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Abstract

The Danish blue-chip index – the KFX Index – provides an interesting case for studying the effects of changes in a stock market index. This is because of the unique selection criterion used for the composition of the KFX Index. The criterion is publicly known and based on a combination of liquidity and market value of the stock.

Consistent with the selection criterion, the stock price effects are generally small at the announcement of a change and at the later date when the change comes into effect. However, the deleted stocks experience an abnormal return averaging -17% in the half year period before the change. The additions experience an average abnormal return of 5%, but in this case the stock price effect is found only in the last month before the announcement.

Furthermore, this study shows that abnormal trading activity and price-pressure occur around the effective date which is consistent with investors rebalancing portfolios. In the long-run deleted stocks experience a decrease in trading volume while stocks that are added maintain their high level of trading volume.

The findings here suggest that the effects are best explained by the so-called imperfect substitutes hypothesis or the information costs/liquidity hypothesis. This means that stocks in the KFX Index are exposed to a higher demand or more attention and lower cost of trading than stocks outside the index.

1 Introduction

The effects on prices and trading volume of a stock when added to or deleted from stock market indices have been widely examined for the U.S. stock market. The great interest is due to the fact that these effects provide important insight into the functioning of stock markets and the behavior of stock market participants, including fund managers. In addition, some of the findings indicate inefficiencies in the stock market. The existing literature on U.S. additions and deletions provides mixed results on the size and duration of the effects and suggests a variety of different explanations for the findings. Even so, all studies of the U.S. market basically agree that the addition of a stock to an index leads to a positive effect on the stock price.

This paper examines the effects on stocks added to and deleted from the Danish blue-chip index, called the KFX Index. The motivation for this paper comes partly from an incident that occurred May 29, 2000 on the Danish stock market. On that date, a Danish financial news wire announced that the stock in Damgaard would be added to the KFX Index due to an ongoing delisting of a current KFX stock. The announcement was released shortly after the stock exchange opened and stated that the information was based on information from the Copenhagen Stock Exchange. As seen from figure 1 this immediately lead to a stock price increase of at least 13% relative to the closing price the day before. However, a few hours later, shortly after eleven o'clock, the stock exchange made an announcement stating that Damgaard would not be added to the KFX Index. This caused a stock price decline of at least 5%. Therefore, based on this specific case, it seems that the stock price effect for Damgaard of being added to the KFX Index is between 5% and 13%.

While it is of course relevant to test more formally whether this stock price effect holds generally for the Danish KFX Index, there are two additional reasons why it is particularly interesting to examine changes in the KFX Index.

First, there is the particular selection criterion used for the Danish KFX Index. For several of the U.S. stock market indices, like the S&P 500, the selection criterion used is loose and not based on specific publicly available information. Furthermore, deletions from the U.S. stock market indices are primarily due to corporate events such as mergers, acquisitions, and spin-offs leaving only a very few clean deletions. In contrast to the U.S. stock market, the composition of the KFX Index is based on a specific selection criterion using information accessible for all market participants. As described later, the KFX selection criterion is such that the addition of a stock to the KFX Index does not provide any new *fundamental* information about that stock

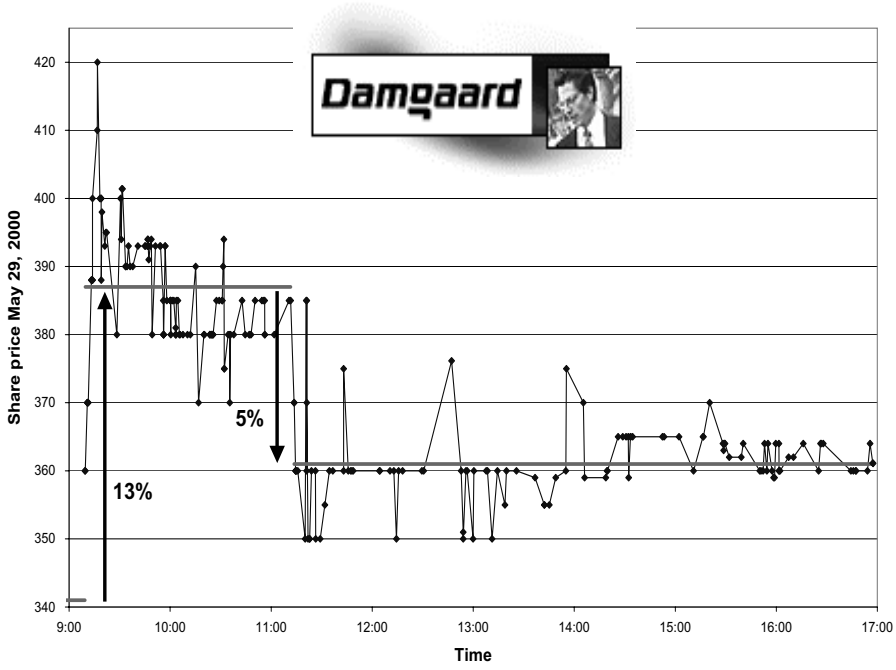

Figure 1: The stock price for Damgaard on May 29, 2000. Just after the stock exchange opened, a news wire announced that Damgaard would enter the KFX Index. Shortly after eleven o'clock Copenhagen Stock Exchange announced that this was a mistake and that Damgaard would not be added to the KFX Index.

to the stock market. This makes it possible in the case of the KFX Index to examine some of the explanations for an effect separate from the pure information signaling explanation. Similarly, the KFX selection criterion also implies that there will be approximately the same number of clean additions to as clean deletions from the index. Thereby, it is possible to make a more rigorous examination of the evidence related to clean deletions and a more credible comparison between additions to and deletions from an index. Finally, since the KFX selection criterion implies that some stocks get added and deleted several times, there is a unique opportunity to examine if this influences the effects.

Second, for the KFX Index there is a long period of time (normally more than one month) between the date at which the composition of a new index is determined and announced (the announcement date) and the date when the new index comes into effect (the effective date). This long period makes it possible to consider the effect on stock prices and trading volume around the two dates separately. For the U.S. stock market indices this time period is much shorter varying from 0 days to approximately one week.

The remaining part of this paper is organized as follows. Section 2 explains the competing explanations for an index effect and describes the existing evidence for index effects. Section 3 provides information concerning the selection criterion for the KFX Index while section 4 describes the data set and the methodology used. The results are presented in section 5. Section 6 discusses the implications of the results and concludes.

2 Explanations and literature review

The following considers explanations for an index effect and describes the related literature. Section 2.1 gives a detailed overview of the possible explanations and discusses their implications for the effect on stock prices and trading volume. Section 2.2 reviews the related literature.

2.1 Explanations for an index effect

Not less than five hypotheses have been suggested as explanations for the effects on stock prices and trading volume from changes in stock indices. First, there is the *information signaling* hypothesis according to which the deletion from or addition to an index provides new information to the stock market regarding the stock's future prospects. Second and third, it may be that whether or not a stock is part of an index has consequences for the demand for or trading volume of the stock. Such a change in the demand for and liquidity of the stock leads to the *price-pressure* hypothesis or the *imperfect substitutes* (or downward-sloping long-run demand curves) hypothesis dependent on whether the effect is temporary or permanent. Fourth, and closely related to the imperfect substitutes hypothesis, is the *information costs/liquidity* hypothesis which states that an index effect on stock prices is due to a change in the general costs of trading the stock. The fifth and a somewhat alternative explanation is the *selection bias* explanation stating that the reason for the effect is related to the criterion used to determine the composition of the index. The following provides a more detailed description of these explanations and discusses their implications for the pattern of stock prices and trading volume around a change in an index.

