Stock Market Reactions to Changes in the FTSE SmallCap and S&P/TSX SmallCap Indices

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Abstract

Stocks added to (deleted from) the Russell 2000 and the S&P 600 indexes experience positive (negative) abnormal returns following the announcement. However, researchers disagree on whether these abnormal returns are permanent or temporary and offer competing explanations. I address this controversy by examining market reactions for firms that are added to or deleted from the FTSE SmallCap index (the main testing sample) and the S&P/TSX SmallCap index (the comparison sample). For the main testing sample, all stocks except pure additions, experience a permanent price change that is accompanied by a permanent change in liquidity. However, for the comparison sample, abnormal returns over the announcement period fully reverted within 30 days. In further examination of stock liquidity for the main testing sample, sample stocks experience permanent change in liquidity. Taken together, the observed results support the price pressure and liquidity hypotheses.

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Table of Contents

List of Tables

List of Figures

Chapter 1 Introduction

A large body of literature examines stock price and trading volume reactions to index changes in the Standard and Poor's (S&P) 500 index in the United States. Those studies consistently find a significant increase in stock price and trading volume on the announcement day for additions. But the evidence is mixed regarding the post-announcement trends. Since the first time that the event study methodology was introduced by Fama, Fisher, Jensen and Roll (1969), several hypotheses are developed to explain the post-announcement trends. Harris and Gurel (1986) document a temporary market reaction to index changes. They suggest that any effect, which is caused by index changes, is reverted completely once the excess demand is met. In contrast, Shleifer (1986) finds a permanent 3% abnormal return on the announcement day for the S&P 500 index additions from 1976 to 1983. Based on this result, Shleifer (1986) suggests that the long-term demand curve may be downward sloping, rather than being horizontal. Beneish and Whaley (1996), who examine all S&P 500 index additions and deletions from 1986 to 1994, extend Shleifer's (1986) study and find evidence consistent with the downward sloping demand curve hypothesis. Recently, Chen, Noronha, and Singal (2004), who observe an asymmetric market reaction for S&P 500 index additions and deletions from 1962 to 2000, propose the investor awareness hypothesis. In addition, other hypotheses are suggested in the literature, such as the information content (Jain, 1987) and liquidity (Amihud and Mendelson, 1986) hypotheses.

The non-US stock indices do not get much attention from researchers in early years. Table 1 provides an overview of studies that analyze changes in on non-US and US small capitalization stock indices. Chung and Kryzanowski (1998) find evidence that is consistent with the price pressure hypothesis by examining changes in the Toronto Stock Exchange (TSE) 300 index[1], and Vespro (2006) and Mazouz and Saadouni (2007) also provide evidence consistent with the price pressure effect by examining changes in the Financial Times-Stock Exchange (FTSE) 100 index. But Kaul, Mehrotra, and Morck (2000), who examine the index weight adjustment in the TSE 300 index that occurred in 1996, find evidence consistent with the downward sloping demand curve hypothesis.

[1] The TSE 300 index was replaced by the S&P/TSX Composite index in May 2002.

Table 1: Overview of Studies that Examine Index Effect in the US Small-Cap Indices, Canadian Indices, and UK Indices[2]:

Author(s)	*Object(s) of the study*	*Index(es)*	*Sample Size*	*Period*	*Support Hypotheses*
Chung and Kryzanowski (1998)	Price effects of additions and deletions	TSE 300	82 annual + 30 non-annual additions; 49 annual + 23 non-annual deletions	1990 - 1994	Price pressure hypothesis; Liquidity hypothesis
Masse, Hanrahan, Kushner, and Martinello (2000)	Price effects of additions and deletions	TSE 300	134 additions; 109 deletions	1984 - 1994	Price pressure hypothesis
Kaul, Mehrotra, and Morck (2000)	Price effects of an index weights adjustment	TSE 300	31 stocks experienced weight adjustment	1996	Downward sloping demand curve hypothesis
Madhavan (2003)	Price and volume effects of indices reconstitution	Russell 2000; Russell 3000	404 additions; 242 deletions	1996 - 2002	Price pressure hypothesis; Liquidity hypothesis
Biktimirov, Cowan, and Jordan (2004)	Price, volume, and institutional ownership effects of additions and deletions	Russell 2000	4321 pure additions + 875 downward shifts; 3092 pure deletions + 861 upward shifts	1991 - 2000	Price pressure hypothesis
Chen (2006)	Price, volume, and bid-ask spreads effects of indices reconstitution	Russell 2000; Russell 1000	13 samples grouped as retention, switching, additions, deletions	1993 - 2000	Downward sloping demand curve hypothesis
Shankar and Miller (2006)	Price, volume, and institutional ownership effects of additions and deletions	S&P SmallCap 600	504 pure additions + 52 downward shifts; 112 pure deletions +107 upward shifts	1995 - 2002	Price pressure hypothesis

[2] Liu (2000) finds evidence that is consistent with Beneish and Whaley (1996) by examining index changes to Nikkei 500 (Japan) index.

Table 1 ***(continued)***

Docking and Dowen (2006)	Price effects of additions and deletions	S&P SmallCap 600	181 pure additions + 30 downward shifts; 173 pure deletions[3] + 50 upward shifts	1999 - 2002	Investor awareness hypothesis
Mase (2006)	Long-term price effects of additions and deletions	FTSE 100	85 additions; 72 deletions	1992 - 1999	Investor awareness hypothesis
Gregoriou and Ioannidis (2006)	Price and volume effects of additions to and deletions from the index	FTSE 100	258 additions; 258 deletions	1984- 2001	Information cost/liquidity hypothesis
Vespro (2006)	Price and volume effects of additions to and deletions from the index	FTSE 100; CAC 40; SF 120	FTSE 100: 23 additions and 28 deletions; CAC 40 and SF 120: 24 additions and 14 deletions	1997 - 2001	Price pressure hypothesis
Mase (2007)	Price and volume effects of indices reconstitution	FTSE 100	132 additions and deletions	1992 - 2005	Price pressure hypothesis
Mazouz and Saadouni (2007)	Price and volume effects of indices reconstitution	FTSE 100	190 additions; 187 deletions	1984 - 2003	Price pressure hypothesis

[3] The sample size for pure deletions reduces to 95 at effective day.

Also, as shown in Table 1, three studies, such as Chung and Kryzanowski (1998), Madhavan (2003), and Gregoriou and Ioannidis (2006), support the liquidity hypothesis.

Only a few studies examine index effect in US small capitalization stock indices. Madhavan (2003) finds significant and temporary abnormal returns around the annual rebalancing of the Russell 2000 and Russell 3000 indices from 1996 to 2002. Similar to Madhavan (2003), Biktimirov, Cowan, and Jordan (2004), who examine the Russell 2000 index additions and deletions from 1991 to 2000, find no evidence to support a permanent price reaction that is associated with pure additions and deletions. Chen (2006), however, finds that the market reaction around the annual rebalancing of the Russell indices supports the downward sloping demand curve hypothesis. Several recent studies examine the S&P SmallCap 600 index. Docking and Dowen (2006), who examine all index changes in the S&P SmallCap 600 index from 1999 to 2002, find that additions experience a significant and permanent abnormal return, while deletions experience a temporary abnormal return. In contrast, Shankar and Miller (2006) find evidence consistent with the price pressure hypothesis by examining additions and deletions in the S&P 600 SmallCap index from 1995 to 2002.

It appears none of the studies has examined changes to the United Kingdom or Canadian small capitalization stock markets. The main purpose of this thesis is to investigate quarterly constituent changes in the FTSE SmallCap (UK) index to determine any abnormal movement in stock price, trading volume, institutional ownership, and liquidity. As a comparison, I also examine price and volume effects associated with constituent changes in the S&P/TSX SmallCap[4] (Canada) index.

The rule for the FTSE SmallCap index is primarily related to stock market capitalization. The FTSE SmallCap index contains stocks in the FTSE All-Share index that are not large enough to be included in the FTSE 350 index[5]. In most cases, firms enter the FTSE SmallCap index by being transferred from either the FTSE 250 index or the FTSE Fledgling index and vice versa. Major changes to the FTSE SmallCap index happens through quarterly and annually reviews[6]. In contrast, The S&P/TSX SmallCap

[4] The Standard and Poor's and Toronto Stock Exchange (S&P/TSX) SmallCap index.
[5] The FTSE All-Share index is the combination of the FTSE 350 index and the FTSE SmallCap index.
[6] The dates on which the changes are announced and effective are known in advance.

index is a float adjusted and market capitalization weighted index. Firms enter the S&P/TSX SmallCap index either by transferring from the S&P/TSX 60 and S&P/TSX MidCap indices or are chosen from the firms that are not in the S&P/TSX Composite family of indices[7]. Furthermore firms deleted from the S&P/TSX SmallCap index are either transferred to another S&P/TSX Composite family index or deleted from the S&P/TSX Composite family of indices. The S&P/TSX index Committee evaluates the candidates based on the criteria including eligibility, listing, domicile, market capitalization, and liquidity. A detailed description of these two indices can be found in Chapter 3.

I follow an approach similar to the one used by Biktimirov, Cowan, and Jordan (2004). I divide my original sample into sub-groups and examine them separately. In examining six sub-groups of index changes in the FTSE SmallCap index, I find a permanent price change and permanent change in stock liquidity for all sub-groups except pure additions. Pure additions experience a temporary increase in stock price and non-consistent in liquidity proxies. Overall, these findings support the price pressure and liquidity hypotheses. For four sub-groups of index changes in the S&P/TSX SmallCap index, I conduct only abnormal return and trading volume analyses and find support for the price pressure hypothesis.

This thesis offers several contributions to the literature. First, this thesis provides the first examination of market reactions to index changes in non-US small capitalization indices. Numerous studies have focused on US indices and large capitalization stock indices, but researchers find support for different competing hypotheses. This thesis also offers a more comprehensive study of market reactions to index changes that includes not only abnormal return and abnormal trading volume analyses, but also the examination of changes in instructional ownership and stocks' liquidity. Besides representing the performance of stocks from a non-US stock market, the FTSE SmallCap index has other differences from the Russell 2000 and S&P 600 indices. Specifically, the Russell 2000 and S&P 600 indices have only two groups of additions: pure additions and downward

[7] The S&P/TSX Composite index contains the S&P/TSX 60 index, the S&P/TSX MidCap index, and the S&P/TSX SmallCap index. However, after March 2007, the S&P/TSX SmallCap index is no longer a part of the S&P/TSX Composite index.

additions from the Russell 1000 and S&P 400/500 indices, respectively. In contrast, the FTSE SmallCap index has three groups of additions: pure additions, downward additions from the FTSE 250, and upward additions from the FTSE Fledgling index. In addition, changes to the FTSE index are based on a known criterion (market value) on a known date, which means announcements about the FTSE SmallCap index changes should have no information effect. Moreover, small cap stocks are expected to be more sensitive to changes in liquidity and investor awareness than mid/large cap stocks.

Lastly, this thesis provides a comparison of abnormal return and trading volume reactions to index changes between the FTSE SmallCap and S&P/TSX SmallCap indices. This comparison is interesting given that the FTSE and S&P/TSX index committees use different announcement policies and maintenance rules.

The rest of the thesis is organized as follows. The following chapter describes the competing hypotheses and relevant studies. Chapter 3 describes the samples and the data. Chapter 4 describes the methodology and presents empirical results of abnormal return, trading volume, institutional ownership, and liquidity analyses. Finally, Chapter 5 offers conclusions.

Chapter 2 Literature Review

In this chapter, I discuss five hypotheses in the event study literature (index effect) and several previous studies that examine the market reaction to index changes in non-US large capitalization indices.

2.1 Hypotheses

The hypotheses proposed by previous studies of market reaction to index changes in the literature can be grouped into five basic categories: price pressure hypothesis, downward sloping demand curve hypothesis (or imperfect substitutes hypothesis), liquidity hypothesis, information content hypothesis, and investor awareness hypothesis. A large number of researchers are trying to provide possible explanations for the stock market reactions to index changes through United States stock market, primarily the S&P 500 index. But only a few researchers focus on the international stock markets indices.

2.1.1 Price Pressure Hypothesis

The price pressure hypothesis is the only hypothesis that predicts the temporary reaction to index changes. This hypothesis assumes a perfect elastic long-term demand, but the price may move beyond or below the equilibrium level in the short-term. The temporary reaction around the index changes is caused by index fund managers who rebalance their portfolios according to the index changes (Harris and Gurel, 1986).

Harris and Gurel (1986), who examine a sample of index additions to the S&P 500 index from 1978 to 1983, report an immediate price increase of more than 3% after an addition is announced, but this price effect is fully reversed after 2 weeks. Biktimirov, Cowan, and Jordan (2004) find significant changes in prices, trading volume, and institutional ownership associated with a large sample of additions and deletions in the small capitalization Russell 2000 index, but both changes in prices and trading volume reversed quickly.

Similar to the two studies mentioned above, Scholes (1972), Lynch and Mendenhall (1997), Madhavan (2003), Shankar and Miller (2006), Vespro (2006), Mase (2007), and Mazouz and Saadouni (2007) also provide evidence consistent with the price pressure hypothesis.

2.1.2 Downward Sloping Demand Curve (Imperfect Substitutes) Hypothesis

This hypothesis assumes that the long-term demand curve is downward sloping or there are no perfect substitutes for a firm that is added to an index. Because index funds will hold a substantial portion of the added firm's shares and there are no perfect substitutes for this specific firm, the supply of the stock for other investors is reduced. Consequently, this hypothesis suggests that the share price for the added (deleted) stocks is expected to increase (decrease) permanently. Shleifer (1986), Beneish and Whaley (1996), and Wurgler and Zhuravskaya (2002) present evidence consistent with the downward sloping demand curve hypothesis.

Liu (2000) and Kaul, Mehrotra, and Morck (2000) provide evidence consistent with the downward sloping demand curve hypothesis by examining index changes in non-US indices. Liu (2000) finds a permanent abnormal return of 1.5% (-2.5%) for stocks added to (deleted from) the Nikkei 500 index from 1991 to 1999. Kaul, Mehrotra, and Morck

(2000), who study the index weight adjustment for 31 stocks in the TSE 300 index in November 1996, find a significant and permanent mean excess return of 2.3% during the event week.

2.1.3 Liquidity Hypothesis

The liquidity hypothesis suggests that a stock's liquidity is affected by its addition to or deletion from an index. Shleifer (1986) and Goetzmann and Garry (1996) argue that an addition of a stock to the index increase the public information and number of trades of the stock. This stock, therefore, is traded more actively, becomes more liquid, and has a smaller bid-ask spread. The reversal is true for deleted stocks. Based on this hypothesis, investors should expect a price increase immediately after the inclusion due to the lowered required rate of return on the stock (Shleifer, 1986) or due to the capitalization of improvement in liquidity (Chen, Noronha, and Singal, 2004).

Erwin and Miller (1998) examine the bid-ask spread changes around the S&P 500 index revisions from 1984 to 1988. Erwin and Miller (1998) divide the sample into two subsamples: optioned vs. non-optioned stocks. The result indicates that the price and volume effects of non-optioned stock sample reflect enhanced stock liquidity. But Erwin and Miller (1998) find nothing for the optioned stock sample. Erwin and Miller (1998), therefore, argue that the inability of finding support for the liquidity hypothesis from optioned stocks is mainly because of the lack of informational efficiency of index futures and options.

Hegde and McDermott (2003) examine all index changes to the S&P 500 index from 1993 to 1998. For stocks added to the S&P 500 index, Hegde and McDermott (2003) find a significant and long-term improvement in market liquidity following the addition. For stocks removed from the S&P 500 index, Hegde and McDermott (2003) find an increase in the cost of trading, which indicates a decrease in liquidity.

2.1.4 Information Content Hypothesis

The information content hypothesis suggests that the announcement of an addition or deletion contains valuable information regarding the stock's past and future performance. Based on this hypothesis, Woolridge and Ghosh (1986) suggest that stock prices should

adjust immediately and permanently to a new equilibrium level, and trading volume may increase temporarily. This is also gives support to the theory of market efficiency.

Jain (1987) provides strong evidence that the S&P decisions have information content. Jain (1987) documents the excess returns, which cannot be explained by the price pressure hypothesis, for the firms included in the supplementary indices that are not tracked by index funds. Jain (1987) then suggests the following two possible explanations: a) S&P prefers stable firms for its indices, inclusion of a firm is perceived as a reduction in the riskiness of its securities; b) inclusion signals an increase or perceived increase in quality of management. Dhillon and Johnson (1991), who examine the prices of stocks, bonds and options, find evidence consistent with the information hypothesis.

Denis, McConnell, Ovtchinnikov, and Yu (2003), who examine the earnings forecasts and realized earnings for new additions to the S&P 500 index, argue that an announcement of a stock's impending inclusion in the S&P 500 index is not information free because the S&P may embed some analysis of the future prospects of the candidate companies or because the S&P has access to information not available to other market participants.

2.1.5 Investor Awareness Hypothesis

Chen, Noronha, and Singal (2004) propose the investor awareness hypothesis, which is against the generally accepted explanations[8], to explain the asymmetric market reaction around index changes.

Chen, Noronha, and Singal (2004) examine a sample of 760 additions and 235 deletions of the S&P 500 index in three different regimes from 1962 to 2000. Chen, Noronha, and Singal (2004) find a positive permanent price reaction[9] for stocks added to the index, but there is a price reversal for the stocks deleted from the index. In the case of volume turnover, Chen, Noronha, and Singal (2004) find a permanent change in trading

[8]The generally accepted explanations predict symmetric market reactions around index changes.

[9]For additions during period from 1976 to 1989, abnormal return is over 3.2% on announcement day, and the cumulative excess return from the announcement day to 60 day after is 3.6%. For additions during period from 1989 to 2000, abnormal return is 5.4% on announcement day, and the cumulative excess return from the announcement day to 60 day after is 6.2%.

volume for stocks added to the S&P 500 index during period 1989 to 2000[10]. But, again, there is only a temporary change in the turnover ratios for stocks deleted from the S&P 500 index. Chen, Noronha, and Singal (2004), therefore, suggest the following:

1. Both investor awareness and monitoring do increase significantly for added companies, but they are unlikely to diminish suddenly when companies are removed from the index.
2. Added companies become more efficient and have improved access to capital, but the deleted companies do not necessarily experience a significant change in efficiency or that access.
3. When a company added to an index, more information are produced by the analysts or media, and well-diversified investors are willing to invest in the company with lowed required returns. The "shadow cost" is lowered, which therefore causes the price increase.
4. Abnormal returns are significantly related to changes in the Merton's "shadow cost," Merton (1987). To be more specific, deletion from an index does not imply a significant change of neither awareness nor company's "shadow cost." The price reaction should only be temporary because the index fund managers adjust their portfolios according to the index changes.

The investor awareness hypothesis predicts a permanent effect for the additions to an index and a temporary effect for the deletions from an index. Other studies having results consistent with those of Chen, Noronha, and Singal (2004) include Lynch and Mendenhall (1997), Beneish and Whaley (2002), Docking and Dowen (2006), and Mase (2006).

2.2 Market Reactions to Changes in the UK and Canadian Stock Indices

In this section, I summarize the papers that examine the stock market effect of changes in the constituents of the Canadian and UK indices. The largest Canadian stock index, the TSE 300 index, is similar to the S&P 500 index with some minor differences.

[10] No evidence is found for permanent change in trading volume for additions to the S&P 500 index during period from 1976 to 1989.

However, the FTSE 100 index is very different from the Standard and Poor's indices because its constituent changes primarily by following a ranking related to the market capitalization.

