

# Fundamentals or Frictions

## - The Effects of Equity Indices on the Swedish Stock Market

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### Abstract

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Correctly priced equity markets are important for several reasons, of which one of the more prominent is the effect they have on real investments and the broader economy. Focusing on the Swedish OMXS30 index, this study employs three methods to examine the extent of irregularities introduced to the Swedish equity markets due to indices, if any. Firstly, the price effect of inclusions to, and exclusions from, the index is examined. Secondly, the potential effect on the index constituents' stock price comovement with the index is studied. In the context of this, a proprietary theory on index comovement is derived and empirically tested. In the final approach, a market anomaly called the Turn-of-the-Month effect is studied in the setting of index investing. The extent to which either of these effects has been studied on the Swedish market is limited. In general, it is found that the price effects from index inclusions and exclusions are small, but still prevalent. Notably, the effects on the date when the changes are announced are larger than on the date when the changes are effective. Furthermore, the study of the Turn-of-the-Month effect does not provide evidence of larger mispricings due to index investing. In terms of the stocks' comovement with the index, however, signs of irregularities are more prevalent. The empirical results provide support for the new comovement theory proposed in the paper, whereby index stocks' beta with the index converges to one.

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# 1. Introduction

A view easy to endorse without further reflection is that by merely tracking an index, one takes no part in forming asset prices and will have no effect on the market. Although appealing in its simplicity, it is a naive view. Discussing and testing its validity takes one to the core of the notion of efficient markets and the equilibrium models of asset prices.

This paper aims to study whether the Swedish stock market reflects fundamentals or not, and more specifically what potential effects indices might have on stock prices and stock comovement. Are markets efficient enough to cope with an ever-increasing share of drone investors merely tracking the index, and thus an increasing amount of funds flowing in and out of such investment products? And what effect will it have if these investors show signs of herding and irrational behaviour? In his intriguing article “Noise”, Fischer Black (1986) discusses the presence of noise, as the opposite of information, in financial markets. He holds the view that irrational noise traders make financial markets possible at the same time as they make them imperfect. In the context of noise traders catering for liquid markets where price is discovered, he also highlights the need for active trading in individual shares and not only in baskets of stocks:

*If there is little or no trading in individual shares, there can be no trading in mutual funds or portfolios or index futures or index options, because there will be no practical way to price them. The whole structure of financial markets depends on relatively liquid markets in the shares of individual firms. [...] [However] the noise that noise traders put into stock prices will be cumulative, in the same sense that a drunk tends to wander farther and farther from his starting point. (Black, 1986)*

Correctly priced equity markets are important for several reasons. One prominent being, as is outlined in the following section, the effect they have on real investments and the broader economy. Focusing on the Swedish OMXS30 index, this study examines the extent of the inefficiencies that are introduced to the Swedish equity markets due to indices, if any. The effects the index has on valuation levels and returns are examined through three separate approaches. Firstly, the price effect of inclusions to, and exclusions from, the index is examined. Secondly, the potential effect on the index constituents’ stock price comovement with the index is studied. In the final approach, it is investigated whether the Turn-of-the-Month market anomaly is more pronounced for index stocks than for non-index stocks.

The extent to which either of these effects has been studied on the Swedish market is limited. Therefore, this study contributes with new evidence from a market with distinct characteristics, shedding light on earlier findings from around the world. Furthermore, a proprietary theory is introduced and derived in the study of index comovement, which is then empirically tested. With respect to the Turn-of-the-Month effect, it has not previously been studied in the context of index investments, although such studies may give further insights into the reasons for the anomaly. To enable the examination of index investment in the context of the Turn-of-the-Month effect, a new method is developed and implemented.

In general, it is found that the price effects from index inclusions and exclusions are small, but still prevalent. Notably, the effects on the date when the changes are announced are larger than on the date when the changes are effective. Furthermore, the study of the Turn-of-the-Month effect does not provide evidence of larger mispricings due to index investing. In terms of the stocks’ comovement with the index, however, signs of irregularities are more

prevalent. The empirical results provide support for the new comovement theory proposed in the paper, whereby index stocks' beta with the index converges to one.

## 1.1 Equity Indices and the Importance of Efficient Equity Markets

Investors have since the inception of modern financial markets increasingly been facing a *global* market, not only in terms of investment opportunities in financial instruments, but also in terms of the real markets underlying these instruments. As complexity continues to increase and information becomes abundant, many investors will seek ways to simplify the investment process (Peng & Xiong, 2006; Kahneman, 1973; Broadbent, 1965; Lavie, et al., 2004; Mullainathan, 2000). Barberis and Shleifer (2003) argue that one way investors do this is by grouping financial assets into categories such as small cap stocks, Chinese stocks or junk bonds, and then allocate funds at the level of these categories rather than at an individual asset level. In fact, many authoritative books on portfolio management are directly organised around asset classes and how to allocate the portfolio between these, sometimes referred to as “style investing” (Barberis & Shleifer, 2003; Bernstein, 1995; Swensen, 2000). The financial industry has, as always, not been late in innovating new offerings to cater to this style of asset allocation, with one of the more prominent being indices and products linked to them.

Parallel to the increasing complexity of global markets, several milestones have been passed by academia within the fields of asset allocation and portfolio theory, most notably the Capital Asset Pricing Model (CAPM) (Markowitz, 1952; Treynor, 1961; Sharpe, 1964; Lintner, 1965; Mossin, 1966). Even though the CAPM has been challenged (Fama, 1970; Jensen, 1978; Fama & French, 1992), well established assertions from modern portfolio theory are the benefits of diversification and that the market portfolio encompassing all assets is the optimal portfolio to hold. In trying to follow these assertions many investors will look for ways to diversify and to a larger extent hold the “market portfolio”. Just like many practitioners using the CAPM to calculate the cost of capital use different equity indices, such as the S&P 500, as proxies for the market portfolio, investors use indices as proxies for investing in the market portfolio (Vijh, 1994; Bruner, et al., 1998; Stein, 1996). The diffusion of portfolio theory knowledge coupled with research showing that fund managers rarely beat the market on a consistent basis should thus, just as the increasing complexity, drive investors to devote their capital to index linked investments (Malkiel, 2003; Carhart, 1997).

Index-linked investing can take many forms with the most rudimentary being a mutual fund replicating the index by holding the underlying shares in proportions equal to the index weights. Other forms include exchange traded index funds (ETFs), futures with the index as underlying, and more subtle forms of index linking such as assets invested in mutual funds that are not directly tied to indices but benchmarked to them. Portfolio managers for such benchmarked funds may have an incentive not to deviate too much from the index in order to minimise tracking error (Woolley & Bird, 2003). The substantial positions taken in these index-linked assets and instruments make it interesting to look beyond the developments outlined above and the phenomenon of index investing, to potential effects it might have.

An obvious question to pose is whether mispricings may arise. Lorie and Hamilton (1973) discuss that there could be a risk for such effects, but continue by arguing that even though “indexing (and quasi-indexing) represents an attractive investment option [...] any significant growth in such passive investing will reduce the competitiveness within markets

and so introduce the possibility for active managers to outperform by exploiting inefficiencies as they occur” (Lorie & Hamilton, 1973). The possibility for other market participants to easily correct potential mispricings has though, as will be elaborated on below, been much scrutinised and contested in subsequent literature, and a pioneering study examining the effect of indices on security prices was carried out by Shleifer (1986). He looked at the share price of companies around the date when they were being included in the S&P 500 index, finding a significant abnormal price increase resulting from the event. The study spurred a considerable interest in the topic, and even though most studies have found a significant price effect from being included, literature agrees on neither the price effect’s persistence nor the explanations for it.

The index inclusion effect on security prices is interesting in itself, but what make the topic even more important are the implications it can have. The most immediate effects are the possible consequences for investors, and in particular index investors. Petajisto (2008; 2011) theoretically derives and quantifies a “hidden” cost borne by index investors due to buying stocks with the index premium and selling stocks without it upon index inclusions and exclusions, respectively. He labels the cost the “index turnover cost”. However, repeating the reasoning above, the effect on investors is only as important as the effect it may or may not have on real economic activity. The discussion of this effect dates back to, at least, John Maynard Keynes (1936):

*[The] daily revaluations of the Stock Exchange, though they are primarily made to facilitate transfers of old investments between one individual and another, inevitably exert a decisive influence on the rate of current investment. For there is no sense in building up a new enterprise at a cost greater than that at which a similar existing enterprise can be purchased; whilst there is an inducement to spend on a new project what may seem an extravagant sum, if it can be floated off on the Stock Exchange at an immediate profit. (Keynes, 1936)*

Fischer and Merton (1984) more formally present the same reasoning as Keynes, and in stressing the importance of the stock market, they seek a greater interaction between macroeconomics and finance. In particular, they ask for more interaction on the topic of the stock market’s effect on investment decisions.<sup>1</sup> Fischer and Merton (1984) also show that managers will alter their investment behaviour regardless of whether a change in the stock market is due to a rational change in preferences or merely due to an irrational change in investors’ beliefs about future states’ probabilities. In their review of theory and research they also, consistent with their economic reasoning, conclude that changes in stock prices are a better predictor of changes in investments than are real interest rates.

Morck et al. (1990) outline four ways in which the stock market may or may not affect investments. The one that perhaps is the most common, and also consistent with Keynes as well as Fischer and Merton, posits that investments are affected through the stock markets influence on the cost of financing. In their data, Morck et al. (1990) only find a weak relationship between the stock market and investments and conclude that “the market may not be a complete sideshow, but nor is it very central” (Morck, et al., 1990). Barro (1990), though, finds that stock market changes have great explanatory power for investments even

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<sup>1</sup> Please see the original article for a good discussion on both financial economists’ and macroeconomists’ views and empirical works on the stock market as a predictor of the business cycle, how to measure the discount rate for investments, Tobin’s  $q$  in relation to investments, the rationality of the stock market, and, of course, stock prices as a cause of investment.

after controlling for multiple cash flow variables, as do Becker-Blease and Paul (2006) when they, just as this paper, study index inclusions. Baker et al. (2003) show that stock prices should have a stronger impact on the investments of “equity-dependent” firms, which they also find support for in their data, and challenge the weak findings of Morck et al. (1990) who only use company size as proxy for equity dependence. In aggregate, literature on economic theory as well as empirics suggest that the changes of the stock market do have an effect on real economic activity in general, and the investments of firms in particular. An argument central to this paper is put forward by Woolley and Bird (2003), in that companies that are part of indices have a favoured access to capital compared to those companies who are not, since included companies have a proportion of their current shareholders that have no option but to participate in any new capital raisings.

## 2. Previous Research

### 2.1 Theoretical Background

Underlying many studies and theoretical work on financial markets is the notion of efficient markets. Fama (1970) outlines sufficient conditions for an efficient market to be prevalent; “(i) there are no transactions costs in trading securities, (ii) all available information is costlessly available to all market participants, and (iii) all agree on the implications of current information for the current price and distributions of future prices of each security”. If these preconditions are met, the share price of a company should fully reflect all available information and no market participants can earn abnormal returns. This is one of the three forms of market efficiency that Fama (1970) presents as plausible market outcomes, namely the *strong form*. In real markets however, there are transactions costs, not all information is available to all participants and information is not costless. The *semi-strong form* entails prices to rapidly and correctly adjust to, and include, all publicly available information. As such, there are no abnormal returns to be earned from conducting fundamental analysis. The last form, the *weak form*, posits that current prices fully reflect all historical price information, implying that future prices cannot be predicted through, for example, technical analysis. Future prices are then only set by information that is not contained in the price history, and the price series follows a random walk (Samuelson, 1965; Fama, 1965).

The hypothesis of efficient markets is called the Efficient Market Hypothesis (EMH) and is very much in focus in the studies of index effects. If markets rapidly and correctly include all publicly available information, and thus price assets according to their fundamental values, events that do not convey any new information or are known in advance should yield no price reaction. As such, assuming that no new information is conveyed about a company from being included in an index, there should be no price effect from the event of merely putting a “label” on it. Even if assuming that an inclusion *does* have some implications relevant to the price, the price reaction to this information should be rapid and not reversed. Furthermore, the price *comovements* of stocks should according to this reasoning only be driven by common new information that affects the fundamentals of the securities. This is in line with the CAPM, which posits that comovement between assets are caused by the fundamental systematic risks common to all assets (Sharpe, 1964; Lintner, 1965). An index inclusion fulfilling the “no new information” criteria above should therefore not cause a change in the comovement between the company’s stock and the index it is introduced in.

In case a mispricing would still occur in the market, exploitation of arbitrage opportunities should cause it to diminish and disappear rapidly (Ross, 1976; Fama, 1965). This is an important fundament of efficient markets. An arbitrage relationship is for example what ensures that index futures prices are consistent with index spot prices. This causes speculation, hedging and the creation of investment products using index futures as underlying to, although indirectly, have an effect on the spot prices of index constituents (Figlewski, 1984; Grossman, 1988). Arbitrage can be defined as "the simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices" (Sharpe & Alexander, 1990). Since the purchase and sale is defined as simultaneous, the transaction is risk free and requires no capital. Underlying the assumption that arbitrage will ensure that prices are kept at equilibrium levels is the precondition that there are no information or trading costs. As stated above, this is not the case in real world markets. Grossman and Stiglitz (1980) show that when transactions and information acquisition are costly, prices can deviate from the true equilibrium up to the magnitude of the difference between how much it costs to exploit the mispricing and how much the arbitrageur can earn from it. In Fama's (1991) words, "a weaker and economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information [...] do not exceed the marginal costs". In such a market, it is not always optimal for arbitrageurs to act as a force that corrects prices to a point where they fully reflect fundamentals.

The above mentioned limit to arbitrage, called the Grossman-Stiglitz paradox, is thus a first indication that arbitrageurs may not always be able to correct mispricings in markets. In fact, arbitrage according to Sharpe and Alexander's definition above as risk free is often not the type of trade that is referred to when using arbitrage in many contexts. When the transactions needed to exploit a mispricing do not guarantee an immediate risk free profit, it should rather be referred to as *risk arbitrage* (Figlewski, 1984). The prospects for arbitrageurs to eliminate fundamental mispricings through risky transactions have though been questioned (Black, 1986; Figlewski, 1984; Shleifer & Vishny, 1990; 1997; Shleifer & Summers, 1990; De Long, et al., 1990; Wurgler & Zhuravskaya, 2002). Firstly, the arbitrageur will in fact often need to temporarily commit capital to be able to exploit an arbitrage opportunity. Putting up money is seldom risk free to begin with, and if the mispricing persists for a long time or even widens before returning to fundamentals, the arbitrageur might be required to commit even more capital or close out the position with a loss. Further, according to Shleifer and Vishny's (1997) "limits of arbitrage" hypothesis, a situation when prices have deviated the most from fundamentals is likely to correspond to when arbitrageurs have the least capital to exploit the opportunities. The implication is that arbitrage is least effective in returning prices to fundamentals precisely when investor sentiment has driven prices the furthest away. Secondly, Shleifer and Vishny (1990) argue and show that to maximise profits, arbitrageurs will be clustered around short-term assets rather than long-term assets. The perpetual characteristic of stocks naturally sorts them in the latter category. They furthermore argue that "[s]ince arbitrage in long-term assets is more expensive than it is in short-term assets, the former must be more mispriced in equilibrium for net returns to be equal. Thus the rational behavior of arbitrageurs leads to greater mispricing of long-term assets in equilibrium" (Shleifer & Vishny, 1990). Thirdly, the efficient market is questioned by behavioural finance.<sup>2</sup> Shiller (1984) shows that in a market consisting of smart money investors and irrational investors, smart money investors do not

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<sup>2</sup> Please see Barberis and Thaler (2003) for an extensive review of theory and evidence.

only consider fundamentals in their investment process but also the expected behaviour of irrational investors, often referred to as “noise traders” (Kyle, 1985; Black, 1986). In such a market, fundamental mispricings are not necessarily instantaneously corrected by smart money.

The preceding general theoretical background will hopefully have provided the reader with the necessary frameworks and their criticisms required to delve deeper into the theories and empirical evidence on the topic of index effects. The next section begins with a review of the existing literature on index inclusion price effects by first looking at the proposed hypotheses, and then its empirical evidence. The concluding two parts of the literature review are structured in the same manner, first covering literature on change in comovement upon inclusion or exclusion, and finally the Turn-of-the-Month effect. For the sake of brevity, the term inclusion is often used to denote an event which could be either an index inclusion or index exclusion, rather than explicitly stating both types in each discussion.

## 2.2 Price Effects

### 2.2.1 Price Effect Theories

Although the efficient market hypothesis posits that there should be no effects from becoming included in an index, there are still some hypotheses that suggest the opposite. Given imperfect markets, these hypotheses try to give rational explanations for why an index inclusion could still warrant a share price reaction. An outline of these hypotheses follows below.

#### *Imperfect Substitutes Hypothesis*

A key assumption underlying the CAPM is that all market participants have homogenous expectations, which means that they all have identical estimates of expected returns and the associated probability distributions for all assets (Sharpe, 1964). If all market participants have the same expectations of future returns, standard deviations and correlations between assets, all investors also agree upon the correct price of a given security. In equilibrium then, all market participants will be willing to buy or sell the security at this price, and a buyer or seller will thus always be able to find a counterpart for a transaction that does not entail nudging the market price in any direction. As such, the price for a security is *perfectly elastic*.

