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The Increasing Number of Listed Firms in Sweden and the Changing Nature of the Public Market

A study on the changing number of public firms on the Nasdaq OMX Stockholm and the effects on firm profitability and returns to investors

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Abstract

There is a global trend of decreasing number of publicly traded firms on stock markets affecting the nature of industries, firm performance, and investor returns. Concerns have been raised regarding this development. Though, the stock market in Sweden has during the last decades experienced the opposite development with an increasing number of publicly traded firms. This paper examines how the number of publicly traded firms on the Stockholm Stock Exchange has changed over time and what the effects are on company performance and returns to investors. We study all listed firms on Large-, Mid-, and Small-cap during the period 1997-2018. Our study concludes that the number of publicly traded firms has increased over time and the market concentration has decreased. Furthermore, our study show that an increased number of publicly traded firms is associated with lower firm profitability and worse firm performance.

Keywords: Public firms, Industry concentration, Nasdaq OMX Stockholm, Returns to investors, Company performance, Swedish IPO

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1. Introduction

1.1. Background of the market

There is a global trend of a declining number of Initial Public Offerings (IPOs) and shrinking number of listed firms on the stock markets around the world and it is affecting the nature of the public markets. A well-functioning stock market is important for a flourishing business sector as the stock markets serve as a vital function in the economy by reallocating capital. Previously economists have considered frequent IPOs to be a sign of economic prosperity and the number of public companies has been used as a measurement of financial strength. Although, the U.S. has experienced higher returns to investors and positive development in firm performance, despite a declining number of publicly traded firms. Though, concerns have been raised whether a declining number of publicly traded firms will have a negative impact on the economy and result in fewer investments, lower salaries, higher prices for consumers as well as worse business policy and politics, (Koptyug et al., 2017).

In the U.S., the number of publicly traded firms has systematically declined in the past decades going from 7,322 in 1996 to 3,671 in 2016 representing a decrease of fifty percent. During the same period, the GDP has increased by over 150% and the total market capitalisation has more than doubled, (Mauboussin et al., 2017). This significant decrease in the number of firms has affected industry concentration as half of the industries in the U.S. have lost half of their publicly traded peers. The decline in the number of publicly traded firms has not been offset by increased number of private firms or increased foreign competition. Furthermore, the pattern in the U.S. can be considered as general as the trend could be identified in 90% of the U.S. industries. The decline in the number of publicly traded firms and increased industry concentration has affected firm performance in a positive way as the publicly traded firms are generating higher profit margins and higher return to investors (Grullon et al., 2015). The change in the number of public firms is thereby of significant importance to several different stakeholders, not at least the shareholders, and it has a severe impact on market characteristics. Patterns of a declining number of IPOs and the growing fear of shrinking public markets is evident in the rest of the world, although not as severe as in the U.S., (Spencer, 2019).

In Sweden on the other hand, the development has been the opposite. At the end of 2019, the number of companies listed at the Nasdaq OMX Stockholm Stock Exchange main market reached 333, which is an all-time high record. In 1990, the number of publicly traded firms in Sweden amounted to 237, thus, the net change during the last three decades is an

increase of 96 firms, representing a growth of 40.51%. In addition, Sweden had an IPO boom in 2015 and 2016 with record-high numbers of Initial Public Offerings per year, ranking at the top in Europe in terms of the number of new listings during the time, (VA Finans, 2016).

Sweden has enjoyed an overall favourable market environment over the past decades, with increasing GDP, low-interest rates, and expansion of capital markets. The climate has been favourable for the financial market and the business sector. Though, the Swedish economy has suffered two severe crises during this period as well. During the 1990s, the IT-bubble was building up and the Swedish stock market was booming. Investor capital was flowing into all firms associated with the internet. Share prices and company valuations were soaring. In the spring of 2000, the bubble burst and the Swedish stock market continued to fall until it reached a bottom in 2002 (Dillén, Sellin, 2003). In 2008, the next financial crisis hit. Originating in U.S. mortgages, the crisis started with the bankruptcy of the investment bank Lehman Brothers and spread across the world. In Sweden, the stock market fell by 60%, interest rate spiked, and the currency lost 40% of its value from 2008 to 2009. The financial crisis had severe effect on companies as they had a difficult time getting financing and it did also affect company performance and returns to investors, (Ohlin, 2018).

As company performance and investor returns are affected by changing environment in public markets, and there is a growing concern regarding the global trend of declining number of public firms, it is essential to generate an understanding of this area in Sweden as well. There is currently a lack of literature covering the changing nature of the public market in Sweden, the reasons behind the changes and the following consequences. Our aim with this paper is to fill this research gap and add to the existing body of literature by examining how the Swedish public market has developed over time, what the underlying factors and drivers to the change are as well as what the potential effects on different stakeholders are.

1.1. Research Question

The aim of this paper is to investigate the change in number of listed firms in Sweden and the changing nature of the public market. In this paper, the following question will be addressed:

How has the number of publicly traded firms in Sweden changed over time and what are the effects on company performance and return to investors?

1.2. Disposition

The disposition of this paper is organised as follows. Section 2 consists of a review of existing literature on the subject. To fulfil the purpose of this paper, that is to examine the research question, two hypotheses are formulated and are presented in Section 3. Section 4 consists of a detailed presentation of the data gathered followed by Section 5 where the methodology of how the data is used and analysed is presented. In Section 6, descriptive statistics and results are presented. Section 7 consists of a discussion of the results. Finally, Section 8 consists of conclusions, limitations, and suggestions for future research. References are presented in Section 9 and Appendix in Section 10.

2. Literature Review

The changing nature of concentration in the Swedish public market and the change in the number of public firms in Sweden has drawn little attention in academic literature, while the underlying factors of this issue have been more extensively examined independently from each other. This section will thereby introduce existing research on the different aspects of the topics. Subsection 2.1. will provide insights in how financial variables and macroeconomic factors affect the number of IPOs. In subsection 2.2. a study from the U.S on the decline in number of public firms in the U.S, how it affected industry concentration and what effect it had on firms' profitability and return to investors is presented. Subsection 2.3. will cover literature regarding the changing nature in the IPO landscape and the reasons behind the changing nature. In subsection 2.4., the relationship between profitability and concentration is discussed. To conclude the literature review, we will in subsection 2.5. present the gap in existing literature we have identified.

2.1. The economy's effect on the number of IPOs

There are significant changes in the volume of IPOs over time as an initial public offering is highly dependent on the market and the market's appetite for new issues. The market environment and the market's appetite for new issues is uncertain and is changing over time. Times with rising stock prices has historically been followed by a higher IPO activity. When these patterns are evident in industries there is also a historical pattern of an even more significant bunching of offerings. During these times of rising stock prices and higher IPO activity, an initial public offering is more likely to be successful as it is easier to sell shares to external investors in the market, (Lerner, 2007).

Fluctuations in the IPO volume can be identified over time where the change in number of firms going public can be attributable to variations in macroeconomic factors. Angelini and Foglia (2018) analyses the relationship between the number of IPOs and macroeconomic factors; interest rates, stock market return, volatility of the stock market and industrial production, in the UK between 1996 and 2016. According to their research, there is significant causality between the number of IPOs and volatility, interest rate and industrial production. In addition, according to Jovanovic and Rousseau (2004), firms commonly delay the IPO process during an environment with low rates. The rationale behind the delay is that the low interest rate is of higher matter in relation to the earnings the firm forgoes. Furthermore, Lerner and Tsai (1990) argue that the changing IPO volume over time is strongly correlated with the business cycles. A higher number of IPOs is evident in a market with economic expansion

where the demand for capital is high. In addition, investor optimism is a factor that is changing over time driving the IPO volume, Lowry (2005).

2.2. Changing number of public firms in the U.S.

The number of public firms in the U.S. has changed during the past decades with a significant systematic decline. Grullon et al. (2015) examine the disappearance of public firms and the following consequences and effects on the nature of U.S. industries.

First, they show that the number of publicly traded firms has experienced a significant decline and that the decline has not been compensated by other mechanisms. The study show that the overall market concentration has increased with the disappearance of public firms. The aggregated number of firms, both public and private firms, has decreased over time, hence the decreased number of public firms has not been compensated by private firms. Secondly, the presence of foreign firms has not offset the decreased number of public firms. Findings show that foreign firms have maintained their presence in the industries and the U.S. market. Import growth and public firms have been expanding at similar rates and the share of imports to U.S. public firms aggregated revenues has remained the same during the last decades. Thirdly, their study shows that over 50% of publicly traded peers have disappeared in more than half of the U.S. industries and that the changing nature of decreasing number of firms and increasing concentration index has affected 90% of all industries.

Furthermore, the study provides evidence that U.S. companies in less competitive industries, that is industries with a declined number of firms, hence higher concentration index, generate higher profitability in terms of profit margins as well as generate higher returns to investors. In addition, these firms operating in industries with a higher concentration index benefit from better investment opportunities through merger and acquisition deals. There are generally more positive reactions to these M&A deals due to the fact that the key source of value of these transactions origin from market power consideration, (Grullon et al., 2015).

