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**HOW VOLATILITY LEVELS AND CHANGES AFFECT THE
UNDERPRICING AND AFTERMARKET PERFORMANCE OF INITIAL
PUBLIC OFFERINGS**

Master's Thesis in
Accounting and Finance

Finance

VAASA 2010

TABLE OF CONTENTS	page
ABSTRACT	5
1. INTRODUCTION	7
1.1 Purpose of the study	9
1.2 Structure of the study	10
2. INITIAL PUBLIC OFFERINGS	11
2.1 The purpose of going public	11
2.1.1 Benefits of going public	12
2.1.2 Disadvantages of going public	15
2.2 Listing process	16
3. PREVIOUS LITERATURE	21
3.1 Underpricing of IPOs	21
3.2 Reasons for underpricing	24
3.2.1 Asymmetric information models	26
3.2.2 Institutional explanations	28
3.2.3 Control theories	31
3.2.4 Behavioral explanations	32
3.3 Long-run performance of IPOs	34
3.4 Explanations for the poor long-run performance	38
3.5 The role of firm-specific risk	39
4. DATA AND METHODOLOGY	42
4.1 Data	42
4.2 Methodology	43
5. EMPIRICAL RESULTS	46
5.1 Descriptive statistics of the sample	46
5.2 Post-IPO volatility movement	48
5.3 Increasing versus decreasing volatility firms	50
5.4 Implications of the initial volatility level	53
5.5 Implications of both initial volatility level and change	56

6. SUMMARY AND CONCLUSIONS	61
REFERENCES	63
APPENDIX	72

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Pages: 73**ABSTRACT**

Going public is an important decision in the life of a company. Most companies that decide to go public do so via an initial public offering (IPO). Earlier studies have revealed that IPOs are prone to be underpriced, in that the share prices experience a substantial jump in the first trading day. Another established anomaly concerning initial public offerings is their long-run poor performance. In addition to IPO related literature, the role of a firm-specific risk is very important regarding this study. Previous studies document a significant increase in firm-specific volatility of stock returns over the past two decades. This increase has been documented to be even more dramatic for newly listed firms.

The purpose of this paper is to investigate the effects of post-IPO firm-specific volatility level and volatility change on IPO-underpricing and post-IPO performance, cross-sectionally for new public companies in Finland. Three research questions are raised to address the focus of the study. First, what is the trend of post-IPO firm-specific volatility behavior? Second, how are the post-IPO return volatility levels and changes in return volatility related to the IPO underpricing? Third, how is the long-run post-IPO performance related to return volatility level and change?

A negative association was found between the initial firm-specific volatility level and the post-IPO volatility change. The empirical evidence in this study indicates a strong association between high initial firm specific volatility and underpricing. The long-run performance evaluation reveals that the initial low volatility firms seem to outperform the high volatility firms in the first 240 trading days. Furthermore, low and increasing volatility firms are far better performers than the low and decreasing volatility firms.

KEYWORDS: IPO, firm-specific risk, underpricing, long-run performance

1. INTRODUCTION

Going public is an important decision in the life of a company. It gives access to public equity capital and so may reduce the cost of funding the operations and investments of the company. It also provides a market place for the existing shareholders to diversify their investments, which is an important attribute for venture capitalists. In addition to the direct benefits, the act of going public itself may bring numerous indirect benefits, for example attracting different caliber managers and getting positive advertisement for the company. Regardless the great potential of getting listed, it also has numerous direct and indirect disadvantages, such as administrative expenses and the loss of privacy, which may be crucial to their competitive advantage. (Ljungqvist 2007)

Most companies that decide to go public do so via an initial public offering (IPO). IPOs have been a widely researched topic over many decades. Early studies of Logue (1973) and Ibbotson (1975), reported that IPOs are prone to be underpriced, in that the share prices experience a substantial jump in the first trading day. Since the 1960's, when the IPO research began, this underpricing anomaly phenomenon has averaged around 19 % in the United States, indicating that the issuing companies are leaving a significant amount of money on the table. Bonds, for instance, are hardly ever mispriced more than a few basis points, whereas the price jump from the offer price of an IPO to its first day closing price can be over hundred percent. Thus, a considerable amount of money is at risk, when companies go public. This considerable empirical regularity of underpricing has motivated an extensive theoretical literature and further has inspired to rationalize why IPOs are underpriced. (Ritter & Welch: 2002)

Another established anomaly concerning initial public offerings is their long-run poor performance. Ritter (1991) found that excess returns of IPOs do not cumulate after the first day of trading. He demonstrates that IPOs underperform significantly compared to a matching firm portfolio. International evidence also confirms the existence of long-run underperformance. However, efficient market proponents, especially Fama, argue that the anomaly does not exist. Fama (1998) claims that abnormal returns often disappear with some rea-

sonable changes in the methodology, therefore it can hardly be called an anomaly.

In addition to IPO related literature, the role of a firm-specific risk is very important regarding this study. Previous studies document a significant increase in firm-specific volatility of stock returns over the past two decades. This increase has been documented to be even more dramatic for newly listed firms. Although the presence of the firm-specific risk had been noticed and that it accounts for the major part of the total risk, its relation to IPO anomalies remained unexplored. It was not until 2009, when Beneda and Zhang did a novel study, in which they investigated how different initial firm specific volatility levels and the subsequent aftermarket firm-specific volatility changes affect on the previously mentioned two IPO anomalies.

Although, as already stated, the underpricing and the long-run underperformance have been well-explored, yet the Finnish evidence is somewhat limited to Keloharju's (1993) study. Data used in his study is from 1984-1989, so the results might not be relevant anymore. Indeed, the results in Keloharju's paper are quite far from the results that are obtained from more recent studies in other countries. This paper provides two main contributions to previous literature. First, more recent data are used; the sample period consists of 68 IPOs listed in Helsinki stock exchange between 1994 and 2006. Second, this paper adapts Beneda and Zhang's novel methodology, in which both initial volatility levels and changes are investigated cross-sectionally. More importantly, what is their association to underpricing and performance in the long-run?

From a practical point of view, this paper discusses whether there is a lucrative investment strategy considering IPOs. According to the numerous previous studies, there is mispricing involved considering IPOs. When anomaly is detected, a superior trading strategy could be, in theory, created or even arbitrage opportunities could be at hand. It is quite clear at this stage that on average, IPOs are very worthwhile investments for their subscribers, but the more relevant issue is how to pursue after the first day of trading?

1.1 Purpose of the study

This paper examines the heterogeneity of both levels and changes in the after-market IPO stock return volatility and their associations to IPO-underpricing and post-IPO performance. To address the focus of the thesis, three questions will be raised. First, what is the trend of post-IPO firm-specific volatility behavior? After an IPO, the firm-specific risk can either increase, decrease or remain stable. This paper tries to find a relation, if there is any, between the initial volatility levels and post-IPO volatility change. The behavior of IPO stock returns volatilities are examined cross-sectionally. In addition to the examination of firm-specific risk, also the change in systematic risk is explored. However, the main focus is on the firm-specific risk considering its notable proportion to total risk. Second, how are the post-IPO return volatility levels and changes in return volatility related to the IPO underpricing? Third, how is the long-run post-IPO performance related to return volatility level and change?

These relationships are important given the significant information implication contained in the firm-specific risk. The firm-specific risk reflects a higher degree of heterogeneity in investors belief, hence it conveys a higher “firm-specific risk information”. On the one hand, information asymmetry argument predicts a negative relationship between underpricing/performance and firm-specific risk. On the other hand, a positive relationship between underpricing and firm-specific would be expected, if underpricing compensates investors for acquiring costly information. Moreover, the paper does not only examine the risk level, but also to the risk evolution. (Beneda & Zhang 2009)

In general, the purpose of this study is to investigate if a small sample of Finnish IPOs have similar characteristics to Beneda and Zhang’s larger sample from U.S markets. A thin security market as Finland, it is likely to have some interesting features. The small number of IPOs naturally limits the scope of the research. But at the same time, these special characteristics of Finnish stock market, makes it interesting to analyze the empirical findings.

1.2 Structure of the study

The rest of the paper is organized as following. Next section (2) discusses the initial public offerings in general. The motivations to go public as well as the advantages and disadvantages are presented. The discussion in this section ends to a brief demonstration of how the actual listing process is conducted. Third section concentrates on the most meaningful previous literature regarding this study. This literature consists of studies that have investigated the underpricing and the long-run underpricing issues. In addition to those IPO related anomalies, this section discusses the significant role of firm-specific risk. In fourth section the data and the methodology used in this paper are described in detail, whereas the fifth section provides the empirical results of this study. The last section offers the concluding remarks.

2. INITIAL PUBLIC OFFERINGS

When firms need to raise new capital to fund their operations and investments they may sell or float securities. These new issues of stocks, bonds, or other securities are typically marketed to the public by investment bankers in what is called primary market. Transactions of already-issued securities happen in secondary market. Trading in the secondary market does not change the securities outstanding, only the ownership changes. (Bodie, Kane & Marcus 2008:57)

Primary offerings can be sold either in a *private placement* or in a public offering. In a case of private placement, the firm (using an investment banker) sells shares to a small group of investors. Private placements are cheaper than public offerings, but are less suitable for larger offerings. Additionally, private placements do not trade in the secondary market. This causes liquidity problems and reduces the price to be paid for the issue. (Bodie, Kane & Marcus 2008:58-59)

There are two types of primary market issues of common stock, which are initial public offerings (IPOs) and seasoned new issues. IPOs are stocks issued by a formerly privately owned firm that is selling stock to the public for the first time. Seasoned new issues are offered by companies, who have already gone public, and are in need for new capital. This section concentrates solely on initial public offerings. (Bodie, Kane & Marcus 2008:58-59)

Going public is a substantial change in a company's life cycle. It is a long process that takes a lot of time and requires harmonious co-operation between various parties. This section discusses the motives and both benefits and disadvantages for a company's decision in going public. The process of going public will also be discussed.

2.1 The purpose of going public

There can be numerous reasons for going public, which can serve different kind of purposes. Usually, going public becomes relevant when a company wants to grow and/or expand the ownership. Pagano, Panetti and Zingales (1998) argue that the decision to go public is one of the most important and yet least studied questions in corporate finance. They state that the majority of corporate finance

textbooks are limited to describing the institutional aspects of this decision and providing little information on its motivation.

The general opinion is that going public is simply a stage in growth of a company. Pagano, Panetti and Zingales however, point out that this is not necessarily the case, as even in developed capital markets such as the United States, some large companies are not publicly traded. Moreover, other countries, such as Germany and Italy, publicly traded companies are exceptions rather than the rule. According to their paper, these cross-sectional and cross-country differences indicate that going public is not a stage of a company's life cycle, but rather it is a choice. This raises the question of why some companies choose to go public and some do not? The decision to go public depends on various factors. Benefits can be seen as the driving force and costs can be seen as the counterforce.

