwengen (1995) demonstrate that fund managers achieve higher returns when investing in their home markets than fund managers investing abroad.

Generally, several researchers (e.g., (Brennan & Cao, 1997; Coval & Moskowitz, 2001; Doukas & Travlos, 1988) have argued that local investors appear to have superior access to information on local firms. This superior access to information results in an outperformance compared to foreign investors. If the foreign investors were to acquire the same information, they would face higher costs. For example, it is cheaper and more accessible for investors close to the target firm to visit a company's operations. This closeness makes it simpler for local investors to talk to the firm's board of directors, management, and employees face-to-face.

Furthermore, it is simpler for a local investor to know and understand the market conditions (operational, tax, and legal) under which a firm operates. Consequently, proximity allows for obtaining valuable private information. However, these opportunities decrease with increasing distance to a target firm (Stotz et al., 2010).

The realization of this home bias undermines the classical approach, which is to invest in a globally well-diversified portfolio (French & Poterba, 1991).

2.3 Information asymmetry from a private equity perspective

Having examined the previous research on the public market home bias, we will introduce information asymmetry into our analysis and argue why information asymmetry may translate into a strong private equity home bias.

Information asymmetry in finance is a widely known and studied concept (Sahar & Vaez, 2013; Bazamusa et al., 2016). An information asymmetry problem arises when one of the parties in a transaction has more information about an investment's performance than the other party (Goergen, 2018). Hence more information will be advantageous in evaluating whether the investment is profitable, involved risks, and the most accurate price. This is crucial in finance, as information can translate into value and returns (Grossman, 1976).

Given that there is strong evidence of a public market observed home bias, we believe there is a high chance of a private market home bias. Especially in private equity, the informational advantage might be strong due to substantial asymmetric information Hochberg & Rauh, 2013).

Due to less transparency in private markets than in public markets, the asymmetric information problem is more severe (Harris et al., 2014). Hence, not all information will be available to all players. Portes and Rey (2005) examine the determinants of cross-border equity flows. They conclude that with increasing distance between the investor and the target, costs of information increase, and information transmission becomes more complex. This distance creates an asymmetric information situation between foreign and domestic investors. Domestic investors closer to the target company can acquire information cheaper and more efficiently (Portes & Rey, 2005).

Additionally, over time private equity companies will build up a vast network of contacts that will provide them with information about deals and investment opportunities efficiently (Teten & Farmer, 2010). This efficiency decreases with increased distance to the target markets.

2.4 Agency theories potentially increase the private equity home bias

In addition to information asymmetry, agency theories may significantly increase the potential private equity home bias.

Agency theories are about societal order, motivation, contractual relationships, and implicit assumptions (Hofstede et al., 2010). Agency theory becomes highly relevant for this paper as the general and limited partners in a private equity fund are in a principal-agent relationship. Jensen and Meckling (1976) describe the principal agency theory, explaining that the portfolio company manager is motivated through financial incentives. The general partner is the agent managing funds from limited partners that are the principals.

This relationship creates a moral hazard problem. The agent might not always act in the principal's best interest due to the agent's personal benefits from taking on projects that adversely affect the principal (Jensen & Meckling, 1976; Eisenhardt, 1989; Cable & Shane, 1997). In public stock markets, the shareholders can easier exit their investment or act against management and the board of directors that expropriate shareholders' wealth (Edmans, 2009). This is more difficult within private equity as limited partners have committed to investing in the fund. They must fulfill this commitment or pay hefty fines making it costly to withdraw their funds prematurely. Hence, moral hazard problems are more severe than in public stock markets.

The private equity company can mitigate agency problems' effects by aligning the general payoff structure with the interests of the limited partners. Bienz et al., (2016) examine risk-taking in private equity funds. They find that the target company's beta negatively correlates with general partners' invested wealth in the fund.

Furthermore, the management and employees of the target company share the same interest and goals as the PE company through incentive provisions (Kaplan, 1989; Kaplan & Strömberg, 2009; Acharya et al., 2013). On average, management and employees of target companies are set to hold 17% of the equity (Gompers et al., 2016). Moreover, governance is one of the primary PE concepts (Gompers et al., 2016). It is hence crucial that the selected management (the agent) of the portfolio company do share the same interests and values as the investor (the principal) to minimize agency costs (Spliid, 2013).

However, more than 90% of organizational behavior literature considers theory and research based on U.S. cultural norms (House et al., 2004). Subsequently, we need to examine whether the principal-agent theory based mainly on US research applies to the Nordics.

2.5 Nordic culture and organizational structure

There is almost no research in the Nordic market concerning PE companies and none for a potential private equity home bias (Sharma et al., 2021). The Nordic region is unique, connoting a community of different values that transcend boundaries of language and culture (Østeegaard, 2002). The motivator-hygiene theory distinguishes between hygiene factors (extrinsic motivation) and motivators (intrinsic motivation). Hygiene factors are company administration, salary, supervision, and policy, whereas motivators are achievement, the work itself, recognition, advancement, and responsibility (Herzberg et al., 1959). The principal-agent theory underestimates intrinsic motivation by not accounting for cultural values, which influence management styles and incentive rewards (Spliid, 2013).

According to Spliid (2013), Nordic countries are more feminine in their values. Hence, monetary rewards and competition are not the only motivating aspects (Hofstede, 2001). Due to Nordic countries' feminine values, people work to live and not live to work, prefer leisure over more money, and social welfare for the whole society is highly valued (Hofstede et al., 2010). These aspects contrast with the US and many European countries like Germany, France, and Italy, which are considered more masculine (Hofstede et al., 2010), implying that motivation factors are monetary rewards, competition, and rewards for winning (Spliid, 2013).

However, the central values of the managers in the Nordic region are significantly different from their American peers, as explained above. Hence, they may not react according to the principal agency theory (Johnson & Droege, 2004). Therefore, it becomes crucial for non-Nordic PE companies to understand the different motivation factors in the Nordic market fully. It is uncertain whether financial incentives for managers will work as efficiently in the Nordic market as in other countries where masculine values dominate (Spliid, 2013). These cultural differences may explain a private equity home bias in the Nordics.

However, according to the convergence hypothesis presented in comparative management literature of the 1960s, management practices and philosophies should converge (Kerr et al., 1966). However, Hovstede (1960) opposes this view as he finds evidence for some convergence through the vital force of technological modernization, but variety will not cease to exist.

Hence, we will seek to answer which factors contribute to the private equity home bias and whether quantifiable cultural differences are a reason.

3. Hypothesizes

We have developed two major hypotheses.

3.1 Main Hypothesis: Private equity home bias

Firstly, we test whether there is a home bias for private equity investments in the Nordics.

Hypothesis 1: There is a home bias for private equity deals in the Nordics. Nordic PE companies achieve a higher IRR than non-Nordic PE companies when investing in Nordic companies.

Prior research has focused exclusively on public markets but has established the existence of a home bias on several occasions, starting with French and Poterba (1991). However, prior research also focused mainly on the US market. Based on our interviews, most industry professionals confirmed that they believe there can be a private equity home bias in the Nordic market.

3.2 Reasons for Home Bias

Given a home bias, we establish one additional central hypothesis.

Hypothesis 2: The location of the PE company proxies for other distinctive variables and characteristics of Nordic and non-Nordic PE firms and becomes insignificant once these variables are added to the regression.

Given Spliid's (2013) analysis, there are significant differences between Nordic private equity firms and non-Nordic private equity firms. Consequently, these differences should then partly explain the home bias. To better understand the proposed differences, we split this hypothesis into four sub-hypotheses that should explain part of the proxying characteristics of the locational variable while considering the additional input from feedback received from industry experts. Our interviewed industry experts doubt that cultural factors explain perceived differences between Nordic and non-Nordic private equity companies. Previous examined research is as well split on the issue. Therefore, we additionally examine whether perceived cultural differences are significant in explaining achieved IRR differences between Nordic and non-Nordic private equity companies.

3.2.1 Sub-hypothesis one: way of conducting business

Nordic PE firms have a different way of conducting business, leading to higher returns than non-Nordic PE firms

According to Hofstede (2001), there are different ways of conducting business that may affect achieved returns. According to Spliid (2013), Nordic countries conduct business differently than non-Nordic countries, especially the US and UK. We believe that the way of conducting business can explain part of the home bias. Our industry experts agree that there is a different way of conducting business in the Nordics compared to outside the Nordics. However, they are uncertain if this affects return significantly.

3.2.2 Sub-hypothesis two: holding period difference

Nordic PE firms have shorter holding periods for Nordic investments compared to non-Nordic PE firms, increasing the IRR

Bain & Company (2022) show that private equity companies with shorter time horizons of holding an investment achieve higher returns. We hypothesize that Nordic companies are better at exiting deals faster, increasing the achieved IRR.

3.2.3 Sub-hypothesis three: niche players

Nordic PE firms are more often niche players, creating higher returns

The investment success of a private equity company is very likely to be positively related to the managers' expertise in monitoring, skills, and developing their portfolio company (Das et al., 2003). As these skills are a costly resource, niched funds have a higher informational advantage and skill in their expertise industry, translating into superior performance (Cressy et al., 2014).

Hence, we hypothesize that a part of the home bias and superior Nordic PE returns are caused by specializing in a specific industry.

3.2.4 Sub-hypothesis four: larger, diversified international players with close office proximity

Larger, international diversified players with offices close to the portfolio companies' headquarters outperform smaller local players

Whereas Huss and Steger (2020) find no significant relation between geographical diversification and private equity fund performance, Humphery-Jenner (2013) finds a significant relationship between geographical diversification and PE fund performance. Although Lopez-deSilanes et al. (2015) find no significance between fund size and performance, Song et al. (2014) find a significant positive relation. According to Coval and Moskowitz (1999), there is a geographically proximate preference within a radius of 100km for investments in publicly traded firms. Shukla and van Inwengen (1995) show that fund managers achieve higher returns when investing in their home markets than fund managers investing abroad. Considering the above-mixed evidence, we hypothesize that larger, international diversified private equity companies with offices close to the portfolio companies' headquarters achieve a higher IRR when investing in the Nordic market.

3.2.5 Additional sub-hypothesis: organizational structure

Additional sub-hypothesis: Nordic PE firms have a different organizational structure, leading to higher returns over non-Nordic PE firms

We include an additional hypothesis based on Spliid's (2013) research that Norwegian PE companies have a different organizational structure than non-Nordic PE firms. According to Kashefi-Pour et al. (2020), a culture primarily depends on masculinity and power distance. These two characteristics may then lead to higher returns. However, as our industry experts are uncertain rather these differences explain higher returns, we have only included it as an additional hypothesis.

4. Data description

This section describes our data sample. We start our analysis with three significant definitions. Subsequently, we discuss the data collection process. Finally, we discuss vital variables and display their summary and descriptive statistics.

4.1 Major definitions

4.1.1 Nordic Private equity company

We first define the term Nordic private equity company.

Definition 1: A Nordic private equity company is a private equity company with headquarters in the Nordics or a significant presence (more than 30% of all deals by deal volume conducted in the Nordics on average for the last five years).

We include the second part of the definition as some private equity companies have been founded in the Nordics but subsequently moved their official headquarters to other locations or do not have a designated headquarter but significant operations within the Nordics.

4.1.2 Nordics

Definition 2: We define Nordics as Sweden, Norway, Denmark, and Finland

We focus on the four above countries. As for other Nordic countries, insufficient data is available.

4.1.3 Nordic portfolio company

Definition 3: A Nordic portfolio company is a company with headquarters located in the Nordics.

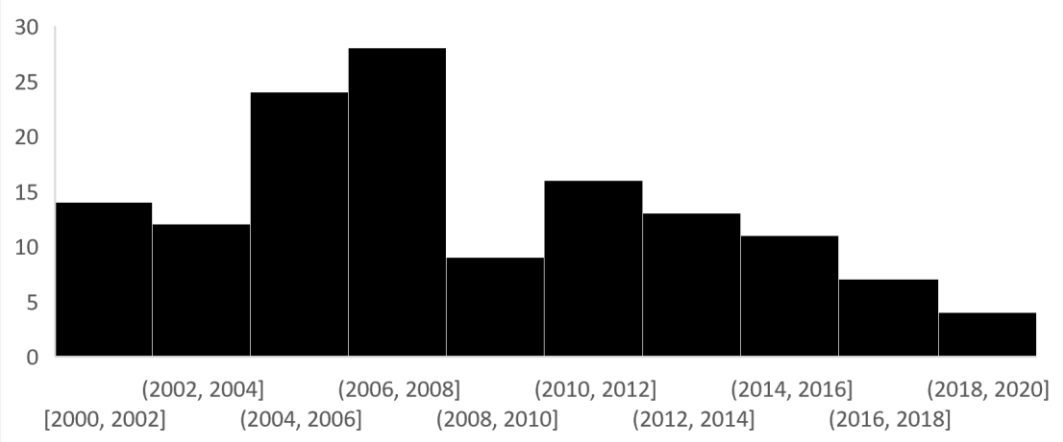
4.2 Data Collection

We select our data from two primary databases: Mergermarkets (102 deals) and preqin (48 deals). We cross-check reported data via Mergr, Zephyr, Pitchbook, valu8, and Crunchbase. We select deals conducted by private equity companies for which all needed information is available: Target company, buyer, seller, effective purchase and selling date, entry & exit price. Hence, we only use those deals with a complete loop where a private equity company bought and sold a target company between 2000 and 2020.

We analyze 150 PE deal loops in the Nordics between 2000-2020. Nordic PE firms conducted 94 and non-Nordic PE firms 56. Of the target companies, 71 are in Sweden, 49 in Norway, 22 in Denmark, and 8 in Finland. Figure four displays the exit deal year distribution.

Figure 4: Distribution of deal exits by year of private equity companies in the Nordics

This figure shows the deal exit distribution of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe.



4.3 Key Variables

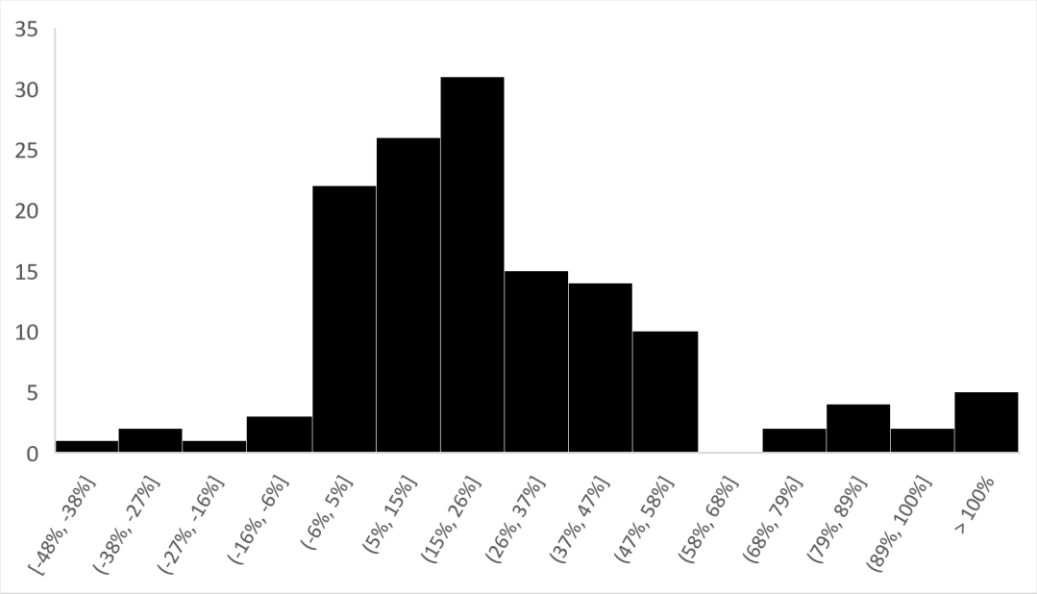
We identify IRR as our preferred return characteristic as the dependent variable for hypotheses one and two. Home bias is an independent variable for hypotheses one and two. Additionally, we apply twelve key variables to analyze the four sub-hypotheses and the additional sub-hypothesis, explaining the home bias. If several PE firms jointly undertake a deal, we use the PE firm that buys the portfolio company's larger share. The following sub-sections explain all critical variables and their data collection process.

4.3.1 Dependent variable IRR for Hypothesis one and two

We use the IRR to measure the achieved return for each deal. We extract and cross-check purchase price, sales price, date of purchase & date of sale. We then use proff.no for Norway, allabolag.se for Sweden, proff.dk for Denmark, and proff.fi for Finland to check for potential dividends paid to the PE company and investments made by the PE company during the investment horizon into the portfolio company. Finally, we calculate the IRR for each deal. Figure five shows the resulting IRRs and their frequencies in a histogram. The graph depicts three essential observations. Firstly, there is a dramatic increase in observations around 0% IRR. Within our sample, only a few deals achieved a negative IRR. Secondly, most of the achieved IRRs are between -6% and 26%, in line with previous research about the average achieved IRR of PE companies for their investments. Thirdly, there is a substantial drop after 26%, which aligns with statements from interviewed industry experts, stating that it is difficult to achieve an IRR significantly above 25%.

