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Financial Economics

Initial Public Offerings in “Hot” and “Cold” Markets

- A Study of the Swedish IPO market

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Abstract

This thesis aims to test if the IPO market differs in hot and cold market conditions in terms of industry clustering, firm characteristics, and long-run performance. The study is conducted on the Swedish IPO market ranging from 1992 to 2020 and 2017 in analyzing the long-run performance. The study compares different variables across the period depending on the market condition. The long-run performance is measured by taking the risk-adjusted returns over three years. The results from the study support that there are differences in some of the firm characteristics in different market conditions and a slight difference in industry clustering. Hot market firms tend to have a higher percentage of institutional owners and overallotment by underwriters. One of the industries that are analyzed differs in long-run performance. However, the study rejects any difference in risk-adjusted long-run performance depending on the market conditions. Regressing firm characteristics and market conditions on returns performance we find no significant difference between conditions or effects of firm characteristics.

Keywords: Initial public offering, IPO, hot and cold markets, efficient market, long-run performance, Swedish stock market

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1. Introduction

Initial public offering (IPO) is when a firm issue shares to the public and allows its shares to be traded on the open market. IPOs vary in number over time and the frequency appears in recurring patterns and previous studies have shown that IPOs in hot markets tend to be underpriced, at least in the short run (Ritter, 1991). Underpricing is when the price that the firm offers to the public is lower than what it sells for at the open market. Previous studies define hot markets differently, some studies classify periods with frequent IPOs as hot markets and others classify it based on abnormal excess returns (Ritter, 1991). Ritter (1991) uses this method by putting the offering price to the first-day closing price. Hot and cold markets are described by previous researches as periods of either high underpricing or a high volume of offerings.

To better grasp and give a comprehensive understanding of performance in hot and cold markets, Helwege and Liang (2004) study the different characteristics of the market conditions. Their study has shown that firms from certain industries are more likely to go public in either hot or cold markets. Other characteristics have also been analyzed to study the variations in different market conditions. Besides the clustering of industries in different market conditions, Helwege and Liang (2004) studies different firm-specific variables and interestingly find differences in what types of firms go public in the mentioned market conditions.

Studies of the hot and cold markets and what impact it has on the performance can be used by investors and managers to time their investment or IPO to maximize the returns and gross proceeds. The studies that have been conducted in this area are mainly analyses of the U.S. stock market. Other countries may differ in size, range of different industries in the market, and investor sentiment. Hence, there are motives to test if the attributes of the hot and cold market and its effect on the performance in other countries appear in the same way. Studies of the Swedish IPO market have shown that in the short run hot markets are related to good performance in the stock market for the firms, Fathi & Simonsson (2018) argues that in the long run the market is characterized by an initial overvaluation which ends up with lower returns over time. This study will test a long period and put the performance to industry clusters and firm characteristics, testing differences in the characteristics of market conditions. Through this study, we aim to give answers to whether it is rational from the investors' point of view to invest in IPOs in different market temperatures and if there are any risk-adjusted abnormal returns to harvest.

1.1. Problem Description and Problem Analysis

There are many reasons why firms choose to go public. Some have to do with raising capital for growth-opportunities (Pastor & Veronesi, 2005) and other reasons could be exit-opportunities for pre-IPO owners (Black & Gilson, 1998). However, when to go public and when not to go public can be an important question. This could lead firms to attempt timing of the market for higher potential valuations from overly optimistic investors (Shiller, 1988).

Depending on when the firm goes public, it will have implications for investors. Buying into an IPO when the market for IPOs is hot, that is IPO volume is high, could produce sub-optimal returns. Loughran et.al (1994) have found that there is a tendency for high IPO volume to be correlated with market peaks. Previous research by Alti Aydogan (2005) concluded that the quality of firms deteriorates as the market becomes hotter. Therefore, the research questions are the following:

- Do certain industries cluster in any market condition?
- Do the IPOs differ in terms of firm-characteristics?
- Do IPOs from hot market conditions create value in the long-run, in terms of higher risk-adjusted long-run return compared to other market conditions?

The rationale behind investigating industry clustering and firm-specific variables is that it will contribute to the analysis of the long-run performance. If there exist an over- or underperformance, in the long run, depending on market conditions and at the same time specific types of firms go public in specific market conditions, it will bring a context to the decision-making in the sense that it will indicate that certain types of firms have determinant variables which generate higher risk-adjusted returns. Moreover, it is also interesting to study industry clusters and firm-specific variables from the perspective of portfolio optimization. Depending on whether certain types of industries have higher risk-adjusted returns the characteristics of the firm with indicative power of risk and industry exposure can be evaluated when optimizing a portfolio.

Research conducted by Fathi and Simonsson in 2018 found that IPOs on the Swedish market overperformed their benchmarks. If we compare that to research by Ritter in 1991 who found underperformance on the U.S. market, Sweden might have a somewhat different IPO market. The difference in industry distribution and firm characteristics could explain some of the performance in the Swedish market. Further motives for conducting this study is to study how our results relate to previous studies in this area.

1.2. Purpose of the Thesis

The body of research has yet to reach a unified conclusion on general trends in the IPO market. We build a thesis based on the work done on the U.S. market and testing the ideas on the Swedish market could give some insights to the subject.

The purpose of this thesis is to study if firms that go public create value, in terms of portfolio optimization and long-run risk-adjusted returns, for investors and if this value creation differs between market conditions. When investors create portfolios and try to optimize performance, new entrants to the stock market could bring opportunities to the knowledgeable investor.

It has been shown by previous researchers that the IPO market has certain characteristics that can be analyzed (Helwege & Liang, 2004). The thesis seeks to add knowledge about the industry composition and firm characteristics in times of high IPO volume and low IPO volume. If this thesis finds any significant relationship, investors could optimize their portfolios by choosing to hold shares of the IPOs in certain industries; that have certain firm characteristics and were issued in better market conditions.

1.3. Limitations of the Thesis

The Swedish stock market has a relatively small size compared to other countries’ markets. This could cause the analysis to not be comparable to other research. The sample will contain much fewer observations than for example the U.S. market.

When it comes to market conditions, specifically the temperature, where the threshold is put for cold and hot markets will have an impact on how the analysis will unfold.

1.4. Thesis Structure

The remaining structure of the thesis is as follows: In chapter 2 we go through theories and literature that help explain behavior and previous research relating to the research to be conducted. In chapter 3 we present the dataset and the methods used for the analysis of the data. In chapter 4 the results are presented together with comments. Finally, in chapter 5 the results will be discussed, and a conclusion will be formed in chapter 6.

2. Theoretical Framework and Results from Literature Studies

Section 2 provides information regarding the IPO process, investor behavior, and the results from previous research regarding IPO market characteristics.

2.1. Initial Public Offerings

The Process of Initial Public Offerings

The journey a firm takes when going public usually starts at an investment bank. These banks act as underwriters for public offering meanings that they prepare and launch the firm onto the stock market. They do this by acting as a middleman, setting issue price, and acquire capital. In some cases when the initial public offering is large, several investment banks form a syndicate to raise the capital for the issuing firm (Jenkinson & Ljungqvist, 2001).

The relationship between the firm and an investment bank can take different forms. When the two parts enter a "firm commitment", the investment bank agrees to buy all the issued shares and then resells them to investors. Another way they interact is through a so-called "best efforts agreement" where the investment bank sells the shares to the public on behalf of the issuing firm but does not guarantee the firm the capital they need (Jenkinson & Ljungqvist, 2001).

In the next step, the investment bank handles financial regulatory authorities to provide them with all the details of the initial public offering. When the authorities approve issuance the investment bank will form a prospectus outlining all the available public information about the firm. The firm and investment bank now start marketing the public offering to create investor awareness (Jenkinson & Ljungqvist, 2001).

The two most common methods for an initial public offering are auctions and book-building. In an auction, investors bid for the shares and the shares are sold to the highest bidders. Through a book-building process, potential investors are contacted which then informs the issuers of what quantity and price they are willing to buy at. In the book-building process, the issuers can choose whom to allocate the shares to (Sherman, 2002).

