The Activity of the Underwriter in Initial Public Offerings, Evidence from the Limit Order Book of the Helsinki Stock Exchange.

Joakim Westerholm
Swedish School of Economics and Business Administration, Finland

Abstract

In this paper the initial public offerings [IPOs] in Finland during the 90's are examined. The purpose is to detect the typical behaviour of the underwriters in respect to their activity in bidding for the stock and asking to sell the stock in the limit order book on the Helsinki Stock Exchange. Based on previous research we look at the distribution of the returns, bid-ask spreads and underwriter activity in the IPO stocks. In line with earlier studies we find positive skewness and high kurtosis in the distribution of returns as well as widening bid-ask spreads over time. We find that the presence of the underwriters in the aftermarket is higher than expected during the first trading days of the IPOs and unevenly distributed between bid and ask. We propose that the purpose of this presence is to provide liquidity and to support the IPOs in the aftermarket. The underwriters in our sample are net buyers while they are entering passive buy orders and active sell orders. The underwriters appear to be reluctant to initiate purchases perhaps to emphasise their presence on the bid and this behaviour is also consistent with an attempt to close short positions taken against overallotment options. We estimate that one third of the observed underpricing of 4.7 percent has been sustained in the aftermarket by the underwriters.

Keywords: IPO; Market microstructure; Price support; Stabilization; Limit order book
JEL Classification: G14, G24

We are grateful for comments obtained at the 5th Annual Conference of the Multinational Finance Society, 1998, Helsinki, Finland. The author can be contacted at: Swedish School of Economics and Business Administration, PO Box 479, Fin-00101 Helsinki, Finland. Phone: (+358)-9-431331, Fax:(+358)-9-43133393, e-mail: joakim.westerholm@shh.fi

The Activity of the Underwriter in Initial Public Offerings, Evidence from the Limit Order Book of the Helsinki Stock Exchange.

In this paper the initial public offerings [IPOs] in Finland during the 90's are examined. The purpose is to detect the typical behaviour of the underwriters in respect to their activity in bidding for the stock and asking to sell the stock in the limit order book on the Helsinki Stock Exchange. Based on previous research we look at the distribution of the returns, bid-ask spreads and underwriter activity in the IPO stocks. In line with earlier studies we find positive skewness and high kurtosis in the distribution of returns as well as widening bid-ask spreads over time. We find that the presence of the underwriters in the aftermarket is higher than expected during the first trading days of the IPOs and unevenly distributed between bid and ask. We propose that the purpose of this presence is to provide liquidity and to support the IPOs in the aftermarket. The underwriters in our sample are net buyers while they are entering passive buy orders and active sell orders. The underwriters appear to be reluctant to initiate purchases perhaps to emphasise their presence on the bid and this behaviour is also consistent with an attempt to close short positions taken against overallotment options. We estimate that one third of the observed underpricing of 4.7 percent has been sustained in the aftermarket by the underwriters.

Keywords: IPO; Market microstructure; Price support; Stabilization; Limit order book

We are grateful for comments obtained at the 5th Annual Conference of the Multinational Finance Society, 1998, Helsinki, Finland.

1. Introduction

In the vast initial public offering [IPO] research literature we identify at least four important empirical works that can be followed up in the study of the aftermarket behaviour of IPO stock. Ruud (1993) introduces stabilization as one explanation for the underpricing of IPOs. Hanley Kumar and Seguin study the development of the bid ask spread of IPOs after the issue. Schultz and Zaman (1994) look at the behaviour of underwriters in the aftermarket of IPOs and Aggarwal (1998) points to the importance of the agreement between underwriter and issuing company for the pricing process of IPOs.

Using data from the IPO market in Finland during the 1990s we apply the methods introduced in the four papers above. With higher quality intra-day trading and limit order book data we improve some of the methods suggested by Ruud (1993), Hanley, Kumar, Seguin (1994) and Schultz, Zaman (1994). The higher detail of data is offset by a lower frequency of IPOs than the studies on US data. A new approach to detecting the effects of underwriter trading is introduced.

2. Literature

The hypothetical explanations for under pricing of IPOs that have been presented in the literature can be divided in at least 11 groups. They are: (1) Asymmetric information or the investment banker's monopsony power, (2) Winner's curse, (3) Costly information acquisition, (4) Cascades, (5) Signalling, (6) Legal liability or lawsuit avoidance, (7) Regulatory constraint, (8) Wealth redistribution, (9) Ownership dispersion, (10) Market incompleteness and (11) Stabilization. In Ibbotson and Ritter (1995) a complete overview of the literature in the area is presented. Four important empirical papers for the study of underwriter activity in the aftermarket for IPOs are Ruud (1993), Hanley Kumar and Seguin, Schultz and Zaman (1994) and Aggarwal (1998).

On 1982 and -83 US data on 469 IPOs Ruud (1993) finds that the distribution of initial returns following IPOs shows that positive mean initial returns may reflect the existence of a partially unobserved left (negative) tail. Most of the IPOs in Ruud's sample with zero one-day returns subsequently fall in price, suggesting that underwriter support may account for

the skewed distribution and hence the observed positive average initial IPO returns, even if the offering prices are set at expected market value. Ruud (1993) is the first to challenge the presumption underlying previous research that positive average initial IPO returns result primarily from deliberate underpricing.

Using 1,523 NASDAQ traded firm commitment IPOs issued between 1982 and 1987 Hanley, Kumar & Seguin (1993) find that bid-ask spreads narrow when the market price is close to the offer price and stabilization of the IPO is most likely. Significant negative returns are documented after the hypothesised termination of stabilizing activities, suggesting that stabilization and its cessation affect market prices.

Schultz and Zaman (1994) study the aftermarket for 72 NASDAQ firm commitment IPOs from 1992 using comprehensive trade and quote data from every market maker for the first three days of trading. Schultz and Zaman find: underwriters quote higher bid prices than other market makers for issues that commence trading at or below the offer price; underwriters repurchase large quantities or stock in the aftermarket without risk by overselling the issue by the amount of the overallotment option; if the IPO is hot, the overallotment option is exercised, if not, the short position is covered by purchase of the higher supply of stock in the aftermarket.

Aggarwal (1998) have access to records of underwriter activity from the lead underwriters of issues in the US during May, June and July 1997. Under new SEC rules introduced in April 1997, lead underwriters are required to keep records on syndicate covering transactions and penalty bids in addition to records of pure stabilization bids. For 114 of the 137 offerings included in the test Aggarwal has details on short covering transactions and whether penalty bids where part of the contract and if they actually were assessed. The major findings include that no direct stabilizing bids to provide support are posted by the underwriters and this is true for a longer control period in 1997 as well. In more than half of the IPOs a short position is established and then covered in the after-market with an average of 10.75 percent of shares offered. It takes on average 16.58 days and 22.05 transactions that result in a loss of 3.61 percent of underwriter compensation to cover the short position. The average underwriter compensation - the underwriter spread - is 6,95 % of the issued capital. Penalty bids are typically assessed in weak offerings (in 25 percent of the issues investigated).

Aggarwal finds that aftermarket support appears to have a permanent long-term effect on the return on IPOs. The stronger issues have no short covering in the aftermarket trading and tend to stay strong, drifting from a mean cumulative market-adjusted return of 23 percent on day one to a 28 percent return 20 days after the issue. For weak IPOs with short covering the return is 8 percent on day one followed by a downward drift between days five and ten, settling around 8 percent on day 20. The mean return on the weak issues rise to 14 percent by day 40.