2.1.1 Information signaling

According to the information signaling hypothesis an addition to an index is considered good news while a deletion is bad news. There are many reasons for this. Several of these are related to the other explanations for an effect and will therefore be described later. One reason why information could be revealed by changes in an index is if the decisions by an index committee are based on non-public information about a stock. This argument is especially relevant for such U.S. stock market indices as the S&P 500 whose composition is decided by an index committee using loose selection criteria. An example of such criteria is that the firms in S&P 500 should be leading companies reflecting the U.S. stock market.

However, there are also other reasons why a deletion could be bad news and an addition good news, but several of these are more difficult to categorize and evaluate. An example is the value of belonging to the stock market's prestigious "premier league" and the increased attention caused by this. A similar example is related to the general perception that such indices provide a list of potential targets for take-overs by foreign firms. Hence, a positive stock price effect associated with being part of an index could be explained by an increase in the likelihood of receiving a take-over premium.

According to the information signaling hypothesis, a stock price effect is expected to be of permanent nature but it is difficult to say anything specific about the implications for the trading volume.

2.1.2 Price-pressure and imperfect substitutes

The addition of a stock to an index can lead to an increase in the demand for or the trading volume of the stock, while its deletion can lead to the opposite effect. There are four reasons for this:

First, there are different types of funds (so-called index funds or index trackers) that primarily invest in the stocks in a certain stock index. The investment strategy behind these funds is to invest in the stocks proportionally to their weights in the index. This means that a change in the index will lead these funds to sell the stocks that are deleted from the index and buy the stocks that are added.

Second, many stock indices are used as benchmarks for active portfolio managers. Such benchmarking will lead to an increased incentive for a risk-averse portfolio manager to invest in the stocks in the index. An investment in the benchmark index will be riskless from the

portfolio manager's point of view because the manager thus avoids results that are worse than the benchmark used for evaluating his performance.[1]

Third, foreign investors invest primarily in stocks from the major stock indices. This behavior may be caused either directly by investment rules/strategies or simply because the stocks within the major stock indices are the only stocks that are followed closely by the foreign investment banks.

Fourth, it often happens that there are futures and options traded on a stock market index. Hedging to minimize the risk involved with such instruments will also increase trading in the stocks in the index.

Dependent on whether such changes in demand for and trade with the stocks has a temporary or more permanent effect, we have the price-pressure hypothesis and the imperfect substitutes (or downward-sloping long-run demand curves) hypothesis.

Price-pressure:

One possibility is that the only change in trading volume is a temporary change around the announcement or effective date when the investors are rebalancing their portfolios. The rebalancing will make the investor sell the stocks deleted from the index and buy the stocks added to the index causing what is denoted price-pressure. Price-pressure is the term used to refer to an immediate price drop (rise) associated with large sales (purchases) of a stock. This price change is the compensation for the transaction costs and portfolio risks to the investors who are willing to buy or sell securities they otherwise would not trade and hence provide liquidity to the market. The compensation comes when prices again rise (drop) to their full-information levels.

Hence, according to the price-pressure hypothesis we should only expect a temporary price change. Furthermore, the pattern in trading volume is expected to be consistent with the stock price pattern, i.e. abnormal trading volume is expected around the time where the stock price effect is found.

Imperfect substitutes (or downward-sloping long-run demand curves):

If different stocks are not close substitutes the long-run demand curve will be less than perfectly elastic. This implies that stock prices will have to increase in order to eliminate an excess

[1] In addition, Cuoco and Kaniel (2001) show that with symmetric performance fees, managers will actually have an incentive to overweight the benchmark portfolio.

demand for a stock caused by an increase in demand. Hence, we should expect that an increase in demand for stocks added to an index will lead to a permanent stock price increase as long as that stock is in the index. Similarly, a decrease in the demand for stocks deleted from an index will lead to a permanent stock price decline. The effect expected on trading volume is less clear. This is because an increase in the trading volume for instance could be either a short term or permanent effect dependent on the trading behavior of the investors causing the change in demand. For example the effect will be only short term if investors simply hold on to the stocks as long as the stock is part of an index. In this case, there will only be an increase in the trading volume around the change in the index when additions are bought and deletions sold. As long as a stock is part of an index, the trading volume will just be normal or maybe even lower than normal. On the other hand, if investors generally buy and sell stocks that are part of an the index, the effect on trading volume will be permanent as long as the stock is part of the index.

2.1.3 Information costs/liquidity

An addition to an index can lead to an increase in the information available and lower the cost of acquiring additional information about a stock. This is because stocks in the main indices attract more attention and more often are the target for analysts. Furthermore, the increase in the information available about the stock may, together with a potential increase in the trading volume, lower the bid-ask spread and thus also lower the overall transactions costs.

According to the information costs/liquidity hypothesis, investors demand a premium for higher trading costs and for holding securities that have relatively less available information. Hence, when a stock is added to an index the stock price will increase because the addition to the index will lower the general costs of trading that stock. Therefore, for stocks added to an index we should expect a permanent stock price increase, an increase in the liquidity of the stock, and a decrease in the bid-ask spread.

2.1.4 Selection bias

A final and somewhat different explanation for some of the effects found for changes in an index is the selection bias. A selection bias will for example occur if only stocks with high returns in the period before a change in an index are added to that index. In such a case, the selection criterion simply implies that stocks selected for the index will have shown high stock returns

in the period before the change. This explanation may be relevant in cases where a selection criterion implies that changes are partially anticipated. We will return to this later.

2.2 The existing evidence – literature review

Many papers have considered index revisions since Shleifer (1986) and Harris and Gurel (1986) first found a price effect for revisions of the S&P 500 index. However, the literature has focused primarily on revisions of the S&P 500 index. The following briefly describes the different findings to date.

Shleifer (1986) finds a permanent stock price increase for additions to the S&P 500 index and explains this by the imperfect substitutes hypothesis. Direct evidence for an increase in demand from index funds can be found in Pruitt and Wei (1989). Pruitt and Wei (1989) document that the holdings of institutional investors change in connection with changes in the composition the S&P 500 index. In contrast with the findings in Shleifer (1986), Harris and Gurel (1986) find that stock prices fully revert to their pre-event levels within two weeks. Furthermore, Harris and Gurel (1986) find a significant increase in trading volume associated with the announcement of a change. These findings can be taken as evidence for a temporary price-pressure. Jain (1987) finds no evidence for a temporary effect and suggests that the effect instead is due to new information revealed by the announcements.

Dhillon and Johnson (1991) find a positive permanent stock price effect and a permanent increase in the trading volume following the announcement of an addition to the S&P 500 index. Furthermore, prices of call options increase while prices of put options decrease. These findings are taken as evidence that the effect is due to an increase in the liquidity of the stock and a decrease in the information costs and bid-ask spread of the stock.

Originally, changes in the S&P 500 index were announced and became effective the same day. This procedure was changed in 1989 so that changes now are announced approximately one week before the new index comes into effect.[2] Beneish and Whaley (1996) and Lynch and Mendenhall (1997) show that after the change in the revision procedure there is still a positive stock price reaction associated with being added to the S&P 500 index. However, now the stock price effect is found primarily at the announcement date and solely in the period from the announcement until the effective date. Furthermore, Beneish and Whaley (1996) and Lynch and

[2]Beneish and Whaley (1996) argue that this change in the procedure was an attempt to avoid the extensive buying pressure around changes in the index.