Given that the future is uncertain and thus forecasts difficult to make, the assumption that all investors will reach the same conclusions seems implausible. If investors rather have different expectations of future returns and the associated probability distributions of assets, only some of them will demand a stock at a given price. At different given prices there would then be a varying number of investors for which the price meets (or is lower than) what is required under their individual expectations, thus demanding the stock. Correspondingly, as demand for the stock changes, the price will adjust. The price for the security is thus not perfectly elastic with regards to demand, and this theory is accordingly referred to as stocks having *downward sloping demand curves*. The demand effect could though be partially or fully offset if different securities could be substitutes for one another. This view is introduced by Modigliani and Miller (1958) in their article on capital structure, in which one of the

underlying assumptions is that “firms can be divided into ‘equivalent return’ classes such that the return on the shares issued by any firm in any given class is proportional to (and hence perfectly correlated with) the return on the shares issued by any other firm in the same class”. Under this assumption, firms can be classified “into groups within which the shares of different firms are ‘homogeneous’, that is, perfect substitutes for one another” (Modigliani & Miller, 1958). Arbitrage relationships between stocks that are substitutes should in such a setting significantly decrease, or fully eliminate, the slope of the demand curve for individual stocks. The assertion of stocks having substitutes is however strongly contested by Durand (1959) in his comment on the Modigliani and Miller (1958) article. In the opposing view that he supports, securities are viewed as having unique characteristics in terms of cash flows, risks and returns, and as such there are no close substitutes for a given security. Without a perfect substitute, true arbitrage relationships between stocks, which could prevent the sloping demand curves for individual stocks to prevail, will not exist.

When the downward sloping demand curve theory is used as the basis for explaining index inclusion price effects, it is often referred to as the *imperfect substitutes hypothesis*. As the stock is included in an index, a large community of index investors will be forced to buy the stock, thus increasing the demand for it, and hypothetically pushing the price to a higher level. The theory of downward sloping demand curves was subsequent to Modigliani and Miller (1958) mathematically derived by Lintner (1962) and further discussed and developed by for example Scholes (1972) and Miller (1977).

In an early study, Scholes (1972) studies secondary distributions of stocks in an effort to examine whether potential price effects are the result of downward sloping demand curves or rather *price pressure* (which is another theory outlined below). His results support the notion that stocks do have close substitutes and that the price elasticity of stocks is very large. Kraus and Stoll (1972) similarly study institutional block trades and finds significant price impacts, though do not specifically try to entangle whether these could be due to downward sloping demand curves or not. Looking at new issues of seasoned securities, Hess and Frost (1982) do not find support for downward sloping demand curves in their data. Wurgler and Zhuravskaya (2002) hypothesise that stocks only have imperfect substitutes and show that imperfect substitutes deter risk-averse arbitrageurs from flattening demand curves. This is also consistent with what they find in their data, showing that mispricings are larger for stocks without close substitutes.

#### *Price Pressure Hypothesis*

In early literature, the price pressure hypothesis is used somewhat interchangeably with the imperfect substitutes hypothesis as the alternative to the perfect substitutes hypothesis (Scholes, 1972; Kraus & Stoll, 1972; Hess & Frost, 1982). That definition of the price pressure hypothesis encompasses both short and long-term effects of a changing demand or supply of a stock. However, the definition used in this paper is more in line with subsequent literature, of which a first outline was introduced in Harris and Gurel (1986). The later literature define price pressure separately from the imperfect substitutes hypothesis as a *temporary* pressure on the price of a security due to a short-term spike in demand or supply in excess of what can normally be absorbed by the market without the price being affected (Bechmann, 2002; Biktimirov, et al., 2004; Doeswijk, 2005; Shankar & Miller, 2006). When a stock is included in an index, it is hypothesised that this will spur a temporary increase in

trading volume upon the time of inclusion, since index investors will need to include the stock in their portfolios.

Underlying the price pressure hypothesis is this supposition that the market cannot, at least not in the short term, absorb an abnormally large shift in demand or supply of a stock without causing a change in price. According to the theory, a price effect due to such a shift in demand or supply does not necessarily entail that demand curves for stocks slope down, but merely that the market does not hold enough liquidity readily available to instantaneously cater to the spike in volume. As long as the price effect is temporary, meaning that it reverses after some time, it is just an indication that the market needs some time to provide this required liquidity. The price increase/decrease and subsequent reversal is seen as compensation to the market participants that provide liquidity for “the transaction costs and portfolio risks that they bear when they agree to immediately buy or sell securities which they otherwise would not trade” (Harris & Gurel, 1986).

#### *Information Hypothesis*

The information hypothesis contends the notion that the inclusion in an index entails no new fundamental information about the company, instead proposing that a price reaction to the inclusion is due to new information being conveyed by the event. Since different indices have different inclusion criteria, the information hypothesis can have different bearing depending on the index in question. Since the early, as well as the most influential, studies of index inclusions focus on the S&P 500, the potential information content of S&P 500 inclusions has been of particular interest in literature (Shleifer, 1986; Jain, 1987; Dhillon & Johnson, 1991). Neubert (1985), as cited by Shleifer (1986), is early in discussing Standard & Poor’s concern for excessive turnover of constituents in the S&P 500 index. Since changes in the composition of the S&P 500 index incur several types of transaction costs for investors that are tracking the index, excessive constituent turnover may drive them to track an alternative index. Given this assertion, Standard & Poor’s should be interested in the longevity of a firm, which coupled with their specialisation within bond ratings can cause an inclusion to also be interpreted as a certification of the company (Beneish & Whaley, 1996; Kaul, et al., 2000; Denis, et al., 2003; Chen, et al., 2004). However, after talking to Standard & Poor’s staff and examining the index inclusion criteria documents, citing that “[j]udgements as to the investment appeal of the stocks do not enter into the selection process”, Harris and Gurel (1986) argue that the inclusion is free from information. Furthermore, the information hypothesis is more easily contested when index inclusion is based on publicly and previously known information, such as market capitalisation.

#### *Liquidity Hypothesis*

Amihud and Mendelson (1986) model, and empirically find, that a decrease in bid-ask spread leads to a reduction in investors’ required return and a consequent increase in share price. Similarly, Stoll and Whaley (1983) claim that infrequent trading activity in a stock leads to a higher bid-ask spread and higher trading costs, and thus a higher required return for the stock, which they find support for in their data. It is in line with this reasoning that the liquidity hypothesis is suggested. The hypothesis posits that an inclusion in an index increases the liquidity of a stock through, for example, introducing it to new investors and the index tracking community. As Amihud and Mendelson (1986) as well as Stoll and Whaley

(1983) argue, with increased liquidity comes increased price, potentially explaining the price effect of being included in an index. Liu (2000) however, argues that if, following an index inclusion (exclusion), "some institutional investors buy and hold (release) those added (deleted) stocks in large amounts, the number of floating shares would decrease (increase) significantly, and liquidity would decline (rise) significantly for stocks added (deleted)". In such a setting, the liquidity effect of an inclusion would actually have a *negative* price effect due to a *decrease* in liquidity.

### *Attention Hypothesis*

The event of becoming included in a major index, and subsequently being part of it, will arguably lead to the company in question getting both a temporary and a permanent boost in attention. Grinblatt et al. (1984), studying stock dividends and stock splits, hypothesise that these "call attention to the firm, triggering reassessments of the firm's future cash flows". Arbel and Strebel (1982) empirically examine the question of whether the different levels of attention companies receive affects the capital asset pricing process. Their findings suggest that there is a "neglected firm effect", leading to less researched companies having superior performance even after controlling for the small firm effect (Arbel & Strebel, 1982). Similarly, Merton (1987) develops a model of capital market equilibrium where companies may be subject to a "shadow cost" if investors do not know about their stock. If investors are exposed to a "new" company they will evaluate detailed information about the firm and potentially become shareholders, and as a result the value of the firm may rise. Even though the information might have been previously publicly available, the event of bringing the company to the attention to new investors can still impact the stock price in a positive way given that the information is "new" to them. Merton (1987) further shows that the market value of a firm will always be lower when there is incomplete information, and the smaller the investor base, the bigger the difference. Expected returns will thus be lower for well-known firms with relatively larger investor bases. In an intriguing article by Cooper et al. (2001), looking at data from 1998 and 1999 they find that changing the name of company to a dot-com sounding name led to a 74% abnormal return over 10 days that did not revert, and hypothesises that this is due to the fact that the company is brought to the attention of a large investor community looking for internet stocks.

Not only does an inclusion potentially lead to increased awareness of a stock. Shleifer (1986) argues that an inclusion could lead to a situation where more public information is made available about the company. Through being included in an index, a company could see more analysts and investors covering the stock (Shleifer, 1986) at the same time as there are more news stories reported in big magazines such as the Wall Street Journal (Becker-Blease & Paul, 2003). In relation to this, Barry and Brown (1985) develop a model incorporating differential information about investment opportunities. The model shows that investors which are presented with securities that otherwise have identical expected returns and risks, will choose to invest in the security with more available information. Thus, if more information is generated after an index inclusion, a price increase might be warranted if this is an important investor preference. Denis et al. (2003) take it one step further and claim that an index inclusion could lead to improved future performance of the firm. They argue that an inclusion could possibly lead to increased scrutiny of the management of the firm and also that a mistake on behalf of the management might be more costly in terms of their own

reputation. The increased scrutiny incentivises the management to perform better and therefore improves future performance of the firm, thus warranting a higher share price.

### 2.2.2 Price Effect Empirics

Several studies have looked into how stocks are affected when they become included in a stock index. What most, if not all, articles have in common is that they find a positive abnormal price effect around the inclusion date (Shleifer, 1986; Harris & Gurel, 1986; Jain, 1987; Pruitt & Wei, 1989; Dhillon & Johnson, 1991). The magnitude of the inclusion effect varies between the different studies, but is usually around 3 per cent (Shleifer, 1986; Jain, 1987; Chakrabarti, et al., 2005). However, it is not the magnitude of the effect that sparks the biggest controversies, but rather whether the price effect is persistent or not.

Shleifer (1986), the first scholar to investigate the effects on stock prices following index inclusions, established that a stock introduced into the S&P 500 index experience a positive price effect upon inclusion. He furthermore argues that since he fails to find any significant price reversal in the post-inclusion period, it should provide evidence for the existence of *downward sloping demand curves*. Following Shleifer's ground-breaking article, several scholars (Hegde & McDermott, 2003; Beneish & Whaley, 1996; Wurgler & Zhuravskaya, 2002) follow in his footsteps and perform similar event studies on the S&P 500, while looking at different time periods. They also fail to find any significant reversal in the time period following the inclusion date, and therefore also contend that downward sloping demand curves ought to be the main reason behind the observed price increase following an inclusion.

Even though authors fail to show any significant reversal looking at a post-inclusion period of up to 60 days (Dhillon & Johnson, 1991), Morck and Yang (2001) are not completely convinced that a permanent effect is best demonstrated by looking at long post-inclusion time periods. Instead they turn their attention to Tobin's  $q$ . If a stock experiences a price increase that is not motivated by fundamentals, then the stock's  $q$  ratio should increase as a consequence of this.<sup>3</sup> Their results show that the average  $q$  ratios for firms included in the S&P 500 index are substantially higher compared to firms not included in the index, which they argue is a clear indication that index firms experience a permanent price effect. This finding lends further support to the hypothesis that the index inclusion effect is not transient and therefore that demand curves do slope down.

If one assumes that downward sloping demand curves cause the price increase following an S&P 500 inclusion, the effect should not be an isolated phenomenon relevant only for S&P 500 stocks, but should rather apply across a variety of indices and markets. Chakrabarti et al. (2005) examine indices all over the world and find support for downward sloping demand curves in as many as 27 out of 29 countries, demonstrating that the inclusion price effect very much is a phenomenon transcending all borders. Other studies have provided support for downward sloping demand curves in for example Canada (Kaul, et al., 2000), Denmark (Bechmann, 2002), Germany (Deiningner, et al., 2000) and Japan (Liu, 2000). The study conducted by Kaul et al. (2000) in Canada is different in the sense that it looks at a re-weighting of the TSE 300 index rather than inclusions or exclusions from an index. Considering that the stocks were already part of the index, the re-weighting should be a

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<sup>3</sup> This is assuming that Tobin's  $q$  is at least a proxy for fundamental value. For an explanation of Tobin's  $q$ , please see Tobin and Brainard (1976).

completely information-free event which was publically known three months prior to the change. Still, the change in weights results in significant abnormal returns.

With a widespread support for the imperfect substitutes hypothesis it would seem that there is no contention about what causes these price effects. However, even though Lynch & Mendenhall (1997) to some extent support long-run downward sloping demand curves, they also acknowledge the existence of a *price pressure effect*. The positive abnormal return they find in the S&P 500 index is significantly positive, but is partially reversed after the event date. Herein lies the stumbling block between the two theories, that is whether the price effect is permanent or not. Whereas Lynch and Mendenhall (1997) find evidence for both imperfect substitutes and price pressure in their study, Harris and Gurel (1986) when examining the S&P 500 between 1973 and 1983, find only temporary price and volume increases. This finding is interesting in that they look at the index during approximately the same years as Shleifer (1986). Even though they examine more or less the same dataset they reach contradictory conclusions. Harris and Gurel (1986), through two different tests, find evidence for full reversal of the initial price increase, which is in stark contrast to Shleifer's (1986) finding of a permanent effect. Together with the temporary volume effect, Harris and Gurel (1986) argue that the reversed price effect favours the price pressure hypothesis over the imperfect substitutes hypothesis.

Harris and Gurel (1986) are not alone in finding support for price pressure. Looking at a similar time period as them, Pruitt and Wei (1989) also provide evidence for the price pressure hypothesis in the S&P 500 index. Furthermore, they are able to show that the abnormal returns associated with the index inclusions are positively correlated with the level of institutional ownership, which was only hypothesised earlier by Shleifer (1986) and Harris and Gurel (1986). They find that institutional holdings increase by about 2 per cent following an index inclusion, which, given the size of index funds, is a bit lower than expected. They argue however that this is a net effect where non-index institutions sell off part of their holdings. Hence, there seems to be evidence of institutional trading around the inclusion dates, which is corroborated by Shankar and Miller (2006) who also find an increase in institutional ownership when investigating stock inclusions to the small cap index S&P 600. Their finding is interesting in the sense that S&P 600 is not as commonly known or widely tracked as the S&P 500 index (Shankar & Miller, 2006), but there still seems to be a price increase effect attributable to price pressure around inclusions. Additional indices where the price pressure hypothesis seems to be able to explain the price effect include the FTSE 100 (Mase, 2007), the TSE 300 (Chung & Kryzanowski, 1998), the AEX 25 (Doeswijk, 2005), the MIB 30 (Barontini & Rigamonti, 2000) and the Russel indices (Biktimirov, et al., 2004).

Even though many articles conjecture that the price pressure hypothesis underlies the price inclusion effect, Jain (1987) claims that the premises the conclusions build upon are wrong. In his view, the price increase effect for firms included in the S&P 500 needs to be controlled for using a group of companies included in indices that are not held by index funds, and thus uses inclusions in complementary indices published by Standard & Poor's as a control group. According to Jain (1987), there was no significant difference between the abnormal returns for the stocks included in the supplementary indices and the stocks that were included in the S&P 500 index, which is a violation of the price pressure hypothesis. Instead, Jain (1987) hypothesises that in lack of any reasonable explanatory factor, the price effect might be due to some information contained in the S&P 500 inclusions. Thereby he lends his support to the *information hypothesis*. He suggests that the market might perceive S&P's preference for

stable firms as though the riskiness of the firms have decreased. A similar conclusion to the one reached by Jain (1987) is also reached by Dhillon and Johnson (1991) who take a broader approach and look at the effect on firms' stock, bond and option prices upon S&P 500 inclusion. Through looking at the price effects for all these financial instruments they find that their evidence is consistent with the information hypothesis.

Evidence in favour of the information hypothesis is primarily found in articles studying the S&P 500 (Jain, 1987; Dhillon & Johnson, 1991; Graham & Pirie, 1994; Denis, et al., 2003). A possible reason behind this isolated effect might lie in the selection criteria that Standard & Poor's applies when including stocks to its indices. Even though they claim to look at five publicly communicated criteria, "changes are [still] fully discretionary and [...] determined by the Index Committee" (Standard & Poor's, 2000). The limited transparency paired with the explicit objective of trying to "keep turnover to a minimum by not making excessive changes to the indices" (Standard & Poor's, 2000) have however caused some people to suspect that Standard & Poor's, as a credit rating agency, might have information that enable them to pick companies as to minimise index turnover (Kaul, et al., 2000). Denis et al. (2003) speculate that Standard & Poor's possibly embeds analysis of future prospects when deciding which companies to include. If either of these contentions is true, it could very well be that an S&P 500 inclusion is not an information-free event. If there is information contained in the inclusion, the observed price effect might be warranted by it.

Different indices use different criteria for what stocks to include, so even if S&P 500 inclusions might not necessarily be information-free events, inclusions in other indices could very well be. Mase (2007) investigates index inclusions to the British FTSE 100 index, which utilises quarterly rebalancing based on market capitalisation and as a result contains the 100 largest companies listed on the London Stock Exchange. Considering that the process is publically known and not arbitrary, any inclusion to the index is ought to be expected by traders. On top of this, the inclusion should not entail any information about the quality of the company. In line with this, Mase (2007) finds that there is full reversal of the price increase, which indicates that there is no information signalling effect when the inclusions are based on a transparent process. The re-weighting of the TSE 300 index mentioned above is another example of what should be an information-free event, since it was publically known and entailed only stocks already included in the index (Kaul, et al., 2000).

Even though an inclusion does not necessarily convey any previously unknown information, there could still be positive effects from being included in an index. Poloncheck and Krehbiel (1994) for example show, through using two indices where inclusions are disclosed differently, that a price effect is only present for the index with more exposed constituent change announcements. This finding seems to provide support for the *attention hypothesis*. The results of Chen et al. (2004) could also be interpreted to support the attention hypothesis. They find an asymmetric response to inclusions and exclusions. The studied exclusions do not suffer as big price declines as expected, which could indicate that when investors have gained knowledge of a firm, the knowledge does not disappear as soon as the stock is dropped from the index. Instead the stock was brought to investors' attention upon the initial inclusion, and it was this increased awareness of the stock that generated the positive abnormal return in the first place. By using Merton's (1987) concept of shadow cost as a proxy for the investor awareness hypothesis and looking at the change following inclusion, Elliot et al. (2006) in a multivariate setting contend that this hypothesis is the one best explaining the index inclusion effect in the S&P 500 index.