2.2.1 Changes to the UK FTSE SmallCap Index

Gregoriou and Ioannidis (2006) look at the additions to (deletions from) the FTSE 100 list for the period of 1984 to 2001. They find a cumulative average prediction error from day -2 to +2 of 11% which is distinguishable from zero for firms added to the FTSE 100 list and a cumulative average prediction error from day -2 to +2 of -7.42% is distinguishable from zero for firms deleted from the FTSE 100 list. Moreover, they find that the behavior of stock prices from one to three months subsequent to the announcement suggests that the price increase (decrease) for additions (deletions) in the FTSE 100 index is permanent. In their trading volume analysis, they find significant and permanent increase (decrease) in trading volume associated with additions (deletions) to the FTSE 100 index. Their findings related to information availability changes and liquidity changes are important to distinguish between the liquidity hypothesis and the imperfect substitutes hypothesis. The average number of analysts following the stock increases (decreases) significantly for additions (deletions), and the bid-ask spreads decrease (increase) significantly for additions (deletions). As a robustness check, they employ a cross-sectional test using the model that is similar in spirit to that of Beneish and Gardner (1995). The authors then claim that they provide evidence that is consistent with the information cost/liquidity hypothesis.

Mase (2006) takes a long-term approach to extend the results documented by Chen, Noronha, and Singal (2004) in the United Kingdom stock market. The author examines one-year and three-year abnormal buy-and-hold returns using a sample of changes in the FTSE 100 index from 1992 to 1999 (85 additions and 72 deletions). For additions to the FTSE 100 index, Mase (2006) finds significant mean abnormal returns, estimated on the announcement day, over an one-year holding period and over a three-year holding period

are 10.8% and 17.6%[11], respectively. In the case of deletions from the FTSE 100 index, Mase (2006) find only one significant buy and hold abnormal return. Given that the changes in composition of the FTSE 100 index follow a ranking based on the market capitalization, the author argues that stock's addition or deletion must reflect its relative performance prior to the announcement. Results in Mase (2006) demonstrate that this relative performance continues for up to three years after changes taking place, and the return continuation is unlikely to be explained by a momentum effect. Mase (2006) concludes that his results are inconsistent with the long-term downward sloping demand curve hypothesis, which predicts symmetric post-event price effects. Therefore, Mase (2006) provide support for the investor awareness hypothesis.

Vespro (2006) provides evidence of price and volume effects associated with index changes by analyzing the additions to (deletions from) the French CAC40, SBF120, and FTSE 100 indices. His FTSE 100 sample includes 89 additions and 89 deletions between January 1997 and March 2001. He finds that the event period mean CAR is significant, but reverted quickly. Based on his findings, the author suggests that the price pressure hypothesis is the most robust theory.

Mase (2007) examines the impact of changes in the FTSE 100 index. The sample in the paper contains 132 inclusion and deletions resulting from the quarterly reviews that took place from 1992 through 2005. By applying the market model and conducting robustness checks, the author finds an asymmetric pre-event return reversal and no significant abnormal returns over the complete event window for both additions and deletions. The author argues that the evidence is consistent with the short-term downward sloping demand curve. Mase (2007) then defines two sub-samples based on whether the stock is new to the index or previous constituents, and suggests that the investor awareness and the increased monitoring are unlikely to be the factors that explain the price effect associated with inclusion in the FTSE 100 index.

Mazouz and Saadouni (2007) examine both short-term and long-term effects associated with the changes in the FTSE 100 index using a sample that contains 190 additions and 187 deletions during the period from 1984 to 2003. They find significant

[11] Mase (2006) finds significant mean abnormal returns, estimated from 21 days after the event date, over a one-year holding period and over a three-year holding period are 12.1% and 20.9%, respectively.

abnormal returns around the effective day and the price reversal is total rather than partial. Mazouz and Saadouni (2007) then argue that this is strong evidence to support the price pressure hypothesis. Furthermore the authors find a permanent volume increase associated with the added stock.

Vespro (2006), Mase (2007) and Mazouz and Saadouni (2007) provide support for the price pressure hypothesis, yet their results are inconsistent with those reported in Mase (2006) or Gregoriou and Ioannidis (2006).

It appears that the studies examining market reaction to index changes in Canadian and UK large capitalization stock indices find inconsistent results. This means further investigations are necessary.

2.2.2 Changes to the Canadian TSE 300 Index

Chung and Kryzanowski (1998) examine the impact of changes in the constituents of the TSE 300 index. They use daily data over a five-year period from 1990 to 1994 with a sample of 112 index additions and 72 index deletions after removing all units, the impact of confounding events, and the impact of low priced shares on price impact. They then divide the sample into two sub-samples based on whether the change was part of an annual revision or not. They find that large traders buy prior to the simultaneous inclusion of numerous stocks to the TSE 300 index to better balance the tradeoff between price pressure and tracking error. Large traders, therefore, appear to avoid making portfolio adjustments on the effective date for simultaneous index deletions. The authors then measure the abnormal returns using the modified market models taking into account the selection criteria effect, market sensitivity shift, liquidity change, and large trade activity. The results from the modified models provide the support for the price pressure hypothesis and the liquidity hypothesis[12].

Masse, Hanrahan, Kushner, and Martinello (2000), who examine the market reaction to additions or deletions in the TSE 300 index, make use of the fact that the Toronto Stock Exchange announces changes to the TSE 300 index after they actually have taken effect prior to 1988. For the period from 1984 to 1994, two sub-samples are defined: one

[12] Trade and quote data are extracted from the TSE *Equity History File* (Chung and Kryzanowski, 1998).

contains changes that occurred during 1984 to 1988 that the announcement occurring after the changes and another contains changes that occurred during 1989 to 1994 that the announcement occurring before the changes. The sample consists of 134 additions and 109 deletions. The authors use the dummy variable approach to estimating abnormal returns considered by Thompson (1985) and adjust the estimated standard error for arbitrary heteroskedasticity and clustering of events. In addition, data are adjusted for missing values based on the trade-to-trade method[13]. The authors find a positive reaction for the inclusion; CARs reached 4.75% and 2.56% by the event for the respective periods. Regardless of when the announcement takes place the reaction for inclusion is positive and statistically significant even when the information should already be known. In addition, no evidence of return reversal is found up to 30 days after effective day (or announcement day). Masse, Hanrahan, Kushner, and Martinello (2000) claim the result is consistent with Shleifer's (1998) hypothesis that the actual indexing causes index fund managers to enter the market. In the case of deletions, there is a negative reaction, but none of the results is significant. There is no further discussion regarding the asymmetry effects, but the asymmetry effects are consistent with the investor awareness assumption (proposed by Chen, Noronha, and Singal, 2004), in a short-term framework, that an addition can lead to a significant increase in awareness, but it is unlikely to fall significantly fallowing a deletion.

Unlike most of event study papers, which focus on index additions and deletions, Kaul, Mehrotra, and Morck (2000) examine the market reaction to changes in the weights of 31 stocks in the TSE 300 index in 1996. In the week the weight change became effective, the authors find a statistically significant excess returns of 2.34%. In addition, all 31 stocks experience unusually high trading volume, but there is no evidence for bid-ask spread changes. Both uni-variate and multi-variate results show that the reported effects are permanent. The authors then argue that the event is information free since the announcement was made three months earlier, and all the stocks were already in the index so that the reduction in liquidly costs is insignificant. All the evidence, therefore, supports the downward sloping demand curve hypothesis.

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[13] See Maynes and Rumsey (1993).

The market reactions associated with index changes in the large-cap TSE 300 are consistent with those reported for the changes in the large-cap S&P 500 index, but the results are inconsistent whereas Chung and Kryzanowski (1998) suggest the price pressure hypothesis, Kaul, Mehrotra, and Morck (2000) suggest the downward sloping demand curve hypothesis while Masse, Hanrahan, Kushner, and Martinello (2000) provide support for the investor awareness hypothesis.

Chapter 3 Samples

In this chapter, I provide an overview of the S&P/TSX SmallCap and the FTSE SmallCap indices and a discussion about my samples.

3.1 Overview of the FTSE SmallCap Index

FTSE International Limited introduced the FTSE SmallCap index on January 4, 1993. The FTSE SmallCap index consists of the FTSE All-Share index constituents that are too small to be the constituents of the FTSE 350 index[14]. Consequently, after the constituents of the FTSE 100 and FTSE 250 indices are determined, companies left in the FTSE All-Share make up the FTSE SmallCap[15]. Starting on March 25, 1996, the FTSE SmallCap index has been calculated in real time, rather than "at the end of day".

The index committee reviews the constituents of the FTSE SmallCap index on a quarterly basis. Eligible stocks are determined based on liquidity rules and restrictions, such as free float restrictions and the type of the stock. The constituents of the FTSE SmallCap index are determined based on a ranking of market capitalization among eligible stocks. The review meetings are held on the Wednesday after the first Friday in March, June, September and December, and index changes take place on the first trading

[14] The FTSE 350 index consists of 350 largest UK companies, and it contains the FTSE 100 and the FTSE 250 indices.

[15] According to the FTSE UK Series Ground Rules, the FTSE Fledgling index consists of those fully quoted companies too small to be constituents of the FTSE All-Share. Companies which are large enough to be constituents of the FTSE All-Share but do not meet all the relevant liquidity criteria will not be included in any FTSE UK family indices. See Ground Rules for the Managements of The UK Series of the FTSE Actuaries Share Indices, http://www.ftse.com/Indices/UK_Indices/Downloads/FTSE_UK_Index_Series_Index_Rules.pdf#

day after the third Friday of the same month. Under this schedule, there is a fixed number of trading days between the announcement (release of the reviews) and the effective dates.

An addition to the FTSE SmallCap usually occurs in quarterly reviews. Yet the addition can also happen in association with a stock re-assessment or demerger. For a deletion, stocks that do not meet the relevant liquidity or market capitalization requirements are generally deleted through the quarterly reviews. A deletion caused by replacing the stock in the FTSE 250 index can happen anytime since the FTSE 250 index is maintained with a fixed number of 250 constituents.

As of September 2008, there were 311 firms in the FTSE SmallCap Index with a total market capitalization of about 36.5 billion British pounds, which represents approximately 2% of the UK market capitalization. Firms from financial sector and Industrial sector make up about 70% of the index in terms of market capitalization.

3.2 The UK sample

An initial sample of 936 additions and 736 deletions in the FTSE SmallCap index over the period January 1998 through December 2008 are identified from the FTSE UK Quarterly Review (in March, June, and September) and the FTSE Annual Review (in December). The sample starts on 1998 is because there were a few important changes to the FTSE UK series indices. First, the FTSE Fledgling index was introduced in 1995. Second, the FTSE SmallCap index has been calculated in real time, rather than "at the end of day" since March 1996. Finally, in 1998, the index committee decided to bring forward the implementation of the usual annual index constituent changes, which was effective in the following year, to the same date as the December's annual reviews. The effective day, denoted as ED, is one trading day before the actual change takes place.

Consequently, the effective day is defined as the last day available for investors to trade on the information relating to index changes. I define the announcement day, denoted as AD or ED-6, as the first trading day after the day on which the FTSE releases the quarterly reviews to the public since the FTSE announces changes after the close of trading on the day. In addition, the event window runs from 30 trading days before to 60 trading days after the effective day, [ED-30, ED+60]. The initial sample is reduced to a final clean sample of 672 additions and 532 deletions after applying the following screens.

The first screen applies to additions only: seven additions that are caused by the IPO of the stock within 30 trading days before the effective day are removed. The second screen removed stocks for which the event window overlapped with another index change (removed 26 additions and 4 deletions). The third screen kept only unique stocks in the sample. For example, if one stock appears more than once in the one of the sub-samples, I only keep the earliest event for this stock (removed 99 additions and 61 deletions). The last screen removed stocks having more than 20 non-trading days in the 91-trading-day event window (removed 132 additions and 139 deletions).

Panel A in Table 2 shows the detailed construction of the final clean sample for additions. Following similar sample construction methodology used by Biktimirov, Cowan, and Jordan (2004), I divide all additions in the FTSE SmallCap index into the following three sub-groups:

1. Pure additions consist of 187 stocks added to the FTSE SmallCap Index that were not previously in any other FTSE index.
2. Downward additions consist of 289 stocks that were demoted from the FTSE 250 Index to the FTSE SmallCap Index.
3. Upward additions consist of 196 stocks that were promoted from the FTSE Fledgling Index to the FTSE SmallCap Index.

Panel B in Table 2 shows the detailed construction of the final sample for deletions. I divide the deletions into the following three sub-groups:

1. Pure deletions consist of 30 stocks deleted from the FTSE SmallCap Index that were not shifted to any FTSE family index.
2. Upward deletions consist of 203 stocks that were promoted from the FTSE SmallCap Index to the FTSE 250 Index.
3. Downward deletions consist of 299 stocks that were demoted from the FTSE SmallCap Index to the FTSE Fledgling Index.

Table 3 presents summary statistics of the levels of daily closing price, trading volume in shares, market value, and relative spread before and after index additions and deletions. The pre-event window covers 50 trading days from ED-80 to ED-31, and the post-event window covers 50 trading days from ED+61 to ED+110. Since all six sub-

groups of index changes are considered to be independent from each other, I use a parametric test, two independent samples *t*-Test, and a non-parametric test, Wilcoxon-Mann-Whitney Test, to test whether the levels of daily closing price, daily trading volume in shares, market value, and relative spread before and after index additions and deletions are significantly different between sub-groups.

Table 2: FTSE SmallCap Index Sample Additions and Deletions

This table provides detailed construction of the final clean samples for the FTSE SmallCap Index quarterly/annually additions and deletions for period Jan 1998 through Dec 2008. Pure additions are stocks added to the FTSE SmallCap Index that were not previously in FTSE family index. Downward additions are stocks that were demoted from the FTSE 250 Index to the FTSE SmallCap Index. Upward additions are stocks that were promoted from the FTSE Fledgling Index to the FTSE SmallCap Index. Pure deletions are stocks deleted from the FTSE SmallCap Index that were not shifted to any FTSE family index. Upward deletions are stocks that were promoted from the FTSE SmallCap Index to the FTSE 250 Index. Downward deletions are stocks that were demoted from the FTSE SmallCap Index to the FTSE Fledgling Index.

Panel A: Additions	
Initial Quarterly Additions Sample	936
Less:	
Step 1: IPO within 30 trading days before the ED	-7
Step 2: Event window overlapped with other changes	-26
Step 3: Appeared more than once in the sub-sample	-99
Step 4: More than 20 non-trading days during event window	-132
Clean sample:	
Pure additions	187
Downward additions	289
Upward additions	196
Total clean sample	**672**
Panel B: Deletions	
Initial Quarterly Deletions Sample	736
Less:	
Step 1: Event window overlapped with other changes	-4
Step 2: Appeared more than once in the sub-sample	-61
Step 3: More than 20 non-trading days during event window	-139
Clean sample:	
Pure deletions	30
Downward deletions	299
Upward deletions	203
Total clean sample	**532**

Summary statistics for additions in the FTSE SmallCap index are shown in Panel A of Table 3. Pure additions have a mean (median) pre-event level of market capitalization of £172 (£152) million and experience very small impact on the market capitalization after the addition. But it is surprising that the mean (median) daily trading volume drops in an economic significant sense from the pre-event level of 842 (224) thousand shares to the post-event level of 307 (183) thousand shares. Downward additions experience a decrease in both market capitalization and daily trading volume, mean (median) market capitalization decreases from £350 (£334) million to £235 (£226) million and daily trading volume decreases from 1784 (451) thousand shares to 1283 (451) thousand shares. Note that, on average, firms in the downward additions sub-group are significantly larger and traded more frequently than the other two sub-groups. This is not surprising since firms in the downward additions sub-group were in the mid-cap FTSE 250 index. In contrast, on average, firms in the upward additions sub-group are the smallest and least frequently traded among three sub-groups of additions in an economic and statistical significant sense. This is not surprising since firms in the upward additions sub-group were in the non-real-time calculated FTSE Fledgling index.

Panel B of Table 3 presents the summary statistics for deletions in FTSE SmallCap index. Pure deletions have a mean (median) pre-event level of market capitalization of £124 (£112) million and experience slightly decline on the market capitalization. Similar to pure additions, the change in daily trading volume is opposite to the expected. The mean (median) daily trading volume increases in an economic significant sense from the pre-event level of 80 (38) thousands of shares to the post-event level of 218 (131) thousands of shares. Note that, on average, firms shifted up to the mid-cap FTSE 250 index have the largest market capitalization and daily trading volume while firms shifted down to the FTSE Fledgling index have the smallest market capitalization and daily trading volume. This is not surprising given that FTSE family of indices determine members based primarily on the market capitalization. Similar to additions, the pre-event levels of all three sub-groups of index deletions are significantly different from each other.

Table 3: Summary Statistics for the UK Final Sample

This table presents summary statistics on the levels of daily closing price, daily trading volume (in thousand shares), market value (in millions £), and relative spread before and after addition to and deletion from the FTSE SmallCap index. The pre-event levels are averaged over a 50-day window that runs from ED-80 to ED-31, and post-event levels are averaged over a 50-day window that runs from ED+61 to ED+110.

Panel A	Closing Price		Volume (thousand shares)		Market Value (millions £)		%Spread	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	(i) Pure additions (N=187)							
Mean	**2.33**	**2.45**	**843**	**307**	**172**	**179**	**0.0254**	**0.0299**
Max	28.56	25.04	35,518	2,057	563	826	0.1207	0.2230
Q3	2.50	2.62	597	398	213	234	0.0320	0.0340
Median	**1.55**	**1.55**	**224**	**185**	**152**	**146**	**0.0228**	**0.0239**
Q1	1.10	1.04	87	80	103	105	0.0150	0.0160
Min	0.26	0.19	0	4	45	34	0.0030	0.0024
	(ii) Downward additions (N=289)							
Mean	**3.07**	**2.09**	**1,784**	**1,283**	**350**	**235**	**0.0245**	**0.0309**
Max	27.64	13.66	71,578	30,235	1,057	817	0.1357	0.1331
Q3	3.94	2.74	1,225	964	401	310	0.0327	0.0408
Median	**2.35**	**1.38**	**540**	**451**	**334**	**226**	**0.0204**	**0.0239**
Q1	1.25	0.77	235	176	272	150	0.0123	0.0140
Min	0.12	0.01	8	8	16	7	0.0009	0.0000
	(iii) Upward additions (N=196)							
Mean	**2.17**	**2.87**	**398**	**411**	**84**	**118**	**0.0305**	**0.0300**
Max	67.08	108.34	8,811	7,212	368	564	0.1353	0.1683
Q3	2.56	3.31	304	327	96	137	0.0382	0.0367
Median	**1.37**	**1.76**	**152**	**132**	**76**	**103**	**0.0253**	**0.0244**
Q1	0.71	0.94	63	67	60	75	0.0175	0.0173
Min	0.04	0.06	0	2	26	22	0.0063	0.0066
	Wilcoxon-Mann-Whitney Test: Pr > |z| *Two independent sample t-Test: Pr > |t|*							
(i) vs. (ii)	0.0004 *0.0061*	0.0250 *0.1144*	<.0001 *0.0370*	<.0001 *<.0001*	<.0001 *<.0001*	<.0001 *<.0001*	0.0597 *0.5595*	0.8936 *0.6496*
(i) vs. (iii)	0.0078 *0.6903*	0.6334 *0.4892*	0.0049 *0.0471*	0.1115 *0.1226*	<.0001 *<.0001*	<.0001 *<.0001*	0.0057 *0.0050*	0.3413 *0.9661*
(ii) vs. (iii)	<.0001 *0.0125*	0.0302 *0.1078*	<.0001 *0.0008*	<.0001 *0.0002*	<.0001 *<.0001*	<.0001 *<.0001*	<.0001 *0.0006*	0.3209 *0.6514*