2.3. A changing nature in the IPO landscape

According to Jay Ritter, (2014), there has been a changing nature in the IPO landscape in the U.S. which has resulted in a fundamental shift in the composition of the U.S. public market. It is evident that the number of IPOs in the U.S. market has experienced a significant downturn since the beginning of the 21st century. First, Ritter claims that private firms stay private for a longer period and go public later. Secondly, as there now are other options to raise funding, fewer companies are choosing the option to go public. The U.S. market has in previous years

experienced a significant increase in the median time to exit a privately held company in an IPO. In Ritter's research the median time to exit a private company in an IPO in 2018 was six and a half years. In 2016 and 2017 the period of holding a company private before IPO was significantly longer reaching a median of almost 8 years. Back in 2011, the median time amounted to four years. Comparing recent years with the history, it is evident that the median time to IPO exit has increased, (NVCA, 2020). Furthermore, it can be concluded that there is a changing nature in exits of privately held firms where IPOs have been replaced by private equity exits to strategic buyers. In the beginning of the 21st century there was no notable difference in the number of private equity exits to strategic buyers and the number of IPOs. Since then, the number of private equity exits to strategic buyers have increased significantly being 8.75 times the number of IPOs in 2018. Burroughs (2019), explain the main reason for this is that private equity funding nowadays is cheaper and easier to access compared to before due to the abundance of cash in the private market that is flowing around.

Raising capital is one of main reasons companies choose to conduct an IPO. An alternative to going public is to raise capital in the private equity market. Private equity and venture capital are an asset class that has been growing in Sweden and is now a fundamental part of the financial ecosystem. Since 2007, SEK 266 billion has been invested as private equity or venture capital money in Sweden and together the private equity and venture capital industry are currently contributing with 6.80% of total GDP in Sweden. Sweden has, as of today, a total of 1,160 portfolio companies that employ 3.40% of total employees in Sweden, (SVCA, 2018). The capital city of Sweden, Stockholm, is widely considered as a start-up hub being one of top three countries with highest number of investments per GDP, both as an average 2013-2017, but also in 2017 as a single year. In addition, Stockholm has six unicorns, six billion-dollar start-ups, which means Stockholm has the greatest number of unicorns per capita in the world after Silicon Valley (InvestStockholm, 2018).

Though, the relationship between private equity and the public market is more than competing alternatives for capital raising. Black and Gilson (1998), claim, "a well-developed stock market is critical to the existence of a vibrant venture capital market". It is evident that there exists a strong relationship between the two and that the IPO process is important for entrepreneurial firms backed by venture capital or private equity companies. Thus, both markets can benefit from growing and prospering together.

Another market characteristic that has emerged in the U.S. market is a growing proportion of loss-making firms going public. In 2018, 80% of firms that went public in the U.S. were loss making, resulting in shareholders expecting less potential value creation and

lower returns on equity. The primary reason for the growing proportion of loss-making companies is that fewer companies produce products in factories, and the value in companies has shifted to intellectual property such as patents or other intangible assets. What this means is that the companies can be loss-making but still have high asset value due to these intangible assets. According to Analyst Inigo Fraser-Jenkins and his team at Bernstein, "The decision to list later or not at all means that the potential for large returns in public equity from the relatively early high-growth stage of companies is diminished, and this is happening at the same time that the asset price inflation of the last 35 years means that aggregate market returns are likely to be lower as well,", (Burroughs, 2019).

2.4. Profitability and concentration

There is no consensus among researchers regarding how industry concentration affects firm profitability. According to Baumol (1982), firms in highly concentrated industries should behave as if the industry had low concentration and as the firms had a high number of competitors. By doing so, the market will continue being competitive due to the threat of new entrants. As a result, the number of firms in an industry will not affect the firm's profitability and the abnormal profits will be driven down to zero. Alternatively, abnormal profits could be generated by firms operating in concentrated industries where significant barriers of entry are present by exercising their market power. With a lower number of firms competing against each other in the industry where there are barriers to entry, hence the threat of new entrants is low, the firm's profitability could be expected to increase.

However, Hou and Robinson (2006), provides evidence that the concentration of an industry is a vital factor to understand stock returns. Stock returns and concentration of an industry is linked through both distress risk as well as innovation. Stock returns are expected to be higher in industries where innovation risk is evident and where the distressed risk is higher. Furthermore, firms operating in industries with low concentration, that is high competition, are expected to command higher stock returns. Firms that operate in highly concentrated industries should expect lower returns as they are either protected by non-diversifiable risk because of barriers to entry or that they are less risky due to less focus on innovation.

Bustamante and Donangelo (2014) further elaborate on the reduction of firm value with increasing market competition. Their study shows that firms in more competitive industries generate higher earnings-to-price and book-to-market ratios, as more of the value comes from existing assets as opposed to growth options. Thereby, with increased market competition the

value of risky growth opportunities is decreased in relation to safer existing assets, lowering expected return on assets. On the other hand, lower profit margins for firms operating in competitive markets imply weaker financial buffers and thus inflated sensitivity to shocks, resulting in higher operating leverage. Thus, expected returns will increase in highly competitive markets as profits become more sensitive to systematic shocks. Though, the authors find that the negative effect on stock returns associated with increased market competition dominates. Thus, increased competition generally entails value destruction of firms. Intuitively, if the structure of product markets affects the optimal operating decisions of firms, which in turn affect cash flows, stock return will be impacted.

2.5. Research Gap

Based on the collection of research presented above, it is evident that the number of public firms in the U.S. has experienced a significant systematic decline during the past decades. The disappearance of publicly traded firms has resulted in a generally increased industry concentration and the publicly traded firms have generated both higher profit margins and higher returns to investors as well as benefited from advantageous investment opportunities through merger and acquisition deals. Furthermore, previous research provides evidence that the IPO volume could be affected by several different factors. First, times with rising stock prices has historically been followed by a higher IPO activity. Secondly, there is a changing nature of exits where IPOs have been replaced by private equity exits to strategic buyers. Third, fluctuations in the IPO volume can be identified over time where the change in number of firms going public can be attributable to variations in macroeconomic factors in the environment.

It is evident that there is a lack of research on how the nature of public firms has been changing over time in Sweden. Furthermore, there is no literature covering explanations to the changes of nature in the public market or how a changing nature of publicly traded firms affects firm profitability, returns to investors or M&A opportunities. Studies on the relationship between firm profitability and industry concentration in Sweden does not exist although the topic is of significant importance, hence the gap in existing literature needs to be covered. No literature covers the development and changes in the number of IPOs in Sweden or the relationship between number of IPOs and stock prices. In addition, there is a lack of research on how the private market is affecting the public market in Sweden even though Sweden is considered to be a hub for start-up companies and private equity. As can be concluded, Sweden is a country that is subject to a limited amount of research regarding the number of public firms, the reason for changes in number of public firms and its effects.

3. Hypotheses

To fulfil the purpose of this paper; to answer the research question "How has the number of publicly traded firms in Sweden changed over time and what are the effects on company performance and return to investors?", two hypotheses are formulated. They are based on the research presented in the literature review and will be tested through quantitative tests.

Our first hypothesis is formulated as follows:

H1: The number of public firms in Sweden has increased and the market concentration has decreased.

In the U.S. there is a pattern of decreasing number of public firms resulting in an increased market concentration. We expect that the number of public firms has increased over time in Sweden, resulting in a decrease in market concentration. In the U.S. there has been a significant decrease in the number of public firms and IPOs. In line with existing research, we believe that the development is the opposite in Sweden, as the market conditions have been favourable during the last decades.

Our second hypothesis is formulated as follows:

H2: Increased number of publicly traded firms results in lower firm profitability and lower returns to investors.

Given the existing research, firm profitability could be expected to increase when a lower number of firms compete against each other, as seen in the U.S. Furthermore, firms that are present in a market with a declining number of firms generate higher returns to investors. Hence, an increased number of firms competing against each other could be expected to result in lower firm profitability and lower returns to investors.

4. Data

This section consists of a description and motivation of the data sample and how it has been gathered and transformed. Furthermore, possible risks and potential limitations that are associated with the data as well as with the gathering of the data will be presented.

4.1. Public firm data set

Information regarding the number of publicly traded firms listed on the Stockholm Stock Exchange (SSE) is based on data retrieved from Nasdaq OMX for the period 2000-2018. The data set includes the number of firms listed on the Small-, Mid-, and Large-cap, at each year-end. The data set includes companies with its primary listing on the SSE, thus excluding companies which are trading on the SSE but has its primary listing elsewhere. Firms listed at Spotlight Stock Market and Nordic Growth Market are subject to less strict reporting requirements which results in an inadequate amount of information for this study and they are therefore excluded from the data set. Furthermore, First North is not included in the sample as it covers the Nordic region and is not an EU regulated stock exchange but a Multilateral Trading Facility. Moreover, the data set includes the yearly number of entries and exits by companies on the lists mentioned above.

Nasdaq OMX does not provide data regarding listed companies prior to 2000, hence, for the period 1997-1999 data regarding publicly traded firms is collected from the Swedish House of Finance Data Centre's database "Historical Archives". The firms included in the data set during this period are those listed on the A-list, OTC-list and O-list. The number of publicly traded firms is extracted as of the last trading day of each year.

The company id numbers are extracted from the Bisnode Serrano Data set, which comprises company information of firms registered in Sweden over the period 1997-2018. Serrano, in turn, collects information from the Swedish Companies Registration Office (Bolagsverket) and Statistics Sweden (SCB) as well as from the Bisnode group register. Missing firm ids are addressed by completing with data from the Swedish Tax Agency.

4.1.2. Company financials

Data regarding company-specific performance metrics for the Swedish publicly traded firms are retrieved from S&P Capital IQ. S&P Capital IQ is a financial database and platform, widely used by financial professionals, extracting data from numerous sources. The extracted company-specific information comprises of Total Revenue, Return on Equity, Return on Assets, and Founding Year. The data is imported for each company on a yearly basis over the

period 1997-2019. The ISIN number for the stock of each company is also collected in order to merge this data with the stock price data set.