2.1.1 Benefits of going public

Access to alternative source of capital

Overcoming the borrowing constraints by gaining an access to a new source of capital other than banks is probably the most well-known benefit of going public. The possibility to raise funds from public markets is most attractive for companies with large current and future investments. High leverage and high growth companies are also likely to seek new capital with a public offering. Going public also gives the company a chance to gain more capital by consequent offerings. (Pagano, Panetti and Zingales 1998)

Bargaining power with banks

Going public improves the company's ability to borrow money. According to Rajan (1992), by gaining access to stock market and disseminating information to the generality of investors, a company elicits outside competition to its lender and ensures a lower cost of credit, a larger supply of external finance, or both. This leads to a prediction that companies facing higher interest rates and more concentrated credit sources are more likely to go public. After the offering, the company becomes less leveraged and thus credit will become cheaper and more easily available. (Pagano, Panetti and Zingales 1998)

Liquidity and portfolio diversification

Owners of a private company may have a hard time selling their holdings. For selling shares, the owner has to find a counterpart through informal searching, which can be time consuming and expensive. Selling shares of a publicly traded company is easy and cheap. Especially small investors, who want to sell on short notice, will benefit from the new situation. Liquidity is far better for publicly traded companies, but depends on the trading volume. (Pagano, Panetti and Zingales 1998)

The decision to go public affects the opportunities to diversify for the initial owners of the company. If diversification is a significant motive for going public, it can be expected that riskier companies are more likely to go public and the initial owners of the company will sell a large amount of shares at the time of IPO or soon after it. (Pagano, Panetti and Zingales 1998)

Monitoring

Publicly traded companies are out in the open for everyone to see and assess. Therefore, stock market provides a managerial discipline device by creating the danger of takeovers and by giving other market participants an opportunity to assess the managerial decisions. Firstly, if a company's management is working insufficiently, an outside source can take over the company and fire the management. Secondly, managerial choices are assessed by the market and are consequently shown in changes of stock prices. Stock price can work as an instrument for managerial incentives and a basis for their compensation e.g. salaries indexed to the stock price and stock options (Holmström & Tirole 1993). (Pagano, Panetti and Zingales 1998)

Investor recognition

Merton (1987) stated that stock prices are higher the greater the number of investors aware of the particular security. Investors are prone to ignore that a certain company exists and they hold only a fraction of existing securities in their portfolio. Getting listed might help to overcome this obstacle, by acting as an advertisement for the company. (Pagano, Panetti and Zingales 1998)

Stock exchange releases, interim and annual reports guarantee that updated information about the company is available. This has a positive all-around effect to the company. It generates interest and trust towards the company's products and service and attracts capable personnel to come forward and work for the company. Getting listed in a foreign market enhances the company's credibility as a future business partner. It is easier to start a business relation with a company that is well-known rather than with an unknown company. (Pagano, Panetti and Zingales 1998)

Change of control

According to Zingales (1995a), initial owners planning to eventually sell the company want to maximize the value by going public. Initial shareholders might have been financing the company for a long time without a reasonable yield. Going public gives them an opportunity to get the proper compensation for their work/investment. Especially, small shareholders find it a lot easier to sell and more importantly, sell for a value that reflects the company's real value. The ultimate goal for venture capitalists is to get listed, cash out and find a new lucrative investment opportunity, so going public serves the purpose perfectly. (Zingales 1995a; Sabine 1987: 41-44; Eskelinen & Räsänen 1995:10-11; PricewaterhouseCoopers 2003)

In many cases the change of control happens inside the family. Change of generation is a lot easier when the company is publicly traded. As stated earlier, going public increases the liquidity of the stock and therefore makes the process easier, if some of the inheritors want to leave the family business. The share price is usually higher for listed companies than unlisted companies. This is because there is more information available for publicly traded companies than private companies. Information increases the demand and the value of the company. (Eskelinen & Räsänen 1995)

Windows of opportunity

Ritter (1991) suggests that there are periods, in which stocks are mispriced. Companies recognizing this "window of opportunity" that other companies in their industry are overvalued have an incentive to go public. Ritter found that

there are concentrations in volume of IPOs that are associated with taking advantage of a window of opportunity.

Evidence exists in several markets that issuers take successful advantage of a window of opportunity to lower the cost of capital. For example, Kim and Stulz (1988) presents evidence that issuers take advantage of difference in borrowing costs that periodically arise between the domestic and Eurobond markets. Furthermore, Lee, Schleifer and Thaler (1991) present evidence that closed-end funds are issued more often in periods when discounts are smaller than usual.

2.1.2 Disadvantages of going public

Regardless the great advantages that going public has to offer, numerous disadvantages have also been documented. Previous literature consisting of Leland and Pyle (1977), Rock (1986), Pagano, Panetti and Zingales (1998), Sabine (1987:43-44), Ritter (1998), Ibbotson, Sindelar & Ritter (1988:37), Fuerst, Geiger, Peres, Gilo and Lubash (2002:219-220) and Eskelinen & Räsänen (1995) found the following disadvantages of going public.

Adverse selection

Investors are less informed about the true value of the company going public than the issuers. Investors do not know the true value of the company and this information asymmetry adversely affects the average quality of the companies seeking a new listing and therefore at which price their shares will be sold and also determines the magnitude of the underpricing needed to sell them. The cost of this adverse selection is more serious for young and small companies. They usually have little track record and low visibility compared to older and bigger companies going public.

Administrative expenses and fees

Going public is very expensive and risky. Each of the three major parties (issuer, investor and investment bank) face risk, therefore initial public offerings are often fairly risky. Besides leaving money on the table in the form of initial underpricing, going public contains certain costs associated to the need to provide information about the company to investors and regulators. There are consider-

able direct costs consisting of underwriting fees, legal fees etc. There are also yearly layouts on auditing, certification, and dissemination of accounting information, stock exchange fees etc. On top of the direct costs of going public are also indirect costs, which include for example the time and effort spent for conducting the IPO.

Loss of privacy

Public companies are forced to disclose a great deal of information about its business. Secrecy of these pieces of information may be crucial for their competitive advantage, such as data about ongoing research and development projects or future marketing strategies.

Going public also means fewer chances to “avoid” taxes compared to private companies. Additionally, public companies are in general far more exposed to legal suits than private companies. Loss of privacy might not be the only thing the initial owners lose within IPO. They might lose the control of the firm, but that is something that should be expected.

Problems caused by new owners

Getting listed means that management needs to serve the shareholders' interests. It gets harder to sell long-term business ideas, which reduces short-term performance. This is usually because shareholders and other practitioners monitoring the company are mainly interested in the next quarter's numbers. Reduction of operational flexibility becomes evident after getting listed. To do business efficiently, decisions may need to be done quickly. The need to stop and ask the approval from shareholders, could mean a lost opportunity in a fast paced business environment. Dividend policy brings also certain limitations to the table. Once the policy is chosen, shareholders are usually not willing to change it, because any changes affect the share price.

2.2 Listing process

Going public is a process which takes a lot of time and careful preparation. Numerous important matters have to be considered to make the listing process successful and at the same time keep all parties satisfied and committed to the

task. Furthermore, going public, exposes the company to new challenges, new obligations and a variety of new uncertainty factors. Successful listing requires, in addition to favorable market condition, that the market has trust towards the listing company and the lead underwriter. On top of the requirements for the exchange, companies getting listed have to take into consideration post-listing obligations regarding public relations and insider information. (Pricewaterhousecoopers 2003; Brau and Fawcett 2006)

Preparations before listing are usually related to the decision to go public and organization of different parties. The board of directors starts the listing process together with the owners and manages the listing preparations. According to Hiden (2002), the process requires that certain variables are considered, such as, the company's financial position, the needs of the initial owners and other possible sources of finance. After the decision to go public is set, a project organization is established, which includes the lead underwriter or syndicate, legal advisors, accountants and marketing advisors. The planning and execution of getting listed involves the participation and co-operation of all three parties. The initial owners also have an important role in determining the terms and conditions of the offering (Eskelinen and Räsänen 1995: 29). (Pricewaterhousecoopers 2003)

Once the lead underwriter is chosen, they and the listing company negotiate with the stock exchange about the terms and schedule of getting listed. The terms regarding the company's operational and financial status have to be met in order to go public. The vast majority of the listing requirements are harmonized between NASDAQ OMX Helsinki, NASDAQ OMX Stockholm, NASDAQ OMX Copenhagen and NASDAQ OMX Iceland. However, some differences can be observed regarding national legislation or other differences in the regulatory framework in a specific jurisdiction. The general requirements are summarized as follows:

Incorporation

Validity

Negotiability

Whole class to be listed

Annual financial reports and operating history

Profitability and working capital

Liquidity

Market value of shares

Suitability

Incorporation: the company must be duly incorporated or otherwise validly established according to the relevant laws of its place of incorporation or establishment.

Validity: the shares of the issue must conform with the laws of the company's place of corporation, and have the necessary statutory or other consents.

Negotiability: The shares must be freely negotiable.

Whole class to be listed: The application for listing must cover all issued shares of the same class.

Annual financial reports and operating history: the company and its consolidated group of companies shall have prepared and disclosed annual financial reports for at least three years in accordance of with accounting laws applicable to the company and its consolidated group of companies. In addition, the line of business and the field operating of the company and its consolidated group of companies shall have a sufficient operating history.

Profitability and Working Capital: the company shall demonstrate that it possesses documented earnings capacity on a business group level. A company that does not possess documented earnings capacity shall demonstrate that it has sufficient working capital available for its planned business for at least twelve months after the first day of listing. Briefly, this means that the company has to be able to prove that it is profitable.

Liquidity: Conditions for sufficient demand and supply shall exist in order to facilitate a reliable price formation process. A sufficient number of shares shall be distributed to the public. In addition, the company shall have a sufficient number of shareholders. a sufficient number of shares shall be considered as being distributed to the public when 25 percent of the shares within the same class are in public hands.

Market value of shares: The expected aggregate market value of the shares shall be at least 1 million euro.

Suitability: The Exchange may also, in cases where all Listing requirements are fulfilled, refuse an application for listing if it considers that the listing would be or is detrimental for the securities market or investors' interests. (NASDAQ OMX)

Often when preparing an offering, a thorough investigation about financial and legal state is needed, so called due diligence (Ritter 1998). Analysis of the financial state is important when going public. In the case that returns have not been favorable in the near past, it will presumably reduce investors' trust and have an effect on the IPOs success. Therefore, during the preparation period, the lead underwriter tries to evaluate the company's strengths and weaknesses in order to analyze how it is positioned compared to other companies in the field.

An underwriting agreement shows the tasks and liabilities of the lead underwriter. The task of underwriting is to share the risk of the offering, though the role of underwriting can be determined in several ways. Most common roles are *firm-commitment contract* and *best-efforts contract*. In firm commitment contract the underwriter subscribes the issue as a whole, to sell the securities again to investors. From an issuer's point of view this sounds like a safe bet, because the underwriter bears all the risk. Although, the issuer has to pay a substantially larger risk premium in these kinds of contracts, otherwise a different contract is chosen. In unfavorable situations some portion of the issue is unsold and that loss is realized by the underwriter. In Finland firm commitment issues are usually sold to institutional investors.

In the best efforts contract the underwriter's role is to market the issue and receive a commission for the sold shares. In this contract the underwriter does not bear the risk, they only provide a distribution channel for the issue. The best efforts contracts are usual, if the premium is too high for firm commitment contracts. According to Sherman (1992), the best efforts-issues are usually sold to small investors and are more underpriced than firm commitment-issues. Dunbar (1998) though, argued that the size and the price of the issue are more important factors than which contract is used. Stand-by contracts and all-or-none contracts are less common roles than the two previous ones. In stand-by contract the underwriter is committed to buy the remaining shares that were not subscribed by the investors. All-or-none contract means that the underwriter has an option to cancel the issue if it is not fully subscribed. (Pricewaterhousecoopers 2003)

When stocks are eventually offered to the public for the first time, it is followed by a subscription period in which the stocks are sold to the public. Trading with the newly issued stocks cannot start in the stock exchange before the subscrip-

tion period has expired. The final decision of whether the IPO is accepted to be listed is made by the listing committee. After the new issue has been accepted for listing and the subscription period has expired, trading in the secondary market can start. (Pricewaterhousecoopers 2003)

3. PREVIOUS LITERATURE

Numerous empirical findings on the pricing of initial public offerings raise a puzzle to those who otherwise believe in market efficiency. IPOs are a widely studied topic and there are some typical anomalies concerning IPOs which seem to be repeated in academic research. Firstly, new issues are underpriced on average. Secondly, long-run performance of the IPOs tend to underperform the market in general. Thirdly, the extent of underpricing is highly cyclical, with some periods lasting many months at a time, in which the average initial return is much higher.

This section concentrates on the first two anomalies mentioned. In addition to IPO anomalies, the role of idiosyncratic risk is also discussed because of its significant relation to the thesis. (Ritter 1991:3)

3.1 Underpricing of IPOs

The earliest study considering underpricing was conducted in 1963 by U.S. Security and Exchange Commission (SEC). SEC was established in 1933 to regulate the stock market in U.S. and in 1963 they published the Cohen Report. That was the report of The Special Study which purpose was to find grounds for regulations and introduce proposals for new regulations to protect investors in the security markets. One of the study's results involved underpricing, the results stated that companies getting listed have positive initial returns on average. In 1964 Stigler argued in his paper against the The Special Study of SEC. Stigler's main concern was the manner in which the proposals of the report were reached. Consequently, Stigler executed basic tests comparing the performance of new common stock issues before and after establishing the SEC. His data consisted of all the new issues of industrial stocks with a value exceeding \$2.5 million in 1923-28, and exceeding \$5 million in 1949-55, and measures of the values of these issues (compared to their offering price) in five subsequent years. The comparisons revealed that the investors did little better after establishing the SEC, though they were constantly outperformed by the benchmark index (the market average in NYSE). In addition, Stigler claims that equity offerings are miserable investments in the long-run. Stocks were already losing

one-fifth of their value after the first year on average and only performing more poorly after the years to come.