Table 3 ***(continued)***

Panel B	Closing Price		Volume (thousand shares)		Market Value (millions £)		%Spread	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	(iv) Pure deletions (N=30)							
Mean	**1.93**	**1.74**	**80**	**218**	**124**	**107**	**0.0414**	**0.0386**
Max	7.79	7.09	409	1,944	354	312	0.1450	0.1543
Q3	2.31	1.93	82	229	133	128	0.0510	0.0397
Median	**1.48**	**1.14**	**38**	**131**	**112**	**109**	**0.0304**	**0.0312**
Q1	0.96	0.63	15	78	72	58	0.0244	0.0196
Min	0.05	0.03	2	14	6	4	0.0140	0.0138
	(v) Upward deletions (N=203)							
Mean	**3.11**	**3.75**	**901**	**886**	**304**	**400**	**0.0195**	**0.0186**
Max	11.58	16.66	26,193	17,184	492	1,170	0.0768	0.0841
Q3	4.27	4.79	890	920	349	480	0.0251	0.0232
Median	**2.64**	**3.06**	**329**	**351**	**308**	**369**	**0.0171**	**0.0169**
Q1	1.34	1.46	142	132	248	278	0.0114	0.0098
Min	0.10	0.26	0	0	8	34	0.0025	0.0019
	(vi) Downward deletions (N=299)							
Mean	**0.78**	**0.62**	**577**	**545**	**47**	**36**	**0.0715**	**0.0914**
Max	8.27	6.60	26,013	10,807	156	110	0.4401	2.0000
Q3	1.07	0.89	362	452	60	49	0.0935	0.0861
Median	**0.56**	**0.38**	**159**	**177**	**43**	**33**	**0.0558**	**0.0552**
Q1	0.27	0.16	71	83	30	19	0.0331	0.0375
Min	0.01	0.00	0	1	4	0	0.0000	0.0000
	Wilcoxon-Mann-Whitney Test: Pr > |z|							
	Two independent sample t-Test: Pr > |t|							
(iv) vs. (v)	0.0028	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
	0.0081	*0.0005*	*0.0634*	*0.0681*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
(iv) vs. (vi)	<.0001	<.0001	<.0001	0.0680	<.0001	<.0001	0.0004	<.0001
	<.0001	*<.0001*	*0.1768*	*0.1540*	*<.0001*	*<.0001*	*0.0040*	*0.1387*
(v) vs. (vi)	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
	<.0001	*<.0001*	*0.0993*	*0.0189*	*<.0001*	*<.0001*	*<.0001*	*<.0001*

3.3 Overview of the S&P SmallCap Index

The precursor of the S&P/TSX SmallCap index, S&P/TSE Canadian SmallCap index is a float adjusted and market capitalization weighted index. It was introduced on 29 April, 1999 by Standard and Poor's and the Toronto Stock Exchange. The S&P/TSE Canadian SmallCap index consists of 180 smallest representatives from each sector of the TSE 300 Composite index. Because a fixed number of constituents are maintained, an addition to the index usually occurs corresponding to the deletions from the index. In the following few years, there were a series of name changes and redefinition of the S&P/TSX family indices. As a result, the number of constituents is no longer fixed since May 2002 and income trusts make up a significant portion of the index since 2005. Before March 2007, the S&P/TSX Index Committee maintained the S&P/TSX SmallCap index and met on a quarterly basis. Changes made through the quarterly review were effective after the close of trading on the third Friday of March, June, September and December. Since March 2007, the S&P/TSX SmallCap is no longer a member of the S&P/TSX Composite index. Consequently, the S&P/TSX SmallCap index is maintained separately from the S&P/TSX Composite family of indices and is reviewed annually in September.

The index candidates must meet all criteria for index additions including eligibility, listing, domicile, market capitalization, and liquidity. All securities added to the index must be listed on the on the TSX for at least 12 full calendar months with no more than 25 non-trading days over the past 12 calendar months. In addition, added securities must have at least C$100 million and at most C$ 1.5 billion in both quoted market value and total market value[16]. Deletions usually occur when firms are involved in mergers, acquisitions, important restructuring, or no longer meet the relevant requirements. Announcements are made after the daily close of trading and press releases are posted on the Standard and Poor's web site and major news services.

As of 2008, there were 208 firms in the S&P/TSX SmallCap index with a total market capitalization of about 70 billion Canadian dollars. Firms from the energy sector, materials sector, financial sector and industrial sector make up about 75 percent of the

[16] See S&P/TSX SmallCap Methodology for more information, http://www2.standardandpoors.com/spf/pdf/index/SP_TSX_SmallCap_Methodology_Web.pdf

index in terms of market capitalization. Since the launch of the S&P/TSX SmallCap index, the performance of the index was remarkable until the recent financial crisis.

3.4 The Canadian Sample

My Canadian sample consists of 367 additions and 429 deletions in the S&P/TSX SmallCap index over the period May 1999 through August 2008. Index changes are identified from the monthly TSX Review and the LexisNexis database. Similar to my UK sample, the effective day, denoted as ED, is the last trading day before the actual change takes place and the announcement day, denoted as AD, is the first trading day after the day on which Standard and Poor's announces the changes. Given that the number of trading days between the effective and announcement dates varies for different stocks, the event window for my Canadian sample covers the period of [AD-30, ED+60].

For deletions in the S&P/TSX SmallCap index, 85 deletions are caused by merger and acquisition, four deletions are caused by spin-off, and one deletion is caused by bankruptcy. The initial sample is reduced to a final clean sample of 335 additions and 251 deletions after applied the following screens. The first screen removed stocks for which the event window overlapped with another index change (removed two additions and two deletions). The second screen kept only unique stocks in the sample. For example, if one stock appears more than once in the one of the sub-samples, I only keep the earliest event for this stock (removed 13 additions and 16 deletions). The last screen removed stocks having more than 20 non-trading days in the event window (removed 17 additions and 70 deletions)

Table 4 shows the detailed construction of the final clean sample. Furthermore my Canadian sample is divided into four sub-groups, which are pure additions, downward additions, pure deletions, upward deletions. Pure additions consist of 310 stocks added to the S&P/TSX SmallCap index that were not previously in the S&P/TSX index universe. Downward additions consist of 25 stocks that were demoted from the S&P/TSX MidCap or S&P/TSX 60 indices. Pure deletions consist of 179 stocks deleted from the S&P/TSX SmallCap index and S&P/TSX index universe. Upward deletions consist of 72 stocks that were promoted to the S&P/TSX MidCap or S&P/TSX 60 indices.

Table 4: S&P/TSX SmallCap Index Sample Additions and Deletions

This table provides detailed construction of the final clean samples for the S&P/TSX SmallCap Index additions and deletions for period May 2002 through Aug 2008. Pure additions are stocks added to the S&P/TSX SmallCap index that were not previously in the S&P/TSX index universe. Downward additions are stocks that were demoted from the S&P/TSX MidCap or S&P/TSX 60 indices. Pure deletions are stocks deleted from the S&P/TSX SmallCap index and S&P/TSX index universe. Upward deletions are stocks that were promoted to the S&P/TSX MidCap or S&P/TSX 60 indices.

Panel A: Additions	
Initial Additions Sample	367
Less:	
Step 1: Event window overlapped with other changes	-2
Step 2: Appeared more than once in the sub-sample	-13
Step 3: More than 20 non-trading days during event window	-17
Clean sample:	
Pure additions	310
Downward additions	25
Total clean sample	**335**
Panel B: Deletions	
Initial Deletions Sample	429
Mergers and Acquisitions	-85
Spin-offs	-4
Bankruptcy	-1
Useable Events:	339
Less:	
Step 1: Event window overlapped with other changes	-2
Step 2: Appeared more than once in the sub-sample	-16
Step 3: More than 20 non-trading days during event window	-58
Clean sample:	
Pure deletions	179
Upward deletions	72
Total clean sample	**251**

Table 5 presents summary statistics of the levels of daily closing price, trading volume in shares, market value, and relative spread before and after addition to and deletion from the S&P/TSX SmallCap index. The pre-event and post-event levels are estimated over the period of [AD-80, AD-31] and [ED+61, ED+110], respectively. Similar to the UK sample, I use a parametric test, two independent samples *t*-Test, and a non-parametric test, Wilcoxon-Mann-Whitney test, to test whether the levels are

Table 5: Summary Statistics for the Canadian Final Sample

This table presents summary statistics on the levels of daily closing price, daily trading volume (in thousand shares), market value (in millions C$), and relative spread before and after addition to and deletion from the S&P/TSX SmallCap index. The pre-event levels are averaged over a 50-day window that runs from AD-80 to AD-31, and post-event levels are averaged over a 50-day window that runs from ED+61 to ED+110.

	Closing Price		Volume		Market Value		%Spread	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	(i) Pure additions (N=310)							
Mean	**14.21**	**15.95**	**2,924**	**3,400**	**751**	**905**	**0.0127**	**0.0110**
Max	60.25	78.17	46,755	73,134	8,856	7,808	0.0775	0.0905
Q3	19.60	21.59	2,766	3,026	813	1,128	0.0168	0.0146
Median	**11.46**	**13.11**	**1,248**	**1,319**	**443**	**611**	**0.0087**	**0.0077**
Q1	6.12	7.12	554	637	243	298	0.0058	0.0048
Min	0.55	0.06	6	27	79	23	0.0017	0.0016
	(ii) Downward additions (N=25)							
Mean	**9.23**	**6.64**	**4,703**	**8,582**	**680**	**432**	**0.0130**	**0.0191**
Max	26.97	26.62	32,745	99,374	2,539	1,184	0.0288	0.1039
Q3	12.76	8.70	3,901	5,885	767	651	0.0152	0.0190
Median	**9.29**	**3.97**	**1,847**	**1,912**	**547**	**325**	**0.0116**	**0.0129**
Q1	3.55	1.89	1,075	1,395	367	169	0.0090	0.0118
Min	1.29	0.05	197	341	170	6	0.0061	0.0047
	Wilcoxon-Mann-Whitney Test: Pr > |z|							
	Two independent sample t-Test: Pr > |t|							
(i) vs.	0.0256	<.0001	0.0597	0.0091	0.3366	0.0019	0.0782	0.0004
(ii)	*0.0259*	*0.0004*	*0.1228*	*0.0081*	*0.7325*	*0.0308*	*0.884*	*0.0002*
	(iii) Pure deletions (N=179)							
Mean	**11.61**	**10.45**	**2,090**	**2,796**	**399**	**365**	**0.0198**	**0.0357**
Max	227.22	204.09	71,335	154,123	8,077	7,661	0.0776	1.4245
Q3	11.91	8.93	1,629	1,819	396	342	0.0249	0.0334
Median	**5.72**	**4.26**	**646**	**645**	**206**	**158**	**0.0175**	**0.0190**
Q1	2.41	1.61	279	228	111	70	0.0101	0.0116
Min	0.26	0.02	18	8	33	2	0.0027	0.0023
	(iv) Upward deletions (N=72)							
Mean	**27.45**	**26.83**	**4,755**	**3,997**	**2,215**	**2,412**	**0.0069**	**0.0067**
Max	71.83	97.04	57,740	49,737	9,903	11,175	0.0208	0.0221
Q3	38.69	35.58	4,624	3,945	2,404	2,859	0.0094	0.0089
Median	**24.42**	**23.41**	**1,791**	**2,037**	**1,427**	**1,689**	**0.0060**	**0.0051**
Q1	15.06	14.89	983	1,235	1,043	1,146	0.0039	0.0037
Min	2.91	4.22	344	299	386	372	0.0019	0.0013
	Wilcoxon-Mann-Whitney Test: Pr > |z|							
	Two independent sample t-Test: Pr > |t|							
(iii) vs.	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
(iv)	*<.0001*	*<.0001*	*0.007*	*0.4283*	*<.0001*	*<.0001*	*<.0001*	*0.0251*

significantly different between sub-groups.

As shown in Table 5, pure additions have a mean (median) pre-event level of market capitalization of C$750 (C$443) million. Firms in this sub-group experience an increase in market capitalization in an economic significant sense. In contrast, the mean (median) market capitalization of downward additions decreases in an economic significant sense from C$680 (C$547) million to C$432 (C$325). This is not a surprise that demotion from a larger index to the S&P/TSX SmallCap has negative impact on the firm's value. Pure deletions have a mean (median) pre-event level of market capitalization of C$399 (C$365) million. The post-event level of market capitalization of this sub-group is slightly smaller than the pre-event level. In contrast, the mean (median) level of market capitalization of upward deletions increases from C$2,215 (C$1,427) million to C$2,412 (C$1,689).

When compared to the stocks in my UK sample, stocks in my Canadian sample are much larger than those in my UK sample in terms of market capitalization. In addition, stocks in my Canadian sample have much higher daily trading volume than those in my UK sample.

3.5 Data Sources

I obtain all data for the analyses for my UK sample from Thomson Datastream database. Thomson Datastream is the leading database in terms of number of markets covered and number of securities covered in each market. In my analyses in the next chapter, I will specify the definition of the data I download form Thomson DataStream and its corresponding Thomson Datastream variable.

The Toronto Stock Exchange – Canadian Financial Market Research Center (TSX-CFMRC) provides daily data from January 2, 1975 to December 31, 2008 (2009th Edition). For my Canadian sample, I use daily data such as rate of return[17], volume, and closing bid and ask prices which are obtained from the CFMRC database.

[17] Daily return are calculated as if the security was purchased at the close yesterday and sold at the close today. See CFMRC Database Documentation, http://dc1.chass.utoronto.ca/cfmrc/docs/datadoc.html.

Chapter 4 Methodology and Empirical Results

In this chapter, I describe the methods for capturing the abnormal changes and empirical results in abnormal return, trading volume, institutional ownership, and liquidity analyses.

4.1 Abnormal Return Analysis

There are several approaches to measure the abnormal returns. The market-adjusted model and the market model are the most basic and frequently used models. The market-adjusted model suggests that the abnormal return of any stock j on day t, $AR_{j,t}$, is the difference between the daily individual stock return and the daily market return:

$$AR_{j,t} = R_{j,t} - R_{m,t}, \tag{1}$$

where $R_{j,t}$ is the daily return of stock j on day t and $R_{m,t}$ is the market return on day t.

I choose the market-adjusted model[18] over the standard market model or three-factor model based on findings in Edmister, Garham, and Pirie (1994) that the selection of estimation window of parameters surrounding index additions can significantly influence estimated abnormal returns. In addition, the use of the estimation window significantly reduces the sample size because of insufficient trading days of a stock or overlaps[19].

The sample mean abnormal return on day t is given by:

$$\overline{AR_t} = \frac{1}{N}\sum_{j=1}^{N} AR_{j,t}, \tag{2}$$

where N is the sample size. The cumulative mean abnormal return over a certain time window $[\tau_1, \tau_2]$ is calculated as:

$$\overline{CAR}(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} \overline{AR_t}. \tag{3}$$

[18] Becker-Blease and Paul (Forthcoming) and Gregoriou and Ioannidis (2006) use only the market-adjusted model to calculate abnormal returns.

[19] For one stock, its estimation window may overlap with another index change. To avoid any possible influence to the estimated abnormal returns, those stocks are excluded from the analysis.

An appropriate method to deal with missing returns is necessary because small capitalization stocks may be infrequently traded. There are several ways to deal with missing stock returns: the uniform return, the lumped return, and trade-to-trade return[20] adjustments. In this thesis, I follow the lumped return procedure because of three reasons. First, given that both S&P/TSX SmallCap and FTSE SmallCap indices have relevant liquidity requirements, most stocks in my sample are, at least, moderately traded stocks. Second, Maynes and Rumsey (1993) suggest that the lumped returns, by increasing the number of return observations, can improve the efficiency of estimators and test statistics used in event studies. Finally, significantly more computational efforts are required for the trade-to-trade procedures while the lumped returns are easy to implement. The lumped return procedure is used in Datastream database. When there is not enough information to calculate stock return, Datastream assigns a zero stock return and multi-period return is assign to the next trading day.

4.1.1 The UK sample

In this section, I perform abnormal return analysis to examine whether the abnormal return is associated with addition to and deletion from the FTSE SmallCap Index. If any abnormal return is present, I examine whether the observed abnormal return is transitory or permanent.

I calculate abnormal returns from the market-adjusted model, using the FTSE SmallCap value-weighted index as the market portfolio, for firms added to or deleted from the FTSE SmallCap index. I use return of the FTSE SmallCap index as the market return proxy in order to control for the size factor. Few studies, such as Shankar and Miller (2006), Chen (2006), and Becker-Blease and Paul (Forthcoming), also use return of smallcap index as their market return proxy. Note that Thomson Datastream returns are calculated from changes in the Thomson Datastream return index, RI[21]. The effective day (ED) is the last trading day before the actual change takes place and the announcement day (AD or ED-6) is the first trading day after the day on which FTSE

[20] See Marsh (1979).

[21] Datastream defines the variable RI as "this shows a theoretical growth in value of a share holding over a specified period, assuming that dividends are re-invested to purchase additions units of an equity or unit trust at the closing price applicable on the ex-dividend date."

release the annually or quarterly reviews to public. The 91-day long event window runs from 30 trading days before to 60 trading days after the effective day, [ED-30, ED+60].

As some stocks share the same announcement and effective days, I use the "crude dependence" adjustment described by Brown and Warner (1980), to correct for a possible event-clustering problem. In addition to a parametric *t*-test, I also use two nonparametric statistics, the rank test described by Corrado (1989) as well as a sign test suggested by Corrado and Zivney (1992) and Cowan (1992). Nonparametric tests do not require a symmetrical distribution of security abnormal returns for correct specification.

For robustness checks, I use different models and market index proxies. Results are qualitatively the same using the market model with a 180 trading days post estimation window that starts from ED+61. Results are also qualitatively the same when I use the FTSE SmallCap value-weighted (results are shown in Table 6 and Table 7 and plots in Figure 1, 2 and 3), FTSE All-Share value-weighted (results are shown in Table 8 and Table 9), Datastream UK equal-weighted index as the proxy for the market index.

Table 6 presents abnormal returns for the three sub-groups of additions to the FTSE SmallCap index. In examining the three sub-groups of additions to the FTSE SmallCap index, I find that the price effects for downward additions are substantially different from the price effects for pure and upward additions. This is because pure and upward additions are stocks new to the FTSE SmallCap index or promoted from the FTSE Fledgling index while downward additions are stocks demoted from the FTSE 250 index. It is, therefore, not a surprise that downward additions experience a significant pre-event cumulative loss of 12.86% over the period of [ED-30, ED-11]. I also find a significant abnormal return of -0.95% and 1.27% on the announcement and effective day, respectively. Thus, the abnormal return on the announcement day is offset on the effective day. Note that no significant cumulative abnormal return (CAR) is found over the post-event period.

Upward additions experience significant pre-event cumulative gain of 10.72% and 3.06% over the period of [ED-30, ED-11] and [ED-10, ED-7], respectively. Also, there is a significant abnormal return of 0.80% on the announcement day, 2.09% on the effective day, and 3.79% over the period of [AD+1, ED-1]. The long term CAR over the period of [AD, ED+60] is still positive and significant (according to CDA *t*-Test and Sign test).

Pure additions are associated with a significant pre-event cumulative gain of 1.68% over the period of [ED-10, ED-7]. Also, there is a significant abnormal return of 1.19% on the announcement day, 1.73% on the effective day, and 4.46% over the period of [AD+1, ED-1]. However, the long term CAR over the period of [AD, ED+60] is -1.63%.

Table 7 present abnormal returns for three sub-groups of deletion in the FTSE SmallCap index. Given that upward deletions are stocks promoted to the FTSE 250 index, it is not a surprise that they recorded a significant CAR of 11.06% over the pre-event period of [ED-30, ED-11]. The abnormal returns on the announcement and effective day are negative but economically and statistically insignificant. But I find a significant and negative CAR of 1.64% over the period of [AD+1, ED-1]. The long term CAR is 1.10% over the period of [AD, ED+60]. In contrast to the upward deletions, downward deletions recorded significant CARs of -9.05% and -3.62% over the period of [ED-30, ED-11] and [ED-10, ED-7], respectively. Moreover, downward deletions lose 5.75% over the period of [AD+1, ED-1] and 3.18% on the effective day. But the CAR over the period of [AD, ED] offset completely in the post-event period of [ED+1, ED+20].