4.1.3. Industry classification

We have used Standard Industry Classification (SIC) codes to classify the industry for the respective firm. The SIC codes are imported from S&P Capital IQ. SIC-codes are used for industry classification and are a system for organizing firms by their main business activity. The U.S. Government created the system of SIC-codes back in 1937 with the purpose to classify companies to be able to make economic analyses across industries. There are 10 SIC-codes which means that the publicly traded firms in our data set can be attributable to a maximum of 10 different industries per year. The number of publicly traded firms varies across industries with several industries being significantly more dominant in terms of number of firms. SIC-codes can be used in a four-digit system. In this paper, the focus is on a one-digit level which corresponds to 10 industries. We do not use the SIC further detailed sub-sections in order to generate an appropriate amount of data points in each category and achieve statistically significant results. According to the SIC code one-digit classifications, a company can be classified in one of the following industries:

1 - Agriculture, Forestry and Fishing, 2 – Mining, 3 – Construction, 4 – Manufacturing, 5 - Transportation, Communications, Electric, Gas and Sanitary Services, 6 - Wholesale Trade, 7 - Retail Trade, 8 - Finance, Insurance, and Real Estate, 9 – Services, 10 - Public Administration

4.1.4. Stock price data

Historical stock price data for companies listed on the Stockholm Stock Exchange Large-, Mid- and Small-cap is collected from the Swedish House of Finance Data Centre's database "Finbas". The covered period is 1997-2018 and consists of yearly prices, as in the closing price and market value of equity at the last trading day each year. As the Finbas database does not provide figures for 2019, the examination of potential effects on the stock price will be conducted on a data sample one year shorter than that of companies' financial performance metrics. The data set also includes firm individual ISIN-numbers, which is the identification variable used to merge this data set with the information extracted from S&P Capital IQ.

4.1.5. Final company data set

The final dataset is an unbalanced time series panel data, containing information regarding the publicly traded firms with the Stockholm Stock Exchange as its primary listing over the period 1997-2019. The total number of unique firm ids for the sample period is 666.

4.1.6. Limitations

Due to the scope and aim of this paper, the data is limited to a period of 23 years. By incorporating a more extensive period in the study, other patterns and interactions could emerge, and different conclusions would be reached. Thus, it is important to bear in mind that the following results are applicable to this specific period.

Due to the limitation of access to quarterly or half-year figures, the study is completed at an annual level. Thereby, potential adverse seasonal effects across the variables that appear in the fourth quarter could distort the results. Moreover, any events occurring and disappearing in one specific year are not recognised in this study, for the same reason as above, and might skew the interpretation of our results. To remedy this potential issue, extended efforts into data collection should be allowed in future research.

As the main data sample is collected from third-party sources and not directly from each company or stock exchange, missing values cannot be attributed to a certain cause. Though, data points are more commonly missing for firms listed and delisted earlier in the sample period as well as for smaller firms, which is another potential cause of bias and require further efforts to remedy.

4.2. Complementing data

4.2.1. Private companies

Statistics on the number of private companies in Sweden have been extracted from Statistics Sweden. The data is limited to limited liability companies (“aktiebolag”) and to include operationally active companies while excluding latent or non-operating firms, only firms with at least one employee are included.

4.2.3. The Swedish Private Equity market

Data regarding the aggregated investment volumes per year in Swedish venture capital portfolio companies is retrieved from the Swedish private equity and venture capital Association (SVCA). The data is collected from a statistical report covering all details regarding formal investments in venture capital covering Swedish portfolio companies per year

between 2007 and 2018. The statistical report consists of data provided by the Swedish Private Equity and Venture Capital Association (SVCA) together with Invest Europe.

5. Methodology

In this section, a presentation and motivation of the model design is provided, and the research question and hypothesis presented in Section 3 will be tested. Hypothesis 1 will be tested through descriptive statistics the construction of an HHI index. Hypothesis 2 will be tested through regression models and the construction of portfolios. Furthermore, to validate the use of the model, tests have been performed which will be presented in this section.

5.1. Measuring market concentration by constructing HHI index

To determine the level of competition in the market, the degree of market concentration in an industry is commonly used where increased concentration in the market results in decreased competition and efficiency as well as increased market power and vice versa. The Herfindahl-Hirschman Index (HHI) is a measure of market concentration that is commonly used and could be considered as the standard. Therefore, the Herfindahl-Hirschman Index (HHI) is the selected metric applied in this report, (Irvine and Pontiff, 2009).

The HHI index is calculated by considering all firms competing in a market, squaring their market shares, and then summing up the numbers. If a single firm has 100% market share, the HHI index will equal 10,000. In contrast, if there is a high number of competing firms in the market the sum of the square of their market shares will be closer to zero. As a result, the HHI can range from close to 0 up to 10,000. Hence, the HHI index is be used as a measure for between. The higher the concentration in the market, the closer the industry is to be a monopoly and vice versa. According to the U.S. Department of Justice, a highly concentrated market has an HHI index of 2,500 or higher, a moderately concentrated market has a HHI index of between 1,500 and 2,500 and a competitive market has a HHI index of less than 1,500.

$$HHI = s_1^2 + s_2^2 + s_3^2 + \dots s_n^2$$

s = market share in percentage, n= number of firms

The HHI index is a commonly accepted measurement of market concentration due to the simple calculation where a small amount of data is required. But, the simplicity of the metric incurs some disadvantages to account for. Due to the simple calculation and the limited amount of data required in the calculation, the measure may lack ability or even fail to incur the market's complexities needed in order to provide an accurate measure of the concentration in the market. Furthermore, the inability to define industries is commonly mentioned as a

serious weakness. Undefined industries could result in being highly concentrated when using HHI index if these industries for example have 10 companies with 10% market share each. The measure also lacks the ability of considering a firm's market share of a specific segment or product. In addition, the geographic factor is an issue as firms in the same industry can have almost monopoly in different geographic regions, but the HHI measure only takes into account the market share of the industry as a whole, (Kvålseth, 2018).

5.2. Substitution by foreign firms

We investigate whether globalization and competition from foreign firms is affecting the number of public firms in Sweden. To examine if there is any apparent relationship between the two, we look at the ratio of Swedish imports to the aggregated revenue per year generated by the publicly traded firms. The change in the ratio of competition from foreign firms to the revenue of domestic firms is examined over time.

5.3. Fixed-effects model for firm profitability and efficiency

Our final data set consists of an unbalanced but fixed panel data as the data set is multidimensional with measurements over time that is specific for each company with recurrently missing data points for companies over time.

As the aim is to analyse the effects of time-varying variables, we use a fixed-effects regression model. By using the fixed-effects model, we account for effects from time-invariant characteristics and thus being able to assess the net effect in the outcome of the dependent variable, (Torres-Reyna, 2007). The characteristics that are considered are firm-fixed effects and year-fixed effects, to eliminate the impact of time-specific events affecting all firms, (Giroud and Mueller, 2010; Bertrand and Mullainathan 2003). To validate that if the year variable should be included as a fixed effect, we use the command *testparm,* which is a joint test to see if the dummy variables for all years are equal to zero. The results indicate that this is not the case and therefore we include a year fixed effect in our model.

The Hausman Specification test is performed to decide if the random- or fixed effect model is appropriate. The test looks for any correlation in the model between the regressors and the unique errors. The results of the test performed on our dataset provide no evidence of correlation. Thus, the null hypothesis of random effects being the preferred model is rejected, in favour of the alternative hypothesis of a fixed-effects model, (Torres-Reyna, 2007).

The equation for the fixed effects model is presented below:

$$(1)\ \gamma_{it} = \beta_1 x_{it1} + \cdots + \beta_k x_{itk} + \alpha_i + u_{it}, t = 1, \ldots, T,$$

the β_j are the parameters to estimate and αi is the unobserved effect

To resolve the validity of our regression model, several assumptions need to hold. Therefore, we test for multicollinearity. Evidence of multicollinearity implies that the predictor variables are correlated, which would pose problems for interpretation of the results from the regression. The correlation between the variables show only weak signs of possible existence of multicollinearity. We further investigate this by calculating the Variance Inflation Factor (VIF). The VIF indicates to what degree the variance of the coefficient estimate is being inflated by multicollinearity. Lower VIF-values suggest no need for further investigation, while higher values, indicate the existence of some multicollinearity and need for adjustments, (Mansfield and Hems, 2012). There is no consensus as to at which level of VIF variables should be dropped or adjusted, although a common rule of thumb is to be concerned if they exceed 5.0 (Williams, 2015). The output from our model suggests that there is no significant issue of multicollinearity between the independent variables, as all VIF values are between 1.0 and 2.0.

Furthermore, we need to establish if there is heteroskedasticity in the errors of our data sample. Therefore, we perform a modified Wald statistic for groupwise heteroskedasticity. This test is chosen as it is applicable to the residuals in a fixed-effects regression model on an unbalanced panel data. The test examines if the errors from the regression model are dependent on the predictor variables (Greene, 2000). The null hypothesis states that the residuals are homoscedastic, i.e. of the same variance. If the alternative hypothesis, heteroskedasticity, appears to be true, we will use robust standard errors to account for this issue. The test results reject the null, thereby implying some presence of heteroskedasticity and therefore the option of robust standards errors will be incorporated in the model. In the fixed-effects regression model used, the option for robust standard errors also manages issues with autocorrelation. Thus, there is no need to test for autocorrelation specifically.