2.2. Market Sentiment

Prospect Theory and Investor Behavior

The behavior of investors can at times seem to be irrational. Prospect theory as developed by Kahneman and Tversky (1979) explains that the behavior stems from problems in estimating gains and losses. Furthermore, there is an asymmetrical relation between them. For example, a gain of 100 followed by a loss of 50 is not equivalent to a gain of 50 without the initial loss when it comes to behavioral reactions to them. The loss weighs more than the gain. Both are a gain of 50 but not equivalent to the reactions of subjects. As individuals weigh gains and losses ex-ante, the perceived likelihoods of events become important when deciding on a course of action. In the case of the example given above, for the two situations to be equal, the perceived probability of the gain of 100 must be higher than the probability of the loss of 50 (Kahneman & Tversky, 1979).

In the long run, when observing through the lens of prospect theory, potential IPO underperformance might not be a problem in the eyes of the average investor. This can be explained because IPOs provide a chance for large returns compared to stocks with historical performance. Due to this frame of mind investors might accept the average underperformance of IPOs because some of them will give large returns. The asymmetrical tendencies between gains and losses are outweighed in favor of gains when it comes to IPOs. That is because the upper limit to gains is hard to conceive. Small probabilities of an almost inconceivable upper bound in returns give high probability-weighted gains; whereas there is a clearly defined lower limit of stock returns (100% loss).

Efficient Market Hypothesis

Efficient Market Hypothesis (EMH) is a theoretical framework that was primarily popularized by Eugene F. Fama (1970) and suggests that no opportunity for arbitrage or over-average return exists in a market with sufficient conditions. And that is because all assets in the market are priced based on available information and the assets' prices reflect all information that is available for investors. Fama (1970) discusses in his paper the sufficient market conditions which he refers to be a combination of no transaction costs (1), easily accessible information for all investors with minimal costs (2) and that everyone agrees on the current price based on the available information (3).

There are three levels to the EMH where the first one is a weak form of efficiency and is referred to as a reflection of historical information and performance on current asset price. A second level is a semi-strong form which suggests that other public information is determining factor for the asset pricing and not only the historical performance. It could for example be a firm's annual report. The strong form is the third level and this idea encompasses all available information, whether it is public or non-public. That is, insider information determines the price of the asset as well (Fama, 1970).

Looking at IPOs from the lenses of EMH we know that historical information is less for IPOs at least when it comes to historical stock price levels. The available and public information is primarily the prospect description provided by the firm and insider information could have a great impact on the returns, since expectations of the investors may be asymmetric when it comes to IPOs (Fama, 1970). Furthermore, as presented in Ritter's study (1981), in hot markets there are short-term abnormal excess returns followed by decreasing and negative returns in upcoming years, which could imply asymmetric information among investors due to lack of historical performance.

2.3. Results from Literature Studies

Hot Issues Market

Research by Ibottson and Jaffe in 1975 analyzed different key features such as the return performance of IPOs during either hot or cold markets. The researchers wanted to primarily test if hot markets could be predicted. The hot market condition was a period of unusually high average first month returns in contrast with a broad market index. The first test they conducted was to see if there was any relationship between returns in one period and the returns in one period going forward. Their finding was that there existed autocorrelation between IPO returns. The second test was to see if there was any relationship between returns and the frequency of IPOs, here they tested lags going back 12 months and found a significant relation between IPO returns and IPO volume 6 months forward. However, even though there was a significant relation they concluded that there was no real relationship between the average monthly IPO returns and IPO volume when using a Cochrane-Orcutt regression which adjusts for serial correlation in the error term.

When Ritter in 1984 started researching this area he aimed to test the underpricing phenomenon as relating to IPOs. The tests were conducted to see how the issues performed over time and if it differed whether the shares were bought during a period of high volume or low volume. In his research, he found that over the performance of IPOs only existed in the short-term. An explanation given by Ritter in 1991 for the long-run underperformance is that over-optimistic investors flock to buy IPOs and misprice the new shares. Seeing that investors are overoptimistic; firms will choose to go public when the market is "hot" to get higher prices or for shareholders to exit at higher prices.

A study conducted by Fathi and Simonsson (2018) investigates how IPOs in the Swedish market performs in the long-run and focuses on firms that are private equity-backed. They compare all IPOs during a specific period with private equity-backed IPOs to prove if there is a positive effect on IPOs in the long-run on firms that are private equity-backed. Private equity firms are firms that take active positions in firms to try to enhance their value. Their study shows that Swedish IPOs during the period 2004-2010 have overperformed the market, which differs from other studies that were examined since the study is not based upon a comparison between hot and cold markets.

Furthermore, results also show that private equity-backed firms underperformed except when BHAR (buy and hold abnormal returns) is used as a method and the overperformance examined using the BHAR model is a slight +1,26% in returns. The underperformance of private equity-backed firms is of interest since it can be a result of managers timing the IPO to a larger extent which is an area this thesis aims to explore – how Swedish IPOs in hot market performs in the long run. Additionally, the period of 2004-2010 is a relatively small sample set compared to other studies in this area. The goal is to have a larger sample size ranging from 1992 to 2017 could give more significant results when it comes to the evaluation of over- and underperformance.

Market Timing

Different interpretations of why firms choose to go public at certain times are discussed with somewhat differing rationale. Ritter in 1984 argued that large clusters of IPOs arise when there are abundant investment opportunities. From a different perspective, Loughran et al. (1994) argued that large clusters of IPOs happen in times when investors place high valuations on shares. Furthermore, Aydogan (2005) argues that the increase in IPOs in a time of hot markets is most evident in the early stages of the hot market and that the quality of the IPOs deteriorates over time in a hot market cycle. Among other interesting points to consider in this study is that investors who use the return of an IPO for investments shortly outperform those who hold onto their returns from the IPO, which confirms mentioned underperformance in the long-run in previous studies.

Plotnicki & Szyszka (2014) analyze timing the IPO based on hot and cold markets, however, they define hot and cold markets differently where they take the speed of an IPO process after deciding to go public, to classify the market as hot or cold. They find that firms with faster IPO process than the median match their IPO with peaks in the market. Furthermore, among their result is that winning stocks are sold more quickly compared to falling stocks where those are held for a longer time, and they suggest that this behavior is in line with the prospect theory – considering the asymmetric relationship.

A study conducted by Guney & Hafezali (2010) on the UK market from the perspective of firms capital structure concludes that firms that choose to go public in a hot market, where the hot market

is defined based on number of IPOs, tend to raise more capital than those that go public in the cold market. On the other hand, the authors suggest that firms that have had their IPOs in hot markets encounter poorer investment opportunities in the following years. This increases their leverage in the long run. Whereas firms that go public in the cold market tend to decrease their leverage in the subsequent years.

Robert J. Shiller (1988) argues that the underpricing of IPOs in hot markets can be explained by the fact that underwriters may have incentives to underprice the stocks to create publicity for themselves, by high initial returns, and increase the overall enthusiasm of the investors as well. Underwriters are firms and institutions that guarantee a certain price for the shares to the issuing firm and then sell them to the market. These market participants are usually investment banks. Furthermore, Shiller (1998) hypothesizes that the reputation of the underwriter is of high interest for the investor in IPO’s. Moreover, Shiller (1988) argues that these incentives are coherent with the fact that IPOs are not priced by the market and there are opportunities for underwriters to target specific groups by their pricing to get the attention from the mass of investors. That is due to investors' need to avoid “winner’s curse”, which is the phenomenon that occurs when placing the highest bid due to lack of information. This leads underwriters to give compensation for that by underpricing. Furthermore, issuing firms go along with an underpricing by the underwriters, since the reputation of the underwriters contributes to acquiring more capital compared to underwriting without a third party.

Reasons for Going Public in a Hot Market

Pastor and Veronesi (2005) argue that when the market performs worse the number of IPOs issued decreases as a result. Firms tend to await more favorable market conditions before going public. The authors have developed a model in their research paper where they predict that hot markets are preceded by abnormal returns in the market and followed by a period of small returns. The model is based on empirical data and supported by the data. They argue that the discrepancy in stock prices and volatility between old and new firms is larger before a hot market period. Moreover, the model also predicts hot markets on the basis that IPO volume, which is the determinant factor of hot and cold markets, is related to stock price fluctuations and not traded quantity. These market conditions are fundamental factors when managers decide to go public. The optimal IPO timing for managers is argued to be when the expected aggregated profitability is highly above the expected market return, meaning in periods with high excess returns. However, the firms also take the volatility into account and enter the market in time with the least volatility combined with high excess returns. When it comes to firms with relatively high intangibles and patents, a determinant factor for timing the IPO is also the time to expiry of the patent. As time passes and the expiry date of the patent becomes closer, going public becomes less attractive. (Pastor & Veronesi, 2005).