Mendenhall (1997) document that the pattern in trading volume is related to the change in the index. These findings are explained by the so-called S&P game where arbitrageurs buy stocks added to the index at the announcement and then later, when the new index comes into effect, sell the stocks to index trackers and others who want to hold the index stocks.

A few other papers have considered revisions of indices other than the S&P 500 index. Beneish and Gardner (1995) examine changes in the Dow Jones Industrial Average (the DJIA) and find that there is no stock price increase for additions but that deletions from the index experience negative abnormal returns. The explanation suggested is that added firms are usually actively traded prominent firms, whereas deleted firms are often smaller, less actively traded firms. Therefore, only the latter of the two groups will be influenced by a change in the liquidity and the information available.

Chung and Kryzanowski (1998) examine revisions of the Canadian TSE300 index. Brealey (2000) examines revisions of the FTSE share indices. Elayan, Li, and Pinfold (2001) examine changes in the NZSE10 and NZSE40 indices for the stock market in New Zealand. Barontini and Rigamonti (2000) examine revisions of the Italian MIB30 and MIDEX indices while Bildik and Gulay (2001) examine changes in two indices for the Istanbul Stock Exchange. All find that revisions of an index lead to a price effect for the relevant stocks. The size of the effect ranges from 2% to 7%. However, the evidence is mixed on whether the effect is temporary or permanent. Similarly, the few studies that include trading volume in the analysis also provide mixed evidence on the effect on trading volume.

3 The Danish blue-chip index – the KFX Index

The KFX Index was introduced in 1989 to represent the development in stock prices of major Danish blue-chips and to be used as an underlying index in connection with the establishment of an option and futures market (the FUTOP market) for stocks on the Copenhagen Stock Exchange. The KFX Index is the most important Danish stock index, constituting 67% of the total market value and accounting for 79% of the total turnover in market value.[3]

When a stock is added to the KFX Index it becomes part of the so-called KFX portfolio and the KFX Index is calculated as a market-value weighted price index of the stocks in this portfolio. Thereby, it is actually not the firms as such that are in the index but individual stocks.

[3] As of the end of December 2001 according to the Monthly Report, Copenhagen Stock Exchange.

The same basic selection criterion has been used to select the index in most of the period since the introduction in 1989. However, in connection with the revision of the index in November 2000, several firms were accused of trying to influence the revision i.e., accused of trading in the stock market to get the firms included in the KFX Index. Following this incident, the Copenhagen Stock Exchange decided to change the selection criterion. The following will describe the selection criterion used for most of the period and briefly mention how the selection criterion was changed.

According to the original selection criterion, the KFX portfolio was selected through a two-step selection procedure in which liquidity was the primary consideration and market value the secondary. More precisely, the selection of the stocks is made as follows. First, the Exchange selected the basic portfolio consisting of the 25 most traded stocks throughout the so-called reference period (typically the preceding half a year). Thus, for a review on November 1, the reference period would be the period from May 1 to October 31 of the same year. For each trading day in the reference period, a list was made of the 25 most traded stocks according to the market value of so-called system-generated trades. The 25 stocks featuring most frequently on the daily top-25 lists during the reference period were selected for the basic portfolio. These were then ranked according to their total market value on the trading day preceding the selection day, and the 20 stocks with the highest market values were selected as the new KFX portfolio. The new KFX portfolio came into effect approximately one and a half months after the selection and the announcement hereof. Appendix A describes and illustrates this selection procedure in connection with the revision that was made May 1, 2000.

As mentioned, this selection procedure has been used from the first calculation of the index in 1989 until June 2001. The only changes in the procedure during this period was with respect to the frequency of the revisions, the number of stocks in the index, and the length of the time period between the announcement date and the effective date. The frequency of the revisions has been changing from being every three months to just once a year. Until 1992 the number of stocks included in the basis portfolio was 40 stocks instead of 25 while the KFX portfolio consisted of 25 stocks instead of 20. Until 1995 the period of time between the announcement and the effective date was approximately one month.

The new selection procedure that became effective in June 2001 considers only the liquidity of the stocks. Briefly explained, the 20 stocks are still selected based on two criteria. The primary criterion is highest turnover in terms of market value during the reference period. The

second criterion is that the stock must have been on the daily top 25 lists described above at least 40% of the days in the reference period.[4]

One important consequence of both selection procedures is that, as the time of a revision approaches, it will be possible to predict the changes in the index with more accuracy. Hence, one should in general not expect that the market is surprised by the changes when they finally are announced. How early it is possible to predict the changes will differ from revision to revision due to the different factors in the selection criterion. On several occasions it has occurred that the competition for being part of the index was not determined until the date of the revision.

3.1 The explanations for an effect in connection with the KFX Index

The following considers the implications of the explanations described in section 2.1 in connection with changes in the KFX Index. It is here important to remember that the selection criterion for the KFX Index implies that changes in the index will be partly anticipated. For example, some of the major Danish investment banks have since 1994 published predictions of the changes in the KFX Index. The announcement of these predictions started approximately one month before the selection date.

In a perfect capital market the selection criterion implies that an eventual stock price effect from a change in the index should be expected in the period before the announcement of the change. Hence, the only possibility for a stock price effect around the announcement, or the date where the new index comes into effect, is if abnormal trade around these dates creates price-pressure and the effect is then expected to be temporary.

There are also several reasons why it will be difficult to determine the exact size and location of an eventual stock price effect. First, the certainty by which changes can be predicted will differ from one revision to another. Second, the stock market may, in determining the value of being added to the KFX Index, take into account the possibility that the stock later is deleted from the index. Third, the effect might have been changing over time since the introduction of the KFX Index in 1989. Reasons for such a change could be the increase in attention paid to the index, the use of the index as benchmark, or the investment from foreign investors.

For the KFX Index the selection bias might also be particularly relevant in the case of the original selection criterion. This is because the market value of the stock was part of the selec-

[4]For a more detailed description of the KFX Index and the current selection procedure, please see "Guidelines for calculation of the KFX Index" published by the Copenhagen Stock Exchange.

tion criterion and it may be that the most actively traded stocks are also the stocks that have the highest returns in the period before the selection. If this is the case, part of a KFX effect can simply be caused by the fact that the stocks selected for the KFX portfolio are exactly those stocks which have yielded a higher return than the market. However, for the KFX Index the reference period is (at least) half a year before the change of the index. This implies that if the selection bias is the only explanation of an effect, the effect should be expected to be distributed over the whole reference period and not only over a relatively short period of time before the change of the KFX Index.

All in all, it is clearly difficult to separate the possible explanations of an effect. However, because of the selection criterion the "pure" information hypothesis cannot be the explanation of an effect. Furthermore, the results on trading volume will also help to shed some light on the possible explanations.

4 Data-set and methodology

In order to examine the effect of changes in the composition of the KFX Index we determine all changes in the index since the introduction. From this initial set of changes in the index all changes that are related to name changes, mergers, spin-offs or delistings of the stock are removed.[5] Furthermore, we do not consider the latest changes made using the new selection criterion. This leads to a data-set consisting of 50 observations of stocks which were added to the KFX Index and 50 observations of stocks which were deleted from the index. A total of 46 different stocks are involved as some of the stocks have been deleted from or added to the index several times.[6] The distribution through time of the changes follows from table 1. The table shows that even though there are slightly more changes in the earlier periods where the index was changed every three months there does not seem to be a severe problem with clustering.