On a similar note, Baker et al. (2002) find that stocks cross-listed between the New York Stock Exchange and the London Stock Exchange are covered by more analysts and have more news stories published about them compared to stocks that are only listed in one market. Hence, becoming included in an additional index results in an increased attention for the firm. The authors however manage to take it one step further and show that this increased awareness is associated with a decrease in cost of equity capital, which all else equal justifies a higher stock price. Denis et al. (2003) find evidence that firms newly added to the S&P 500 receive higher earnings forecasts by analysts and also that these earnings forecasts are realised to a larger extent compared to benchmarks. The authors claim that their results support the notion that inclusion in an index leads to better performance.

A higher share price could also be justified through *liquidity* effects, as Erwin and Miller (1998) show in their study of index inclusions to the S&P 500. They find that particularly non-optioned stocks experience a significant decrease in bid-ask spread following inclusion. Stocks that have traded options do not experience the same decrease in bid-ask spread, which Erwin and Miller (1998) suggest is because options already provide investors with an arbitrage opportunity that increases liquidity. Hence, the arbitrage opportunity through index future contracts that comes from being part of an index is limited. Hegde and McDermott (2003) as well as Chakrabarti et al. (2005) are examples of other scholars who also find significant evidence of a positive liquidity effect. Their results are however contrasted by Pape and Schmidt-Tank (2004) who fail to find any significant bid-ask spread effect when looking at the STOXX 50 index, even though they find a price increase upon inclusion.

The price effect accompanying an index inclusion is thoroughly documented and has been shown in samples dating back to 1962 (Chen, et al., 2004). What is noticeable is that the price effect has changed over time. Both Shleifer (1986) and Harris and Gurel (1986) document a stronger effect in the latter halves of their respective samples, indicating that the price effect might have increased over time in line with increased index investing, as is hypothesised in both articles. A much later report released by Standard & Poor's (2008) indicates that excess returns around index inclusions had decreased during the five years leading up to 2008, compared to the previous five-year period. This pattern was found to be true for the S&P 500, the Nikkei 225, the TSX 60 and the DAX 30, but not the FTSE 100. Similarly, Petajisto (2011) finds that the price effect upon inclusion peaks at 12.3 per cent during 2000 before coming down to an average of 4.5 per cent in the period leading up to 2005.

Although the results regarding excess returns around inclusions, as can be seen above, are relatively unidirectional, some criticism can still be found. Edmister et al. (1994) as well as Kasch and Sarkar (2012) claim that a reason behind the positive index inclusion effect is not the inclusion itself, but could rather be due to changing business characteristics or momentum effects stemming from the pre-inclusion period. Firms which are not subject to inclusion but experience similar pre-inclusion trends also show positive excess returns "post-inclusion". Even though Jain (1987) claims to control for the momentum effect, these assertions still cast some valid concerns as to whether the inclusion effect could be biased.

## 2.3 Comovement

### 2.3.1 Comovement Theories

While the price effect is the most thoroughly examined market anomaly related to index inclusions, a less studied effect that also has important implications is changes in comovement. Traditional theory and present value models in which discount rates only depend on macroeconomic variables posit that stocks should only co-move to the extent that their individual cash flows are correlated, or due to common movements in macroeconomic variables (Pindyck & Rotemberg, 1993). Such fundamentals-based comovement requires rational investors and frictionless economies. However, the frictionless economy with only rational investors does not seem to prevail. Instead there is plenty of evidence of comovement not justified by fundamentals, also known as excess comovement (Pindyck & Rotemberg, 1990; 1993; Lee, et al., 1991). Kumar and Lee (2006) look at 1.85 million retail investor transactions and find evidence of significant comovement beyond the usual risk factors. Their findings indicate that there is a “common directional component in the trading activities of retail investors” that is not justified by fundamentals, and conclude that investor sentiment has a saying in the comovement of stocks (Kumar & Lee, 2006). They also show that this is especially true when the stocks are costly to arbitrage. Similarly, Goetzmann and Massa (2003) find that inflows into index funds linked to the S&P 500 are highly correlated with the actual returns of the index. They also find that negative returns can induce subsequent selling in the index funds. Potentially irrational flows in and out of different “baskets” of stocks do thus, not only theoretically, seem to introduce a common factor in returns. As for example Stein (1996) notes, such movements in and out of baskets should introduce a bias in the stocks’ beta with regards to the basket. These theories and findings are consistent with a market where irrational noise-trader sentiment affects prices and comovement (Black, 1986; Barberis, et al., 2005; Kumar & Lee, 2006).

To accommodate these irrational movements, Barberis et al. (2005) present an alternative view of comovement that complements the traditional view of fundamentals-based comovement. Their view, which they label friction- or sentiment-based theories of comovement, acknowledges that economies are filled with frictions and that investors are not always rational. They divide this view into three hypotheses that may help explain why these non-fundamental comovements occur.

The first hypothesis, labelled the *category view*, was originally presented by Barberis and Shleifer (2003). The underlying reasoning of the hypothesis stems from works such as Mullainathan (2000) claiming that “categorization simplifies problems of choice and allows us to process vast amounts of information reasonably efficiently”. Barberis and Shleifer (2003) argue that investors tend to group assets into broad categories such as large-cap stocks, value stocks and government bonds before allocating money across these different categories. If investors act in accordance with the findings of Kumar and Lee (2006) and irrationally show evidence of herd behaviour,<sup>4</sup> their investment behaviour will also cause

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<sup>4</sup> Herd behaviour has been the subject of extensive studies in areas such as economics (Hirshleifer & Teoh, 2003; Shiller, 1989), physics (Sornette, 2003a; 2003b; Sornette & Andersen, 2002; Lux & Sornette, 2002), and sociology (Prechter, 2001). A herd is often defined as a group which members are inclined to move more with the other members of the group than with the movement of other groups. Other versions of herding

irrational comovement. In a world with limits to arbitrage, assets within the same category will experience excessive comovement unwarranted by fundamentals when investors move money between different categories, since they blindly buy or sell all the securities in the same category at the same time. Along the same reasoning, securities within a category will co-move too little with securities belonging to other categories.

The second hypothesis presented by Barberis et al. (2005) is called the *habitat view*. It suggests that investors might willingly or unwillingly be restricted to trade in only a certain habitat, or subset of securities. It could for example be a mutual fund that is limited to owning stocks in one geographical market. If several investors restrict themselves to similar subsets they induce a common factor in returns, which therefore creates a non-fundamental comovement. Support for the habitat view can be found when investigating “Siamese twin” companies, that is, two separate companies that have rights to the same cash flows. Froot and Dabora (1999) investigate three Siamese twins with the twin companies listed in different countries. They find that the stocks’ prices move more with the market on which they are listed than should be the case given the set-up with identical cash flows. This is an indication that the market on which a stock is listed will impact its price movements. A similar phenomenon can be observed with closed-end mutual funds. Such funds often trade at a discount compared to the value of the underlying stocks, and Lee et al. (1991) find that this discount co-move across funds to an extent not motivated by the comovement of the underlying stocks. They also show that the discount co-move with the prices of small stocks, which, just as closed-end mutual funds, is a habitat disproportionately populated by individual investors who typically hold similar sentiments. Thus, the entry and exit of a habitat’s investors as their sentiment changes seem to cause comovement that is not motivated by fundamentals. The category view and the habitat view have some similar characteristics and can also have similar empirical implications, and are thus sometimes treated as a single “demand-based” view.

The final hypothesis of Barberis et al. (2005) that can help explain excessive comovement is the *information diffusion view*. It is based on the notion that news might be incorporated faster in the prices of some stocks than others. The view is similar to reasoning first presented by Scholes and Williams (1977), who argue that nonsynchronous trading can cause market model betas to be biased since the prices of stocks with low turnover might be stale. An increase in trading should lead to a higher beta as prices are updated more frequently, and thus have a higher contemporaneous covariation with the wider market. Barberis et al. (2005) argue that stocks included in for example the S&P 500 are quicker to incorporate news that have market-wide effects on cash flows. Stocks that incorporate new information at similar speeds will then co-move more with each other than stocks incorporating information at different speeds.

### 2.3.2 Comovement Empirics

One of the first scholars to delve into the comovement effects of index inclusions is Vijh (1994) who, somewhat different to subsequent scholars, estimates index comovement as the beta of stock returns to market-wide returns rather than index returns. Using matched pairs

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which is even stronger, for example the information cascade models of Bikhchandani, Hirshleifer and Welch (1992), furthermore assume that private information is dominated in favour of imitating the crowd.

of stocks, he finds that S&P 500 stocks have overstated betas and non-S&P 500 stocks have understated betas. Looking at the earliest period of his sample, 1975 to 1979, he finds a slight decrease in beta upon inclusion, but for the latest period, 1985 to 1989, he finds a significant increase in daily and weekly beta of 0.211 and 0.130, respectively. Vijh (1994) contends that the beta increase is partially due to the emergence and growth in index investing and futures trading in the index during the period. Also studying the S&P 500 index, Barberis et al. (2005) reach a similar result as Vijh (1994), namely that there is an increase in beta with the S&P 500 upon inclusion. They argue that the increase in daily beta of 0.214 during their latter period of 1988 to 2000 cannot be explained solely by increases in comovement of fundamentals. Instead they claim that the remainder of the increase is best explained by friction- and sentiment-based comovement.

Following the methodology of Barberis et al. (2005), Coakley & Kougoulis (2004) investigates inclusion effects for the FTSE 100 index. The weekly betas increase with a significant 0.340 upon inclusion for this index during the years 1992 to 2002, and an even larger increase of 0.538 for 1998 to 2002. The effect has continued to increase over time as shown in a study by Mase (2008). In an attempt to understand the reasons behind the increase in beta, he also investigates if there is a difference in effect between stocks that are added to the index for the first time and stocks that are reintroduced to the index. Interestingly, he finds that new constituents experience a larger increase in beta than do previous constituents. This asymmetry cannot be fully explained by the friction- and sentiment-based hypotheses presented by Barberis et al. (2005).

Another approach to show that stocks co-move in ways that are not warranted by fundamentals is undertaken by Kaul et al. (2008). Investigating firms that switch their listing from NASDAQ to the NYSE, they find that the stocks start to co-move more with NYSE stocks and less with NASDAQ stocks. This comovement effect cannot be explained by changes in the comovement of cash flows or by firm characteristics. Rather, Kaul et al. (2008) suggest that the observed effect is further evidence for the behavioural view of comovement put forward by Barberis et al. (2005). In a similar study, Boyer (2011) examines stocks moving between S&P/Barra's Value and Growth indices. As a result of the switch, the stocks have a significantly higher beta with the index they move to, and a lower beta with the index they leave. As Boyer (2011) states, this provides another example of how investors can drive prices away from fundamentals.

Evidence from around the world indicates that the increased comovement within an index is a widespread phenomenon. Greenwood and Sosner (2007) as well as Greenwood (2008) find support for increased comovement in Nikkei 225. Coakley et al. (2008) find that stocks added to the MSCI Canada Standard Country Index on average have their beta increased by a factor of 1.6. More generally, Claessens and Yafeh (2013) find a significant increase in beta upon inclusion in an index in a majority of 40 studied markets.

## **2.4 Turn-of-the-Month Effect**

### **2.4.1 Turn-of-the-Month Effect Theories**

Most research studying the Turn-of-the-Month (TOM) effect focus on the mere existence of the market anomaly, as well as its size and longevity, and rather few propose theoretical explanations for it. Ogden (1990), however, provides one plausible explanation for why there

might be a positive return effect around the turn of each month. He assumes that out of the investor's wealth, he or she will choose to allocate a certain proportion to stocks. He further argues that most investors receive their income at the end of each month, while their expenses accrue uniformly throughout the month. To minimise transaction costs, the investor will only invest in stocks if the accumulated cash he or she has at hand to be allocated to purchasing equity is big enough to warrant a purchase in a potentially illiquid stock. Because the salary is paid at the end of the month, the accumulated cash position should be most favourable at the turn of the month, therefore generating a higher demand for stocks.

Another reason that is sometimes presented as a possible explanation for the TOM effect is that it is an artefact of other market anomalies. Lakonishok and Smidt (1988) for example insinuates that the January, or Turn-of-the-Year, effect could be one of the market anomalies that through its existence create the TOM effect. The Turn-of-the-Year effect was popularised in the academic literature by Rozeff and Kinney (1976) who documented a higher mean return in January than any other month. One potential reason for this pattern is presented by Reinganum (1983) who shows that the January effect can be explained by tax-loss selling in December, followed by a rebound in stock prices when the stocks are bought back with a lack of selling pressure in January. Alternatively, the selling and re-buying could be explained by window dressing by fund managers at the turn of the year when the performance of their current holdings might be scrutinised by sponsors (Lakonishok, et al., 1991). Cadsby and Ratner (1992) suggest a Turn-of-the-Quarter effect as another market anomaly that potentially could explain the monthly effect. It is essentially a quarterly version of the yearly window dressing theory that occurs at the end of each quarter rather than at year-end.

#### **2.4.2 Turn-of-the-Month Effect Empirics**

The first author to academically present what has become known as the Turn-of-the-Month effect was Ariel (1987) when he documented a market anomaly that suggested that there were only positive mean returns for stocks during the first half of the month. For the second half of the month there were on average zero returns to be made. Ariel (1987) discusses whether another known market anomaly, the January effect, could be the explanatory factor behind the TOM effect, though reaching the conclusion that this is likely not the case. He furthermore considers a few statistical reasons and potential dividend effects, but fails to identify any of them as the reasons behind the effect and therefore leaves a void regarding the causes of the effect. Nonetheless, the effect is still present in his data, and to such an extent that between the studied years, 1963 through 1981, investing in only the first half of each month would have been better than having your money invested for entire months.

Confounded by the findings of Ariel (1987), Lakonishok and Smidt (1988) extends the time period used by Ariel to see whether the effect is present also over other time periods by looking at data from a 90-year long time period, 1897 to 1986. Furthermore, they take an approach where they only look at days -1 to +3 around the turn of the month, thereby setting the standard for future research within this field. In their data, these four days have an average return that is 0.41 per cent higher than any other random 4-day period, with the difference being highly significant. Hence, the earlier finding of Ariel (1987) seems to be corroborated by Lakonishok and Smidt (1988).

Whereas Lakonishok and Smidt (1988) also fail to provide any reasons as to why the TOM effect exists, Ogden (1990) makes an effort in trying to decipher what actually brings about this effect. He argues and shows that the TOM effect depends on investors having higher demand for stocks during the days measured by Lakonishok and Smidt (1988). The surge in demand stems from the fact that investors receive dividend income, salary, etc. at the end of the month and therefore tend to invest some of it. This reasoning is supported also by Ziemba (1991) who discusses potential reasons for the effect with stockbrokers and concludes that salary payment is one likely explanatory factor.

Other potential reasons are investigated by Cadsby and Ratner (1992), who try to explain the TOM effect through other market anomalies such as the Turn-of-the-Quarter effect and the Turn-of-the-Year effect. However, even after controlling for these anomalies the TOM effect persists, indicating that the TOM effect is an independent market anomaly whose returns are not contingent on these other irregularities.

The data used by Cadsby and Ratner (1992), Lakonishok and Smidt (1988) as well as Ariel (1987) extends to 1987. However, due to the fact that many market anomalies disappear after being discovered, McConnell and Xu (2008) apply a dataset including years 1987 to 2005 to see whether the effect is still present for this new period spanning years after the publication of the effect. In fact, the period between 1987 and 2005 has exactly the same difference between TOM and non-TOM days as the periods 1926-1986 and 1926-2005 have, only with significance levels that are slightly lower. Nonetheless, the effect is present and highly significant in their data.

Another way to ascertain that the effect is not just an artefact of data snooping is to investigate whether the phenomenon exists in other markets than the one where it was found initially. In an article by Kunkel et al. (2003), 19 non-US markets are scrutinised. The results indicate that there is a TOM effect in 16 out of these 19 markets, thereby lending strong support for its existence. The authors find that the 4-day TOM period on average accounts for as much as 87 per cent of the monthly returns. Ziemba (1991) also finds support for the TOM effect in a non-US market, namely the Japanese. However, since the salaries in Japan are paid earlier than in the US, the TOM period is adjusted to -5 to +2 around the turn of the month to account for the earlier payment. In a similar fashion, Oguzsoy and Güven (2006) look at differing periods to account for some salaries being paid on the 15th each month when studying the Turkish market.

### **3. Hypotheses**

Given the theories and empiric evidence on the separate topics as well as the theoretical background outlined above, some theoretically and empirically expected outcomes from studying the Swedish OMXS30 index are outlined below.

#### **3.1 Price Effect Hypotheses**

When evaluating potential effects from inclusions in, and exclusions from, the OMXS30 index, it is important to consider the inclusion and exclusion rules. Slightly simplified, the OMXS30 index includes the 30 stocks that were the most traded on the Stockholm Stock Exchange during the preceding six months, though the exact rules are outlined in the data

section below. The important fact here is that the inclusion rules are public as well as based on data that is publicly available, and an inclusion should thus not convey any new information about the company.

Given the quite consistent evidence of price effects in relation to index inclusions and exclusions, an effect is still expected for the Swedish market despite the index' characteristics. Other theories, such as the imperfect substitutes hypothesis and the price pressure hypothesis, could still warrant an effect. Along the lines of the presented hypotheses and previous findings on the topic, a price effect is expected on the effective date when the stock is actually included in the index, but most likely not on the announcement date due to the announcement being an information-free event. If there was to be a price effect on the announcement date though, it could be lessened for the OMXS30 index due to the possibility for investors to predict the event. Even though the attention hypothesis could still be argued to be valid for the announcement date, it is unlikely that a stock which has been among the 30 most traded during the preceding six months would not already be known to investors.