Figure 5: Deal IRR distribution

This figure shows the internal rate of return (IRR) distribution of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe.



4.3.2 Location of the PE company

As per definition one, we define Nordic PE companies as PE companies with headquarters in the Nordics. We extract the data from Mergermarkets and preqin. Additionally, we make three manual adjustments for headquarters as for these three private equity companies, the second part of definition one applies.

4.3.3 Sub-hypothesis one: Way of conducting business

For sub-hypothesis one, we identify three key variables: PE number of employees, optimal ticket size, and percentage of women on the board.

4.3.3.1 PE number of FTE

We use the available data from our two primary databases. We cross-check the reported values with company reporting and our secondary databases to account for the number of FTE working at the PE company. All reported data do not deviate from each other by more than 5%. Hence we use available preqin data. Table one shows summary statistics for PE number of FTE for the complete sample, Nordic PE companies, and non-Nordic PE companies.

We split the sample into five different size brackets, namely small (less than 9 FTE), medium (10-49 FTE), large (50-99 FTE), and very large (100-500 FTE), enormous (bigger than 500 FTE).

Table 1: Descriptive statistics of private equity number of FTE

This table shows the results of the descriptive statistics for private equity number of full-time equivalent (FTE) for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*225*	*96*	*373*	*9*	*3500*
Nordic PE	*94*	*160*	*34*	*209*	*9*	*1034*
Non-Nordic PE	*56*	*336*	*172*	*535*	*57*	*3500*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. The sample size for both samples is sufficient. Hence, a z-test is appropriate as the sample variance converges with the variance of the population (Brooks, 2008). Table two below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic PE firms have the same or a higher FTE mean than non-Nordic PE firms.

Table 2: Z-test of mean difference between Nordic and non-Nordic PE number of FTE

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' numbers of full-time equivalent (FTE). The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' number of FTE is equally high or higher than non-Nordic private equity companies' number of FTE.

Z-test statistic	p-value	z critical value	H_0
-2.2552	*0.01206*	*-1.65*	*"Rejected"*

4.3.3.2 Optimal ticket size

We split our sample into five different categories based on entry deal value in Euro, namely small deals (<15milEUR), medium deals (≥15milEUR and <50milEUR), large deals (≥50milEUR and <100milEUR), very large deals (≥100milEUR and <300milEUR), and enormous deals (≥300milEUR). We use the reported entry deal values from our primary databases and cross-check them through our secondary databases. Table three shows summary statistics for ticket sizes for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 3: Descriptive statistics of ticket size

This table shows the results of the descriptive statistics for ticket size for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. The ticket size is based on entry deal value. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

In milEUR	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*295*	*107*	*443*	*2*	*2100*
Nordic PE	*94*	*218*	*83*	*367*	*2*	*2100*
Non-Nordic PE	*56*	*426*	*197*	*527*	*15*	*2022*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table four below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic private equity firms have the same or a higher mean ticket size than non-Nordic private equity companies.

Table 4: Z-test of mean difference between Nordic and non-Nordic PE deal size

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' deal sizes. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' deal size is equally high or higher than non-Nordic private equity companies' deal size.

Z-test statistic	p-value	z critical value	H_0
-2.48936	*0.0064*	*-1.65*	*"Rejected"*

4.3.3.3 Percentage of women on the board of the PE firm

For the percentage of women on the board of the private equity firms, we use PE company information from their respective websites. We cross-check the number via LinkedIn premium information about employees. We divide the number of women on the board by the number of persons. Table five shows summary statistics for the percentage of women on the board for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 5: Descriptive statistics of the percentage of women on the board of the PE firms

This table shows the results of the descriptive statistics for the percentage of women on the board of the private equity firm for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. The percentage of women on the board is calculated by the number of women on the board divided by the total members. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*35%*	*33%*	*19%*	*0%*	*66%*
Nordic PE	*94*	*39%*	*33%*	*16%*	*0%*	*66%*
Non-Nordic PE	*56*	*27%*	*25%*	*20%*	*10%*	*50%*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table six below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic private equity firms have the same or a lower mean percentage of women on the board than non-Nordic private equity firms.

Table 6: Z-test of mean difference between Nordic and non-Nordic PE percentage of women on the board of the PE firm

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' percentage of women on the board. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' percentage of women on the board is equally high or smaller than non-Nordic private equity companies' percentage of women on the board.

Z-test statistic	p-value	z critical value	H_0
3.7050	*0.0001*	*1.65*	*"Rejected"*

4.3.4 Sub-hypothesis two: Holding period difference

We split our sample into four different holding periods, namely short duration (< 3 years), medium duration (≥ 3 years and < 5 years), long duration (≥ 5 years and < 7 years), and very long duration (> 7 years). Table seven shows summary statistics for the holding period for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 7: Descriptive statistics of investment holding periods

This table shows the results of the descriptive statistics for the holding period in years for an investment of the private equity firm for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. The holding period is calculated by the difference in years between the reported sales date and purchase date. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

In years	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*4.75*	*4.25*	*2.62*	*0.75*	*13.3*
Nordic PE	*94*	*4.39*	*4.23*	*2.05*	*0.75*	*10.9*
Non-Nordic PE	*56*	*5.46*	*4.51*	*3.31*	*1.66*	*13.3*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table eight below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic private equity firms have the same or a higher mean holding period than non-Nordic private equity companies.

Table 8: Z-test of mean difference between Nordic and non-Nordic PE investment holding periods

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' holding periods. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' holding is equally high or larger than non-Nordic private equity companies' holding period.

Z-test statistic	p-value	z critical value	H_0
-2.0733	*0.0191*	*-1.65*	*"Rejected"*

4.3.5 Sub-hypothesis three: Niche players

For sub-hypothesis three, we evaluate one key variable. A private equity company is a niche player if it operates in only one sector, based on preqin's industry classification system, which table 28 in the appendix displays. Table nine below shows summary statistics for the number of sectors operating for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 9: Descriptive statistics of sector presence for PE firms

This table shows the results of the descriptive statistics for the sector presence of the private equity firm for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. Sector presence is calculated by adding the number of sectors the private equity company operates based on the industry classification system. If several private equity companies undertake a deal, the characteristic of niche player classification of the private equity company taking a larger share is used. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

In number of sectors	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*4.75*	*5.00*	*2.29*	*1.00*	*10.0*
Nordic PE	*94*	*4.44*	*5.00*	*2.50*	*1.00*	*10.0*
Non-Nordic PE	*56*	*5.27*	*6.00*	*1.77*	*1.00*	*10.0*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table ten below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic private equity firms have the same or a higher mean number of operating industries than non-Nordic private equity firms.

Table 10: Z-test of mean difference between Nordic and non-Nordic PE sector presence

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' sector presence. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies operate in the same amount of industries or more than non-Nordic private equity companies.

Z-test statistic	p-value	z critical value	H_0
-2.2943	*0.0109*	*-1.65*	*"Rejected"*

4.3.6 Sub-hypothesis four: Larger, international diversified players with close office proximity

For sub-hypothesis four, we evaluate three key variables: the excess return of our sample's biggest three PE firms, international diversification, and proximity to the nearest office.

4.3.6.1 Excess return of the biggest three PE firms

Based on the combined deal volume for every PE firm within our sample, we find the three biggest represented in our sample to be EQT, Ratos, and Nordic Capital.

4.3.6.2 International diversification

If the PE firms within our sample operate in more than two regions, based on our defined region system (table 29 in the appendix), they will be internationally diversified.

4.3.6.3 Proximity to the nearest office

Accounting for potential larger network effects, we calculate via Matlab the distance between the nearest office of the PE firm and the portfolio company. Table 11 shows summary statistics for the distance between the portfolio company and the respective private equity company for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 11: Descriptive statistics of the distance between nearest office and portfolio company

This table shows the results of the descriptive statistics for the distance between the private equity company and the portfolio company for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. The distance in kilometer (km) is the distance between the private equity company's nearest office and the portfolio company. If several private equity companies undertake a deal, the distance of the private equity company taking a larger share is used. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value

In km	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*663*	*514*	*702*	*5*	*6223*
Nordic PE	*94*	*507*	*416*	*481*	*5*	*2291*
Non-Nordic PE	*56*	*930*	*737*	*916*	*550*	*6223*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table 12 below shows the reported test statistic and the critical value. Based on the results, we can reject that Nordic private equity firms have the same or a higher mean distance between the portfolio company and the private equity firm's nearest office than non-Nordic private equity firms.

Table 12: Z-test of mean difference between Nordic and non-Nordic PE distance between nearest office and portfolio company

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity companies' distances. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' distance between their nearest office and the portfolio size is equally high or higher than non-Nordic private equity companies' distance.

Z-test statistic	p-value	z critical value	H_0
-3.0603	*0.0011*	*-1.65*	*"Rejected"*

4.3.7 Additional Sub-hypothesis: Organizational structure

We identify three critical variables for the additional sub-hypothesis: median employee tenure, employee distribution, and world bank factors.

4.3.7.1 Median employee tenure

We use LinkedIn's premium feature to record the median employee tenure for all PE companies conducting deals within our sample. Table 13 shows summary statistics for the median employee tenure for the complete sample, Nordic PE companies, and non-Nordic PE companies.

Table 13: Descriptive statistics of median employee tenure

This table shows the results of the descriptive statistics for the median employee tenure of the private equity company for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. If several private equity companies undertake a deal, the median employee tenure of the private equity company taking a larger share is used. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

In years	Sample Size	Mean	Median	Standard deviation	Min	Max
Complete Sample	*150*	*3.8*	*3.2*	*1.6*	*2.6*	*10.7*
Nordic PE	*94*	*4.1*	*3.2*	*1.1*	*2.8*	*10.7*
Non-Nordic PE	*56*	*3.6*	*3.0*	*2.2*	*2.6*	*8.7*

Additionally, to further analyze our sample, we use a one-tailed z-test to test for statistical significance in the difference of means. Table 14 below shows the reported test statistic and the critical value. Based on the results, we fail to reject that Nordic private equity firms have the same or a higher mean median employee duration compared to non-Nordic private equity firms.

Table 14: Z-test of mean difference between Nordic and non-Nordic PE median employee tenure

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity median employee tenure. The reported z-test statistic is evaluated against the z critical value for a one-tailed test. H_0 is the null hypothesis that Nordic private equity companies' median tenure is equally high or higher than non-Nordic private equity companies' median tenure.

Z-test statistic	p-value	z critical value	H_0
-1.6325	*0.0513*	*-1.65*	*" Fail to reject."*

4.3.7.2 Employee distribution

For employee distribution, we use LinkedIn's premium feature to manually record employee distribution in administration, finance, development, and entrepreneurship in percentage for each PE firm. Table 15 shows summary statistics for the four chosen employee distributions for the complete sample, Nordic PE companies and non-Nordic PE companies.

Table 15: Descriptive statistics of employee distribution in finance, business development, administration, entrepreneurship

This table shows the results of the descriptive statistics for the employee distribution in Finance, business development, administration, and entrepreneurship of the private equity company for the entire sample and for Nordic private equity (PE) as well as Non-Nordic private equity companies separately. "Employee distribution in finance" is the percentage of employees working in finance. "Employee distribution in business development" is the percentage of employees working in business development. "Employee distribution in administration " is the percentage of employees working in administration. "Employee distribution in entrepreneurship" is the percentage of employees working in entrepreneurship. If several private equity companies undertake a deal, the distributions of the private equity company taking a larger share are used. The distance in kilometer (km) is the distance between the private equity company's nearest office and the portfolio company. "Sample size" is the number of observations. "Min" is the minimum value. "Max" is the maximum value.

Employee Distribution in %		Sample Size	Mean	Median	Standard deviation	Min	Max
Finance	Complete Sample	*150*	*22%*	*20%*	*7%*	*0%*	*45%*
	Nordic PE	*94*	*22%*	*20%*	*7%*	*0%*	*41%*
	Non-Nordic PE	*56*	*23%*	*21%*	*7%*	*7%*	*45%*
Business Development	Complete Sample	*150*	*15%*	*13%*	*8%*	*0%*	*37%*
	Nordic PE	*94*	*15%*	*13%*	*8%*	*0%*	*33%*
	Non-Nordic PE	*56*	*15%*	*13%*	*8%*	*2%*	*37%*
Administration	Complete Sample	*150*	*15%*	*14%*	*6%*	*0%*	*26%*
	Nordic PE	*94*	*16%*	*20%*	*6%*	*0%*	*26%*
	Non-Nordic PE	*56*	*13%*	*13%*	*6%*	*3%*	*24%*
Entrepreneur-ship	Complete Sample	*150*	*8%*	*6%*	*5%*	*0%*	*27%*
	Nordic PE	*94*	*8%*	*6%*	*5%*	*0%*	*27%*
	Non-Nordic PE	*56*	*7%*	*6%*	*5%*	*3%*	*27%*

Additionally, to further analyze our sample, we use the two-tailed z-test to test for statistical significance in the difference of means. Tables 16-19 below show the reported test statistic and the critical value for the four categories. Based on the results, we fail to reject that Nordic private equity firms have a different mean of employee distribution in finance, business development, and entrepreneurship compared to non-Nordic private equity firms.

However, we reject it for administration, where Nordic private equity firms have a statistically significantly different contribution than non-Nordic private equity firms.

Table 16: Z-test of mean difference between Nordic and non-Nordic PE employee distribution in finance

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity employee distribution in finance. The reported z-test statistic is evaluated against the z critical value for a two-tailed test. H_0 is the null hypothesis that Nordic private equity companies' employee distribution in finance equals non-Nordic private equity companies' employee distribution in finance.

Z-test statistic	p-value	z critical value	H_0
-1.3856	*0.1659*	*±1.9600*	*"Fail to reject."*

Table 17: Z-test of mean difference between Nordic and non-Nordic PE employee distribution in business development

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity employee distribution in business development. The reported z-test statistic is evaluated against the z critical value for a two-tailed test. H_0 is the null hypothesis that Nordic private equity companies' employee distribution in business development equals non-Nordic private equity companies' employee distribution in business development.

Z-test statistic	p-value	z critical value	H_0
0.3025	*0.7623*	*±1.9600*	*"Fail to reject."*

Table 18: Z-test of mean difference between Nordic and non-Nordic PE employee distribution in administration

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity employee distribution in administration. The reported z-test statistic is evaluated against the z critical value for a two-tailed test. H_0 is the null hypothesis that Nordic private equity companies' employee distribution in administration equals non-Nordic private equity companies' employee distribution in administration.

Z-test statistic	p-value	z critical value	H_0
2.9183	*0.0035*	*±1.9600*	*"Rejected"*

Table 19: Z-test of mean difference between Nordic and non-Nordic PE employee distribution in entrepreneurship

This table displays the z-statistics for the mean difference test between Nordic and non-Nordic private equity employee distribution in entrepreneurship. The reported z-test statistic is evaluated against the z critical value for a two-tailed test. H_0 is the null hypothesis that Nordic private equity companies' employee distribution in entrepreneurship equals non-Nordic private equity companies' employee distribution in entrepreneurship.

Z-test statistic	p-value	z critical value	H_0
0.4113	*0.6808*	*±1.9600*	*"Fail to reject."*

4.3.7.3 World bank factors

We use the world Bank database of the country specifications to select eight variables, split into six groups: education, goods market efficiency, labor market, financial markets, market size, and performance orientation, accounting for differences in the headquarters country organization and structure. The appendix tables 26 and 27 display all values for each country where a PE firm in our sample had its headquarters.

4.4 Interview of Nordic PE companies

In Q1 2022, we conducted interviews with PE companies and advisors. We have spoken to the top management of ten PE companies and four advisors. Among them are top wall-street banks with a significant presence in the Nordics, three of the five largest, based on raised capital over the last 20 years, PE companies in the Nordics, and two of the four most prominent private equity deal advisors for the Nordics based on deal volume.

During the meetings, we displayed our initial results and aimed to understand what makes Nordic PE companies different from the rest of the world and what makes the Nordic market different from the rest of the world. Furthermore, we asked for their input utilizing their unique experience on what variables they think are the most economically significant in explaining the home bias. The meetings were set up on an informal basis to reveal as much additional information as possible while considering obtaining data for testable hypotheses.

5. Methodology

We split the methodological section into four parts. We begin by explaining how we conduct our analysis. We then discuss the major regressions assumptions, continue with a robustness check, and finish with potential other biases affecting our study.

5.1 Hypothesis Testing

5.1.1 Hypothesis 1: Private Equity Home Bias

For hypothesis one, we run a simple linear regression. A dummy variable, one for Nordic PE companies and zero otherwise, is regressed on every observation's logged internal rate of return (IRR). The internal rate of return is the prevalent measure of performance in the private equity industry (Gompers et al., 2016). Therefore, we are using IRR to measure achieved returns. The IRR is the discount rate that equates to the present value of the cash inflows and outflows associated with an investment in a discounted cash flow analysis (Berk & DeMarzo, 2016). We have used the log transformation to achieve a less skewed distribution and satisfy the criteria for statistic inference (Stock & Watson, 2019).