3. The market for IPOs in Finland

During the 1980's the common practice in Finland was to list new companies on a separate list for smaller companies or on the OTC market. The markets for new small issues were active, but the long term performance of the issues were typically weak and few companies grew enough to be transferred to the main board as originally planned. Some companies even delisted and went back under control by the old owners when the listing wasn't as successful as hoped. The initial public offerings during the 1990's have generally been significant companies, listing on the main board of the Helsinki Stock Exchange. New more serious marketing and book building procedures involving international investment banks have become common practice. The offerings listed in the beginning of the decade have not been strong performers in the after-market, while several of the later issues have showed substantial initial returns. Towards the end of '97 the market for new issues grew quieter and the most recent issues drifted down from the offer price. A few strong performing issues have been listed during '98. It is interesting to note that the new issue market revives during the later stages of a bull market, while there were no new issues in the depressed first years of the 90's. The sizes of the issues range from 46 million FIM to 6,262 million FIM, with an average at 831 million FIM. During their first year of trading the IPOs issued after 1990 had a share of the total market trading volume ranging from 7.3 % to 0.04 %, with a total for all issues of 17.1 % of the total market volume. Thus the importance of the IPOs for the Finnish stock market is significant. In table 1 the IPOs on the Finnish market during the period 1990 to 1998 are listed, including issue date, issue size before overallotment, overallotment size, overallotment used and market share of the stock in the aftermarket during the first year. The

overallotment sizes are reported since they are an important source of information used in the following analysis of underwriter activity.

4. The role of the underwriters and the dynamics of an IPO

It is commonly reported by issuing firms that an equity offering has been many times oversubscribed. This applies to fixed priced offerings as well as offerings where the book building method is used. Furthermore, returns of IPOs have been reported to be abnormally positive. Thus the allocation of shares of such oversubscribed issues represents an allocation of wealth. The underwriter plays an equally central role in the allocation of the shares as in the pricing of the issue. The legal environment sets out how allocation can be made on each market. In many countries underwriters are legally bound to allocate shares evenly to subscribers and in others the issuing companies board of directors decide on the allocation. Under the U.S. securities regulations underwriters can determine both offer price and share allocation in a book building offering. The U.S. issuance method has become common in many countries, including Finland. The underwriters allocation strategies are distinctly different from those of the issuing company. The issuers aim is to maximise proceeds from the offering and to avoid cancellation of the offering. The underwriter aims at securing the flow of underwriting business which it achieves by balancing the interests of the investors and the issuers. The rationale for the use of an underwriter stems from this operation as an intermediary. When a reputed underwriter certifies the offerings it undertakes, the information asymmetry between the issuer and the investor is reduced.

IPOs on the Finnish stock market are arranged by (1) securities houses specialised on share issues or by (2) brokerage houses or (3) banks. The underwriter itself may or may not be a member of the Helsinki Stock Exchange. The underwriter handles the book building process which follows the international method of share issuance. Under the book building period the price of the offered stock is determined, usually within a specific range according to the supply and demand for the share. The issue price of most IPOs is negotiated between the Investment Bank underwriting the issue and the company shareholders. A minimum price may be guaranteed by the underwriter. Usually a large part of the responsibility for the pricing is left with the underwriter, who is seen to have the best information on the potential

demand for the stock. It is in the interest of the company to negotiate an agreement that makes it profitable for the underwriter to use this information in the best interest of the company. As a part of the underwriting contract the underwriter may also receive a “green shoe” or an overallotment option contract from the company, that entitles him to buy additional shares from the company at the offering price. If the underwriter has an overallotment option he can choose to sell more shares in addition to the ones originally offered in the issue. The underwriter typically sells these shares short so that he ends up with a deficit of shares. If the IPO is starting to weaken in the aftermarket, this deficit can be covered by buying back shares from the increased flow of sellorders. It is more or less understood that these additional purchases are aimed at stabilizing the stock in the case it weakens. If the demand for the IPO stock stays continuously high however, it is not easy to buy back the shares at a price close to the issue price. The underwriter can then simply exercise his overallotment option to cover his deficit of shares at the issue price. The practice of using overallotment options moderates swings in the aftermarket price of an IPO and gives the underwriter a motive to defend the offering price level. The overallotment option gives the underwriter less incentive to underprice an issue, since if an IPO is largely underpriced it is not likely that any profit will occur in from the short selling of stock. An overallotment option might however also induce the underwriter to not support a positive performance of an IPO as long as the overallotment option is valid, since in the case of the price going substantially above the offer price, the overallotment option is not generating any profit for the underwriter. Thus an overallotment option contract between the underwriter and the issuing company, brings the interests of the company and the underwriter closer to each other and should make the determination of an offering price easier. During the 1990’s most IPOs in Finland have been supported using an overallotment option. The issues where the lead manager is a non Finnish investment bank all tend to have an overallotment option and stabilization policy documented in their prospectuses, while the domestically arranged IPOs tend to not incorporate overallotment options in the underwriting contract. The reason for this is that stabilization is not allowed under Finnish law.

From the above we would expect an underwriter to behave differently when the demand for an IPO is strong. When the demand is strong during the book-building process and in the

aftermarket, the underwriter has to see that the issuing company gets a good price for its shares as well as simultaneously guaranteeing a fair allocation of the shares. Any existing overallotment option can be used and allocated, which will increase the proceeds of the underwriter. Also a wider margin between the issue price and the market price will probably increase the proceeds of the underwriter. The underwriter would thus be seen to underprice a strong issue as much as it can get away with without losing reputation. The underwriter would also be seen selling shares from excess stock actively into a strong market. When the demand is weak during the book-building process and in the aftermarket the underwriter has to guarantee the success of the issue by pricing the share low enough and by using an overallotment option and other available means to support the price. Shares will be allocated to investors closely to the amount they subscribe for. The underwriter would in this situation be present on the bid, restricting the selling to stronger windows in the share price. One of the purposes of this paper is to study the behaviour of the underwriters of IPOs to see if any distinct patterns can be detected.

5. Data, research methodology and findings

5.1 Descriptive statistics and research questions

The empirical evidence presented here is based on intra-day trading data and on the limit order book from the Helsinki Stock Exchange. The intra-day trading data is a log of all trades identifying exact time, stock, amount, price, in-house trades and the buying and the selling broker-dealer company. The limit order book is reconstructed from a log of all entries posted by the brokers into the exchange system using a method developed by Hedvall (1993). The constructed limit order book consists of a log of every schedule in the order book. A new schedule is created each time a revision is made to the register of orders in a particular stock. The limit order book shows the schedule stock by stock and day by day while it is ordered by the time stamp within the day. For a more detailed description of the institutional framework and the trading system of the Helsinki Exchanges, HEX Ltd see appendix 1. The time period investigated is 1994 to 1997. There where 14 IPOs during this period that were listed on the main board of the Helsinki Stock Exchange. In this study limit order book data is analysed for five of these companies. In future studies the same methods

could be applied to a larger sample of IPOs if more data is made available by HEX Ltd.

To identify the trades and orders that are connected to a specific underwriter we assume that the trades are booked by the underwriting company itself when it is a member of the exchange, and by securities broker-dealers with the same parent company as the underwriter when the underwriter is not a member. We regard this as a reasonable assumption since it is unlikely that any underwriter would carry the extra transaction costs from executing its trades through a broker with which it is not associated. One could speculate that underwriter trades might be directed through unassociated brokers to disguise the trades, especially if stabilization is illegal. We regard this possibility as too remote however to motivate an inclusion in the test. Table 2 shows the share offerings under investigation here, the leading underwriter(s) of the specific issue and the broker-dealer associated with each underwriter.

Our specific research questions in this paper are as follows. Is the presence of the underwriter in the aftermarket significant and what is the purpose of this presence, stabilization or a liquidity providing function? Does the underwriter activity have a significant effect on the price formation of a new issue? Can the impact of the underwriter activity on the stock price be measured and is it significant in comparison to the initial return? One purpose is to detect the methods that are best suited to provide the answers to these questions and to empirically test the methods on the Finnish IPO data.

5.2 Distribution of initial returns

Ruud (1993) investigates US data from 1982 and 1983 using a cross sectional sample of logarithmic daily returns on IPOs. We apply the same method in our analysis of the distribution of returns. We do not perform the Tobit analysis Ruud presented to estimate the mean of the distribution if it would be normal, since it would not in our opinion add much additional value to our results.

The summary statistics of the initial returns on all the issues from 1994 through 1997 are presented in table 3. The initial returns and their distribution over the days after the issue is denoted as:

$$R_t = ln\,(P_t / P_0) \qquad (1)$$

, where R_t is the return or change in price from the issue price to day t, P_t is the price of the issue day t and P_0 is the issue price.