The first studies to consider the initial price behavior of newly issued stocks, are those of Reilly and Hatfield (1969), Stoll and Curley (1970), McDonald and Fisher (1972) and Ibbotson and Jaffe (1975) can be considered Common for these surveys is that they studied short-run performance as a main target, in addition all of them also included at least one year long-run period. Reilly and Hatfield (1969) investigated one week and one month short-run performance and also one year long-run performance. As benchmark indexes they used the Dow Jones Industrial Average (DJIA) and the National Quotation Bureau Over-the-Counter Industrial Average (OTC). The sample involved 53 new offerings that were issued between December 1963 and June 1965. The first week average return of initial public offerings beat the market index (OTC) by 9.9 %. Interestingly, in the long-run, IPOs performed better having an average return of 43.7 % (30 stocks out of 53 had a positive gain), while the market index average was 23.1 %. Their conclusion is that issues which increase in price in initial trading tend to also have greater than average returns over the next year. This finding about long-run superior returns is not consistent with newer studies.

McDonald and Fisher's (1972) study was implemented much like that of Reilly and Hatfield's study. Their study consisted of 142 IPOs brought to market in 1969. The first week excess return (IPO percentage price change adjusted for market movements) was 28.5 %. Compared to Reilly and Hatfield's study (9.9%) the price increase in the first week was nearly three times larger. McDonald and Fisher came to a different conclusion about the long-run performance than Reilly and Fisher did before. Their main finding is that short-term returns were substantial for initial subscribers, but buying the stock a short time after IPO did not have predictive value of the future price behavior. Noteworthy in these two studies is that they were conducted in different market conditions. The earlier study was done in a bull market and the other was mainly done in bear market conditions.

Since the late 1960s and early 1970s, research has developed in many ways. Researchers have created new techniques and adopted different variables to explain the initial price behavior of IPOs. For example, risk factor (Ibbotson and Jaffe 1975), industry effect (Johnston 2000), different event windows (Barry &

Jennings 1993), size (Loughran 1993; Young & Zaima 1988) and market conditions (Buckland, Herbert & Yeomans 1981) were used in more novel studies to contribute to existing literature.

Lehtinen (1992) was the first to study the performance of IPOs in Finnish stock markets. Unlike prior research made on the topic, Lehtinen examined the effect only in the OTC-market. Data of his paper included 39 IPOs going public through OTC market between 1985 and 1989. Lehtinen used two methods to evaluate abnormal returns. First, he calculated the initial abnormal returns without beta coefficient or any other risk factor. He found that the initial return was 20 % on average. Next, Lehtinen took the risk factor into consideration and calculated the beta coefficient by using Ibbotson's (1975) RATS-model. Risk-adjusted initial abnormal return did not provide additional information. Lehtinen concluded that there is no significant difference whether the risk factor is used or not in the calculation of abnormal returns of IPOs. Further, underpricing of IPOs were studied by Keloharju (1993) with evidence of 80 IPOs issued between January 1984 and July 1989, listed in Helsinki Stock Exchange (at present *OMX Helsinki*). He found that the initial returns were 8,7 %.

After the early studies, the underpricing research broadened outside the U.S. Table 1 summarizes the findings from different countries. It shows that underpricing is a world-wide phenomenon only the amount of underpricing varies from country to country. China has by far the most substantial underpricing, on average 388%. Second is Malaysia with an average underpricing of 80,3%. Next are Brazil and Korea with average underpricing, 78,5 % and 78,1% respectively. It is clear that China is in a league of its own, but still even the lowest initial underpricing documented in France (4,2%) is statistically significant. Time periods are not the same for each research conducted, which may have a significant effect on the results, but the general idea about the existence of underpricing is clearly shown. (Ritter 1998)

Table1 Average initial returns for 33 countries. (Ritter 1998)

Country	Author(s) of Article(s)	Sample Size	Time Period	Average Initial Return
Australia	Lee, Taylor & Walter	266	1976-89	11.9%
Austria	Aussenegg	67	1964-96	6.5%
Belgium	Rogiers, Manigart & Ooghe	28	1984-90	10.1%
Brazil	Aggarwal, Leal & Hernandez	62	1979-90	78.5%
Canada	Jog & Riding; Jog & Srivastava	258	1971-92	5.4%
Chile	Aggarwal, Leal & Hernandez	19	1982-90	16.3%
China	Datar and Mao	226	1990-96	388.0%
Denmark	Bisgard	32	1989-97	7.7%
Finland	Keloharju	85	1984-92	9.6%
France	Husson & Jacquillat; Leleux & Muzyka; Paliard & Belletante	187	1983-92	4.2%
Germany	Ljungqvist	170	1978-92	10.9%
Greece	Kazantzis and Levis	79	1987-91	48.5%
Hong Kong	McGuinness; Zhao and Wu	334	1980-96	15.9%
India	Krishnamurti and Kumar	98	1992-93	35.3%
Israel	Kandel, Sarig & Wohl	28	1993-94	4.5%
Italy	Cherubini & Ratti	75	1985-91	27.1%
Japan	Fukuda; Dawson & Hiraki; Hebner & Hiraki; Pettway & Kaneko; Hamao, Packer, & Ritter	975	1970-96	24.0%
Korea	Dhatt, Kim & Lim	347	1980-90	78.1%
Malaysia	Isa	132	1980-91	80.3%
Mexico	Aggarwal, Leal & Hernandez	37	1987-90	33.0%
Netherlands	Wessels; Eijgenhuijsen & Buijs	72	1982-91	7.2%
New Zealand	Vos & Cheung	149	1979-91	28.8%
Norway	Emilsen, Pedersen & Sættem	68	1984-96	12.5%
Portugal	Alpalhao	62	1986-87	54.4%
Singapore	Lee, Taylor & Walter	128	1973-92	31.4%
Spain	Rahnema, Fernandez & Martinez	71	1985-90	35.0%
Sweden	Rydqvist	251	1980-94	34.1%
Switzerland	Kunz & Aggarwal	42	1983-89	35.8%
Taiwan	Chen	168	1971-90	45.0%
Thailand	Wethyavivorn & Koo-smith	32	1988-89	58.1%
Turkey	Kiyamaz	138	1990-95	13.6%
United Kingdom	Dimson; Levis	2,133	1959-90	12.0%
United States	Ibbotson, Sindelar & Ritter	13,308	1960-96	15.8%

3.2 Reasons for underpricing

Table 1 establishes that underpricing has received a great deal of interest from the academic world for several years. This empirical evidence around the world inspired a large theoretical literature in 1980s and 1990s trying to rationalize why new issues are underpriced.

A number of reasons have been documented to shed light on IPO underpricing phenomenon. The empirical IPO literature is fairly mature, the main stylized facts have been established and most theories have been subjected to rigorous empirical testing. By now we know that IPOs are underpriced, and the number of IPOs fluctuates over time as well as the amount of underpricing. Time and space constraints require the author to be selective. Indeed, for example an entire book by Jenkinson and Ljungqvist (2001) is devoted to IPOs. This chapter outlines the main theories of IPO underpricing and discusses the evidence.

There are different ways of classifying theories of IPO underpricing. For example, Ritter and Welch (2002) categorize the theories on the basis of whether asymmetric information or symmetric information is assumed. Ritter (1998) lists eight hypotheses for the IPO underpricing: the winner's curse hypothesis, the market feedback hypothesis, the bandwagon hypothesis, the investment banker's monopsony power hypothesis, the lawsuit avoidance hypothesis, the signaling hypothesis and the ownership dispersion hypothesis.

Ljungqvist's (2007) divides the theories of underpricing into four groups: asymmetric information, institutional, control considerations, and behavioral approaches. The best established group in Ljungqvist's categorization is the theories based on the information asymmetry. The key parties involved in IPO are the issuing firm, the underwriter, and the investor. According to the model, information asymmetries arise when one of these parties is better informed than the others.

Baron (1982) assumes that the underwriting bank knows better about the demand conditions than the issuing firm, leading to a principal-agent problem in which underpricing is applied to stimulate optimal selling effort. Welch (1989) on the contrary, assumes that the issuing firm is better informed about its true value, leading to a situation in which higher-valued firms use underpricing as a signal. Rock (1986) claims that some investors are more informed than the other key parties and with the help of this knowledge they can avoid subscribing overvalued IPOs.

Institutional theories focus on three features of the marketplace: litigation, underwriter's stabilization activities after listing, and taxes. Control theories argue that underpricing helps to allocate the shares so the possible intervention by

outside investors is reduced once the company is publicly traded. Behavioral theories can assume that irrational investors bid up the price of the new offerings or the issuer does not put sufficient amount of pressure to the underwriter to have the underpricing reduced, because they suffer from a behavioral bias.

3.2.1 Asymmetric information models

The winners curse

As mentioned above, theories based on information asymmetry assume that one of the parties involved in IPO (the issuing firm, the underwriter or the investor) knows better about the true value of an IPO than the others. Rock's winner's curse theory, is probably the best known information asymmetry model. Rock claims that investors can be separated into two groups: uninformed investors and informed investors. Informed investors know more about the true value of the shares on offer than investors in general, the issuing firm, or its underwriters. Because of the informational advantage, informed investors bid only for attractively priced IPOs, whereas uninformed investors bid for all new issues coming onto the market indiscriminately. Thus, uninformed investors not only face competition for good shares, but they also have a higher probability of obtaining bad shares due to the rationing of oversubscribed offerings. Rock argues that the bias in rationing produces an equilibrium offer price with a discount sufficient to attract uninformed investors. Implicit in the winner's curse hypothesis is the notion that when adjusted for rationing and risk, uninformed investors' initial returns should be on average equal to the riskless rate, which is just enough to ensure their future participation in the IPO market. (Lungqvist 2007)

Winner's curse hypothesis has been tested and confirmed in many studies over the years. The already mentioned Keloharju's (1993) study in the Finnish stock market, proved in practice that the winner's curse theory reduced the potential profits available to an uninformed investor. A recent study of Ting and Tse (2006) examined three hypotheses that may explain the large underpricing in China; the winner's curse hypothesis, the ex ante uncertainty hypothesis and the signaling hypothesis. They used data sample of 343 online fixed-price offerings (November 1995 to December 1998) and found that the winner's curse hypothesis is the main reason for the IPO underpricing in China. Furthermore,

Boelen and Hubner (2006) also confirmed the winner's curse hypothesis in Belgian stock market from 1989 to 2004.

Information revelation theory

Bookbuilding, the worldwide leading procedure for selling IPOs, gives the underwriter a high degree of discretion in the pricing and allocation decision. Where this procedure is used, underwriters may underprice the issue to induce investors to reveal information during the pre-selling period. Information obtained, are then used in setting the price of an IPO. (Ljungqvist 2007)

However, if there are no inducements to reveal positive information, then there are no incentives for investors to reveal any. This is because, if the investors were to reveal information, it would most likely result as a higher offer price and thus lower profits for the investors. Even worse, there is a strong opposite incentive to claim that the future prospects of the firm are bad when they actually are not. This way the investors try to induce the underwriter to set the offer price lower. Considering the underlying scenario above, the underwriter's main task is to design a system that serves both the issuing firm and the investors. The system involves inducing the investors to reveal information truthfully, and it would be their best interest to do so. (Ljungqvist 2007)

According to Benveniste and Spindt (1989), Benveniste and Wilhelm (1990), and Spatt and Srivastava (1991), in certain situations, bookbuilding can be such a system. After the underwriter collects the information about the interest of various investors, they then decide to whom to allocate the shares. The investors who bid conservatively will receive none, or only few shares. This system will discourage investors to misrepresent positive information, as by doing so, would exclude themselves from the allocation. On the contrary, investors whom choose to bid aggressively are rewarded with large allocation of shares. As mentioned earlier, to make it the investors' best interest to reveal information truthfully, the offering must be underpriced.