According to Ljungqvist et al. (2006), average monthly first day returns are proxies for investor sentiment, which in turn predicts whether a firm is more likely to go public. Ljungqvist et al. (2006) also argue that the reason for a commonly existing underpricing in a hot market as well as increased IPOs in cycles is irrational investors. When there is an increased sentiment among the investors the stock prices are initially pushed up, which becomes an attractive period in terms of IPOs for managers and firms. Furthermore, a long-run underperformance is also caused by investor sentiment where high initial returns due to high investor sentiment give lower long-run returns as the uncertainty reduces. (Ljungqvist et al., 2006).

Long-Run Performance of Initial Public Offerings

When analyzing data on the performance of IPOs, research conducted by Thomadakis et al. in 2012 on the Greek market found that they tend to overperform in the short-run (1-year), slightly overperform in the medium-term (2-years) and underperform in the long-run (3-years). This phenomenon is also called the “new issues puzzle” and is found to be the case for the U.S market as well, where IPOs tend to underperform in the long run. One explanation given by Ritter in 1991 for the long-run underperformance is that over-optimistic investors flock to buy IPOs and misprice the new shares. Seeing that investors are overoptimistic; firms will choose to go public when the market is “hot” to get higher prices or for shareholders to exit at higher prices.

Mario Levis (1993) have conducted a study of long-run IPO performance in the UK and concludes that high initial average returns, based on first-day return, end up with underperformance in the long run of 3 years. The underperformance is more noticeable for certain periods, more specifically in market booms. Since firms with significantly higher initial returns, in their study, performs the worst, while firms with moderate initial returns outperform in the long run - they suggest that an underpricing is not of a conscious form, as suggested in other studies, such as Shiller (1988).

Chan et al. (2002) study the long-run IPO performance in the Chinese market with 570 observations between 1993 and 1998 grouped into A and B shares. The results are significant underpricing of A-shares with high initial returns, while B shares are less underpriced with a first closing day average return of 11.6%. However, the long-run performance differs significantly where the wealth return (WR), $WR = \frac{1+average\ t\ period\ total\ return\ on\ IPOs}{1+average\ t\ period\ total\ return\ on\ benchmark}$ (1), is 0.98 for A-shares in 3 years and B shares outperform with 1.36 with the same period of 3 years. This result is coherent with other studies, such as Levis (1993), where firms with comparing lower initial returns tend to perform better than firms’ issues with high initial returns.

Industry clustering

Hoffman-Burchardi (2001) discusses the fact that there is an information spillover from the first IPO in an industry. Investors tend to minimize their cost by free-riding on the publicized information and depend on information from earlier IPOs. This phenomenon is related to managers' decision to go public. Firms that go public after there have been other successful IPOs do not have to provide a large risk premium since there is already the information from the past that the investors rely upon (Hoffman-Burchardi, 2001).

2.4. Hypotheses

The main questions, framework and null hypotheses of the thesis are the following:

1. ***Are the industries and types of firms that go public different between hot and cold markets?***

   H_0: Types of industries and firms that go public are not different between hot and cold markets.

2. ***Do IPOs bought during hot markets perform worse than IPOs bought during cold markets when held for three years?***

   H_0: The risk-adjusted returns from IPOs do not differ between hot and cold markets.

When it comes to the first question, Helwege & Liang (2004) have shown from their results that some industries are more likely to go public in hot markets and that there exists significant difference between some industries, as well as firm-characteristics which significantly differ between hot and cold in some areas. The second question is mainly studied in the U.S. market and Ritter (1994) concluded that IPOs from hot market conditions tend to underperform in the long-run, despite an initial underpricing that exists. Hence, we expect that the types of firm and industries are different in hot market conditions in Sweden and that IPOs from hot market conditions underperform in the long-run compared to cold market conditions. Industry clustering and firm-characteristics will give the investor useful information on which types of firms are to expect generate higher risk-adjusted returns if there exist any in the long-run.

3. Method

Section 3 provides the variables that are to be analyzed and the statistics used on the dataset.

a. Methods of Analysis

IPOs will be tracked considering performance, industry distribution, and firm characteristics depending on if the share issuance was conducted during a hot or a cold market. To identify if the market is hot or cold, a quarter (three months) will be considered either hot or cold depending on if the volume of issuance is high or low during a given quarter. A quarter is chosen as a period instead of a month because doing so allows for the periods to have more observations. Swedish IPO issues historically have been infrequent but, has increased in frequency in the last ten years.

To classify if a period (three months) is hot, the threshold is set at the third quartile of quarterly IPO volume across the sample. The reason for setting the threshold at the third quartile is to make sure that the classification of hot is representative of a higher than usual issuance volume. For a period to be considered cold, anything below the median quarterly volume will fit that classification. Cold is set at below the second quartile, i.e. the median, and not the first because all quarterly IPO volume at the first quartile is only one. This would produce a very small group and reduce the reliability of any results.

i. Industry Classification

To ascertain if IPOs are in a specific industry, Standard Industry Classification (SIC) codes are gathered from Capital IQ for each firm. The SIC codes are comprised of four digits with the first digit being the broadest category and the fourth digit the narrowest. Checking the data for the distribution of SIC codes, given the complete four digits, we get a very wide range of industries. To create workable groups, we use two digits of SIC codes, which allow us to identify the major industry group that the firm is in. For example, 2834 is the SIC code for Pharmaceutical preparations, that is production and materials for medicine. When using the first two digits 28, we get that the industry is “Chemicals and allied products” and more firms have the potential to fit the classification. As the firms get classified the dataset ends up showing 38 different SIC codes.

ii. Firm-Specific Information

Firm-specific information is used as control variables in the analysis of differences between IPOs in cold and hot markets and is downloaded from Capital IQ. The variables are from the first trade date and if any other date is used, it will be specified in the description below.

Variables that are used in the study are the following:

Price to book ratio. It indicates how the market is valuing the firms' growth potential. Since the price of the share is what is paid for the firms' equity a higher price to the book value of equity is an indication of investors' valuation of the firms' growth, i.e. it is a forward-looking ratio. Helwege and Liang in 2004 found that hot markets had a higher price to book ratio and suggests that this could be due to growth potential or investor sentiment.

Intangible/Total- assets. Previous researchers found that hot markets tend to have firms with a low amount of tangible assets. Firms with high intangible assets are more complex to value and information on firms with high intangible assets is harder to analyze, (Barth and Kasznik, 1999). Guo and Zhou in 2014 found that firms that possess the capacity to innovate (proxied by intangible assets), as estimated by the intangible ratio, have a positive impact on stock performance.

Market Capitalization. The size of the firm doing the initial public offering will give an indication of how established the firm is on the market. Larger firms are usually older than small firms and thus have more history which increases the information at hand for investors to analyze, (Barth and Kasznik, 1999). It is empirically established that small-capitalization firms have higher stock returns while also having higher volatility (Rompotis, 2019). The market cap is based on the IPO date.

% Net insider trading. When this ratio is positive (negative) it means that insiders (people with access to non-public information) bought (sold) a certain percent of all traded volume for three months. This is indicative of the firms' potential performance in the short run and a significant difference in insider trading between hot and cold markets indicates the firms' expected future performance. Patrik Sentis (2008) in his research found evidence of insiders using non-public information to sell overvalued equity.

The ratio of institutional ownership. This variable is gathered as of one quarter after the IPO, which is after the ownership distribution is presented through the quarterly report. The assumption is that institutional investors are investing from the perspective of an agent which requires a more thorough analysis and that they have a different risk appetite. The difference is confirmed in a study by Deng and Xu in 2011 conducted on Chinese investors. The research found a tendency for institutional investors to increase (reduce) the holdings of shares that perform well (bad), while the opposite is true for retail investors, where they reduce (increase) holdings of shares that perform well (bad). Field and Lowry in 2009 find that IPOs with higher levels of institutional investors perform better than those with lower levels.