For each stock the relevant price and trading volume information is obtained from Datastream and the Danish stock price database denoted Børsdatabasen. Daily stock returns (continuously compounded) are calculated from the stock prices and are adjusted for dividends. The

[5]Only a few stocks are removed from the initial sample meaning that nearly all changes in the index are due to deletions from and additions to the index and not as for example for the S&P 500 where most deletions are related to mergers, acquisitions, reorganizations or bankruptcy.

[6]There are 16 cases where a stock deleted from the KFX Index has experienced a deletion before and there are 14 cases where a stock added to the index has been added to the index before. One Danish bank has been added to the KFX Index five times and deleted four times.

Year	89	90	91	92	93	94	95	96	97	98	99	00
Deletions	5	4	6	11	4	4	3	2	2	2	4	3
Additions	5	7	6	6	5	4	3	2	2	2	4	4

Table 1: Distribution through time of the sample of changes in the composition of the KFX Index.

return on the All-Share Index (Totalindekset) is used as market return.[7] The All-Share Index is a market-value-weighted index for all the stocks traded on the Copenhagen Stock Exchange. The daily total trading volume on the Copenhagen Stock Exchange is obtained from the Daily Stock Price Record (Officiel Kursliste) for the Copenhagen Stock Exchange.

A standard event-study methodology is used to examine the stock price effects associated with the changes in the KFX Index. In order to avoid a possible bias caused by the period used as estimation period, we use simple market adjusted returns.[8] However, this is not a crucial issue for the short periods around the announcement and the effective dates.

Regarding the long-run stock returns there is unfortunately no standard and agreed-upon method of examination. In particular, the problem as to which benchmark should be used and the way the adjusted stock returns should be obtained and measured has been the topic for much discussion. We will here present the results from using the event study methodology to examine the stock returns. The analysis from using wealth relatives (WR) leads to quite the same conclusions.[9]

In order to provide further insight into the stock returns around changes in the KFX Index we also estimate the relation between the return for stock i and the market index using the market model. This is done for different time periods relative to the change in the index. More precisely, for each stock i and for each of the different time periods considered, we run the following ordinary least squares regression:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}. \tag{1}$$

[7]The return on the KFX Index has also been used as market return and the results regarding the abnormal returns are similar to those obtained when using the All-Share Index.

[8]As discussed earlier we could expect that deletions (additions) underperform (overperform) the market in the period before the change according to the selection criterion. Hence, using a pre-event estimation period would create a bias in the abnormal returns. Edmister, Graham, and Pirie (1994) consider this problem in connection with the effect of changes in the S&P 500 Index.

[9]The wealth relative measures what a DKK 1 investment in a stock deleted from or added to the index would have yielded relative to a DKK 1 investment in the market during the period under consideration.

Here $R_{i,t}$ denotes the return for stock i during day t, while $R_{m,t}$ denotes the return on the market index (again the All-Share Index).[10]

In order to examine whether the addition to or deletion from the index leads to a change in the trading activity in the stock, we analyze trading activity using the methodology proposed in Harris and Gurel (1986) and Beneish and Gardner (1995). For stock i during period t abnormal trading activity is measured using the market adjusted volume ratio, VR_{it}, defined as:

$$VR_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_{m.}}{V_{i.}} \tag{2}$$

Here, V_{it} is the trading volume (number of shares traded) of stock i and V_{mt} is the total trading volume at the Copenhagen Stock Exchange during period t. $V_{i.}$ and $V_{m.}$ denote the average of V_{it} and V_{mt}, respectively in the periods $AD-120 : AD-26$ and $ED+26 : ED+120$, where AD is the announcement date and ED the effective date. If there is no change in trading volume associated with a change in the KFX Index, the expected value of VR_{it} is one. Finally, in order to examine a change in trading activity further, we also calculate the "volume" ratio VR_{it}, using market value of the stocks traded instead of the trading volume.

5 Results

The following describes the effect of changes in the KFX Index in two parts. First, section 5.1 considers the stock price effect closely around the announcement and the effective date and the stock price effect over a longer time horizon. Second, section 5.2 provides the results about the effect on trading activity.

5.1 The stock price effects

We begin by examining whether stock price effects can be found around the announcement or the effective date. Table 2 shows the abnormal return for day -1, day 0, and day $+1$ relative to the announcement date and the effective date for deletions from and additions to the KFX Index. Day -1 is included because the two events as discussed above are partially anticipated and hence we cannot exclude the possibility of an effect on the day prior to the announcement

[10] The KFX Index has also been used as marked index here. This changes the size of especially the estimated β parameter but does not change the basic conclusions.

date or the effective date. Furthermore, the table shows the cumulative abnormal return over the period from the announcement date to 1 day after and the period from 1 day before the effective day to 1 day after. The reason for this difference will be explained later.

Deletions					
	Eventdays	$\overline{AR}$ ($\overline{CAR}$)	Median AR	t-test	$\% > 0$
AD	-1	-0.09%	-0.04%	-0.54, p=59%	49.0%, p=44%
	0	-0.22%	-0.23%	-1.05, p=30%	44.9%, p=24%
	$+1$	-0.14%	-0.09%	-0.71, p=48%	46.9%, p=33%
	$0:+1$	-0.36%	-0.04%	-0.98, p=33%	46.9%, p=33%
ED	-1	-0.63%	-0.53%	-2.66, p=1%	48.8%, p=6%
	0	-0.01%	-0.07%	-0.04, p=97%	46.9%, p=33%
	$+1$	0.12%	-0.25%	0.46, p=65%	44.9%, p=24%
	$-1:+1$	-0.51%	-0.52%	-1.4, p=17%	42.9%, p=16%

Additions					
	Eventdays	$\overline{AR}$ ($\overline{CAR}$)	Median AR	t-test	$\% > 0$
AD	-1	0.08%	-0.06%	0.50, p=62%	47.9%, p=40%
	0	0.26%	0.17%	1.45, p=15%	54.2%, p=28%
	$+1$	0.65%	0.18%	2.20, p=3%	64.6%, p=2%
	$0:+1$	0.91%	0.47%	2.18, p=4%	64.6%, p=2%
ED	-1	0.97%	0.66%	3.58, p<1%	68.8%, p<1%
	0	-0.32%	-0.25%	-1.91, p=6%	31.3%, p<1%
	$+1$	-0.11%	-0.13%	-0.74, p=47%	43.8%, p=20%
	$-1:+1$	0.54%	0.06%	1.68, p=10%	50.0%, p=50%

Table 2: The mean and median abnormal return and the fraction, $\% > 0$, of positive abnormal returns around the announcement date (AD) and the day where the new index comes into effect (ED) for deletions and additions. The table also provides two tests for whether the abnormal returns are significant. The t-test is a standard t-test for whether the average is different from zero while the sign-test is a non-parametric test for whether the number of positive returns are different from the number of negative returns. For both tests p denotes the p-value for the test.