Ljungqvist argues that issuers benefit from these arrangements, despite the fact that their issues are underpriced. The bookbuilding procedure creates a chance to extract positive information and thus in response, raise the offer price even though the price rise will continue post-IPO. This is because some money has to

be left on the table in form of compensation to the investors for revealing information. Consequently, the price adjustments during the bookbuilding period and the first-day returns are positively associated. This is often referred in IPO-literature as the “partial adjustment” phenomenon (Hanley 1993).

3.2.2 Institutional explanations

Legal liability

Legal liability, in other words lawsuit avoidance hypothesis, is mentioned in Ritter’s (1998), Ritter & Welch’s (2002) and Lundgqvist’s (2007) explanations of IPO underpricing. Earlier studies of Logue (1973) and Ibbotson (1975) provided the basis for this idea. They argue that companies willingly underprice the IPOs to reduce the likelihood of future lawsuit from a shareholder disappointed with the post-IPO returns of their shares. Later, Tinic (1988), Hughes and Thakor (1992), and Hensler (1995) confirmed in their studies that issuers underprice the issue to reduce their legal liability. Considering the direct cost to the defendants, such as damages, legal fees, diversion of management time, etc. - the lawsuits can be very costly. Furthermore, the potential damage to their reputation may cause losing future clients. The issuer, in this case the plaintiff, is not a clear-cut winner in this scenario either; they may face a higher cost of capital in future capital issues.

Drake and Vetsuypens (1993) investigated the matter with a sample of 93 IPO firms that were subsequently sued after the offering. They were compared to a control sample of 93 IPOs that did not face litigation problems. The control sample matched on IPO year, offer size, and underwriter prestige. In this cross-sectional research Drake and Vesuypens found that the sued firms were just as underpriced as the control sample, and that underpriced firms were sued more often than overpriced firms.

Drake and Vetuypens paper was later criticized by Lowry and Shu (2002). They argued that such an ex-post comparison misses the point, because it fails to consider the probability of being sued. Lowry and Shu emphasize that the empirical analysis of the association between underpricing and the probability of litigation needs to be cautious, because of the following simultaneity problem: the firms choose a specific level of underpricing in order to reduce the probability

of being sued, but the magnitude of underpricing they choose is dependable on the probability of being sued. More simply, higher underpricing reduces the probability of being sued, but greater litigation risk requires higher level of underpricing.

Because of this particular simultaneity problem, ordinary least squares estimates are prone to be biased. Therefore, Lowry and Shu suggest a two-stage least square approach. As identifying variable in the underpricing equation, they employ prior market returns and the IPOs' expected stock turnover in the litigation equation.

Loughran and Ritter (2002) find a positive association between lagged index returns and underpricing, but added that there is no reason to expect lagged index returns to affect litigation problems many years later. Thus, it can be interpreted that lagged index returns are a plausible instrument for underpricing. Whereas, stock turnover may be a plausible instrument for litigation a priori, this is because damages tend to increase in the amount of shares traded at the "allegedly" misleading prices.

The problem is that different research methods indicate substantially different conclusions. Using the OLS (ordinary least squares) estimate, the results suggest that underpricing decrease in the incidence of (actual) lawsuits, indicating that firms underprice less, the more frequently they face lawsuits. Whereas, adopting the 2SLS model (two stage least squares) leads to an opposite conclusion. In this case, underpricing increases in the predicted probability of lawsuits, consistent with the lawsuit avoidance hypothesis. (Ljungvist 2007)

Lowry and Shu's study is sensitive to econometric concerns, and using more careful tools than prior work, it finds evidence consistent with the proposition that firms use underpricing as a form of insurance against future litigation. Unfortunately, their empirical model is not able to gauge the economic magnitude of this effect (because their system cannot identify all relevant parameters). They are thus unable to say if litigation risk has a first-order effect on underpricing. (Ljunqvist 2007)

Despite the existence of legal liability, it cannot be considered as a primary determinant of underpricing; this explanation is somewhat U.S. - centric, whereas

underpricing is a global phenomenon. For instance, Keloharju's (1993) found from the sample groups that the realized legal liabilities resulting from the IPO was zero. This was despite a generally low standard of information content, lack of regulation for the issuing of securities and the rare damage compensation in the Finnish environment. Thus legal liabilities should not have a role to play in the pricing or performance of IPOs. In addition to Finland, the risk of a lawsuit is not economically significant in Australia (Lee, Taylor, and Walter 1996), Germany (Ljungqvist 1997), Japan (Beller, Terai, and Levine 1992), Sweden (Rydqvist (1994), Switzerland (Kunz and Aggarwal 1994) or the U.K. (Jenkinson 1990), all of which experience underpricing.

Stabilization

Stabilization is also acknowledged as a reason for underpricing. This practice of price support is, according to Lundqvist's categorization, the second institutional explanation for IPO underpricing. Typically, when trading starts with newly issued stock, rather than generating a symmetric distribution around some positive mean, underpricing returns will usually peak sharply at zero and rarely fall below zero. Ruud (1993) uses these statistical findings as her starting point to argue that IPOs are not deliberately underpriced. Her investigation of the distribution of returns subsequent the offering indicates that positive mean initial returns may reflect the existence of a partially unobserved left (negative) tail. Moreover, most IPOs with zero first-day returns are followed by a fall in price, according to Ruud, suggests that underwriter price support may account for the skewed distribution and hence the positive average price jump, even if offering prices are set at expected market value.

Ruud's argument that the underpricing of IPOs is the byproduct of price support and not a deliberate choice of action was tested by Asquith, Jones and Kieschnick (1998). They estimated the average underpricing returns for the two hypothesized distributions of supported and unsupported IPOs. If Ruud is correct in claiming that there is no deliberate underpricing, then the initial return distribution on supported IPOs should result in a mean of zero. Ruud's argument was not confirmed in Asquith, Jones and Kieschnick's study. Instead, they found that the distribution interpreted as reflecting unsupported firms had mean underpricing of approximately 18 %, while the other distribution interpreted as reflecting supported IPOs had zero mean underpricing. These find-

ings suggest that underpricing is in fact not a byproduct of price support, but rather has independent causes.

3.2.3 Control theories

Going public can often be interpreted as a stage before the forthcoming separation of ownership and control. An agency problem may arise between non-managing and managing shareholders, if the separation of ownership and control is incomplete. A manager's goal may be to maximize their own wealth, instead of maximizing the expected shareholders' value. Two opposite models have been discovered to explain the underpricing within the context of an agency cost approach.

The first approach is presented by Brennan and Franks (1997). They argue that underpricing entrenches managers' private benefits, by allocating shares strategically to small investors. Managers try to avoid allocating a large proportion of the shares to investors, because it induces a higher level of external monitoring. In other words, they are not willing to give up their non-value maximizing behavior and this way they do not have to face unwelcome scrutiny. Grossman and Hart (1980) add another benefit that managers experience with the greater ownership dispersion, that is it reduces the threat of incumbent managers to be ousted from the company in a hostile takeover.

Stoughton and Zechner (1998) presented the opposite approach to Brennan and Franks' model. They argue that it may enhance the value to prefer large outside investors, instead of small investors. Stoughton and Zechner's view on the increase of monitoring is positive. They claim that monitoring is a public good, as all shareholders benefit, whether or not they contribute to its provision. According to Stoughton and Zechner, managers try to encourage better monitoring by allocating a large stake to an investor. In the case where the allocation is sub-optimally large, underpricing is applied as an added incentive to lure the investors to participate in the offering.

Ljungqvist describes two reasons why these two approaches are so different. The first reason arises from the difference of institutional environments in which the models are placed. The second difference involves Stoughton and Zechner's assumption that managers internalize the agency cost they impose on

outside investors, via the lower price that investors are willing to pay for the stock. This particular internalization is not done in the Brennan-Frank model. Ljungqvist states that the ownership and control aspect on underpricing shows great potential, but it is still in its infancy.

3.2.4 Behavioral explanations

At the turn of the century initial returns of IPOs increased remarkably. In 1999 and 2000, for instance, the average initial return for IPO was 71 % and 57 %, respectively. In dollar terms, U.S. new issuers left an aggregate of \$62 billion on the table in those two years alone. Many researchers have become doubtful over the past two or so decades, whether information asymmetries, litigation problems, control and ownership issues could possibly explain underpricing of this scale. As a consequence, some argue that one should turn to behavioral explanations for a better understanding of the underpricing phenomenon. (Ritter 1998; Ljungqvist 2007)

Traditional finance theories argue that investors are rational and therefore make optimal decisions. Whereas, behavioral finance relaxes this rationality assumption and argue that investors are still human and therefore are prone to make suboptimal decisions.

Cascades

When IPO shares are sold sequentially, later potential investors can condition their bids on the bid of earlier investors. This can rapidly lead to “cascades”, in which subsequent investors rationally disregard their own information and imitate earlier investors. Successful initial sales can be interpreted by later investors as evidence that earlier investors held favorable information about the offering, encouraging later investors to invest regardless of their own information. Analogously, disappointing initial sales can encourage later investors from investing irrespective of their private information. As a result, demand for the IPO can either snowball or remain low over time. To prevent the negative outcome, an investor banker may underprice the issue to induce a so called bandwagon effect. Cascade hypothesis is also referred to as the bandwagon hypothesis or fad effect. (Welch 1992)

Investor sentiment

Ljungqvist considers investor sentiment as one of the three behavioral explanations to underpricing. Behavioral finance is interested in how irrational or sentiment investors can affect stock prices. The probability of such an irrational behavior is particularly large in the case of IPOs. Because of the youth, immaturity, and informational opaqueness of the company, they are prone to be hard to value. Ljungqvist, Nanda and Singh's (2006) study was the first to model an IPO company's optimal response to the presence of sentiment investors. If sentiment investors are confident about the positive future prospects of the IPO company, then the issuer's goal is to maximize the excess valuation over the fundamental value of the company. Ljungqvist, Nanda and Singh state that flooding the market with stock will lower the price, and consequently suggest that the optimal strategy is to hold back stock in inventory to avoid the price fall. In the long-run, the price of the stock will revert to its fundamental value. That is, in the long-run IPO returns are negative. The next section discusses this particular IPO anomaly in more detail.

Prospect theory

Loughran and Ritter (2002) propose an explanation that emphasizes behavioral biases among the IPO firm's executives, rather than among the investors. They provide a cognitive psychology argument to why issuers will not be upset with leaving money on the table, in terms of underpricing of an IPO. Loughran and Ritter argue that the key element is the covariance of money left on the table and wealth gains accruing to the investors due to underpricing. In this kind of situation a behavioral finance term *framing* shows its importance. Framing means that people choose differently among same alternatives, dependent on how the issue is framed (Shefrin 2002:23). If the issuers viewed the opportunity cost of underpricing by itself, they would most likely be upset leaving millions on the table. On the other hand, if the issue is framed in a way that it becomes part of the package deal, which also includes good news in wealth gain, then there is certainly less resistance.

3.3 Long-run performance of IPOs

Those who believe in efficient markets would argue that once an IPO is publicly traded it should be regarded as any other stock. Thus, the post-IPO price should reflect the stocks' fundamental value. Similarly to other stocks, after market risk-adjusted price behavior should not be predictable for IPOs. Thus, efficient markets proponents argue that post-IPO long-run performance is less of an IPO issue as it is more of a standard asset-pricing issue. (Ritter & Welch 2002)

Yet, the poor long-run performance is another established anomaly regarding the initial public offerings. Ritter's (1991) study, *The Long-Run Performance of Initial Public Offerings*, is considered to be the first in the field. By the time Ritter accomplished his study, it was already widely acknowledged in the academic community (e.g. Ritter 1984, 1987; Miller & Reilly 1987) the existence of two anomalies related to IPOs: (1) the short-run under pricing phenomenon, and (2) the "hot issue" market phenomenon. Instead of focusing on those two already established anomalies, Ritter concentrated on the long-run performances of IPOs with a large database of 1,526 companies going public during years 1975-1984.