For a sample of all offerings the distribution of returns has positive kurtosis and skewness. In the first five days after the issue the returns follow a non-normal distribution at the 5 % significance level except for the first day. The positive skewness might partly be caused by the positive initial returns or by price trends, but is also an indication of underwriter support disturbing the distribution. The positive kurtosis indicates a concentration around the offer price. The shrinking trends evident in the skewness and kurtosis imply gradually decreasing supportive interests contrary to underpricing that should correct the first day.

We extracted the following findings from the distribution of returns: The minimum return for all 14 offerings drops steadily during the first 15 days, while the maximum return stays on the same level for the first 15 days and then rises slightly. The same trend in minimum returns can be observed when we divide the sample in IPOs with positive and IPOs with negative returns; The distribution of returns is positively skewed and peaked at zero in a cross-sectional sample of all 14 offerings. A significant non-normality on the 5 % confidence level is confirmed by the Bera-Jarque statistic for all offerings on days two to five after the offer date. Since the sample is small for the use of the Bera-Jarque statistic we also compare the results to the distribution of returns for 30 liquid stocks between 1.5.1991 and 30.4.1993, a period outside the one investigated here. We find the average skewness to be 0.36 and the average kurtosis to be 0.40, thus significantly lower for the control sample. As the holding period lengthens, the average skewness and kurtosis decrease for the sample of 14 IPOs ; All 7 IPOs in the sample with a weak performance in the aftermarket were traded at a lower price than the issue price 15 to 20 days after the issue. 3 months after the issue date 5 of these were still below the offering price.

5.3 Bid-ask spread

Hanley, Kumar and Seguin (1993) investigate a sample of 1523 NASDAQ IPOs issued between 1982 and 1987. They present a model where they explain the relation of ln(Bid price/Offer price) to bid-ask spreads (here offer price means the price the IPO stock was

issued at). They also explain the relation of the Black and Scholes value of a put option to bid-ask spreads and in this way value a put option that is held by market makers when they know the issuers will be stabilizing the IPO stock. We apply the same model of ln(Bid price/ Offer price) to bid-ask spreads but do not apply the put option calculations since the Finnish market does not have market makers. Thus the put would be evaluated differently by the investors holding the best bid ask spread in the IPO stock. The function of market makers may partially be filled by the underwriters and that is why we substitute the variable number of market makers with the number of underwriters in the model of bid-ask spreads, keeping other variables similar to Hanley, Kumar and Sequin. We estimate 30 separate cross-sectional regressions (one for each of the 30 event days)of the following form:

$$ln(Relative\ spread_{jt}) = \alpha_t + \beta_{1\,t}\, ln(Volume_{j\,t}) + \beta_{2\,t}\, ln(Number\ of\ underwriters_{j\,t}) + \beta_{3\,t}\, ln(Price_{j\,t}) + \beta_{4\,t}\, ln(Volatility_{j\,t}) + \beta_{5\,t}\, ln(Bid\ price/Offer\ price_{j\,t}) \quad (2)$$

,where Volume is the number of stocks traded, Number of underwriters is all broker dealers active connected to the underwriters, Price is the mid-point closing price, Volatility is the standard deviation in daily returns over the 11 first event days for the six first regressions and the rolling 11 standard deviation (including 5 days before and 5 days after the event day) for regressions 7 to 30 and Bid Price/Offer price is the closing bid to the issue price of the IPO.

The purpose is to detect whether or noth the difference between the bid and the IPO price is related to the bid-ask spread, which would indicate supportive interests as the stock approaches the offer price level.

The distribution of the relative bid-ask spread in the secondary market for IPOs during 1994-97 is described in table 4 where the relative spread is:

$$BAS = (ask-bid) / ((ask + bid) /2) \quad (3)$$

In the descriptive data a widening of the mean-spread over time can be detected and thus the behaviour of the spread complies with the stabilization hypothesis. If there was no distur-

bance in the spread around and after the issue date, one would rather expect the spread to become narrower over time as the price level for the new company settles.

The results of the estimation of model (1) in a cross sectional regression are presented in table 5. The results are not as consistent as in Hanley, Kumar and Seguin (1993). For the event days one and two the sign of the coeffecient for the Bid price / Offer price variable is positive and takes the highest value of the elasticities in the log-log model. For day 7 the coefficient is significantly positive. Thus the distance between the best bid and the IPO price has the largest impact on the closing bid ask spread of the variables during the first days as expected. The insignificant negative impact during later days may be a result of greater liquidity in the IPOs with a strong positive performance. The results are not a strong evidence of support but show that the relative spread is different during the first days of trading in an IPO stock compared to later dates.

We find that the bid-ask spread widens with time after the issue when the spread is measured as a time weighted average of all best buy and best sell limit orders. The average time weighted bid ask spread for the reported five IPOs starts to widen approximately five days after the issue. During the first five days the spread lies around the 1.3 percent level while it goes up above 2 percent towards the 10^{th} day. However, the standard deviations are only slightly lower than the means which only qualifies the results as indicative, although they support the interpretations of the distribution of the closing bid ask spreads. We do not report the specific results due to their low degree of significance.

5.4 Underwriter trades

Schultz and Zaman (1994) investigated US intra-day data in IPOs. They have to go through a lengthy process, first determining which trades are buyer and seller initiated and then indentifying which trades are done by the underwriters of an issue. In our data we already know these things and are able to look directly at the activities of the underwriters. We apply similar methods as Schultz and Zaman in calculating the underwriters' share of orders and trades. The Finnish data is more reliable than the US data because the actual share of trades

of the underwriters is available (this has to be estimated in the US data). The US data has the advantage that the underwriters' market maker function, when applicable, clearly identifies the purpose of the quotes while underwriters own orders and client orders cannot be separated in the Finnish data. This is why we do not evaluate the time spent at the best bid by the underwriter as Schultz and Zaman. Instead we try to go a step further in using the limit order book data for determining the market impact of underwriter induced trades.

The share of trades where the underwriter was a party is described in table 6. From the table it can be concluded that the underwriters share of the purchases are greater than the share of the sales during the weeks after the issue and that the underwriters market share is shrinking over time. The market share of the purchases is highest during the first two trading days. This is the case when the market share is measured as the number of trades and when it is measured as trade value. The difference between purchases and sales seems to even out in a month after the offering and the share of purchases remains greater. This implies that there might be an ongoing support of the stock for a longer time by the underwriter. In three months the market share of purchases is close to the same as the market share of sales and the distribution has a higher standard deviation indicating that any difference might be noise. One could expect the greater buy interest from the underwriter as a result of recommendations of the stock by a well-informed underwriter, not necessarily a result of deliberate support. A greater secondary market activity by the underwriter on the buy side in the offered stock compared to the sell side still remains a fact. The trend of shrinking activity by the underwriter overall and a decreasing difference in purchases compared to sales with time is indicative of supportive activity. When we divide the sample into issues with positive initial return and issues with negative initial return the results are similar, with a greater share of underwriter buying in the weak issues than in the strong issues. We do not report the divided sample since it also reduces reliability due to small sample size.

The relatively comprehensive limit order book data available in this study give us the opportunity to study the activity of the underwriter from three main perspectives. We can look at the **presence** of the underwriter in the aftermarket and we can attempt to conclude if the underwriter is supporting the price of the stock in the aftermarket. The supportive activity

can further be divided into **static support and dynamic support**. The underwriter presence can be measured by looking at total activity of the underwriter both as buyer and as seller in carried out trades as well as in the limit order book. Static support can be measured by comparing the activity of the underwriter on the bid to the activity on the ask. Dynamic support can be measured by identifying how the underwriter reacts to sell orders in the market that affects the amount of stock at the bid or changes the level of the bid price. When we look at the static, active and dynamic support of the IPO stocks we find that the underwriters are posting more best ask than best bid orders as well as more ask orders in total than bid orders in total. We find that the underwriter buy orders are closer to the midpoint between bid and ask than the sell orders. A more efficient method of capturing all these measures in one summary measure however is to look at the market impact of the underwriter induced trades. The analysis of market impact is a more powerful tool for interpreting the behaviour of the underwriters so we will concentrate on these issues in the remainder of the study.