5.4.1. Dependent Variables

To examine the relationship between the number of publicly traded firms and profitability, three company performance metrics will be used. The first ratio for profitability is Return on Equity (ROE), which is net income divided by the value of shareholder equity and is a measure of financial performance.

Furthermore, we seek to eliminate the effects of changes in a firm's capital structure, by using Return on Assets (ROA), as the second measure for firm profitability. ROA indicates how efficient a firm is using its total assets to generate profits. Moreover, compared to other measures, ROA is the preferred metric to use for detecting abnormal operating performance, (Barber and Lyon, 1996). Although ROA is the preferred measure to use to detect abnormal operating performance, ROA has some drawbacks. First of all, total assets is recorded at the balance sheet as an historic cost while operating income is recorded as current value. Secondly, Total Assets is a measure of all assets in a firm and does not consider only the operating assets. Hence, the operating asset's true productivity could therefore be underestimated. Therefore, we also look at asset utilization as a measurement of a firm's operating efficiency, (Barber and Lyon, 1996).

With an increasing number of publicly traded firms, it is of interest to investigate potential sources of any changes in profits. The operational efficiency could be worsened and decreasing firm profitability because of a higher number of firms competing against each other leading to firms being less flexible and not able to reallocate resources to achieve highest possible productivity per unit of capital. To investigate whether the change in profitability is attributable to the firm generating higher operational risk, asset utilization ratio, will be a third dependent variable used in the regressions. Asset utilisation is a measure of how efficiently a firm uses its assets to generate sales. It is calculated by dividing total sales by total assets of the firm, (Filbeck and Gorman, 2000).

5.4.2. Independent Variables

The aim of this of the study is to examine the relation between the number of public firms and profitability. Therefore, the number of publicly traded firms at the Stockholm Stock Exchange main market at each year end is used as the independent variable.

5.4.3. Control Variables

Two control variables are added in the regression to control for other factors potentially affecting the dependent variables. The following control variables are added and used in the form of their natural logarithm:

1. Age - Age is calculated as the number of years from the year the company is founded. The age of a firm is included in the regression to control the effect of learning (Pastor and Veronesi, 2003).

2. Assets - The book value of total assets is used as a measurement of firm size (Hall, Weiss, 1967). Size is a commonly used control variable for studies on firm profitability as it is repeatedly found to have significant impact on profits. By incorporating the size of firms in the regression, effects such as economies of scale are accounted for (Stierwald, 2009). Total assets comprise total book value of debt and total book value of equity, as defined by S&P Capital IQ.

Due to the use of a fixed-effects model, there is no need to control for company-specific factors that are constant over time, such as the industry in which a firm operates. Thus, no control variables for industries are generated.

5.4.4. Regression

To test our second hypothesis, we perform the fixed-effects regression model, in line with the findings presented earlier in this section. The first two regressions tests how profitability is affected by the number of publicly traded firms through the following models:

$$(1)\ ROE_{ijt} = \alpha_i + \alpha_j + \beta_1 \log(Assets_{it}) + \beta_2 \log(Age_{it}) + \beta_3 \log\left(Number\ of\ firms_{jt}\right) + \epsilon_{ijt}$$

$$(2)\ ROA_{ijt} = \alpha_i + \alpha_j + \beta_1 \log(Assets_{it}) + \beta_2 \log(Age_{it}) + \beta_3 \log\left(Number\ of\ firms_{jt}\right) + \epsilon_{ijt}$$

Following, we look for changes in operational efficiency as a potential driver of increased or decreased profitability. The third model is formulated as follows:

$$(3)\ Asset\ utilisation_{ijt} = \alpha_i + \alpha_j + \beta_1\, log(Assets_{it}) + \beta_2\, log(Age_{it}) + \beta_3\, log\left(Number\ of\ firms_{jt}\right) + \epsilon_{ijt}$$

5.5. Construction of portfolios

In this section, we look for a relationship between change in the number of public firms in an industry and stock returns. We compare the stock price development for industries exposed to an increase in the number of firms to the industries with a decreased or unchanged number of firms. To conduct this examination, we look at the change in the number of firms in the different industries over time and construct three portfolios to which the companies in each industry are assigned. The first portfolio (High) consists of the three industries with the largest positive change, the second portfolio (Mid) consists of the four industries in the middle and the third portfolio (Low) contains the three industries with the smallest positive change in number of publicly traded firms.

We calculate the stock return for both equally weighted returns and value-weighted returns for each portfolio over the whole sample period as well as for three sub-periods. There are advocates for using both value-weighted and equally weighted portfolios in asset-pricing models and empirical studies in finance (Plyakha et.al, 2014). Therefore, we include both techniques, as both methods contribute with unique insights. The equally weighted portfolios present a simple average of returns, providing indication of the overall performance of firms, while the value-weighted returns reflect the actual stock market performance and overall returns to investors. We use sub-sections of time to investigate whether the relationship has changed over time. For the value-weighted returns, we use the year end market capitalisation for all firms within each industry at the respective cut off years to compute an aggregate market value of equity per industry. Following, we adjust the returns of each portfolio according to the value-weighted industry returns.

6. Descriptive Statistics and Results

In this section, descriptive statistics of the data will be presented. The first section will present data on what has happened in the market during the selected period, 1997-2019. The change in the number of private firms and change in the number of publicly traded firms will be presented as well as the development of HHI index. The development of publicly traded firms and HHI index will be presented on a general market level as well as on an industry specific level. In order to generate a deeper understanding of the change in number of publicly traded firms over time, the number of entries and exits in the public market over the time period will be presented. In addition, the substitution of foreign firms will be presented and STIBOR rate and a stock market index will be examined over time. To conclude the first part, the venture capital investment volume in portfolio companies will be presented as well as the share of publicly traded firms that are loss making over time. In the second part of the descriptive statistics and results, we look at the implications of the development of publicly traded firms over time by performing regressions and constructing trading portfolios to be able to analyse the effects on returns to investors and company performance.

6.1. The changing nature of public firms in Sweden

To measure the relative development in the number of public and private firms during the period 1997-2019, the change in the number of firms has been indexed with the 1997 value at 100. Looking at Figure 1, it is evident that both the number of publicly traded firms and privately held firms have been increasing over time. Although, the growth in the number of private firms has been constantly increasing, whilst the growth in publicly traded firms has been more variable. For the selected period, the number of private companies increased by 77.40% and the number of publicly traded firms increased by 32.14%. The number of private firms has been growing at a CAGR 1997-2019 of 2.64% and the number of public firms has been growing with a CAGR 1997-2019 of 1.27%. Between 1997-2000 the number of publicly traded firms increased significantly, growing with 23.41% at a CAGR 1997-2002 of 7.26%. Following 2000 the number of publicly traded firms experienced 13 years of decline in number, decreasing with -17.68% at a CAGR 2000-2013 of -1.34%. Between 2009-2013 the number was relatively unchanged varying between 258 and 256. Between 2013-2019 the negative trend in the number of publicly traded firms shifted significantly with the number growing 30.08% during the period at a CAGR 2013-2019 of 4.48%.

Figure 1: Change in the number of public and private firms (indexed)

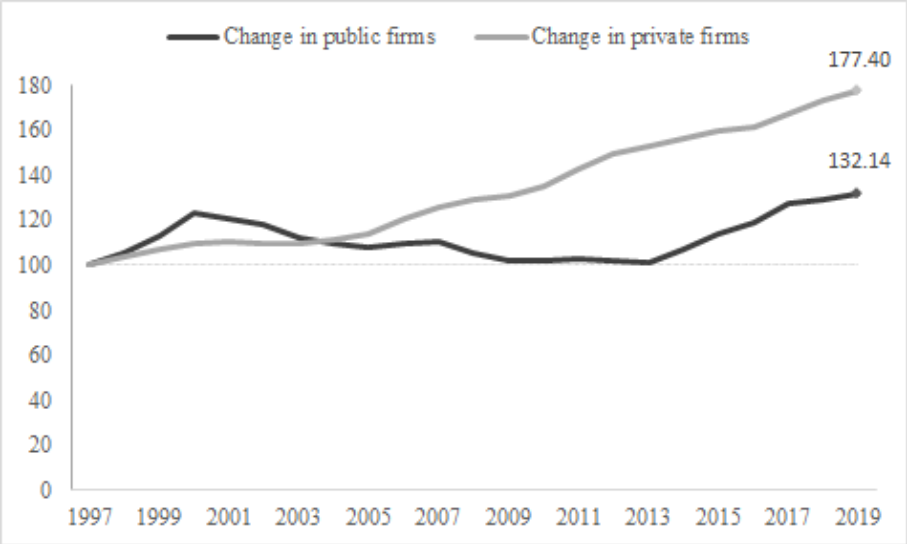


Figure 2 presents the actual development of the number of public firms in Sweden from 1997 to 2019 and the aggregated HHI-index for all industries. Looking at the first-order autocorrelation in the dependent variable for the number of public firms and conducting an Augmented Dickey-Fuller (ADF) unit root test over the years 1997-2019, there is an indication of non-stationarity. The ADF test generates a p-value of 0.76, indicating non-stationarity in the time series with 76% certainty. Using the first differences in the number of public firms, performing the ADF test generates a p-value equal to 0.63. Thus, the results imply that the number of public firms is not reverting towards a mean during the sample period, but instead, there is an underlying trend in the number of public firms.