The resulting regression is as follows:

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy \quad (1)$$

With the regression above, we test if Nordic private equity companies achieve a higher IRR on investments into portfolio companies in the Nordic market than non-Nordic private equity companies.

5.1.2 Hypothesis two: Reasoning of home bias

For hypothesis two, we create four sub-hypotheses and run a multivariate regression for each of them. The dependent variable remains the log IRR, whereas one of the independent variables remains the dummy for private equity location. We will add additional variables to the regression, testing if the locational variable proxies for other variables.

5.1.2.1 Sub-Hypothesis one: way of conducting business

We create five dummy variables based on the size of the PE firm, like the classification used by Gompers et al., (2016), and adjust for Nordic private equity companies based on interviews with industry experts. To avoid the dummy variable trap, we do not include the largest private equity company size (above 500 FTE) category in our regression model. The dummy variable trap occurs when including a qualitative variable with two or more categories in the regression model. According to Hirschberg & Lye (2001), additional constraints on the parameters are required to obtain determinate estimates in the regression. Two of the most common additional constraints to solve the dummy variable trap are to omit one of the dummy variables from the equation or to set the constant term to zero. We have opted for option one on all potential dummy variable traps.

Moreover, we run two additional regression specifications to check model resilience and further analyze private equity FTE impact on achieved return. The first model specification uses only the first of the four above-described dummies (Size of private equity firm below 10FTE). In contrast, the second additional model only uses the second of the five dummies (size private equity firm >10FTE and <50FTE).

Additionally, we create five dummy variables for ticket size, like the classification used by Gompers et al. (2016), and adjust for Nordic private equity companies based on interviews with industry experts. We do not include the largest deal size category (above 300milEUR) like for private equity firm size.

Both dummy variables take on the value one if the characteristic described in our data collection section matches the PE firm and zero otherwise. Our interviewed industry experts have two theories. Firstly, smaller players achieve higher IRR than larger players. As generally accepted in the finance literature, achieving a high IRR on a relatively small investment is more straightforward than on a relatively larger one. Smaller players raise smaller funds and need fewer employees working in the company to conduct business. Secondly, they think that more significant players might be able to achieve a higher return due to having "boots on the ground."

Additionally, we calculate the percentage of women on the board as our governance variable proxying for different governance approaches of PE companies. Spliid (2013) shows that the Nordic culture is more feminine than the UK and USA. Moreover, Lückerath-Rovers (2013) describes that public firms in the Netherlands with women on the board outperform those without them.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * size\ PE < 10FTE\ dummy + \beta_3 * size\ PE\ between \geq 10FTE\ and < 50FTE + \beta_4 * size\ PE \geq 50FTE\ and < 100\ dummy + \beta_5 * Size\ PE \geq 100FTE\ and < 500FTE\ dummy + \beta_6 * ticket\ size < 15milEUR\ dummy \quad (2)$$
$$\beta_7 * ticket\ size \geq 15\ and < 50milEUR\ dummy + \beta_8 * ticket\ Size \geq 50\ and < 100milEUR\ 50 + \beta_9 * ticket\ size \geq 100\ and < 300milEUR + \beta_{10} * Percentage\ of\ women\ on\ board$$

5.1.2.2 Sub-Hypothesis two: Holding Period Difference

For sub-hypothesis two, we create four dummy variables for holding periods or exits, based on Bain & Company's (2022) global private equity report, where PE companies achieve significantly higher IRR when their investment horizon is shorter. We use similar year ranges but adjust them based on interviews with industry experts for the Nordics. The three different dummy variables take on the value one if the deal was exited within three years, more than three and less than five years, and more than five and less than seven years, respectively. We do not include the fourth category of exits after seven years to avoid the dummy variable trap.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * exit < 3\ years\ dummy + \beta_3 * exit \geq 3\ and < 5\ years\ dummy + \beta_4 * Exit \geq 5\ and < 7\ years\ dummy \quad (3)$$

5.1.2.3 Sub-Hypothesis three: Niche Players

For sub-hypothesis three, we create a dummy variable concerning niche players according to the industry classification system used by preqin. Niche player private equity companies receive one, while all non-niche private equity companies have the dummy value of zero.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * niche\ player \quad (4)$$

5.1.2.4 Sub- Hypothesis four: Large international diversified players with close office proximity

For sub-hypothesis four, we create three dummy variables. If one of the three biggest PE firms within our sample undertakes a deal, the dummy variable for the biggest 3 PE firms is one and zero otherwise. If the private equity company is internationally diversified, as defined in our data collection section, the used dummy is one and zero otherwise. If the distance between the nearest office of the private equity company and the portfolio company is below 800km, the used dummy is one and zero otherwise.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * biggest\ 3\ PE\ firms\ dummy + \beta_3 * international\ diversification\ dummy + \beta_4 * distance\ portfolio\ company\ and\ PE\ nearest\ office\ dummy \quad (5)$$

5.1.3 Additional sub-hypothesis: Cultural Differences

We use a mix of world bank factors and PE firms' characteristics to proxy for cultural differences between Nordic and non-Nordic PE companies in a multivariate regression setting for the additional sub-hypothesis. The resulting regression equation is displayed below. We test for masculinity and power distance using similar world bank factors of selected countries as described by Spliid (2013). Among them are social values, efficient use of talent, and competition which proxy for masculinity. At the same time, we proxy for power distance, among others, by including employee distributions in four essential business functions and trustworthiness.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * EMPL\ distribution\ in\ finance + \beta_3 * EMPL\ distribution\ in\ business\ development + \beta_4 * EMPL\ distribution\ in\ administration + \beta_5 * EMPL\ distribution\ in\ entrepreneurship + \beta_6 * quality\ of\ education + \beta_7 * competition + \beta_8 * efficient\ use\ of\ talent + \beta_9 * efficiency + \beta_{10} * trustworthiness + \beta_{11} * domestic\ market + \beta_{12} * society\ values \quad (6)$$

5.2 Major regression assumptions

When using a classical linear regression model to conduct data analysis, five major regression assumptions need to hold. The regression model requires these desirable properties for running hypothesis tests regarding the soundness of the estimated coefficients. Additionally, we test for multicollinearity.

5.2.1 Assumption one

The first assumption of the classical linear regression model is that the average value of the error terms estimated by the model should be zero. The model will not violate the first assumption by including a constant term in the regression model. Estimated coefficients may become biased by violating this assumption. Having biased estimated coefficients would lead to a result that may not be consistent with the actual data sample. Additionally, violating assumption one could also lead to a negative R^2. Thus, the estimated dependent variable from the model explains more of the variation than the explanatory variables (Brooks, 2008).

All regression models performed in this master thesis include an intercept term; therefore, assumption one holds.

5.2.2 Assumption two

Homoscedasticity is the second major regression assumption. Homoscedasticity implies that error terms in the regression model have a constant variance. The error terms are heteroscedastic if this does not hold. (Stock & Watson, 2019). Consequently, the error terms are not BLUE, resulting in the estimated coefficient being still consistent and unbiased, but they are no longer the best linear unbiased estimate. They no longer have the minimum variance compared to other unbiased estimators. Even though the estimated coefficients may be correct, the standard deviation of the coefficients may not be, caused by using the error terms when estimating the standard deviation for coefficients. Therefore, any inferences made and tests conducted to test the validity of the coefficients may be deceiving (Brooks, 2008).

The most common statistical approaches to testing heteroscedasticity are the Goldfeld-Quandt (1965) and White's (1980) general test. As White's general test is the most common (Brooks, 2008), we opt to use it for all our estimated regressions.

Tables 36-42 in the appendix display the results from all tests. We fail to reject the null hypothesis that the errors are homoscedastic for all our tests. Hence, we conclude that the second regression assumption holds for all our estimated regressions.

5.2.3 Assumption three

Autocorrelation is the third major regression assumption. Autocorrelation is when the regression models' error terms have a nonzero correlation over time. If autocorrelation is present in the model and ignored, the estimated coefficients will be unbiased, but they will not be BLUE (Brooks, 2008). The data used to analyze in this paper is not time series data but cross-sectional. Therefore, autocorrelation will not be a significant issue in our model (Tong, 2011).

5.2.4 Assumption four

Explanatory variables are non-stochastic when they are not generated by a random process and are independent of each other. An explanatory variable is stochastic when drawn randomly from a population with a finite mean and a non-zero variance. Estimated coefficients will remain unbiased and consistent when stochastic regressors are present, provided there is a zero correlation between explanatory variables and error terms. Endogeneity is present when the zero-correlation criterion is violated, and estimated coefficients will not be consistent. There are three sources of endogeneity.

The correlation of an omitted variable with one of the explanatory variables in the regression model is the first source of endogeneity, causing a correlation between the error terms and the explanatory variable as the error terms capture the effects of the omitted variable. To address this problem, we look at previous research and conduct interviews with industry experts to ensure that the model includes explanatory variables relevant to explaining the home bias.

The second source of endogeneity is due to reverse causality. With reverse causality, a third common variable either influences two variables in the model or the variables simultaneously affect each other. We have gone through all the variables used in this model and done our best to check for simultaneity and reverse causality among variables conceptually.

The third source of endogeneity is due to measurement error. The error terms capture the difference between the wrongly measured variables and their actual value, resulting in a non-zero correlation between the explanatory variable and the error term. To mitigate the risk of this problem, we have thoroughly done the data collection process of the variables, controlling the validity of numbers and sources used.

5.2.5 Assumption five

Normally distributed error terms are the fifth major regression assumption. Having normality in the error terms is required for conducting joint or single hypothesis tests (Stock & Watson, 2019). A normally distributed data set should be symmetric about the mean with equally sized tails.

We use a Bera-Jarque test for normality which measures the skewness and kurtosis in the data (Brooks, 2008). Tables 43-48 in the appendix display the results for each regression. We reject the null hypotheses for all the tests that the error terms are normally distributed. The assumption of normality does not hold for any estimated regression. However, financial research papers such as Granger (1979) expect that when dealing with economic data.

5.2.6 Multicollinearity

Multicollinearity is when explanatory variables in the regression model are correlated. There exist two cases of multicollinearity, perfect and near multicollinearity. Perfect multicollinearity implies that there is an exact correlation between two explanatory variables. Coefficient estimation would then not be possible. There is a relationship between two variables with near multicollinearity, but it is imperfect. This type of multicollinearity is more likely to occur with empirical data (Stock & Watson, 2019).

When multicollinearity is present in the regression model, R^2 will be high, and standard errors of the individual coefficients will also be high, resulting in falsely giving the impression that the regression model explains a significant amount of the variation in the data. However, the estimated coefficients will be insignificant due to the large standard errors. The model becomes sensitive to minor changes in its structure. Removing or adding a variable will significantly impact estimated coefficient values and statistical significance (Brooks, 2008).

We create a correlation matrix for each regression to test whether our data sample suffers from multicollinearity. Tables 30-35 display the results in the appendix. The highest correlation from these matrices is -0.53 between international diversification and niche players, within the acceptable range for multicollinearity (Schober et al., 2018). Therefore, we can conclude that our data do not suffer from severe multicollinearity.

5.3 Regression robustness checks

In Empirical studies, it is a widespread practice to perform a robustness check to test how the estimated regression coefficients react to changes in the structure of the model. Leamer (1983) argues that the instability of estimated coefficients indicates a structural fault in the model. We can mitigate misinterpretation and structural errors by performing robustness tests of the regression models. A common way to conduct these tests is to add or remove variables from the model and observe how coefficients react to these structural changes (Lu & White, 2014). For a model to be robust, the critical estimated coefficients should not be sensitive to adding or removing variables from the model (Stock & Watson, 2019).

We test the robustness of our regressions models by combining all regressions of hypothesis two into one combined regression and analyze if any of the explanatory variables change their significance.

$$LogIRR = \beta_0 + \beta_1 * location\ PE\ dummy + \beta_2 * size\ PE < 10FTE\ dummy + \beta_3 * size\ PE\ between \geq 10FTE\ and < 50FTE + \beta_4 * size\ PE \geq 50FTE\ and < 100\ dummy + \beta_5 * Size\ PE \geq 100FTE\ and < 500FTE\ dummy + \beta_6 * ticket\ size < 15milEUR\ dummy + \beta_7 * ticket\ size \geq 15\ and < 50milEUR\ dummy + \beta_8 * ticket\ Size \geq 50\ and < 100milEUR + \beta_9 * ticket\ size \geq 100\ and < 300milEUR + \beta_{10} * Percentage\ of\ women\ on\ board + \beta_{11} * exit < 3\ years\ dummy + \beta_{12} * exit \geq 3\ and < 5\ years\ dummy + \beta_{13} * Exit \geq 5\ and < 7\ years\ dummy + \beta_{14} * niche\ player + \beta_{15} * biggest\ 3\ PE\ firms\ dummy + \beta_{16} * international\ diversification\ dummy + \beta_{17} * distance\ portfolio\ company\ and\ PE\ nearest\ office\ dummy \quad (7)$$

Table 49 in the appendix displays the combined regression. The combined regression has 17 explanatory variables plus the constant term. Out of the 18 variables, 16 remained unchanged regarding their statistical significance. However, exit below three years becomes insignificant, whereas international diversification becomes significant. Our regression is relatively robust. We expect the two changes in statistical significance as the sample is within private market data.

5.4 Potential other biases

5.4.1 Sample selection bias

Heckman (1979) discusses the sample selection bias of normally distributed data that is not perfect. Our sample's average realized IRR is 37%, which may lead to a significant upward bias. The average IRR for PE companies is significantly lower, according to Kaplan and Schoer (2005), at 17%. Interviews with industry experts confirm that a 20% IRR is what the average PE firm tries to achieve within the Nordic market. It appears that deals, where complete information is available through one or more databases, seem to be those where the private equity company achieves a high return and willingly shares this return to attract new investors for future funds potentially.

However, we assume that all PE companies within our sample behave similarly; hence, this bias may not be significant for the results of our study. From a future research perspective, it would be interesting to research if the home bias still holds with a more extensive data set of most private equity deals. However, this may be very difficult due to the secrecy of private equity companies.

5.4.2 Survivorship Bias

According to a study by Hendricks et al., (1997), performance can enhance survival probability. In case it does, this induced randomness challenges unbiased and robust inference. Private equity companies structure most deals with a substantial proportion of debt. Hence, there is a strong survivorship bias. Suppose the portfolio company fails to service its loans. In that case, it may go bankrupt; as in most private equity deals, the ability and collateral of the portfolio company are the only security for the loans. Our databases only record those deals which can be sold to another company, creating a survivorship bias. Therefore, they significantly overestimate the average achieved return. However, we have no reason to suspect that this survivorship bias differs from Nordic to Non-Nordic companies when investing in the Nordics and should not affect our analysis. Nevertheless, on a larger scale, it may be exciting in future research; if there is a higher bankruptcy rate for PE investments made by Nordic vs. Non-Nordic PE companies.

5.4.3 Omitted Variable Bias

According to Collot & Hemauer (2021), the omitted-variable bias arises when the regression model omits some significant explanatory variables, which can cause one or more of the coefficients of the explanatory variables to be biased.

Our analysis focuses on a wide array of parameters, which are measurable to dissect the reasoning of the private equity home bias in the Nordics. To address this problem, we look at previous research and conduct interviews with industry experts to ensure that the model includes explanatory variables relevant to explaining the home bias.

6. Results and analysis

6.1 Main Findings

We find a private equity home bias that is statistically significant at the 99% confidence level, confirming hypothesis one for our sample. When investing in the Nordics, Nordic private equity firms significantly outperform non-Nordic private equity firms, achieving a 17% higher IRR. Further, hypothesis two confirms that the dummy variable for the location becomes insignificant/less significant with additional variables in the model. We reject none of the sub-hypotheses except the anticipated rejection of the additional hypothesis for hypothesis two.

6.2 Hypothesis one – Existence of home bias

We find a significant relationship between the headquarter of a private equity company and its realized return in IRR when investing in the Nordic market, as table 20 displays below. Private equity companies in the Nordics achieve a significantly greater return than non-Nordic PE companies. The result is significant at the 99% confidence level, aligning with previous public market home bias research and our interviewed industry experts' beliefs. Hence, our sample for the Nordic market has a strong private equity home bias.