## 3.2 Comovement Hypotheses and the Proposed Convergence Theory

In line with the quite unanimous previous research on change in comovement following an inclusion or exclusion, a change in this parameter is expected. The inclusion rules of the specific index should arguably have less of an effect on a potential change in comovement than it may have on a price effect. Further to the standard expectation of an increase in comovement upon inclusion, which is in line with what has been found in previous research, a proprietary theory is developed. In this theory, an increase in comovement with the index is expected for stocks with a pre-inclusion comovement of less than one, and a decrease in comovement with the index is expected for stocks with a pre-inclusion comovement of more than one. The hypothesis of a decrease for the latter group is contrary to empirical findings in previous studies which mostly look at all inclusions as one group, whereby an average increase is found. A proprietary theory in which the hypothesis of a convergence to one in comovement with the index holds true is outlined below. The general reasoning behind the theory is that the potentially correlated buying and selling activities of subgroups of investors that are overrepresented in some indices, will induce a common factor in the returns of the index stocks driven by these demand shocks, and that this factor will be equal for all stocks in the index regardless of its fundamental beta, thus introducing a convergence to one in comovement.

### 3.2.1 Outline of the Beta Convergence Theory

Initially, assume a market where the CAPM assumptions hold, and let  $\beta_s$  denote the CAPM market beta for stock  $s$ , defined as

$$\beta_s = \frac{Cov(r_s, r_{mkt})}{Var(r_{mkt})}$$

where  $r_{mkt}$  is the market return and  $r_s$  is the return of stock  $s$ , both in excess of the risk free rate which is assumed to be constant. This “fundamental beta” reflects the true fundamental covariation of the stock's return with the market. It is assumed that the fundamental return

covariance matrix and the resulting fundamental betas are not altered by introducing indices to the market.

Further, define  $L$  as an arbitrary time period long enough for there to take place

$$L = J + K$$

return events, where  $J$  are the number of *market wide systematic return events* and  $K$  the number of *index return events*, as will be defined below. The  $J$  market wide systematic return events induce a market return of

$$m_j, \quad j = 1, 2, \dots, J$$

thus causing stocks' generalised return for each of the market wide systematic return events to be

$$r_s = \beta_s m_j$$

A value-weighted equity index  $X$  is now introduced in the market, where  $I$  is the number of stocks which are included in  $X$ . Along the lines of Kumar and Lee's (2006) finding of an "existence of a systematic (or common directional) component in the trading activities of retail investors" and the demand based "style" and habitat" views of Barberis et al. (2005), the CAPM assumptions are relaxed and there is in each of the  $K$  index return events a demand shock for the  $I$  index stocks, whereby a large subset of investors which is investing in the  $X$  index buys or sells the whole index, i.e. all stocks, at the same time. Since the index is value-weighted, the subset of investors buys or sells an equal portion of each company's total shares. Under the assumption that the market does, on average across the  $K$  demand shocks, have the same liquidity ready for each of the  $I$  index stocks relative to their market value,<sup>5</sup> the demand shock induces a return of

$$\theta_k, \quad k = 1, 2, \dots, K$$

for each stock,<sup>6</sup> regardless of its beta. These shocks are thus assumed to be orthogonal to other shocks.<sup>7</sup> For each index stock  $i$ , there is a resulting set of  $L = J + K$  return outcomes, which we denote

$$\begin{aligned} R_i &= \{r_{i1}, r_{i2}, \dots, r_{iL}\} \\ &= \{\beta_i m_1, \beta_i m_2, \dots, \beta_i m_J, \theta_1, \theta_2, \dots, \theta_K\} \end{aligned}$$

of which the first  $J$  returns of the set are different across the index stocks due to each of them having an individual  $\beta_i$ , while the last  $K$  returns are common for all the  $I$  index stocks.<sup>8</sup>

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<sup>5</sup> Which is not an implausible assumption for an index such as the OMXS30 index, which includes the most traded stocks on the exchange

<sup>6</sup> This return can be temporary or permanent depending on which assumption is made regarding stocks having downward sloping demand curves or not

<sup>7</sup> One could relax the stringent assumption that the shocks are completely independent of other shocks in the market. However, since the general conclusion would still be the same, assuming independence allows for simpler annotation and easier comprehension of the derivation of the hypothesis

If estimating each index stock's realised beta,  $\hat{\beta}_i$ , over its realised return set  $R_i$ , the index demand shocks are equivalent to the reaction a stock with an index beta of one would have to a market wide systematic return event, rather than the reaction the specific stock  $i$  would have to such an event given its individual  $\beta_i$ . In the outlined setting, there is thus a component introduced in the comovement of index stocks that spurs a bias in their beta towards one with respect to the other index stocks. This bias increases with the ratio  $K/L$ , i.e. with the share of returns that are driven by investors in the index having a common component in their trading activities. If the final assumption is made that the index stocks are representative of the broader market, and thus as a group have a beta of one with the market, the bias in the comovement will cause a convergence of one in the realised beta  $\hat{\beta}_i$  of the index stocks such that

$$\hat{\beta}_i = \left\{ \begin{array}{l} < \beta_i \mid \beta_i > 1 \\ > \beta_i \mid \beta_i < 1 \end{array} \right\}$$

### 3.3 Turn-of-the-Month Effect Hypotheses

Although not in focus for this study, a significant TOM effect is expected to be found. This is a prerequisite to use the TOM effect to examine the effects of the phenomenon that is of primary concern for this paper, namely index effects. As outlined in the previous research section, one potential explanation for the TOM effect is that investors receive their income at the end of the month and that part of this income will simultaneously be invested in the financial markets. In Sweden, it is common to have this monthly investment at the end of the month automated, whereby the bank on the investors' behalf automatically transfers a certain amount of the salary into different types of investment vehicles. It is probable that a large share of these automatic transfers will flow into investment vehicles such as mutual funds that are benchmarked to an index as well as index linked funds. It is thus hypothesised that the TOM effect will be more pronounced for index stocks than for non-index stocks.

## 4. Data

Large parts of this paper rest upon data and analyses related to the OMXS30 index. The OMXS30 index is an index comprising stocks listed on the Stockholm Stock Exchange, and is published by the company operating the exchange, Nasdaq OMX. Even though there are several indices tracking the Stockholm Stock Exchange, the OMXS30 index is arguably the most quoted and is furthermore the index that index derivative products linked to the Stockholm Stock Exchange follow. The index comprises the 30 most traded stocks on the exchange and is revised biannually. Changes to the index are announced in December and June for revision changes being implemented at the start of January and July, respectively. Due to extraordinary events, such as for example mergers or takeovers, some inclusions and exclusions also take place in between the regular revisions. Even though the index is communicated as comprising the 30 most traded stocks on the exchange, there are some exceptions in place to avoid excessive turnover of index constituents. The rules are such that

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<sup>8</sup> The order in which the events take place in time is of course arbitrary, the systematic ordering in the set is merely used for ease of presentation

as to become included in the index, a non-index stock has to be among the 15 most traded stocks during the six months preceding the revision, and if so it replaces the least traded of the current index stocks. Similarly, a stock is excluded if it is not among the 45 most traded stocks during the six months preceding the revision, and is then replaced by the most traded non-index stock.

To enable the study of inclusions to, and exclusions from, the OMXS30 index, lists containing all inclusions and exclusions as well as the index composition for each period were provided by Nasdaq OMX. The index started in January 1987, and the lists cover the years 1987 through 2012. The information provided includes both the announcement date and the effective date for the inclusions and exclusions of the index. Announcement date denotes which date the index change is communicated to the public, and the effective date denotes the date from which the stock is actually included in the index. For the period 1987 until mid-1994, there is however no available information on the exact announcement dates. Inclusions and exclusions from this period have thus been excluded when studying effects relative to the announcement date to ensure a clean dataset with an exact measurement of the announcement day. When studying effects relative to the effective date however, the observations from this period are used since their effective date is known with certainty.

The common use of multiple share classes with differing voting rights, where occasionally several or all of them are listed, make the Swedish market somewhat special compared to many other studied markets. There are several instances where a firm has two different stocks of different share classes present in the OMXS30 index at the same time. Another irregularity compared to some other markets is the previous existence of *limited* and *free* stocks<sup>9</sup> within the share classes. The system, which was abolished in 1993, entailed that only Swedish investors were allowed to own the limited stocks, while the free stocks were possible to buy also for foreign investors.

Since the index' inception in 1987, there has been a total of 161 exclusions and, naturally, 161 inclusions made to the index. However, far from all of these can be used for the purposes of this paper. To begin with, during the early years of 1987-1991, the index experienced excessive turnover. For example, as many as 29 inclusions occurred during 1988. Drawing conclusions regarding, for example, comovement with an index that has a constituent turnover of almost 100 per cent may naturally lead to spurious results. After excluding the observations from 1987-1991, there are 58 inclusions and 58 exclusions remaining. Furthermore, each remaining event is scrutinised and those that are caused by matters such as mergers, spin-offs and name changes are excluded since the events are either disturbed or rather non-events. Because a minimum of 120 observations per estimation period are required for each stock, as is discussed in the method section, events with fewer observations are dropped. Excluding observations on the above outlined criteria results in a final usable dataset of 38 inclusions and 26 exclusions.<sup>10</sup>

For the final set of events, daily observations of the share price, the market value of the share class, and trading volume, are collected over the years 1990-2012 using Thomson Datastream. The risk of obtaining misspecified data when using a secondary source is as always present. However, considering that only relatively widely used variables are downloaded for some of the largest stocks on a well-developed and scrutinised market, the

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<sup>9</sup> Authors' translation of the Swedish terminology *bundna* (limited) and *fria* (free)

<sup>10</sup> See Appendix 1 for lists of the included index changes

risk is deemed to be relatively small in this study. An additional issue related to the data gathering from Thomson Datastream relates to the previous system of limited and free shares in Sweden. The stock lists in Thomson Datastream do not contain any direct information as to which of the stock series were limited or free. Indications are sometimes found in the stocks' mnemonics<sup>11</sup>. In other instances, the limited stocks are often distinguished on the basis of having time series which end in 1992-1993. Also collected from Thomson Datastream are prices for the indices OMXS30 and OMXSALL<sup>12</sup>. The risk-free rate, proxied by the Swedish 3-month T-bill, is obtained from the Swedish central bank, Riksbanken. The 3-month rate is chosen as the proxy since it is short enough to not contain any substantial default risk and the fact that the 3-month T-bill market is characterised by a high liquidity. Through using an interest rate with a highly liquid market, the liquidity risk premium is minimised, as is the risk of stale observations in the time series.

For the construction of the SMB and HML portfolios, data is gathered for all equities obtainable from Thomson Datastream that are denominated in SEK and were listed in Sweden at some point between the years 1988-2012. Because this dataset contains both dead and alive stocks, the sample ought to be free from survivorship bias, which otherwise could have biased our SMB and HML estimations. The data needed for these estimations, and therefore the data collected for the companies in this dataset, are price, price to book value and market value per share class.

## 5. Method

### 5.1 Price Effect Study

In order to investigate whether there is a price effect associated with index inclusions and exclusions, an event method is applied. The method has gained widespread popularity due to its ability to use the rationality of the marketplace to observe the impacts of specific events on companies (MacKinlay, 1997). Estimating how the stock would most likely have performed in the absence of the event and comparing it with the actual return that is affected by the event, gives an indication of how the market perceives the event. In this paper, the events of interest are the index inclusions and exclusions that occur in the OMXS30 index between the years 1992-2012. For the price effect study, the aim is to investigate the returns surrounding the index changes. Daily returns will be used in both this part and throughout the rest of the paper and are defined as the difference in lognormal closing price between the current and the preceding day.

In order to observe whether there is an effect from becoming included in an index, the first step is to check whether there are any abnormal returns around the inclusion. There are several methods that can be applied to calculate the abnormal return. Peterson (1989) suggests three categories of methods: (1) market-adjusted models, (2) mean-adjusted models and (3) market models, which are all outlined in Appendix 2.

In a *market model*, the returns of each stock are regressed against market factors, such as the market index return. This is usually done over an estimation period that is separate from

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<sup>11</sup> The alphanumerical codes used by Thomson Datastream to identify stocks

<sup>12</sup> A value-weighted index comprising all stocks listed on the Stockholm Stock Exchange

the event window in order to determine how each stock should normally move given changes in the market factors

$$R_{it} = \alpha_i + \beta_i R_{mt} + \tilde{u}_{it}$$

The abnormal returns in the event window are then calculated by subtracting the expected market return from the stock's realised return

$$AR_{it} = \hat{u}_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

where  $\hat{\alpha}_i$  and  $\hat{\beta}_i$  are the market parameters estimated by employing the regression in the first equation. In order to provide as accurate approximations of expected returns as possible, the market model is applied in this paper, since this method ensures that the expected returns incorporate both firm-specific sensitivities and general market conditions. Even though MacKinlay (1997) claims that the benefits to be made from using a multifactor market model rather than a single-factor model are limited, he acknowledges that multifactor models can be useful when the sample firms have a common characteristic. Further, there have also been several studies witnessing about the shortcomings of the CAPM, for example that it does not take size into consideration properly (Banz, 1981) and that it fails to acknowledge the effect of the earnings yield (Basu, 1983). Using the Fama French 3-factor model (henceforth the FF3F model) better helps to explain the cross-section of average returns through measuring size and value sensitivity on top of the sensitivity to the market excess return that the CAPM builds upon (Fama & French, 1993). Fama and French (1995) suggest that the value, or HML, variable functions as a proxy for relative distress, whereas the size, or SMB, variable captures covariation in small stocks that are not accounted for by the normal market factor. In order to ascertain that any potential abnormal returns only depend on the event itself rather than firms being sensitive to these parameters, the FF3F model is applied in this paper. A single-factor model, the CAPM, is also applied to ascertain robust results. In addition to having these advantageous properties, using a market model also helps mitigate some of the potential statistical issues with the data, which are discussed in greater detail below.

The market, size and value factors in the FF3F model are estimated for each stock during the estimation period, and the resulting prediction errors during the event window are the estimated abnormal returns.

$$R_{it} = \alpha_i + \beta_i R_{mt} + s_i SMB_t + h_i HML_t + \tilde{u}_{it}$$

$$AR_{it} = \hat{u}_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt} + \hat{s}_i SMB_t + \hat{h}_i HML_t)$$

To estimate the SMB and HML factors, the method of Fama and French (1993; 1996) is applied on all the stocks that are, or have previously been, listed on the Stockholm Stock Exchange between 1989 and 2012. Portfolios are formed at the end of June each year, when stocks are allocated to five different size groups and five different book-to-market groups. The intersections of the five size groups and the five book-to-market groups are used to form portfolios, resulting in a total of 25 portfolios. A weighted return is then calculated for each of these portfolios. The SMB factor is then estimated by calculating the difference between the average return of the five portfolios containing the smallest companies and the average return of the portfolios containing the largest companies. The estimation of the HML factor

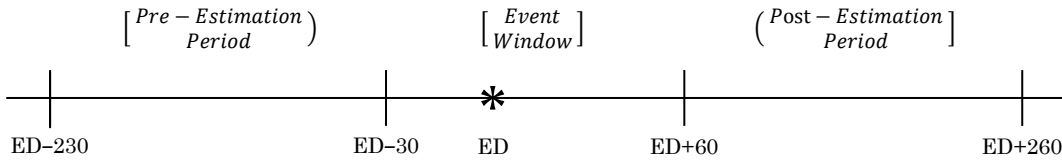
follows the same pattern. By estimating the factors in this manner, the factors should be relatively free from effects stemming from differences in size and book-to-market ratio, respectively. The exact procedures employed in the formation of the SMB and HLM factors are outlined in Appendix 3.

The estimation periods for the market model factors are set so that the event window is not included when the market model parameters are estimated. This ensures that the event itself does not influence the estimated parameters, which would otherwise have biased the estimates. If the event window was to be included, the event returns would influence the market model parameters, which would lead to a situation where the expected returns, and not only the estimated abnormal returns, would capture the impact of the event (MacKinlay 1997). Furthermore, as pointed out by Fama et al. (1969) as well as Brown and Warner (1980), the coefficients would be biased since the disturbances of the regression would not be mean zero. As a result, the estimated abnormal returns could be under or overestimated by including the event window in the estimation of the market parameters.

Another problem related to the estimation of the market model parameters is the issue of non-stationary parameters. The estimated coefficients in the market model may not be the same before and after the event, which makes it inappropriate to use the estimation parameters before the event to calculate expected returns after the event has taken place. In a similar fashion as Jain (1987), two different estimation periods are used to account for the difference in parameter values. One pre-event estimation period is used to estimate the parameters used to calculate abnormal returns up until the effective date of the inclusion, and a second post-event estimation period is used to estimate the parameters used to calculate the abnormal returns for the effective date and beyond.

For both estimation periods, the market model parameters are estimated over 200 days, with a minimum of 120 observations required during the estimation period for the event to be included. Denoting the effective date as  $ED$ , and also taking the event window of  $[ED - 30; ED + 60]$  into consideration, the estimation periods are thus given by  $[ED - 230; ED - 30)$  and  $(ED + 60; ED + 260]$ . The lengths of the estimation periods are deemed to be long enough to give appropriate estimations of the parameters, but still short enough for the parameters to be relatively stable over the estimation period. The chosen estimation periods are slightly longer than some studies (Jain, 1987; Shankar & Miller, 2006), but match the length of the estimation period used by for example Elliott et al. (2006). Furthermore, it is the midpoint in the range of 100 to 300 estimation days that Peterson (1989) suggests as appropriate for daily data. The event window is given perhaps an unusually long period before the actual implementation, but this is to safeguard against pre-implementation trading as well as it enables checking for abnormal returns for longer periods before the announcements are made. Considering that the rules for inclusions and exclusions in the OMXS30 index are public and well-known, as is the data used to calculate which stocks are to be included, there is a relatively high degree of predictability compared to other indices. High predictability of index revisions can potentially spur some trading by investors trying to pre-empt index investors through buying the new index stock before announcement. By using a slightly longer period prior to the event the hope is to capture any such behaviour.