As can be seen in Figure 2, the number of publicly traded firms has been changing over time. At the inception of the examined period, 1997, the number of publicly traded firms in Sweden amounted to 252 and at the latest recorded year, 2019, the number of publicly traded firms amounted to 333. The net increase over the examined period is 81 firms and the number of public firms in 2019 is the highest recorded number during the period, 333 firms, and the lowest number is identified in 1997, amounting to 252. Between 2013 and the latest recorded year 2019, the number of public firms has been increasing significantly reaching an all-time high record of the number of publicly traded firms on the Nasdaq Stockholm OMX.

As the HHI index can amount to a maximum of 10,000, the relatively low HHI index, varying between 531 and 245, indicates a low concentration in the market and hence, a competitive landscape. In 1997 the HHI index amounted to 531 which is the highest recorded HHI index during the examined period. As of the last recorded year, 2019, the HHI index was

250. The trend in concentration during the period is negative, but with a significant increase during 2007-2009 spiking to 497, which is the second highest recorded HHI index during the period. The HHI index is used to determine the level of competition in the market, hence we have looked at the correlation between the HHI index and number of publicly traded firms. The correlation between the two measured over the whole selected period, 1997-2019, is -0.51. To generate a deeper analysis of the correlation we have divided the time into four periods and measured the correlation between the HHI index and number of publicly traded firms for each period. Between 1997-2001 the correlation is -0.92, between 2002-2007 the correlation is -0.19, between 2008-2013 the correlation is +0.90 and between 2014-2019 the correlation is -0.97.

Figure 2: Number of public firms over time and HHI index

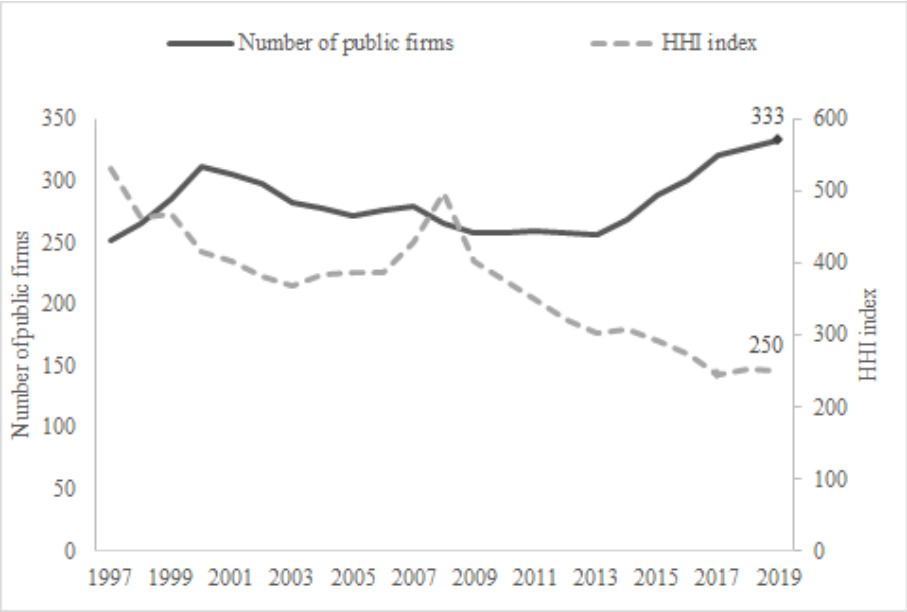


Table A1, found in the Appendix, presents the change of publicly traded firms in all industries by mean and median. Furthermore, the percentage of industries with an increasing number of publicly traded firms per period is also presented. During the complete period there are a total of ten industries that the publicly traded firms are operating in. Between 1997 and 2019, the median change of the number of publicly traded firms in all industries is 43%. As two industries had zero publicly traded firms in 1997, the mean is not taken into consideration as the result would be based on an inaccurate calculation of the mean. The number of industries in which publicly traded firms are operating changes slightly over the years with one to two industries during specific years lacking publicly traded peers. Between 1997-2002 public firms

represented 8 industries and 63% of those industries experienced an increase in number of public firms over the selected period. The average increase was 12% and the median change was 16%. Between 2002-2007 the public firms represented 9 industries and 44% of those industries experienced an increase in number of public firms over the years. Hence, the vast majority, 56%, of the industries experienced a decrease of publicly traded firms. During 2002-2007 the number of publicly traded firms decreased with an average of -1% and median -1%. Between 2007-2013 the public firms represented 9 industries and 22% of those industries experienced an increase of public firms over the years. As in the previous period, the vast majority, 78%, of the industries experienced a decrease of publicly traded firms with a median of -4%. Between 2013 and 2019 the public firms represented 10 industries and 70% of those industries experienced an increase in number of public firms over the years. During this time the largest amount of industries experienced an increase of publicly traded firms. The average increase in the industries was 38% and the median change was 33%.

Table A2 in Appendix illustrates the share of industries in which the HHI index has been increasing or decreasing, respectively. Over the whole period, the number of publicly traded firms has represented 10 industries. Of these 10 industries, 40% have experienced an increase in the HHI index, and 60% have experienced a decrease in HHI index. The results indicate that 4 industries have experienced decreased competition and 6 industries have experienced increased competition between 1997-2019. Between 1997-2002, the number of publicly traded firms represented 8 industries of which a third experienced an increase in HHI index and two thirds a decrease. Between 2002-2007, the public firms represented 9 industries and the HHI index increased in 22% of these industries and decreased in 78%. Between 2007-2013, the number of industries represented was 9, but the development was the opposite with 56% of all industries experienced an increase and 44% a decrease. In the latest period, 2013-2019, the number of industries in which the publicly traded firms were present increased from 9 to 10. The development in HHI index shifted compared with previous year with 40% of industries experiencing an increase in HHI index and 60% a decrease. Thus, the results indicate that the majority of industries have experienced a decrease in industry concentration and hence, an increase in competition. Only during one period, the majority of industries experienced an increase in HHI index indicating a decreased level of competition.

The number of publicly traded firms has been changing over time because of firms entering or exiting the public market. A company can enter the public market either through an IPO or a spin-off and an exit is a result of bankruptcy, liquidation, voluntary delisting or failing to meet the regulatory requirements. As can be seen in Figure 3, the change in the number of

listed companies is driven by variations in both entries and exits. Th highest number of entries was recorded in 2000, amounting to 46. Since then, the level of entries has been significantly lower, with one spike in 2006 of 24 entries. The trend of low number of entries shifted in 2014. In 2018, the highest number of publicly traded firms was recorded at the Nasdaq OMX Stockholm main market as a result of a relatively high number of entries between 2014 and 2018, amounting in between 20 to 26 each year, in combination with a relatively low number of de-listings. The negative trend from 2000 to 2013 is mainly driven by years with a generally high number of exits, with a record of 35 in 2000. A negative trend in the number of entries can be identified between 2017-2019, going from 26 in 2017 to 16 in 2019. At the same time the number of exits has increased, going from 5 in 2016 to 16 in 2019.

Figure 3: Entries and exits in the public market

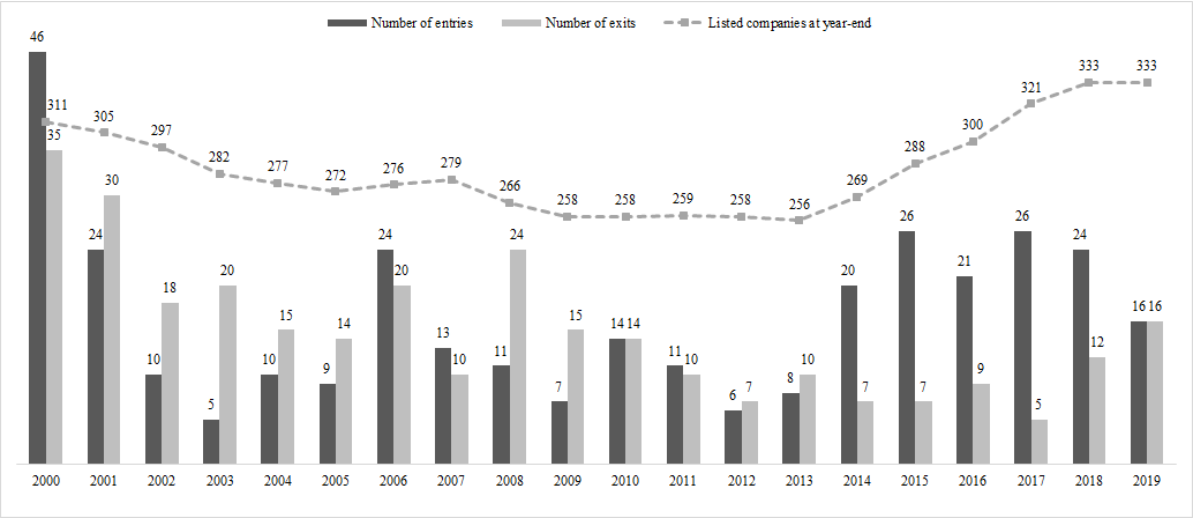


Figure 4 summarizes the share of imports out of the aggregated revenues generated by publicly traded firms per year. As can be seen in the Figure 4, the share of imports out of total revenues by publicly traded firms has not been significantly changing over time. The share of import was at its lowest in 2001 representing 30% of total revenue. Between 2001 and 2004 the share of imports increased, reaching 39% in 2004. From 2004 to 2010, the share of imports has been relatively stable hovering around 39% each year. In 2011 the share of imports increased with 4 percentage units and has since then been relatively stable varying between 41% to 43%. In the latest recorded year, 2017, the share of imports amounted to 42%.