Table 20: Regression results for hypothesis one - existence of home bias

This table shows the results of regressing performance on a dummy for private equity firm location. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. "SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	0.0569***	0.0201	0.0055
PE location dummy	0.0669***	0.0252	0.0090
R^2	0.0491		
Adjusted R^2	0.0421		
F-Test	7.02		
Observations	150		

6.3 Hypothesis two – sub-hypothesis one

We find a significant relationship between the percentage of women on board and the achieved IRR, as table 21 displays below. Our data description section shows that Nordic PE firms have significantly more women on the board than non-Nordic PE firms. Combining our regression results with the descriptive statistics, we can conclude that the variable of women on the board is one of the explanatory factors in rationalizing the home bias. The result is statistically significant at the 99% confidence level, aligning with previous research by Spliid (2013) about the distinct cultural values of the Nordics and the rest of the world, our interviewed industry experts, and a study by Lückerath-Rovers (2013). Nevertheless, we believe that percentage of women on the board proxies for other factors that are challenging to further quantify due to the limited amount of data available on governance parameters for the private market in the Nordics.

Additionally, we compare all ticket size dummies to ticket sizes above 300milEUR, which has been removed as a dummy variable to avoid the dummy variable trap. However, none are statistically significantly different from zero. Nevertheless, our interviewed industry experts believe that smaller deals achieve a higher IRR than larger deals, which our sample cannot confirm. Hence, ticket size does not have explanatory power to decode the home bias within our sample. They also point out that larger ticket sizes have more international bidders, increasing the purchase price and making it more complicated to achieve superior returns.

Additionally, all four private equity FTE dummy variables are statistically significant at the 95% confidence level. In contrast, private equity companies under 10 FTE and 10 to under 50 FTE are significant at the 99% confidence level. The model omits the dummy variable for private equity firms above 500 FTE as the constant term represents it. Interpreting the results, private equity companies with less FTE achieve significantly higher returns than very large private equity companies.

Our data description section shows that Nordic PE firms have fewer FTE than non-Nordic PE firms. Combining our regression results with the descriptive statistics, we can conclude that the FTE of a PE company is one of the explanatory factors in rationalizing the home bias.

From the estimated coefficients and the p-values, PE companies with less than 10FTE have the highest estimated coefficient compared to very large PE companies with more than 500FTE. The estimated coefficients decrease for the other categories, except between the 10 to less than 50FTE and 50 to less than 100FTE PE companies, where the estimated coefficient increases. We interpret this as noise in our data. This disturbance is consistent with our industry experts' opinion. They believe that smaller private equity companies are often younger and take on more risk in their first funds to attract more capital for subsequent funds. Due to the data reporting and survivorship bias, we assume that only successful small firms report deal loop information.

In contrast, unsuccessful small firms do not do so, distorting the picture. On the other hand, the reporting bias may not be as tilted as initially assumed. Some of our industry experts point out that sometimes reporting a low sales price and hence low IRR may be required by the purchasing party as it may be listed.

Moreover, for sub-hypothesis one, we can see that the dummy variable for PE location does get insignificant once other variables it partly proxies for are added to the regression, which is in line with the main second hypothesis. Additionally, the adjusted R^2 has increased fourfold compared to hypothesis one. We explain about four times as much of the total variation of the dependent variable log IRR when just including the dummy variable for private equity location.

Table 21: Regression results for hypothesis two, sub-hypothesis one - way of conducting business

This table shows the results of regressing performance on a dummy for private equity firm location, percentage of women on the board of the private equity company, and measures of ticket and private equity (PE) firm sizes. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. " Percentage of women on the board" is the percentage of women on the board of a private equity company. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used. The four "ticket size dummy variables" are one if the entry deal value falls within the category and zero otherwise. The four "size PE dummy variables" are one if the private equity company's' Full-time equivalent (FTE) falls within the category and zero otherwise. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. "SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	-0.1672**	0.0713	0.0206
PE location dummy	0.0303	0.0272	0.2672
Percentage of women on the board	0.2247***	0.0681	0.0013
Ticket size < 15milEUR dummy	0.0109	0.0561	0.8454
Ticket Size ≥ 15mil and < 50milEUR dummy	0.0302	0.0544	0.5807
Ticket Size ≥ 50milEUR and < 100milEUR dummy	0.0047	0.0574	0.9346
Ticket Size ≥ 100milEUR and < 300milEUR dummy	0.0483	0.0461	0.2969
Size PE < 10 FTE dummy	0.2310***	0.0677	0.0009
Size PE ≥ 10 FTE and < 50 FTE dummy	0.1632***	0.0507	0.0016
Size PE ≥ 50 FTE and < 100 FTE dummy	0.1675**	0.0766	0.0306
Size PE ≥ 100 FTE and < 500 FTE dummy	0.1148**	0.0504	0.0245
R^2	0.2140		
Adjusted R^2	0.1520		
F-Test	3.4600		
Observations	150		

6.3.1 Two additional model specifications for private equity firm size

Finally, we run two additional model specifications confirming our analysis regarding private equity firm size and expected return. Additional model specification one only includes the first dummy variable for private equity firm size, which is one if it is below ten and zero otherwise. In contrast, additional model specification two includes only the private equity firm size dummy for 10 to less than 50 FTE. Tables 50 and 51 in the appendix show the resulting regression models. Both individual PE size variables are significant at the 95% confidence level. The estimated coefficients are positive, indicating that smaller firms achieve higher returns within our sample.

Moreover, the estimated coefficient is almost twice as high for PE firms with less than 10 FTE compared to PE firms with 10 to less than 50 FTE. Additionally, within the first additional model specification, the reported p-value for private equity firms with less than 10 FTE is significant at the 99% confidence level.

6.4 Hypothesis two – sub-hypothesis two

We compare the reported estimates and p-values for the three dummy variables for years until the exit to the omitted fourth dummy variable of exits above seven years, which is in the constant term. Table 22 below displays the regression results and shows that exiting below three years yields a significantly greater return than exiting after seven years within our sample. This result is consistent with arguments from our industry experts as they state that it is much easier to achieve a high IRR for a short duration than to achieve a high IRR for a medium to long-term. It is also consistent with industry reports like Bain & Company (2022), which show that faster exits generate higher IRR.

Our data description section shows that Nordic PE firms exit significantly faster than non-Nordic PE firms. Combining our regression results with the descriptive statistics, we can conclude that the holding period is one of the explanatory factors in rationalizing the home bias.

Interestingly, the industry experts state that exits after five years should have lower returns as most PE companies make forecasts of their acquisitions for five years (Gompers et al., 2016). They often plan to hold their investments for five years or less due to the limited time a private equity fund exists. When a private equity company holds an investment for more than five years, industry experts state that something has often not gone after the initial improvement plan. Hence, they need to extend their holding period to achieve the desired improvements, often lowering the IRR. Despite its statistical insignificance, the negative estimated coefficient of exits between five- and seven years underlines this.

Finally, the adjusted R^2 is about twice as high as the reported adjusted R^2 for hypothesis one. We explain about twice as much of the total variation of the dependent variable log IRR when just including the dummy variable for private equity location. However, unlike for sub-hypothesis one, the reported p-value for PE location remains significant at the 95% confidence level for sub-hypothesis two.

Table 22: Regression results for hypothesis two, sub-hypothesis two - holding periods

This table shows the results of regressing performance on a dummy for private equity firm location and holding period. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. The three "exit dummy variables" are one if the holding period in years between reported purchase date and sales date value falls within the category and zero otherwise."SE" is the standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	0.0317	0.0357	0.3759
PE location dummy	0.0640***	0.0249	0.0112
Exit < 3 years dummy	0.0833**	0.0368	0.0251
Exit ≥ 3 years and < 5 years dummy	0.0150	0.0378	0.6910
Exit ≥ 5 years and < 7 years dummy	-0.0159	0.0388	0.6809
R^2	0.0963		
Adjusted R^2	0.0761		
F-Test	4.7600		
Observations	150		

6.5 Hypothesis two – sub-hypothesis three

Our regression results in table 23 below for sub-hypothesis three show that niche players focusing on just one of the ten defined industries generate higher returns. The reported results are significant at the 95% confidence interval.

Our data description section shows that Nordic PE firms operate in fewer industries than non-Nordic PE firms. Combining our regression results with the descriptive statistics, we can conclude that being a niche player is one of the explanatory factors in rationalizing the home bias.

The reported results are consistent with previous research by Cressy et al. (2014) and our industry experts' opinions. They expect niche players to generate higher IRRs than generalists as information is costly. Hence, niche players have an information advantage in evaluating potential targets and are better able to understand the sub-market of the industry. These advantages should lead to more substantial performance improvements and higher achieved IRRs. As Nordic private equity companies operate on average in fewer industries when Non-Nordic private equity companies, the result further explains how the home bias arises.

Like sub-hypothesis two, the dummy PE location variable loses part of its significance but remains significant at the 95% confidence level. Together with the twice as high adjusted R^2 compared to hypothesis one, this result explains about twice as much of the total variation of the dependent variable log IRR when just including the dummy variable for private equity location. Therefore, this result underlines the dummy variable for location proxies for other variables.

However, our industry experts also state that big players might have niche funds or employees focusing on just one sector or vertical. Hence, despite not being considered niche players in the above hypothesis, they may be able to generate niche player returns through specialization and economies of scale in some of their funds. We test big players further in sub-hypothesis four.

Table 23: Regression results for hypothesis two, sub-hypothesis three - niche players

This table shows the results of regressing performance on a dummy for private equity firm location and niche player. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. "Niche player dummy" is one if the private equity company purchasing the portfolio company is only operating in one of the ten defined sectors and zero otherwise. If several private equity companies undertake a deal, the characteristic of niche player classification of the private equity company taking a larger share is used. "SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	0.0378*	0.0211	0.0758
PE location dummy	0.0586**	0.0249	0.0205
Niche player dummy	0.0638**	0.0247	0.0109
R^2	0.0938		
Adjusted R^2	0.0804		
F-Test	6.9900		
Observations	150		

6.6 Hypothesis two – sub-hypothesis four

Only one of the three examined factors is statistically significantly different from zero in sub-hypothesis four. The dummy for the distance between the portfolio company and the private equity company's nearest office under 800km is statistically significant at the 99% confidence level. Table 24 below displays the result and is consistent with previous research by Coval & Moskowitz (2001) and Shukla and van Inwengen (1995) on public markets. Our industry experts agree that close distance between the target and the private equity company's office is crucial to understand better the target's business, sub-market, and future opportunities to improve the target's business model. Our interviewed industry experts state that they would not invest in a country where they do not have a physical office. From the advisory side, the advisors state that having "boots on the ground" is crucial for private equity companies to achieve strong returns.

Within our sample, diversification is not statistically significant. However, the industry experts claim that international diversification helps achieve higher returns as a similar operating company may exist in several markets. Furthermore, they state that similar investments can be undertaken several times in different markets. Additionally, private equity companies can evaluate targets more efficiently as they have set KPIs for a similar company before. This experience significantly reduces the time needed to evaluate a potential target and reduces the potential risk of overpaying and underachieving. Our results are consistent with most of the previous research. Most of the evaluated papers show no significance in achieving higher returns when internationally diversified, like the paper from Huss and Steger (2020).

Thirdly, the biggest three private equity firms in our sample do not, in a statistically significant way, outperform other private equity companies in the Nordics, consistent with previous research by Lopez-deSilanes et al., (2015). Our industry experts agree partly. On the one hand, they state that larger private equity companies can become niche players in several sectors by specializing certain funds and employees to a sector, a region, or size, which should help them achieve niche-like returns.

Conversely, our industry experts agree that larger private equity companies manage more considerable funds with larger ticket sizes. Despite not being statistically significant for our sample, they state that larger private equity companies focus more on money multiples than achieved IRRs. However, within our data set, we cannot confirm this claim as being one of the three largest private equity companies neither increases nor decreases achieved returns in a statistically significant way. Combining our regression results with the descriptive statistics, we can conclude that a distance of under 800km is one of the explanatory factors in rationalizing the home bias. It is statistically significant within our regression, and Nordic PE companies are closer to their portfolio companies.

Finally, for sub-hypothesis four, we can see that the dummy variable for private equity location gets insignificant with the inclusion of other variables that the locational variable partly proxies, consistent with the main second hypothesis.

Additionally, the adjusted R^2 has doubled compared to hypothesis one. We explain about twice as much of the total variation of the dependent variable log IRR when just including the dummy variable for private equity location.

Table 24: Regression results for hypothesis two, sub-hypothesis four - larger international diversified PE companies with close office proximity

This table shows the results of regressing performance on a dummy for private equity firm location, international diversification, the biggest three private equity firms, and distance between the private equity company and the portfolio company. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. "International diversification dummy" is one if the private equity company operates in two or fewer regions and zero otherwise. "Biggest three PE firms in sample dummy" is one if a private equity company is one of the three biggest private equity firms based on combined deal volume, which are EQT, Ratos, and Nordic Capital undertake a deal and zero otherwise. "Distance <800km dummy" is one if the distance between the portfolio company and the private equity company's nearest office is below 800km and zero otherwise. For all three variables: if several private equity companies undertake a deal, the characteristics of the private equity company taking a larger share are used."SE" is the standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	-0.0198	0.0400	0.6244
PE location dummy	0.0496*	0.0292	0.0915
International Diversification dummy	0.0415	0.0316	0.1905
Biggest three PE firms in sample dummy	0.0003	0.0295	0.9907
Distance < 800km dummy	0.0785***	0.0283	0.0064
R^2	0.1060		
Adjusted R^2	0.0792		
F-Test	3.9500		
Observations	150		

6.7 Hypothesis two – additional hypothesis

None of the different organizational structure variables are significant at the 5% confidence level. The reported results displayed in table 25 below are inconsistent with previous research conducted by Kashefi-Pour et al. (2020). However, our industry experts state that organizational structure should not affect achieved returns. Although the organizational structure is different in different countries/regions, the impact on IRR should be negligible. Moreover, median tenure does not differ significantly for Nordic and non-Nordic private equity companies within our sample.

Competition & domestic market are the only two world bank factors statistically significant at the 90% confidence level. The negative coefficient of competition is consistent with its economic explanation as higher national competition should reduce achieved IRRs for private equity companies. This reduction in IRR is consistent with previous research by Kaplan and Strömberg (2009), who show that capital commitments are a proxy for competition within the private equity industry. Private equity performance decreases with increased committed capital (Kaplan & Strömberg, 2009). Additionally, the positive coefficient for the domestic market is consistent with economic theory as a higher quality domestic market leads to better access to finance and human capital, among others, leading to higher returns.

Both regression results and descriptive statistics give evidence to a similar conclusion that organizational differences do not rationalize the home bias.

As for sub-hypothesis two & three, the dummy private equity location variable losses part of its significance but remains significant at the 95% confidence interval. Together with the twice as high adjusted R^2 compared to hypothesis one, this result explains about twice as much of the total variation of the dependent variable log IRR when just including the dummy variable for private equity location. This outcome underlines that the dummy variable for location proxies for other variables.

Table 25: Regression results for hypothesis two, additional hypothesis - organizational structure

This table shows the results of regressing performance on a dummy for private equity firm location, median employee tenure, employee distribution characteristics, and world bank factors. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. "Median tenure" is the median tenure of the private equity company. "EMPL distribution in finance" is the percentage of employees working in finance. "EMPL distribution in business development" is the percentage of employees working in business development. "EMPL distribution in administration " is the percentage of employees working in administration. "EMPL distribution in entrepreneurship" is the percentage of employees working in entrepreneurship. "Quality of education" is the world bank factor of the quality of education of the private equity firm's headquarters country. "Competition" is the world bank factor of competition of the private equity firm's headquarters country. "Efficient use of talent" is the world bank factor of the efficient use of talent of the private equity firm's headquarters country. "Efficiency" is the world bank factor of the efficiency of the private equity firm's headquarters country. "Trustworthiness " is the world bank factor of the trustworthiness of the private equity firm's headquarters country. "Domestic market" is the world bank factor of the quality of the domestic market of the private equity firm's headquarters country. "Society values" is the world bank factor of the society values of the private equity firm's headquarters country. For all 12 variables: if several private equity companies undertake a deal, the characteristics of the private equity company taking a larger share are used."SE" is the standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	-4.6101	3.3504	0.1713
PE location dummy	0.0598**	0.0267	0.0271
Median tenure	0.0064	0.0089	0.4699
EMPL distribution in finance	0.2879	0.1933	0.1389
EMPL distribution in business development	-0.1922	0.1585	0.2275
EMPL distribution in administration	0.1547	0.2491	0.5357
EMPL distribution in entrepreneurship	-0.0199	0.3208	0.9703
Quality of education	-0.2641	0.2267	0.2463
Competition	-0.4493*	0.2535	0.0788
Efficient use of talent	0.3746	0.2515	0.1389
Efficiency	-0.0100	0.0782	0.8939
Trustworthiness	0.0588	0.0837	0.4837
Domestic market	0.1337*	0.0742	0.0742
Society values	0.3596	0.4223	0.3961
R^2	0.1590		
Adjusted R^2	0.0710		
F-Test	2.6100		
Observations	150		

7. Conclusions

Our study shows a strong private equity home bias, which is significant at the 1% threshold. Nordic PE firms outperform non-Nordic PE firms with a 17% higher achieved IRR when investing in Nordic portfolio companies for our sample, confirming our first hypothesis.