**Figure 1: Overview of Estimation Period and Event Window**



### 5.1.1 Calculation of Average Abnormal Returns

In this paper, two methods are used to assess the average abnormal and cumulative average abnormal returns for the events, as well as to test them for significance. These are the *traditional method* and *Patell's standardised residual model*.

#### *The Traditional Method*

The main method used in this paper to assess average abnormal returns and to test their significance is widely used in event studies (Brown & Warner, 1985), and dubbed the “traditional method” by Boehmer et al. (1991). Average abnormal return  $\overline{AR}_t$  is calculated as

$$\overline{AR}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} AR_{it}$$

$$\overline{CAR}_L = \sum_{t=1}^L \overline{AR}_t$$

where  $N_t$  is the number of sample securities with an available excess return on day  $t$ , and  $L$  is the length of the accumulation period. Average abnormal returns for each day in “event time” are thus calculated cross-sectionally. The standard deviation used for the test statistic is the standard deviation of the average abnormal returns during the estimation period, that is, the average residuals from the market model estimations. The full specification of the model and its test statistics can be found in Appendix 4.

#### *Patell's Standardised Residual Method*

To check the results for robustness, Patell's (1976) standardised residual model is also employed. Firstly, this model takes into consideration that the event period residuals are out-of-sample predictions, which is further discussed in the model's exact specification found in Appendix 4. Secondly, by standardising the residuals before averaging them allows for heteroskedastic event-day residuals, and prevents securities with large variances to dominate the results (Boehmer, et al., 1991).

For the Patell test, the security-specific abnormal returns  $AR_{it}$  are estimated as the residuals produced by applying the market model coefficients estimated prior to the event, in the same manner as for the traditional method. The standard deviation for each security is also, in the

same manner, estimated using the regression residuals. The standardised abnormal return measure  $AR_{it}$  and the cumulative abnormal return measure  $CAR_{iL}$  for each stock, are calculated as

$$AR_{it} = \frac{\hat{u}_{it}}{\hat{S}(\hat{u}_i)\sqrt{C_{it}}}$$

$$CAR_{iL} = \sum_{t=1}^L \frac{\hat{u}_{it}}{\hat{S}(\hat{u}_i)\sqrt{LC_{it}}}$$

where  $\hat{u}_{it}$  is the abnormal return,  $C_{it}$  is a factor adjusting for the fact that  $\hat{u}_{it}$  is an out-of-sample prediction, and  $L$  is the number of days in the accumulation of abnormal returns.

### 5.1.2 Discussion of Methods

Studying abnormal performance using an event method requires special care when designing the abnormal return measurements and their test statistics with respect to the method's specific characteristics.

A first source of error can be cross-sectional dependence of security-specific abnormal returns. The degree of dependence is usually higher when events are clustered in time. The events studied here are indeed clustered to some extent, since there is often more than one stock included at each regular index revision. The impact of cross-sectional dependence is that fewer event observations will be independent than would otherwise be the case. If estimated residuals from the abnormal return measurement method, such as market model residuals, are correlated over time, the variance of the estimated abnormal returns will be lower in the presence of event clustering. However, as Brown and Warner (1980; 1985) discuss, it is likely that cross-sectional correlation is small in calendar time, and even smaller in event time, when applying a market model to estimate abnormal returns. Through simulations, Brown and Warner (1980; 1985) show that the effect of this issue is indeed negligible when applying a market model, as is done here. Potential cross-sectional dependence in security-specific abnormal returns can also be taken into account through estimating the variance of the estimated average abnormal returns by using the average residuals of the regressions during the estimation period, which is exactly what is done in the traditional method applied in this paper. Further complexities to adjust for cross-sectional dependence and clustering, such as Brown and Warner's "Crude Dependence Adjustment" (Brown & Warner, 1980) or the portfolio method applied by Jaffe (1974) and Mandelker (1974), are thus not necessary.

A well-known bias is, however, introduced by using the standard deviation of the cross-sectional average residuals during the estimation period as the estimator for the standard deviation of the estimated residuals in the event window. The bias is that the prediction residuals will always have a greater variance than the estimation residuals, due to the fact that the prediction residuals capture the variance of the disturbances as well as the estimation errors of the coefficients. However, the Patell test applied in this paper for robustness checks corrects for this bias.

Another potential issue is time-series dependence, or autocorrelation, in security-specific residuals. Autocorrelation violates the OLS regression assumption that the error terms are uncorrelated, though it does not bias the estimates of the coefficients. It tends, however, to cause the standard errors to be underestimated. If autocorrelation in the security-specific time-series are combined with clustering of events it may as well induce positive time-series dependence in the average abnormal returns. Brown and Warner (1985) however only find limited benefits of adjusting for autocorrelation when applying a market model, both for clustered and non-clustered events. Hence, no adjustment for autocorrelation is made in this study.

### 5.1.3 Volume Effect

In order to observe whether any extraordinary trading behaviour occurs around the inclusions and exclusions, trading volumes around the events are investigated. This is operationalised by using a measure of abnormal volume presented by Harris and Gurel (1986) and later applied by for example Beneish and Gardner (1995) and Bechmann (2002). It measures the cross-sectional mean of volume in event time as

$$MVR_t = \frac{1}{N} \sum_{i=1}^N VR_{it}$$

where

$$VR_{it} = \frac{V_{it}}{V_{mt}} * \frac{\bar{V}_m}{\bar{V}_i}$$

in which  $V_{it}$  and  $V_{mt}$  are the trading volumes of stock  $i$  and the total trading volume of the OMXS30 index stocks, respectively, on day  $t$ .  $\bar{V}_i$  and  $\bar{V}_m$  are the average trading volumes during the estimation period for stock  $i$  and the OMXS30 index stocks. Similar to Harris and Gurel (1986), the estimation period is set to the 40 trading days leading up to 10 trading days prior to the announcement. See Appendix 5 for a complete description of the method.

## 5.2 Comovement Study

The focus of this part of the study is a potential shift in the comovement between the included stock and the index stocks following an index inclusion. Again an event study approach is applied to investigate the phenomenon. Using two separate estimation periods for the market model coefficients, one before and one after the event, is necessary in this part as the intent is to examine whether the stock co-moves differently with the index stocks after compared to before the inclusion. The first estimation period is set to  $[ED - 230 ; ED - 30]$  and the second is set to  $(ED + 30 ; ED + 230]$ , which matches the length of the estimation periods in the price effect study, with the difference that the event window is set to a slightly shorter time span of  $[ED - 30 ; ED + 30]$ . The length of the event window is set to ensure that the estimation parameters are not biased by the event itself.

Comovement is measured as the regression coefficient of the stock's return on the OMXS30 index return. This coefficient is studied, just as in the price effect study, both in a univariate and a multivariate setting using the CAPM and the FF3F model, respectively. The SMB and

HML factors used for studying changes in comovement are the same as those constructed for the price effect study. The FF3F model is applied to control for potential effects of size and value. The stock in focus in each event is excluded from the OMXS30 index when calculating the coefficients to avoid a bias in the estimated OMXS30 coefficient. Without this adjustment, the newly included stock would be part of the index for the second estimation window, thereby causing the stock to, by construction, have an increased comovement with the index. This bias would lead to a too frequent rejection of the null hypothesis that there is no change in comovement. A new unique OMXS30 index is thus calculated for each index inclusion, and through running the regressions against the remaining index constituents, the problem is mitigated. The specifications of the regressions to estimate the coefficients before and after the events are

$$R_{it} = \alpha_i + \beta_i R_{OMXS30it} + \tilde{u}_{it}$$

$$R_{it} = \alpha_i + \beta_i R_{OMXS30it} + s_i SMB_t + h_i HML_t + \tilde{u}_{it}$$

Rather than using OLS regressions to estimate the coefficients, we follow Coakley et al. (2008), Coakley and Kougoulis (2004), Mase (2008) and others in applying a seemingly unrelated regressions – feasible generalised least squares (SUR-FGLS) estimation method. As for example Coakley et al. (2008) point out, this ensures that the standard errors used to test for significance are appropriate estimators in the presence of cross-sectional correlation. Average coefficients,  $\bar{\beta}$ , and their standard errors are defined as

$$\bar{\beta} = \frac{1}{N} \sum_{i=1}^N \hat{\beta}_i$$

$$S(\bar{\beta}) = \frac{S(\hat{\beta}_s)}{\sqrt{N}}$$

where

$$S(\hat{\beta}_i) = \sqrt{\sum_{i=1}^N (\hat{\beta}_i - \bar{\beta})^2 / (N - 1)}$$

A paired t-test is then used to assess whether the difference between the coefficients is significant. Furthermore, a Wilcoxon signed-rank test is applied for robustness checks.

### 5.3 Turn-of-the-Month Effect Study

The method developed for this study takes its starting point in the method applied by Kunkel et al. (2003), who estimate the Turn-of-the-Month effect with the regression

$$R_t = \alpha + \beta_{TOM} TOM_t + \tilde{u}_t$$

where  $R_t$  is the market index return on day  $t$ ,  $\alpha$  is the intercept of the regression,  $TOM_t$  is a binary dummy variable indicating whether  $t$  is a day within the TOM period or not, and  $\tilde{u}_t$  is

the error term. The intercept in such a specification represents the average return of the index on the days which are not included in the TOM period, and the coefficient on the TOM variable captures the difference in return between the days included in the TOM period and those which are not.

This paper differs in that the primary focus is not the TOM effect itself, but rather the difference in TOM effect between index stocks and non-index stocks. As a result, the traditional method used to study the TOM effect is developed and extended for this paper's specific purpose. The dataset containing all the stocks that are, or have been, listed on the Stockholm Stock Exchange is used in order to make sure that both index and non-index stocks are included. To test for a potential difference, the returns of all individual stocks at each point in time on the Stockholm Stock Exchange, rather than the aggregate market return used by other studies, are regressed on a standard TOM dummy variable, an OMXS30 index dummy variable indicating whether the stock is included in the OMXS30 index or not, and an interaction dummy variable to single out the difference in effect between index and non-index stocks. The basic form of the regression that is utilising daily data from 1990 through 2012 is

$$R_{it} = \alpha + \beta_{TOM}TOM_t + \beta_{OMXS30}OMXS30_{it} + \beta_{IV}IV_{it} + \tilde{u}_{it}$$

where  $R_{it}$  is the return of stock  $i$  on day  $t$ ,  $\alpha$  is the intercept of the regression,  $TOM_t$  is a binary dummy variable indicating whether  $t$  is within the TOM period or not,  $OMXS30_{it}$  is a dummy variable indicating if stock  $i$  is included in the index at time  $t$ , and  $IV_{it}$  is the interaction variable indicating if  $t$  is within the TOM period *and* stock  $i$  is an index stock. In this specification, the intercept represents the average return of non-index stocks on the days not included in the TOM period, the  $\beta_{TOM}$  coefficient indicates the difference in return for non-index stocks on days which are included in the TOM period, the  $\beta_{OMXS30}$  coefficient captures any potential systematic difference in return between index stocks and non-index stocks, and the  $\beta_{IV}$  coefficient captures the effect in focus, which is a potential difference in return on TOM days for stocks that are included in an index compared to those that are not.

The basic form of the regression, however, suffers from a misspecification stemming from using individual stock returns rather than merely a single index return. Even though the time parameter of the data used in the regression is reduced to a measure of days relative to the turn of the month, groups of individual stock return observations will inevitably stem from the same historical day. Returns stemming from the same historical day will share a common factor, namely the market-wide return on that day. As such, the error terms of the regression will be correlated in clusters within the historical dates, violating the OLS assumptions. Specifically, the error terms of the model will not be independently and identically distributed. An elaboration of the adjustment made to correct for this can be found in Appendix 6, but in essence, the covariance matrix of the disturbances is specified to have intracusters for each historical day within which the covariations are allowed to be non-zero. Even though the point estimates of the coefficients compared to the basic form of the regression are not affected by these adjustments, the standard errors of the coefficients will be corrected to enable correctly specified tests of their significance.

The TOM period is set to start three days prior to the turn of the month and last until two days after it. The time period is chosen as to pick up the potential effect from monthly savings schemes in which money is transferred to fund managers after the monthly salary is

collected. Because salaries in Sweden are typically paid on the 25<sup>th</sup> of each month, the start of the TOM period is chosen so that it on average starts after this date, and ensures that funds have enough time to pass through. However, due to the months having a varying number of days and the fact that weekends from time to time affect the exact timing of the salary payment, a perfect match with payments cannot be guaranteed. Two days after the turn of the month is chosen as the end of the period to ensure that there is enough time for the savings to reach the hands of the fund managers, and for them to have a couple of trading days to invest the money in the market. The TOM period thus contains a total of five days, which is in the range of the commonly used periods of 5-7 days (Ziemba, 1991; Kunkel, et al., 2003; Lakonishok & Smidt, 1988). Further alternative specifications are also employed to check the results for robustness.

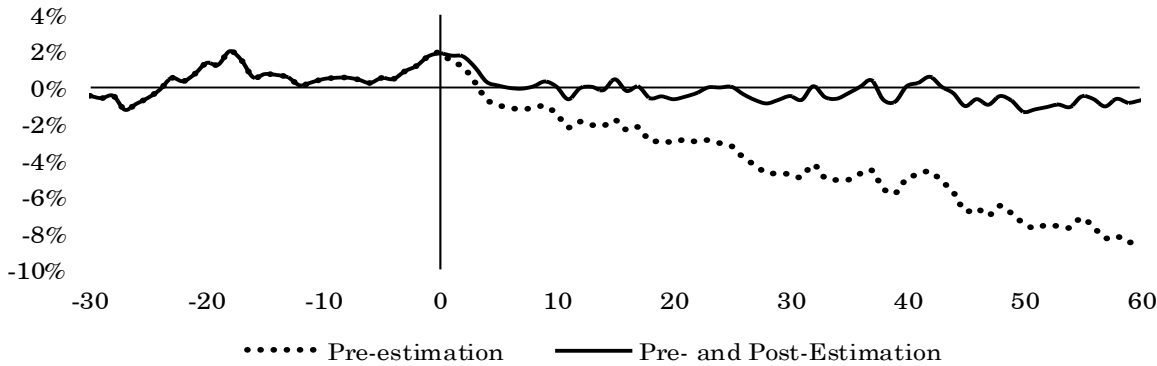
## 6. Results

In the following section the findings of the undertaken tests will be presented and analysed. The first section, section 6.1, discusses the results of the price effect study, followed by the comovement study results in section 6.2. Lastly the results of the Turn-of-the-Month study are covered in section 6.3.

### 6.1 Price Effect Study

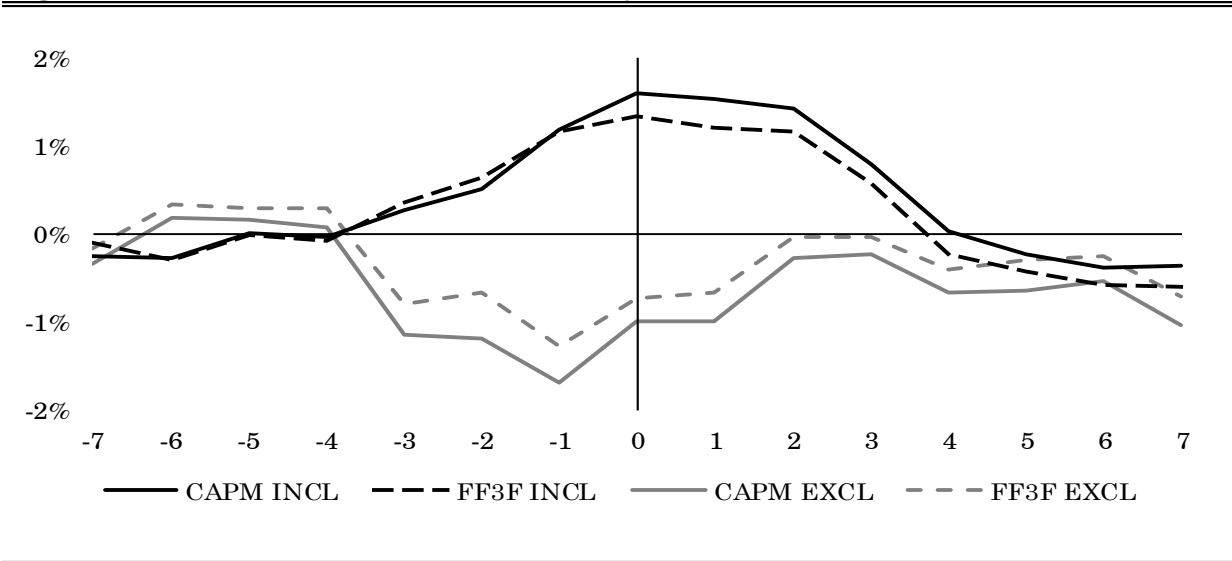
In order to study the price effect of index membership an event study approach is selected. As mentioned in the method, two estimation periods, one before and one after the event, are applied to estimate the coefficients of the market models. The reasoning behind this was that the betas might be non-stationary, an assertion that is further investigated in the comovement study. Figure 2 illustrates the effect of the non-stationary betas, where the CARs calculated using the one period estimation method, with market model coefficients only estimated prior to the event, experiences a downward drift. This occurs since the calculations of CARs during the time after the event are carried out with erroneous betas not accounting for the shift in the market model parameters occurring around the event.