5.5 Quantifying measures of static and dynamic support, and market impact.

To quantify the power of dynamic support and to measure the impact of the underwriter's activity we calculate the market impact of the underwriter induced trades on the spread and the mid-quote and compare these to the market impact of trades induced by other broker dealers. Spread is the relative spread: (ask-bid)/((bid+ask)/2). Mid-quote is the midpoint between bid and ask price: (bid+ask)/2. We arrive at the measures of impact by identifying trades where an underwriter is involved, separating the trades where the underwriter is a buyer and where he is selling. We calculate the change in the quoted spread and mid-quote that occurs from the schedule in the limit order book before these trades are executed until a new schedule is established after the trade. Typically it takes a few minutes before any new postings to this particular part of the order book arrives. We are therefore looking at the short-term impact of the trades, while allowing the order book to stabilise since we are including the first revision of the orders for the investigated stock. If several trades are executed between the measure points, the impact of the trades are weighed equally. An overview of these results are presented in table 7. In the table Δ Spread is the average impact

on the quoted bid-ask spread and PrcImp is the average impact on the mid-quote.

$$\Delta Spread = (ask_t - bid_t)/((bid_t + ask_t)/2) - (ask_{t-1} - bid_{t-1})/((bid_{t-1} + ask_{t-1})/2) \quad (4.)$$

$$PrcImp = ((bid_t + ask_t)/2) - ((bid_{t-1} + ask_{t-1})/2) \quad (5.)$$

In the analysis of the market impact we use the following reasoning. Trades can be produced in two ways. A trade can be a result of a change in the price level on the market moving the midpoint between bid and ask closer to an limit order posted into the order-book earlier. We call this a passive order. A trade can alternatively be a result of a new order posted at the best price offered or asked in the market and thus executed directly. We call this an active order. In figure 1 we describe how we expect the midpoint between the bid and the ask (the price level) to behave when a bid or an ask order of either category is executed. We expect the price level to rise when an active buy order is executed and to decrease when a passive buy order is executed. We expect the price level to decrease when an active sell order hits the market and to rise when a passive sell order is executed. Eg if a passive buyer with limit orders posted at the bid that gets hit, the impact on the price is negative on average since on average the following best bid will be lower. If a trade is produced by a seller actively entering a order to sell at a new lower level than the previous sell this have a negative impact on the price level in the instances where the order is not completely filled or causes other seller to lower their sales.

Figure 1.

	active order	passive order
Buy	p ↑	p ↓
Sell	p ↓	p ↑

p is the midpoint between the highest bid- and the lowest ask order for the stock. ↑ means a strengthening price level while ↓ means a weakening price as a reaction to the execution of the order.

In our data the impact on the mid quote price of IPOs caused by the trades involving under-writers are negative on average both for trades where the underwriter is a buyer and where he is a seller (more strongly for the buys however) (table 7). The average impact of under-writer trades is that the spread widens with 0.30 (0.36) percent for purchases and 0.11 (0.16) percent for sales. The mid-quote price goes down by 0.17 (0.24) percent for purchases and

0.030 (0.050) percent for sales. T-values for the averages are reported in brackets. This may be interpreted as an indication that the underwriter is on **average a passive buyer with limit orders posted at the bid that gets hit** and thereby results in trades. The impact on the price would then be negative on average since on average the following best bid will be lower. The negative impact of the trades where the underwriter is a seller in turn, is an indication that the **trade is induced by the underwriter actively entering market orders to sell** at a new lower level than the previous sell. These trades have a negative impact on the price in the instances where the order is not completely filled or causes other seller to lower their sales. An alternative approach would have been to detect the trades that have already been present in the order book before they are executed and the orders that are posted at the best available price and thus executed immediately. This way the actual frequency of passively produced trades and actively produced trades could be detected. A flaw of this approach though is that no numerical measures of the impact would be generated.

To evaluate the price impact of underwriter purchases in comparison to the initial returns we develop a hypothetical situation in table 8. The calculations estimate what the change in price is, if the sales where the underwriter is a buyer, **would** be sold at the following best bid (by a broker dealer **not** associated with the underwriter). Thus we estimate the value of the presence of the underwriter in relative price change and in difference in amount received for the sales.

We observe that the executed trades where the underwriter is the buyer would have had to be sold at a level on average 1.40 percent lower if the underwriter was not present on the bid, (table 8). For the IPOs investigated here it means that roughly one third of the observed underpricing of 4.7 percent (4,1 percent market adjusted), has been sustained by aftermarket activity of the underwriter.

5.6 The overallotment option and a model of the whole IPO pricing process.

From table 1 we can see that the overallotment has been used only partly or not at all in 6 out of 13 IPOs where an overallotment option has been made available to the underwriter. These are all weak issues where most underwriter support would be expected since only a part of

the overallotment option is exercised.

To be able to explain the whole IPO pricing process, we need a model accounting for both the pricing process before the issue and the support activities by the underwriter after the issue. Based on the evidence in earlier research presented in section II and our findings here these can be narrowed down to the negotiated contract between underwriter and issuer and to the short covering in the aftermarket. The outcome of the negotiations is dependent on information from the book building process while the extent to which short covering is exercised is dependent on the strength of the issue in the aftermarket. Thus the key factors in a model for the whole IPO pricing process are (1) the negotiated underwriter fee, (2) the issue price limits, (3) the size of the overallotment option and the (4) the size of the short position taken by the syndicate before the issue, and the size of the issue and current market conditions. Aggarwal (1998) tests a similar model to the one we suggest. She explains the market-adjusted cumulative return for the IPO stock over one, 20 and 40 trading days after the issue. The independent variables are: offer price, size of issue, penalty bid dummy, percent of short position covered, size of the syndicate, underwriter spread (fee) and percent of over allotment option exercised. In markets where the underwriter syndicate short position is not public information, the input for such a model would have to be estimated using the measures of aftermarket activity developed in this paper.

6. Conclusions and suggestions for future research.

The findings above show that additional evidence can be obtained by including the limit order book [LOB] in the study of IPOs. One contribution of this paper is making such a database available and developing appropriate methodology for analysing it. The introduction of a measure of market impact from trades involving underwriters further clarifies what is going on in the aftermarket for new issues. In earlier studies it has been shown that the bid-ask spread widens with time after the issue. When the spread is measured more exactly as a time weighted average of all best buy and sell limit orders this is also true. This in turn implies an abnormal presence on the bid side of the LOB immediately after the issue. This effect could be caused by higher trading volume in the stocks right after the issue. We actually observe a decreasing volume over the first ten days after the issue, supporting the hy-

pothesis of volume effects on the bid-ask spread. The spreads remain wider than during the initial days in the long term, despite an increase in trading volume over time which contradicts the volume effect as the sole explanation to the widening spreads. The fact that the spread widens more for strong than weak issues may be an indication of volume effects, but we would need a larger sample to draw any conclusions from this. The regressions of the model of ln(Bid price/Offer price) to Bid-ask spread are adjusted for volume and volatility effects and give some support of a narrowing spread when the bid approaches the price level where the IPO was issued. We further find that the underwriters are posting more best ask than best bid orders as well as more ask orders in total than bid orders in total. We find that the underwriter buy orders are closer to the midpoint between bid and ask than the sell orders. We also find indications that underwriters are passive in their bidding and active when they post sell orders. This might be a sign that underwriters are using the existing order flow in a supportive way for the price of the IPO or at least avoiding harm to the price of the stock by incoming sell orders. The findings are consistent in that they imply a different behaviour of the underwriter on the bid than on the ask as well as in weak versus strong IPOs. If the presence of the underwriter was a purely liquidity providing function, we would not expect these differences. The overall order flow in the new issues investigated here includes more sell orders than ask orders in total. The reasons for this may be that the insecurity around a newly priced issue makes investors wary of posting orders to buy the stock or simply that the demand for the share has been temporarily fulfilled through the issue leaving more sellers out there. We however concluded that the underwriter stands for a relatively larger part of the total order flow on the ask than on the bid. An overall basis towards selling cannot explain our findings. The stronger flow of ask order rather emphasises our conclusions, since we still found more actual buying than selling by the underwriter.