Remarkable in Ritter's methodology was that he compared the profits of IPOs to his own indexes, containing matching firms by size and industry, instead of market indexes used in previous studies. Another important addition to his methodology compared to previous literature, is that Ritter excluded the first day profits from his data. In this way, he noticed that abnormal returns do not cumulate after the first day of trading. The most notable of his findings was a cited third anomaly: in the long-run IPOs tend to be overpriced. This was demonstrated with comparisons in three year period where the issued firms significantly underperformed a set of comparable firms. The average holding time return was 34,47 % in a the three years after the IPO when the matching stocks produced an average total return of 61,86 %. Accordingly, every dollar invested in the matching portfolio profited over one-fourth more than the one invested in the IPO portfolio.

According to the results that Ritter's paper provides, it is reasonable to state that IPOs are lucrative investments for their subscribers. However, buy-and-hold strategy after first day of trading does not provide superior returns in a 36

month time period, rather quite the contrary. In addition, Ritter identified some possible reasons for his results, for example, many firms go public near the peak of industry-specific fads and the high transaction costs of raising external equity partly offsets the long-run returns. (Ritter 1991)

Keloharju (1993) conducted his study much like Ritter. He found mutual results in the Finnish stock market about the long-run underperformance. The average cumulative value-weighted index adjusted return from the IPO date to month 36 was -51, 9%. Keloharju, like Ritter earlier, excluded the first-day returns from his data. Also notable, is the stock market cycle at the time of the study. Most of the IPOs were issued during relatively high activity in the Finnish stock market, whereas by the time of the aftermarket of IPOs, the stock market was downward. Consequently, the study excludes the possibility of "bad luck" in the previous studies and approves the effects of financial cycles on IPOs.

Table 2 summarizes the international findings on the long-run performance of IPOs. The total abnormal return can be interpreted that buying a portfolio of IPOs would leave the investors that much more/less wealth three years later than if the money had been invested in the market index or a matching non-issuing firm portfolio. The poor long-run performance regarding the IPOs is evident. However, few exceptions do exist; Korean and Swedish IPOs have outperformed the benchmark to some extent in their investigation periods. (Ritter 1998)

Table 2 International evidence on long-run underperformance. (Ritter 1998)

Country	Author(s)	Number of IPOs	Issuing years	Total abnormal return
Australia	Lee, Taylor & Walter	266	1976-89	-46.5%
Austria	Aussenegg	57	1965-93	-27.3%
Brazil	Aggarwal, Leal & Hernandez	62	1980-90	-47.0%
Canada	Jog and Srivistava	216	1972-93	-17.9%
Chile	Aggarwal, Leal & Hernandez	28	1982-90	-23.7%
Finland	Keloharju	79	1984-89	-21.1%
Germany	Ljungqvist	145	1970-90	-12.1%
Japan	Cai & Wei	172	1971-90	-27.0%
Korea	Kim, Krinsky & Lee	99	1985-88	+2.0%
Singapore	Hin & Mahmood	45	1976-84	-9.2%
Sweden	Loughran, Ritter & Rydqvist	162	1980-90	+1.2%
U.K.	Levis	712	1980-88	-8.1%
U.S.	Loughran & Ritter	4,753	1970-90	-20.0%

The most well-known advocate of market efficiency, Fama (1998), argues that the long-term underperformance anomaly is fragile. He claims that abnormal returns often disappear with some reasonable changes in the methodology. One of the many studies Fama criticized in his study was Loughran and Ritter's (1995) paper. They found that companies conducting an IPO or SEO during 1970-1990 significantly underperform compared to non-issuing firms for five years after the issue. The results show that the average buy-and-hold annual returns during the five years after the issue is only 5 % for IPOs, and only 7 % for SEOs. These results support Ritter's (1991) conclusions.

Loughran and Ritter claim that the magnitude of underperformance is economically significant. However, Fama's view on the subject is quite the opposite. He disapproves the way Loughran and Ritter had measured the abnormal returns. Fama states that since the long-run buy-and-hold returns in Loughran and Ritter's study only control for size, their results might be influenced by other variables known to be associated with average stock return, such as book-to-

market equity (Fama and French 1992), and short-term past return (Jegadees and Titman 1993).

Numerous studies have been made regarding the long-run underperformance of IPOs, but the results are often not as self righteous as they are with the underpricing phenomenon. Brav and Gompres (1997) for example, investigated whether the involvement of venture capitalists affects the long-run performance of IPOs. They find that although the venture-backed IPOs outperform non-venture-backed IPOs, the underperformance is not an IPO effect. When issuing firms are matched to size and book-to-market portfolios that exclude all recent firms that have had equity issues, IPOs do not seemingly underperform. Underperformance is more of a characteristic of small, low book-to-market firms whether they are IPO firms or not. This result somewhat supports the statement made by Fama, that abnormal return often disappears with some reasonable changes in the methodology.

It is important to note that the choice of sample period plays a major role in how significant this occurred underperformance was. For example, Lee, Taylor and Walter (1996) provide evidence from Australian markets about the post-issue performance of 266 industrial firms going public 1976-1989. According to the table 2, Lee, Taylor and Walter found that IPOs perform poorly in the first three years, as the average total abnormal return was -46.5%. (This research design is not constructed to show whether underperformance is related to small firms with low book-to-market ratios.) A later study of Rosa, Velayuthen and Walter (2003), also in Australian markets, provide evidence indicating that IPOs do not underperform in the long-run. They explain that the severe underperformance documented by Lee, Taylor and Walter is most likely sample specific. Rosa, Velayuthen and Walter also suggested that US results in Ritter's (1991) paper could be partly explained by the influence of specific time period.

Furthermore, long-run returns are prone to be very noisy. Thus, even if the long-run returns are extremely low, statistical significance are often not found. Brav (2000) states that it can require an abnormal return of -40% (depending upon specification) to have a sufficient statistical significance to reject the hypothesis that those long-run buy-and-hold returns are not underperforming.

Another study supporting Fama's claim was conducted by Moshirian, Ng and Wu (2010), which investigated the underpricing and long-run underperformance phenomena in the Asian markets from 1991 to 2004. Their evidence on underpricing supports the earlier literature. However, the existence of long-run underperformance was not supported. They examined the long-run performance in multiple ways, like Fama had insisted, and found that the underperformance is indeed dependent on the methodology used for assessment.

It is evident that there are mixed results regarding the long-run performance of IPOs. This is mainly because the previous literature on asset-pricing fails to provide a conventionally accepted model of risk adjusted performance that would be able to measure the post-IPO performance. Thus, it remains vague how abnormally poor the post-IPO performance is. Even so, it is obvious that IPOs have quite unattractive performance at the same time when the overall stock market performed well. All in all, long-run performance of IPOs may be the most controversial topic of IPO research, with some researchers supporting the efficient markets point of view and others backing up behind the behavioral point of view. (Ritter and Welch 2002)

3.4 Explanations for the poor long-run performance

According to Ritter and Welch (2002), there are only two semi-rational explanations for the poor long-run performance of IPOs. Miller (1977) provides the first explanation. He assumes that there are short selling constraints, and that individual investors possess diverged future expectations of a firm. The most optimistic investors will be the buyers of the IPO. If there is a great deal of uncertainty about the value of an IPO, the spread between optimistic investors' valuation and pessimistic investors' valuation will be substantially larger. Over time, more information about the firm becomes publicly available, and therefore the variance of opinions decreases between optimistic and pessimistic investors. Consequently, the market price will fall. This explanation is also known to be referred as *the divergence of opinion hypothesis*.

Schultz (2003) offers the second explanation. He examined a phenomenon that he referred to as *pseudo market timing* and show that it can explain the poor long-run performance of IPOs. The premise of pseudo market timing, as Schultz characterizes it, is that the more firms can receive for their equity the

more likely they are to issue new equity even if the market efficiency holds and managers have no timing ability. Therefore, more IPOs snowballs successful IPOs. Thus, the last larger group of IPOs would underperform and be the majority of the whole sample. Schultz' explanation is seemingly close (or the same) as the window of opportunity hypothesis.

Additionally, multitude other of studies has addressed the issue of low post-trading returns of IPOs. Various studies have been able to shed light to the issue and revealed a series of factors that have been documented to account for post-IPO performance, including initial IPO returns (Derrien 2005; Purnanandam and Swaminathan 2004), poor post-IPO accounting performance (Mikkelsen, Partch & Shah 1997), institutional ownership (Houge, Loughran, Suchanek & Yan 2001), underwriter prestige (Carter, Dark & Singh 1998), growth (Pastor & Veronesi 2003) and managerial overconfidence (Bernardo and Welch 2001). Some recent studies argue expected return and idiosyncratic risk (Jiang, Xu & Yao 2009; Ang, Hodrick, Xing, Zhang 2006) in general, showing that idiosyncratic volatility is inversely related to future earnings shocks and this link is induced by the information content of idiosyncratic volatility on future earnings. Further Wei and Zhang (2006) find that on average, corporate earnings have depreciated and their volatilities have increased over the sample period, which is more evident for newly listed stocks than for existing stocks. This finding indicates that volatility evolution itself contains essential information in addition to volatility level.

3.5 The role of firm-specific risk

Firm-specific risk has caught great attention in recent studies. Previous research documents an increase in firm-specific volatility of stock returns over past two decades. Campbell, Lettau, Malkeil & Xu (2001) study illustrates that there has been a noticeable increase in firm-specific volatility relative to market volatility. Accordingly, correlations among individual stocks and the explanatory power of the market model for a typical stock have declined. In the paper they confirm and update Schwert's (1989) finding that market volatility has no significant trend using monthly data from 1926 to 1997. When estimating market, industry and firm-level variances using daily GRSP data spanning from 1962 to 1997, they found that market and industry variance have been fairly stable in the sample period. Interestingly, firm-level variance though, displays a large and

significant positive trend, more than doubling in past four decades. As a conclusion of the paper, it can be said that the market as a whole has not become more volatile, but uncertainty on the level of individual firms has increased substantially. According to Johnson and Marietta-Westberg (2004), this increase is found to be even more dramatic for newly listed firms. They find increase in volatility is over twice as large for IPOs than for firms matched to the IPOs based on size and book-to-market ratio.

Firm-specific risk has been documented to be responsible for a large proportion of total risk. Argue that the high ratio of firm specific risk to total risk indicates that more firm-specific information is incorporated into stock prices (Beneda & Zhang 2009). Roll (1988) observes low R^2 statistics for common asset pricing models due to vigorous firm-specific return variation not associated with public information. Roll (1988) concludes that this implies “either private information or else occasional frenzy unrelated to concrete information variation, measured relative to total variation, is associated with more informative stock prices, where informativeness is defined as how much information stock prices contain about future earnings”. Durnev, Morck, Young and Zarowin (2003) document that firms and industries with lower market model R^2 statistics exhibit higher association between current returns and future earnings, indicating more information about future earnings are included in current stock prices. This supports Roll’s first interpretation: a higher ratio of firm-specific risk to total risk reflects higher information-laden stock prices and, therefore, more efficient stock markets. This positive association with current returns and future earnings appears to have an upward trend ranging from 1983- 1995.

The most important piece of previous literature regarding to the thesis is Benade and Zhang’s (2009) study *Heterogeneous relationship between IPO return and risk across idiosyncratic variance characteristics*. Their study emphasizes the role of firm-specific risk on IPO underpricing and post-IPO performance. This particular paper is used as a benchmark study in the thesis. Benade and Zhang analyze the levels and changes in the post-IPO stock return volatility and provides insight into market responses to the presence of firm-specific risk.

First, they document a negative relation between initial firm-specific volatility level and the post-IPO volatility change in that initially low volatility firms have more volatility increase and vice versa. According to Benade and Zhang this

evidence suggest fundamental firm-specific changes after the IPO. Second, they find that underpricing and short-run post-IPO returns are positively related to the initial and corresponding firm-specific risk level. This evidence suggests that underpricing compensates investor for acquiring costly information and firm-specific information is being incorporated into offer prices, as well as post trading post-trading prices of new public companies. A similar argument was documented by Sherman and Titman (2002), they argue that underpricing offsets the investors' costs of acquiring information. Third, Beneda and Zhang found that higher long-run post-IPO performance is related to both lower initial risk level and decreasing risk in the first year after the IPO. Derrien (2005) links large individual investors' demand to poor long-run performance and Loughran and Ritter (2002) suggest that pre-IPO shareholders are not upset about leaving so much money on the table.