% Overallotment. This is an option that underwrites can use to issue more shares a period after the initial public offering. These options are used to adjust the number of shares they issue to the public (Schultz and Zaman, 1993). Underwriters short some IPOs after the IPO, if the issue shows underpricing, the short position is covered using the option. If the issue does not appreciate in pricing after the offering, they cover the short by buying back the shares. We test if the overallotment is different between hot and cold markets as the exercising of the option can indicate positive market conditions. The overallotment is put into relation to its gross proceeds since firms with large market capitalization have a larger nominal value of overallotment.

Venture capital and private equity. These types of investors take an active position in the firm to increase the performance and usually do so in the early stages of the company’s lifecycle. Thus, firms backed by these investors should show a positive relation in performance analysis. This information is derived from the IPO date which gives the value of venture capital and private equity investments in percentage. Fathi & Simonsson (2018) show in their results that private equity backed firms tend to underperform in the long-run, therefore we expect that this variable have an effect on the performance which needs to be controlled for in our tests and regressions.

iii. Performance Measure

Markowitz divides the process of evaluating and choosing a portfolio into two stages where the first stage consists of observing the options and evaluating them based upon previous experiences. In the second stage, the investor builds its own opinion and selects one portfolio. As Markowitz suggests, his theory is primarily concerned with the second stage. The Markowitz portfolio theory is normative and gives an understanding of how investors should behave. The main corpus of the theory suggests that investors diversify their portfolio and choose the portfolio with the least volatility. The investors optimize returns to risk, which is the volatility of the stock price on the market. Thus, the optimal portfolio would be that which had the highest returns to variance and every stock would be analyzed in relationship to every other stock the investor held. Markowitz describes this phenomenon using a relationship between expected value and variance of a combination of stocks. The investor chooses the highest attainable combination of expected return and variance. (Markowitz, 1952).

In our thesis, we put the return of the IPOs to its risk, by calculating the Sharpe ratio. The Sharpe ratio gives a suggestion on the stock's level of attractiveness for investors, considering that the IPOs have different volatility and is in different size and shape, such as industry. To be able to compare the different stocks, the Sharpe ratio takes the volatility into account and the returns we are using to determine if a stock has high abnormal returns are put to its risk.

Since it does not make sense to compare returns without also looking at the risk taken, we use risk-adjusted returns to describe an IPOs' long-run performance. To risk-adjust the returns we use the Sharpe ratio.

When analyzing performance, three years of data will be dropped from the dataset. This is because the analysis uses a performance period of three years. Previous researchers have used either three or five years as "long-run". The problem of using five years as "long-run" on the Swedish market is that the sample size would be reduced by 231 IPOs which is 62% of the entire sample.

Sharpe ratio is the difference between the three-year return of the observed IPO and the risk-free rate divided by the standard deviation of the IPO on the market. The risk-free rate used is the three-year bond rate.

$$Sharpe\ ratio = \frac{r_i - r_f}{\sigma_i} \tag{2}$$

What the Sharpe ratio does, is that it takes into consideration the volatility of the share on the market. This allows for the performance measurement to be more in line with reality as investors optimize returns to risk as put forward by Markowitz.

Potential problems with using the Sharpe ratio could be that a share has an exceptionally low standard deviation and low returns. This would cause the Sharpe ratio to become larger and hence give an impression of having good returns. Hence, we need to be careful as not to necessarily equate the Sharpe ratio with returns, but stock returns to its standard deviation.

b. Data Collection

Since financial data can be clustered in return characteristics due to stretches of bull runs and bear markets, we collected data as far back as possible which gave us data as far back as 1992 to even out market bubbles and crashes. Bull markets are stock markets where stocks have a long period of price appreciation whereas bear markets have long periods of price declines.

Data was collected from the Capital IQ database (S&P Global Market Intelligence). The number of observations initially was 431 firms, however, due to a lack of information going forward from the IPO date, the dataset was reduced to 398 firms. From the omitted observations some of them had publicized an IPO but withdrew the offering prematurely. In the dataset, there were some observations that Capital IQ could not upload which were manually documented from nyemissioner.se and company IPO prospectus.

As this study aims to put returns to risk, standard deviations are calculated for the period between the first trade date and the first year, second year, and third year.

Historical Swedish government bond yields were collected from riksbank.se. Since there are no bonds with a maturity of three years to fit the three-year holding period of the IPO, we used five-year bonds and seven-year bonds and deduced a three-year bond yield. To arrive at the three-year bond rate, the yield for holding a bond for two more years was calculated by taking the difference between the seven- and the five-year bond. This difference was then removed from the five-year bond rate to arrive at the three-year bond rate.

$$r_{f,3years} = r_{f,5years} - (r_{f,7years} - r_{f,5years}) \quad (3)$$

This bond rate is used in the calculation of Sharpe ratios.

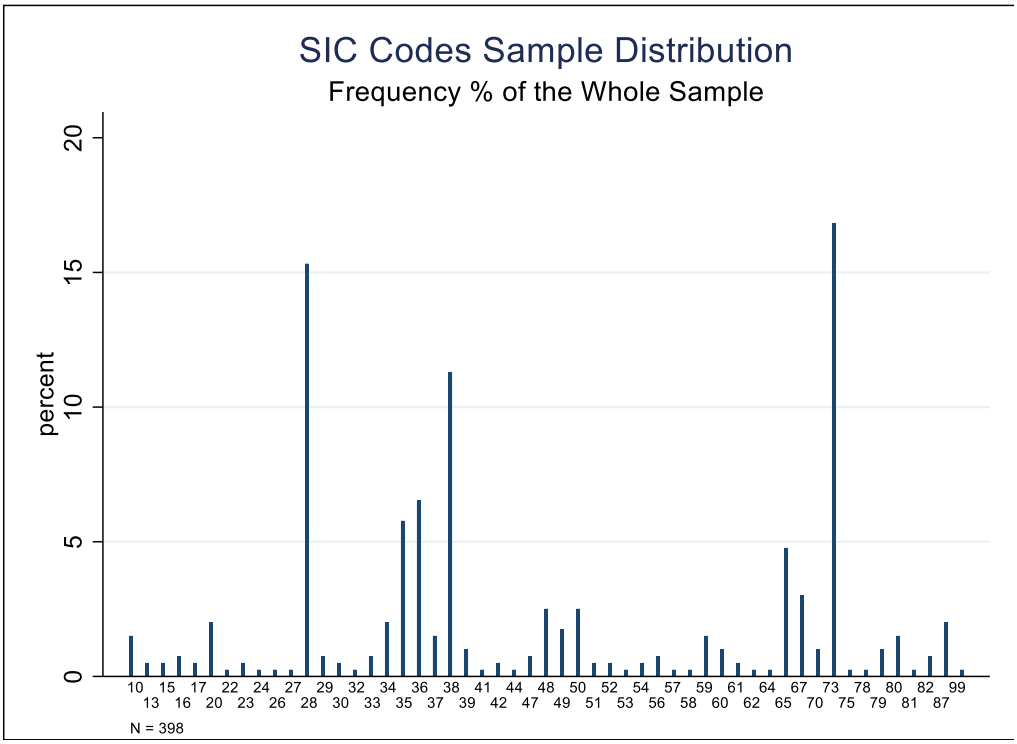

Figure 1. The graph shows the distribution of the SIC codes as a percentage of the total sample of 398 observations. For definitions of the SIC codes, see appendix. The distribution of the SIC codes will be analyzed to determine if there are industry clusters in different market conditions. This will be done through a chi-square test.

Table 1. Summary statistics of the 7 firm characteristics that will be used in the statistical analysis.

Summary Table for Firm Characteristics

Variables	Mean	Standard deviation	Median	Min	Max
Price to book	57.42	656.68	4.5	-307.74	11146.6
Intangible to total assets	.19	.256	.048	0	.97
Market Cap (in million)	2524	14311.8	280	.003	252331
% Insider trading	.0071	.19	0	-.67	3.64
% Institutional holder	.14	.19	.07	0	.87
Allotment	.036	.096	0	0	1.4
VC/PE	.045	.108	0	0	.63
N	398				

Table 1 gives the summary statistics for firm characteristics. We can see that price to book and market cap have very large means and standard deviations compared to the medians, indicating the presence of large outliers. These will have to be cleaned for. Looking at% insider trading the maximum value is 3.64 which means that 364% of all traded shares on the stock market are due to insider trading. This makes no sense since the maximum number of shares you can trade is 100%. Any observation that is above 1 will, therefore, be removed.