We then further examine whether the home bias proxies for alternative explanations by developing four sub-hypotheses. It does proxy for other variables. It becomes insignificant/less significant once we add additional variables explaining the difference between Nordic and non-Nordic PE companies to the model.

Particularly, smaller private equity firms outperform larger private equity firms, and Nordic private equity firms are statistically significantly smaller than non-Nordic private equity firms. Moreover, Nordic private equity firms have statistically significantly more women on the board, and more women on the board lead to higher achieved returns. Besides that, Nordic private equity companies hold their investments statistically significantly for shorter periods. Holding an investment below three years increases the achieved return significantly compared to an above seven years. Furthermore, Niche players generate statistically significantly higher returns than generalists, and Nordic Private equity firms operate in fewer industries than non-Nordic private equity companies. Finally, Nordic private equity companies are significantly closer to their portfolio companies. If the distance between the portfolio company and the private equity company is below 800km, statistically significantly higher returns are achieved. These quantifiable variables within our sample partly explain the proxying characteristics of the home bias for the Nordic market.

Knowing the existence of the private equity home bias can help both Nordic and non-Nordic private equity companies significantly in how they approach fundraising from new investors, expand into new geographies, and manage existing portfolio companies. Finally, our study helps investors how to allocate capital efficiently when choosing private equity investments.

8. Recommendations and Limitations

The results from this paper give rise to a wide array of potential future research in identifying more of the reasoning behind the private equity home bias. Future research can examine whether the local observed home bias exists in other geographies. At the same time, it confirms one of the major value propositions of Nordic private equity companies stating that Nordic PE companies know and understand the market's uniqueness better than non-Nordic PE companies.

The design of the current study is subject to some limitations. Firstly, the data set used in the study may suffer from survivorship bias as only good deals tend to get reported. Nevertheless, we do not see this affecting the study's overall results as we believe that both Nordic and non-Nordic PE companies act similarly when reporting successful deals. Future research can test the same hypothesis with a more complete data set containing most deals conducted in the Nordic market. However, as private equity companies do not share all deal characteristics, this may be challenging.

Secondly, the model may suffer from omitted variables bias even though the study has thoroughly searched for explanatory variables by reviewing previous research papers and interviewing industry experts. The possibility of omitted variables is high due to the complexity of the research question. Hence, we encourage a continuation of the research to exhaust all possible explanatory variables.

ESG has been an intensively discussed topic during our interviews with industry experts. They agreed that Nordic private equity firms, on average, are further in their usage of ESG in their investment analysis and improvement plans during the holding period. However, they were uncertain; if this would create a higher return. Moreover, the window for achieving this abnormal return may already be closed. Nevertheless, future research can analyze whether ESG in private equity creates higher returns and if ESG partly explains the private equity home bias for the Nordics. In the coming years, private equity firms will realize the first portion of ESG investments, which future research can examine.

Finally, our interviewed industry experts highlight another recent trend for private equity companies operating in the Nordics. If a private equity company has several different funds with different preferred investment sizes or industry preferences, more portfolio companies remain under the same private equity owner for several fund duration cycles. The private equity company conducts this process by selling portfolio companies from one of its funds to another, for example, small-cap to medium-cap. As the private equity market becomes increasingly competitive, private equity companies prefer to hold on to their existing investments longer. Future research can extend on this trend, as PE companies may be willing to accept a lower return on holding an existing investment but at an increased risk-adjusted return. This process may increase the opportunity set available for Nordic Private equity companies and decrease the opportunity set to non-Nordic private equity companies, potentially increasing the private equity home bias.

9. Appendix

9.1 Descriptive tables

Table 26: World bank factors for selected countries (1)

This table displays four world bank factors for the home countries of the private equity firms used in the analysis. For each factor, the maximum value is seven (exceptionally well), and the minimum is one (not well at all).

Countries	Education	Good market efficiency	Market size	Performance orientation
	Quality education	Competition	Domestic market	Society Values
Norway	*5.5*	*5.0*	*4.2*	*5.8*
Sweden	*5.2*	*5.1*	*4.4*	*5.8*
Denmark	*5.2*	*5.2*	*4.0*	*5.6*
Finland	*5.8*	*5.0*	*4.0*	*6.1*
Bahrain	*4.8*	*5.3*	*2.9*	*6.0*
Channel Island	*5.3*	*5.3*	*5.7*	*5.9*
Germany	*5.2*	*5.0*	*5.9*	*6.0*
Iceland	*5.4*	*4.6*	*2.0*	*5.8*
Jersey	*5.3*	*5.3*	*5.7*	*5.9*
UK	*5.3*	*5.3*	*5.7*	*5.9*
US	*5.2*	*5.1*	*7.0*	*6.1*
France	*5.0*	*4.7*	*5.7*	*5.7*
Canada	*5.5*	*5.2*	*5.3*	*5.8*

Table 27: World bank factors for selected countries (2)

This table displays three groups of world bank factors for the home countries of the private equity firms used in the analysis. For each factor, the maximum value is seven (exceptionally well), and the minimum is one (not well at all).

Countries	Labor market	Financial markets		Market size
	Efficient use of talent	Efficiency	Domestic market	Trustworthiness
Norway	*5.4*	*5.2*	*4.2*	*5.3*
Sweden	*5.2*	*4.8*	*4.4*	*5.2*
Denmark	*5.1*	*4.0*	*4.0*	*5.2*
Finland	*5.2*	*5.0*	*4.0*	*5.8*
Bahrain	*3.8*	*4.6*	*2.9*	*4.3*
Channel Island	*5.3*	*4.7*	*5.7*	*5.0*
Germany	*5.1*	*4.6*	*5.9*	*4.9*
Iceland	*5.1*	*3.7*	*2.0*	*4.1*
Jersey	*5.3*	*4.7*	*5.7*	*5.0*
UK	*5.3*	*4.7*	*5.7*	*5.0*
US	*5.4*	*5.2*	*7.0*	*5.8*
France	*4.5*	*4.5*	*5.7*	*4.6*
Canada	*5.4*	*4.9*	*5.3*	*6.0*

Table 28: preqin industry classification system

This table presents the primary industry classification system that preqin uses. There are a total of 11 primary industries. “Business services” is a commercial enterprise that provides work performed expertly by an individual or team to benefit its customers, typically through intangible products. “Consumer discretionary” are companies involved in producing goods and services considered non-essential by consumers but desirable if their available income is sufficient to purchase them. “Energy & utilities” are companies involved in the provision of essential services, the production, and the sale of energy. “Financial & insurance services” are companies involved in the finance industry. “Healthcare” are companies that provide goods and services to treat patients with preventive, curative, preventive, palliative, and rehabilitative care. “Industrials” are companies that relate to producing goods used in manufacturing and construction. “Information technology” are companies that focus primarily on developing or operating computers and their applications. “Raw materials & natural resources” are companies involved in the cultivation or extraction, exploration, refinement, and distribution of natural resources. “Real estate” are companies involved in the construction, development, management, or services required for buildings. “Telecom & media” are companies involved in transmitting messages, signs, images, signals, sounds, or information of any nature by various signals.

Industry
Business services
Consumer discretionary
Energy & utilities
Financial & insurance services
Healthcare
Industrials
Information technology
Raw materials & natural resources
Real estate
Telecoms & media

Table 29: Regional classification system

This table displays preqin's primary regional classification system. Europe is divided into secondary regions: west & central, east, Nordics, and southern.

North America
West & Central Europe
East Europe
Southern Europe
Nordics
Central Asia
East and Southeast Asia
Greater China
South Asia
Australasia
Middle East
Latin America & Caribbean
North Africa
Sub-Saharan Africa

9.2 Correlation matrices

Table 30: Correlation matrix for hypothesis two, sub-hypothesis one - way of conducting business

This table displays the correlation matrix for the first sub-hypothesis of hypothesis two of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis. The four "size private equity (PE) dummy variables" are the private equity company's' Full-time equivalent (FTE) dummy variables. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. The four "ticket size dummy (TS) variables are the different dummy variables for entry deal value. " Percentage of women on the board" is the percentage of women on the board of a private equity company. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used.

	Dummy location	Size PE < 10 employees	Size PE ≥ 10 and < 50 employees	Size PE ≥ 50 and < 100 employees	Size PE ≥ 100 and < 500 employees	TS < 15 MEUR	TS ≥ 15 and < 50 MEUR	TS ≥ 50 and < 100 MEUR	TS ≥ 100 and < 300 MEUR	Percentage of women on board
Dummy location	1.00									
Size PE < 10 employees	-0.01	1.00								
Size PE ≥ 10 and < 50 employees	0.33	-0.22	1.00							
Size PE ≥ 50 and < 100 employees	-0.02	-0.05	-0.17	1.00						
Size PE ≥ 100 and < 500 employees	-0.36	-0.21	-0.32	-0.16	1.00					
TS < 15 MEUR	0.05	0.10	0.16	-0.07	-0.18	1.00				
TS ≥ 15 and < 50 MEUR	0.28	0.04	0.35	-0.09	-0.27	-0.18	1.00			
TS ≥ 50 and < 100 MEUR	0.00	-0.08	0.09	-0.07	0.02	-0.13	-0.16	1.00		
TS ≥ 100 and < 300 MEUR	-0.21	-0.07	-0.33	0.11	0.23	-0.39	-0.42	-0.35	1.00	
Percentage of women on board	0.34	-0.08	0.19	-0.09	-0.19	-0.10	0.20	0.06	-0.07	1.00

Table 31: Correlation matrix for hypothesis two, sub-hypothesis two - holding period differences

This table displays the correlation matrix for the second sub-hypothesis of hypothesis two of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis.

	Dummy Location	< 3 years	≥ 3 and < 5 years	≥ 5 and < 7 years
Dummy Location	1.00			
3 years <	0.06	1.00		
≥ 3 and < 5 years	-0.15	-0.44	1.00	
≥ 5 and < 7 years	0.00	-0.38	-0.36	1.00

Table 32: Correlation matrix for hypothesis two, sub-hypothesis three - niche players

This table displays the correlation matrix for the third sub-hypothesis of hypothesis two of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis.

	Dummy Location	Niche or all sectors
Dummy Location	1.00	
Niche or all sectors	0.13	1.00

Table 33: Correlation matrix for hypothesis two, sub-hypothesis four - larger international diversified players with close office proximity

This table displays the correlation matrix for the fourth sub-hypothesis of hypothesis two of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis.

	Dummy Location	Biggest 3 PE firms' excess return	Diversification	Distance < 800km
Dummy Location	1.00			
Biggest 3 PE firms' excess return	0.40	1.00		
Diversification	-0.27	-0.21	1.00	
Distance < 800km	0.35	0.06	-0.26	1.00

Table 34: Correlation matrix for hypothesis 2, additional hypothesis – cultural differences

This table displays the correlation matrix for the additional sub-hypothesis of hypothesis two of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis.

	Dummy Location	Average employment duration	Employee Distribution in Finance	Employee Distribution in Business Development	Employee Distribution in Administration	Employee Distribution in Entrepreneurship	Quality education	Competition	Efficiency	Trustworthiness	Domestic market	Society Values
Dummy Location	1.00											
Average employment duration	-0.16	1.00										
Employee Distribution in Finance	-0.10	-0.09	1.00									
Employee Distribution in Business Development	-0.02	0.07	-0.23	1.00								
Employee Distribution in Administration	0.25	-0.30	-0.20	-0.15	1.00							
Employee Distribution in Entrepreneurship	0.07	0.27	0.14	-0.24	0.29	1.00						
Quality education	-0.04	0.11	-0.01	0.05	-0.07	0.03	1.00					
Competition	-0.01	-0.16	-0.02	0.00	0.13	-0.06	-0.35	1.00				
Efficiency	0.10	0.16	-0.07	0.05	0.08	0.14	0.46	-0.44	1.00			
Trustworthiness	0.09	0.05	0.04	0.05	0.04	0.09	0.34	-0.39	0.28	1.00		
Domestic market	-0.01	-0.17	-0.06	-0.02	0.18	-0.04	-0.12	0.39	0.07	0.25	1.00	
Society Values	-0.06	-0.13	0.06	-0.09	0.12	0.01	0.06	0.24	0.23	0.41	0.40	1.00

Table 35: Correlation matrix for robustness check - combined regression of sub-hypothesis one to four

This table displays the correlation matrix for the regression robustness check of all 150 deal loops. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a Nordic private equity company buying and selling a portfolio company within the timeframe. "Dummy location" is the locational variable used in the regression analysis.

	Dummy location	Size PE < 10	Size PE ≥ 10 and < 50	Size PE ≥ 50 and < 100	Size PE ≥ 100 and < 500	TS < 15	TS ≥ 15 and < 50	TS ≥ 50 and < 100	TS ≥ 100 and < 300	percentage of women on board	3 years <	≥ 3 and < 5 years	≥ 5 and < 7 years	Niche or all sectors	Biggest 3 PE firms' excess return	Diversifi-cation	Distance < 800km
Dummy location	1.00																
Size PE < 10	-0.01	1.00															
Size PE ≥ 10 and < 50	0.33	-0.22	1.00														
Size PE ≥ 50 and < 100	-0.02	-0.05	-0.17	1.00													
Size PE ≥ 100 and < 500	-0.36	-0.21	-0.32	-0.16	1.00												
TS < 15	0.05	0.10	0.16	-0.07	-0.18	1.00											
TS ≥ 15 and < 50	0.28	0.04	0.35	-0.09	-0.27	-0.18	1.00										
TS ≥ 50 and < 100	0.00	-0.08	0.09	-0.07	0.02	-0.13	-0.16	1.00									
TS ≥ 100 and < 300	-0.21	-0.07	-0.33	0.11	0.23	-0.39	-0.42	-0.35	1.00								
percentage of women on board	0.34	-0.08	0.19	-0.09	-0.19	-0.10	0.20	0.06	-0.07	1.00							
3 years <	0.06	0.23	0.09	0.03	-0.15	-0.07	0.00	0.13	-0.03	0.04	1.00						
≥ 3 and < 5 years	-0.15	-0.09	-0.01	0.13	0.06	-0.05	-0.13	0.00	0.16	0.00	-0.44	1.00					
≥ 5 and < 7 years	0.00	-0.07	-0.18	-0.11	0.16	0.00	-0.04	-0.08	0.03	-0.06	-0.38	-0.36	1.00				
Niche or all sectors	0.13	0.06	0.33	0.09	-0.29	-0.07	0.13	0.18	-0.11	0.14	0.20	-0.04	-0.16	1.00			
Biggest 3 PE firms excess return	0.40	-0.15	0.05	-0.12	-0.08	-0.18	0.05	0.06	0.10	0.25	-0.11	-0.14	0.11	0.21	1.00		
Diversification	-0.27	-0.03	-0.43	-0.10	0.42	-0.09	-0.18	-0.01	0.20	-0.08	0.11	0.00	0.07	-0.53	-0.21	1.00	
Distance < 800km	0.35	-0.04	0.29	-0.04	-0.26	0.15	0.19	0.07	-0.22	0.20	0.08	-0.03	-0.18	0.13	0.06	-0.26	1.00

9.3 General white's test

Table 36: White test for hypothesis one

This table displays the chi-squared statistics for the White test of hypothesis one, the existence of the home bias. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the error terms are homoscedastic.

alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.28	2.63	5.9915	"Do not reject H_0."

Table 37: White test for hypothesis two, sub-hypothesis one

This table displays the chi-squared statistics for the White test of hypothesis two, sub-hypothesis one, way of conducting business. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the error terms are homoscedastic.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.92	35.801	66.334	"Do not reject H_0."

Table 38: White test for hypothesis two, sub-hypothesis two

This table displays the chi-squared statistics for the White test of hypothesis two, sub-hypothesis two, holding period difference. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the error terms are homoscedastic.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.11	19.41	22.36	"Do not reject H_0."

Table 39: White test for hypothesis two, sub-hypothesis three

This table displays the chi-squared statistics for the White test of hypothesis two, sub-hypothesis three, niche players. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the error terms are homoscedastic.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.31	6	11.07	"Do not reject H_0."

Table 40: White test for hypothesis two, sub-hypothesis four

This table displays the chi-squared statistics for the White test of hypothesis two, sub-hypothesis four, larger, diversified international players with close office proximity. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H0 is the null hypothesis that the error terms are homoscedastic

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.67	11.26	23.69	"Do not reject H_0."

Table 41: White test for hypothesis two, additional sub-hypothesis

This table displays the chi-squared statistics for the White test of hypothesis two, additional sub-hypothesis, organizational structure. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H0 is the null hypothesis that the error terms are homoscedastic

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	1	2.31	111	"Do not reject H_0."

Table 42: White test for regression robustness check - combined regression of sub-hypothesis one-four

This table displays the chi-squared statistics for the White test of the regression robustness check, combined regression of sub-hypothesis one-four. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H0 is the null hypothesis that the error terms are homoscedastic

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.99	119.4	187.24	"Do not reject H_0."