As specific answers to our research questions we conclude the following. The presence of the underwriter in the aftermarket is significant and the purpose of this presence appears to be aftermarket support in addition to a liquidity providing function. The underwriter activity significantly affects the price formation of a new issue. The impact of the underwriter activ-

ity on the stock price can be measured and it is significant in comparison to, though not larger than, the initial return. Over the long run this significant impact of the underwriter activity may become more important than the initial pricing.

If we wish to model the whole IPO pricing process, these results call out for the development of new theory or rather a new combination of old theories. The theory, as we see it, should take into account both the asymmetric information between the issuing company and the underwriter and the supporting activity of the underwriter in the aftermarket.

References

Aggarwal, Reena, (1998), Stabilization activities by underwriters of IPOs, working paper, the McDonough School of Business, Georgetown University, Washington, D.C., USA.

Hanley, Kathleen Weiss, A.Arun Kumar, Paul J. Seguin, (1993), Price stabilization in the market for new issues, Journal of Financial Economics 34, pp 177-197, North-Holland.

Hedvall, Kaj, (1994), Essays on the market microstructure of the Helsinki stock exchange, dissertetion, Swedish School of Economics and Business Administration, Helsinki, Finland.

Ibbotson, Roger G. and Jay R. Ritter, (1995), Initial Public Offerings, R. Jarrow et al., Eds., Handbooks in OR & MS, Vol. 9, Elsevier Science B.V.

Ruud, Judith, S., (1991, -93), Underwriter price support and the IPO pricing puzzle, Journal of Financial Economics 34, pp135-151.

Schultz, Paul, H., Mir A. Zaman, (1994), Aftermarket support and underpricing of initial public offerings, Journal of Financial Economics 35, pp 199-219.

TABLE 1. IPOs in Finland during 1990 to 1998

	Company	First Trd	Issue Size	Over-Allotment Option Size	Over-Allotment Excercised	IPO share of market
		Day	M Fim	% of Issue Size	% of Issue Size	%
1	Fortum Oyj	18.12.98	2806	0.00%	0.00%	2.13%
2	Rapala Normark Oyj	4.12.98	560	10.00%	10.00%	0.09%
3	Sonera Yhtymä Oyj	10.11.98	6262	13.55%	13.55%	7.33%
4	JOT Automation Group Oyj	15.9.98	302	14.88%	6.42%	0.29%
5	Mandatum Pankki Oyj	3.8.98	2211	0.00%	0.00%	0.04%
6	Sponda Oyj	1.6.98	823	0.00%	0.00%	0.22%
7	A-rakennusmies Oyj	30.4.98	137	0.00%	0.00%	0.08%
8	HK Ruokatalo Oyj	3.4.98	242	15.38%	15.38%	0.05%
9	Metsä Tissue Oyj	9.12.97	689	14.97%	10.98%	0.91%
10	Jaakko Pöyry Group Oyj	2.12.97	520	12.50%	0.00%	0.51%
11	Elcoteq Network Oyj	26.11.97	602	11.63%	5.23%	0.31%
12	Helsingin Puhelin Oyj	25.11.97	595	0.00%	0.00%	0.56%
13	Novo Group Oyj	24.9.97	110	0.00%	0.00%	0.08%
14	Rocla Oyj	17.6.97	81	20.78%	20.78%	0.19%
15	Kyro Oyj	9.6.97	221	0.00%	0.00%	0.29%
16	Nordic Aluminium Oyj	24.4.97	152	14.83%	14.83%	0.16%
17	PK Cables Oyj	3.4.97	109	0.00%	0.00%	0.26%
18	KCI Konecranes International Oyj	27.3.96	490	11.11%	11.11%	0.84%
19	Neste Oyj	27.11.95	749	34.94%	34.94%	0.76%
20	Suunto Oyj	14.6.95	50	0.00%	0.00%	0.20%
21	Nokian Renkaat Oyj	1.6.95	158	34.09%	0.00%	0.35%
22	Espoon Sähkö Oyj	24.11.94	881	0.00%	0.00%	0.19%
23	Kemira Oyj	10.11.94	1140	16.67%	11.67%	1.22%
24	Raute Oyj	27.9.94	46	0.00%	0.00%	0.04%
	Average		831	18.78%	12.91%	0.71%
	Total		19935			17.11%

Note: In the table all IPOs that have been listed on the mainboard during the period 1990 to 1998 in Finland. Companies that have been transferred from another list without the issue of new shares are excluded. The full company name in Finnish, first trading day for the new share, size of the IPO before overallotments, size of overallotment option as percentage of issue size, size of overallotment option used as percentage of issue size and the market share of traded value are reported. The market share is calculated over the days the stock has been traded during the first calendar year the company was listed and for the IPOs dated earlier than 1997 during 1997 to make the numbers comparable. The average for the overallotment sizes are calculated for the issues with an overallotment option only.

TABLE 2. Underwriters and Broker Dealers

	Company	Code	Offer Date	Leading Underwriters	Broker Dealers
1	Jaakko Pöyry Group Oyj	JPG1V	2.12.97	Carnegie Finland Ltd	CAR, MER
2	Elcoteq Network Oyj	ELQAV	26.11.97	Union Bank of Switzerland	ALF, PSP, MER
3	Helsingin Puhelin Oyj	HEPEV	25.11.97	SBC Warburg Dillon Read	PSP, SEB, ARC
4	Rocla Oyj	ROC1V	17.6.97	Carnegie Finland Ltd	CAR, PSP
5	Kyro Oyj	KYR1V	9.6.97	Mandatum Securities Ltd	MER, ABB, OPS
6	Nordic Aluminium Oyj	NOA1V	24.4.97	Enskilda Bank	SEB
7	PK Cables Oyj	PKC1V	3.4.97	Carnegie Finland Ltd	CAR, OPS
8	KCI Konecranes Int. Oyj	KCI1V	27.3.96	Merill Lynch, Enskilda., Merita, Carnegie, Postipankki	SEB, MER, CAR, PSP
9	Neste Oyj	NES1V	27.11.95	Prospectus Ltd, Mandatum.	PSP, PTS, ALF, MER, OPS
10	Suunto Oyj	SUU1V	14.6.95	Prospectus Ltd, Arctos Securities Ltd	MER, ARC
11	Nokian Renkaat Oyj	NOR1V	1.6.95	Enskilda Bank, Prospectus Ltd	SEB, MER
12	Espoon Sähkö Oyj	ESS1V	24.11.94	Prospectus Ltd	KM
13	Kemira Oyj	KRA1V	10.11.94	Merill Lynch, Postipankki, Union Bank of Finland	PSP, SYP
14	Raute Oyj	RUTAV	27.9.94	Prospectus Ltd	KM

Note: This table refers to the initial public offerings during the period 1994 to 1997 (studied here). The companies are the IPOs included in this study. The code is used for the issued share in the limit order book system on the Helsinki Stock Exchange and is also used later in the tables below. Listing date is the date when the stock was listed on the Stock Exchange. Leading underwriters are the underwriter/underwriters carrying the main responsibility for the issue. Broker Dealers are the brokerage firms or banks that either are underwriters of the issue or subsidiaries of the same company as one of the underwriters. The broker dealer corporations are denoted by the symbol used in the limit order book system on the Helsinki Stock Exchange: CAR is Carnegie Finland Ltd, PSP is Postipankki Oy, MER is Merita Bank, ABB is ABB Aros Securities Ltd, OPS is Opstock Securities Ltd, SEB is Enskilda Bank, PTS is Protos Securities Ltd, ALF is Alfred Berg Securities Ltd, ARC is Arctos Securities Ltd, KM is Kansallismeklarit Ltd and SYP is Union Bank of Finland.