**Figure 2. Inclusions - One versus Two Estimation Periods for Market Model Parameters**



The same figure also bears witness to what looks to be a bump in CARs around the effective date, which suggests that there are abnormal returns associated with the stock being introduced to the index. This would be consistent with the general findings within the research area as well as the stated hypothesis. Taking a closer look at the CARs around the effective date in Figure 3 below gives the same indication. A pattern of CARs starting to amass approximately four days before the stock is introduced to the index, and whose reversion ends about four days after the inclusion, is evident. It is also noticeable that the exclusions, as expected, experience the opposite effect compared to the inclusions. Examining the CARs around the effective date statistically does however not yield significant results, as can be seen in the two rightmost columns of Table 1 on the next page.

**Figure 3. Cumulative Abnormal Returns for Days -7 to +7 around Effective Date**



From Table 2, containing the mean volume ratios around the event days, it can be seen that the demand around the effective date of the inclusion is higher than usual. As is evident from the table, there are abnormally high trading volumes which are statistically significant during the day leading up to the effective date of the inclusion, and on the effective date itself. Even though not statistically significant, the following days also seem to experience a higher turnover than usual, which indicates an increased demand during the days surrounding the effective date of the inclusion.

**Table 1. Inclusions - Cumulative Abnormal Returns for Days -7 to +7**

Time		Announcement		Effective	
Start	End	CAPM	FF3F	CAPM	FF3F
-7	-7	0.008 (1.647)	0.005 (1.116)	-0.002 (-0.541)	-0.001 (-0.237)
-7	-6	0.005 (0.759)	0.004 (0.589)	-0.003 (-0.418)	-0.003 (-0.471)
-7	-5	0.009 (1.159)	0.007 (0.867)	0.000 (0.001)	0.000 (-0.022)
-7	-4	0.018* (1.919)	0.016* (1.775)	0.000 (-0.047)	-0.001 (-0.090)
-7	-3	0.026** (2.507)	0.024** (2.398)	0.003 (0.271)	0.003 (0.350)
-7	-2	0.028** (2.482)	0.026** (2.363)	0.005 (0.448)	0.006 (0.588)
-7	-1	0.032*** (2.613)	0.030** (2.560)	0.012 (0.984)	0.012 (0.989)
-7	0	0.046*** (3.518)	0.042*** (3.348)	0.016 (1.242)	0.013 (1.054)
-7	+1	0.044*** (3.171)	0.038*** (2.868)	0.015 (1.119)	0.012 (0.903)
-7	+2	0.035** (2.390)	0.029** (2.067)	0.014 (0.977)	0.012 (0.821)
-7	+3	0.035** (2.306)	0.030** (2.016)	0.008 (0.519)	0.006 (0.386)
-7	+4	0.029* (1.821)	0.023 (1.476)	0.000 (0.026)	-0.002 (-0.152)
-7	+5	0.026 (1.590)	0.020 (1.248)	-0.002 (-0.143)	-0.004 (-0.271)
-7	+6	0.027 (1.596)	0.022 (1.304)	-0.004 (-0.220)	-0.006 (-0.342)
-7	+7	0.040** (2.229)	0.032* (1.871)	-0.004 (-0.205)	-0.006 (-0.353)

\*\*\*p&lt;0.01, \*\*p&lt;0.05, \*p&lt;0.10

t-s tastic in parenthesis

**Table 2. Inclusions - Mean Volume Return around Event Day**

Time	Announcement		Effective	
	MVR	t-stat	MVR	t-stat
-7	1.097	0.790	0.951	-0.395
-6	1.213	1.280	0.947	-0.381
-5	1.091	0.733	0.930	-0.668
-4	1.784**	2.186	1.105	0.821
-3	1.604**	2.203	1.017	0.098
-2	1.310*	1.822	1.222	1.272
-1	0.967	-0.227	2.075***	3.054
0	1.211	1.063	1.362**	2.219
1	0.952	-0.406	1.157	1.415
2	1.070	0.470	1.268	1.510
3	0.740***	-3.471	1.018	0.163
4	1.078	0.277	1.199	0.861
5	0.955	-0.350	1.309	1.343
6	1.156	1.151	1.295	0.799
7	1.303*	1.749	1.334	1.236

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

The general results obtained for the effective date are not only weaker in terms of significance, but also smaller in magnitude when compared to the effect found in many articles where a positive abnormal return of 3 per cent is not uncommon (Shleifer, 1986; Jain, 1987; Chakrabarti, et al., 2005). In this study, the CARs relative to the effective date for the period -7 to 0 peak at 1.3 per cent, and that is for a seven day period rather than just on a single day. The individual abnormal returns around the effective date in Table 3 corroborate the lack of an economically and statistically significant return. For the effective date, the return is, surprisingly enough, not significant and only amounts to 0.2 per cent. For exclusions, presented in Appendix 7, there is similarly no significant negative abnormal return upon index exclusion, which is also surprising as one would expect the index funds to sell off their holdings when the stock is excluded.

**Table 3. Inclusions - Abnormal Return around Event Days**

Time	Announcement		Effective	
	CAPM	FF3F	CAPM	FF3F
-2	0.002 (0.473)	0.002 (0.427)	0.002 (0.491)	0.003 (0.657)
-1	0.004 (0.833)	0.004 (0.983)	0.007 (1.506)	0.005 (1.177)
0	0.014*** (3.039)	0.012*** (2.698)	0.004 (0.910)	0.002 (0.362)
+1	-0.002 (-0.438)	-0.004 (-0.865)	-0.001 (-0.154)	-0.001 (-0.272)
+2	-0.009* (-1.955)	-0.009** (-2.067)	-0.001 (-0.270)	-0.001 (-0.113)

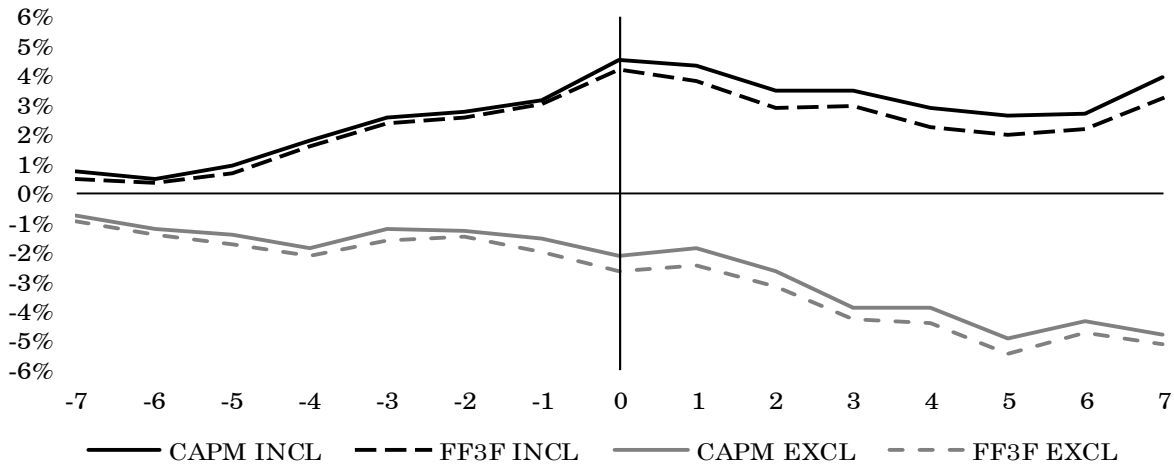
\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

t-s tatic in parenthe s is

Contrary to what was expected however, there is a significant price effect on the announcement day, with an average abnormal return of 1.2 per cent. Looking at the

announcement columns in Table 1, the CAR starting seven days prior to the announcement date is also significant from four days before the announcement until four days after it, as well as again on the seventh day. The pattern is seen graphically in Figure 4 below, where the opposite pattern is as well observed for exclusions. As can be seen in Appendix 7, the downward drift for the exclusions are significant from three days after the announcement and onwards. We thus observe significant price reactions around the announcement dates, though they do not seem to be permanent by looking at the results in Table 4 and Appendix 7. Notable is that the CARs start to accumulate already prior to the actual announcement, when information on potential changes has yet not been communicated.

**Figure 4. Cumulative Abnormal Returns for Days -7 to +7 around Announcement Date**



When expanding the horizon and taking long-term trends in CARs into account, the price effect upon the implementation of inclusions seems to be negligible, if not even non-existent, in Sweden. As can be observed in Table 4, there are no significant CARs for any of the studied time intervals. Looking at the entire -30 to +60 event window there is only an insignificant CAR of 0.7 per cent, which strongly implies that there is no effective date price effect in the Swedish market, or that any potential effect is at best short-lived. For the announcement date, however, a price effect is observed, which starts to amass already before the announcement date of the index changes.

In Appendix 8, the significances for the different CAR periods are specified if the Patell test rather than the traditional method is applied. The results of this alternative test method are similar to those presented above, which is an indication that the results are robust to alternative specifications.

**Table 4. Inclusions - Cumulative Abnormal Returns**

Time		Announcement		Effective	
Start	End	CAPM	FF3F	CAPM	FF3F
-30	0	0.010 (0.392)	0.011 (0.449)	0.026 (1.001)	0.023 (0.938)
-20	0	0.021 (0.995)	0.018 (0.876)	0.008 (0.379)	0.005 (0.257)
-10	0	0.038** (2.522)	0.035** (2.369)	0.015 (0.975)	0.014 (0.954)
0	+10	-0.019 (-1.220)	-0.021 (-1.427)	-0.018 (-1.151)	-0.018 (-1.239)
0	+20	0.000 (0.000)	-0.003 (-0.130)	-0.018 (-0.839)	-0.025 (-1.232)
0	+30	-0.025 (-0.986)	-0.029 (-1.166)	-0.019 (-0.745)	-0.023 (-0.945)
0	+40	-0.023 (-0.796)	-0.037 (-1.304)	-0.009 (-0.306)	-0.018 (-0.632)
0	+50	-0.011 (-0.348)	-0.028 (-0.865)	-0.011 (-0.341)	-0.032 (-1.007)
0	+60	0.002 (0.066)	-0.024 (-0.690)	-0.005 (-0.145)	-0.026 (-0.742)
-30	+60	0.005 (0.124)	-0.019 (-0.439)	0.016 (0.373)	-0.007 (-0.163)

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10  
t-statistic in parenthesis

### *Analysis*

The lack of a long-term price effect, the bump in CARs around the effective date together with the high volumes around the same time can be seen as support for the price pressure hypothesis. The inclusion spurs an increase in demand around the effective date, as hinted by the increased trading volumes, but the sellers fail to provide enough volume at the given price level. As a result of this, the forced buyers have to pay a premium to induce more investors to sell their shares. Soon however, the temporary high demand abates as the index funds have purchased the stocks they need to replicate the index and the price falls back to a normal price level supported by the market. An outcome worth pointing out again is the general insignificance of the CARs obtained for the effective date, because it is an unexpected and marked deviation from an otherwise quite uniform stream of evidence. The lack of significance may merely be due to the combination of fairly few observations and a quite small effect, rather than a complete lack of effect, whereby a discussion of the CARs is still of interest. The price effects surrounding the announcement show higher statistical significance, and are similarly also coupled with statistically significant increases in volume, but are as well smaller in magnitude compared to what has been found on many of other studied markets.

Potential explanations for the lesser effect may lie in the characteristics of the OMXS30 index and the stock market in Sweden in general. One such characteristic is the use of

several share classes for each company, which is a prevalent phenomenon in Sweden. The availability of more than one share class with rights to the same underlying cash flows should increase the likelihood of arbitrageurs being able to exert a pronounced effect on the market. Consider a company that has two different share classes, one A-share and one B-share which are identical in all aspects besides a difference in voting power. Further posit that the A-share becomes included in the index, while the B-share remains outside the index. If there is a positive price reaction from becoming included in the index, the share price of the A-share rises. However, given the existence of the non-index B-share, investors can easily sell the now overpriced A-share and buy the relatively cheaper B-share and still possess the same rights to the company's cash flows. A consequence would then be an increased sell-side pressure on the included A-share, thus limiting the positive price inclusion effect. This line of reasoning implicitly assumes that investors focus on the fact that the cash flows of the shares are the same, partially disregarding the differing voting rights attributable to them in assessing the arbitrage trades upon inclusion.

The potential impact of different share classes has implications for the imperfect substitutes hypothesis. For firms with at least two share classes, the classes are perfect substitutes for some investors and imperfect substitutes for others, depending on the type of investor. For an index fund that has to hold the constituents of the index, there is no substitute for the included share. For other investors however, who do not need to hold the index stocks, the added stock has a "sibling" stock that for most purposes is a perfect substitute. Considering that there is no long-term price effect, it would seem as though the existence of several share classes might have invalidated the imperfect substitutes hypothesis as an explanatory factor. Under a regime with several share classes, stocks can have perfect, or at least very close, substitutes. This implies that the demand curve for these stocks is nearly fully elastic and that an inclusion therefore should not warrant a price increase. Doeswijk (2005), when studying the Dutch AEX index comprising the most actively traded stocks on that exchange documents a long-term price effect. Thus, the insignificant and limited price effects found for OMXS30 index inclusions are probably not only explained by the index selection criteria of having the most traded stocks in the index. Rather the results can also be seen as an indication of the importance of arbitrage opportunities for the market to be able to mitigate price effects.

The basis for inclusions and exclusions is, however, an important example of another local characteristic of the OMXS30 index that stands out from many other previously studied markets, and deserves some further discussion. The price inclusion effect has been claimed to stem from increased investor awareness about the company, for example through the information and the attention hypotheses. For the OMXS30 index however, unlike for example the much studied S&P 500 index, inclusions are based on only one publically known and easily observable parameter, trading volume. Hence, in the case of Sweden, there is no possibility that the index owner makes judgments as to the economic viability of the included company in order to avoid excessive turnover, as scholars have argued could be the case with the S&P 500 (Beneish & Whaley, 1996; Kaul, et al., 2000; Denis, et al., 2003; Chen, et al., 2004). As a result of studying an index with an arguably information free inclusion criterion in combination with a non-existent long-term price effect, this paper cannot reject the information hypothesis as an explanatory theory for the index price effect found in other markets. Had there been a long-term price effect also on the Swedish market, then the information hypothesis would not have sufficed as an explanatory factor because it would not

have explained the price effect, considering that an inclusion to the OMXS30 index reveals no new information about the added stock.

The public rules regulating the index composition might also help explain the premature CARs prior to the announcement day. Considering that the trading volume parameter, which the inclusions are based upon, is also publically available, it is possible for investors to anticipate which stocks will become included in the index ahead of announcement. Investors buying the stocks ahead of announcement could either be interested in the announcement day abnormal return or be holding out to sell the stocks at a premium to index funds that will be forced to buy the stocks upon inclusion regardless of the price.

A similar premature return is evident also for the effective date. One possibility behind the increase in price prior to the effective date is that quasi-index funds, funds that are benchmarked against an index, might start their purchases prior to the actual index inclusion in order to pre-empt the index funds. Because of their nature, index funds would most likely have to wait until very close to, or even until, the effective date before they buy the included stock. Rational for quasi-index funds is therefore to start buying prior the actual inclusion day in an attempt to avoid buying on the inclusion day when the index funds will induce a temporary high demand for the stock.

## 6.2 Comovement Study

Rather than controlling for market wide returns and thus focusing on the OMXSALL share index as in the price effects study, the focus in the comovement study is the stocks' change in comovement with the narrower index they are becoming included in, to the OMXS30 index. Market beta, or simply beta, in this section thus refers to the regression coefficient on the OMXS30 index.

The data does indeed provide some evidence of an increase in market beta following inclusion, which is in line with previous studies on other markets and indices. As can be seen in Table 5, the market beta in the FF3F model increases by an average of 0.123. Also the CAPM model indicates an increase, although the increase is not statistically significant. The results from the non-parametric Wilcoxon signed-rank test corroborates the results from the t-test as can be seen in Table 6.

**Table 5. Inclusions - Average Pre and Post Inclusion Market Betas**

Model	Sample	Obs	Beta			t-stat
			Pre $\beta_m$	Post $\beta_m$	$\Delta \beta_m$	
CAPM	(full)	38	0.851	0.909	0.058	1.124
FF3F	(full)	38	0.743	0.866	0.123**	2.073
CAPM	$\beta > 1$	12	1.415	1.268	-0.147*	-1.829
FF3F	$\beta > 1$	7	1.404	1.131	-0.273**	-3.372
CAPM	$\beta < 1$	26	0.590	0.743	0.152**	2.678
FF3F	$\beta < 1$	31	0.593	0.806	0.212***	3.550

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

In order to investigate the hypothesis of a convergence of market beta to one, the sample is split into two samples. As can be seen in Table 5, the hypothesis of convergence is strongly

supported by the data. Both the CAPM and the FF3F model show a *decrease* in beta following the inclusion for stocks with a pre-inclusion beta higher than one, and an *increase* in beta for stocks with a pre-inclusion beta lower than one. All changes in betas for the different subsamples are significant. Moreover the t-stats and significances are markedly larger for both models when distinguishing between high and low market beta stocks, despite the smaller sample sizes compared to the overall sample. Again, as shown in Table 6, the Wilcoxon signed-rank test provides evidence that the results are robust to alternative test specifications. The results provide a strong case for the alternative view where a convergence to one is the expected result rather than a general increase in comovement. It is also evident from Table 6 that the result of *decreasing* betas for stocks with a pre-inclusion beta higher than one is not driven by outliers. Out of the 12 observations with a CAPM market beta higher than one, 9 experience a decrease, equivalent to 75 per cent of the observations. An even higher ratio is true for the FF3F model observations with a pre-inclusion beta higher than one, where 6 out of 7 observations, or 86 per cent, experience a decrease in beta.