Figure 4: Substitution by foreign firms

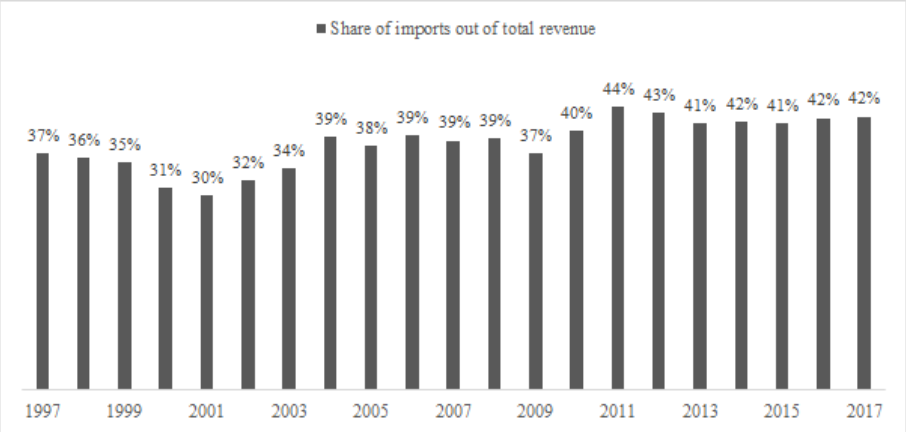
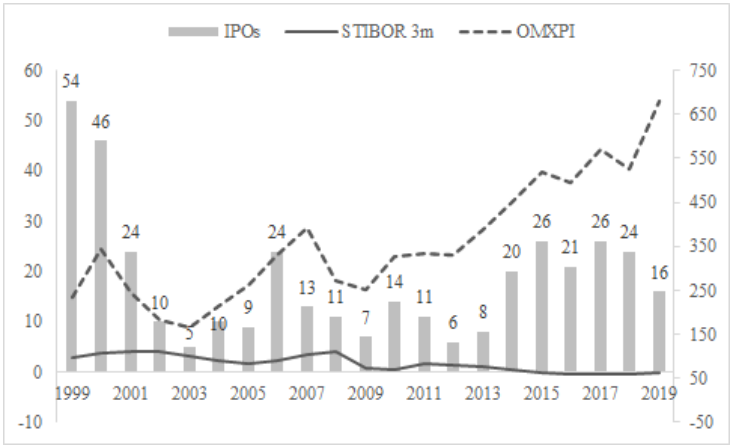


Figure A1 in Appendix presents the investment amount in venture capital portfolio companies and the number of IPOs over time. The venture capital investment volume peaked in 2008 where the total invested capital in Swedish portfolio companies amounted to SEK 4.8 billion. Since 2008, the investment volume has had a negative trend with decreasing investment volumes. Between 2010-2017 the investment volume per year has been on average SEK 2.2 billion. Between 2008 and 2012 the investment volume has been constantly decreasing each year reaching a total investment volume of 2.0bn in 2012. The years after 2012, the investment volume started to increase each year reaching SEK 2.6bn in 2014. In 2015 the investment volume dropped with over 40% and decreased to 1.5bn which is the lowest investment volume recorded during the time period. Since 2015, the negative trend has shifted, and the investment volume has experienced an increase each year growing with a CAGR 2015-2018 of 29.26%. Between 2017 and 2018, there was a significant increase in investment volume growing with 39.94%.

In Figure 5, the number of IPOs is presented in relation to the market rate and the stock market development over the sample period. The stock market has trended upward throughout the period, with sharp upticks before the economic crises and followed by significant downfalls, in 2000 and 2008, respectively. Though, the steepest increase in OMXPI is seen during the last few years. The trend in the number of IPOs appear to have followed the development of the stock market relatively well, up until 2017. The number of IPOs has declined since, presenting an opposite development to the stock market. The deviation from a common trend is notable. The interest rate has remained exceptionally low, especially from 2015 when the interest rate became negative for the first time. Likewise, the market rate appears to follow a similar trend as the other two variables, but of much smaller movements and slightly

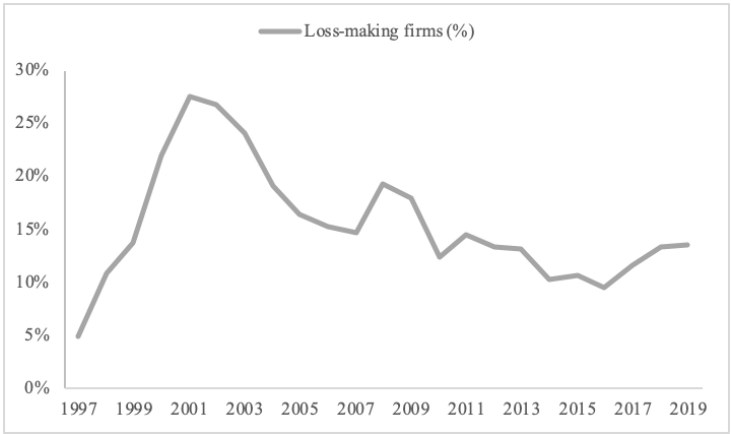
lagged. Thus, the results suggest that a relationship between rate and stock market exists, while the number of IPOs appear to have deviated.

Figure 5: Economic variables; Market interest rate, Stock market performance and IPOs



In Figure 6, the share of publicly traded firms that are loss-making is presented. It is evident that the share of loss making companies has been varying significantly over time, although there has been a negative trend since the beginning of the 21st century until 2017 when the negative trend shifted and the share of loss making firms started to increase each year. Furthermore, there was a remarkable spike in 2008, followed by an almost constant decrease until 2017. At the beginning of the examined time, the share of publicly traded firms that were loss making was at its lowest, reaching 5%. In only a couple of years, the share increased from being 5% to almost 30%. Since this significant increase, the share has not recovered as it was at its lowest in 2016 reaching almost 10%. In the latest recorded year, 2019, the share of public firms that were loss making amounted to 14%.

Figure 6: Share of publicly traded firms that are loss making



6.2. The changing nature of public firms' effect on firm profitability and returns to investors

Below are the results presented from the fixed-effects regressions and the portfolio construction, as motivated and explained in the methodology section.

6.2.1. Results of regressions

The results from the regression with ROE as the dependent variable over the complete period of 1997 to 2019, as well as the four sub-periods 1997-2002, 2002-2007, 2007-2013, 2013-2019, are presented in Table 1. The number of public firms is a statistically significant coefficient at a 1% level for the whole sample period, as well as in 1997-2002. In the period 2002-2007 the number of firms was significant at the 5% level, while there is no statistical significance for the variable in the last two sub-periods. The coefficient for the number of public firms remains large and negative through all periods, indicating that an increase in the number of publicly traded firms is associated with lower return on equity. Thus, the result show that financial performance is better when the number of firms is lower.

The control variable for firm size is also of statistical significance. Over the whole sample period it is significant at a 1% level and is significant below 10% in all sub-periods except in 2007-2013 when it is not statistically significant. As the coefficient is consistently positive, it is implied that larger firms tend to generate higher profits. This finding supports theories arguing for the importance of economies of scale in terms of profitability. Firm age, on the other hand, although of statistical significance in some periods, does not have an equally obvious relation with ROE. The coefficient changes sign over time and is both largely negative and positive over the sample periods and therefore it is impossible to infer any economical meaning to the estimator.

In the period 2007-2013, the regression model does not fit the data adequately as the F-test cannot ensure that all coefficients in the model are different from zero. Neither firm size, firm age of the number of publicly traded firms present a statistically significant correlation with the return on equity in this period. This deviation from results in other subsections coincides with the financial crisis of 2008, which could potentially be a source of distortion in the correlation between ROE and other explanatory variables.

Table 1: The number of firms and profitability (ROE)

	Dependent variable: ROE				
	1997-2019	1997-2002	2002-2007	2007-2013	2013-2019
log(Assets)	15.99***	8.75***	7.15*	71.50	36.75**
	(2.27)	(2.62)	(1.69)	(1.36)	(2.35)
log(Age)	-6.28	-27.34***	22.31*	-78.95	-46.24*
	(-0.96)	-3.52	(1.84)	(-1.52)	(-1.86)
log(NFirms)	-93.44***	-58.47***	-112.47**	-126.72	-36.82
	(-2.94)	(-3.53)	(-2.35)	(-0.67)	(-1.60)
_cons	434.58***	348.69***	502.03*	448.92	88.31
	(2.76)	(4.34)	(1.74)	(0.50)	(1.00)
N	6974	1371	1675	2359	2512
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

In Table 2, the results from the regression with ROA as the dependent variable are presented. The results are similar to those of the regression using ROE, and most of the coefficients have the same signs. The sizes of the coefficients are smaller when looking at return on assets, although of overall higher statistical significance. Firm size continues to present an evident positive relation with profitability. The number of public firms are negatively correlated with the return on assets at a significance level below 5% in all periods, except for 2007-2013, when there is no statistical significance. By looking at ROA, abnormal performance is meant to be visible, in line with presented theory. Thus, the negative correlation between ROA and with the number of publicly traded firms indicate the existence of underlying changes in firm performance with changes in the number of firms on the public market, where a higher number of market participants is related with poorer performance.