Table 2. Summary statistics of the performance measures that will be used in the statistical analysis.

Summary Table for Performance Variables

Variables	Mean	Standard deviation	Median	Min	Max
1 Year Raw Returns	5.488	39.216	0.011	-1.000	599.000
2 Year Raw Returns	4.670	30.594	-0.052	-1.000	359.000
3 Rear Raw Returns	2.868	20.502	-0.200	-1.000	317.182
1 Year Standard Deviations	0.183	0.221	0.124	0.041	2.379
2 Year Standard Deviations	0.196	0.171	0.150	0.043	1.695
3 Year Standard Deviations	0.185	0.131	0.146	0.039	1.385
Sharpe ratios	14.53	106.865	-1.299	-21.473	1592.405
N	283				

Table 2 is a summary of the descriptive statistics relating to the measurement of performance. Observations between 2020 and 2017 are dropped to make the three-year analysis doable, leaving us with 283 observations. As can be seen from Table 2, some outliers make the mean and standard deviation become very large. Specifically, this can be seen for the raw returns and Sharpe ratios. These will need to be cleaned before doing statistical analysis.

c. Statistical Analysis

i. Chi-square

A chi-square test will be conducted to test whether there is a significant difference in industry distribution during hot and cold markets. This statistical method tests if the probability of distribution is coincidental. The test will result in a chi-square value which will have a probability assigned to it. The null hypothesis that the industry distribution does not differ in the hot and cold market will be rejected if the probability of the chi-square value is less than 5%. However, this test

does not give any information on the probabilities of an IPO to be issued in a hot or cold market. For this part of the analysis, a logit estimation will be conducted.

ii. Logistic Regression

A logistic estimation is used when the data is binary, as in our case with either hot or cold market. As opposed to a regular regression, a logit estimation does not output the effect of the independent variable on the dependent variable. Comparatively, the logistic estimation outputs a probability of an independent variable to be assigned a specific characteristic. This method will output the odds ratios of the industries to be more likely to have clustered in either hot or cold markets, from which the probabilities can be interpreted. Odds ratios that are greater than one will indicate that those industries are more clustered in hot (cold) markets. The odds ratio is calculated by taking the probability of success (hot) and dividing it by the probability of failure (cold).

$$odds(hot) = odds\ ratio = \frac{p}{1-p} \tag{4}$$

We will be presenting the data with only the odds ratios and to calculate the probabilities from the ratios following formula is to be used.

$$p = \frac{odds\ ratio}{1 + odds\ ratio} \tag{5}$$

iii. Quarterly Cluster Analysis

To test if hot and cold markets exhibit differences in quarterly clustering, each quarter is given a cluster value. The cluster value is calculated by taking the weight of a SIC within the quarter and dividing it by that SICs weight for the entire sample. For example, an IPO has a SIC code of 81 and is 20% of the total SIC codes during that quarter. SIC code 81 in turn is 5% of the entire sample. The firms' industry cluster value is $\frac{0.2}{0.05} = 4$ in that given quarter. These values are then averaged for the entire quarter. If an industry has a large cluster value relative to the other industries present during that quarter, the large cluster value will heavily influence the average for that quarter.

iv. Firm Characteristics in Hot and Cold Markets

The statistics on firm characteristics is done through a regression using two dummy variables as independent variables. One for hot markets and one for cold markets where a firm characteristic is the dependent variables. When both the dummies are 0, a neutral market is present.

$$\begin{aligned} Firm-specfic\ variable_i = {} & \beta_0 \\ & + \beta_1 Market\ condition_{Hot\ quarter} \\ & + \beta_2 Market\ condition_{Cold\ quarter} + \varepsilon \end{aligned} \tag{6}$$

v. Hot and Cold IPO Return Performance Over Three Years

To test if performance differs Sharpe ratio will be used. This allows for the returns to be compared to risk.

$$\begin{aligned} Sharperatio = {} & \beta_0 + \beta_1 Market\ condition_{Hot\ quarter} \\ & + \beta_2 Market\ condition_{Cold\ quarter} + \varepsilon \end{aligned} \tag{7}$$

This test will allow us to test if there are any differences between shares bought during hot and cold markets and neutral markets. By doing a regression with independent dummy variables we test the groups against each other. This test will check if the groups differ in averages and variance when it comes to the performance measure Sharpe ratio.

The performance will be regressed upon firm characteristics and temperature to test if any of them have a significant impact on stock return performance. Neutral quarters will hence be the benchmark group.

$$\begin{aligned} Sharperatio = {} & \beta_0 + \beta_1 Temp_{q_{hot}} + \beta_2 Temp_{q_{cold}} + \beta_3 Overallotment + \beta_4 VC \\ & + \beta_5 Institutional + \beta_6 MarketCap + \beta_7 Intangibles + \beta_8 PB \\ & + \beta_9 Insider + \varepsilon \end{aligned} \tag{8}$$

4. Empirical Results

a. Industry Analysis

To begin the analysis of hot and cold IPO markets we analyze differences between said markets as relating to differences in types of industries going public. We test the null hypothesis that hot and cold markets do not differ in the distribution of industries. Theories such as information spillover and market timing, predict that hot markets have larger clusters of industries as an IPO within a specific industry trigger other firms within the same industry to go public.

The distribution of the 12 most common SIC codes is presented below in figure 3. See appendix for SIC code definitions.

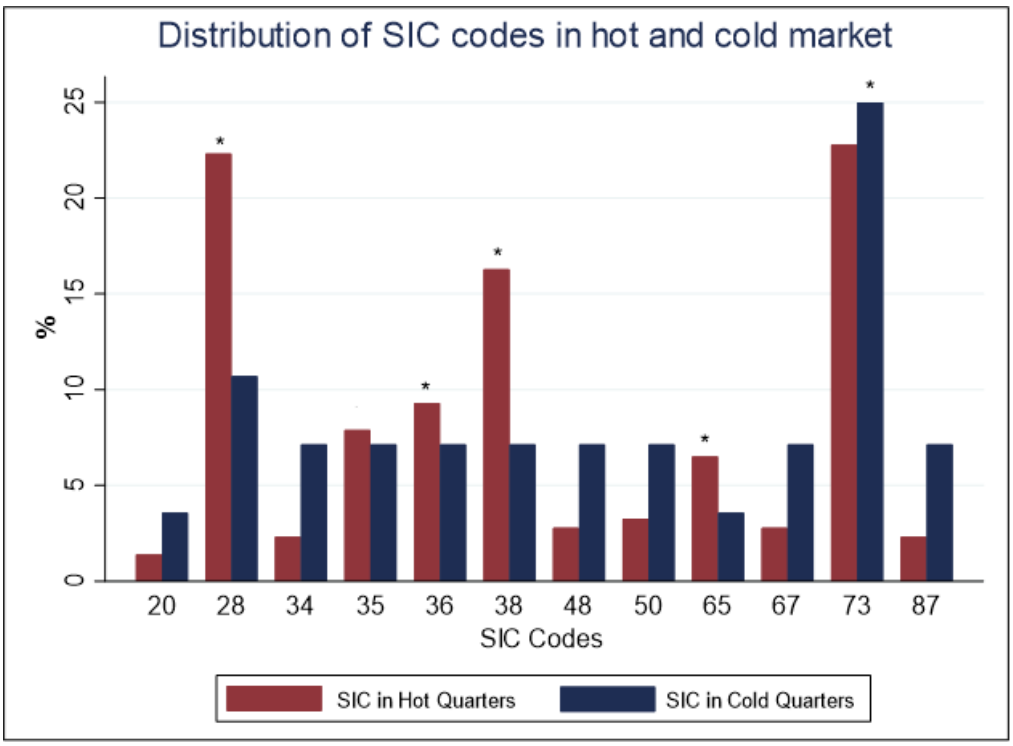

*Figure 2. This bar graph depicts the percentage distribution in hot and cold markets for the top 12 industries. Four of the SIC codes, i.e. industries, have a higher probability of being in a neutral market and one in a hot market at a significance level of minimum 5%, marked with * (see the logistic regression). The industries shown in the box graph represents 75.7% of the data set.*

The 12 most frequent from a total of 38 industries represent 75.7% of all IPO observations. Checking for even more industry concentration we find that 5 industries make up 59.8% of all industries. Figure 2 shows that there are some unique characteristics for the market. In comparison with studies conducted on the U.S. market (Helwege & Liang, 2004), they also found that a few sets of industries go public. For example, 73 and 28 are most common in both hot and cold markets. 73 represents Business services while 28 represents Chemicals and allied products. Helwege and Liang (2004) showed that U.S. markets had a high percentage from SIC 73 and 35, Business services, and Computer hardware. Hence, there seems to be a tendency for nations' stock markets to become somewhat specialized and reflective of the overall industry composition of the nation. However, comparing only two nations in this respect is not nearly enough and would need further research.