**Table 6. Inclusions - Wilcoxon Signed-Rank Test on Pre and Post Market Betas**

Model	Sample	$\Delta \beta_m$	Obs	z	Prob >  z
CAPM	(full)	Positive	20	1.182	0.237
		Negative	18		
FF3F	(full)	Positive	22	1.704*	0.088
		Negative	16		
CAPM	$\beta > 1$	Positive	3	-1.647*	0.100
		Negative	9		
FF3F	$\beta > 1$	Positive	1	-2.197**	0.028
		Negative	6		
CAPM	$\beta < 1$	Positive	17	2.400**	0.016
		Negative	9		
FF3F	$\beta < 1$	Positive	21	2.920***	0.004
		Negative	10		

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

### Analysis

The results with the two subsamples have some interesting implications. The information diffusion view, which is directly related to the issue of nonsynchronous trading raised by Scholes and Williams (1977), predicts that stocks included in an index incorporate news at the same speed, while stocks not included in the index might react to news at a slower pace. As a stock is included in the index, it is projected to react to news contemporaneously with the other index stocks, as the stock becomes more scrutinised and more actively traded. In the setting of this theory, the price reactions to the news, regardless of when in time they occur, will on average be in line with the stock's fundamental beta. A higher contemporaneous covariation, in the magnitude predicted by the stock's fundamental beta, should thus always lead to an increase in beta and not a convergence to one (Vijh, 1994). The results for the subsamples thus lend support to the demand based views of comovement

rather than the information diffusion view, whereby the changes in demand among investors within a particular habitat or style shift the comovement patterns.

### 6.3 Turn-of-the-Month Effect Study

Studying the results of the TOM regression in Table 7, and specifically the TOM variable, it is obvious that a TOM effect is present in our data, just as expected. The highly significant result lends support to the various previous findings that have documented such an effect around the turn of the month. Also noteworthy is the regression constant of -0.11 per cent, which indicates that for non-index stocks there is an average negative daily return during the days not included in the TOM period. This is also true for the index stocks as they have a negative average daily return outside the TOM period. Further it is notable that the index stocks on average experience a higher return than do other stocks. However, when it comes to the variable of particular interest in this study, namely the interaction variable, *IV*, the small positive effect is found to be insignificant. Thereby, it cannot be established that index stocks have a more pronounced TOM effect than non-index stocks, leading to a rejection of the stated hypothesis. The results are similar for sub-periods of the studied time period, as can be observed in Appendix 9, as well as for alternative specifications of TOM days.

**Table 7. TOM Regression 1990-2012**

Variable	Coefficient	t-stat
TOM	0.00194***	6.61
OMXS30	0.00078***	4.98
IV	0.00018	0.51
(constant)	-0.00108***	-7.44

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

#### *Analysis*

The lack of a more pronounced TOM effect for index stocks might be due to the products banks choose to offer and promote. Because of the low fees associated with index funds, banks rarely promote them to their customers. The banks usually prefer customers to save in the banks' own broad Swedish market mutual funds carrying higher margins. Given this scenario, a large share of the monthly savings will flow to funds not restricted to only hold the 30 most traded stocks. As a result there will be no distinct difference between the flows into index and non-index stocks, since money is allocated to both types of stocks proportionally to their size. Thus, the returns of the stocks are affected to the same degree, everything else equal.

Even if relatively more capital was allocated to the index companies the relative difference might not be big enough to warrant a difference in TOM effect. It has to be considered that the index is comprised of the 30 most traded stocks. Because of this underlying characteristic of the index, the included stocks will undoubtedly have a better liquidity than non-index stocks. Thus, it may be the case that the liquidity of the index stocks is high enough to absorb the extra inflow of money around the turn of the month on top of the normal trading in the stock. The index and non-index stocks are hence affected to the same degree as if capital had been allocated proportionally.

Another possibility is that some investors who are likely to invest in an index fund for its simplicity, for example foreign investors, obtain their salaries at a different point during the month. Consequently, the additional monthly savings coming from abroad that goes to index funds would be nonsynchronous with the Swedish savings, whereby this test would fail to capture these additional demand shocks. However, alternative specifications of the TOM days different from the ones presented here do not either yield a significant coefficient.

## 7. Conclusions and Implications

Three distinct methods are used to study one main topic, namely the potential effects indices might have on stock prices and stock comovement. The evidence provided does however not allow for a clear-cut answer as to whether prices and comovement are affected by the index or not. In general, it is found that the market is relatively efficient in terms of stock pricing in the context of indices, but less so in terms of the stocks' comovement with the index.

When studying the price reaction of an index inclusion or exclusion, the focus lies on the announcement date and the effective date. Around the date when an inclusion is announced, evidence of an abnormal price increase is found. According to the efficient market hypothesis (EMH), stock prices should only change due to new information reaching the market. Arguably, the only information conveyed upon announcement is the fact that the stock is one of the 30 most traded stocks, and even this is no new information since trading volumes can easily be observed by the market. Given that no new information is published, the price reaction is unwarranted. However, one piece of information that is conveyed by the announcement, though the announcement can be anticipated, is the fact that the stock becoming included might be set to experience the positive price effect that has been documented by other studies. Incorporating this information through a price increase already on the announcement can thus in a sense be seen as rational by the market, although not motivated by fundamentals. Also upon the effective date of the index inclusion, the price of the particular stock appears to increase temporarily. There is definitely no new information released by simply implementing the already announced inclusion. Prices diverging from fundamental value in this way bear witness to irregularities in the market and to potential irrationality among investors.

Extending the time horizon slightly, however, shows that the market seems to revert to the prior price level in the long run, and thus potentially also to a price more warranted by fundamentals. After just a few days, any cumulative abnormal return stemming from the period around the effective date has vanished. A potential explanation might be that the market is not liquid enough in the short run to accommodate the demand shocks caused by multiple investors demanding the new index stock at the same time. Investors on the sell side are possibly too immobile to quickly provide buyers with enough volume. Given a few more days, the higher price becomes evident and enough investors emerge as willing sellers. Another possibility is that arbitrageurs enter the market to trade on the discrepancy when they see a stock's diverging from its fundamental value. In a reasonably short period of time, the price of the included stock thus reverts back to normal, indicating a long-run rationality in the market.

The short peak in prices around the inclusion will however impose index investors with an additional cost, as outlined by Petajisto (2008; 2011). If the index funds buy the included

stock on the effective date when the stock price appears to rise, they will almost instantly incur a loss when the price reverts a few days later. Hence, index investors are paying a price for the short-run market irregularities that they are partially inflicting themselves through investing in indices.

The evidence on price effects from the Swedish market is particularly interesting in relation to arbitrageurs' ability to exploit divergences from fundamental value. The small temporary price increase that does not have any long-run price effects is contrary to what has been found on many other markets, and may hence be an indication that the Swedish market provides arbitrageurs with better opportunities to keep prices in line with fundamentals. It is proposed that one way the Swedish market caters for this is the common use of multiple share classes. As many investors see the different share classes as perfect substitutes for each other, the arbitrage trade is easily facilitated and, arguably, less risky. In that sense, the market structure helps facilitate counter-reactions making the market efficient in the long run.

Similarly, the possibility to trade in index futures may help explain why there is no evidence of a more pronounced TOM effect for index stocks compared to non-index stocks. Should index stocks as a group depart more in valuation than other stocks, trading in futures would provide a possible route to counter the price increases during the TOM period. Thus, the existence of futures and other index-linked derivatives, providing arbitrageurs with tools to scrutinise markets, might limit what would otherwise potentially be a higher TOM effect for index stocks. Further the futures market arguably works as an anchor and an added level of scrutiny of the price level. When the index stocks, as found, follow the general market movement during the TOM period, it is difficult to distinguish whether the remaining concurrent movement of all stocks is part of a rational or irrational price movement.

Regarding the change in beta it is more difficult for the market to correctly adjust this parameter. As shown in this paper, the included stock's comovement with the other index stocks tends to converge to one. This change in beta does arguably not reflect any fundamental change in the correlation of the firm's underlying cash flow with the other firms' cash flows. Through applying the Fama French 3-factor model, potential concurrent changes in two firms' characteristics are controlled for. However, the change in comovement with the index is still prevalent. The findings indicate that it may very well be the in- and outflow of index-linked funds that drive the change in beta. Regardless of the correct beta for a stock, a change in the factor without changes in fundamentals is unwarranted, and is a sign of frictions in the market.

Incorrectly set betas imply that they are not in line with the companies' underlying fundamentals. This has several important implications. First of all, the value of a company is, in accordance with the CAPM, closely linked to its comovement with other assets. When investors discount the company's future cash flows to come up with a valuation, the discount rate used contains a cost of the firm's equity capital that is usually found using the CAPM. As a result, the company's beta will affect the value investors ascribe to the company. If the beta is incorrect following the inclusion, the valuation will obviously be spurred and the prices on the market will diverge from fundamental values. Bear in mind that the price effects were adjusted for the non stationarity of betas, so the cumulative abnormal returns do not communicate such value changes. Secondly, an incorrect beta impacts the investment decisions taken by the firm. Given that the cost of capital is calculated in a similar fashion as

for the investors, the companies select projects in a similar way as the investors value the company. The firm will essentially discount the expected cash flows of the project with the discount rate, subtract the cost of the project and come up with a net present value, indicating whether it is a project that should be carried invested in. If the beta has changed to an unjustifiable level, it will result in companies incorrectly rejecting or initiating projects it would otherwise not have if evaluated according to its fundamental beta. Similarly, when companies need to raise funding for investments in the market, their valuation level, affected by the beta, will affect their ability to do so. Systematic errors in betas will thus cause an incorrect allocation of capital, hurting economic growth as the capital within the economy is allocated inefficiently.

Overall, the market seems to be relatively efficient in handling index inclusions and exclusions to the OMXS30 index, leaving the long-term price unaffected. Even if there appears to be a short-term effect caused by a demand shock, it is quite small and the market relatively quickly corrects it and brings the valuation back to pre-inclusion levels. This could potentially be due to the design of the index and its regulations, as well as the market structure with available futures and several share classes, enabling the market to quickly mitigate price effects caused by demand shocks. More troubling are the changes in betas, bearing witness to a market less linked to fundamentals. Such changes risk causing suboptimal investment decisions in the economy and also to prices not reflecting fundamental values of the firms.

Further research testing the beta convergence hypothesis would be desirable to substantiate its predictions and the supportive evidence presented here. Since the change in comovement can have important implications, further understanding of its roots and behaviour is warranted. Although not finding a significant difference in Turn-of-the-Month effect for index and non-index stocks in Sweden, implementing the research method in other markets and on other datasets would also be of interest since the method proposed here can lead to an increased understanding of both the effects of index investing and the roots to the anomaly.

## 8. References

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## 9. Appendix

### Appendix 1: Included Events

**Table A1. Included Events**

Inclusions		Exclusions	
Company	Effective Date	Company	Effective Date
Procordia B*	02/01/1992	AGA B, fr*	02/01/1992
Procordia B, fr*	02/01/1992	Lundberg B*	02/01/1992
Sandvik A*	02/01/1992	Proventus B*	02/01/1992
Nobel Industrier*	01/07/1992	Trygghansa B*	02/01/1992
Hennes & Mauritz B, fr*	01/07/1992	Argonaut B, fr*	01/07/1992
Incentiv B, fr*	01/07/1992	Esselte B, fr*	03/01/1994
AGA B, fr*	04/01/1993	Gambro B, fr	03/07/1995
Gambro B, fr*	04/01/1993	Sydskraft C, fr	03/07/1995
Investor A, fr*	04/01/1993	Trygghansa B, fr	03/07/1995
Esselte B, fr*	04/01/1993	Incentive B	02/01/1996
Trygghansa B, fr*	03/01/1994	Celsius B	01/07/1996
Avesta Sheffield	03/07/1995	Investor A	01/07/1997
Modo B	03/07/1995	Stora B	02/01/1998
Autoliv	02/01/1996	Avesta S	01/07/1998
Kinnevik B	02/01/1996	Stora Enso A	03/01/2000
Pharmacia Upjohn	01/07/1996	Scania B	03/01/2000
Nokia SDB	01/07/1997	Kinnevik B	02/01/2001
Scania B	01/07/1997	Trelleborg B	02/01/2001
Autoliv Sdb	02/01/1998	Framtidsfabriken	02/07/2001
Nordbanken Holding	01/07/1998	Icon Medialab	02/07/2001
Netcom	01/07/1999	WM Data B	02/01/2003
Securitas B	03/01/2000	Fabege B	03/07/2006
WM Data B	03/01/2000	Holmen B	02/01/2007
Icon Medialab B	03/01/2000	Stora Enso R	02/07/2007
Framtidsfabriken	03/07/2000	Autoliv SDB	02/01/2008
Assa Abloy B	02/01/2001	Eniro	01/07/2009
Eniro	02/07/2001		
Europolitan	02/07/2001		
Alfa Laval	02/01/2003		
Swedish Match	02/01/2003		
Drott	01/07/2003		
Boliden	03/07/2006		
Vostok Nafta SDB	03/07/2006		
Scania B	02/01/2007		
SSAB A	02/07/2007		
Lundin Petroleum	02/01/2008		
Getinge B	01/07/2009		
MTG B	01/07/2009		
<b>Sum</b>	<b>38</b>	<b>Sum</b>	<b>26</b>

\*The announcement date is unknown and the event is therefore excluded from studies of announcement date effects

## Appendix 2: Alternative Abnormal Return Specifications

One of the easier methods to apply is the *market-adjusted model* where the market return,  $R_m$ , is subtracted from the individual stock's return,  $R_i$ , for each day, thereby implicitly assuming a beta of one for all stocks.

$$AR_{it} = R_{i,t} - R_{mt}$$

The *mean-adjusted model* instead assumes that a stock's return is constant over time, and estimates abnormal return as the return for day t minus the average return,  $\bar{R}_i$ , for each stock.

$$\bar{R}_i = \frac{1}{T} \sum_{t=1}^T R_{it}$$

$$AR_{it} = R_{it} - \bar{R}_i$$

In the *market model*, the returns of each stock are regressed against market factors, such as the market index return. This is usually done in a separate estimation period to determine how each stock should move given the changes in the market factors. The abnormal returns in the event window are then calculated by subtracting the expected market return from the stock's realised return.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \tilde{u}_{it}$$

$$AR_{it} = \hat{u}_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

### Appendix 3: Calculation of the FF3F SMB and HML Factors

To estimate the SMB and HML factors, the method of Fama and French (1993; 1996) is applied on all the stocks that are, or have previously been, listed on the Stockholm Stock Exchange between 1989 and 2012. At the end of June each year, the stocks are allocated to five different size groups based on the market value of equity for the entire company. The entire firm's equity value is used since this better represents the size of the company, as is aimed by the SMB factor, than the individual share classes do. The highest quintile with the biggest firms is assigned to group five, whereas the lowest quintile, containing the smallest companies, is assigned to group one. Similarly, the stocks are also allocated to five different book-to-market groups based on the ratios of book value of equity to market value of equity. Here, the firms with the highest book-to-market are placed in the highest quintile group, 5. The firms with the lowest book-to-market ratios are likewise placed in the lowest quintile group, namely group 1.

The intersections of the five size groups and the five book-to-market groups are used to form portfolios, resulting in a total of 25 portfolios. For these portfolios, a weighted return is calculated based on the market value of equity for that particular share class. Here it is the relative weight of the individual share class and not the size of the entire company that is of interest why this variable is chosen. The returns are calculated from July of year  $t$ , which is just after the formation of the portfolios, until the end of June  $t+1$  when the portfolios are reformed once again. The cut-off point in June is chosen, along the lines of Fama and French's (1993) reasoning, to ascertain that the book value of year  $t-1$  has been disclosed to the market.

The estimation of the SMB factor prescribes calculating a difference between the returns of small companies and big companies. The returns of all five portfolios containing the smallest companies are thus averaged to generate the returns of small companies. This return figure should, because it contains companies spanning all different levels of book-to-market ratios, be relatively free from all return effects stemming from differences in the book-to-market ratio. After having performed the same procedure for the big firms, the returns of the big firms are subtracted from the returns of the small firms, thus resulting in a daily SMB factor.

The estimation of the HML factor follows the same pattern, only that the returns are instead averaged across the different size portfolios, thus removing a potential size effect from the returns of book-to-market. The average of the low book-to-market portfolios are subtracted from the average of the high book-to-market portfolios to create the HML factor.

## Appendix 4: Calculations and Tests of Abnormal Returns

In this paper, two methods are used to assess the average abnormal and cumulative average abnormal returns for the events, as well as to test them for significance. These are the *traditional method* and *Patell's standardised residual model*.

### *The traditional method*

The main method used in this paper to assess average abnormal returns and to test their significance is widely used in event studies (Brown & Warner, 1985), and dubbed the “traditional method” by Boehmer et al. (1991). The test statistic for the average abnormal return  $\overline{AR}_t$  is

$$t\text{-stat} = \frac{\overline{AR}_t}{\hat{S}(\overline{AR}_t)}$$

where

$$\overline{AR}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} AR_{it}$$

$$\hat{S}(\overline{AR}_t) = \sqrt{\left( \sum_{t=\tau}^T (\overline{AR}_t - \overline{\overline{AR}})^2 \right) / (T - 1)}$$

$$\overline{\overline{AR}} = \frac{1}{T} \sum_{\tau}^T \overline{AR}_t$$

in which  $N_t$  is the number of sample securities with an available excess return on day  $t$ , and  $\tau$  and  $T$  are the starting and ending date for the estimation period, respectively.