From table 2 we observe that the abnormal returns around the announcement date are consistently negative for deletions and positive for additions. The effects are generally small and insignificant in size. The only exception is for day $+1$ for additions where there is a significant positive effect of 0.65%. For the abnormal returns around the effective date, the results are slightly more mixed. For deletions the abnormal return on the day prior to the effective date

is significantly negative, whereas the abnormal return on the following two days is close to zero or actually positive leading to an insignificant cumulative abnormal return for the period from 1 day prior to 1 day after the new index comes into effect. The additions show the opposite pattern. The abnormal return on the day prior to the effective date is a significant +0.97%, whereas the abnormal return on the following day is significantly negative (at the 10% level according to the t-test and at the 1% level using the sign-test). The abnormal return on the day after the effective date is also negative but not significant. All in all this leads to an insignificant cumulative abnormal return of +0.54% in the period from one day prior to one day after the new index comes into effect. This pattern where negative (positive) abnormal returns are followed by positive (negative) returns around the effective date indicates the existence of price-pressure which we will return to when the trading volume is examined.

All in all, there is no clear overall stock price reaction to the changes in the KFX Index around either the announcement date or the effective date. However, as discussed earlier there are also reasons why an effect associated with a change in the index should be expected prior to the change. Therefore, the following examines the abnormal returns for longer periods of time relative to the change in the index.

A first look at the abnormal returns over longer periods relative to the change can be found in figure 2. The figure plots the time pattern of the cumulative average abnormal returns in the period from 120 days before to 120 days after the announcement.[11]

From the figure we observe that stocks deleted from the KFX Index underperform the market with around 19% in the period from a half year before to approximately a half year after the announcement. The underperfomance corresponding to 14% is strongest in the period before, however, the effect seems to be evenly distributed in the period from 120 days before to approximately 40 days after the announcement.

From the figure we further observe that stocks added to the KFX Index do relatively well compared to the market. The additions show an average abnormal return of around 10% in the period from approximately one half year before to approximately one half year after the announcement. However, it is primarily in a relatively short period leading up to the announcement that the stocks yield a higher return than the market. Thus, the figure shows that additions to

[11]Two additions are excluded when drawing this figure and when studying the long run abnormal returns in the following. The two observations are Navision and Vestas with abnormal return of 113% and 79% respectively in the period before they were added to the KFX Index. These two extreme observations are excluded because they indeed would influence the abnormal return in favor of finding a positive effect of being added to the KFX Index.

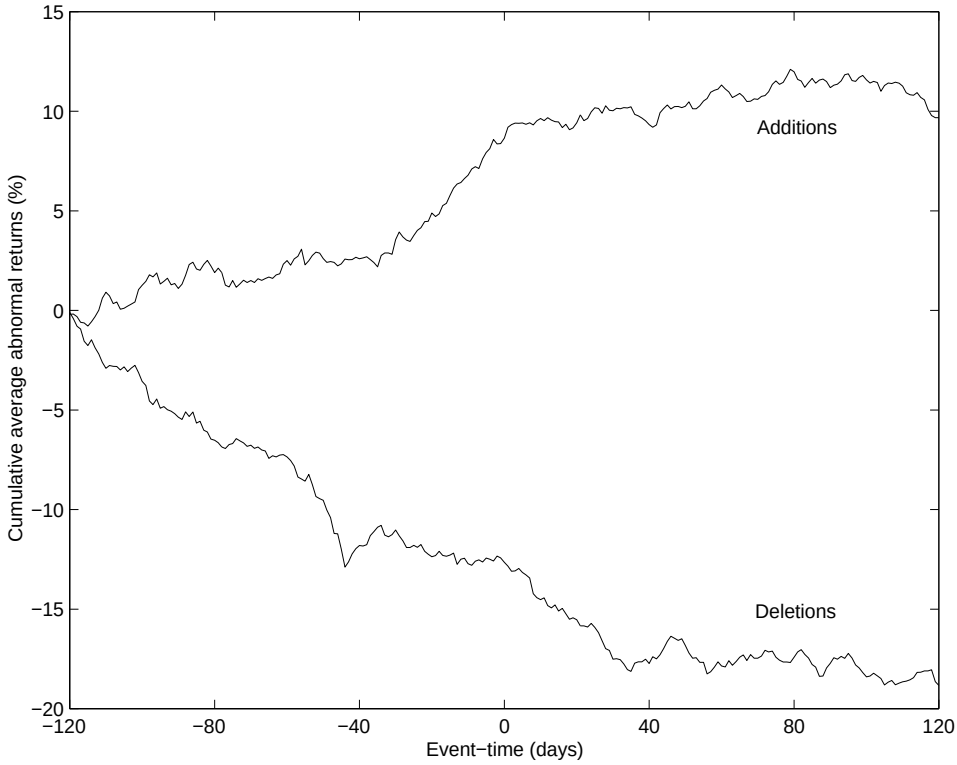

Figure 2: The time pattern in event time of the cumulative average abnormal return ($\overline{CAR}$) for both deletions from and additions to the KFX Index. Date 0 is the announcement date. The All-Share Index is used as market index.

the KFX Index have a positive effect on stock prices, and that this effect results in an abnormal return of around 5% within the last month before the announcement.

Statistical analyses presented in table 3 confirm the observations made based on figure 2. In particular for deletions the cumulative abnormal return is -20.69% for the period from 120 days before the announcement date until 120 days after the effective date and the effect is significantly negative in several of the time periods. For additions the cumulative average abnormal return is only significant in one of the time periods considered, namely from 25 days before until 2 days before the announcement date. In this period the average "actual effect" of being added to the KFX Index is 4.94% (median 4.88%).

In neither of the cases do we find evidence that the price change is only temporary, as there is no strong evidence for significant abnormal returns in the period after the effective date.[12]

[12]This observation can also be taken as evidence that the simple market adjustment used to obtain the abnormal returns is appropriate.

Deletions				
Eventdays	$\overline{CAR}$	Median CAR	t-test	$\% > 0$
$AD-120 : AD-26$	-11.75%	-8.12%	-4.24, p<1%	22.4%, p<1%
$AD-25 : AD-2$	-1.44%	-2.18%	-1.88, p=6.7%	40.8%, p=9.9%
$AD-1 : ED+1$	-4.37%	-3.47%	-2.79, p<1%	24.5%, p<1%
$ED+2 : ED+120$	-3.15%	-3.26%	-1.63, p=10.9%	38.8%, p=5.8%
$AD-1 : ED+120$	-7.51%	-8.16%	-3.07, p<1%	30.6%, p<1%
$AD-120 : ED+120$	-20.69%	-16.45%	-5.24, p<1%	22.4%, p<1%

Additions				
Eventdays	$\overline{CAR}$	Median CAR	t-test	$\% > 0$
$AD-120 : AD-26$	3.47%	1.27%	1.00, p=32%	52.2%, p=38%
$AD-25 : AD-2$	4.94%	4.88%	5.15, p<1%	82.6%, p<1%
$AD-1 : ED+1$	1.11%	0.40%	0.92, p=37%	60.9%, p=7.0%
$ED+2 : ED+120$	0.76%	1.34%	0.33, p=74%	52.2%, p=38%
$AD-25 : ED+120$	6.81%	9.88%	2.15, p=3.7%	63.0%, p=3.8%

Table 3: The mean and median cumulative abnormal return (CAR) and the fraction, $\% > 0$, of positive cumulative abnormal returns for different time periods relative to the change in the KFX Index for deletions and additions. The table also provides two tests for whether the abnormal return is significant. The t-test is a standard t-test for whether the average is different from zero while the sign-test is a non-parametric test for whether the number of positive CAR's are different from the number of negative CAR's. For both tests p denotes the p-value for the test.