Chi-square Test on Cluster Distribution

We perform a chi-square test to test if there is any significant frequency distribution difference between the market conditions. The result is that we do not reject the null hypothesis that there is a difference in frequency distributions. This is an indication that the industries are distributed similarly. To test what industry that is most probable to be going public in a hot market, we perform a logistic regression where each SIC code is a dummy.

Logistics Regression

Table 3. The table describes the odds ratios and their significance level along with the p values. The dependent variable which is market condition is

one for a hot market or zero for the cold and neutral market condition. The SIC codes represent the top 12 industries of the data set and all the significant odds ratios are greater than one, meaning that they are

concentrated in hot markets. The odds ratio is to be interpreted as a greater cluster in hot markets if the ratio is greater than one.

Binary Logistic Regression on Hot Market with Industries as Independent Variables

SIC20	SIC28	SIC34	SIC35	SIC36	SIC38	SIC48	SIC50	SIC65	SIC67	SIC73	SIC87
0.600	1.773*	1.667	1.091	1.364	1.500	1	1.500	1.375	0.714	1.481	1
(0.484)	(0.032)	(0.484)	(0.835)	(0.435)	(0.183)	(1.000)	(0.530)	(0.493)	(0.566)	(0.115)	(1.000)
N	398										

Odds ratio; p-values in parentheses
+ p < 0.1, * p < 0.05, ** p < 0.01

Table 3 gives the results from the logistic regression, showing the odds of an industry being in a hot market rather than cold or neutral. An odds ratio greater than one is a positive relationship and implies a greater concentration in hot markets for the respective industry. The only industry that has a significant statistical probability of being in a hot market is SIC 28 chemicals and allied products.

Table 4 presents the odds of an industry to be in a cold market rather than hot or neutral. All the significant SIC codes are below 1. This means that the industries are more probable to be in either neutral or hot markets. SIC 36, 38, 65, and 73 are likely to be in a hot or neutral market. However, as the logistics regression for hot markets only found a significant probability for SIC 28 the other SIC codes are probable to be in a neutral market rather than hot.

There appears to be no preference for market conditions for the industries that show no significant odds ratio. However, the test does not account for how the industries are clustered by quarter. This is tested through a cluster analysis where each quarter is given a cluster value.

Table 4. This is the second regression with cold markets as an independent variable meaning that zero is for hot and neutral. The first row describes the odds ratios and their significance level along with the p values. The SIC codes represent the top 12 industries of the data set and all the significant odds ratios are less than one, meaning that they are more clustered in hot or neutral market conditions.

Binary Logistic Regression on Cold Market with Industries as Independent Variables

SIC20	SIC28	SIC34	SIC35	SIC36	SIC38	SIC48	SIC50	SIC65	SIC67	SIC73	SIC87
0.333	0.298**	0.600	0.643	0.368*	0.364**	0.429	0.667	0.357*	0.714	0.396**	0.600
(0.178)	(0.000)	(0.484)	(0.301)	(0.024)	(0.003)	(0.220)	(0.530)	(0.048)	(0.566)	(0.001)	(0.484)
N	398										

Odds ratio; p-values in parentheses
+ p < 0.1, * p < 0.05, ** p < 0.01

Quarterly Cluster Analysis

The mean cluster value for hot markets is 5.03 while cold markets are 11.35.

Testing the amount of clustering per quarter for hot versus cold and neutral we find that hot markets differ at a 10% significance level. The clustering value is lower for hot markets which is indicative of hot markets having a wider range of industries going public.

The test on clustering values for cold versus neutral and hot markets shows a difference at a 1% significance level. Cold markets are more clustered in the industries going public which means that some firms in specific industries do not pay attention to quarterly market conditions.

b. Firm Characteristics

Table 5. The table gives the averages of different firm characteristics and if they differ between the different market conditions, (hot, cold, and neutral). Two of the variables are significantly different in hot market conditions from cold and neutral. Those are the percentage of institutional holdings and percentage overallotment. The market capitalization is in millions. Market capitalization is in nominal values whereas intangible assets to assets, institutional holders, and overallotment are in percentage. The overallotment is a percentage of total proceeds from the IPO.

Firm Characteristics of Swedish IPOs 1992-2020

	Market condition		
	Hot	**Cold**	**Neutral**
Price to book	0.307	0.999	0.302
Intangible assets to assets	0.037	-0.053	0.184
Market capitalization	235.12	18.89	1027.33
% Insider trading	0.01	0.012	-0.012
% Institutional holder	0.059*	-0.012	0.109
% Overallotment	0.022**	0.006	0.018
% Venture capital and private equity	0.016	0.006	0.033

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Overallotment has a statistically significant higher percentage, 2.2%, than neutral markets. As cold markets are not significantly different we conclude that overallotment is greater in hot markets than in cold markets. Since hot markets tend to have more overallotment, an underpricing is present. As the underwriters use the overallotment to cover the short positions on the IPO, the variable indicates that hot markets tend to have better price momentum. Institutional investors increase their holdings of IPOs in hot markets by 5.9%. Putting that into relation with better price momentum through overallotment and that institutional owners tend to buy when prices go up one might confirm the theories put forward by Deng and Xu in 2011. However, we test for the correlation between the two variables and find no significant one.

c. Long-run Performance

After tabulating the data concerning the Sharpe ratio we observe that there exist very high and very low ratios that need to be cleaned to make the distribution more in line with a normal one. The observations become infrequent as we go above 9 and below -10 which we remove from the dataset. Furthermore, 22 observations have missing values after a period, which are due to buyouts, mergers, or defaults, and those are removed from the data set as well. This leaves us with a total of 205 observations.

Even though the observations are normally distributed after cleaning the data set, the spread in the observations of the Sharpe ratio is relatively wide-ranging from -10 to 9. In the dataset, there existed 56 observations that were considered extreme points, i.e. above and below the final range. These were necessary to remove to be able to run the statistical analysis. The main reason why investors buy these initial public offerings is due to the chance of big returns. In effect, it is these outliers that were removed that are interesting for investors and our thesis fails to provide information in regards to the outliers.

For a quarter to be classified as a hot market the threshold is set at 5 which is the third to fourth quartile of the IPO volume after cleaning for extreme values. Quarters below 3 are classified as cold.

When tabulating the three-year return, we find that around 65.85% of all IPOs have negative returns after three years. This is consistent throughout our dataset and like other studies, as most of the observations have a negative return as well as negative Sharpe ratio. IPOs as a group produce no returns to investors on average.

As the dataset is grouped in hot, cold, and neutral markets there are more observations in the hot category. This is not surprising as the nature of how the group was defined, which is periods of a high volume of IPOs, makes hot markets have more observations.

Hot market IPOs have lower standard deviations than cold markets. To observe this phenomenon figure 2 shows a boxplot with the distribution of standard deviations. The size of the boxes is larger for cold markets and the spread of the observations within the 25^{th} and 75^{th} percentile is wider.

Compare this with the hot market where the spread is tighter but with more outliers at least for the first year.