Average abnormal returns for each day in “event time” are thus calculated cross-sectionally for both the estimation period and the event window. The standard deviation used for the test statistic is the standard deviation of the average abnormal returns during the estimation period, i.e. the average residuals from the market model estimations. Under the assumption that the  $\overline{AR}_t$  are independent, identically distributed and normal, the test statistic follows the Student- $t$  distribution. The test statistic for cumulative abnormal returns under this traditional method is

$$t\text{-stat} = \sum_{t=S_1}^{S_2} \overline{AR}_t / \left( \sum_{t=S_1}^{S_2} \hat{S}^2(\overline{AR}_t) \right)^{\frac{1}{2}}$$

### *Patell's standardised residual method*

To check the results for robustness, Patell's (1976) standardised residual model is also employed. Firstly, this model takes into consideration that the event period residuals are out-of-sample predictions, which is further discussed [below]. Secondly, by standardising the

residuals before averaging them allows for heteroskedastic event-day residuals, and prevents securities with large variances to dominate the results (Boehmer et al XXXX).

For the Patell test, the security-specific abnormal returns  $AR_{it}$  are estimated as the residuals produced by applying the market model coefficients estimated prior to the event, in the same manner as for the traditional method. The standard deviation for each security is also in the same manner estimated using the regression residuals.

$$AR_{it} = \hat{u}_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

Under the assumption that the OLS assumptions hold during the forecast period, the prediction errors  $\tilde{u}_{it}$  have the following properties

$$E(\tilde{u}_{it}) = 0$$

$$cov(\tilde{u}_{is}, \tilde{u}_{it}) = \begin{cases} 0, & s \neq t \\ C_{it}\sigma_i^2, & s = t \end{cases}$$

$$cov(\tilde{u}_{it}, R_{mt}) = 0$$

That is, the security-specific error terms have an expected value of zero, are serially uncorrelated and have a variance equal to  $C_{it}\sigma_i^2$ , and that their covariance with the market is zero. An additional assumption, shared with the traditional method, is that the returns are normally distributed and that

$$cov(\tilde{u}_{it}, \tilde{u}_{jt}) = \begin{cases} 0, & i \neq j \\ C_{it}\sigma_i^2, & i = j \end{cases}$$

This assumption of cross-sectional independence between the firm-specific abnormal returns is discussed further [below]. The term  $C_{it}$  in equation (X) and (X) above corrects for the aforementioned fact that the event period residuals are out-of-sample predictions, which is also discussed below, and

$$C_{it} = 1 + \frac{1}{T} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{\tau=1}^T (R_{m\tau} - \bar{R}_m)^2}$$

where  $T$  is the number of days in the forecast period and

$$\bar{R}_m = \frac{1}{T} \sum_{\tau=1}^T R_{m\tau}$$

The test statistics for the average abnormal returns  $\overline{AR}_t$  and the cumulative abnormal returns  $\overline{CAR}_t$ , respectively, are

$$Z \overline{AR}_t = \frac{\sum_{i=1}^N \frac{AR_{it}}{S_{(AR_i)} \sqrt{C_{it}}}}{\left( \sum_{i=1}^N \frac{T_i-2}{T_i-4} \right)^{1/2}}$$

$$Z \overline{CAR}_L = \frac{\sum_{i=1}^N \left( \sum_{t=1}^L \frac{AR_{it}}{S_{(AR_i)} \sqrt{LC_{it}}} \right)}{\left( \sum_{i=1}^N \frac{T_i-2}{T_i-4} \right)^{1/2}}$$

where  $L$  is the number of days in the accumulation,  $T_i$  is the number of observations in each firm's estimation period, and the equations following after the first summation in the numerators are the security-specific  $t$ -statistics with the sum of their respective variance in the denominators. The distributions of these test statistics, which are sums of assumed independent random variables that are distributed Student  $t$  with  $T - 2$  degrees of freedom divided by their respective standard deviation, are unit Normal distributed if the Lindeberg Central Limit Theorem condition is satisfied. The Lindeberg theorem relaxes the requirement of the classic central limit theorem that the variables be identically distributed. The condition though requires that each observation's contribution to the summed variances is small. With  $T_i$  ranging from 126 to 200 in this paper's data, the variances of the observations have the narrow range of 1.010 to 1.016, indicating that the Lindeberg condition is fulfilled despite the relatively small  $N$ .

## Appendix 5: Calculations and Tests of Abnormal Volumes

The study of abnormal returns is operationalised by using a measure of abnormal volume presented by Harris and Gurel (1986). It measures the cross-sectional mean of volume in event time as

$$MVR_t = \frac{1}{N} \sum_{i=1}^N VR_{it}$$

where

$$VR_{it} = \frac{V_{it}}{V_{mt}} * \frac{\bar{V}_m}{\bar{V}_i}$$

in which  $V_{it}$  and  $V_{mt}$  are the trading volumes of stock  $i$  and the total trading volume of the OMXS30 index stocks, respectively, on day  $t$ .  $\bar{V}_i$  and  $\bar{V}_m$  are the average trading volumes during the estimation period for stock  $i$  and the OMXS30 index stocks. Since the expected value of  $MVR_t$  in the absence of abnormal volume is 1, the test statistic for testing if there is an abnormal volume is

$$t\text{-stat} = \frac{MVR_t - 1}{S(MVR_t)} = \frac{MVR_t - 1}{S(VR_t)/\sqrt{N}}$$

where the standard deviations are measured cross-sectionally during the event window.

## Appendix 6: Cluster Adjustment of the Turn-of-the-Month Effect Regression

The basic form of the regression

$$R_{it} = \alpha + \beta_{TOM}TOM_t + \beta_{OMXS30}OMXS30_{it} + \beta_{IV}IV_{it} + \tilde{u}_{it}$$

suffers from a misspecification since groups of individual stock return observations stem from the same historical day. Returns stemming from the same historical day will share a common factor, namely the market-wide return on that day. As such, the error terms of the regression will be correlated in clusters within the historical dates, violating the OLS assumptions. Specifically, the error terms of the model will not be independently and identically distributed. In terms of the covariance matrix of the error terms, the requirement is that it is diagonal with a constant variance

$$\sum_{\tilde{u}} = \begin{pmatrix} \sigma^2 & 0 & \dots & 0 \\ 0 & \sigma^2 & \dots & 0 \\ & & \vdots & \\ 0 & 0 & \dots & \sigma^2 \end{pmatrix}$$

As stated, the dataset is posited to rather contain clusters within which the correlations between the disturbances are non-zero. When implementing the regression specified above, a block-diagonal covariance matrix with clustered disturbances is specified to adjust for this (Baum, 2006). The assumed covariance matrix is specified to have intracusters in the form of the covariance matrices  $\sum_d$  of the disturbances for each historical day  $d$  on the diagonal, within which the elements are allowed to be non-zero

$$\sum_{\tilde{u}} = \begin{pmatrix} \sum_1 & 0 & \dots & 0 \\ 0 & \sum_2 & \dots & 0 \\ & & \vdots & \\ 0 & 0 & \dots & \sum_D \end{pmatrix}$$

Even though the point estimates of the coefficients compared to the basic form of the regression are not affected by these adjustments, the standard errors of the coefficients will be corrected to enable correctly specified tests of their significance.

## Appendix 7: Results for Index Exclusions

**Table A2. Exclusions - Abnormal Return Around Event Days**

Time	Announcement		Effective	
	CAPM	FF3F	CAPM	FF3F
-2	0.000 (-0.043)	0.002 (0.237)	0.000 (-0.057)	0.001 (0.208)
-1	-0.002 (-0.360)	-0.006 (-0.855)	-0.005 (-0.752)	-0.006 (-0.960)
0	-0.006 (-0.880)	-0.006 (-0.968)	0.007 (1.020)	0.006 (0.852)
+1	0.003 (0.386)	0.002 (0.332)	0.000 (0.019)	0.001 (0.083)
+2	-0.008 (-1.151)	-0.008 (-1.163)	0.007 (1.059)	0.006 (0.970)

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10  
t-statistic in parenthesis

**Table A3. Exclusions - Mean Volume Return around Event Day**

Time	Announcement		Effective	
	MVR	t-stat	MVR	t-stat
-7	1.260	0.762	0.975	-0.240
-6	1.078	0.393	1.692*	1.812
-5	1.076	0.357	1.171	0.834
-4	1.080	0.424	1.231	1.100
-3	1.043	0.255	1.674**	2.471
-2	0.931	-0.606	1.429**	2.551
-1	0.990	-0.061	2.754***	4.964
0	0.896	-0.799	1.579***	2.895
1	1.085	0.286	1.664*	2.005
2	1.115	0.440	1.357*	1.917
3	1.186	0.869	0.900	-0.682
4	1.347	0.865	1.963	1.255
5	1.351	1.304	0.913	-0.681
6	1.316	1.627	1.085	0.379
7	1.596*	2.045	1.166	0.638

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A4. Exclusions - Cumulative Abnormal Returns for days -7 to +7**

Time		Announcement		Effective	
Start	End	CAPM	FF3F	CAPM	FF3F
-7	-7	-0.008 (-1.108)	-0.010 (-1.487)	-0.003 (-0.511)	-0.002 (-0.248)
-7	-6	-0.012 (-1.251)	-0.014 (-1.526)	0.002 (0.189)	0.003 (0.360)
-7	-5	-0.014 (-1.203)	-0.018 (-1.556)	0.002 (0.136)	0.003 (0.253)
-7	-4	-0.019 (-1.387)	-0.021 (-1.646)	0.001 (0.055)	0.003 (0.217)
-7	-3	-0.012 (-0.812)	-0.016 (-1.112)	-0.011 (-0.750)	-0.008 (-0.547)
-7	-2	-0.013 (-0.758)	-0.015 (-0.919)	-0.012 (-0.708)	-0.007 (-0.414)
-7	-1	-0.015 (-0.838)	-0.020 (-1.174)	-0.017 (-0.940)	-0.013 (-0.746)
-7	0	-0.021 (-1.095)	-0.027 (-1.440)	-0.010 (-0.518)	-0.007 (-0.397)
-7	+1	-0.019 (-0.904)	-0.024 (-1.247)	-0.010 (-0.482)	-0.007 (-0.346)
-7	+2	-0.026 (-1.221)	-0.032 (-1.551)	-0.003 (-0.123)	0.000 (-0.022)
-7	+3	-0.039* (-1.709)	-0.043** (-1.990)	-0.002 (-0.104)	0.000 (-0.012)
-7	+4	-0.039 (-1.636)	-0.044* (-1.958)	-0.007 (-0.278)	-0.004 (-0.178)
-7	+5	-0.049** (-1.999)	-0.055** (-2.339)	-0.006 (-0.263)	-0.003 (-0.125)
-7	+6	-0.043* (-1.699)	-0.048* (-1.963)	-0.005 (-0.206)	-0.002 (-0.102)
-7	+7	-0.048* (-1.818)	-0.052** (-2.047)	-0.010 (-0.394)	-0.007 (-0.285)

\*\*\*p&lt;0.01, \*\*p&lt;0.05, \*p&lt;0.10

t-s tastic in parenthesis

**Table A5. Exclusions - Cumulative Abnormal Returns**

Time		Announcement		Effective	
Start	End	CAPM	FF3F	CAPM	FF3F
-30	0	0.032 (0.829)	0.027 (0.745)	-0.013 (-0.339)	-0.010 (-0.276)
-20	0	0.062* (1.969)	0.060** (2.018)	-0.043 (-1.357)	-0.039 (-1.301)
-10	0	-0.016 (-0.689)	-0.024 (-1.116)	-0.025 (-1.091)	-0.020 (-0.948)
0	+10	-0.028 (-1.241)	-0.023 (-1.044)	0.000 (-0.005)	0.001 (0.029)
0	+20	-0.057* (-1.824)	-0.050* (-1.666)	-0.013 (-0.416)	-0.012 (-0.388)
0	+30	-0.066* (-1.743)	-0.058 (-1.605)	-0.011 (-0.282)	-0.008 (-0.213)
0	+40	-0.058 (-1.334)	-0.053 (-1.274)	-0.039 (-0.893)	-0.030 (-0.712)
0	+50	-0.063 (-1.298)	-0.054 (-1.170)	-0.020 (-0.404)	-0.010 (-0.221)
0	+60	-0.071 (-1.331)	-0.059 (-1.152)	-0.043 (-0.797)	-0.031 (-0.607)
-30	+60	-0.046 (-0.700)	-0.039 (-0.625)	-0.040 (-0.609)	-0.025 (-0.405)

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10  
t-statistic in parenthesis

**Table A6. Exclusions - Average Pre and Post Inclusion Market Betas**

Model	Sample	Obs	Beta			t-stat
			Pre $\beta_m$	Post $\beta_m$	$\Delta \beta_m$	
CAPM	(full)	26	0.839	0.733	-0.106	-1.282
FF3F	(full)	26	0.860	0.791	-0.069	-0.721
CAPM	$\beta > 1$	6	1.418	1.105	-0.313	-1.002
FF3F	$\beta > 1$	9	1.355	1.026	-0.321	-1.458
CAPM	$\beta < 1$	20	0.665	0.622	-0.043	-0.790
FF3F	$\beta < 1$	17	0.598	0.667	0.069	0.976

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A7. Exclusions - Wilcoxon Signed-Rank Test on Post and Pre Market betas**

Model	Sample	$\Delta \beta_m$	Obs	z	Prob >  z
CAPM	(full)	Positive	8	-1.232	0.218
		Negative	18		
FF3F	(full)	Positive	10	-0.419	0.675
		Negative	16		
CAPM	$\beta > 1$	Positive	3	-0.524	0.600
		Negative	3		
FF3F	$\beta > 1$	Positive	3	-1.244	0.214
		Negative	6		
CAPM	$\beta < 1$	Positive	5	-1.456	0.145
		Negative	15		
FF3F	$\beta < 1$	Positive	7	0.450	0.653
		Negative	10		

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

## Appendix 8: Significance for Patell Tests

**Table A8. Inclusions - Patell Significances for CARs**

Time		Announcement		Effective	
Start	End	t-stat		t-stat	
		CAPM	FF3F	CAPM	FF3F
-30	0	0.064	0.091	0.918	0.831
-20	0	0.125	0.171	0.819	0.691
-10	0	1.476	1.440	1.115	1.033
0	+10	-0.043	-0.250	-0.544	-0.711
0	+20	0.796	0.598	-0.582	-0.908
0	+30	-0.319	-0.522	-0.933	-1.106
0	+40	-0.480	-0.876	-0.625	-0.815
0	+50	-0.135	-0.548	-0.603	-1.056
0	+60	0.163	-0.382	-0.525	-0.889
-30	+60	-0.128	-0.547	-0.021	-0.341

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A9. Inclusions - Patell Significances for CARs -7 to 7**

Time		Announcement		Effective	
Start	End	t-stat		t-stat	
		CAPM	FF3F	CAPM	FF3F
-7	-7	1.091	0.728	-0.403	-0.338
-7	-6	0.567	0.434	-0.620	-0.769
-7	-5	0.480	0.273	0.042	-0.169
-7	-4	1.256	1.183	0.063	-0.152
-7	-3	1.743*	1.670*	-0.072	-0.228
-7	-2	1.633	1.554	-0.059	-0.132
-7	-1	1.762*	1.713*	0.981	0.766
-7	0	2.656***	2.574**	1.349	1.049
-7	+1	2.244**	1.994**	1.245	0.902
-7	+2	1.462	1.221	1.205	0.911
-7	+3	1.393	1.165	0.922	0.698
-7	+4	1.206	0.962	0.617	0.312
-7	+5	1.012	0.778	0.434	0.135
-7	+6	1.144	0.948	0.459	0.144
-7	+7	1.841*	1.597	0.218	-0.094

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A10. Exclusions - Patell Significances for CARs**

Time		Announcement		Effective	
Start	End	t-stat		t-stat	
		CAPM	FF3F	CAPM	FF3F
-30	0	0.007	-0.011	-0.807	-0.810
-20	0	0.056	0.028	-1.759*	-1.745*
-10	0	-0.491	-0.707	-1.994**	-1.917*
0	+10	-0.789	-0.497	0.516	0.379
0	+20	-1.488	-1.453	-0.172	-0.316
0	+30	-1.416	-1.391	0.281	0.225
0	+40	-0.584	-0.677	-0.927	-0.723
0	+50	-0.547	-0.541	-0.266	-0.106
0	+60	-0.829	-0.756	-0.439	-0.223
-30	+60	-0.504	-0.465	-0.828	-0.593

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A11. Exclusions - Patell Significances for CARs -7 to +7**

Time		Announcement		Effective	
Start	End	t-stat		t-stat	
		CAPM	FF3F	CAPM	FF3F
-7	-7	-1.565	-1.598	0.580	1.005
-7	-6	-1.217	-1.254	1.378	1.674*
-7	-5	-1.064	-1.076	0.622	0.887
-7	-4	-1.447	-1.411	0.570	0.900
-7	-3	-0.616	-0.683	0.151	0.517
-7	-2	-0.502	-0.533	-0.244	0.054
-7	-1	-0.557	-0.658	-0.416	-0.224
-7	0	-1.096	-1.157	-0.399	-0.421
-7	+1	-1.015	-1.016	0.119	0.097
-7	+2	-1.353	-1.365	0.558	0.463
-7	+3	-1.805*	-1.818*	0.539	0.456
-7	+4	-1.568	-1.614	0.393	0.308
-7	+5	-1.414	-1.476	0.633	0.596
-7	+6	-1.285	-1.319	0.600	0.536
-7	+7	-1.245	-1.253	0.504	0.460

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

## Appendix 9: Results for Turn-of-the-Month Effect for Sub-Periods

**Table A12. TOM Regression 1990-1999**

Variable	Coefficient	t-stat
TOM	0.00167***	3.89
OMXS30	0.00090***	4.53
IV	0.00025	0.58
(constant)	-0.00083***	-4.33

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10

**Table A13. TOM Regression 2000-2012**

Variable	Coefficient	t-stat
TOM	0.00211***	5.36
OMXS30	0.00063***	2.70
IV	0.00019	0.34
(constant)	-0.00123***	-6.10

\*\*\*p<0.01, \*\*p<0.05, \*p<0.10