4. DATA AND METHODOLOGY

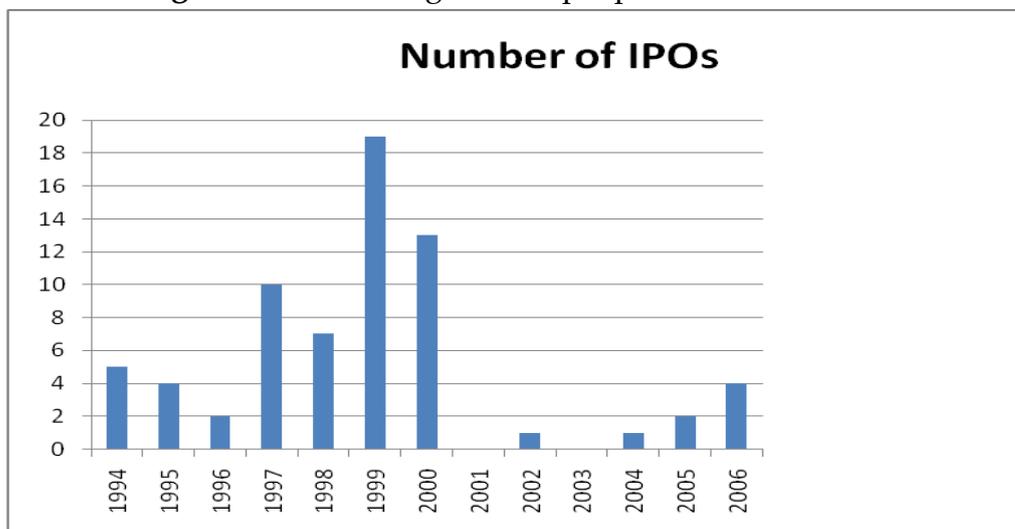
This section briefly presents the data used in this study followed by the methodology. Beneda and Zhang's (2009) novel methods, which are adopted in this study, are described in detail. Typical to similar studies, this analysis adopts a statistical approach and therefore this section also includes a short presentation on how the statistical significance is measured.

4.1 Data

The data for this paper were collected from a couple of different sources. Information related to initial public offerings between 1994 and 2006 were obtained from the database of University of Vaasa. This data provided issuance dates, size of the issues, and subscription prices. The resulting sample consists of 68 IPOs listed in the Helsinki stock exchange. Two IPOs were excluded from the sample because daily return data were not available for the particular companies.

Figure 1 illustrates the distribution of IPOs over the examination period. In cases before 2002, where the values were in Finnish markka (FIM), an exchange rate of 5.94573 was used for conversion into Euros (EUR). Daily time series returns for equities and OMX Helsinki CAP index were assembled from Kauppa-lehti and OMX Group.

Figure 1 IPOs during the sample period



4.2 Methodology

Window sets

The methodology in the thesis follows that used in Beneda and Zhang (2009) paper. This study focuses on 240 trading days after IPO. First, it defines three window sets for the analysis. Initial post-IPO windows under examination are days (1, 30), (1, 60) and (1, 120), where day 1 represents the first trading day of IPO. Correspondingly, the ending windows are days (121, 150), (121, 180) and (121, 240).

The changes in different measures of risk and index adjusted returns are measured across three window sets: days (1, 30) to (121,150), days (1, 60) to (121, 180) and days (1, 120) to (121, 240). First window set is referred as the shortest window set. Second and third windows sets are called the intermediate and the longest window sets, respectively

Initial price changes and index adjusted returns

Initial price changes for IPOs were obtained by calculating the difference between the subscription price and the closing price of the first trading day. Index return for the particular day was attained by calculating the difference between the offering price and the closing price. Then by deducting the market return from the IPO return, index adjusted abnormal return were obtained. Same methodology is used for measuring the returns in each of the windows and the 240-day index adjusted returns.

$$(1) \quad ar_{it} = r_{it} - r_{mt}$$

where : ar_{it} = abnormal return for stock i in period t

r_{it} = return on stock i in period t

r_{mt} = market return in period t

Average index adjusted abnormal returns are then computed as the sum of initial abnormal returns adopted from equation 1:

$$(2) \quad AR_t = \frac{1}{n} \sum_i^n ar_{it}$$

where: AR_t = average abnormal return in period t
 ar_{it} = abnormal return for stock i in period t
 n = the number of stocks

Different measures of risk

Systematic risk is measured by beta obtained by regressing daily returns on the OMX Helsinki CAP index returns over each beginning and ending windows. Firm-specific risk is the variance of residuals from this particular the regression.

The means and medians for changes in selected measures of risk across three window sets are measured for the entire sample. The changes in risk, variance ratios, are calculated by the variance of days (121,150), (121,180), and (121,240) divided by the variance of days (1, 30), (1, 60), and (1,120), respectively. As in, that the ending window variance is divided by the beginning window variance in all three window sets. Variance ratios are calculated for firm-specific risk, total risk and market risk. So a value greater than 1 indicates an increase in the selected measure of risk.

The change in beta and change in index adjusted return (variance ratios are not calculated for beta and returns since these can take on negative values) is computed as the beta/return of the ending windows days (121,150), (121,180), and (121,240) minus the beta/return of the beginning windows days (1,30), (1,60), and (1,120), respectively. Here a value greater than zero indicates an increase in beta or index adjusted return in the ending window.

Cross-sectional analysis

To study the cross-sectional heterogeneity, both two-way and a four-way split sample analyses are adopted. Across groups of high/low variance level and/or variance increasing/decreasing IPO firms, heterogeneous relationships between volatility and underpricing and between volatility and post-IPO performance are investigated. This cross-sectional analysis becomes more familiar in the next section, where the results are discussed.

Statistical significance

T-test assesses the statistical significance of the difference between two independent sample means. T-test is used in the analysis to see whether the changes in variance ratios, index adjusted returns and systematic risk are statistically significant.

$$(3) \quad t = \frac{\bar{D} - \mu_{D_0}}{S_D / \sqrt{n}}$$

Where: \bar{D} = the sample average difference between each pair of observations
 S_D = the sample standard deviation of the differences
 μ_{D_0} = the population mean difference under the null hypothesis
 n = the number of pairs observation

5. EMPIRICAL RESULTS

This section discusses the empirical findings of the paper. The most significant results are presented in the tables and discussed further in writing. The results are compared to the most notable findings of Beneda and Zhang's (2009) paper. First, descriptive statistics of the sample are reviewed. Then, post-IPO volatility movements across different window sets are reported. Under the following subheading, the empirical data is divided into two, based on whether the volatility is increasing or decreasing. Next, the sample is divided into two, based on the initial volatility level. The last subheading, documents the results when the sample is divided into two, based on both the initial volatility level and the volatility change.

5.1 Descriptive statistics of the sample

Table 3 Descriptive statistics of the sample.

year	Number of ipos	Underpricing (mean)	240-day in-dex adjusted return mean	60-day firm-specific risk (mean)	60-day systematic risk
1994	5	15,39 %	5,36 %	0,391	0,495
1995	4	1,17 %	28,66 %	0,071	0,342
1996	2	18,89 %	55,25 %	0,222	-0,021
1997	10	24,14 %	46,77 %	0,934	0,563
1998	7	16,98 %	74,90 %	0,316	0,966
1999	19	36,31 %	28,13 %	2,929	0,920
2000	13	28,40 %	-9,60 %	3,123	0,869
2001	0				
2002	1	-31,06 %	-61,78 %	0,743	-1,670
2003	0				
2004	1	5,91 %	-8,91 %	0,042	-0,286
2005	2	4,38 %	-22,46 %	0,105	0,691
2006	4	4,30 %	61,25 %	0,143	0,456
	68				
	mean	22,24 %	26,22 %	1,648	0,679
	median	4,12 %	-0,55 %	0,231	0,585

Table 3 documents the summary statistics of IPO distribution on a yearly basis, as well as a brief overview on the main variables used in this study. The table

shows that the IPOs are clustered in time, majority of the IPOs occurring 1997-2000 (50 IPOs). Average underpricing, for the whole 68 IPO sample, is 22.24%. However, the average underpricing experiences dramatic changes over the sample period, peaking around the dot com bubble. The most recent IPOs of the sample are substantially less underpriced, on average, than the earlier IPOs of the sample. Keloharju (1993) reported an average underpricing of 8.7% with a sample that included 80 IPOs listed in the Finnish stock exchange between 1984-1989. This finding confirms the notion that underpricings vary to a large extent over the years. Interestingly, the difference between the overall mean underpricing and median underpricing is quite substantial, indicating that the distribution is strongly skewed to the right, even if the outliers are excluded.

Also over the sample period, 240-day index adjusted returns, 60-day firm-specific risk and 60-day systematic risk experience dramatic change. A somewhat strong association between firm-specific risk and underpricing can already be seen from this table. This association is discussed further in the remaining parts of the results.

5.2 Post-IPO volatility movement

Table 4 Changes in risk.

	Systematic risk (beta)	Firm-specific risk variance	Total risk variance	Market risk variance	Index adjusted return
Panel A. Days (121,150)/(1,30)					
1-30days	0,761	3,0520	3,0395	0,0461	21,46 %
121-150days	0,760	0,3286	0,3934	0,0636	-2,97 %
Variance ratio/change:mean	0,000	1,2457	1,2448	2,6508	-24,42 %
t-value	0,004	2,1304	2,1212	-1,8572	3,428
Variance ratio/change:median	0,104	0,6213	0,6422	1,1718	-10,56 %
Panel B. Days (121,180)/(1,60)					
1-60days	0,679	1,6476	1,6781	0,0429	38,89 %
121-180days	0,717	0,4252	0,4744	0,0569	1,33 %
Variance ratio/change:mean	0,037	1,3632	1,3768	1,9058	-37,55 %
t-value	-0,461	1,923	1,910	-2,318	2,721
Variance ratio/change:median	0,040	0,8485	0,9638	1,3748	-14,44 %
Panel C. Days (121,240)(1,120)					
1-120days	0,732	1,015	1,0835	0,0471	21,42 %
121,240days	0,723	0,432	0,4880	0,0578	-1,43 %
Variance ratio/change:mean	-0,008	1,4081	1,4415	1,5612	-22,85 %
t-value	0,128	1,733	1,720	-2,233	2,802
Variance ratio/change:median	-0,008	1,1652	1,1601	1,1759	-22,70 %
Panel D. (240days) risk/return					
	0,767	0,7319	0,7858	0,0526	26,22 %

Table 4 reports the means and medians for changes in selected measures of risk across the three window sets for the entire sample. To better examine these changes, like already stated in the methodology section, three beginning post-IPO windows are defined: days (1, 30), days (1, 60) and days (1, 120). Corresponding ending windows are defined as following: days (121, 150), days (121,

180) and days (121, 240). The changes in risk are measured across three window sets: days (1, 30) to (121,150), days (1, 60) to (121, 180) and days (1, 120) to (121, 240). Table 4, panels A-C, respectively, correspond to these three window sets.

Table 4 shows the general picture of the aftermarket volatility behavior. Firstly, the results indicate that firm-specific risk accounts for the major part of the total risk. This finding is consistent with Beneda and Zhang (2009), and Durnev et al. (2001, 2003). Secondly, also consistent with Beneda and Zhang, the mean variance ratios for firm-specific risk and total risk are greater than one for all window sets, indicating that the after-market firm-specific risk increases for the sample overall. This finding gives an answer to the first research question of the paper “what is the trend of post-IPO firm-specific risk behavior”. Statistical significances for the variance increases are somewhat low for the two longer window sets. Later in the following table, it can be observed that the volatilities behave quite differently when examined cross-sectionally. This methodology also improves the significance levels.

Thirdly, according to the t-values, the market risk increases significantly across the two longer windows. However, despite the increase in market risk, the systematic risk remains somewhat constant across the same windows. This may be interpreted partly that the firm-specific risk increases and the explanatory power of beta decreases.