Two additional aspects of the stock price pattern examined above are of interest in the attempt to understand the stock price effect associated with changes in the KFX Index. The following briefly describes the results from examining these two aspects.

The first aspect is if the stock price effect has changed over time. Given the increase in the focus on the KFX Index, the increase in investment funds and foreign investors through time, it follows from section 2 that one could expect that the effect of being part of the KFX Index has increased. This means that the more recent changes in the KFX Index are expected to have caused a larger stock price decrease for stocks deleted from the index and a larger stock price increase for stocks added to the index. The data shows strong evidence for such a change over time based on several different tests. If we, for deletions, consider the period $AD-120 : ED+120$ as in table 3, we find that the median stock price effect before 1994 is -13.52% while it after

1994 is -22.97%.[13] If we for additions consider the last month before the announcement of the change, then the median before 1994 is 2.84% while it after 1994 is 6.55%. Furthermore, if we run a regression of the abnormal return in the two periods considered on a year dummy, this dummy comes out with a negative (positive) coefficient significant at the 2% (6%) level for the deletions (additions).

The second aspect is if the stock price effect depends on whether it is the first time a given stock is added to or deleted from the KFX Index. As mentioned, the selection criterion for the KFX Index is uniquely relative to, for example, the S&P 500 in the sense that it makes it possible for a stock to be added to and deleted from the KFX Index several times. For the deletions there are 34 stocks that are deleted from the KFX Index for the first time while there are 16 cases where a stock deleted from the KFX Index has experienced a deletion before. For the first group the median stock price decline in the same period as considered above is -14.11% while it is -17.63% for the second group and a t-test and other tests provide no evidence for a difference between the two groups. Similarly, for the additions there are 36 stocks that are added to the KFX Index for the first time while there are 14 cases where the stocks added to the index have been part of the index before. Using the same time period as above the median for the first group is 3.79% while it is 6.48% for the second group. Furthermore, again there is no evidence for a difference between the two groups based on a t-test and other tests. For both deletions and additions we observe indications of the effect being larger for stocks that have already experienced a similar change in the KFX Index which is consistent with the findings of an increase of the effect over time.

Some final results on the effect on stock returns from changes in the KFX Index can be found in table 4. The table shows results from running the market model regression in equation (1). Consistent with the findings above we observe that the estimated $\hat{\alpha}$s are significantly negative (positive) for deletions (additions) in the period before the announcement of the change in the index while the estimated $\hat{\alpha}$s are insignificant after the effective date. With respect to the estimated $\hat{\beta}$s, the deletions experience a significant decrease while additions experience a significant increase in the β-value. Finally, there is no evidence indicating that a change in the KFX Index leads to a change in the volatility of stock returns but in general the deletions seem to have a higher volatility than additions.

[13] Here we use 1994 to divide the sample into two groups, because 1994 as mentioned earlier was the year when the Danish financial press started to announce predictions of changes in the KFX Index. It makes only a small difference if the dataset instead simply is divided in to two groups of equal size.

Deletions						
	$\hat{\alpha}$ (%)		$\hat{\beta}$		$\hat{\sigma}$	
Timeperiod	mean	median	mean	median	mean	median
a) $AD-120:AD-26$	-0.067^{***}	-0.058	0.934	0.901	0.245	0.240
b) $AD-25:ED+5$	-0.069^{**}	-0.066	0.897	0.779	0.247	0.208
c) $ED+6:ED+120$	-0.031	-0.021	0.781^{***}	0.768	0.255	0.221
Diff. c) minus a)	0.035	0.041	-0.153^{*}	-0.254	0.010	-0.003
% with an increase	60%*		30%***		52%	

Additions						
	$\hat{\alpha}$ (%)		$\hat{\beta}$		$\hat{\sigma}$	
Timeperiod	mean	median	mean	median	mean	median
a) $AD-120:AD-26$	0.045^{**}	0.035	0.727^{***}	0.620	0.221	0.198
b) $AD-25:ED+5$	0.116^{***}	0.108	0.826^{**}	0.861	0.225	0.204
c) $ED+6:ED+120$	0.001	-0.010	0.936	0.955	0.225	0.223
Diff. c) minus a)	-0.044	-0.026	0.208^{**}	0.115	0.004	-0.002
% with an increase	43%		68%***		50%	

Table 4: Estimated market model parameters for the deletions from and additions to the KFX Index for the ordinary least squares regression described in equation (1) and the volatility, $\hat{\sigma}$ of stock returns. The different time periods are relative to the announcement date (AD) and the effective date (ED). For $\hat{\alpha}$ the test is for significance of the estimated parameters, whereas for $\hat{\beta}$ the test is for difference from 1. Both are based on a standard t-test. Diff. c) minus a) denotes the difference between the parameters from period c) and period a). The test for difference in parameters between these two periods is a standard t-test for the difference of means between two samples. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

To conclude, it is quite difficult to provide an exact estimate of the tsock price effect of being added to or deleted from the KFX Index. This is because the selection criterion for the KFX Index is publicly known and based on available information. Therefore, the stock market will in general anticipate the changes in the index meaning that one should be somewhat careful not to make too strong conclusions from an event study. However, the data set also provides several cases in addition to the example in the introduction in which the stock market on a given day learns *new* information in connection with deletions from or additions to the KFX Index. Most of these cases are situations where there is uncertainty about changes in the index until the day of the announcement due to close competition between a few stocks. The evidence found in

these cases is not in conflict with any of the findings above and provides in several cases further evidence for the findings of a stock price effect in the order of 5% to 10%.

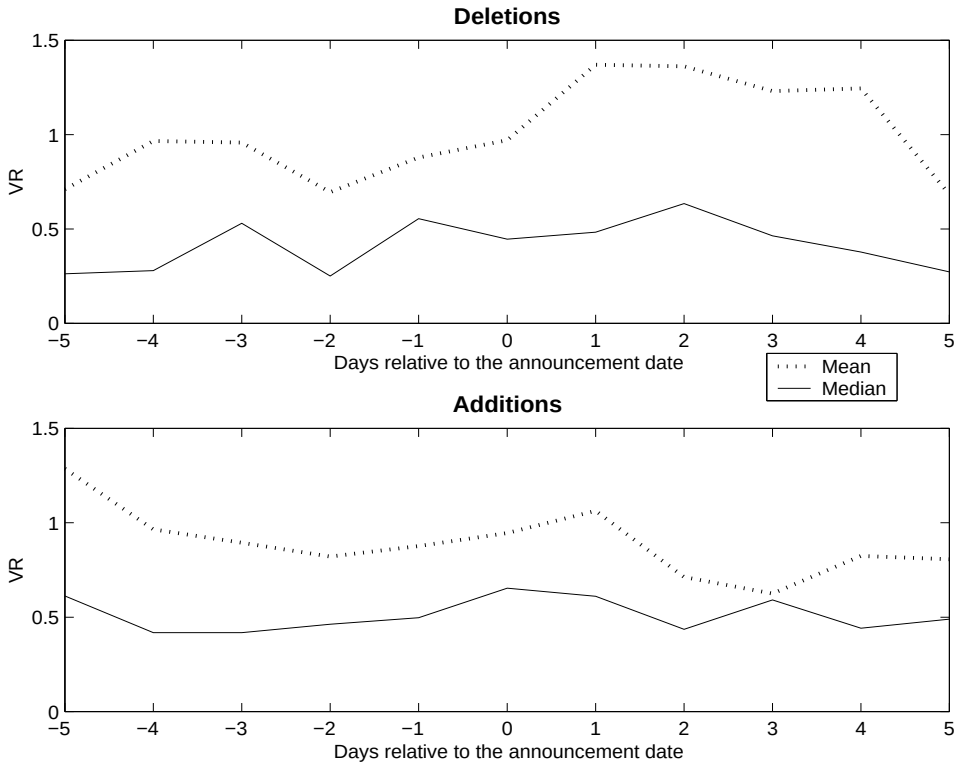

Figure 3: Time pattern of the mean and median volume ratio VR_{it} as defined in section 4 for both deletions from and additions to the KFX Index. The volume ratio is calculated based on the trading volume. Date 0 is the announcement date.