TABLE 3. Distribution of returns

Price	i.p.	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	day 15	day 20	day 30	3 mths
Jaakko Pöyry	65	**65**	**63**	**62**	**65**	**63.5**	**62.6**	**62**	**60**	**58**	**57**	**55**	**59**	**52.5**	**60**
Elqotec	70	76	71.5	70.9	70.7	71	70.5	**70**	70.1	**70**	70.2	**64.7**	**67.5**	**68**	**62.5**
Helsingin Puh	85 +	115	128	122	121	123	126	126	123.3	123.9	123	119	116	137.5	164.5
Rocla	42	44	**41**	**41**	**41**	**40.2**	42.2	42.5	42.5	42.2	43	42.5	42.8	**41.6**	**47.1**
Kyro	27 +	40	37.5	37.3	38	38	38.5	37.5	37.2	36.5	37.5	36.7	37.9	38	36.5
Nordic Alum.	50 +	55	54	52	50.5	50.5	51	51.5	52	52	52	**50**	51	**50**	52
PK Cables	42 +	62	71	72	74.9	73	70.1	69	68.5	67.5	70	69.9	72	78.5	76.9
KCI Konecr.	68 +	83	82	82	81.5	82	83.2	86	84	82	81.5	82	90	101	120
Neste	78 +	83	80.2	81.5	80.3	79.8	79.9	79.8	79.5	79.9	79.5	**78**	**78**	**76.5**	**75**
Suunto	31	**31**	**31**	31.5	32	**31**	31.5	**28**	**29.2**	**29**	**29**	**29.5**	31.5	35	34
Nokian Renk.	36	**36**	**35.9**	37.5	37	36.9	36.5	36.5	36.3	**36**	**36**	**35.8**	**36**	**33.5**	**36**
Espoon Sähkö	56	**56**	**55**	**55**	**53.5**	**52**	**53.2**	**53**	**53.5**	**53**	**53**	**53**	**51**	**50**	**49**
Kemira	38	38.5	**38**	38.2	38.2	**38**	38.1	**38**	**38**	38.1	**37.8**	**37.8**	**37.9**	**35.6**	**36**
Raute	72	**72**	**72**	**71**	**71.5**	**71.4**	**71.1**	**72**	**72**	**72**	**71.9**	**70.5**	80.5	85	87.1

Log Return	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	day 15	day 20	day 30	3 mth
Jaakko Pöyry	0.0000	-0.0313	-0.0473	0.0000	-0.0233	-0.0376	-0.0473	-0.0800	-0.1139	-0.1313	-0.1671	-0.0968	-0.2136	-0.0800
Elqotec	0.0822	0.0212	0.0128	0.0100	0.0142	0.0071	0.0000	0.0014	0.0000	0.0029	-0.0787	-0.0364	-0.0290	-0.1133
Helsingn Puh	0.3023	0.4094	0.3614	0.3531	0.3695	0.3936	0.3936	0.3720	0.3768	0.3695	0.3365	0.3109	0.4810	0.6603
Rocla	0.0465	-0.0241	-0.0241	-0.0241	-0.0438	0.0048	0.0118	0.0118	0.0048	0.0235	0.0118	0.0189	-0.0096	0.1146
Kyro	0.3930	0.3285	0.3232	0.3417	0.3417	0.3548	0.3285	0.3205	0.3015	0.3285	0.3069	0.3391	0.3417	0.3015
Nordic Alum.	0.0953	0.0770	0.0392	0.0100	0.0100	0.0198	0.0296	0.0392	0.0392	0.0392	0.0000	0.0198	0.0000	0.0392
PK Cables	0.4014	0.5370	0.5510	0.5905	0.5648	0.5242	0.5084	0.5011	0.4864	0.5228	0.5214	0.5510	0.6374	0.6168
KCI Konecr.	0.1993	0.1872	0.1872	0.1811	0.1872	0.2017	0.2348	0.2113	0.1872	0.1811	0.1872	0.2803	0.3956	0.5680
Neste	0.0621	0.0278	0.0439	0.0291	0.0228	0.0241	0.0228	0.0190	0.0241	0.0190	0.0000	0.0000	-0.0194	-0.0392
Suunto	0.0000	0.0000	0.0160	0.0317	0.0000	0.0160	-0.1018	-0.0598	-0.0667	-0.0667	-0.0496	0.0160	0.1214	0.0924
Nokian Renk.	0.0000	-0.0028	0.0408	0.0274	0.0247	0.0138	0.0138	0.0083	0.0000	0.0000	-0.0056	0.0000	-0.0720	0.0000
Espoon Sähkö	0.0000	-0.0180	-0.0180	-0.0457	-0.0741	-0.0513	-0.0551	-0.0457	-0.0551	-0.0551	-0.0551	-0.0935	-0.1133	-0.1335
Kemira	0.0131	0.0000	0.0052	0.0052	0.0000	0.0026	0.0000	0.0000	0.0026	-0.0053	-0.0053	-0.0026	-0.0652	-0.0541
Raute	0.0000	0.0000	-0.0140	-0.0070	-0.0084	-0.0126	0.0000	0.0000	0.0000	-0.0014	-0.0211	0.1116	0.1660	0.1904

Measures														
Mean	0.1140	0.1080	0.1055	0.1074	0.0989	0.1044	0.0957	0.0928	0.0848	0.0876	0.0701	0.1013	0.1158	0.1545
Median	0.0543	0.0106	0.0276	0.0187	0.0121	0.0149	0.0128	0.0101	0.0037	0.0110	-0.0026	0.0174	-0.0048	0.0658
Minimum	0.0000	-0.0313	-0.0473	-0.0457	-0.0741	-0.0513	-0.1018	-0.0800	-0.1139	-0.1313	-0.1671	-0.0968	-0.2136	-0.1335
Maximum	0.4014	0.5370	0.5510	0.5905	0.5648	0.5242	0.5084	0.5011	0.4864	0.5228	0.5214	0.5510	0.6374	0.6603
Standard Dev.	0.1432	0.1782	0.1746	0.1827	0.1851	0.1792	0.1824	0.1754	0.1745	0.1833	0.1863	0.1858	0.2442	0.2668
Skewness	1.2009	**1.4782**	**1.5597**	**1.6858**	**1.5271**	1.4109	1.2390	1.3089	1.2637	1.2917	1.2782	1.2105	0.8542	0.9479
Kurtosis	-0.0280	**0.9824**	**1.5557**	**2.1037**	**1.3727**	0.6409	0.2656	0.5021	0.5180	0.7590	0.9046	0.6663	-0.3204	-0.5114
Bera-Jarque	3.3653	5.6617	7.0879	9.2132	6.5404	4.8844	3.6228	4.1449	3.8825	4.2289	4.2895	3.6779	1.7626	2.2491

Note: The first panel shows the initial offering price i.p. and the first traded price for days 1-10, 15, 20, 30 and 3 months after the issue. The second panel shows the logarithm of returns for each stock from the issue price to the daily opening price Rt = ln(Rt/R0). The summary measures are calculated on the logarithm of returns for each day separately. The reported measures are: Mean, Median, Minimum, Maximum, Standard Deviation, Skewness, Kurtosis and Bera-Jarque. If the skewness and kurtosis deviate significantly from zero the distribution of returns is non normal. The significance of the deviation from the normal distribution is measured by the Wald statistic introduced by Bera-Jarque (1981). In the first panel bold font highlights the days when the stock has opened at or below the initial offering price.In the summary measures bold font highlights significance of 5 %.