9.4 Bera-Jarque Test

Table 43: Berra-Jarque test for hypothesis one

This table displays the chi-squared statistics for the Berra-Jarque test of hypothesis one, the existence of the home bias. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	1020.8	5.56	"reject H_0"

Table 44: Berra-Jacque test for hypothesis two sub-hypothesis one

This table displays the chi-squared statistics for the Berra-Jarque test of hypothesis two, sub-hypothesis one, way of conducting business. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	519.9	5.56	"reject H_0"

Table 45: Berra-Jacque test for hypothesis two-sub-hypothesis two

This table displays the chi-squared statistics for the Berra-Jarque test of hypothesis two, sub-hypothesis two, holding period difference. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	762.26	5.56	"reject H_0"

Table 46: Berra-Jacque test for hypothesis two-sub-hypothesis three

This table displays the chi-squared statistics for the Berra-Jarque test of hypothesis two, sub-hypothesis three, niche players. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	897.28	5.56	"reject H_0"

Table 47: Berra-Jacque test for hypothesis two-sub-hypothesis four

This table displays the chi-squared statistics for the Berra-Jarque test of hypothesis two, sub-hypothesis four, larger, diversified international players with close office proximity. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	944.41	5.56	"reject H_0"

Table 48: Regression results for robustness check - combined regression of sub-hypothesis one to four

This table displays the chi-squared statistics for the Berra-Jarque test of the regression robustness check, combined regression of sub-hypothesis one-four. The reported chi-squared test statistic is evaluated against the chi-critical value for a one-tailed test. H_0 is the null hypothesis that the data is normally distributed.

Alpha	p-value	Test-statistic	Critical value	Reject
0.05	0.001	1005.1	5.56	"reject H_0"

9.5 Robustness check – hypothesis two

Table 49: Regression Robustness check

This table shows the results of regressing performance on a dummy for private equity firm location, percentage of women on the board of the private equity company, measures of ticket and private equity firm sizes, holding period, niche player, international diversification, biggest three private equity firms, and distance between the private equity company and the portfolio company. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. " Percentage of women on the board" is the percentage of women on the board of a private equity company. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used. The four "ticket size dummy variables" are one if the entry deal value falls within the category and zero otherwise. The four "size PE dummy variables" are one if the private equity company's' Full-time equivalent (FTE) falls within the category and zero otherwise. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. The three "exit dummy variables" are one if the holding period in years between reported purchase date and sales date value falls within the category and zero otherwise. "Niche player dummy" is one if the private equity company purchasing the portfolio company is only operating in one of the ten defined sectors and zero otherwise. International diversification dummy" is one if the private equity company operates in two or less regions and zero otherwise. "Biggest three PE firms in sample dummy" is one if a private equity company is one of three biggest private equity firms based on combined deal volume, which are EQT, Ratos, and Nordic Capital undertake a deal and zero otherwise. "Distance <800km dummy" is one if the distance between the portfolio company and the private equity company's nearest office is below 800km and zero otherwise. For percentage of women on the board, size PE, niche player, international diversification, biggest three PE firms, and distance : if several private equity companies undertake a deal, the characteristics of the private equity company taking a larger share is used."SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Independent variable	Coefficient	SE	p-value
Constant	-0.2955***	0.0422	0.0005
PE location dummy	0.0142	0.0292	0.6291
Percentage of women on the board	0.0283***	0.0085	0.0048
Ticket size < 15milEUR dummy	-0.0076	0.0545	0.8895
Ticket Size ≥ 15mil and < 50milEUR dummy	0.0027	0.0527	0.9591
Ticket Size ≥ 50milEUR and < 100milEUR dummy	-0.0488	0.0561	0.3866
Ticket Size ≥ 100milEUR and < 300milEUR dummy	-0.0226	0.0447	0.6146
Size PE < 10 FTE dummy	0.2203***	0.0726	0.0029
Size PE ≥ 10 FTE and < 50 FTE dummy	0.1694***	0.0554	0.0027
Size PE ≥ 50 FTE and < 100 FTE dummy	0.1839**	0.0814	0.0257
Size PE ≥ 100 FTE and < 500 dummy	0.1114**	0.0505	0.0292
Exit < 3 years dummy	0.0282	0.0397	0.4781
Exit ≥ 3 years and < 5 years dummy	-0.0135	0.0381	0.7239
Exit ≥ 5 years and < 7 years dummy	-0.0009	0.0377	0.9803
Niche Player dummy	0.0604**	0.0297	0.0439
Diversification dummy	0.1148***	0.0380	0.0031
Biggest 3 PE firms in sample dummy	0.0233	0.0319	0.4675
Distance < 800km dummy	0.0719***	0.0269	0.0085
R^2	0.2430		
Adjusted R^2	0.1500		
F-Test	2.6100		
Observations	150		

9.6 Alternative model specification

9.6.1 Alternative model specification one of sub-hypothesis one

Table 50: Regression results for alternative model specification one of sub-hypothesis one

This table shows the results of regressing performance on a dummy for private equity firm location, percentage of women on the board of the private equity company, and measures of ticket and private equity firm sizes. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. " Percentage of women on the board" is the percentage of women on the board of a private equity company. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used. The four "ticket size dummy variables" are one if the entry deal value falls within the category and zero otherwise. "Size PE < 10 FTE dummy" is one if the private equity company's' full-time equivalent (FTE) is below ten and zero otherwise. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. "SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	-0.0416	0.0474	0.3821
PE location dummy	0.0416	0.0265	0.1191
Percentage of women on the board dummy	0.1599**	0.0684	0.0211
Ticket size < 15milEUR dummy	0.0361	0.0544	0.5088
Ticket size ≥ 15mil and < 50milEUR dummy	0.0752	0.0526	0.1551
Ticket size ≥ 50milEUR and < 100milEUR dummy	0.0143	0.0566	0.8016
Ticket size ≥ 100milEUR and < 300milEUR dummy	0.0518	0.0462	0.2645
Size PE < 10 FTE dummy	0.1157***	0.0381	0.0029
R^2	0.1780		
Adjusted R^2	0.1340		
F-Test	4.0300		
Observations	150		

9.6.2 Alternative model specification two of sub-hypothesis one

Table 51: Regression results for alternative model specification two of sub-hypothesis one

This table shows the results of regressing performance on a dummy for private equity firm location, percentage of women on the board of the private equity company, and measures of ticket and private equity firm sizes. The population is all Nordic (Norway, Sweden, Denmark, and Finland) private equity deal loops with majority ownership in 2000-2020. The sample excludes deals for which the private equity company has not sold the portfolio company yet, deals with insufficient information, and non-majority ownership sales. A deal loop is a private equity company buying and selling a portfolio company within the timeframe. The logged dependent variable internal rate of return (IRR) is calculated by extracting the purchase price, sales price, date of purchase & date of sale, adjusting for any refinancing during the holding period, and finally logging the IRR. "PE locational dummy" is one if a Nordic private equity company completed the deal loop and zero otherwise. " Percentage of women on the board" is the percentage of women on the board of a private equity company. If several private equity companies undertake a deal, the percentage of the private equity company taking a larger share is used. The four "ticket size dummy variables" are one if the entry deal value falls within the category and zero otherwise. "Size PE ≥ 10 FTE and < 50 FTE dummy" is one if the private equity company's' full-time equivalent (FTE) is ten or more but below 50 and zero otherwise. If several private equity companies undertake a deal, the size of the private equity company taking a larger share is used. "SE" is standard error. Statistical significance at the 10%, 5%, 1%, level is indicated by *,**,***, respectively.

Dependent variable: Log internal rate of return (IRR)

Independent variable	Coefficient	SE	p-value
Constant	-0.0223	0.0478	0.6421
PE location dummy	0.0228	0.0275	0.4082
Percentage of women on the board	0.1857***	0.0687	0.0078
Ticket size < 15milEUR dummy	-0.0001	0.0564	0.9982
Ticket Size ≥ 15mil and < 50milEUR dummy	0.0249	0.0551	0.6526
Ticket Size ≥ 50milEUR and < 100milEUR dummy	-0.0087	0.0583	0.8816
Ticket Size ≥ 100milEUR and < 300milEUR dummy	0.0267	0.0469	0.5700
Size PE ≥ 10 FTE and < 50 FTE dummy	0.0614**	0.0271	0.0248
R^2	0.1530		
Adjusted R^2	0.1080		
F-Test	3.3700		
Observations	150		

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11. Code

Data import

```
clear all;
close all;
clc;

%%table=readtable ('Master thesis/Matlab_v21.xlsx');
opts               = detectImportOptions('Master thesis/Matlab_v25_final.xlsx');
opts.VariableNames = {'Log_IRR', 'Dummy_Location', 'Size_P_E_Firm',...
    'Average_employment_duration', 'Employee_Distribution_in_Finance',...
    'Employee_Distribution_in_Business_Development',...
    'Employee_Distribution_in_Administration',...
    'Employee_Distribution_in_Entrepreneurship',...
    'Duration_of_investment','"Partnerships_of_PE"',...
    'Quality_education', 'On_the_job_trading',...
    'Competition', 'Qulity_of_demand_conditions', 'Flexibility',...
    'Efficent_use_of_talent', 'Efficiency', 'Trustworthiness',...
    'Domestic_market', 'Foreign_market', 'Capacity_for_innovation',...
    'Company_spending_RD', 'University_industry_collaboration_in_RD',...
    'Availability_of_scientists', 'Society_Practies', 'Society_Values',...
    'Years_of_investment', 'under_3_years', '3_to_5_years',...
    'between_5_and_7_years', 'larger_7_years', 'Revenue_initial',...
    'Revenue_exit', 'd_Exit_entry', 'Manufacturing_TA', 'Health_TA',...
    'TMT_TA', 'Real_Estate_Construction_TA', 'Tech_TA',...
    'Consumer_Services_TA', 'Financial_Services_TA',...
    'Age_of_target_company', 'Number_of_employees',...
    'Niche_or_all_sectors', 'Tech_investments',...
    'Manufacturing_investments', 'Energy_investments', ...
    'Health_investments', 'TMT_investments', 'Financial_investments',...
    'Diversication', 'Size_board_of_directors',...
    'Number_of_women_on_board', 'percentage_of_women_on_board',...
    'Native_speaker', 'Nordic_office0', 'years_since_founded_PE',...
    'Distance_in _km', 'EQT_exces_Return', 'Biggest3_ecess_return',...
    'Location_Sweden_PE', 'Location_Norway_PE', 'Location_Finnland_PE',...
    'Location_Dennmark_PE', 'NoC_Indeks', 'NoC_Klasse',...
    'Distance_less_than_400km', 'Distance_less_than_600km',...
    'Distance_less_than_800km', 'Distance_less_than_1000km',...
    'Distance_less_than_500km', 'NON_Distance_Below_800km',...
    'PE_Domain_Updated', 'PE_Domain_created', 'TS_below_15',...
    'TS_between_15_50', 'TS_between_50_and_100', 'TS_between_100_300',...
    'TS_above_300', 'Size_PE_below_10', 'Size_PE_between_10_50',...
    'Size_PE_Between_50_100', 'Size_PE_between_100_500',...
    'Size_PE_above_500',};

 data            =readtable('Master thesis/Matlab_v25', opts);
```

Hypothesis one

```
modelspec = ['Log_IRR ~ Dummy_Location '];
mdl_2 = fitlm(data,modelspec);
```

Hypothesis two – sub-hypothesis one - way of conducting business

```
modelspec = ['Log_IRR ~ Dummy_Location + Size_PE_below_10 + '...
    'Size_PE_between_10_50 + Size_PE_Between_50_100 + '...
    'Size_PE_between_100_500 + TS_below_15 + TS_between_15_50 + '...
    'TS_between_50_and_100 + TS_between_100_300 + '...
    'percentage_of_women_on_board'];
mdl_3 = fitlm(data,modelspec);
```

Hypothesis two – sub-hypothesis one - way of conducting business - alternative model specification one

- Small size PE with 10 or less FTE model

```
modelspec = ['Log_IRR ~ Dummy_Location + Size_PE_below_10 + '...
    'TS_below_15 + TS_between_15_50 + TS_between_50_and_100 +'...
    'TS_between_100_300 + percentage_of_women_on_board'];
mdl_4 = fitlm(data,modelspec);
```

Hypothesis two - sub-hypothesis two - way of conducting business - alternative model specification two

- Small Size PE with 11 to 50 FTE model

```
modelspec = ['Log_IRR ~ Dummy_Location + Size_PE_between_10_50 + '...
    'TS_below_15 + TS_between_15_50 + TS_between_50_and_100 +'...
    'TS_between_100_300 + percentage_of_women_on_board'];
mdl_5 = fitlm(data,modelspec);
```

Hypothesis two – sub-hypothesis two - holding period difference

```
modelspec = ['Log_IRR ~ Dummy_Location + under_3_years + x3_to_5_years +'...
    'between_5_and_7_years '];
mdl_6 = fitlm(data,modelspec,"Intercept",true);
```

Hypothesis two – sub-hypothesis three - niche players

```
modelspec = ['Log_IRR ~ Dummy_Location + Niche_or_all_sectors'];
mdl_7 = fitlm(data,modelspec);
```

Hypothesis two – sub-hypothesis four - Large international well diversifed players with close office proximity

```
modelspec = ['Log_IRR ~ Dummy_Location + Biggest3_ecess_return + '...
    'Diversication + Distance_less_than_800km '];
mdl_8 = fitlm(data,modelspec);
```

Hypothesis two – regression robustness check - combined sub-hypothesis one to four

```
modelspec = ['Log_IRR ~ Dummy_Location + Size_PE_below_10 + '...
    'Size_PE_between_10_50 + Size_PE_Between_50_100 + '...
    'Size_PE_between_100_500 + TS_below_15 + TS_between_15_50 + '...
    'TS_between_50_and_100 + TS_between_100_300 + '...
    'percentage_of_women_on_board + under_3_years + x3_to_5_years + '...
    'between_5_and_7_years + Niche_or_all_sectors + '...
    'Biggest3_ecess_return + Diversication + Distance_less_than_800km '];

mdl_9 = fitlm(data,modelspec);
```

Hypothesis two - additional hypothesis – cultural differences

- different organizational structure

```
modelspec = ['Log_IRR ~ Dummy_Location + Average_employment_duration + '...
    'Employee_Distribution_in_Finance + '...
    'Employee_Distribution_in_Business_Development + '...
    'Employee_Distribution_in_Administration + '...
    'Employee_Distribution_in_Entrepreneurship + '...
    'Quality_education + On_the_job_trading + Competition + '...
    'Efficiency + Trustworthiness + Domestic_market + '...
    'Society_Values '];
mdl_10 = fitlm(data,modelspec);
```

White test hypothesis one

```
data.h1 = data.Dummy_Location.^2;

u_H1 = mdl_2.Residuals.Raw;
data.u2_H1 = u_H1.^2;
%Auxiliary regression
modelspec = ['u2_H1 ~ Dummy_Location + h1'];
mdl_11 = fitlm(data,modelspec);

URSS_H1     = mdl_1.SSE;
T_H1        = mdl_1.NumObservations;
k_H1        = mdl_1.NumEstimatedCoefficients;
R2_aux_H1   = mdl_1.Rsquared.Ordinary;

alpha  = 0.05;
m_H1      = 2;

hyp1             = table();
hyp1.test_stat   = R2_aux_H1 * T_H1;
hyp1.crit_val    = chi2inv(1-alpha, m_H1);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_H1);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test hypothesis one