5.2 Trading volume effects

As for the stock price effect, we start examining the trading activity closely around the announcement date and the effective date. Figures 3 and 4 plot the average and median volume ratio around the announcement and effective date, respectively. Figure 3 provides no clear evidence that the time pattern in the volume ratio around the announcement date is related to the announcement itself. Figure 4, however, provides quite strong evidence of abnormal trading activity on the day prior to the effective date even though the magnitude of the effect is larger for deletions than for additions.[14] The abnormal trading activity on the day prior to the ef-

[14]The same conclusions are obtained by considering the same figures based on turnover, i.e. the number of shares traded divided by the total number of shares outstanding. However, in these figures the increase in trading activity one day before the effective date is much more pronounced.

fective date indicates that a number of investors adjust their portfolios in accordance with the change in the KFX Index on that date. This is consistent with the evidence in table 2, showing some price-pressure on the day before the effective day as discussed in section 5.1. However, the increase in trading activity on the day prior to the effective date is clearly most pronounced for deletions. One possible explanation is that it may be more important for investors to make the necessary adjustment of their portfolio for deletions than for additions before the change in the index comes into effect. For example, some investors are required to hold only KFX stocks meaning that the stocks deleted at the latest should be sold when the change in the index becomes effective. For stocks added to the index, there is more flexibility with respect to when the stocks are bought. Another explanation is related to the general trading activity for the two groups i.e., that in the period before the change in the index, the mean (median) turnover for deletions is 0.09% (0.07%) while it is 0.17% (0.12%) for additions. This illustrates, as expected, that stocks added to the index are generally more heavily traded than stocks deleted from the index. Hence, given the same increase in the number of shares traded, this change will on a relative scale be most pronounced for the deletions.

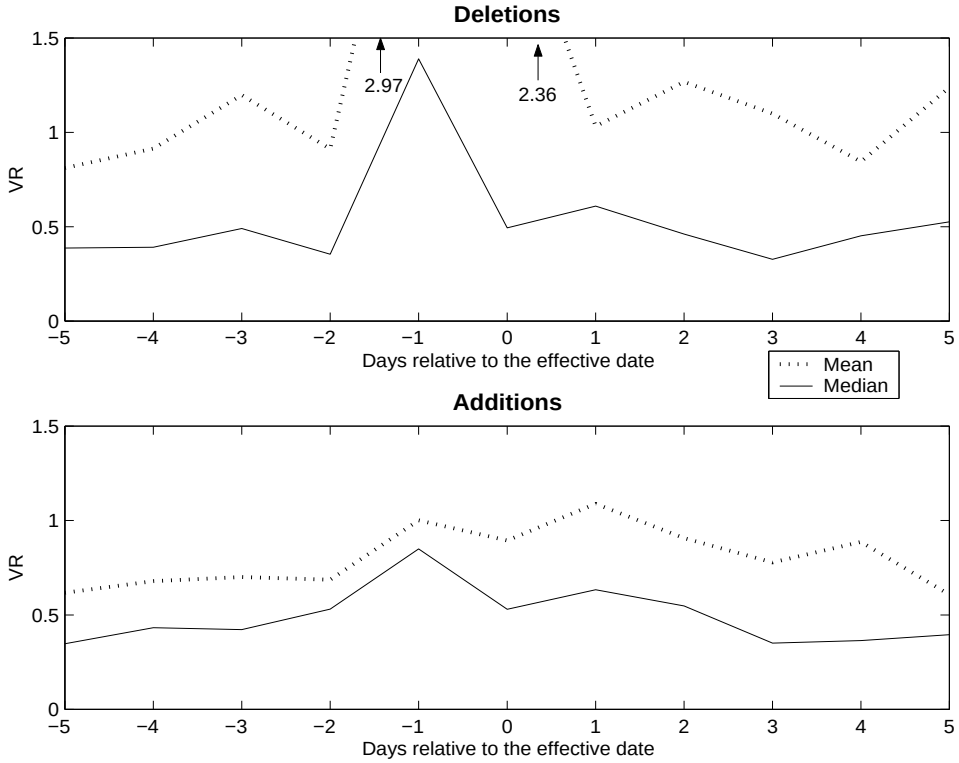

Figure 4: Time pattern of the mean and median volume ratio VR_{it} as defined in section 4 for both deletions from and additions to the KFX Index. The volume ratio is calculated based on the trading volume. Date 0 is the effective date.

The long-run effects on trading activity for deletions from and additions to the KFX Index can be found in table 5. The results in the table indicate a decrease in the trading activity for deletions while the trading activity for additions stays at the relatively high level mentioned above. However, deletions are decreasing in stock price while the opposite holds for additions. Therefore, these results are somewhat sensitive to whether the market value of stocks traded or the number of stocks traded are used to measure trading activity.

Volume ratios, VR				
Market value of shares traded				
	Deletions		Additions	
Timeperiod	mean	median	mean	median
a) $AD-120:AD-26$	1.101**	1.098	0.982	0.956
b) $AD-25:ED+5$	1.122	1.069	0.974	0.900
c) $ED+6:ED+120$	0.952	0.965	1.015	1.001
Diff. c) minus a)	−0.146***	−0.112	0.033	0.024
% with an increase	35%***		63%**	
Number of shares traded				
	Deletions		Additions	
Timeperiod	mean	median	mean	median
a) $AD-120:AD-26$	1.082*	1.058	1.102*	1.039
b) $AD-25:ED+5$	1.148*	1.094	0.999	0.903
c) $ED+6:ED+120$	0.967	0.954	0.980	0.943
Diff. c) minus a)	−0.115**	−0.091	−0.122	−0.093
% with an increase	43%		44%	

Table 5: Volume ratios defined in equation (2) for the deletions from and additions to the KFX Index for three different periods relative to the announcement date (AD) and the effective date (ED). The trading activity is measured using both the market value of shares traded and number of shares traded. The tests are for difference from 1 based on a standard t-test. Diff. c) minus a) denotes the difference between the volume ratios from period c) and period a). The test for a difference in volume ratios between these two periods is a standard t-test for the difference of means between two samples and a binomial test for if the number of increases differs from the number of decreases. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

The fact that the results about the trading volume are not clearer may be explained by the group of investors who primarily buy stocks in the index. If this group simply buys and holds the stocks added to the index one should not expect a general increase in the trading volume. However, if they are more active investors, an increase should be expected.