Table 6: Price Effects for Stocks Added to the FTSE SmallCap Index

Abnormal returns are calculated using the market-adjusted model. Value-weighted FTSE SmallCap Index is used as a proxy for the market return. Panels A, B, and C report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks newly added to the index (pure additions), stocks promoted from the FTSE Fledgling Index (upward additions), and stocks demoted from the FTSE 250 index (downward additions), respectively. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

	Period	CAR	CDA t	sign z	rank z
Panel A	Pure addition to the index (N=187)				
	ED-30,ED-11	1.09%	1.079	4.118***	1.427
	ED-10,ED-7	1.68%	3.722***	5.585***	3.022**
	AD	**1.19%**	**5.241*** **	**7.639*** **	**4.947*** **
	AD+1,ED-1	4.46%	8.817***	9.107***	7.658***
	ED	**1.73%**	**7.631*** **	**6.759*** **	**4.283*** **
	ED+1,ED+10	-2.18%	-3.051**	-2.486*	-3.402***
	ED+11,ED+20	-0.22%	-0.314	-0.431	-1.041
	ED+21,ED+30	-1.93%	-2.704**	-2.926**	-2.240*
	ED+31,ED+60	-4.66%	-3.764***	-1.165	-1.507
	AD,ED+60	**-1.63%**	**-0.882**	**1.476**	**-0.371**
Panel B	Upward addition from the FTSE Fledgling Index (N=196)				
	ED-30,ED-11	10.72%	10.341***	8.308***	3.928***
	ED-10,ED-7	3.06%	6.605***	6.869***	4.392***
	AD	**0.80%**	**3.458*** **	**6.725*** **	**3.446*** **
	AD+1,ED-1	3.79%	7.311***	9.891***	7.303***
	ED	**2.09%**	**9.001*** **	**8.020*** **	**4.921*** **
	ED+1,ED+10	-1.57%	-2.138*	-2.915**	-3.011**
	ED+11,ED+20	0.64%	0.879	0.682	-0.541
	ED+21,ED+30	0.15%	0.202	1.689$	0.129
	ED+31,ED+60	0.30%	0.239	1.257	-1.031
	AD,ED+60	**6.20%**	**3.271** **	**3.704*** **	**1.005**
Panel C	Downward addition from the FTSE 250 Index (N=289)				
	ED-30,ED-11	-12.86%	-9.940***	-7.188***	-8.681***
	ED-10,ED-7	-0.59%	-1.023	-1.168	-1.797$
	AD	**-0.95%**	**-3.278** **	**-3.647*** **	**-3.062** **
	AD+1,ED-1	-1.04%	-1.61	0.72	0.704
	ED	**1.27%**	**4.399*** **	**3.317*** **	**3.278** **
	ED+1,ED+10	1.68%	1.837$	2.608**	2.450*
	ED+11,ED+20	-1.28%	-1.396	0.956	0.275
	ED+21,ED+30	1.27%	1.392	1.074	0.297
	ED+31,ED+60	-2.91%	-1.838$	0.484	-0.99
	AD,ED+60	**-1.95%**	**-0.825**	**2.018***	**0.724**

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 7: Price Effects for Stocks Deleted from the FTSE SmallCap Index

Abnormal returns are calculated using the market-adjusted model. Value-weighted FTSE SmallCap Index is used as a proxy for the market return. Panels A, B, and C report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks deleted from the index (pure deletions), stocks promoted to the FTSE 250 index (upward deletions), and stocks demoted to the FTSE Fledgling Index (downward deletions), respectively. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

	Period	CAR	CDA t	sign z	rank z
Panel A	Pure deletion from the index (N=30)				
	ED-30, ED-11	-3.66%	-1.750$	-0.006	-2.482*
	ED-10, ED-7	-1.23%	-1.316	-1.836$	-2.665**
	AD	**-0.68%**	**-1.458**	**-1.104**	**-1.027**
	AD+1,ED-1	-6.95%	-6.651***	-4.031***	-3.989***
	ED	**-4.03%**	**-8.624*** **	**-2.934****	**-2.948****
	ED+1,ED+10	2.81%	1.901$	-0.006	-0.385
	ED+11,ED+20	-3.86%	-2.612**	-0.372	-2.557*
	ED+21,ED+30	1.22%	0.823	2.190*	1.616
	ED+31,ED+60	-1.05%	-0.409	-0.006	-0.161
	AD,ED+60	**-12.54%**	**-3.279****	**-0.738**	**-2.195***
Panel B	Upward deletion to the FTSE 250 Index (N=203)				
	ED-30, ED-11	11.06%	10.160***	9.053***	6.503***
	ED-10, ED-7	2.00%	4.107***	4.132***	2.467*
	AD	**-0.07%**	**-0.281**	**-1.915$**	**-1.297**
	AD+1,ED-1	-1.64%	-3.016**	-2.899**	-1.896$
	ED	**-0.23%**	**-0.935**	**-1.212**	**-1.232**
	ED+1,ED+10	-0.98%	-1.279	-1.212	-1.671$
	ED+11,ED+20	1.02%	1.328	2.304*	0.271
	ED+21,ED+30	1.26%	1.636	2.444*	-0.636
	ED+31,ED+60	1.74%	1.305	1.741$	0.21
	AD,ED+60	**1.10%**	**0.552**	**1.601**	**-1.473**
Panel C	Downward deletion to the FTSE Fledgling Index (N=299)				
	ED-30, ED-11	-9.05%	-6.232***	-5.257***	-4.673***
	ED-10, ED-7	-3.62%	-5.565***	-3.862***	-3.215**
	AD	**-1.07%**	**-3.301*** **	**-1.886$**	**-1.627**
	AD+1,ED-1	-5.75%	-7.915***	-9.327***	-4.994***
	ED	**-3.18%**	**-9.795*** **	**-4.676*** **	**-3.638*** **
	ED+1,ED+10	7.73%	7.522***	4.742***	1.044
	ED+11,ED+20	2.90%	2.824**	2.068*	1.343
	ED+21,ED+30	1.48%	1.441	2.417*	0.585
	ED+31,ED+60	-0.87%	-0.491	1.603	0.22
	AD,ED+60	**1.23%**	**0.463**	**2.068***	**-0.712**

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 8: Price Effects for Stocks Added to the FTSE SmallCap Index

Abnormal returns are calculated using the market-adjusted model. Value-weighted FTSE All-Share Index is used as a proxy for the market return. Panels A, B, and C report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks newly added to the index (pure additions), stocks promoted from the FTSE Fledgling Index (upward additions), and stocks demoted from the FTSE 250 index (downward additions), respectively. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

	Period	CAR	CDA t	sign z	rank z
Panel A	Pure addition to the index (N=187)				
	ED-30,ED-11	1.67%	1.123	4.573***	1.757$
	ED-10,ED-7	2.31%	3.484***	5.891***	4.079***
	AD	**1.24%**	**3.744*** **	**6.769*** **	**3.918*** **
	AD+1,ED-1	3.83%	5.159***	6.769***	4.588***
	ED	**1.40%**	**4.224*** **	**2.670** **	**1.848$**
	ED+1,ED+10	-2.00%	-1.907$	-2.745**	-2.201*
	ED+11,ED+20	0.54%	0.516	0.036	0.711
	ED+21,ED+30	-2.08%	-1.985*	-2.599**	-1.654$
	ED+31,ED+60	-4.91%	-2.705**	-2.453*	-1.151
	AD,ED+60	-1.98%	-0.731	1.207	-0.027
Panel B	Upward addition from the FTSE Fledgling Index (N=196)				
	ED-30,ED-11	11.82%	7.226***	8.013***	3.072**
	ED-10,ED-7	4.11%	5.622***	7.155***	4.082***
	AD	**0.79%**	**2.167***	**5.867*** **	**2.114***
	AD+1,ED-1	3.18%	3.888***	6.725***	3.252**
	ED	**1.64%**	**4.470*** **	**3.290*** **	**1.804$**
	ED+1,ED+10	-0.26%	-0.223	-1.576	-0.834
	ED+11,ED+20	3.25%	2.809**	3.863***	1.837$
	ED+21,ED+30	-0.28%	-0.244	-0.288	-0.47
	ED+31,ED+60	-0.26%	-0.131	-0.288	-0.954
	AD,ED+60	8.06%	2.690**	3.577***	0.934
Panel C	Downward addition from the FTSE 250 Index (N=289)				
	ED-30,ED-11	-12.72%	-8.363***	-6.762***	-5.900***
	ED-10,ED-7	-0.59%	-0.863	-0.52	-0.852
	AD	**-0.96%**	**-2.820** **	**-3.111** **	**-2.079***
	AD+1,ED-1	-1.57%	-2.063*	-0.873	-0.429
	ED	**1.09%**	**3.204** **	**3.132** **	**2.489***
	ED+1,ED+10	0.85%	0.789	2.425*	0.731
	ED+11,ED+20	-0.43%	-0.4	2.190*	1.328
	ED+21,ED+30	0.93%	0.866	0.187	0.274
	ED+31,ED+60	-2.00%	-1.073	-0.52	-0.223
	AD,ED+60	-2.09%	-0.749	1.601	0.685

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 9: Price Effects for Stocks Deleted from the FTSE SmallCap Index

Abnormal returns are calculated using the market-adjusted model. Value-weighted FTSE All-Share Index is used as a proxy for the market return. Panels A, B, and C report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks deleted from the index (pure deletions), stocks demoted to the FTSE Fledgling Index (downward deletions), and stocks promoted to the FTSE 250 index (upward deletions), respectively. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

	Period	CAR	CDA t	sign z	rank z
Panel A	Pure deletion from the index (N=30)				
	ED-30, ED-11	-2.80%	-0.867	-0.631	-1.001
	ED-10, ED-7	0.41%	0.284	-0.266	0.681
	AD	**-0.92%**	**-1.277**	**-2.092***	**-1.205**
	AD+1,ED-1	-7.75%	-4.798***	-5.014***	-3.701***
	ED	**-4.22%**	**-5.838*****	**-3.553*****	**-3.023****
	ED+1,ED+10	4.98%	2.180*	1.56	1.273
	ED+11,ED+20	-1.03%	-0.45	0.83	0.089
	ED+21,ED+30	0.26%	0.115	1.925$	0.245
	ED+31,ED+60	-0.85%	-0.215	0.83	-0.151
	AD,ED+60	-9.53%	-1.611	-1.361	-1.007
Panel B	Downward deletion to the FTSE Fledgling Index (N=299)				
	ED-30, ED-11	-8.45%	-3.598***	-4.229***	-2.633**
	ED-10, ED-7	-2.85%	-2.719**	-3.534***	-1.342
	AD	**-1.04%**	**-1.984***	**-0.871**	**-1.125**
	AD+1,ED-1	-6.47%	-5.511***	-11.292***	-4.451***
	ED	**-3.64%**	**-6.931*****	**-9.324*****	**-3.694*****
	ED+1,ED+10	8.50%	5.124***	5.150***	1.841$
	ED+11,ED+20	4.39%	2.646**	2.718**	1.598
	ED+21,ED+30	0.84%	0.508	-0.524	0.185
	ED+31,ED+60	-1.56%	-0.543	0.287	-0.144
	AD,ED+60	1.03%	0.24	1.097	-0.501
Panel C	Upward deletion to the FTSE 250 Index (N=203)				
	ED-30, ED-11	10.66%	7.925***	8.616***	3.925***
	ED-10, ED-7	1.94%	3.221**	2.158*	1.504
	AD	**-0.16%**	**-0.539**	**0.473**	**-0.796**
	AD+1,ED-1	-2.15%	-3.197**	-4.440***	-2.231*
	ED	**-0.31%**	**-1.018**	**-3.036****	**-1.901$**
	ED+1,ED+10	-1.61%	-1.693$	-3.036**	-2.441*
	ED+11,ED+20	2.32%	2.440*	3.703***	1.53
	ED+21,ED+30	0.87%	0.915	1.597	-0.42
	ED+31,ED+60	3.17%	1.921$	3.141**	1.108
	AD,ED+60	2.13%	0.864	1.597	-0.712

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

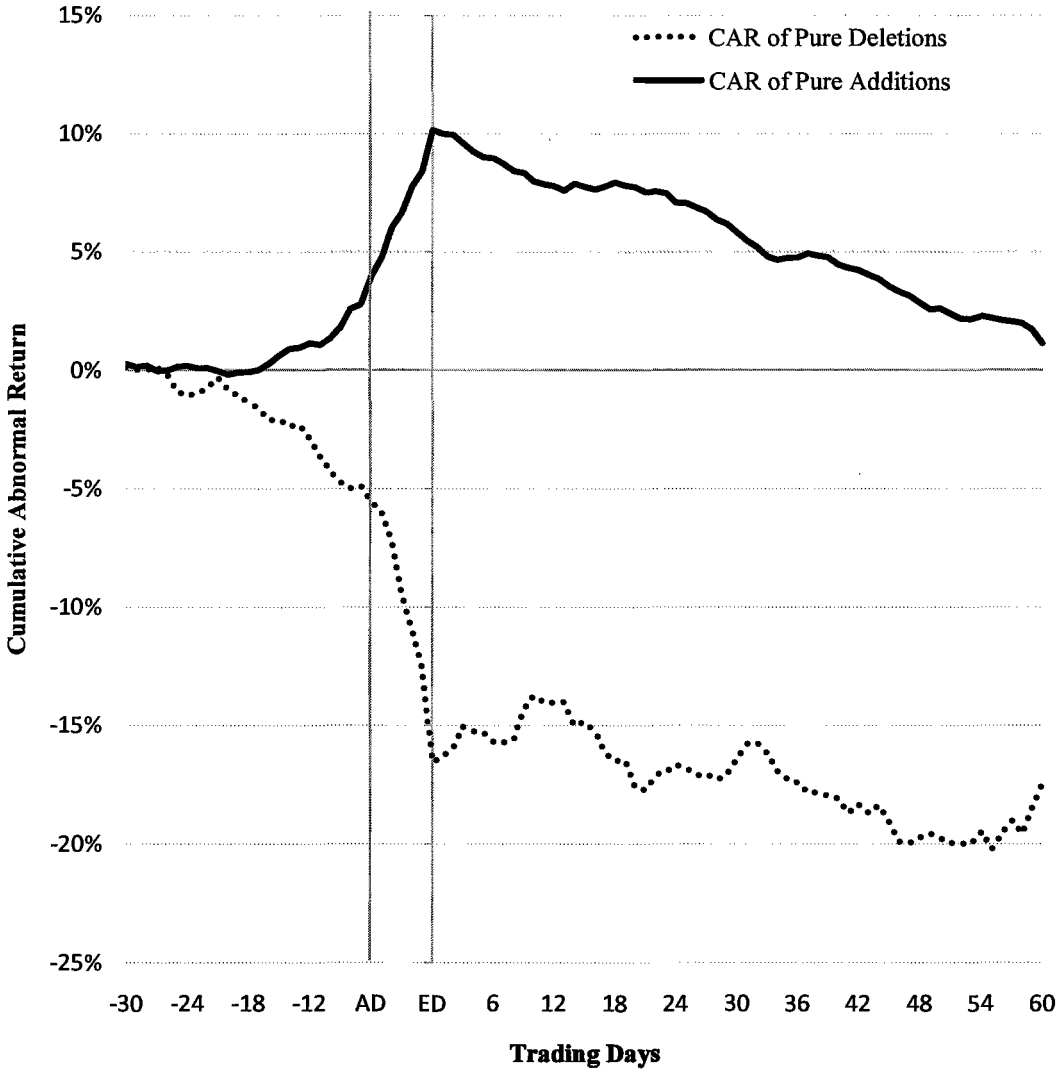

Figure 1: Cumulative abnormal returns for pure additions and deletions in the FTSE SmallCap Index over the period of [ED-30, ED+60]. The trading day ED is the effective day and the trading day AD is the announcement day.

Consequently, the long term CAR over the period of [AD, ED+60] is slightly above zero. Pure deletions do not experience any significant abnormal price changes until the day after the announcement day. I find a loss of 6.95% for pure deletions over the period [AD+1, ED-1]. Moreover, another loss of 4.03% is recorded for pure deletions on the effective day. But the negative abnormal return on the effective day is offset in ten days.

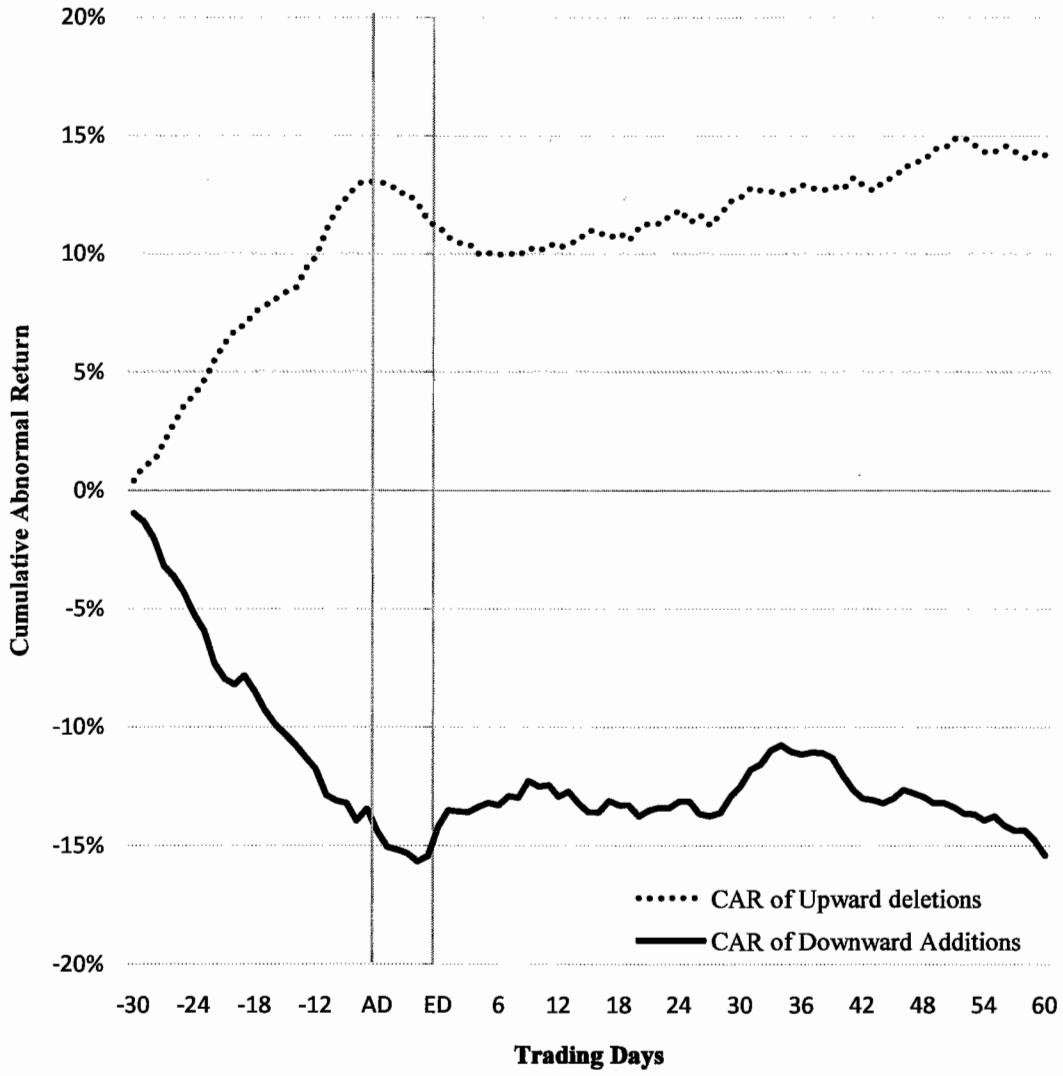

Figure 2: Cumulative abnormal returns for downward additions and upward deletions in the FTSE SmallCap Index over the period of [ED-30, ED+60]. The trading day ED is the effective day and the trading day AD is the announcement day.

I also find that there is not any significant abnormal price change during the post- event period.