The negative relationship between profitability and a greater number of firms listed at the SSE is evident both when testing with ROE and ROA as the dependent variables and should considered to be of economic significance. The examination of both ROE and ROA and their respective correlation with the number of public firms, implies there is a negative effect to be found on profitability, both in terms of return on equity and operational profitability, when the number of public firms is increasing. Although, this regression does not provide evidence of the direction of causality. Thus, it is not possible to say that either of the two causes the other one in any direction. Instead, the aim is to identify the existence of a persistent relationship between the two. The level of statistical significance of the coefficient for the number of firms is similar to that of firm size, which is an established control variable for profitability.

Table 2: The number of firms and profitability (ROA)

	Dependent variable: ROA				
	1997-2019	1997-2002	2002-2007	2007-2013	2013-2019
log(Assets)	2.30***	2.10*	2.39**	6.34**	6.60***
	(4.01)	(1.96)	(2.15)	(2.22)	(3.13)
log(Age)	1.60	-8.10***	7.37**	-4.00	-6.31
	(1.29)	(-3.43)	(2.14)	(-0.89)	(-1.36)
log(NFirms)	-19.22***	-13.17**	-35.40***	1.34	-11.19***
	(-3.93)	(-2.92)	(-3.97)	(0.09)	(-3.07)
_cons	87.86***	84.12***	157.49***	-37.92	36.46***
	(3.65)	(3.86)	(2.87)	(-0.46)	(2.66)
N	6974	1331	1675	2359	2512
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Furthermore, we examine if the relationship between the number of publicly traded firms and profitability is attributable to effects on a firm's operational efficiency by looking at asset utilisation. The results of the regression with asset utilisation as the dependent variable, defined as revenue over total book value of assets, are presented in Table 3. The coefficients for the control variables are overall highly significant and of opposing signs, indicating that increasing firm size is related to lower asset utilisation and an older firm with higher efficiency. Though, the age variable does not appear to retain the same correlation with asset utilization in the last sub-period.

The variable for the number of firms is statistically significant at a 5% level for the whole period and present a negative relationship with asset utilisation, indicating that a higher number of public firms are associated with lower efficiency. Though, the coefficient is much smaller in this regression than in those of ROE and ROA. Apart from being of smaller impact, the coefficient changes sign over the sub-sample periods, and is only negative for the last period. The correlation between efficiency and the number of public firms is not as evident as with profitability. Thereby, changes in profitability in context of a changing number of public firms should be assigned to further causes than improved or declined operational efficiency of a firm.

Table 3: The number of firms and efficiency

Dependent variable: Asset Utilisation					
	1997-2019	1997-2002	2002-2007	2007-2013	2013-2019
log(Assets)	-0.19***	-0.37***	-0.39**	-0.26***	-0.25***
	(-6.27)	(-6.03)	(-2.43)	(-4.24)	(-5.16)
log(Age)	0.22***	0.25***	0.39***	0.46***	0.16
	(4.30)	(3.17)	(2.81)	(3.45)	(0.99)
log(NFirms)	-0.80**	0.52*	1.16**	0.86**	-0.08
	(-2.24)	(1.91)	(2.15)	(2.33)	(-0.58)
_cons	6.19***	0.05	-3.85	-3.323	2.73***
	(3.68)	(0.04)	(-1.32)	(-1.48)	(5.56)
N	6824	1348	1638	2304	2456
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes	Yes

t statistics in parentheses

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

6.2.2. Results of portfolio construction

Table 4 presents the results from the construction of trading portfolios. Our results from the whole sample period show that the High-portfolio, comprising the industries with the most significant increase in the number of public firms, generates the lowest equally weighted return and the Low-portfolio generates the highest equally weighted returns. The equally weighted return from the Mid-portfolio is in between the High and Low portfolio. However, the results from the value-weighted portfolios are different. The Low-portfolio generates the lowest value-weighted returns and the Mid-portfolio the highest value weighted returns. The returns from the High-portfolio is in between, but closer to the Mid-portfolio return.

Equally weighted returns are generally higher than value weighted returns. Only the Mid-portfolio during 1997-2004 generates a value-weighted return that is higher than the equally weighted return during the specific period. Although, considering the three different periods there is no consistency in the results between portfolios as the highest and lowest returns differ between portfolios and time periods.

Table 4: Number of firms and portfolio performance

Portfolio	**1997-2018**	**1997-2004**	**2004-2011**	**2011-2018**
High				
Equally weighted returns	566%	80%	86%	187%
Value weighted returns	468%	63%	45%	175%
Mid				
Equally weighted returns	633%	35%	112%	138%
Value weighted returns	477%	38%	39%	68%
Low				
Equally weighted returns	925%	100%	101%	73%
Value weighted returns	347%	78%	93%	32%

7. Discussion

In this section we will discuss the results presented in Section 6 and answer our research question by addressing the two hypotheses from Section 3.

7.1. First hypothesis

Our first hypothesis is formulated as follows: "The number of public firms in Sweden has increased and the market concentration has decreased" and can be accepted according to our results.

The number of publicly traded firms on the Stockholm Stock Exchange has increased over time and the market concentration has decreased. The aggregated number of firms, both publicly traded firms and privately held firms, has increased over time, hence the increase in the number of publicly traded firms has not been compensated by a decreasing number of private firms. In addition, our findings show that foreign firms have maintained their presence in the Swedish market, hence foreign firms have not offset the increased number of public firms. It can be concluded that the number of publicly traded firms has been increasing, and that the increase has not been offset by privately held companies nor foreign competition. These conclusions are supported by the ADF test showing that the number of public firms is not reverting towards a mean, but instead that there is an underlying increasing trend. Although the hypothesis is accepted, the development has not been constant over time but varied significantly over the years.

Our study shows that the overall concentration in the market has decreased over time with the increasing number of publicly traded firms. It can be concluded that the HHI index, in general, is low in Sweden indicating a highly competitive market. Like the development in the number of publicly traded firms, the HHI index has not been constantly decreasing, but has had a development that has varied significantly over time. This development is in line with existing research suggesting that the market concentration decreases with an increased competition. This relationship between the two variables is especially evident in the first and last periods examined with a correlation of -0.92 and -0.97 respectively. Between 2007 and 2014, the correlation between the HHI index and the number of publicly traded firms was +0.90, as a reflection of a slight decrease in the number of firms in combination with a significant increase in market competition. This is contradictory to existing literature on the topic. It could be discussed whether the financial crisis had an impact on the market, distorting normal and expected market behaviour.

Looking at an industry level during the whole period, our results show the number of publicly traded firms has been increasing in 70% of all industries and decreasing in 30% of all industries. The median change in number of publicly traded firms during the whole period in industries is an increase with +46%. Looking at the development in HHI index in industries over the period, our results show that 60% of all industries has experienced a decrease in HHI index and 40% have experienced an increase in HHI index. The results could be interpreted as the majority of industries have experienced an increased number of publicly traded peers which has resulted in a more competitive environment, hence lower industry concentration. These results are in line with both the general trend on the market and the existing literature and previous research on the topic. As in the findings regarding the overall market developments, the results from the period 2007 to 2013 deviates from the other periods also at the industry level. Compared to other periods, with an increasing number of public peers, 88% of all industries experience a decrease and the HHI index increased in the majority of industries. Our results suggest that the majority of industries lost publicly traded peers during this time period resulting in increased industry concentration.

Comparing the results from our study with previous research covering the U.S. market, it is evident that the market development. Although the development is the opposite of the two markets, the theories of market concentration and number of public firms are still holding. The exception when the literature is not applicable is during the period coinciding with the financial crisis of 2008. What can be concluded is that existing literature is in line with our results, but that the market behaves differently in a crisis and that other theories may be more suitable for systematic shocks to the market.

The increasing number of publicly traded firms has in the latest years been supported by a significant upturn in the number of IPOs, reaching over 20 IPOs per year since 2014. Looking at our results it is evident that the number of IPOs was low during the times when the venture capital volume was at its high compared to the significantly higher number of IPOs during the time when investment volume has been low. This result contrasts with Ritters' theory (2014), that fewer companies are nowadays choosing the option to IPO as private money now is the preferred option to raise funding. Furthermore, claims that the main reason for this is that private equity funding nowadays is cheaper and easier to access compared to before due to the abundance of cash in the private market that is flowing around is not in line with our results, as the number of IPOs in Sweden has been remarkably high during the past years at the same time as the private investment volume in portfolio companies has been decreasing. This research is thereby not applicable in the Swedish market. Instead our results indicate the

presence of a symbiotic relationship, in line with the theories presented by Black and Gilson (1998). It could be discussed whether the Swedish market is different from other markets, as Sweden is considered to be a hub with the second greatest number of unicorns per capita in the world and one of one of top three countries with highest number of investments per GDP. It is possible that the public and the private markets have developed a dependency and have been thrived and benefited on each together.

Our results are in line with Angelini and Foglia (2018), who states that there is a significant causality between the number of IPOs interest rates as it is evident that the number of IPOs increased at the time Sweden applied negative rates. Moreover, it is evident from our results that the number of IPOs is following the development of the stock market, which is to be expected according to Lerner (2007). Hence, our results are in line with existing research on the topic and our research suggests that there is a relationship between the number of IPOs and the rate and stock market development.

It can be concluded that even though the development of the Swedish stock market has been the opposite to the global trend of decline in the number of publicly traded firms, the development is overall in line with existing literature on the topic.

7.2. Second hypothesis

Our second hypothesis is formulated as follows: "Increased number of publicly traded firms results in lower firm profitability and lower returns to investors". Based on the results from our study, the first part of the hypothesis can be accepted, while it is not possible to either reject or accept the second part.