TABLE 4. Bid-Ask Spreads

	day 1	day 2	day 3	day 4	day 5	Day 6	day 7	day 8	Day 9	Day 10
Mean	0.0079	0.0137	0.0131	0.0148	0.0166	0.0151	0.0139	0.0143	0.0126	0.0133
Median	0.0050	0.0108	0.0097	0.0111	0.01	0.0087	0.0063	0.0081	0.0076	0.0071
Minimum	0.0012	0.0026	0.0026	0.0025	0.0026	0.0026	0.0016	0.0026	0.0027	0.0013
Maximum	0.0323	0.0377	0.0488	0.0656	0.0656	0.075	0.0571	0.0755	0.0488	0.0541
Stand. Deviation	0.0078	0.0096	0.0127	0.0154	0.0179	0.0183	0.0168	0.0180	0.0126	0.0144

	day 11	Day 12	Day 13	day 14	Day 15	Day 16	day 17	day 18	day 19	Day 20
Mean	0.0220	0.0191	0.0116	0.0107	0.0258	0.0203	0.0176	0.0156	0.0151	0.0162
Median	0.0113	0.013	0.0095	0.0100	0.0074	0.0112	0.0081	0.0115	0.007	0.0072
Minimum	0.0013	0.0013	0.0027	0.0027	0.0027	0.0013	0.0013	0.0026	0.0023	0.0026
Maximum	0.0826	0.0826	0.0282	0.029	0.2301	0.1176	0.1176	0.0634	0.05	0.0779
Stand. Deviation	0.0234	0.021	0.0076	0.0071	0.0573	0.0291	0.0291	0.0161	0.0168	0.0235

	day 21	Day 22	Day 23	day 24	Day 25	Day 26	day 27	day 28	day 29	Day 30
Mean	0.0165	0.0188	0.0103	0.0249	0.0187	0.0237	0.0224	0.0233	0.0155	0.0213
Median	0.0091	0.014	0.0084	0.0102	0.008	0.0116	0.0112	0.0112	0.0118	0.0115
Minimum	0.0027	0.0064	0.0013	0.0013	0.0024	0.0026	0.0048	0.0048	0.0052	0.0065
Maximum	0.0792	0.0504	0.0339	0.1651	0.0714	0.1091	0.1091	0.1043	0.0392	0.0723
Stand. Deviation	0.0205	0.0123	0.0083	0.0447	0.0225	0.0300	0.0289	0.0288	0.0115	0.0195

Note: The daily bid-ask spread distribution over the first 30 days for the IPOs between 1994 and 1997 is described cross-sectionally in the table. We report mean, median, minimum, maximum and standard deviation for all 14 IPOs in the sample. The relative bid-ask spread in the secondary market of the issue is calculated as:
(2) BAS = (ask-bid) / ((ask + bid) / 2)

TABLE 5. Relation ln(Relative spread) ln(Bid price/Offer price)

	Intercept	ln(Volume)	ln(Number of Underwriters)	ln(Price)	ln(Volatility)	ln(Bid price/ Offer price)	N	$R^2_{adj.}$
Day								
1	1.7870	-0.1569	-0.4027	-0.9559	0.2217	0.2779	14	0.1186
	(0.4804)	(-0.7947)	(-0.7276)	(-1.5652)	(0.55829)	(0.1078)		
2	0.1695	-0.4194	0.1803	-0.2769	-0.1689	1.8220	14	0.6230
	(0.0821)	(-3.9483)	(0.5150)	(-0.7318)	(-0.8831)	(1.2793)		
3	-1.8687	-0.1532	-0.6200	0.2166	0.3807	-2.3270	14	0.5098
	(-0.8930)	(-2.6815)	(-1.8160)	(0.4702)	(1.5755)	(-1.4543)		
4	-1.1547	-0.1837	-0.8774	-0.2158	0.0385	0.8779	14	0.6976
	(-0.7184)	(-4.1305)	(-3.3704)	(-0.6169)	(0.1985)	(0.6829)		
5	-1.3636	-0.1942	-0.3688	0.5041	0.6464	-4.4812	14	0.2590
	(-0.4260)	(-1.4504)	(-0.7105)	(0.7496)	(1.8075)	(-1.9289)		
6	2.8696	-0.2877	0.2647	-0.5437	0.5204	-3.9133	14	0.2140
	(0.7850)	(-1.4271)	(0.4029)	(-0.9117)	(1.6862)	(-1.8913)		
7	-2.1486	-0.2560	-0.3426	-0.3820	-0.2491	3.1414	14	0.6383
	(-0.7497)	(-4.1458)	(-0.8618)	(-0.7273)	(-0.6601)	(2.5644)		
8	-2.8613	-0.1450	-0.4241	0.1261	0.1197	-0.4585	14	0.4562
	(-1.5142)	(-2.3767)	(-1.0969)	(0.2725)	(0.6473)	(-0.4550)		
9	-4.2867	-0.0116	-0.9907	0.6755	0.5316	-0.9589	14	0.4860
	(-2.0354)	(-0.1303)	(-2.6188)	(1.3353)	(1.7924)	(-0.8426)		
10	-1.2245	0.1310	-0.8403	-0.0202	0.9299	-2.1838	14	0.3012
	(-0.4515)	(0.7559)	(-1.4881)	(-0.0281)	(1.7118)	(-1.3566)		
15	-2.8834	-0.1211	0.0888	0.4636	0.6000	-1.2444	14	0.7423
	(-1.5243)	(-2.0800)	(0.2625)	(0.9899)	(2.8067)	(-1.3148)		
20	-3.4810	-0.1832	-0.5403	0.0322	-0.1327	-0.1804	14	0.0000
	(-1.0296)	(-0.9785)	(-0.8606)	(0.0346)	(-0.2855)	(-0.0962)		
30	-3.3047	-0.2344	-0.0273	-0.1897	-0.3463	0.1234	14	0.2040
	(-1.1222)	(-2.3797)	(-0.0484)	(-0.2734)	(-1.2265)	(-0.0953)		

Note: We estimate 30 separate cross-sectional regressions (one for each of the 30 event days)of the following form: $ln(Relative\ spread_{jt}) = \alpha_t + \beta 1t\ ln(Volume_{jt}) + \beta 2_t\ ln(Number\ of\ underwriters_{jt}) + \beta 3_t\ ln(Price_{jt}) + \beta 4_t\ ln(Volatility_{jt}) + \beta 5_t\ ln(Bid\ price/Offer\ price_{jt})$, where Volume is the number of stocks traded, Number of underwriters is all broker dealers active connected to the underwriters, Price is the mid-point closing price, Volatility is the standard deviation in daily returns over the 11 first event days for the six first regressions and the rolling 11 standard deviation (including 5 days before and 5 days after the event day) for regressions 7 to 30 and Bid Price/Offer price is the closing bid to the issue price of the IPO.

TABLE 6. Underwriter trades

Underwriter Share of Number of Trades											
Purchases	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	1 mth
Mean No Trades	0.4410	0.4656	0.4152	0.4714	0.5315	0.4733	0.4676	0.4033	0.4773	0.4523	0.4767
Standard Deviation	0.2052	0.2111	0.3033	0.2905	0.2853	0.2909	0.2912	0.2867	0.3532	0.3457	0.3804
Sales	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	1 mth
Mean Share of Trades	0.3316	0.4545	0.5124	0.4231	0.4435	0.3684	0.3978	0.3678	0.4233	0.3023	0.2904
Standard Deviation	0.1974	0.2418	0.2812	0.2649	0.2724	0.3191	0.2945	0.2137	0.2301	0.2150	0.2954
Underwriter Share of Trade Value											
Purchases	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	1 mth
Mean Share of Value	0.6034	0.4614	0.5342	0.5467	0.5651	0.5026	0.4797	0.4477	0.4831	0.4715	0.4842
Standard Deviation	0.2819	0.2339	0.3254	0.3530	0.3484	0.3604	0.4048	0.4020	0.4021	0.4126	0.4077
Sales	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8	day 9	day 10	1 mth
Mean Share of Value	0.5055	0.4100	0.6184	0.5004	0.4797	0.4354	0.4615	0.4345	0.3072	0.3504	0.2890
Standard Deviation	0.3124	0.2366	0.2852	0.3206	0.3613	0.4038	0.3490	0.3288	0.2922	0.3158	0.3186

Note: The tables show the share of trades where the underwriter was the buyer in the first panel and the share of trades where the underwriter was a seller in the second panel. The measure is based on daily number of trades in the first table and on daily traded value in the second table. The mean is the average of the daily market share in all 14 IPO's between September 1994 and December 1997, reported for the first ten days and one month after the issue. The standard deviation is the deviation from the mean during day_t.