Figure 1 plots the CARs for pure additions and deletions from ED-30 to ED+60. The graph shows that there is an upward (downward) trend starting from ED-18 for pure additions (pure deletions). There is a very small reversal for both sub-groups on ED+1.

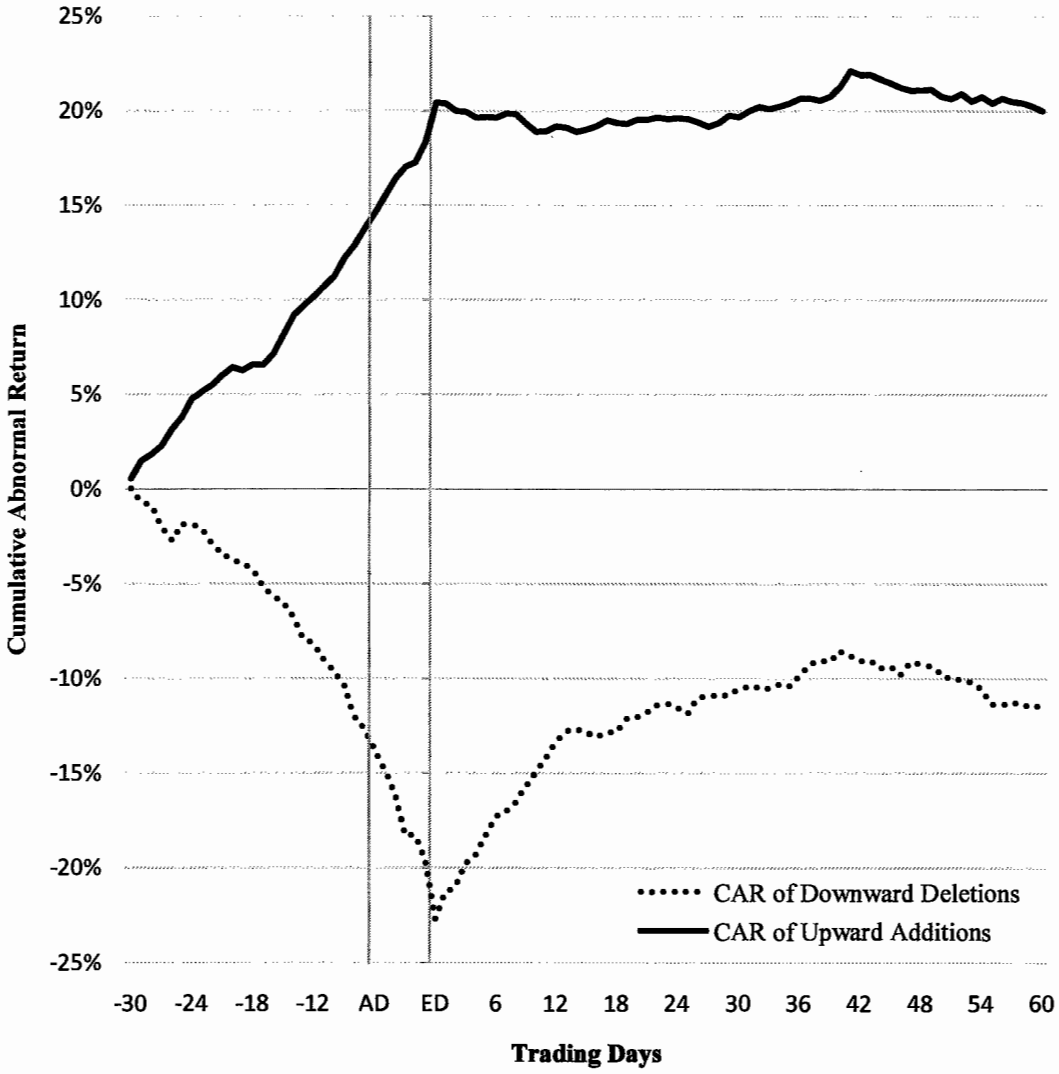

Figure 3: Cumulative abnormal returns for upward additions and downward deletions in the FTSE SmallCap Index over the period of [ED-30, ED+60]. The trading day ED is the effective day and the trading day AD is the announcement day.

The price, however, reverts completely after ED+60 for pure additions only. Figure 2 plots the CARs for downward additions and upward deletions. These two sub-groups are the shifts between the FTSE SmallCap and FTSE Fledgling indices. The graph shows that the upward (downward) trend starting from ED-30 for upward deletions (downward

additions). There is a short-lived reversal on the announcement day (effective day) for upward deletions (downward additions). Visually, it is obvious that the price reversal is temporary. Figure 3 plots the CARs for upward additions and downward deletions. These two sub-groups are the shifts between the FTSE 250 and FTSE SmallCap indices. The graph shows that the upward (downward) trend starting from ED-30 for upward additions (downward deletions) and that there is a price reversal on ED+1. Visually, it is obvious that the price reversal for upward additions is much smaller than the price reversal for downward deletions.

Based on the abnormal return analysis, it is obvious that all sub-groups experience pre-event trends. In addition, because the price reversal is temporary, except pure additions, and part of the change in price seems to be permanent by visual observation, I must test this conclusion and identify the factors, which cause the permanent increase in stock price.

4.1.2 The Canadian Sample

In this section, I perform abnormal return analysis for addition to and deletion from the S&P/TSX SmallCap Index. I calculate abnormal returns from the market adjusted and market models for firms added to or deleted from the S&P/TSX SmallCap index.

Under the market model, the expected return for each stock j on day t is given by:

$$E(R_{j,t}) = \alpha_j + \beta_j R_{m,t} + \varepsilon_{j,t}. \tag{4}$$

Consequently, the abnormal return for each stock j on day t is give by:

$$AR_{j,t} = R_{j,t} - (\alpha_j + \beta_j R_{m,t}), \tag{5}$$

where $R_{j,t}$ and $R_{m,t}$ are defined as above. This market model is estimated over a 180-day long estimation window. The effective day (ED) is the last trading day before the actual changes takes place and the announcement day (AD) is the first trading day after the day on which Standard and Poor's releases the change to the public. Unlike my UK sample, the number of days between the announcement and effective days varies for different events. Consequently, the event window [AD-30, ED+60] does not have a fixed length. The market model estimates are estimated over a post-event period of [ED+61, ED+240].

Similar to my UK sample, the crude dependence adjusted t-test, sign test, and rank test are used to test for the significance. For robustness checks, I use returns on both CFMRC daily equally-weighted and value-weighted index as the market return proxies[22]. This is because a value-weighted index tends to assign more weights on large-cap stocks, but my samples consist of only small-cap stocks. Nevertheless, the results using either CFMRC daily equally-weighted or value-weighted index are qualitatively the same.

Table 10 and Table 11 present abnormal returns for additions and deletions in the S&P/TSX SmallCap index, respectively. As shown in these two tables, it is not a surprise that pure additions and promotions result in a positive effect on the stock price while pure deletions and demotions results in a negative effect on the stock price.

Specifically, in Panel A of Table 10, pure additions experience a significant gain of 2% on the announcement day and additional 2.12% on the effective day (significant at 0.1% level according to the crude dependent adjusted *t*-Test). There is a sign of price reversal as the cumulative abnormal return (CAR) over the period of [AD, ED+10] declines from 2.11% to -0.91% when extending this period to [AD, ED+60]. In contrast, downward additions experience significant loss on the announcement day (-3.7%) and effective day (-4.79%). Note that the only positive CAR for downward additions appears over the period of [AD, ED+10]. Also, the price is volatile as the price loses more than 6% from the period of [AD, ED+10] to [AD, ED+20] and gains more than 9% from the period of [AD, ED+50] to [AD, ED+60]. For the same two sub-groups of additions in S&P/TSX SmallCap index, the results under the market model, using a 180-day long post-event estimation window, are shown in Panel B of Table 10. The results are consistent with those described above except that, for pure additions, the price reverted completely at the end of event window [AD, ED+40], but then starts to increase. Figure 4 plots the CAR for pure additions and deletions over the period of [AD-30, ED+60]. The announcement period, the period of [AD, ED], is compressed into one day and the abnormal returns over this period are compounded together. As shown in the graph, the announcement period CAR reverts slowly for pure additions while it reverts quickly for pure deletions.

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[22] In my abnormal return analysis for the UK sample, I use the FTSE SmallCap index for the market proxy in order to control for the size factor. However, the data for S&P/TSX SmallCap index on CFMRC database is only available after June 1st, 2002 while my sample period starts in May 1999.

Table 10: Price Effects for Stocks Added to the S&P/TSX SmallCap Index

Panels A and B report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks newly added to the index (pure additions) and stocks demoted from the S&P/TSX MidCap index (downward additions), respectively. Abnormal returns are calculated using the market-adjusted model (shown in Panel A) and market model (shown in Panel B). CFMRC daily value-weighted index is used as a proxy for the market return. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

Panel A *MAR*	Period	CAR	CDA t	sign z	rank z
	Pure additions (N=310)				
	[AD-30,AD-11]	6.95%	5.323***	7.248***	3.168**
	[AD-10,AD-1]	4.69%	5.085***	7.021***	4.070***
	AD	**2.00%**	**6.851*** **	**6.990*** **	**4.256*** **
	[AD+1,ED-1]#	1.12%	1.431	3.553***	-0.297
	ED	**2.12%**	**6.460*** **	**1.785$**	**1.401**
	[ED+1,ED+10]	-1.58%	-1.522	-3.900***	-1.536
	[ED+11,ED+20]	-1.82%	-1.750$	-1.512	-1.227
	[ED+21,ED+30]	-1.17%	-1.125	-2.536*	-1.135
	CARs starting from AD of Pure additions				
	[AD,ED+10]	2.11%	1.611	-0.712	0.843
	[AD,ED+20]	0.25%	0.147	-1.806$	-0.816
	[AD,ED+30]	-0.76%	-0.377	-0.531	-1.024
	[AD,ED+40]	-0.80%	-0.33	-0.426	0.771
	[AD,ED+50]	-0.32%	-0.121	0.146	-0.302
	[AD,ED+60]	-0.91%	-0.309	-0.51	0.299
	Downward additions (N=25)				
	[AD-30,AD-11]	-20.26%	-2.087*	-0.845	-1.108
	[AD-10,AD-1]	-0.47%	-0.068	1.57	1.069
	AD	**-3.70%**	**-1.705$**	**-1.248**	**-1.684$**
	[AD+1,ED-1]#	-7.70%	-0.612	-0.005	-0.432
	ED	**-4.79%**	**-2.238***	**-2.875** **	**-3.182** **
	[ED+1,ED+10]	1.29%	0.191	0.747	0.512
	[ED+11,ED+20]	-6.18%	-0.913	-0.058	-1.657$
	[ED+21,ED+30]	-3.24%	-0.478	0.747	-0.585
	CARs starting from AD for Downward additions				
	[AD,ED+10]	-6.83%	-0.862	-0.11	-1.378
	[AD,ED+20]	-13.45%	-1.277	-0.536	-1.146
	[AD,ED+30]	-16.69%	-1.327	-0.134	-0.684
	[AD,ED+40]	-17.13%	-1.192	-0.14	-0.426
	[AD,ED+50]	-19.97%	-1.247	1.055	-0.854
	[AD,ED+60]	-10.73%	-0.617	0.678	0.042

Table 10 ***(continued)***

Panel B	Period	CAR	CDA t	sign z	rank z
MM		Pure addition (N=310)			
	[AD-30,AD-11]	7.84%	5.969***	7.285***	3.211**
	[AD-10,AD-1]	4.87%	5.251***	7.740***	3.762***
	AD	**2.10%**	**7.156*** **	**7.029*** **	**4.231*** **
	[AD+1,ED-1]#	1.21%	1.604	2.955**	0.358
	ED	**2.13%**	**6.612*** **	**2.186***	**1.45**
	[ED+1,ED+10]	-1.26%	-1.238	-2.475*	-1.634
	[ED+11,ED+20]	-1.24%	-1.22	-0.883	-1.146
	[ED+21,ED+30]	-0.64%	-0.632	-2.020*	-1.027
		CARs starting from AD			
	[AD,ED+10]	2.60%	2.033*	0.416	1.149
	[AD,ED+20]	1.08%	0.648	0.244	-0.407
	[AD,ED+30]	2.09%	1.043	-0.416	-1.241
	[AD,ED+40]	0.65%	0.275	-0.665	-0.011
	[AD,ED+50]	2.44%	0.932	1.981*	0.056
	[AD,ED+60]	2.17%	0.753	0.773	0.539
		Downward addition (N=25)			
	[AD-30,AD-11]	-17.34%	-1.794$	-0.864	-0.574
	[AD-10,AD-1]	-0.48%	-0.071	1.55	1.038
	AD	**-4.60%**	**-2.130***	**-0.864**	**-1.596**
	[AD+1,ED-1]#	-8.34%	-0.669	0.584	-0.051
	ED	**-4.64%**	**-2.181***	**-2.893** **	**-3.177** **
	[ED+1,ED+10]	1.92%	0.285	0.727	0.426
	[ED+11,ED+20]	-5.43%	-0.808	-0.077	-1.445
	[ED+21,ED+30]	-0.70%	-0.104	0.325	-0.26
		CARs starting from AD			
	[AD,ED+10]	-7.84%	-0.996	1.153	-1.116
	[AD,ED+20]	-13.95%	-1.327	-0.496	-0.797
	[AD,ED+30]	-16.63%	-1.32	0.273	-0.036
	[AD,ED+40]	-18.19%	-1.265	0.262	-0.135
	[AD,ED+50]	-20.43%	-1.276	1.108	-0.397
	[AD,ED+60]	-11.46%	-0.66	0.33	0.246

#The CAR over period of [AD+1, ED-1] is computed only when there is at least one trading day between the announcement day and effective day. The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 11: Price Effects for Stocks Deleted from the S&P/TSX SmallCap Index

Panels A and B report abnormal returns for the announcement day (AD), effective day (ED), and the cumulative abnormal returns (CAR) for stocks deleted from the index (pure deletions) and stocks promoted to the S&P/TSX MidCap index (upward deletions), respectively. Abnormal returns are calculated using the market-adjusted model (shown in Panel A) and market model (shown in Panel B). CFMRC daily value-weighted index is used as a proxy for the market return. Three test statistics (*t*-test with CDA, generalized sign test, and rank test) are reported.

Panel A MAR	Period	CAR	CDA t	sign z	rank z
	Pure deletions (N=179)				
	[AD-30,AD-11]	-10.67%	-4.401***	-3.757***	-3.806***
	[AD-10,AD-1]	-4.23%	-2.468*	-2.409*	-3.192**
	AD	**-2.68%**	**-4.947*** **	**-4.748*** **	**-5.136*** **
	[AD+1,ED-1]#	-1.65%	-1.415	-1.433	-1.136
	ED	**-3.26%**	**-6.288*** **	**-3.775*** **	**-3.510*** **
	[ED+1,ED+10]	6.71%	4.094***	4.576***	2.782**
	[ED+11,ED+20]	2.01%	1.228	2.773**	1.722$
	[ED+21,ED+30]	2.41%	1.469	-0.23	0.369
	CARs starting from AD for Pure deletions				
	[AD,ED+10]	-0.11%	-0.054	-0.414	0.081
	[AD,ED+20]	1.66%	0.618	1.934$	0.765
	[AD,ED+30]	3.92%	1.238	2.402*	-0.764
	[AD,ED+40]	3.16%	0.867	1.837$	-0.082
	[AD,ED+50]	5.83%	1.442	3.106**	-0.314
	[AD,ED+60]	4.87%	1.073	1.831$	0.096
	Upward deletions (N=72)				
	[AD-30,AD-11]	0.17%	0.115	0.486	1.16
	[AD-10,AD-1]	-1.36%	-1.261	-0.929	-1.768$
	AD	**0.16%**	**0.46**	**2.137***	**1.313**
	[AD+1,ED-1]#	-0.38%	-0.32	0.763	-0.428
	ED	**0.04%**	**0.114**	**1.666$**	**0.858**
	[ED+1,ED+10]	0.15%	0.136	0.723	-0.917
	[ED+11,ED+20]	0.15%	0.135	0.723	0.851
	[ED+21,ED+30]	-0.58%	-0.528	0.959	-0.35
	CARs starting from AD for Upward deletions				
	[AD,ED+10]	0.12%	0.102	0.508	-0.779
	[AD,ED+20]	0.27%	0.169	-0.406	-0.102
	[AD,ED+30]	-0.31%	-0.163	-0.191	-1.328
	[AD,ED+40]	0.41%	0.185	0.757	-0.751
	[AD,ED+50]	-0.24%	-0.095	0.77	0.625
	[AD,ED+60]	-0.83%	-0.293	-0.11	0.243

Table 11 ***(continued)***

Panel B	Period	CAR	CDA t	sign z	rank z
MM			Pure deletions (N=179)		
	[AD-30,AD-11]	-10.19%	-4.352***	-2.806**	-3.585***
	[AD-10,AD-1]	-4.15%	-2.506*	-3.256**	-3.373***
	AD	**-2.62%**	**-5.010*** **	**-5.000*** **	**-5.419*** **
	[AD+1,ED-1][#]	-2.35%	-2.127*	-0.52	-0.673
	ED	**-4.23%**	**-8.563*** **	**-2.689** **	**-3.571*** **
	[ED+1,ED+10]	6.83%	4.378***	4.774***	2.990**
	[ED+11,ED+20]	-2.67%	-1.710$	2.216*	1.232
	[ED+21,ED+30]	-0.60%	-0.387	-0.493	0.545
			CARs starting from AD for Pure deletions		
	[AD,ED+10]	-1.20%	-0.583	0.618	0.595
	[AD,ED+20]	-1.54%	-0.59	1.562	0.954
	[AD,ED+30]	2.10%	0.68	3.079**	-0.868
	[AD,ED+40]	-1.44%	-0.408	2.624**	-0.908
	[AD,ED+50]	3.23%	0.82	2.909**	-0.314
	[AD,ED+60]	1.34%	0.305	2.265*	-0.319
			Upward deletions (N=72)		
	[AD-30,AD-11]	-0.09%	-0.06	0.528	0.647
	[AD-10,AD-1]	-0.88%	-0.828	0.056	-1.334
	AD	**0.17%**	**0.495**	**1.471**	**1.297**
	[AD+1,ED-1][#]	-0.29%	-0.256	0.284	-0.51
	ED	**0.11%**	**0.31**	**1.227**	**1.032**
	[ED+1,ED+10]	0.11%	0.098	-0.423	-0.708
	[ED+11,ED+20]	-0.10%	-0.095	0.52	0.713
	[ED+21,ED+30]	-0.42%	-0.391	0.52	0.031
			CARs starting from AD for Upward deletions		
	[AD,ED+10]	0.15%	0.134	0.584	-0.7
	[AD,ED+20]	0.37%	0.239	0.851	-0.324
	[AD,ED+30]	-0.34%	-0.181	-0.063	-0.525
	[AD,ED+40]	0.52%	0.24	0.635	-0.581
	[AD,ED+50]	-0.33%	-0.136	0.394	0.917
	[AD,ED+60]	0.12%	0.045	-0.292	0.284

[#]The CAR over period of [AD+1, ED-1] is computed only when there is at least one trading day between the announcement day and effective day. The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