6 Implications and conclusions

This paper provides evidence that deletions from the KFX Index are associated with a negative stock price effect while additions are associated with a positive effect. The stock price effect is permanent and, consistent with the selection criterion, primarily observed in the period before the change. The effect has increased over time and is not only observed the first time a stock is deleted from or added to the index. Results on stock returns and trading activity indicate the existence of price pressure around the date where the new index becomes effective. For deletions the trading volume decreases while there is only weak evidence for an increase in trading volume for additions. However, this can at least partly be explained by either of the two following factors. First, the trading volume for additions is much higher than for deletions in the period before the change. Second, it might be that investors buying the stocks added to the index simply hold on to the stock as long as the stock is part of the index.

It is difficult to identify one single reason for the effects on stock prices and trading volume. However, the permanent nature of the stock price effect and the evidence on the trading activity suggest that the imperfect substitutes and information cost/liquidity hypothesis are the most likely explanations for the findings. Furthermore, there is fairly strong evidence against the selection bias being the only explanation of the KFX effect. Future research could examine the effect on liquidity even further by examining the effect on the bid-ask spread in order to separate the two most likely explanations.

The existence of a stock price effect (a KFX effect) has at least three important implications for investments in stocks in general and for the selection criterion for and the calculation of the KFX Index. Firstly, we should note that nothing in this study documents that the stock market is inefficient. The positive KFX effect for additions, in particular, seems to occur as it becomes more and more apparent that the stock in question will be added to the KFX portfolio. If one wishes to take advantage of the KFX effect, one should invest in the *next* KFX portfolio instead of the present one. Of course, this is not a simple task, but if one wants to take the KFX effect into account, the results show that one should try to predict the changes in the KFX Index before other investors in the market. Hence, these predictions of changes in the KFX Index are very important consistent with the rising interest in these predictions.[15]

[15]For example, on November 12, 2001 the Copenhagen Stock Exchange started publishing estimates of the composition of the KFX Index on a daily basis.

Secondly, the investors who will lose from the KFX effect are those who invest only in the existing KFX portfolio and thus wait until the effective date before they rebalance their portfolios. Because of the KFX effect these investors will, at a revision, buy the stocks being added to the index *after* the prices of these stocks have risen and sell the deleted stocks *after* the prices of these stocks have fallen. Similarly, the KFX effect implies also that the KFX Index is affected negatively. This is because the positive effect of an addition to the index occurs before the stock is added to the index, while the negative effect in connection with a deletion occurs while the stock is part of the KFX Index.

Thirdly, the KFX effect and some of the perhaps undesirable consequences of it can be used as an argument for increasing the number of stocks in the index or changing the calculation of the KFX Index into a so-called free-float index.[16] The former change would reduce the weight by which the stocks are included in the index, which may reduce the KFX effect on the individual stock when it is added to or deleted from the index. A change to a free-float index would probably also reduce the KFX effect, as the weight of a stock would thus be determined by the number of shares accessible in the market. Finally, an undesired effect in connection with repeated deletions and additions might be avoided if the KFX Index was of the same type as for instance the S&P 500 where companies are deleted only if they are delisted.

Finally, it is difficult to say whether the recent change in the selection criterion will change anything with respect to the effects of being added to or deleted from the KFX Index. One prediction is that the change will actually increase the effects. This is because total market value is no longer part of the selection criterion and hence, it is now more likely that relatively small firms will be added to the index. For these smaller firms especially the information cost/liquidity hypothesis will predict a larger stock price effect.

[16] "Free float" denotes the number of a company's shares which are accessible on the market, i.e. which are not held by the government, funds or families related to the company etc. A free-float index is an index where the weights are based on the market value of the free-floating shares and not like the KFX Index where the entire market value is included in the calculation of the weights.

A The revision of the KFX Index on May 1, 2000

One revision of the KFX Index occurred May 1, 2000 and the new index came into effect on June 19, 2000. Table 6 shows the information used to determine the new composition of the index based on the original selection criterion. First of all, the column with trading days gives for each stock the number of days this stock has been on the daily top 25 lists for the most traded stocks in the period from November 1, 1999 to April 28, 2000 based on market value.[17] As the basis portfolio (stocks number 1-25) the 25 stocks with the highest number of trade days are selected. Afterwards, these 25 stocks are sorted according to the total market value of the stocks based on the closing prices on April 28, 2000. The 20 stocks with the highest market value are finally selected as the KFX-portfolio (stocks number 1-20) and these stocks thereby constituted the KFX Index when it came into effect on June 19, 2000. Compared to the KFX Index before June 19, 2000 this revision led to a deletion of FLS Industries and Jyske Bank from the index and an addition of NEG Micon and NKT Holding to the index.[18]

[17] For stocks not traded in the whole period (marked with a star) the number of trading days are calculated as a relative number according to the so-called 40/10 rule.

[18] NKT Holding is included in the basis portfolio rather than Jyske Bank even though the two have the same number of trade days, because NKT Holding had the highest total trading activity in market value in the reference period.

No.	Trade code	Company name	Trading days	Mkt. value (mio.) on April 28, 2000	Index weight
1	DK0010253335	Tele Danmark	125	129,876	21.83%
2	DK0010227925	Novo Nordisk B	125	71,159	11.96%
3	DK0010244342	D/S 1912 B	123	44,550	7.49%
4	SE0000645913	Nordic Baltic Holding	125	44,359	7.46%
5	DK0010000207	Den Danske Bank	124	43,134	7.25%
6	DK0010244508	D/S Svendborg B	115	42,290	7.11%
7	DK0010242056	Vestas Wind Systems	121	28,650	4.82%
8	DK0010235860	GN Store Nord	124	26,013	4.37%
9	DK0010254572	H. Lundbeck	103	21,270	3.58%
10	DK0010267046	ISS	123	19,795	3.33%
11	DK0010233659	William Demant Holding	93	18,520	3.11%
12	DK0010126309	RealDanmark	82	16,388	2.75%
13	DK0010251636	Navision Software	123	15,469	2.60%
14	DK0010238880	Ratin B	125	15,463	2.60%
16	DK0010232412	Falck	95	14,643	2.46%
15	DK0010207497	Danisco	119	14,323	2.41%
17	DK0010253681	NEG Micon	96	8,387	1.41%
18	DK0010262674	Coloplast B	65	7,659	1.29%
19	DK0010181759	Carlsberg B	89	7,248	1.22%
20	DK0010011758	NKT Holding	54	5,666	0.95%
21	DK0010257591	Damgaard	102	5,132	
22	DK0010224666	NeuroSearch	65	3,360	
23	DK0010218429	Bang&Olufsen Hold. B	73	3,331	
24	DK0010238534	Sophus Berendsen B	83	2,945	
25	DK0016002306	2M Invest (*)	102	2,136	
26	DK0010258482	Jyske Bank	54	6,572	
27	DK0010259613	i-data international (*)	47	2,067	
28	DK0010234467	FLS Industries B	46	5,884	
29	DK0010006329	Østasiatiske Kompagni	42	2,299	
30	DK0010223775	SAS Danmark	37	3,597	

Table 6: The table shows the information used to determine the revision of the KFX Index on May 1, 2000. Stocks number 1-20 are the KFX-portfolio and are the stocks from which the KFX Index is calculated. Stocks number 1-25 are the KFX basis portfolio while stocks number 26-30 are the aspirants to the index. Trading days are the number of days in the reference period during which the stock has been among the 25 most traded stocks.

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