Table 4 also presents, not surprisingly, that the index-adjusted returns decline substantially from the beginning window to the ending window. Index adjusted returns overall, become a more relevant issue when the sample is divided into different sub groups.

5.3 Increasing versus decreasing volatility firms

Table 5 Risk and return characteristics of firms with increasing versus decreasing idiosyncratic volatility.

	Days (1,30) to(121,150)		Days(1,60) to (121,180)		Days(1,120)to(121,240)	
	Var inc-reasing	Var dec-reasing	Var inc-reasing	Var dec-reasing	Var inc-reasing	Var dec-reasing
Number of firms	21	47	31	37	39	29
Panel A. Risk measures						
Beginning window firm-specific variance	0,223	4,316	0,261	2,810	0,288	1,994
Ending window firm-specific variance	0,580	0,216	0,579	0,296	0,565	0,252
Firm-specific variance ratio:mean	3,116	0,410	2,445	0,457	2,124	0,445
t-value	3,720	-2,254	5,037	-2,224	3,928	-2,363
Beginning window systematic risk (beta)	0,670	0,801	0,644	0,709	0,589	0,924
Ending window systematic risk	0,873	0,710	0,706	0,725	0,713	0,736
Panel B. Underpricing and index adjusted returns						
Underpricing	1,64 %	32,02 %	6,53 %	36,14 %	6,45 %	44,42 %
Beginning window index adjusted return	-7,56 %	34,42 %	15,06 %	58,85 %	16,84 %	27,59 %
Ending window index adjusted return	-2,62 %	0,26 %	4,68 %	-1,47 %	1,33 %	-5,15 %
t-Value difference paired means	-0,750	-3,453	0,990	-2,588	-1,315	-3,074
Index adjusted return over 240days	-3,69 %	39,59 %	36,50 %	17,61 %	25,55 %	27,13 %
Median	-28,63 %	12,13 %	12,13 %	-9,35 %	0,53 %	-8,91 %

From the results reported in the previous table we noticed that for the entire sample of IPOs, the increases in firm-specific risks are statistically quite low for the two longer window sets. But in table 5, when the sample is divided into two sub-samples across the three different window sets with the respect of variance

change, the variance ratios become a lot more significant. The increases of firm-specific risk had t-values of 3.720, 5.037 and 3.928 for the respective window sets: (days 1, 30 to 121, 150), (days 1, 60 to 121, 180) and (days 1,120, 121,240), all statistically significant at 1 % level. The decreases of firm-specific risk were not as significant as the increases were. However, all the t-values are significant at 5 % level, the respective t-values are -2.254, -2.224 and -2.363.

It can be observed that variance increasing firms have lower initial variance level on average, with an ending window variance level very close to the beginning window variance level of variance decreasing firms. Beneda and Zhang also found an opposite trend, which could not be found in this sample. They interpret this finding that the market may be adapting to critical information about the possible changes in firm specific risk. It is also possible that the market participants' price responses in the beginning window IPO aftermarket could be inaccurate which could result in unpredictable volatility patterns. The market has a tendency to correct these patterns as the time goes by.

Table 5 also documents evidence on how the systematic risk changes across the three window sets. Firms with increasing volatilities have relatively smaller beginning window systematic risk than firms with decreasing volatilities. Volatility increasing firms also have increasing systematic risk across all window sets. Whereas, volatility decreasing firms, also experience a decrease in systematic risk in the shortest and in the longest window sets.

Beneda and Zhang's findings were quite similar considering the systematic risk. However, one noteworthy difference can be found from table 5. They reported that the volatility increasing firms' systematic risk remains fairly constant. Whereas, according to this study, the volatility increasing firms also experience an increase in systematic risk. Beneda and Zhang interpret their finding consistent with the notion that firm-specific risk may account for the major part of total risk. Like already stated in this study, firm-specific risk also accounts for the major part of total risk, but it seems that systematic risk might have a larger effect in a thin security market as the Finnish stock market.

Table 5, Panel B documents decrease in index-adjusted returns in all sub-samples, apart from one exception. The sub-sample of variance increasing firms in the shortest window set, in which the ending window return is better than

the beginning window return. However, this difference is not statistically significant. In addition, this particular sub-sample is the only one to report negative index adjusted returns (- 7.56%) in the beginning window. All the other five sub-samples document positive index-adjusted returns in the beginning window. The ending window returns appear to be similar in the two longer window sets. Variance increasing (decreasing) firms report positive (negative) index-adjusted returns.

Panel B also reports that variance decreasing firms are notably more underpriced than the variance increasing firms. Beneda and Zhang found that the initial volatility level is more important in explaining the underpricing than the volatility change. Therefore, the underpricing issue will be discussed further, when the initial variance levels are taken into consideration.

5.4 Implications of the initial volatility level

Table 6 Risk and return characteristics of firms with low versus high idiosyncratic volatility.

	Days (1,30) to(121,150)		Days(1,60) to (121,180)		Days(1,120)to(121,240)	
	Low Var	High Var	Low Var	High Var	Low Var	High Var
Number of firms	34	34	34	34	34	34
Panel A. Risk measures						
Beginning window firm-specific variance	0,126	5,978	0,122	3,173	0,119	1,911
Ending window firm-specific variance	0,171	0,486	0,244	0,606	0,192	0,671
Firm-specific variance ratio:mean	1,742	0,749	1,843	0,883	1,729	1,188
t-value difference paired means	1,254	-2,211	2,323	-2,076	2,205	-1,884
Median	0,714	0,402	1,442	0,577	1,185	0,960
Beginning window systematic risk (beta)	0,508	1,014	0,451	0,965	0,398	1,065
Ending window systematic risk	0,611	0,910	0,469	0,908	0,459	0,987
Panel B. Underpricing and index adjusted returns						
Underpricing	2,02 %	43,26 %	3,24 %	42,05 %	4,64 %	40,65 %
Beginning window index adjusted return	1,06 %	41,86 %	4,16 %	73,62 %	4,80 %	38,05 %
Ending window index adjusted return	-2,44 %	-3,49 %	0,50 %	2,17 %	3,36 %	-6,22 %
t-Value difference paired means						
Index adjusted return over 240days	17,24 %	35,20 %	12,88 %	39,56 %	10,54 %	41,90 %
Median	-2,21 %	-0,08 %	-2,21 %	-0,08 %	-6,46 %	11,67 %

Table 6 aims to establish the implications of the initial volatility level. Moreover, if there are heterogeneous patterns of volatility change, underpricing, and aftermarket IPO performance across IPOs of different initial volatility levels. The sample of IPOs is divided into two equally sized sub-samples based on the median variance of the three beginning windows. The previous table investigates the return volatility behavior of firms with increasing versus decreasing volatili-

ties. Whereas, table 6 investigates return volatility behavior of two sub-samples of high versus low volatility firms.

Because of the sample construction, the mean variances for these two sub-samples (Panel A) are substantially different at the beginning windows. Interestingly, the difference between the mean variances at the ending windows are still dramatic, however the differences shrink. Characteristic for low variance firms across all window sets is that they experience an increase in volatility according to the variance ratios. The t-statistics shows that the increase is not significant for the shortest window firms, yet the increases of two longer windows are statistically significant at 5 % level for the two longer windows. On the contrary, the firms of high initial variance show significant variance decrease over the first two window sets. The 120-day high variance sub-sample show little change in variance according to variance ratio (1.188).

It is clear that the firms with lowest beginning window volatilities had the highest increases at the ending window volatilities, on average. The firms of the low variance sub-samples also had lower systematic risk which increases only a little in the ending window. The firms of the high variance sub-samples have a considerably larger systematic risk, but reducing systematic risk at the ending window. This finding is similar to Beneda and Zhang finding, which they interpret as an indication that firm-specific risk dominates over the market risk.

Table 6, Panel B, show how the initial volatility level affects on underpricing and aftermarket performance. The firms with the highest average of 30, 60, 120 day firm-specific variance experience by far the most dramatic underpricing (an average of 43.26 %, 42.05 % and 40.65 %, respectively). The results indicate a strong association between underpricing and initial variance level. These results are almost identical with Beneda and Zhang paper.

They also find a negative relation between volatilities and ending window adjusted returns and adjusted returns for the whole 240-day period. In this study, the results about those associations are not as clear. Considering the association between volatilities and ending window adjusted returns, a negative association can be found for the shortest and for the longest window sets. However, the intermediate window set (days 1,60 to 121,180) shows positive relation. At first glance, when looking at the 240-day index adjusted returns it appears that

there is a positive association between volatilities and the returns. High volatility firms have higher 240-day index adjusted returns in all sub-samples than the respective low variance sub-sample firms. However, if the first day returns were excluded (underpricing) that would result closer to a negative association between the volatilities and 240-day index-adjusted returns. The firms with lowest underpricing are beating the market after the first day of trading until the 240th trading day, on average. Whereas, the most underpriced firms are not collecting superior returns after the first day of trading. For an illustrative example, if an investor bought a severely underpriced IPO stock after first day of trading, it would not most likely get superior returns in 240-day time-span. But buying a less underpriced IPO after the first day of trading could be a lucrative investment decision.

5.5 Implications of both initial volatility level and change

Table 7 Four-way split sample analysis.

Panel A. Days (1,30) to (121,150)				
	High and increasing volatility firms	High and decreasing volatility firms	Low and increasing volatility firms	Low and decreasing volatility firms
Number of firms	7	27	14	20
Firm-specific volatility (1-30days)	0,460	7,408	0,104	0,142
Firm-specific volatility (121-150days)	1,126	0,320	0,307	0,077
Firm-specific volatility (1-240days)				
Increase in firm-specific volatility (1,30 to 121,150)	1,472	-0,697	2,438	-0,445
t-value	3,013	-2,314	3,013	-6,578
Systematic risk (beta) (1-30 days)	0,955	1,029	0,528	1,078
Systematic risk (beta) (121-150 days)	0,894	0,914	0,863	-0,029
Underpricing	1,05 %	54,20 %	1,94 %	2,08 %
Median	-2,95 %	24,84 %	1,79 %	1,42 %
Index adjusted return (1-30 days)	-17,68 %	57,29 %	-2,49 %	3,54 %
Median	-13,71 %	34,32 %	-4,46 %	1,42 %
Index adjusted return (121-150 days)	-26,23 %	2,40 %	-2,16 %	-2,63 %
Median	-34,41 %	-1,44 %	-5,30 %	-5,82 %
t-value	0,851	-3,468	0,084	-1,305
Index adjusted return (1-240 days)	-43,18 %	55,53 %	16,06 %	18,07 %
Median	-38,99 %	21,98 %	5,84 %	-9,13 %
Panel B. Days (1,60) to (121,180)				
	High and increasing volatility firms	High and decreasing volatility firms	Low and increasing volatility firms	Low and decreasing volatility firms
Number of firms	11	23	20	14
Firm-specific volatility (1-60days)	0,531	4,437	0,112	0,136
Firm-specific volatility (121-180days)	0,983	0,426	0,358	0,082
Firm-specific volatility (1-240days)				
Increase in firm-specific volatility (1,60 to 121,180)	0,969	-0,636	1,706	-0,390
t-value	4,554	-2,280	3,130	-5,036
Systematic risk (beta) (1-60 days)	0,958	0,884	0,472	0,421
Systematic risk (beta) (121-180 days)	0,919	0,986	0,589	0,296

Underpricing	12,33 %	56,26 %	3,34 %	3,08 %
Median	7,95 %	21,75 %	2,21 %	0,59 %
Index adjusted return (1-60 days)	22,57 %	98,04 %	10,94 %	-5,53 %
Median	15,90 %	39,96 %	4,04 %	-3,46 %
Index adjusted return (121-180 days)	2,70 %	1,91 %	5,77 %	-7,02 %
Median	-26,29 %	2,27 %	-7,20 %	-5,15 %
t-value	-0,871	-2,705	-0,483	-0,250
Index adjusted return (1-240 days)	51,52 %	33,84 %	28,23 %	-9,04 %
Median	-25,96 %	0,53 %	14,84 %	-18,66 %
Panel C. Days (1,120) to (121,240)				
	High and increasing volatility firms	High and decreasing volatility firms	Low and increasing volatility firms	Low and decreasing volatility firms
Number of firms	16	17	23	12
Firm-specific volatility (1-120days)	0,525	3,315	0,122	0,123
Firm-specific volatility (121-240days)	1,010	0,372	0,256	0,081
Firm-specific volatility (1-240days)				
Increase in firm-specific volatility (1,120 to 121,240)	1,108	-0,694	1,284	-0,358
t-value	3,267	-2,482	3,062	-5,048
Systematic risk (beta) (1-120 days)	0,854	1,299	0,404	0,393
Systematic risk (beta) (121-240 days)	0,933	1,068	0,560	0,267
Underpricing	10,38 %	70,31 %	3,71 %	7,73 %
Median	3,05 %	41,55 %	1,71 %	5,52 %
Index adjusted return (1-120 days)	37,37 %	38,91 %	2,55 %	11,56 %
Median	14,18 %	31,28 %	-4,21 %	19,44 %
Index adjusted return (121-240 days)	-50,07 %	0,45 %	11,09 %	-13,08 %
Median	-35,78 %	-5,25 %	-5,72 %	-11,32 %
t-value	-2,448	-2,250	0,711	-2,657
Index adjusted return (1-240 days)	39,67 %	45,27 %	15,72 %	1,44 %
Median	2,53 %	21,98 %	0,53 %	-9,13 %

Table 7 takes the effects of both volatility level and volatility change into consideration at the same time. To isolate the contribution of these two factors, a four-way split sample is adopted. First, the sample is divided into two equally sized sub-samples based on the median volatility levels in the three beginning windows (same as table 6). Then, each of these two sub-groups is divided further into two groups based on whether the volatility is increasing or decreasing.