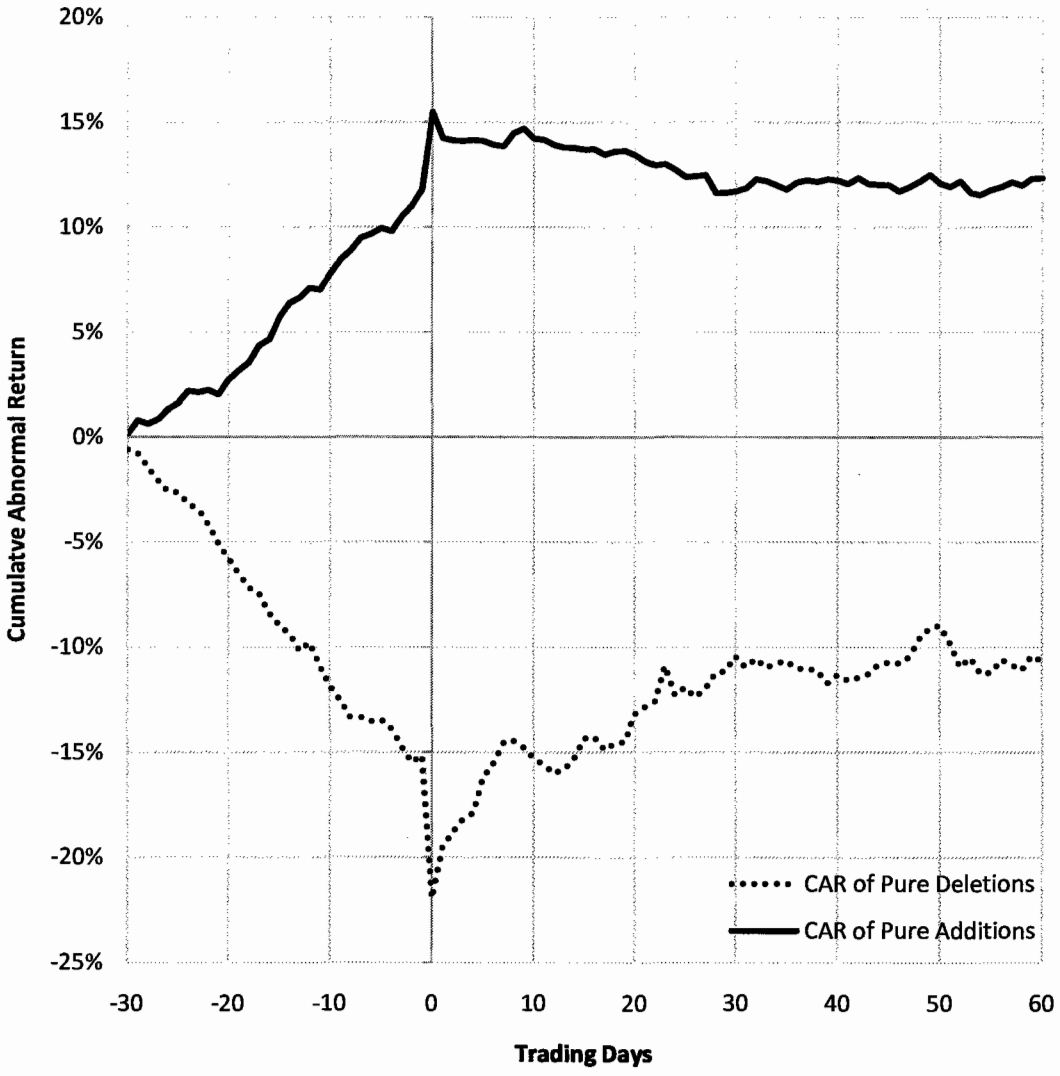

Figure 4: Cumulative abnormal returns for pure additions and deletions in the S&P/TSX SmallCap index over the period of [AD-30, ED+60]. The period of [AD, ED] is compressed into the day zero.

Results for deletions in S&P/TSX SmallCap index under market adjusted model are shown in Panel A of Table 11. Pure deletions experience significant losses of 2.68% on the announcement day and of 3.26% on the effective day, respectively. There is an obvious sign of price reversal as the CAR is close to zero over the period of [AD, ED+10] and becomes even more positive over the period of [AD, ED+60].

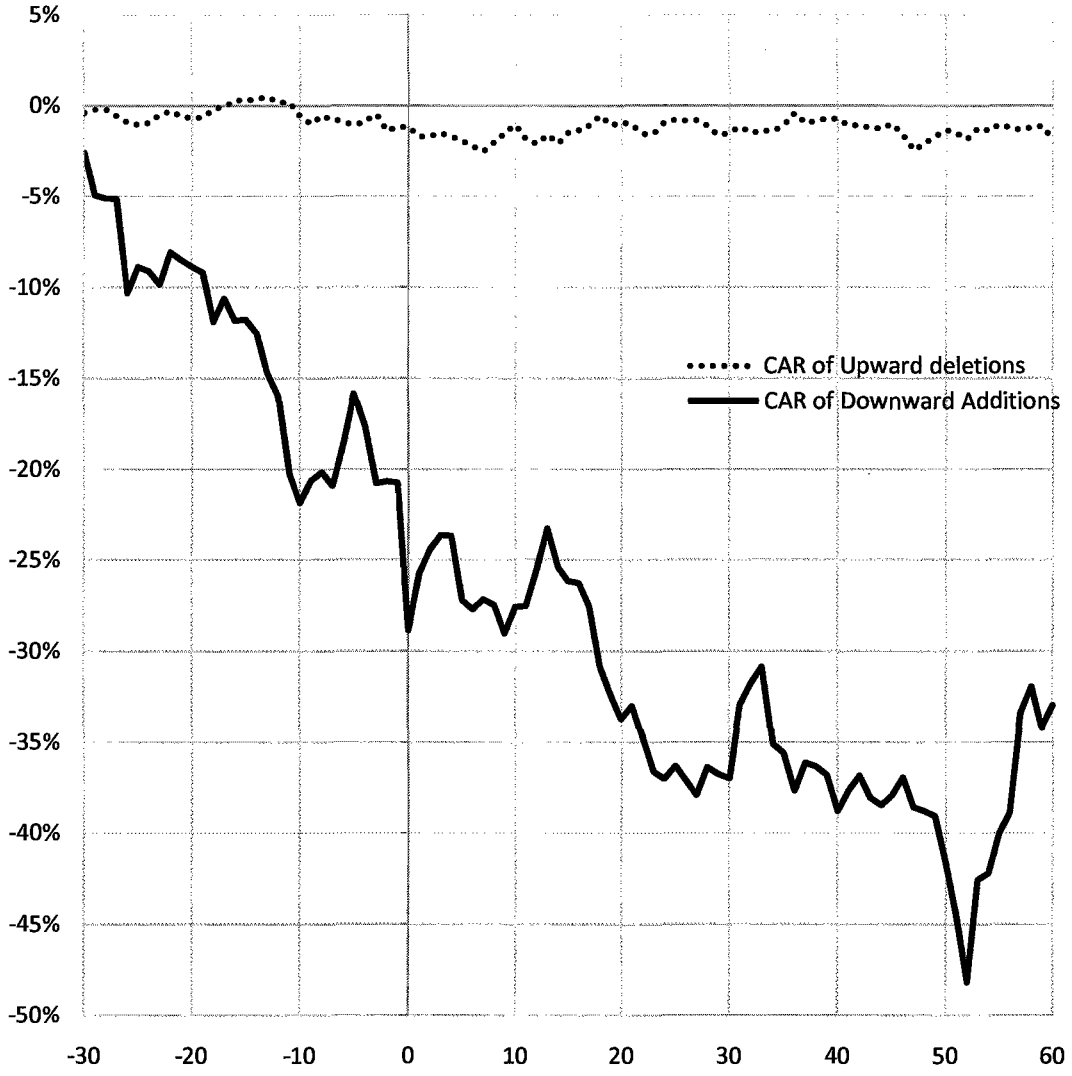

Figure 5: Cumulative abnormal returns for downward additions and upward deletions in the S&P/TSX SmallCap index over the period of [AD-30, ED+60]. The period of [AD, ED] is compressed into the day zero.

For upward additions, there is not much evidence since the abnormal returns are economically and statistically insignificant. In Panel B of Table 11, results from the market model, using 180-day long post-event estimations are consistent with what I described above. Figure 5 plots the CAR for downward additions and upward deletions

over the period of [AD-30, ED+60]. Similar to Figure 4, the announcement period, the period of [AD, ED], is compressed into one day and the abnormal returns over this period are compounded together. As shown in graph, changes in CAR of upward deletions are not obvious during the period of [AD-30, ED+60], but those of downward additions are volatile. Note that there is a quick reversal after the announcement period for downward additions.

4.2 Trading Volume Analysis

To evaluate the finding in abnormal return analysis, I examine the trading volume changes around index changes by following Biktimirov, Cowan, and Jordan's (2004) strategy, which is similar to those in Campbell and Wasley (1996). The first step is to calculate the trading volume measurement as the percentage of outstanding shares traded on day t for stock j:

$$V_{j,t} = \frac{VOL_{j,t} \times 100}{NOSH_{j,t}}, \tag{6}$$

where $VOL_{j,t}$ is the number of shares traded for stock j on day t adjusted for capital changes, and $NOSH_{j,t}$ is the firm's total number of shares outstanding[23] on day t. Rather than using this raw data, I apply the nature logarithm transformation and add a small number, 0.000255, to prevent taking the logarithm of zero[24]. Therefore, the natural logarithm transformed percentage of shares outstanding is given by:

$$V_{i,t} = \ln\left(\frac{VOL_{j,t} \times 100}{NOSH_{j,t}} + 0.000255\right), \tag{7}$$

where $VOL_{j,t}$ and $NOSH_{j,t}$ are defined as in equation (6). Next, I use the market model approach to estimate expected trading volume. Thus, the market model abnormal trading volume is given by:

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[23] Datastream defines the variable VOL as "the number of shares traded for a stock on a particular day adjusted for capital changes." Datastream defines the variable NOSH as "the total number of ordinary shares that represent the capital of the company."

[24] See Ajinkya and Jain (1989) and Cready and Romana (1991) show the importance of log transformation of the volume data to approximate a normal distribution. As in Cready and Ramanan (1991), they add 0.000255 to the daily percentage of shares outstanding to accommodate zero volume

$$AV_{j,t} = V_{j,t} - (\alpha_j + \beta_j V_{m,t}), \tag{8}$$

where α_j and β_j are ordinary least squares (OLS) estimates estimate over a 180-trading-day estimation window.

The market volume measure for a day t is given by:

$$V_{m,t} = \frac{1}{N_t}\sum_{i=1}^{N_t} V_{i,t}, \tag{9}$$

where N_t is the number of stocks in the market index proxy on day t.

4.2.1 The UK Sample

I use the FTSE All-Share index as the market index proxy. Given that the composition of the index changes from one year to another, I calculate each year's daily market volume measure using January's constituent list[25] for that year from 1998 to 2009.

For robustness checks, I use different test statistics and estimation periods. I use both a parametric t-test and a non-parametric rank test, both test statistics are reported. I notice that the standard t-test gives significant results to large number of days because the underlying data is not close to the normal distribution. In addition, Campbell and Wasley (1996) find that the non-parametric rank test is always more powerful in detecting abnormal trading volume than the parametric test. Therefore, my discussion about the abnormal trading volume results is based on the rank test[26].

I use both the pre-event estimation window, which runs for 180 trading days from ED-210 to ED-31, and post-event estimation, which runs for 180 trading days from ED+61 to ED+240. The results using different estimation windows are qualitatively the same. Therefore, to be consistent with the volume event study method in Lynch and Mendenhall (1997), Biktimirov, Cowan, and Jordan (2004), and Mase (2007), I discuss the results based on the pre-event estimation window.

[25] For example, January 1998's constituent list (Datastream constituent list variable LFTALLSH0198) is used for the year 1998

[26] Results using either rank test or standard t-test are qualitatively similar.

It is critical to estimate the normal daily trading volume correctly. The normal return is defined as the expected return without the event taking place. It is important to eliminate any overlaps and infrequently traded stocks to prevent them influencing the parameter estimates. Therefore, I applied two screens to the sample. The first screen removes stocks for which the estimation period overlapped with another index change. The second removes stocks having more than 100 non-trading days in the 180-day estimation period. These two screens are applied to both estimation windows. Stocks must have no more than 100 non-trading days and have no overlap in the 180 days period of [ED-210, ED-31] to be included in the analysis when using the pre-event estimation window. Similarly, Stocks must have no more than 100 non-trading days and have no overlap in the 180 days period of [ED+61, ED+240] to be included in the analysis when using the post-event estimation window.

Table 12 and Table 13 report the percentage abnormal trading volume for additions and deletions in the FTSE SmallCap index using pre-event estimation window, respectively. Table 14 and Table 15 report abnormal trading volume for additions and deletions in FTSE SmallCap index using post-event estimation window, respectively. As shown in those four tables, additions and deletions in the FTSE SmallCap index experience significant increase in trading volume on the effective day. Trading volume peaks on the effective day and then returns to normal. In additions, using a different estimation window does not affect the major conclusion.

In Table 12 and Table 13, the abnormal trading volume on the effective day ranges from 115% significantly higher than normal daily trading volume for downward additions to 276% significantly higher than normal daily trading volume for pure deletions. For pure additions and upward additions, significant abnormal trading volume starts on AD+1 and remains significant over the period of [AD+1, ED]. The percentage abnormal trading volumes increase from the 144% on ED-5 to 254% on the effective day for pure additions. Similarly, the percentage abnormal trading volumes increase from 120% on ED-5 to 242% on the effective day for pure additions. Trading volume is much higher than normal over the period of [AD+1, ED]. Consequently, the mean CARs for the same period are 5.23% and 4.82%, which are both economically and statistically significant, for pure additions and upward additions, respectively.

In contrast, significant abnormal trading volume starts on ED-1 and the percentage abnormal trading volumes peak at 115% on the effective day for downward additions. This number is about 140% lower than those of pure and upward additions. It is consistent with the abnormal return analysis that downward additions experience relative small price reactions around the effective day when compare to those of pure and upward additions. Finally, the significant abnormal trading volume continues until ED+1 for all three subsets of index additions.

For pure deletions, significant abnormal trading volumes over period [ED-3, ED+1] remain above 211% for all five trading days and peak at 276% on the effective day. This confirms the economically and statistically significant abnormal returns of pure deletions for the same period. For downward deletions, significant abnormal trading volume starts on ED-4 and continues until ED+8. The largest percentage abnormal trading volume of 259% is associated with a significant abnormal return of -3.64% on the effective day. Finally, significant abnormal trading volumes start on the effective day and remains in the following two trading days for upward deletions. Despite that, on the effective day, the percentage abnormal trading volume is significant, but the abnormal return is economically and statistically insignificant[27].

Figure 6 and Figure 7 plot the daily abnormal trading volume for the index additions and deletions, respectively, using pre-event estimation window. It is not a surprise that, for all changes, the peak of the daily abnormal trading volume histogram happens on the effective day, and then this peak returns to normal after the event. Note that downward additions seem to experience a permanent decrease in daily trading volume based on the daily abnormal trading volume histogram. In contrast, upward deletions seem to experience a permanent increase in daily trading volume based on the daily abnormal trading volume histogram.

[27] The "crude dependent" adjusted t statistic is insignificant result and tank z statistic is only significant at 10% level on the effective day.

Table 12: Abnormal Trading Volume of Additions in the FTSE SmallCap Index Using Pre-event Estimation Window

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market index is the value-weighted FTSE All Share Index and parameters are estimated over a pre-event period of 180 days (ED-210, ED-31).

	Pure additions (N=108)			Downward additions (N=212)			Upward additions (N=186)		
Day	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t
AD-24	0.314	-0.081	1.884	0.277	1.414	3.810***	0.304	-0.150	2.472*
AD-20	-0.088	-1.363	-0.538	0.120	0.556	1.503	0.593	1.049	5.041***
AD-15	0.388	-0.160	2.418*	0.151	1.322	1.741	0.474	0.557	3.951***
AD-10	0.424	-0.047	2.556*	0.135	0.443	1.448	0.333	0.217	2.954**
AD-5	0.565	0.069	3.028**	0.237	0.954	2.792**	0.443	0.510	3.517***
AD-4	0.483	-0.108	2.575*	0.200	0.719	2.457*	0.462	0.401	4.030***
AD-3	0.565	0.054	3.254**	0.188	0.486	2.180*	0.884	1.819	7.866***
AD-2	0.484	0.047	2.691**	0.253	0.864	3.000**	0.668	0.912	5.081***
AD-1	0.558	0.139	3.497***	0.202	0.956	2.376*	0.603	0.926	5.163***
AD	1.314	1.770	7.495***	0.292	1.422	3.385***	0.994	2.168*	8.861***
ED-5	1.439	2.326*	8.699***	0.399	1.957	5.202***	1.205	1.989*	11.114***
ED-4	1.560	2.316*	9.517***	0.245	1.454	3.107**	1.267	2.749**	11.582***
ED-3	1.715	2.983**	11.062***	0.358	2.312*	4.461***	1.482	2.908**	13.714***
ED-2	1.992	3.337***	12.864***	0.259	1.731	3.443***	1.535	3.672***	15.351***
ED-1	2.189	3.710***	15.574***	0.463	2.690**	6.057***	1.617	3.875***	16.427***
ED	2.541	4.404***	19.907***	1.155	7.419***	18.528***	2.417	4.041***	27.875***
ED+1	1.353	2.318*	8.118***	0.408	2.706**	5.309***	0.916	6.087***	7.465***
ED+2	1.135	1.641	6.126***	0.396	1.861	4.584***	0.762	1.644	5.391***
ED+3	0.781	1.158	3.993***	0.319	1.528	3.626***	0.507	0.803	3.266**
ED+4	0.692	0.887	3.364**	0.222	0.955	2.755**	0.496	0.664	3.163**

Table 12 ***(continued)***

ED+5	0.527	0.787	1.696	0.241	1.139	2.527*	0.088	0.561	0.374
ED+6	0.528	0.826	1.850	0.060	-0.346	0.672	0.180	0.219	1.032
ED+7	0.851	1.168	2.826**	0.104	0.507	1.178	0.110	0.529	0.556
ED+8	0.633	0.336	3.361*	0.121	0.769	1.289	0.672	1.229	5.015***
ED+9	0.765	0.485	4.131***	0.250	1.155	3.312**	0.618	1.085	4.767***
ED+10	1.076	1.263	6.580***	0.299	1.048	3.519***	0.737	1.157	6.762***
ED+15	0.795	0.778	4.090***	0.182	0.281	2.203*	0.610	1.042	5.799***
ED+20	0.748	0.665	4.223***	0.141	0.013	1.689	0.278	0.078	2.303*
ED+25	0.796	0.861	4.242***	0.015	-0.255	0.182	0.350	0.065	3.192**
ED+30	0.351	-0.209	2.013*	-0.012	-0.320	-0.128	0.242	-0.321	1.977*
ED+40	0.408	-0.393	2.358*	-0.009	-0.533	-0.104	0.404	-0.032	3.108**
ED+50	0.229	-0.673	1.526	-0.115	-1.656	-1.239	0.157	-0.617	1.267
ED+60	0.274	-0.502	1.345	-0.227	-2.297	-2.676	0.296	-0.139	2.068*

The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test.

Table 13: Abnormal Trading Volume of Deletions in the FTSE SmallCap Index Using Pre-event Estimation Window

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market index is the value-weighted FTSE All Share Index and parameters are estimated over a pre-event period of 180 days (ED-210, ED-31).