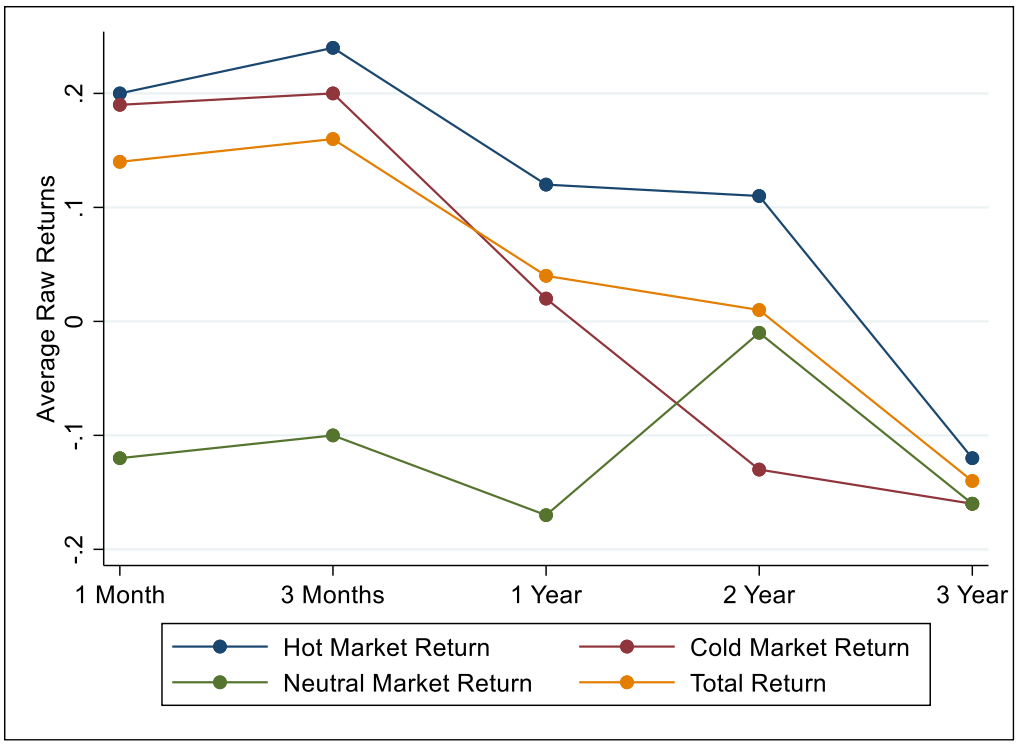

Figure 3. A graph depicting the average raw returns of IPOs from the first trade date until the third year. Returns independent of classifications is shown by the orange line. The green line represents the returns from stocks that went public in neutral markets. The red line represents the returns from stocks that went public in cold markets and blue for hot markets.

Even though there are differences in raw returns we can by just looking at the graph in figure 3 see that there is a negative trend in IPO returns in the long-run.

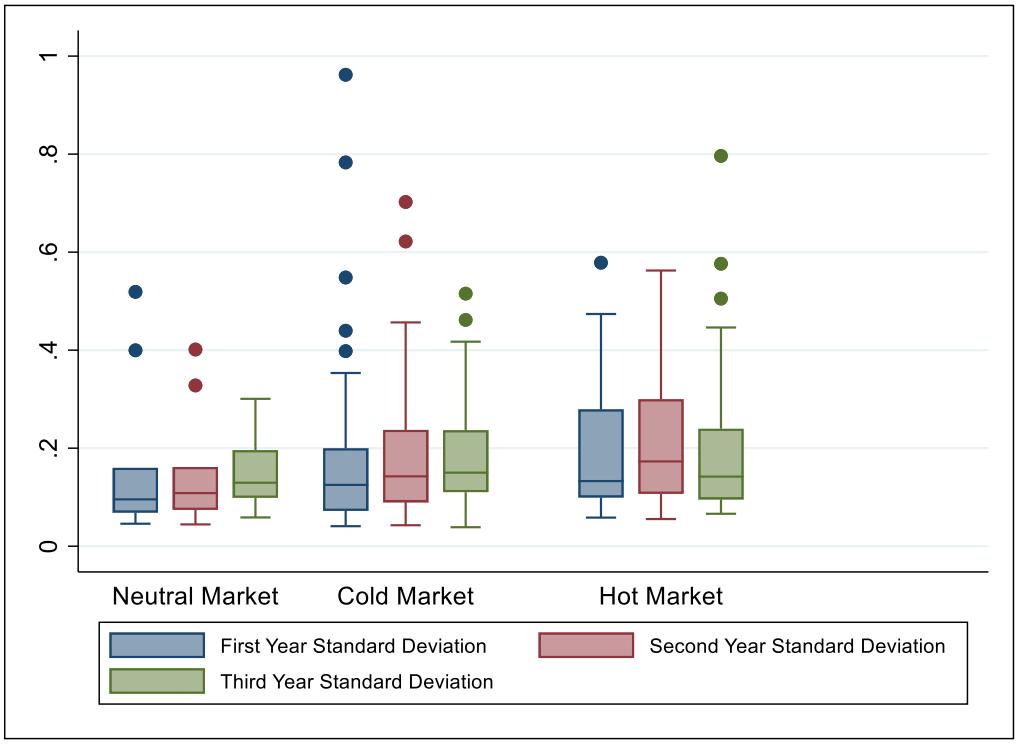

Figure 4. This figure is a box plot of the standard deviation for three periods of a timeline and it depicts the location of the median, the spread, and outliers. The difference between hot, neutral, and cold in standard deviations is significant at a 5% level in the third year.

From figure 4 we can see the distribution of the standard deviation on Sharpe ratio depending on whether the IPO was issued in a hot, cold, or neutral market. In hot markets there are more outliers, however, the spread is not as large as in cold markets which could imply that it is generally riskier to hold IPOs issued in cold markets.

Table 6. This table shows the means of the standard deviation in the different market temperatures over three years. The test is conducted through regression with the standard deviation as the dependent variable and the market conditions as independent variables.

Three-Year Standard Deviation

Hot Market	Cold Market	Neutral Market
0.0333*	0.0430*	0.145**
(0.016)	(0.024)	(0.000)
N	205	

p-values in parentheses
+ p<0.1, * p<0.05, ** p<0.01

Table 7. This regression shows if there is any significant difference in the mean values of Sharpe ratios depending on whether the IPOs have been issued in a hot, cold, or neutral market. The dependent variable is the Sharpe ratio and the market conditions are the independent variables.

Regression on Three-year Sharpe Ratio Controlling for Market conditions

Hot Market	Cold Market	Neutral Market
0.661	0.236	-1.640*
(0.457)	(0.806)	(0.039
N	205	

p-values in parentheses
+ p<0.1, * p<0.05, ** p<0.01

We run a regression on the Sharpe ratio controlling for the market condition. The regression provides no evidence for any significant difference or relationship between hot and cold markets, considering the small t-statistics. We find that the R-squared is very low, which is at 0.04%. This means that the temperature of the market explains practically no variations in the data of the dependent variable, Sharpe ratio. Checking for violations of OLS assumptions we find the result to be robust.

Analyzing the long-run performance, we control for the firm characteristics and market temperature for the IPO in table 4. None of the variables show any significant effect on the Sharpe ratio.

Long-run performance Depending on Industries

Table 8. In the table below we show a regression model with the three-year Sharpe ratio as the dependent variable and industry dummies as independent variables. The regression shows a negative mean of Sharpe ratio from IPOs that is in SIC 67, which is: Holding and other investment offices, at a significance level of 5%. See appendix for the rest of the SIC codes.

Regression on Three-year Sharpe Ratio Controlling for Industries

SIC20	SIC28	SIC34	SIC35	SIC36	SIC38	SIC48	SIC50	SIC65	SIC67	SIC73	SIC87	Constant (others)
-2.920	0.986	1.711	2.408	-0.819	1.254	2.826	4.971	-0.898	-2.307*	0.0373	0.379	-1.644**
(0.259)	(0.276)	(0.232)	(0.189)	(0.468)	(0.243)	(0.295)	(0.106)	(0.540)	(0.019)	(0.966)	(0.793)	(0.004)

p-values in parentheses
+ p<0.1, * p<0.05, ** p<0.01

From the regression above we can see that 11 from the 12 most common industries have no significantly different coefficient of long-run performance (Sharpe ratio). SIC 67 (Holding and other investment offices) has a significant negative mean of Sharpe ratio, at a 5% level. However, we cannot derive if that is specifically for cold or hot markets since the logistic regression does not show any significant probability that SIC 67 is more clustered in either hot or cold markets, see table 4. Furthermore, the general difference in the Sharpe ratio from the 41 other industries is negative, see the constant in the regression model. On the other hand, those constitute the lower quartile of the total sample set and cannot be representative of the general market.