From the results of the regression with ROE, ROA and Asset utilisation it can be concluded that there exists a relationship between the number of publicly traded firms and the performance and profitability of firms. An increase in the number of publicly traded firms is associated with lower profitability in terms of return on equity as well as return on assets. The first part of the second hypothesis can therefore be accepted, as our results show that at times when the number of publicly traded firms is higher, firm profitability is lower. Though, as there is no obvious relationship between the number of publicly and asset utilisation, the change in profitability, is attributable to some other factor of factors than operational efficiency. According to Baumol (1982) firms in highly concentrated markets should behave as if the market had low concentration. By doing so, the market will continue being competitive due to the threat of new entrants. As a result, the number of firms in an industry will not affect the firm's profitability. Our results are in contradiction to Baumol's research, as it is evident from

our results that there exists a relationship between the number of firms and profitability, suggesting that market behaviour changes depending on concentration. Theories suggesting that firm profitability should increase when the number of market participants is lower is more in line with the results from our study. Moreover, our results are also in line with Bustamante and Donangelo (2014), as they suggest that with increased market competition the return on assets could be expected to be lower. One could discuss whether this is due to the decreased value of risky growth opportunities in relation to safer existing assets. Moreover, in the last sub-period the number of publicly traded firms is not statistically significant with ROE as the dependent variable. It could be discussed if this development is in line with the development in the U.S., where a growing proportion of loss-making firms going public, reaching 80% 2018, results in lower expected return on equity. This suggests a change in the nature of the public market, where companies can be loss-making but still have high asset value due to these intangible assets. Thus, also affect the results in our regression model.

It should be noted that the regression models did not fit the data adequately in the period 2007-2013 in any of the regressions. As seen in the descriptive statistics and discussed above, the change in the number of publicly traded firms deviated from the other periods and was not in line with existing research. The number of de-listings from the SSE spiked in 2008 and the stock market fell drastically in 2008-2009. Thus, it is not surprising that the results differ in this period. Furthermore, it could be discussed whether the significant increases in the share of loss-making firms can be attributable to the severe financial events that occurred during the 21st century. The largest change can be attributable to the IT-bubble that burst in the spring of 2000 with a falling stock market as a result. Furthermore, the next significant increase that can be identified happened during the financial crisis in 2008. In the latest years the stock market has experienced a constant increase of loss making firms and it could be discussed the reason for the growing proportion of loss making companies is that fewer companies produce products in factories, and the value in companies has shifted to intellectual property such as patents or other intangible assets.

From our results we are unable to either reject or accept the second part of the hypothesis regarding lower returns to investors with increasing market concentration. Our portfolio construction presents significantly different results depending on the use of equally weighted or value-weighted returns and which period is in question. The inconsistency in the returns of the portfolios, makes it difficult to reach definite conclusions about the relationship between the change in number of public firms in an industry and the stock returns. Although, the variation in our results may on its own provide useful insights to the nature of the public

market as it indicates an absence of relationship between change in the number of publicly traded firms in industries and returns to investors. We are not able to draw any confident conclusions from our results, although existing literature suggests that firms operating in industries with low concentration, that is high competition, are expected to command higher stock returns.

8. Conclusions

8.1. Main conclusions

The aim of this paper is to investigate if the number of public firms has changed in Sweden, the reasons behind this development and its consequences on company performance and returns to investors. Our main findings are as follows.

The number of publicly traded firms has increased over time and the market concentration has decreased. Looking at an industry level it is evident that the number of publicly traded firms has been increasing and the industry concentration, HHI index, has been decreasing in the vast majority of all industries. However, the development over time has not been constant with time periods indicating on the opposite development, as well as indicating on the two variables moving together instead of in opposite direction which existing literature and previous research suggests. Furthermore, our research suggests that it exists a relationship between the number of IPOs and the rate and stock market performance as the number of IPOs is following the pattern of the development of both the rate and the stock market performance. Furthermore, the number of IPOs has in the recent year increased significantly and the private investment amount in portfolio companies has decreased. The increased number of IPOs might be the alternative to raise capital in a market with decreasing private investments.

The number of public firms is statistically significant for the whole sample period with ROE as the dependent variable showing that the firm's financial performance is better when the number of publicly traded firms is lower. The same results are evident when testing ROA as the dependent variable where a higher number of market participants is correlated with poorer firm performance. The negative relationship between profitability and a greater number of firms listed at the SSE is evident both when testing with ROE and ROA. Furthermore, the variable for the number of firms is statistically significant for the whole period and presents a negative relationship with asset utilisation, indicating that a higher number of public firms are associated with lower efficiency. Although, the coefficient is much smaller in this regression than in those of ROE and ROA and the correlation is not as evident as with profitability. Thereof, the effect on profitability is attributable to other causes than change in operational efficiency. The trading portfolios provide no indication of an evident relationship between the change in number of publicly traded firms within an industry and the returns to investors.

8.2 Generalizability

As this paper is a research of the change in the number of publicly traded firms in Sweden over time and its effect on company performance and returns to investors, the findings should not be applied to other countries except from Sweden. Furthermore, we have limited this paper to a specific period, hence, the findings are only attributable to the chosen time period and should not be applied in other time periods. Although, the method in this paper is applicable to all markets and all time periods. In addition, the results from this paper could be used as a benchmark when applying the method and performing the study on other markets during other time periods.

8.3. Limitations of results and suggestions for future research

This study aims to fill the research gap on the changing nature of the public market in Sweden, by examining how the number publicly traded firms have changed over time and how it relates to changes in firm performance and returns to investors. As there is a significant lack of literature covering these topics in Sweden, the scope of this paper is wide rather than narrow in a specific research area. We aim to provide a general understanding of the public market in Sweden, how it has changed over time and the potential effects. Thus, we hope that further research will be conducted based on our study and go deeper into the different research areas and issues we have raised.

Due to the aim and scope of this study, we are aware of certain limitations. As we have only taken into consideration the main market of the Nasdaq OMX Stockholm, it would be of interest to see if the results are applicable also to all publicly traded firms in Sweden, including other or additional lists. Moreover, as the development of the Swedish public market is opposite to the global trends, it would be of interest to further research the reason behind this contradicting market behaviour by comparing stock markets in other countries.

Furthermore, our scope is limited to a selected period and research conducted over overlapping or complementing periods is desirable to reach a more detailed understanding of the changing nature of public markets over time. Due to the aim and scope of this paper, we have chosen to limit our study on an annual level. This implies limitations to the information included in the dataset, as it does not consider time-limited shocks, instant events or seasonal effects. To capture short-term events affecting the public market future research could conduct similar studies with different and complementing periods of time. It is evident in our results that the market behaviour changes during abnormal times such as a financial crisis. Suggestion

for future research is to analyse the change in the number of publicly traded firms and its effect on firm profitability and returns to investors in times that are deviating from the normal.

There are occurrences of missing values in our dataset, which could distort our results. As we collect data from third-party sources, we are unable to attribute a certain cause for the missing values and therefore address the issue in more detail.

We have classified the industries according to the SIC-system, as there are several different industry classification systems, this choice directly affects the industry-level results and the conclusion made. Future research could consider classifying industries according to other systems, in order to evaluate to what degree the results reflect reality. Furthermore, we have only considered the public firms when calculating the concentration index, which limits the study to only measure industry concentration on a public level without considering the private firm operating in the industries as well. Incorporating more detailed company-specific information of both the public and private firms would allow for additional analysis in future research on a more detailed level. Furthermore, by only considering specific performance metrics, this study's results are limited to address the effects on several stakeholders. Future research could incorporate other metrics to address additional stakeholders. Moreover, we have estimated foreign competition at a general market level, and it would be beneficial to estimate and analyse the development of foreign competition at an industry-level. We have limited our study to only consider a few selected macroeconomic and financial variables. There are numerous variables that would be interesting to investigate whether they have an effect on the development of the public market or not.

This study is limited to only consider entries and exits of the public market. Suggestion for further research is to incorporate what types of entries and exits that are driving the change in the number of publicly traded firms and how it relates to the private equity market. In addition, this paper provides evidence of a relationship between the public and private market in Sweden. Hence, future research could further examine this relationship in a more detailed way and compare the characteristics in Sweden to other markets.

Suggestions for future research by extension of the methodology is to include additional dependent variables as well as incorporating other types of control variables to identify other significant factors affecting the nature of the public market and identification of causal inference. The portfolio construction could potentially provide more valuable insights by complementing this study with other methods for construction as well as risk-adjustments.

To conclude, this study shows that the nature of publicly traded firms has been changing in Sweden and we aim to encourage future studies in this area as there is much left to learn about the changing nature of the public markets and the effects on different stakeholders.

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10. Appendix

Table A1: Change in the number of firms in industries

Table A1 presents the change of publicly traded firms in industries by mean and median. The percentage of industries with an increasing number of publicly traded firms per period is also presented.

Year	N	Mean	Median	% of industries with positive change
1997-2019	10	n.a.	43%	70%
1997-2002	8	12%	16%	63%
2002-2007	9	-1%	-1%	44%
2007-2013	9	5%	-4%	22%
2013-2019	10	38%	33%	70%

Table A2: Change in HHI index at an industry level

Table A2 illustrates the share of industries in which the HHI index has been increasing or decreasing.

Year	N	Increase	Decrease
1997-2019	10	40%	60%
1997-2002	8	33%	67%
2002-2007	9	22%	78%
2007-2013	9	56%	44%
2013-2019	10	40%	60%

Figure A1: VC investments in Swedish portfolio companies

Figure A1 presents the investment amount in venture capital portfolio companies and the number of IPOs over time.