	Pure deletions (N=28)			Downward deletions (N=277)			Upward deletions (N=134)		
Day	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t
AD-24	0.590	-0.016	1.596	0.312	-0.011	2.841***	0.190	0.422	1.554
AD-20	0.232	-0.496	0.533	0.157	-0.312	1.454	0.259	0.544	1.868
AD-15	-0.107	-0.949	-0.296	0.250	-0.043	2.227**	0.101	-0.108	0.741
AD-10	0.345	-0.379	0.820	0.276	-0.045	2.487*	0.113	-0.205	0.779
AD-5	0.648	-0.067	1.765	0.303	0.070	2.944**	0.326	0.691	2.871**
AD-4	0.703	0.105	1.785	0.391	0.318	3.920***	0.344	0.778	3.102**
AD-3	0.433	-0.321	1.096	0.539	0.778	5.419***	0.345	0.525	3.003**
AD-2	0.034	-0.648	0.130	0.399	0.407	3.738***	0.299	0.416	2.847**
AD-1	0.006	-0.940	0.020	0.288	0.201	2.646**	0.336	0.549	2.916**
AD	1.036	0.645	2.695*	0.696	1.168	6.008***	0.644	1.746	5.285***
ED-5	0.726	0.092	1.601	0.915	1.591	8.977***	0.335	0.526	2.950**
ED-4	1.416	1.227	3.423***	1.225	2.636**	12.731***	0.384	0.946	3.468***
ED-3	2.111	2.335*	7.069***	1.226	2.655**	13.675***	0.549	1.405	4.954***
ED-2	2.655	2.388*	6.905***	1.379	2.926**	14.467***	0.609	1.723	5.999***
ED-1	2.629	2.536*	6.934***	1.440	3.169**	15.454***	0.577	1.692	5.478***
ED	2.764	2.843**	8.401***	2.586	5.803***	35.135***	1.549	5.516***	18.062***
ED+1	2.329	2.110*	5.441***	2.054	4.130***	17.947***	0.950	3.157**	9.112***
ED+2	1.969	1.871	5.334***	1.449	2.906**	12.003***	0.791	2.318*	6.974***
ED+3	1.504	1.433	3.634**	1.545	3.020**	12.421***	0.530	0.081	3.735***
ED+4	0.683	0.003	1.345	1.776	3.168**	11.627***	0.470	0.161	3.835***

Table 13 ***(continued)***

ED+5	1.870	1.387	3.541**	1.625	2.842**	10.690***	0.567	0.061	3.827***
ED+6	1.955	1.544	3.767**	1.351	2.468*	8.883***	0.477	0.108	3.477***
ED+7	1.588	0.952	3.839***	1.248	2.357*	10.128***	0.474	0.183	4.204***
ED+8	2.328	2.199	6.079***	1.023	2.061*	8.823***	0.579	0.054	5.235***
ED+9	1.694	1.384	4.294***	0.982	1.756	8.739***	0.546	0.053	5.516***
ED+10	1.374	1.232	3.704***	0.680	0.984	6.311***	0.448	0.090	4.279***
ED+15	1.659	1.488	4.317***	0.634	0.808	5.866***	0.481	1.642	3.631***
ED+20	1.062	0.482	2.532*	0.613	0.852	6.492***	0.637	1.635	5.943***
ED+25	0.845	0.421	2.503*	0.356	0.327	3.581***	0.580	1.692	5.414***
ED+30	0.347	-0.377	1.053	0.296	0.117	2.696**	0.384	0.836	3.215**
ED+40	0.563	0.081	1.636	0.325	-0.122	3.195**	0.590	1.406	5.248***
ED+50	0.568	-0.356	1.762	0.050	-0.702	0.459	0.433	0.848	3.656***
ED+60	0.523	-0.070	1.479	0.038	-0.766	0.359	0.202	0.057	1.532

The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test.

Table 14: Abnormal Trading Volume of Additions in the FTSE SmallCap Using Post-event Estimation Window

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market index is the value-weighted FTSE All Share Index and parameters are estimated over a post-event period of 180 days (ED+61, ED+240).

	Pure additions (N=153)			Downward additions (N=198)			Upward additions (N=177)		
Day	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t
AD-24	0.344	0.485	2.324*	0.635	1.967	7.102***	0.437	0.529	3.413***
AD-20	0.080	-0.388	0.510	0.461	1.511	5.088***	0.603	1.209	4.263***
AD-15	0.421	0.805	3.116**	0.481	1.726	4.633***	0.488	0.749	3.912***
AD-10	0.535	0.704	3.73***	0.483	1.439	5.227***	0.559	0.891	4.547***
AD-5	0.455	0.601	3.031**	0.663	1.831	7.572***	0.548	1.058	4.235***
AD-4	0.377	0.418	2.47*	0.556	1.638	6.612***	0.550	0.989	5.058***
AD-3	0.522	0.732	3.618***	0.676	2.090*	7.460***	1.034	2.073*	9.697***
AD-2	0.399	0.666	2.556*	0.660	1.937	7.157***	0.722	1.166	6.08***
AD-1	0.642	0.965	4.437***	0.624	1.861	6.882***	0.619	1.176	5.688***
AD	1.309	2.793**	9.396***	0.622	1.865	7.199***	1.103	2.168*	10.075***
ED-5	1.498	3.377***	11.856***	0.716	2.139*	8.608***	1.354	2.836**	12.859***
ED-4	1.570	3.391***	12.147***	0.616	1.987*	6.834***	1.393	2.897**	14.112***
ED-3	1.730	3.936***	13.736***	0.711	2.356*	8.746***	1.557	3.366***	16.120***
ED-2	1.866	4.185***	14.833***	0.657	2.241*	7.754***	1.653	3.455***	16.937***
ED-1	2.146	4.852***	20.284***	0.789	2.445*	9.127***	1.730	3.563***	16.190***
ED	2.597	5.678***	27.742***	1.518	5.334***	23.845***	2.530	5.086***	30.238***
ED+1	1.464	3.465***	10.757***	0.763	2.528*	9.101***	1.389	2.914**	11.797***
ED+2	1.150	2.635**	9.156***	0.608	1.761	6.947***	1.189	2.454*	9.471***
ED+3	1.006	2.275*	6.929***	0.663	1.930	7.178***	1.097	1.883	7.898***
ED+4	1.046	2.149*	7.433***	0.503	1.569	5.591***	1.119	2.173*	8.865***

Table 14 ***(continued)***

ED+5	0.868	1.826	5.090***	0.472	1.361	4.557***	1.104	2.213*	7.094***
ED+6	0.855	1.673	5.735***	0.496	1.083	5.376***	0.971	1.815	6.980***
ED+7	0.664	1.297	4.179***	0.561	1.629	6.464***	1.031	1.889	7.170***
ED+8	0.531	0.693	3.037**	0.584	1.661	6.371***	1.008	1.831	8.188***
ED+9	0.703	1.493	4.873***	0.524	1.549	6.070***	0.825	1.660	7.012***
ED+10	0.671	1.166	4.991***	0.604	1.605	7.026***	0.766	1.367	8.011***
ED+15	0.450	0.818	3.022**	0.397	0.968	4.373***	0.600	1.057	6.447***
ED+20	0.398	0.504	2.724**	0.328	0.631	3.701***	0.262	0.324	2.349*
ED+25	0.314	0.342	2.105*	0.322	0.848	3.722***	0.332	0.321	3.260**
ED+30	-0.008	-0.572	-0.056	0.230	0.342	2.434*	0.341	0.239	2.956**
ED+40	0.245	0.215	0.948	0.243	0.482	2.580*	0.318	0.219	3.213**
ED+50	0.088	-0.458	0.688	0.204	-0.084	2.196*	0.053	-0.450	0.548
ED+60	0.041	-0.443	0.316	0.033	-0.575	0.366	0.031	-0.364	0.315

The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test.

Table 15: Abnormal Trading Volume of Deletions in the FTSE SmallCap Index Using Post-event Estimation Window

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market index is the value-weighted FTSE All Share Index and parameters are estimated over a post-event period of 180 days (ED+61, ED+240).

	Pure deletions (N=27)			Downward deletions (N=278)			Upward deletions (N=151)		
Day	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t	$\overline{AV}_t$	Rank Z	t
AD-24	-0.328	-1.168	-1.002	0.239	-0.274	1.913	-0.126	-0.811	-0.991
AD-20	-0.803	-1.646	-1.913	0.074	-0.516	0.557	-0.029	-0.057	-0.198
AD-15	-0.552	-1.405	-1.462	0.171	-0.438	1.475	-0.201	-0.645	-1.577
AD-10	-0.156	-0.975	-0.340	0.164	-0.406	1.402	-0.194	-0.827	-1.508
AD-5	-0.039	-0.770	-0.104	0.339	-0.052	3.015**	-0.056	-0.466	-0.495
AD-4	0.289	-0.120	0.719	0.350	0.011	3.457***	-0.016	0.033	-0.145
AD-3	0.003	-0.675	0.008	0.477	0.388	4.256***	-0.068	-0.652	-0.611
AD-2	-0.544	-1.460	-1.467	0.443	0.285	3.866***	-0.091	-1.080	-0.877
AD-1	-0.301	-1.269	-0.986	0.251	-0.185	2.001*	0.026	0.122	0.237
AD	0.787	0.814	2.311*	0.608	0.853	4.804***	0.296	1.343	2.685**
ED-5	0.255	-0.181	0.494	0.753	0.971	6.754***	0.014	-0.294	0.136
ED-4	1.065	1.331	2.187*	1.109	2.202*	10.988***	-0.004	0.230	-0.031
ED-3	1.730	2.567*	5.639***	1.215	2.489*	12.797***	0.123	0.859	1.208
ED-2	2.385	2.898**	6.179***	1.329	2.720**	12.868***	0.147	0.867	1.497
ED-1	2.038	2.481*	4.707***	1.405	2.846**	13.443***	0.274	1.964*	2.690**
ED	2.230	2.830**	5.925***	2.485	5.605***	29.273***	1.054	7.602***	15.256***
ED+1	1.942	2.439*	4.364***	1.592	3.229**	13.161***	0.492	3.9689***	5.174***
ED+2	1.564	1.753	3.548**	1.201	2.308*	9.923***	0.393	2.617**	3.930***
ED+3	1.159	1.525	2.442*	1.250	2.166*	9.521***	0.326	2.520*	2.908**
ED+4	0.214	-0.182	0.395	1.369	2.359*	8.667***	0.259	1.582	2.426*

Table 15 ***(continued)***

ED+5	1.130	1.189	1.739	1.269	2.331*	8.667***	0.427	2.582**	3.732***
ED+6	1.466	1.615	2.594*	1.172	2.089*	7.415***	0.160	1.618	1.257
ED+7	0.826	0.564	1.574	1.044	1.970*	8.557***	0.376	1.904	4.122***
ED+8	1.547	1.893	3.937***	0.886	1.569	6.796***	0.209	1.430	2.243*
ED+9	0.977	0.890	2.208	0.859	1.539	7.206***	0.247	1.392	2.896**
ED+10	0.909	0.938	1.977	0.673	0.888	5.948***	-0.047	0.199	-0.508
ED+15	1.081	1.056	2.629*	0.610	0.706	5.390***	0.181	1.633	1.603
ED+20	0.678	0.539	1.788	0.626	0.713	6.139***	0.261	1.260	3.086**
ED+25	0.244	-0.094	0.640	0.274	-0.010	2.689**	0.249	1.911	2.691**
ED+30	-0.118	-0.855	-0.321	0.268	0.047	2.526*	0.131	0.649	1.250
ED+40	-0.030	-0.272	-0.085	0.295	-0.338	2.884**	0.102	0.419	0.965
ED+50	0.026	-0.447	0.087	0.009	-0.887	0.083	-0.055	-0.537	-0.609
ED+60	0.034	-0.549	0.092	0.096	-0.828	0.987	-0.105	-1.132	-1.126

The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test.

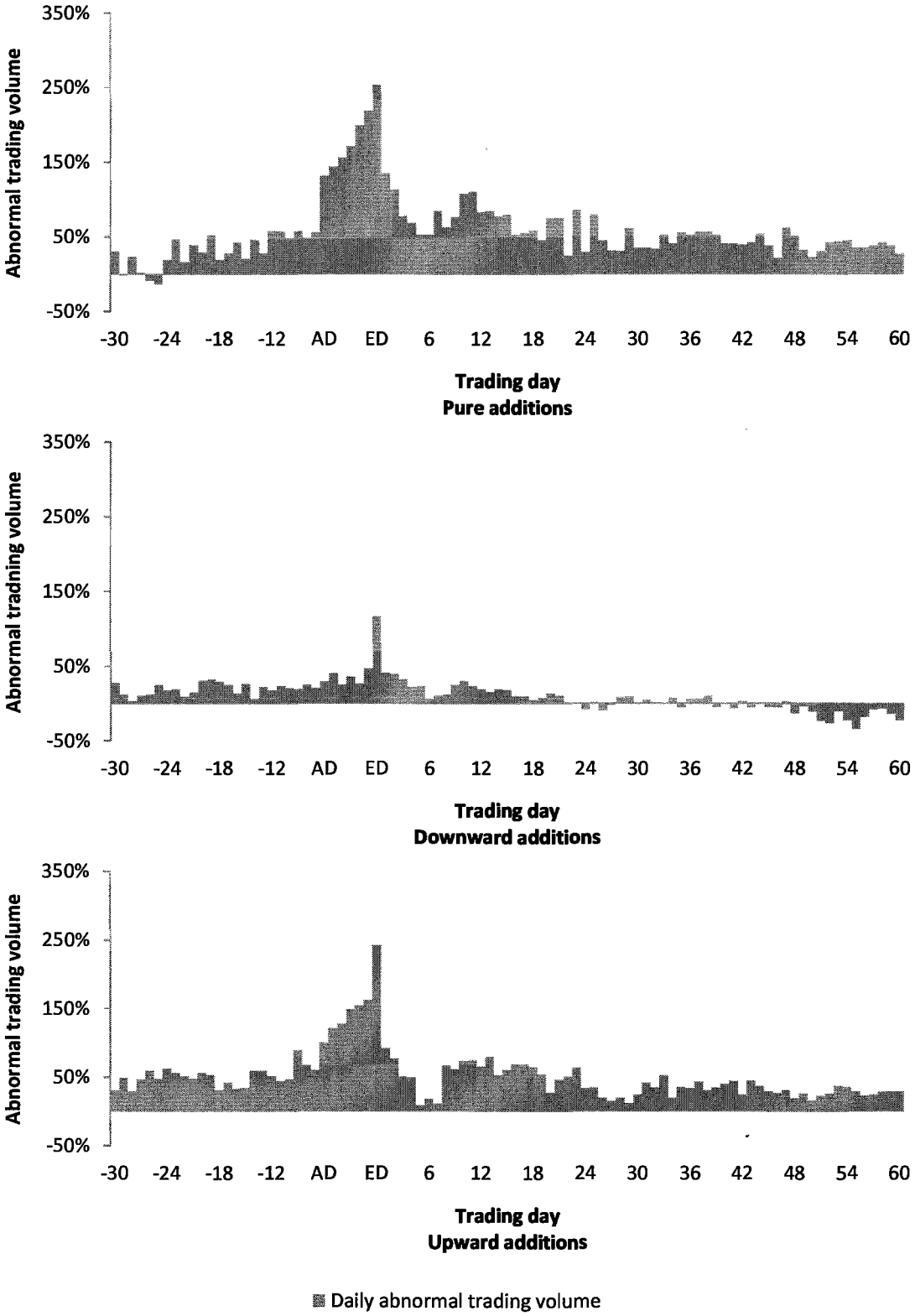

Figure 6: Daily abnormal trading volume for additions to the FTSE SmallCap Index using pre-event estimation window.

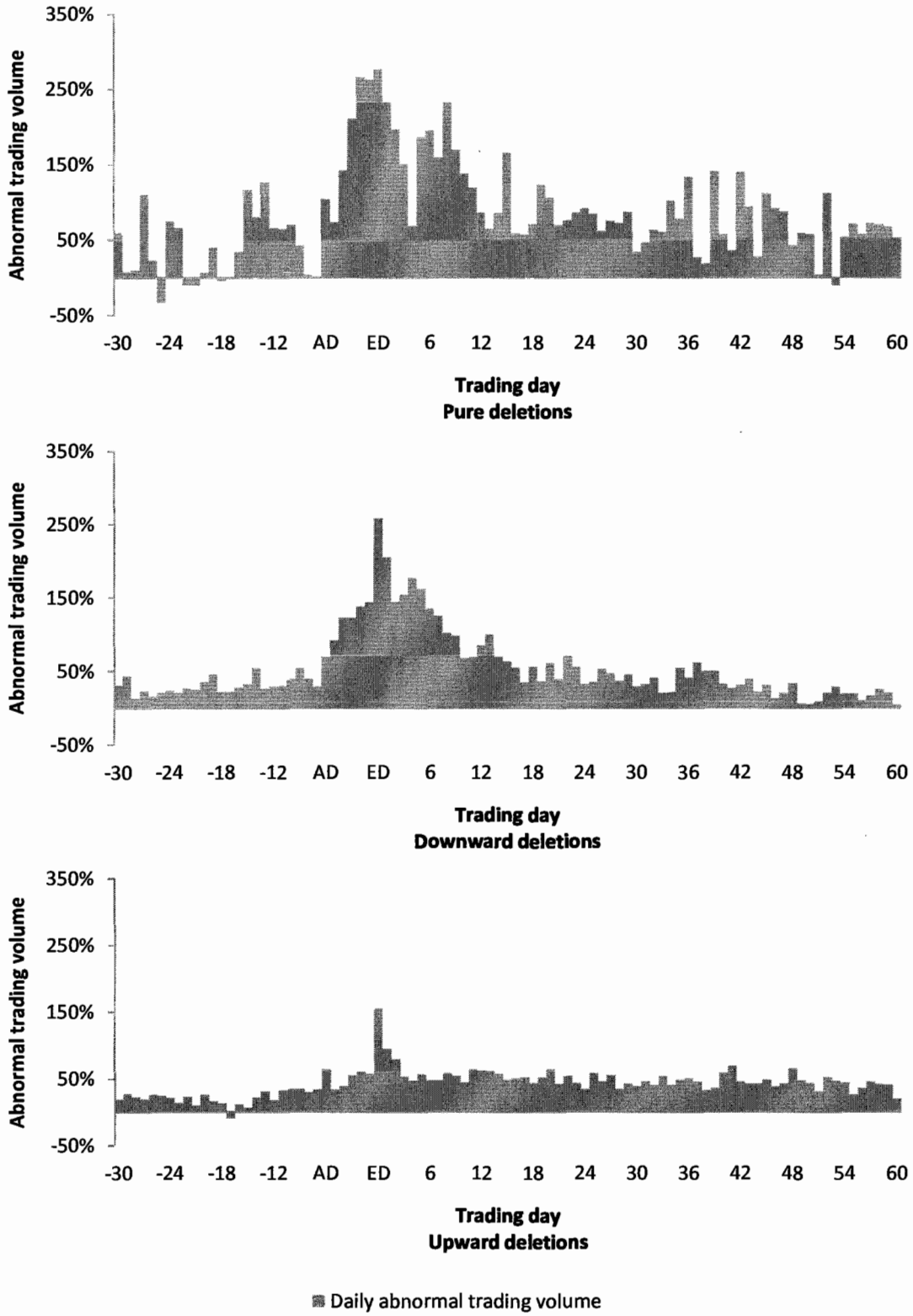

Figure 7: Daily abnormal trading volume for deletions from the FTSE SmallCap Index using pre-event estimation window.

4.2.2 The Canadian Sample

I use all stocks in the CFMRC database as the market portfolio proxy. For any day, the daily market volume measurement is the average of daily stock volume measurement across all stocks on that day.

Similar to my UK sample, two statistics, standard *t*-Test and rank test, are reported. I also use different estimation windows. The pre-event estimation window covers the period of [AD-210, AD-30]. Post-event estimation window covers the period of [ED+60, ED+240].

Returns for different estimation windows are reported. But, to be consistent with my UK sample, I discuss the results based the pre-event estimation window.

In addition, two screens are applied to the sample for pre-event estimation window as well as the post-event estimation window to eliminate any potential bias. The first screen removes stocks for which the estimation window overlapped with another index changes. The second screen removes stocks having more than 100 non-trading days in the 180-day long estimation window.

Table 16 and Table 17 report abnormal trading volume for additions and deletions in the S&P/TSX SmallCap index. In these two tables, Panel A shows the results using pre-event estimation window [AD-210, AD-31] and Panel B shows the results using post-event estimation window [ED+61, ED+240]. As shown in those two tables, all four sub-groups experience significant increases in trading volume on the effective day and the announcement day. Trading volume peaks on the effective day and then returns to normal. In additions, using different estimation windows do not affect the major conclusion.

As shown in Panel A of Table 16 and Table 17, the percentage abnormal trading volume on the effective day ranges from 90% for downward additions to 202.6% for pure deletions. On the announcement day, the percentage abnormal trading volume ranges from 66.2% for downward additions to 110.4% for pure additions.