Long-run performance Depending on Firm Characteristics

Table 9. Regression output for control variable coefficients on the Sharpe ratio. VC/PE stands for "venture capital" and "private equity" and is the percentage ownership by venture capitalists and private equity. The firm-specific variables are not explanatory of the Sharpe ratio, meaning it does not affect the long-run performance. Meanwhile, firms that go public in neutral market conditions do perform poorly since it has a negative mean value of a three-year Sharpe ratio at a 10% significance level.

Regression on Three-year Sharpe Ratio Controlling for Firm Characteristics

Price to Book Ratio	Intagibles to Total Assets	Market Capitalization	% Insider Trading	% Insitutional Holdings	% Overallotment	Venture Capital and Private Equity	Hot Market Condition	Cold Market Condition	Neutral Market Condition
0.00000234	0.00175	3.294	3.565	-5.754	1.299	0.428	0.456	0.165	-1.670+
(0.983)	(0.868)	(0.760)	(0.498)	(0.197)	(0.515)	(0.716)	(0.620)	(0.864)	(0.056)

p-values in parentheses
+ p<0.1, * p<0.05, ** p<0.01

From table 8 we can confirm our null hypothesis that firm-specific variables do not affect the risk-adjusted long-run performance between hot and cold since none of the variables has any significant distribution of the three-year Sharpe ratio.

5. Discussion

As we saw in our industry analysis, there are relatively few sets of industries that go public on the Swedish stock market. Chemicals and allied products firms were found to be more probable to have their IPO in a hot market. As many of these firms are research and patent reliant, meaning that they have more intangible assets, they are harder to value from the perspective of the investor. As theory would suggest there could be a spillover effect, where one of these firms goes public and get favorable valuations; leading others to do the same. Another interpretation would be that there is a surge in innovation that leads to many of these firms to go public to fund their projects and/or the existence of cheap capital. Future researchers could control for effects of cost of equity or do a test on these kinds of firms separately from the overall market.

When we test for quarterly clustering, we found that cold markets are much more clustered than hot markets. We question the viability of the results. Quarters with only one IPO gives a relatively high cluster value even though no obvious cluster is present, i.e. one observation cannot be considered a cluster. To solve the problem of having only one IPO for a quarter, which inflates the cluster values, we recommend future researchers to use longer hot and cold periods on the Swedish market so that the group sizes become larger and hence reduced inflated clustering values.

The fact that percent of institutional owners are higher in hot markets combined with a higher percentage of overallotment is indicative of favorable market conditions when it comes to stock prices. As Deng and Xu (2011) found on the Chinese market institutional holders tend to buy shares of firms that have good price-performance. The overallotment option which is used to cover shorts or resell on the market means that using that option is only profitable in favorable pricing conditions. This gives some indication as to why firms chose to go public during hot markets. However, when we look at the average raw first month returns, there is no difference between hot and cold making it hard to arrive at a conclusion relating to there in fact being favorable pricing in hot markets.

Because of the tendency for IPOs to not perform well in the long run and all the positive returns to mainly be in the short term, we see that IPOs are driven by investor sentiment rather than driven by economics. That means that the investing community's sentiment is the bulk of the valuation given to the firm, i.e. it is heavily forward-looking. The lack of information inherent in IPO

valuations means that human states of mind influence the performance of the shares on the stock market.

A large part of the sample has a negative performance in the long run and suppose an investor does not care about volatility, an investment in IPOs does not produce positive returns on average. Another way to look at it is that investors buy the IPOs because they promise higher than usual returns but are quick to sell when real prospects become apparent.

Our results show that IPOs might not function under the efficient market hypothesis in the short run. Gradually as new information comes along, the market adjusts expectations to be more coherent with reality and thus acts more in line with the efficient market hypothesis. This can be because of a lack of pre-IPO information regarding the firm and investors are not able to properly value the business. However, we found no significant relationship between performance and market capitalization which we postulated would give more information to evaluate.

In our dataset, we had outliers with Sharpe ratios higher than 100 and up to 998, which means that the outliers either have very large returns or very low volatility. In either case, both of the factors weigh evenly much for investors from the lense of Modern Portfolio Theory by Markowitz (1952). Furthermore, investors might flock to those IPOs and increase the sentiment, however, that is not included in our thesis.

We find no significant difference in performance between hot and cold markets. This is also the case when controlling for firm characteristics.

A problem we found was, that what defines a hot and cold market could be changing over time. IPO volume is highly correlated with time and the growth of the overall stock market. Defining hot and cold in this way means that we tested our hypotheses to time. Why is that so? It is due to the IPO market being relatively small the first 10 years and then growing which produces higher IPO volume and thus get defined as hot. We recommend future researchers to use a definition of hot and cold that changes through time and not a static one.

6. Conclusions

In conclusion, we find that hot and cold markets do differ in one industry going public and that there exist some differences in firm characteristics. SIC 28 is more probable to be clustered in hot market conditions. When we look at the likelihood that industries are clustered in cold market conditions, we find that it is more probable to not be the case for SIC 36, 37, 38, 65, and 73 industries (see appendix for SIC definitions). This means that those industries have a greater cluster in neutral market conditions. Furthermore, since there is no difference in the three-year return performance between market conditions, the analysis provides no relevant metrics to strengthen portfolio performances.

As the purpose of the thesis was to contribute with knowledge regarding long-run performance of IPOs in different market conditions as well as providing investors with decision support when it comes to portfolio optimization, we can conclude that long-run performance does not depend on the market conditions since we cannot see any significant difference between hot and cold markets. Furthermore, our results show that one industry is more likely to go public in hot markets, however, this does not contribute to portfolio optimization since we cannot see any performance difference in the long-run, as mentioned. The characteristics of the firms were also of interest but despite showing some differences between hot and cold markets, we cannot derive that those variables have any effect on the performance when conducting the long-run analysis.

To conclude, this thesis has shown that differences in long-run performance in the Swedish market are not of any significance, in contrast to other markets such as the U.S., as previous studies have shown. However, the analysis of industry clustering shows that hot markets are less clustered in terms of industries going public and indicate that it has a wider range of firm-types. However, despite that cold markets are more clustered, the divergence in clustering between hot and cold is large which could indicate that most of the IPOs go public in neutral market conditions in the Swedish market. Finally, firm characteristics do not differ in terms of long-run performance, and there are some differences in firm characteristics between hot and cold market, however, it does not affect the long-run performance.

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Appendix

Major SIC code	Major industry group
10	Metal mining
15	Building construction
16	Heavy construction other than buildiung construction contractors
20	Food and kindred products
22	Textile mill products
24	Lumber and wood products, except furniture
28	Chemicals and allied products
29	Petroleum refining and related industries
32	Stone, clay glass and concrete products
33	Primary metal industries
34	Fabricated metal products, except machinery and transportation equipment
35	Industrial and commercial machinery and computer equipment
36	Electronic and other electrical equipment and components, except computer equipment
37	Transportation equipment
38	Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks
39	Miscellaneous manufacturing industries
41	Local and suburban transit and interurban highway passenger transportation
42	Motor freight transportation and warehousing
44	Water transportation
47	Transportation services
48	Communications
49	Electric, gas, and sanitary services
50	Wholesale trade-durable goods
51	Wholesale trade-non-durable goods
52	Building materials, hardware, garden supply, and mobile home dealers
53	General merchandise stores
54	Food stores
56	Apparel and accessory stores
59	Miscellaneous retail
60	Depository institutions
61	Non-depository credit institutions
65	Real estate
67	Holding and other investment offices
70	Hotels, rooming houses, camps and other lodging places
73	Business services
75	Automotive repair, services, and parking
78	Motion pictures
79	Amusement and recreation services
80	Health services
82	Educational services
87	Engineering, accounting, research, management and related services
99	Nonclassifiable establishments