Consequently, the entire sample is divided into four sub-samples across the three window sets: (1) firms with beginning window high and increasing volatility, (2) beginning window high and decreasing volatility, (3) firms with beginning window low and increasing volatility, and (4) firms with beginning window low and decreasing volatility.

Table 7 reports the findings for these four sub-samples, their firm-specific risk, systematic risk and index adjusted returns across three window sets. Underpricing and 240-day index adjusted returns are also reported for each sub-sample. The t-values show that the changes in firm-specific risk in all four sub-groups are significant at least in 5 % level across the three window sets (Panels A-C). It is obvious that firms with decreasing variances have higher beginning window variances than the firms with increasing variances.

Table 7, Panel A, documents that only seven firms of the 34 firms in the 30-day high volatility group, have increasing volatility across the shortest window set (days 1,30 to 121,150). Those 7 firms experience an average of 147.2% increase in firm-specific risk (t-value 3.013). The majority (27 out of 34) of the 30-day high volatility category experience an average decrease of -69.7% (t-value -2,314) in firm-specific risk. The 30-day low volatility firms are more evenly spread into increasing (14 firms) and decreasing (20 firms) volatility categories than the high volatility firms. The increases and decreases had t- values 3.013 and -6.578, respectively. Both of the high volatility groups have relatively high systematic risk and decreasing systematic risk in the ending window. Low and increasing firms had relatively low and increasing beta, whereas low and decreasing volatility firms experienced an opposite trend.

Beneda and Zhang findings suggest that the underpricing is associated with post-trading level of volatility but not the change in volatility. Table 7, Panel A, indicates that the underpricing is related to both the initial volatility and the volatility change. 27 firms of the high and decreasing volatility group have an average of 54.2% underpricing. The remaining 7 firms are only little underpriced, 1.1% on average. However, it should be noted that the sample is too small to make any conclusive assumptions. Underpricing is also very moderate across the two groups in the 30-day low volatility sub-sample. The low and increasing volatility and low and decreasing volatility firms have average underpricing 1.94% and 2.08%, respectively.

According to table 7, panel A, the worst average beginning window, ending window and 240-day index adjusted return is associated with high initial volatility level and increasing volatility in the ending window. Those seven firms in that particular category document average of -17.68%, -26.23% and -43.18% for the respective index adjusted returns. Decreasing volatility firms, regardless of initial volatility level, have declining index adjusted returns in the ending window. Whereas, low and increasing volatility firms show slight improvement in the ending window. All the three sub-groups, apart from the high and increasing volatility firms, have positive 240-day index adjusted returns. However, the high and decreasing volatility firms' 240-day index adjusted return (55.53%) would be close to the market return, if the first day closing price was used as a reference point. The 30-day low volatility firms seem to outperform the market index, whether the volatility change is increasing or decreasing. The low and increasing volatility firms and the low and decreasing volatility firms have average 240-index adjusted returns of 16.06% and 18.07%, respectively.

Table 7, Panel B, documents the result of the intermediate window set (days 1,60 to 121,180). The findings are somewhat similar with Panel A. Firstly, as mentioned earlier, the volatility increases and decreases are significant in all four sub-groups. Secondly, the changes in systematic risk have the same patterns in three sub groups as they did in panel A. The group of high and decreasing volatility firms, surprisingly, has increasing systematic risk in the ending window. Thirdly, the most notable underpricing is still found in the high and decreasing firm category, in which they report an average of 56.26% underpricing. However, the underpricing is also evident in the high and increasing volatility category (12.33%), if the group was divided into two based on the 60-day median volatility level and further into four based on the volatility change in the ending window.

Lastly, the most significant difference between the results of Panel A and Panel B arises from the index adjusted returns. The average 240-day index adjusted return in high and increasing volatility firms have changed from -43.8% to 51.2%. But when looking at the respective changes in median returns (from -39.99% to 25.96%), it is still obvious that most of the firms in this sub-group perform poorly in the first 240 days of trading.

Panel C documents the results of the longest window set (days 1,120 to 121,240). Here again the changes in volatilities are significant in all of the four sub-groups. The changes in systematic risks move in line with the changes of firm-specific risks, as in volatility increasing (decreasing) firms also have increasing (decreasing) systematic risk, inconsistent with Beneda and Zhang. This finding may be explained partly with a small sample size and the fact that systematic risk could account for more of the total risk in the thin security markets.

In the longest window set the underpricing phenomenon is even more evident with the high and decreasing volatility firms. Their average underpricing is astonishing 70.31%. The high and increasing volatility category experience dramatic changes in their first 240 days in the stock exchange. First, they are underpriced 10,38%, on average, making them second most underpriced sub-group in this window set. Second, they perform well in the beginning window (37.37%), but crash in the ending window (-50.07%). According to Panel C, the largest sub-group is the low and increasing volatility firms (23 firms). They are the least underpriced issues and they perform the best, 11.09 % on average, in the ending window.

6. SUMMARY AND CONCLUSIONS

The purpose of this paper is to investigate the effects of post-IPO firm-specific volatility level and volatility change on IPO-underpricing and post-IPO performance, cross-sectionally for new public companies in Finland. Three research questions are raised to address the focus of the study. First, what is the trend of post-IPO firm-specific volatility behavior? Second, how are the post-IPO return volatility levels and changes in return volatility related to the IPO underpricing? Third, how is the long-run post-IPO performance related to return volatility level and change?

In general, the results show an increase in firm-specific volatility, answering the first research question. However, the results indicate heterogeneous patterns in volatility evolution, when examined across high/low volatility firms or firms with increasing or decreasing volatilities. A negative association was found between the initial firm-specific volatility level and the post-IPO volatility change, in that initially low volatility firms experience volatility increase and vice versa. This finding is consistent with Beneda and Zhang (2009), which can be interpreted that the market may be adapting to critical information about the possible changes in firm-specific risk.

The results indicate a strong association between high initial firm-specific volatility and underpricing. This finding is almost identical with Beneda and Zhang's paper. However, when the sample is divided into four sub-samples based on both the initial volatility level and volatility change, the results are inconsistent with the earlier literature. Beneda and Zhang document that the underpricing is related only to the high initial volatility level, not the change in volatility. Whereas, this study argues that the underpricing is related to both high initial volatility and subsequent decrease in volatility.

According to numerous previous studies, it is reasonable to say that IPOs are lucrative investments for their subscribers, on average. The question is what happens after the first day of trading? Some argue that IPOs are poor investments in the long-run, and the others disagree. This paper attempts to find how the long-run aftermarket performance is related to initial volatility level and change. If the first day returns are excluded, the initial low volatility firms seem

to outperform the high volatility firms in the first 240 trading days. Furthermore, low and increasing volatility firms are far better performers than the low and decreasing volatility firms. Whereas, Beneda and Zhang find that the best performance in the long-run is related to low initial volatility level and decreasing volatility in the first year after IPO. It should be noted that this study has examined only 68 IPOs, so it may be misleading to do any generalizations.

Yet, there may be lucrative investment strategies concerning IPOs. Firstly, if you can, you should always subscribe an IPO, because of its great upside potential on the first day of trading. How to pursue after the first day of trading is dependable on the underpricing. Highly underpriced issues do not perform well in the long-run, so those shares should be sold after the first day. IPOs that are only little underpriced are low initial volatility firms and therefore have a better chance in beating the market index. However, the firms in the low and decreasing volatility category, like already stated, do not gain superior returns in the long-run.

The results also confirm previous findings that firm-specific risk accounts for the major part of total risk. Interestingly, one exception considering the role of systematic risk was found between this study and Beneda and Zhang's study. They reported that firms with increasing firm-specific risk have fairly stable systematic risk. Whereas, according to the empirical findings of this paper, the firms with increasing firm-specific risk also experience increase in systematic risk. Thus, it seems that systematic risk has a larger effect on total risk in a thin security market as Finnish stock market.

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APPENDIX

Data sample used in the study

IPO date	Company
28.4.1994	Lounais-Suomen Sähkö (Länsivoima)
11.7.1994	Santasalo-JOT (Componenta)
27.9.1994	Raute
10.11.1994	Kemira
24.11.1994	Espoon Sähkö
1.6.1995	Nokian Renkaat
14.6.1995	Suunto
27.6.1995	Rauma
27.11.1995	Neste
27.3.1996	KCI Konecranes International
19.7.1996	Kauppakaari
3.4.1997	PK Cables (PKC Group)
24.4.1997	Nordic Aluminium
28.4.1997	Keski-Suomen Puhelin (Yomi)
5.5.1997	Incap
9.6.1997	Kyro (Glaston)
17.6.1997	Rocla
25.11.1997	Helsingin Puhelin
26.11.1997	Elcoteq Network
2.12.1997	Jaakko Pöyry Group
9.12.1997	Metsä Tissue
30.4.1998	A-Rakennusmies (Ramirent)
15.5.1998	PMJ automec (Cencorp)
1.6.1998	Sponda
15.9.1998	JOT Automation Group (Elektrobit)
17.11.1998	Sonera
4.12.1998	Rapala Normark (Rapala VMC)
18.12.1998	Fortum
11.3.1999	Janton
12.3.1999	Marimekko
15.3.1999	TJ Group
23.3.1999	Eimo
30.3.1999	Teleste
12.4.1999	Stonesoft
1.6.1999	Nedecon (Oral Hammaslääkärit)
8.6.1999	Technopolis
18.6.1999	Biohit

22.6.1999 Perlos
6.7.1999 Sanitec
6.9.1999 TH Tiedonhallinta (Solteq)
27.9.1999 SysOpen Digia
28.9.1999 Tieto-X (Ixonos)
8.10.1999 Liinos (Visma Software)
15.10.1999 Proha
22.10.1999 Aldata Solution
5.11.1999 Data Fellows (F-Secure)
9.12.1999 Comptel
29.2.2000 BasWare
15.3.2000 Satama Interactive (Trainer's House)
10.4.2000 Saunalahti
27.4.2000 Etteplan
22.5.2000 Tekla
22.5.2000 Wecan Electronics (Scanfil)
29.5.2000 Iocore (Sentera)
19.6.2000 Done Solutions
29.6.2000 Biotie Therapies
30.6.2000 Tecnomen
3.7.2000 Okmetic
14.12.2000 Vacon
20.12.2000 SSH Communications Security
8.3.2002 QPR Software
14.10.2004 Kemira GrowHow
18.4.2005 Neste Oil
27.5.2005 AffectoGenimap
13.3.2006 Salcomp
14.3.2006 Ahlstrom
13.4.2006 FIM Group Oyj2006
10.10.2006 Outotec