```
hyp2                  = table();
hyp2.alpha            = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_H1, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test hypothesis two – sub-hypothesis one

```
data.j2 = data.Dummy_Location.^2;
data.j3 = data.Dummy_Location .*data.Size_PE_below_10;
data.j4 = data.Dummy_Location .*data.Size_PE_between_10_50;
data.j5 = data.Dummy_Location .*data.Size_PE_Between_50_100;
data.j55 = data.Dummy_Location .*data.Size_PE_between_100_500;
data.j6 = data.Dummy_Location .*data.TS_below_15;
```

```
data.j7 = data.Dummy_Location .*data.TS_between_15_50;
data.j8 = data.Dummy_Location .*data.TS_between_50_and_100;
data.j9 = data.Dummy_Location .*data.TS_between_100_300;
data.j10 = data.Dummy_Location .*data.percentage_of_women_on_board;
data.j11 = data.Size_PE_below_10.^2;
data.j12 = data.Size_PE_below_10 .*data.Size_PE_between_10_50;
data.j13 = data.Size_PE_below_10 .*data.Size_PE_Between_50_100;
data.j14 = data.Size_PE_below_10 .*data.Size_PE_between_100_500;
data.j15 = data.Size_PE_below_10 .*data.TS_below_15;
data.j16 = data.Size_PE_below_10 .*data.TS_between_15_50;
data.j17 = data.Size_PE_below_10 .*data.TS_between_50_and_100;
data.j18 = data.Size_PE_below_10 .*data.TS_between_100_300;
data.j19 = data.Size_PE_below_10 .*data.percentage_of_women_on_board;
data.j20 = data.Size_PE_between_10_50.^2;
data.j21 = data.Size_PE_between_10_50 .*data.Size_PE_Between_50_100;
data.j22 = data.Size_PE_between_10_50 .*data.Size_PE_between_100_500;
data.j23 = data.Size_PE_between_10_50 .*data.TS_below_15;
data.j24 = data.Size_PE_between_10_50 .*data.TS_between_15_50;
data.j25 = data.Size_PE_between_10_50 .*data.TS_between_50_and_100;
data.j26 = data.Size_PE_between_10_50 .*data.TS_between_100_300;
data.j27 = data.Size_PE_between_10_50 .*data.percentage_of_women_on_board;
data.j28 = data.Size_PE_Between_50_100.^2;
data.j29 = data.Size_PE_Between_50_100 .*data.Size_PE_between_100_500;
data.j30 = data.Size_PE_Between_50_100 .*data.TS_below_15;
data.j31 = data.Size_PE_Between_50_100 .*data.TS_between_15_50;
data.j32 = data.Size_PE_Between_50_100 .*data.TS_between_50_and_100;
data.j33 = data.Size_PE_Between_50_100 .*data.TS_between_100_300;
data.j34 = data.Size_PE_Between_50_100 .*data.percentage_of_women_on_board;
data.j41 = data.Size_PE_between_100_500.^2;
data.j42 = data.Size_PE_between_100_500.*data.TS_below_15;
data.j43 = data.Size_PE_between_100_500.*data.TS_between_15_50;
data.j44 = data.Size_PE_between_100_500.*data.TS_between_50_and_100;
data.j45 = data.Size_PE_between_100_500.*data.TS_between_100_300;
data.j46 = data.Size_PE_between_100_500.*data.percentage_of_women_on_board;


u_1 = mdl_4.Residuals.Raw;
data.u2_1 = u_1.^2;
%Auxiliary regression
modelspec = ['u2_1 ~ Dummy_Location + Size_PE_below_10 + '...
    'Size_PE_between_10_50 + Size_PE_Between_50_100 + '...
    'Size_PE_between_100_500 + TS_below_15 + '...
    'TS_between_15_50 + TS_between_50_and_100 +'...
    'TS_between_100_300 + percentage_of_women_on_board + '...
    'j2 + j3 + j4 + j5 + j55 + j6 + j7 + j8 + '...
    'j9 +j10 + j11 + j12 + j13 + j14 + j15 + j16 + '...
    'j17 + j18 + j19 + j20 + j21 + j22  + j23 + j24 + j25 + j26 + '...
    'j27 + j28 + j29 + j30 + j31 + j32  + j33 + j34 + j41 + j42 + '...
    'j43 + j44 + j45 + j46'];
mdl_SUB1 = fitlm(data,modelspec);

URSS_1     = mdl_SUB1.SSE;
T_1        = mdl_SUB1.NumObservations;
k_1        = mdl_SUB1.NumEstimatedCoefficients;
```

```
R2_aux_1   = mdl_SUB1.Rsquared.Ordinary;

alpha  = 0.05;
m_1      = 49;

hyp1             = table();
hyp1.test_stat   = R2_aux_1 * T_1;
hyp1.crit_val    = chi2inv(1-alpha, m_1);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_1);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test Hypothesis two, sub-hypothesis one

```
hyp2                 = table();
hyp2.alpha           = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_1, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test Hypothesis two, sub-hypothesis two

```
data.d1 = data.Dummy_Location.^2;
data.d2 = data.Dummy_Location .*data.under_3_years;
data.d3 = data.Dummy_Location .*data.x3_to_5_years;
data.d4 = data.Dummy_Location .*data.between_5_and_7_years;
data.d5 = data.under_3_years.^2;
data.d6 = data.under_3_years .*data.x3_to_5_years;
data.d7 = data.under_3_years .*data.between_5_and_7_years;
data.d8 = data.x3_to_5_years.^2;
data.d9 = data.x3_to_5_years .*data.between_5_and_7_years;
data.d10 = data.between_5_and_7_years.^2;

u_2 = mdl_5.Residuals.Raw;
data.u2_2 = u_2.^2;
%Auxiliary regression
modelspec = ['u2_2 ~ Dummy_Location + under_3_years + '...
    'x3_to_5_years + between_5_and_7_years + '...
    'd1 + d2 + d3 + d4 + d5 + d6 + d7 + d8 + d9 '];
mdl_SUB2 = fitlm(data,modelspec);

URSS_2     = mdl_SUB2.SSE;
```

```
T_2         = mdl_SUB2.NumObservations;
k_2         = mdl_SUB2.NumEstimatedCoefficients;
R2_aux_2    = mdl_SUB2.Rsquared.Ordinary;

alpha  = 0.05;
m_2      = 13;

hyp1             = table();
hyp1.test_stat   = R2_aux_2 * T_2;
hyp1.crit_val    = chi2inv(1-alpha, m_2);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_2);
if hyp1.test_stat > hyp1.crit_val
        hyp1.reject = "reject H0";
else
        hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test Hypothesis two, sub-hypothesis two

```
hyp2                  = table();
hyp2.alpha            = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_2, alpha);
if hyp2.test_stat > hyp2.crit_val
        hyp2.reject = "reject H0";
else
        hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test – hypothesis two, sub-hypothesis two

```
data.d1 = data.Dummy_Location.^2;
data.d2 = data.Dummy_Location .*data.under_3_year;
data.d3 = data.Dummy_Location .*data.x3_to_5_years;
data.d4 = data.Dummy_Location .*data.larger_5_years;
data.d5 = data.under_3_years.^2;
data.d6 = data.under_3_years .*data.x3_to_5_years;
data.d7 = data.under_3_years .*data.larger_5_years;
data.d8 = data.x3_to_5_years.^2;
data.d9 = data.x3_to_5_years .*data.larger_5_years;

u_2 = mdl_5.Residuals.Raw;
data.u2_2 = u_2.^2;
%Auxiliary regression
modelspec = ['u2_1 ~ Dummy_Location + under_3_years + '...
    'x3_to_5_years + larger_5_years + '...
    'd1 + d2 + d3 + d4 + d5 + d6 + d7 + d8 + d9 '];
mdl_SUB2 = fitlm(data,modelspec);
```

```
URSS_2     = mdl_SUB2.SSE;
T_2        = mdl_SUB2.NumObservations;
k_2        = mdl_SUB2.NumEstimatedCoefficients;
R2_aux_2   = mdl_SUB2.Rsquared.Ordinary;

alpha  = 0.05;
m_2      = 13;

hyp1             = table();
hyp1.test_stat   = R2_aux_2 * T_2;
hyp1.crit_val    = chi2inv(1-alpha, m_2);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_2);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test Hypothesis two, sub-hypothesis two

```
hyp2                 = table();
hyp2.alpha           = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_2, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test hypothesis two, sub-hypothesis three

```
data.w1 = data.Dummy_Location.^2;
data.w2 = data.Dummy_Location .*data.Niche_or_all_sectors;
data.w3 = data.Niche_or_all_sectors.^2;

u_3 = mdl_6.Residuals.Raw;
data.u2_3 = u_3.^2;
%Auxiliary regression
modelspec = ['u2_3 ~ Dummy_Location + Niche_or_all_sectors + w1 + w2 + w3'];
mdl_SUB3 = fitlm(data,modelspec);

URSS_3     = mdl_SUB3.SSE;
T_3        = mdl_SUB3.NumObservations;
k_3        = mdl_SUB3.NumEstimatedCoefficients;
R2_aux_3   = mdl_SUB3.Rsquared.Ordinary;

alpha  = 0.05;
m_3      = 5;
```

```
hyp1             = table();
hyp1.test_stat   = R2_aux_3 * T_3;
hyp1.crit_val    = chi2inv(1-alpha, m_3);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_3);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test hypothesis two, sub-hypothesis three

```
hyp2                  = table();
hyp2.alpha            = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_3, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test hypothesis two, sub-hypothesis four

```
data.a1 = data.Dummy_Location.^2;
data.a2 = data.Dummy_Location .*data.Biggest3_ecess_return;
data.a3 = data.Dummy_Location .*data.Diversication;
data.a4 = data.Dummy_Location .*data.Distance_less_than_800km;
data.a5 = data.Biggest3_ecess_return.^2;
data.a6 = data.Biggest3_ecess_return .*data.Diversication;
data.a7 = data.Biggest3_ecess_return .*data.Distance_less_than_800km;
data.a8 = data.Diversication.^2;
data.a9 = data.Diversication .* data.Distance_less_than_800km;
data.a10 = data.Distance_less_than_800km.^2;

u_4 = mdl_7.Residuals.Raw;
data.u2_4 = u_4.^2;
%Auxiliary regression
modelspec = ['u2_4 ~ Dummy_Location + Biggest3_ecess_return + '...
    'Diversication + Distance_less_than_800km + '...
    ' a1 + a2 + a3 + a4 + a5 + a6 + a7 + a8 + a9 + a10'];
mdl_SUB4 = fitlm(data,modelspec);

URSS_4     = mdl_SUB4.SSE;
T_4        = mdl_SUB4.NumObservations;
k_4        = mdl_SUB4.NumEstimatedCoefficients;
R2_aux_4   = mdl_SUB4.Rsquared.Ordinary;
```

```
alpha  = 0.05;
m_4      = 14;

hyp1             = table();
hyp1.test_stat   = R2_aux_4 * T_4;
hyp1.crit_val    = chi2inv(1-alpha, m_4);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_4);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test hypothesis two, sub-hypothesis four

```
hyp2                  = table();
hyp2.alpha            = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_4, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test hypothesis two – additional hypothesis

```
data.q1 = data.Dummy_Location.^2;
data.q2 = data.Dummy_Location .*data.Average_employment_duration;
data.q3 = data.Dummy_Location .*data.Employee_Distribution_in_Finance;
data.q4 = data.Dummy_Location
.*data.Employee_Distribution_in_Business_Development;
data.q5 = data.Dummy_Location .*data.Employee_Distribution_in_Administration;
data.q6 = data.Dummy_Location .*data.Employee_Distribution_in_Entrepreneurship;
data.q7 = data.Dummy_Location .*data.Quality_education;
data.q8 = data.Dummy_Location .*data.Competition;
data.q9 = data.Dummy_Location .*data.Efficiency;
data.q10 = data.Dummy_Location .*data.Trustworthiness;
data.q11 = data.Dummy_Location .*data.Domestic_market;
data.q12 = data.Dummy_Location .*data.Society_Values;
data.q13 = data.Average_employment_duration.^2;
data.q14 = data.Average_employment_duration
.*data.Employee_Distribution_in_Finance;
data.q15 = data.Average_employment_duration
.*data.Employee_Distribution_in_Business_Development;
data.q16 = data.Average_employment_duration
.*data.Employee_Distribution_in_Administration;
data.q17 = data.Average_employment_duration
.*data.Employee_Distribution_in_Entrepreneurship;
data.q18 = data.Average_employment_duration .*data.Quality_education;
```

```
data.q19 = data.Average_employment_duration .*data.Competition;
data.q20 = data.Average_employment_duration .*data.Efficiency;
data.q21 = data.Average_employment_duration .*data.Trustworthiness;
data.q22 = data.Average_employment_duration .*data.Domestic_market;
data.q23 = data.Average_employment_duration .*data.Society_Values;
data.q24 = data.Employee_Distribution_in_Finance.^2;
data.q25 = data.Employee_Distribution_in_Finance
.*data.Employee_Distribution_in_Business_Development;
data.q26 = data.Employee_Distribution_in_Finance
.*data.Employee_Distribution_in_Administration;
data.q27 = data.Employee_Distribution_in_Finance
.*data.Employee_Distribution_in_Entrepreneurship;
data.q28 = data.Employee_Distribution_in_Finance .*data.Quality_education;
data.q29 = data.Employee_Distribution_in_Finance .*data.Competition;
data.q30 = data.Employee_Distribution_in_Finance .*data.Efficiency;
data.q31 = data.Employee_Distribution_in_Finance .*data.Trustworthiness;
data.q32 = data.Employee_Distribution_in_Finance .*data.Domestic_market;
data.q33 = data.Employee_Distribution_in_Finance .*data.Society_Values;
data.q34 = data.Employee_Distribution_in_Business_Development.^2;
data.q35 = data.Employee_Distribution_in_Business_Development
.*data.Employee_Distribution_in_Administration;
data.q36 = data.Employee_Distribution_in_Business_Development
.*data.Employee_Distribution_in_Entrepreneurship;
data.q37 = data.Employee_Distribution_in_Business_Development
.*data.Quality_education;
data.q38 = data.Employee_Distribution_in_Business_Development .*data.Competition;
data.q39 = data.Employee_Distribution_in_Business_Development .*data.Efficiency;
data.q40 = data.Employee_Distribution_in_Business_Development
.*data.Trustworthiness;
data.q41 = data.Employee_Distribution_in_Business_Development
.*data.Domestic_market;
data.q42 = data.Employee_Distribution_in_Business_Development
.*data.Society_Values;
data.q43 = data.Employee_Distribution_in_Administration.^2;
data.q44 = data.Employee_Distribution_in_Administration
.*data.Employee_Distribution_in_Entrepreneurship;
data.q45 = data.Employee_Distribution_in_Administration .*data.Quality_education;
data.q46 = data.Employee_Distribution_in_Administration .*data.Competition;
data.q47 = data.Employee_Distribution_in_Administration .*data.Efficiency;
data.q48 = data.Employee_Distribution_in_Administration .*data.Trustworthiness;
data.q49 = data.Employee_Distribution_in_Administration .*data.Domestic_market;
data.q50 = data.Employee_Distribution_in_Administration .*data.Society_Values;
data.q51 = data.Employee_Distribution_in_Entrepreneurship.^2;
data.q52 = data.Employee_Distribution_in_Administration .*data.Quality_education;
data.q53 = data.Employee_Distribution_in_Administration .*data.Competition;
data.q54 = data.Employee_Distribution_in_Administration .*data.Efficiency;
data.q55 = data.Employee_Distribution_in_Administration .*data.Trustworthiness;
data.q56 = data.Employee_Distribution_in_Administration .*data.Domestic_market;
data.q57 = data.Quality_education.^2;
data.q58 = data.Quality_education .*data.Competition;
data.q59 = data.Quality_education .*data.Efficiency;
data.q60 = data.Quality_education .*data.Domestic_market;
data.q61 = data.Quality_education .*data.Society_Values;
data.q62 = data.Competition.^2;
data.q63 = data.Competition .*data.Efficiency;
```

```
data.q64 = data.Competition .*data.Trustworthiness;
data.q65 = data.Competition .*data.Domestic_market;
data.q66 = data.Competition .*data.Society_Values;
data.q67 = data.Efficiency .^2;
data.q68 = data.Efficiency .*data.Trustworthiness;
data.q69 = data.Efficiency .*data.Domestic_market;
data.q70 = data.Efficiency .*data.Society_Values;
data.q71 = data.Trustworthiness.^2;
data.q72 = data.Trustworthiness .*data.Domestic_market;
data.q73 = data.Trustworthiness .*data.Society_Values;
data.q74 = data.Domestic_market.^2;
data.q75 = data.Society_Values;
data.q76 = data.Society_Practies.^2;


u_H2 = mdl_3.Residuals.Raw;
data.u2_H2 = u_H2.^2;
%Auxiliary regression
modelspec = ['u2_H2 ~ Dummy_Location + Average_employment_duration + '...
    'Employee_Distribution_in_Finance + '...
    'Employee_Distribution_in_Business_Development + '...
    'Employee_Distribution_in_Administration + '...
    'Employee_Distribution_in_Entrepreneurship + '...
    'Quality_education + Competition + Efficiency + Trustworthiness + '...
    'Domestic_market + Society_Values + q1 + q2 + q3 + q4 + q5 + q6 + '...
    'q7 + q8 + q9 + q10 + q11 + q12 + q13 + q14 + q15 + q16 + q17 + '...
    'q18 + q19 + q20 + q21 + q22 + q23 + q24 + q25 + q26 + q27 +'...
    'q28 + q29 + q30 + q31 + q32 + q33 + q34 + q35 + q36 + q37 + '...
    'q38 + q39 + q40 + q41 + q42 + q43 + q44 + q45 + q46 + q47 + ' ...
    'q48 + q49 + q50 + q51 + q52 + q53 + q54 + q55 + q56 + q57 + '...
    'q58 + q59 + q60 + q61 + q62 + q63 + q64 + q65 + q66 + q67 + q68 +'...
    'q69 + q70 + q71 + q72 + q73 + q74 + q75 + q76'];
mdl_H2 = fitlm(data,modelspec);

URSS_H2     = mdl_H2.SSE;
T_H2        = mdl_H2.NumObservations;
k_H2        = mdl_H2.NumEstimatedCoefficients;
R2_aux_H2   = mdl_H2.Rsquared.Ordinary;

alpha  = 0.05;
m_H2      = 88;

hyp1             = table();
hyp1.test_stat   = R2_aux_H2 * T_H2;
hyp1.crit_val    = chi2inv(1-alpha, m_H2);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_H2);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - hypothesis two – additional hypothesis