TABLE 7. Spread and Price Impact of Underwriter Trades

10 days	Not Underwriter Trades		Underwriter Purchases		Underwriter Sales	
Average	ΔSpread	PrcImp	ΔSpread	PrcImp	ΔSpread	PrcImp
KCI1V+	0.000154	-0.000466	0.000792	-0.000046	0.000925	0.000390
NOR1V	0.001481	0.000777	0.001882	-0.000917	0.000125	-0.000962
ESS1V	0.004389	-0.004976	0.009914	-0.006442	-0.000022	-0.000021
KRA1V	0.001205	-0.000833	-0.000146	-0.000425	0.000130	-0.000077
RUTAV	0.007964	-0.004086	0.002047	-0.000472	0.004167	-0.000847
Mean	0.003039	-0.001917	0.002898	-0.001660	0.001065	-0.000303
Median	0.001481	-0.000833	0.001882	-0.000472	0.000130	-0.000077
Min	0.000154	-0.004976	-0.000146	-0.006442	-0.000022	-0.000962
Max	0.007964	0.000777	0.009914	-0.000046	0.004167	0.000390
Standard Deviation	0.002835	0.002218	0.003597	0.002407	0.001586	0.000518

Note: The table shows the average relative impact trades during the first 10 days have on the spread and the mid-quote. Spread is the relative spread: *(Ask-Bid)/((bid+Ask)/2)*. Mid-quote is the midpoint between bid and ask price: *(Bid+Ask)/2*. ΔSpread is the change in the spread as a result of the trade and PrcImp is the difference between the mid-quotes before and after the trade. The measures are calculated from the last best bid (best ask) order before the sale (buy) occurs to the best bid (best ask) when the first new order after the trade is entered. The strong issues are marked with a + next to the stock code.

TABLE 8. Price Impact of Underwriter Purchases

	Company	Initial Return	Initial Return Adjusted	Mean Prc Change	Difference FIM
1	KCI Konecr. +	0.2206	0.2211	-0.0106	-867501
2	Nokian Renk.	0.0000	-0.0131	-0.0125	-94057
3	Espoon Sähkö	0.0000	-0.0119	-0.0343	-80725
4	Kemira	0.0132	0.0096	-0.0014	-25882
5	Raute	0.0000	-0.0011	-0.0115	-27700
	Mean	0.0467	0.0409	-0.0140	

Note: Initial return is the return on the IPO stock the first day, thus relative change in price from the issue price to the open price the first trading day. The Initial return adjusted for market development is the relative change in price from the issue price to the closing price the first day adjusted for the change in the market index from the close of the day before the IPO to the close the first trading day. Mean price change is the average change in trading price if the trades where one of the underwriters was a buyer are hypothetically extracted and the trade executed at the best following bid (by a broker dealer not associated with the undewriter of the IPO). Difference in FIM is the change in value of the trades where an underwriter has been a buyer if they were executed at the best following bid by a broker dealer not associated with the undewriter of the IPO. Mean reports the mean inital returns and mean price impact by underwriter purchases. The strong issues are marked with a + next to the stock code.

I. Institutional framework

A. The HETI system and the limit order book

The Helsinki Stock Exchange Automated Trading and Information System [HETI] is a Continuous Open Limit Order Book System [COLOB] trading system that was used in Helsinki from 1989 until September 1998. The Helsinki system closely resembles COLOB markets elsewhere such as Toronto, Paris, Tokyo, Stockholm and Sydney. In a COLOB market, liquidity is provided by limit orders submitted in the book by the dual capacity dealers (broker-dealers) who are members of the exchange. The orders are placed in the book in price and time priority and the contents of the book for a particular stock are shown on a computer screen to all members of the exchange. The orders submitted may be client or dealer orders, but there is no difference in precedence in relation to their origin. No obligations to provide liquidity or any privileges exists for members of the exchange in relation to their clients. The immediacy of the market is thus solely provided for by the order book, without temporary depositories of liquidity in the form of designated intermediaries (eg. clearing houses). Some features may differ between markets with regards to market opening procedures and the types of orders that can be submitted. In the HETI system every limit order is displayed individually and limit orders are valid only for one day. The HETI system has only one type of order, the limit order identifying the stock, the price, the time entered, the number of shares and submitting broker. The stock exchange in Helsinki is today called HEX Ltd, and consists of Helsinki Securities and Derivatives Exchange and a clearinghouse. The Helsinki exchanges are currently using an implementation of a modern trading system used in other European exchanges as well. There are plans to transfer to yet another system in connection to proposed co-operation agreements with other European exchanges. The technical implementation of a COLOB trading system should not have any impact on the basic functions of a limit order book driven market.

B. The order schedule

In the following a graphical presentation of how the order schedule that makes up the limit order book is built and updated.

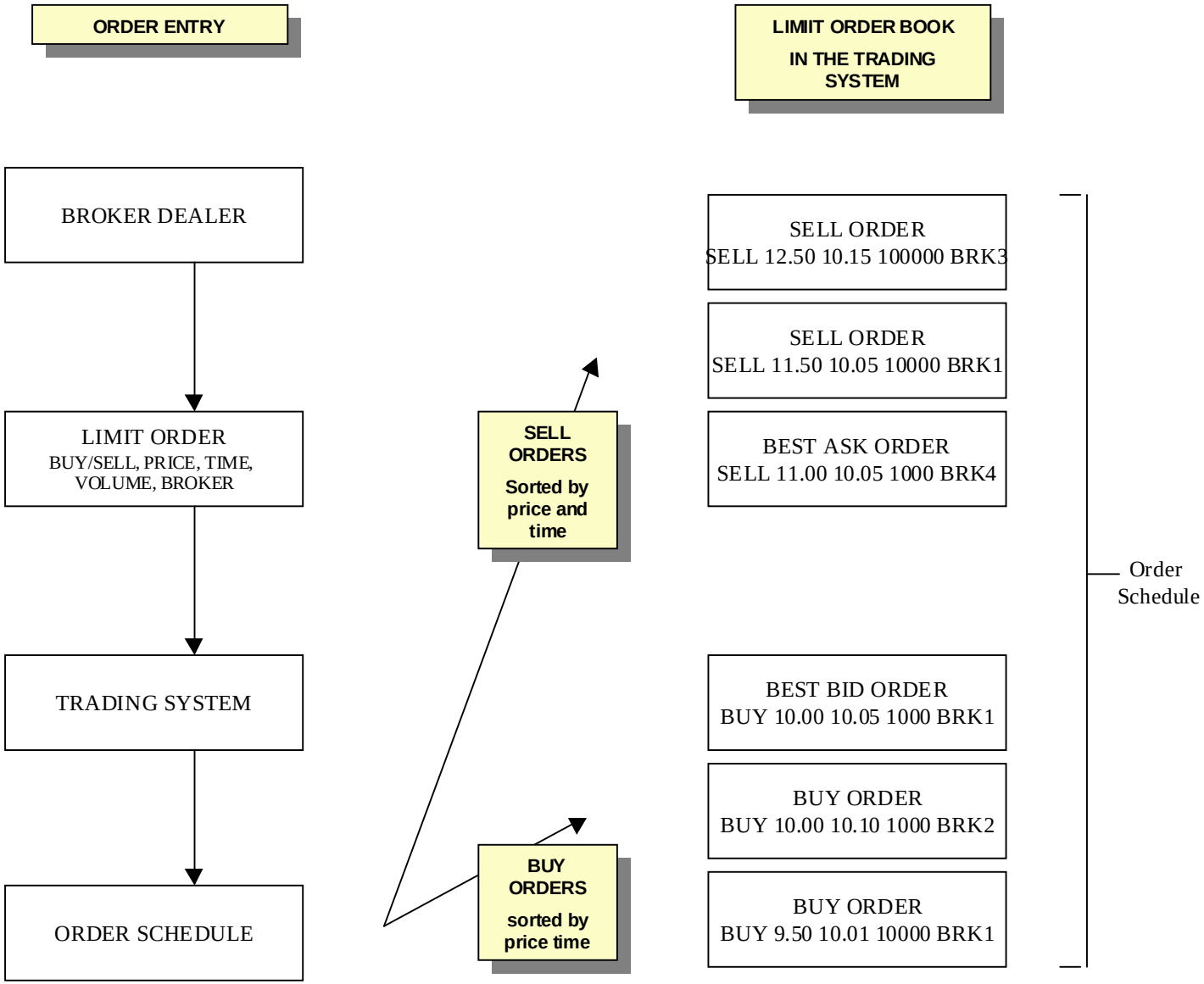

Figure A. 1. Every order contains the following basic information: Type Buy/Sell, price, time, number of shares and broker-dealer code