```
hyp2                  = table();
hyp2.alpha            = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_H2, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

White test combined regression – hypothesis two – sub-hypothesis one to four

```
data.a1 = data.Dummy_Location.^2;
data.a2 = data.Dummy_Location .*data.Size_PE_below_10;
data.a3 = data.Dummy_Location .*data.Size_PE_between_10_50;
data.a4 = data.Dummy_Location .*data.Size_PE_Between_50_100;
data.a5 = data.Dummy_Location .*data.Size_PE_between_100_500;
data.a6 = data.Dummy_Location .*data.TS_below_15;
data.a7 = data.Dummy_Location .*data.TS_between_15_50;
data.a8 = data.Dummy_Location .*data.TS_between_50_and_100;
data.a9 = data.Dummy_Location .*data.TS_between_100_300;
data.a10 = data.Dummy_Location .*data.percentage_of_women_on_board;
data.a11 = data.Dummy_Location .*data.under_3_years;
data.a12 = data.Dummy_Location .*data.x3_to_5_years;
data.a13 = data.Dummy_Location .*data.between_5_and_7_years;
data.a14 = data.Dummy_Location .*data.Niche_or_all_sectors;
data.a15 = data.Dummy_Location .*data.Biggest3_ecess_return;
data.a16 = data.Dummy_Location .*data.Diversication;
data.a17 = data.Dummy_Location .*data.Distance_less_than_800km;
data.a18 = data.Size_PE_below_10.^2;
data.a19 = data.Size_PE_below_10 .*data.Size_PE_between_10_50;
data.a20 = data.Size_PE_below_10 .*data.Size_PE_Between_50_100;
data.a21 = data.Size_PE_below_10 .*data.Size_PE_between_100_500;
data.a22 = data.Size_PE_below_10 .*data.TS_below_15;
data.a23 = data.Size_PE_below_10 .*data.TS_between_15_50;
data.a24 = data.Size_PE_below_10 .*data.TS_between_50_and_100;
data.a25 = data.Size_PE_below_10 .*data.TS_between_100_300;
data.a26 = data.Size_PE_below_10 .*data.percentage_of_women_on_board;
data.a27 = data.Size_PE_below_10 .*data.under_3_years;
data.a28 = data.Size_PE_below_10 .*data.x3_to_5_years;
data.a29 = data.Size_PE_below_10 .*data.between_5_and_7_years;
data.a30 = data.Size_PE_below_10 .*data.Niche_or_all_sectors;
data.a31 = data.Size_PE_below_10 .*data.Biggest3_ecess_return;
data.a32 = data.Size_PE_below_10 .*data.Diversication;
data.a33 = data.Size_PE_below_10 .*data.Distance_less_than_800km;
data.a34 = data.Size_PE_between_10_50.^2;
data.a35 = data.Size_PE_between_10_50 .*data.Size_PE_Between_50_100;
data.a36 = data.Size_PE_between_10_50 .*data.Size_PE_between_100_500;
data.a37 = data.Size_PE_between_10_50 .*data.TS_below_15;
data.a38 = data.Size_PE_between_10_50 .*data.TS_between_15_50;
data.a39 = data.Size_PE_between_10_50 .*data.TS_between_50_and_100;
data.a40 = data.Size_PE_between_10_50 .*data.TS_between_100_300;
```

```
data.a41 = data.Size_PE_between_10_50 .*data.percentage_of_women_on_board;
data.a42 = data.Size_PE_between_10_50 .*data.under_3_years;
data.a43 = data.Size_PE_between_10_50 .*data.x3_to_5_years;
data.a44 = data.Size_PE_between_10_50 .*data.between_5_and_7_years;
data.a45 = data.Size_PE_between_10_50 .*data.Niche_or_all_sectors;
data.a46 = data.Size_PE_between_10_50 .*data.Biggest3_ecess_return;
data.a47 = data.Size_PE_between_10_50 .*data.Diversication;
data.a48 = data.Size_PE_between_10_50 .*data.Distance_less_than_800km;
data.a49 = data.Size_PE_between_100_500.^2;
data.a50 = data.Size_PE_between_100_500 .*data.Size_PE_between_100_500;
data.a51 = data.Size_PE_between_100_500 .*data.TS_below_15;
data.a52 = data.Size_PE_between_100_500 .*data.TS_between_15_50;
data.a53 = data.Size_PE_between_100_500 .*data.TS_between_50_and_100;
data.a54 = data.Size_PE_between_100_500 .*data.TS_between_100_300;
data.a55 = data.Size_PE_between_100_500 .*data.percentage_of_women_on_board;
data.a56 = data.Size_PE_between_100_500 .*data.under_3_years;
data.a57 = data.Size_PE_between_100_500 .*data.x3_to_5_years;
data.a58 = data.Size_PE_between_100_500 .*data.between_5_and_7_years;
data.a59 = data.Size_PE_between_100_500 .*data.Niche_or_all_sectors;
data.a60  = data.Size_PE_between_100_500 .*data.Biggest3_ecess_return;
data.a61 = data.Size_PE_between_100_500 .*data.Diversication;
data.a62 = data.Size_PE_between_100_500 .*data.Distance_less_than_800km;
data.a63 = data.TS_below_15.^2;
data.a64 = data.TS_below_15 .*data.TS_between_15_50;
data.a65 = data.TS_below_15 .*data.TS_between_50_and_100;
data.a66 = data.TS_below_15 .*data.TS_between_100_300;
data.a67 = data.TS_below_15 .*data.percentage_of_women_on_board;
data.a68 = data.TS_below_15 .*data.under_3_years;
data.a69 = data.TS_below_15 .*data.x3_to_5_years;
data.a70 = data.TS_below_15 .*data.between_5_and_7_years;
data.a71 = data.TS_below_15 .*data.Niche_or_all_sectors;
data.a72 = data.TS_below_15 .*data.Biggest3_ecess_return;
data.a73 = data.TS_below_15 .*data.Diversication;
data.a74 = data.TS_below_15 .*data.Distance_less_than_800km;
data.a75 = data.TS_between_15_50.^2;
data.a76 = data.TS_between_15_50 .*data.TS_between_50_and_100;
data.a77 = data.TS_between_15_50 .*data.TS_between_100_300;
data.a78 = data.TS_between_15_50 .*data.percentage_of_women_on_board;
data.a79 = data.TS_between_15_50 .*data.under_3_years;
data.a80 = data.TS_between_15_50 .*data.x3_to_5_years;
data.a81 = data.TS_between_15_50 .*data.between_5_and_7_years;
data.a82 = data.TS_between_15_50 .*data.Niche_or_all_sectors;
data.a83 = data.TS_between_15_50 .*data.Biggest3_ecess_return;
data.a84 = data.TS_between_15_50 .*data.Diversication;
data.a85 = data.TS_between_15_50 .*data.Distance_less_than_800km;
data.a86 = data.TS_between_50_and_100.^2;
data.a87 = data.TS_between_50_and_100 .*data.TS_between_100_300;
data.a88 = data.TS_between_50_and_100 .*data.percentage_of_women_on_board;
data.a89 = data.TS_between_50_and_100 .*data.under_3_years;
data.a90 = data.TS_between_50_and_100 .*data.x3_to_5_years;
data.a91 = data.TS_between_50_and_100 .*data.between_5_and_7_years;
data.a92 = data.TS_between_50_and_100 .*data.Niche_or_all_sectors;
data.a93 = data.TS_between_50_and_100 .*data.Biggest3_ecess_return;
data.a94 = data.TS_between_50_and_100 .*data.Diversication;
```

```
data.a95 = data.TS_between_50_and_100 .*data.Distance_less_than_800km;
data.a96 = data.TS_between_100_300.^2;
data.a97 = data.TS_between_100_300 .*data.percentage_of_women_on_board;
data.a98 = data.TS_between_100_300 .*data.under_3_years;
data.a99 = data.TS_between_100_300 .*data.x3_to_5_years;
data.a100 = data.TS_between_100_300 .*data.between_5_and_7_years;
data.a101 = data.TS_between_100_300 .*data.Niche_or_all_sectors;
data.a102 = data.TS_between_100_300 .*data.Biggest3_ecess_return;
data.a103 = data.TS_between_100_300 .*data.Diversication;
data.a104 = data.TS_between_100_300 .*data.Distance_less_than_800km;
data.a105 = data.percentage_of_women_on_board.^2;
data.a106 = data.percentage_of_women_on_board .*data.under_3_years;
data.a107 = data.percentage_of_women_on_board .*data.x3_to_5_years;
data.a108 = data.percentage_of_women_on_board .*data.between_5_and_7_years;
data.a109 = data.percentage_of_women_on_board .*data.Niche_or_all_sectors;
data.a110 = data.percentage_of_women_on_board .*data.Biggest3_ecess_return;
data.a111 = data.percentage_of_women_on_board .*data.Diversication;
data.a112 = data.percentage_of_women_on_board .*...
    data.Distance_less_than_800km;
data.a113 = data.under_3_years.^2;
data.a114 = data.under_3_years .*data.x3_to_5_years;
data.a115 = data.under_3_years .*data.between_5_and_7_years;
data.a116 = data.under_3_years .*data.Niche_or_all_sectors;
data.a117 = data.under_3_years .*data.Biggest3_ecess_return;
data.a118 = data.under_3_years .*data.Diversication;
data.a119 = data.under_3_years .*data.Distance_less_than_800km;
data.a120 = data.x3_to_5_years.^2;
data.a121 = data.x3_to_5_years .*data.between_5_and_7_years;
data.a122 = data.x3_to_5_years .*data.Niche_or_all_sectors;
data.a123 = data.x3_to_5_years .*data.Biggest3_ecess_return;
data.a124 = data.x3_to_5_years .*data.Diversication;
data.a125 = data.x3_to_5_years .*data.Distance_less_than_800km;
data.a126 = data.between_5_and_7_years.^2;
data.a127 = data.between_5_and_7_years .*data.Niche_or_all_sectors;
data.a128 = data.between_5_and_7_years .*data.Biggest3_ecess_return;
data.a129 = data.between_5_and_7_years .*data.Diversication;
data.a130 = data.between_5_and_7_years .*data.Distance_less_than_800km;
data.a131 = data.Niche_or_all_sectors.^2;
data.a132 = data.Niche_or_all_sectors .*data.Biggest3_ecess_return;
data.a133 = data.Niche_or_all_sectors .*data.Diversication;
data.a134 = data.Niche_or_all_sectors .*data.Distance_less_than_800km;
data.a135 = data.Biggest3_ecess_return.^2;
data.a136 = data.Biggest3_ecess_return .*data.Diversication;
data.a137 = data.Biggest3_ecess_return .*data.Distance_less_than_800km;
data.a138 = data.Diversication.^2;
data.a139 = data.Diversication .*data.Distance_less_than_800km;
data.a140 = data.Distance_less_than_800km;

u_C4 = mdl_8.Residuals.Raw;
data.u2_C4 = u_C4.^2;
%Auxiliary regression
modelspec = ['u2_C4 ~ Dummy_Location + Size_PE_below_10 +'...
    'Size_PE_between_10_50 + Size_PE_Between_50_100 +'...
    'Size_PE_between_100_500 + TS_below_15 + TS_between_15_50 +'...
```

```
    'TS_between_50_and_100 + TS_between_100_300 +'...
    'percentage_of_women_on_board + under_3_years + x3_to_5_years +'...
    'between_5_and_7_years + Niche_or_all_sectors + Biggest3_ecess_return +'...
    'Diversication + Distance_less_than_800km + a1 + a2 + a3 + a4 +'...
    'a5 + a6 + a7 + a8 + a9 + a10 + a11 + a12 + a13 + a14 + a15 +'...
    'a16 + a17 + a18 + a19 + a20 + a21 + a22 + a23 + a24 + a25 +'...
    'a26 + a27 + a28 + a29 + a30 + a31 + a32 + a33 + a34 + a35 +'...
    'a36 + a37 + a38 + a39 + a40 + a41 + a42 + a43 + a44 + a45 +'...
    'a46 + a47 + a48 + a49 + a50 + a51 + a52 + a53 + a54 + a55 +'...
    'a56 + a57 + a58 + a59 + a60 + a61 + a62 + a63 + a64 + a65 +'...
    'a66 + a67 + a68 + a69 + a70 + a71 + a72 + a73 + a74 + a75 +'...
    'a76 + a77 + a78 + a79 + a80 + a81 + a82 + a83 + a84 + a85 +'...
    'a86 + a87 + a88 + a89 + a90 + a91 + a92 + a93 + a94 + a95 +'...
    'a96 + a97 + a98 + a99 + a100 + a101 + a102 + a103 + a104 + a105+'...
    'a106 + a107 + a108 + a109 + a110 + a111 + a112 + a113 + a114 +'...
    'a115 + a116 + a117 + a118 + a119 + a120 + a121 + a122 + a123 +'...
    'a124 + a125 + a126 + a127 + a128 + a129 + a130 + a131 +'...
    'a132 + a133 + a134 + a135 + a136 + a137 + a138 + a139 + a140'];
mdl_SUB4 = fitlm(data,modelspec);

URSS_4     = mdl_SUB4.SSE;
T_4        = mdl_SUB4.NumObservations;
k_4        = mdl_SUB4.NumEstimatedCoefficients;
R2_aux_4   = mdl_SUB4.Rsquared.Ordinary;

alpha  = 0.05;
m_4      = 157;

hyp1             = table();
hyp1.test_stat   = R2_aux_4 * T_4;
hyp1.crit_val    = chi2inv(1-alpha, m_4);
hyp1.alpha       = alpha;
hyp1.p           = 1 - cdf('Chisquare', hyp1.test_stat, m_4);
if hyp1.test_stat > hyp1.crit_val
       hyp1.reject = "reject H0";
else
       hyp1.reject = "do not reject H0";
end
hyp1 = hyp1(:,{'alpha' 'p' 'test_stat' 'crit_val' 'reject'});
disp(hyp1);
```

Test of normality - Bera - Jarque test combined Sub hypothesis 1 to 4

```
hyp2                 = table();
hyp2.alpha           = alpha;
[~, hyp2.p, hyp2.test_stat, hyp2.crit_val] = jbtest(u_C4, alpha);
if hyp2.test_stat > hyp2.crit_val
       hyp2.reject = "reject H0";
else
       hyp2.reject = "do not reject H0";
end
disp(hyp2);
```

Test for multicollinearity hypothesis two – sub-hypothesis one

```
X_SUB1 = [data.Dummy_Location, data.Size_PE_below_10,...
    data.Size_PE_between_10_50, data.Size_PE_Between_50_100,...
    data.Size_PE_between_100_500, data.TS_below_15, data.TS_between_15_50,...
    data.TS_between_50_and_100, data.TS_between_100_300,...
    data.percentage_of_women_on_board];
Cor_SUB1 = corr(X_SUB1);
```

Test for multicollinearity hypothesis two – sub-hypothesis two

```
X_SUB2 = [data.Dummy_Location, data.under_3_years, data.x3_to_5_years,...
    data.between_5_and_7_years];
Cor_SUB2 = corr(X_SUB2);
```

Test for multicollinearity hypothesis two – sub-hypothesis three

```
X_SUB3 = [data.Dummy_Location, data.Niche_or_all_sectors]
Cor_SUB3 = corr(X_SUB3);
```

Test for multicollinearity hypothesis two – sub-hypothesis four

```
X_SUB4 = [data.Dummy_Location, data.Biggest3_ecess_return,...
    data.Diversication, data.Distance_less_than_800km]
Cor_SUB4 = corr(X_SUB4);
```

Test for multicollinearity for hypothesis two – additional hypothesis

```
X_H2 = [data.Dummy_Location, data.Average_employment_duration,...
    data.Employee_Distribution_in_Finance,...
    data.Employee_Distribution_in_Business_Development,...
    data.Employee_Distribution_in_Administration,...
    data.Employee_Distribution_in_Entrepreneurship,...
    data.Quality_education, data.Competition,...
    data.Efficiency, data.Trustworthiness, data.Domestic_market,...
    data.Society_Values];
Cor_H2 = corr(X_H2);
```

Test for multicollinearity hypothesis two – combined regression

```
X_C2 = [data.Dummy_Location, data.Size_PE_below_10,...
    data.Size_PE_between_10_50, data.Size_PE_Between_50_100,...
    data.Size_PE_between_100_500, data.TS_below_15,...
    data.TS_between_15_50, data.TS_between_50_and_100,...
    data.TS_between_100_300, data.percentage_of_women_on_board,...
    data.under_3_years, data.x3_to_5_years, data.between_5_and_7_years,...
    data.Niche_or_all_sectors, data.Biggest3_ecess_return,...
    data.Diversication, data.Distance_less_than_800km];
Cor_C2 = corr(X_C2);
```

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