For pure additions, the announcement day trading volume is 110% and, on the effective day, it is 199%. With downward additions, the trading volume spike occurs only on the announcement day and effective day, when the abnormal trading volume is 66.2% and 90%, respectively. Table 17 shows that deletions experience similar abnormal

Table 16: Abnormal Trading Volume of Additions in the S&P/TSX SmallCap Index

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market portfolio consists of all stocks in CFMRC database. Parameters are estimated over a pre-event period of [AD-210, AD-31] (Panel A) and over a post-event period of [ED+61, ED+240] (Panel B).

Panel A	Pure additions			Downward additions		
Pre-event	N=310			N=25		
Day	AV	Rank Z	t	AV	Rank Z	t
AD-30	0.192	0.220	2.607***	0.128	0.035	0.571
AD-20	0.232	0.846	3.704***	0.087	-0.305	0.346
AD-15	0.253	1.041	4.136***	0.147	0.331	0.753
AD-10	0.301	1.655	4.246***	0.117	0.339	0.489
AD-9	0.273	0.790	3.817***	-0.246	-1.295	-1.070
AD-8	0.254	0.917	3.571***	0.162	0.248	0.753
AD-7	0.287	1.089	4.171***	0.318	1.544	1.943
AD-6	0.351	0.928	5.676***	0.204	0.858	1.062
AD-5	0.326	1.376	4.970***	0.320	1.679	2.097*
AD-4	0.276	0.342	3.827***	-0.115	-0.778	-0.669
AD-3	0.306	0.693	4.112***	0.400	1.380	1.768
AD-2	0.348	0.996	4.499***	0.042	-0.510	0.224
AD-1	0.499	2.081*	6.513***	0.315	0.895	1.643
AD	1.104	4.543***	12.558***	0.662	2.931**	2.824**
ED-1#	0.839	3.885***	12.309***	0.303	0.824	1.490
ED	1.999	8.268***	24.222***	0.900	4.388***	5.375***
ED+1	0.910	4.454***	13.488***	0.435	1.797	2.388*
ED+2	0.639	2.163*	8.695***	0.281	0.999	1.414
ED+3	0.550	1.976*	7.736***	0.450	1.574	2.203*
ED+4	0.377	0.811	5.409***	0.202	0.903	0.971
ED+5	0.269	0.165	3.992***	0.231	0.488	1.040
ED+6	0.364	0.848	5.440***	0.329	1.192	1.382
ED+7	0.387	0.963	5.700***	0.524	1.820	2.196*
ED+8	0.388	0.958	5.440***	0.222	0.399	0.859
ED+9	0.433	1.316	6.870***	0.357	1.478	1.475
ED+10	0.428	1.305	6.336***	0.613	2.288*	2.718*
ED+15	0.225	0.146	3.190**	0.284	0.830	0.929
ED+20	0.209	0.082	3.066**	0.088	0.103	0.413
ED+30	0.187	-0.107	2.770**	0.542	1.853	1.718
ED+40	0.313	1.356	4.826***	0.195	0.678	0.783
ED+50	0.178	0.011	2.816**	0.348	0.214	1.136
ED+60	0.159	0.106	2.562*	0.470	1.863	2.057

Table 16 ***(continued)***

Panel B	Pure additions			Downward additions		
Post-event	N=296			N=25		
Day	AV	Rank Z	t	AV	Rank Z	t
AD-30	0.054	0.117	0.663	0.068	-0.116	0.232
AD-20	0.085	0.736	1.252	-0.032	-0.281	-0.107
AD-15	0.121	0.873	1.838	-0.001	0.149	-0.007
AD-10	0.151	1.447	2.123*	-0.044	0.215	-0.165
AD-9	0.136	0.718	1.907	-0.457	-1.170	-1.789
AD-8	0.099	0.828	1.473	0.007	-0.069	0.029
AD-7	0.153	1.200	2.577*	0.188	0.958	1.392
AD-6	0.254	1.425	4.449***	-0.014	0.138	-0.092
AD-5	0.246	1.833	3.999***	0.162	1.041	1.245
AD-4	0.158	0.464	2.301*	-0.265	-1.027	-1.513
AD-3	0.152	0.669	2.179*	0.240	1.057	1.060
AD-2	0.233	1.309	3.23**	-0.087	-0.460	-0.419
AD-1	0.391	2.293*	5.227***	0.183	0.646	0.886
AD	1.012	4.942***	12.42***	0.388	2.003*	1.367
ED-1#	0.736	4.033***	11.715***	0.165	0.486	0.754
ED	1.908	8.181***	25.462***	0.791	3.451***	4.203***
ED+1	0.798	4.727***	14.139***	0.340	1.417	1.772
ED+2	0.501	2.426*	8.114***	0.171	0.691	0.866
ED+3	0.426	2.110*	6.735***	0.324	1.166	1.703
ED+4	0.260	1.024	4.079***	0.092	0.383	0.397
ED+5	0.130	0.150	2.076*	0.106	0.097	0.452
ED+6	0.214	0.665	3.546***	0.244	0.823	0.966
ED+7	0.208	0.616	3.210**	0.371	1.030	1.449
ED+8	0.206	0.678	3.240**	0.078	0.076	0.301
ED+9	0.294	1.263	4.931***	0.266	1.041	1.270
ED+10	0.281	1.065	4.64***	0.538	1.947	2.659*
ED+15	0.087	0.141	1.369	0.213	0.563	0.760
ED+20	0.036	-0.073	0.62	0.017	0.274	0.091
ED+30	0.067	-0.220	1.133	0.568	2.006*	2.067*
ED+40	0.160	1.191	2.883**	0.242	1.016	1.157
ED+50	0.006	-0.177	0.108	0.401	0.597	1.434
ED+60	0.012	-0.037	0.225	0.387	1.678	2.023

#The AV for day ED-1 is computed only when there is at least one trading day between the announcement day and effective day. The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 17: Abnormal Trading Volume of Deletions in the S&P/TSX SmallCap Index

The market model abnormal trading volume ($\overline{AV}_t$) is estimated using procedures described in Campbell and Wasley (1996). The market portfolio consists of all stocks in CFMRC database. Parameters are estimated over a pre-event period of [AD-210, AD-31] (Panel A) and over a post-event period of [ED+61, ED+240] (Panel B).

Panel A	Pure deletions			Upward deletions		
Pre-event	N=178			N=72		
Day	AV	Rank Z	t	AV	Rank Z	t
AD-30	0.043	0.218	0.422	0.113	0.548	1.153
AD-20	0.182	0.682	1.821	-0.045	-0.498	-0.392
AD-15	0.046	-0.166	0.497	0.055	0.218	0.446
AD-10	0.135	0.860	1.382	0.051	0.100	0.461
AD-9	0.252	1.243	2.510*	-0.087	-0.817	-0.723
AD-8	0.427	1.988*	4.422***	-0.089	-0.756	-0.887
AD-7	0.306	1.310	3.151**	-0.019	-0.573	-0.143
AD-6	0.255	1.067	2.608**	-0.140	-1.386	-1.169
AD-5	0.237	1.188	2.485*	-0.101	-1.473	-0.732
AD-4	0.249	1.407	2.580*	-0.050	-0.613	-0.397
AD-3	0.426	2.066*	4.414***	-0.058	-0.852	-0.478
AD-2	0.313	1.768	3.645***	-0.154	-1.685	-1.334
AD-1	0.285	1.316	3.216**	0.107	-0.091	0.854
AD	0.719	3.937***	8.054***	0.732	5.348***	6.794***
ED-1#	0.873	3.946***	9.939***	0.226	0.813	1.695
ED	2.026	7.529***	21.420***	0.940	6.747***	9.453***
ED+1	0.904	4.331***	10.204***	0.334	2.010*	2.757**
ED+2	0.400	1.687	4.177***	0.136	0.818	1.175
ED+3	0.438	2.073*	4.669***	0.237	1.237	1.807
ED+4	0.314	1.635	3.437***	0.029	0.158	0.285
ED+5	0.213	0.880	2.221*	0.048	0.023	0.448
ED+6	0.160	0.697	1.580	0.101	0.164	0.831
ED+7	0.174	0.520	1.494	0.180	0.610	1.479
ED+8	0.334	1.410	3.343**	0.084	1.024	0.765
ED+9	0.166	0.904	1.781	0.153	1.171	1.404
ED+10	0.351	1.157	3.316***	0.155	0.896	1.354
ED+15	0.103	0.066	1.024	0.090	0.358	0.799
ED+20	-0.106	-0.747	-1.047	0.041	0.341	0.369
ED+30	-0.141	-0.671	-1.427	-0.265	-1.572	-2.174*
ED+40	-0.267	-1.231	-2.819**	-0.198	-1.525	-1.903
ED+50	-0.301	-0.975	-2.706**	-0.114	-0.752	-1.057
ED+60	-0.220	-1.275	-2.456*	0.053	0.144	0.487

Table 17 ***(continued)***

Panel B	Pure deletions			Upward deletions		
Post-event	N=171			N=70		
Day	AV	Rank Z	t	AV	Rank Z	t
AD-30	0.332	0.449	2.425*	0.182	0.990	1.683
AD-20	0.521	1.111	4.434***	-0.007	0.148	-0.062
AD-15	0.382	0.549	3.191**	0.087	0.453	0.737
AD-10	0.436	1.066	3.925***	0.078	0.585	0.792
AD-9	0.586	1.582	4.895***	-0.077	-0.567	-0.677
AD-8	0.759	2.188*	6.583***	-0.062	-0.355	-0.614
AD-7	0.646	1.844	6.001***	-0.006	-0.067	-0.055
AD-6	0.580	1.274	4.935***	-0.189	-1.270	-1.716
AD-5	0.596	1.579	5.380***	-0.059	-0.724	-0.459
AD-4	0.570	1.534	4.710***	-0.014	-0.190	-0.104
AD-3	0.771	2.157*	6.567***	-0.041	-0.049	-0.318
AD-2	0.671	2.080*	6.724***	-0.158	-1.620	-1.452
AD-1	0.598	1.547	5.779***	0.116	0.418	0.952
AD	1.065	3.492***	9.431***	0.731	5.491***	6.702***
ED-1#	1.260	3.855***	11.557***	0.235	1.372	1.909
ED	2.402	6.664***	20.545***	0.949	6.921***	9.660***
ED+1	1.308	4.243***	11.846***	0.312	2.280*	2.889**
ED+2	0.742	2.053*	6.775***	0.126	0.861	1.223
ED+3	0.792	2.480*	7.990***	0.259	1.860	2.172*
ED+4	0.653	1.921	6.130***	0.039	0.383	0.397
ED+5	0.524	1.436	5.081***	0.043	0.185	0.44
ED+6	0.513	1.310	4.655***	0.110	0.512	0.908
ED+7	0.524	1.181	4.499***	0.231	1.394	1.842
ED+8	0.734	1.977*	6.907***	0.167	1.916	1.402
ED+9	0.578	1.699	5.933***	0.229	1.972*	1.999*
ED+10	0.734	1.716	5.912***	0.180	1.502	1.778
ED+15	0.455	0.711	3.776***	0.183	1.156	1.573
ED+20	0.230	-0.067	2.048*	0.087	0.788	0.874
ED+30	0.238	0.213	2.229*	-0.151	-0.793	-1.376
ED+40	0.118	-0.264	1.040	-0.116	-1.075	-1.23
ED+50	0.092	-0.125	0.777	-0.020	-0.118	-0.234
ED+60	0.155	-0.468	1.468	0.145	0.977	1.538

#The AV for day ED-1 is computed only when there is at least one trading day between the announcement day and effective day. The symbols *,**, and *** denote statistical significance at the 5%, 1% and 0.1% levels, respectively, using a two-tail test

trading volumes on the announcement day and the effective day. Upward deletions are affected less than pure deletions on both the announcement day and effective day.

4.3 Differentiating between Temporary and Permanent Price Effects

Obviously, results shown in abnormal return and volume analyses consistently show that additions and deletions of the FTSE SmallCap index are associated with significant price and volume effects. Now, the question is whether the reactions associated with the additions and deletions of the FTSE SmallCap index are temporary or permanent.

In this section, I examine the cumulative abnormal return (CAR) over various post-event periods to differentiate between temporary and permanent price effects. If the price effects are temporary, the abnormal price reaction should be reverted after the event takes place. Table 18 and Table 19 present the CARs for various periods that start from ED-30 to any day up to day ED+60 for additions and deletions in the FTSE SmallCap index, respectively.

As shown in Table 18, the results for pure additions show that there is no significant pre-event upward trend until ED-10 and the CAR increases rapidly after that. On the effective day, the largest CAR of 10.15% is reached and starting to decline. Note that this decline in the CARs after the effective day clearly shows that price reversal exists in the post-event window [ED+1, ED+60].

Results for downward additions show that the CAR is negative and strongly significant since the beginning of the event window [ED-30, ED+60]. The CAR declines rapidly and reaches -15.68% on ED+2. I also find that there is a price reversal during the effective day and few days after. However, the impact of this price reversal is small and short-lived as the post-event CARs stay at almost the same level.

Results for upward additions show that the CAR is economically and statistically significant for the entire event window [ED-30, ED+60]. The CAR increases rapidly and reaches 20.45% on the effective day. Similar to downward additions, I find a small and short-lived price reversal over the few days after the effective day. After that, the upward trend continues as shown in Figure 3.

As shown in Table 19, pure deletions experience different pattern from pure additions. Significant CARs appear after the announcement day and decreases rapidly. A short-lived

price reversal happens after the effective day but does not bring the CAR back to the original level. The CARs over the period of [ED, ED+60] do not experience significant change. By the end of ED+60, the CAR is still negative and economically significant.

CAR for downward deletions is negative and strongly significant since the beginning of the event window [ED-30, ED+60]. The CAR declines rapidly and reaches -22.67% on the effective day. I also find that there is a price reversal after the effective day and CAR is brought back to as high as -8.54%. However, by the end of ED+60, there is still an economically significant CAR of -11.44% indicates that the price reversal after the effective day is partial and short-lived.

It is obvious that the CAR for upward deletions is economically and statistically significant for the entire event window [ED-30, ED+60]. The CAR increases rapidly and reaches 13.06% on ED-7 (also can be expressed as AD-1). Again, the decline in CAR clearly supports the existence of price reversal. However, any reversal disappears around ED+5 as shown in Figure 2.

For all FTSE SmallCap index changes except pure additions, the price reversal disappears soon after the effective day. Pure additions is the only sub-groups experience complete price reversal. The pre-event trend is not a surprise because of the mechanics use to in review FTSE indices. The changes to FTSE SmallCap index are foreseeable for every investor, so it is possible to anticipate the event and trade in advance. According to the price pressure hypothesis, the CAR built up though the pre-event trend should revert completely after the event. However, for five sub-groups I find that the CAR built up though the pre-event trend is permanent. Therefore, in the next two sections, I examine the possible factors that cause the permanent price reaction.

4.4 Institutional Ownership Analysis

To examine institutional ownership changes around the index changes in the FTSE SmallCap index, I use the procedures described in Biktimirov, Cowan, and Jordan's (2004) that are an extension of those used by Pruitt and Wei (1989). However, my procedure is simpler since the percentages of institutional shareholdings can be directly obtained from Thomson Datastream database. Thomson Datastream database defines the percentages of institutional shareholdings as the percentage of total shares in issue held as

Table 18: Cumulative Abnormal Return for Additions in the FTSE SmallCap Index Starting From ED-30.

This table shows the cumulative abnormal returns, CAR, for various periods which start from ED-30 to any day *t* up to ED+60 using the market-adjusted model and the FTSE SmallCap value-weighted index as the market index proxy. The day 0 is the effective day, and the ED-6 is the announcement day. Three two statistics, *t*-test with CDA and Rank test are reported (As robustness check, I also check the Generalized Sign test statistic and find that the results are qualitatively the same).

	Pure additions (N=187)			Downward additions (N=289)			Upward additions (N=196)		
Period	CAR	CDA t	rank z	CAR	CDA t	rank z	CAR	CDA t	rank z
[ED-30,ED-29]	0.13%	0.398	0.386	-1.33%	-3.248**	-3.060**	1.49%	4.542***	2.023*
[ED-30,ED-25]	0.15%	0.274	-0.46	-4.33%	-6.115***	-5.633***	3.81%	6.720***	2.056*
[ED-30,ED-20]	-0.18%	-0.245	-0.085	-8.20%	-8.547***	-7.236***	6.44%	8.374***	1.960$
[ED-30,ED-15]	0.62%	0.685	0.769	-10.31%	-8.907***	-7.874***	8.16%	8.803***	2.982**
[ED-30,ED-10]	1.35%	1.301	1.378	-13.10%	-9.884***	-8.929***	11.27%	10.617***	4.096***
[ED-30,ED-9]	1.82%	1.713$	1.702$	-13.19%	-9.721***	-9.051***	12.22%	11.239***	4.629***
[ED-30,ED-8]	2.59%	2.384*	2.170*	-13.95%	-10.053***	-9.118***	12.87%	11.584***	4.978***
[ED-30,ED-7]	2.78%	2.504*	2.536*	-13.45%	-9.492***	-8.658***	13.78%	12.136***	5.379***
[ED-30,AD]	3.96%	3.502***	3.474***	-14.40%	-9.956***	-9.095***	14.58%	12.582***	5.959***
[ED-30,ED-5]	4.78%	4.146***	3.921***	-15.06%	-10.212***	-9.352***	15.50%	13.120***	6.351***
[ED-30,ED-4]	6.03%	5.128***	4.609***	-15.16%	-10.084***	-9.069***	16.41%	13.632***	6.952***
[ED-30,ED-3]	6.65%	5.555***	5.241***	-15.34%	-10.025***	-8.750***	17.03%	13.890***	7.503***
[ED-30,ED-2]	7.76%	6.372***	5.930***	-15.68%	-10.068***	-8.509***	17.27%	13.841***	7.839***
[ED-30,ED-1]	8.42%	6.796***	6.298***	-15.44%	-9.745***	-8.016***	18.37%	14.471***	8.422***
[ED-30,ED]	10.15%	8.056***	6.965***	-14.17%	-8.797***	-7.297***	20.45%	15.852***	9.168***
[ED-30,ED+1]	10.00%	7.813***	6.945***	-13.50%	-8.248***	-7.127***	20.37%	15.537***	8.960***
[ED-30,ED+2]	9.95%	7.655***	6.766***	-13.55%	-8.156***	-6.842***	20.01%	15.031***	8.643***
[ED-30,ED+3]	9.59%	7.268***	6.342***	-13.58%	-8.051***	-6.687***	19.93%	14.752***	8.376***
[ED-30,ED+4]	9.24%	6.904***	5.968***	-13.35%	-7.800***	-6.334***	19.64%	14.328***	8.018***

Table 18 ***(continued)***

[ED-30,ED+5]	9.00%	6.628***	5.556***	-13.18%	-7.596***	-6.049***	19.68%	14.156***	7.879***
[ED-30,ED+6]	8.95%	6.502***	5.406***	-13.30%	-7.558***	-5.944***	19.65%	13.940***	7.570***
[ED-30,ED+7]	8.72%	6.251***	5.062***	-12.89%	-7.227***	-5.631***	19.86%	13.903***	7.219***
[ED-30,ED+8]	8.42%	5.956***	4.737***	-12.97%	-7.183***	-5.485***	19.82%	13.697***	6.939***
[ED-30,ED+9]	8.34%	5.825***	4.583***	-12.26%	-6.699***	-5.095***	19.33%	13.189***	6.711***
[ED-30,ED+10]	7.97%	5.498***	4.376***	-12.49%	-6.742***	-5.135***	18.89%	12.728***	6.486***
[ED-30,ED+15]	7.75%	5.047***	3.853***	-13.58%	-6.920***	-4.963***	19.00%	12.091***	5.834***
[ED-30,ED+20]	7.74%	4.791***	3.463***	-13.76%	-6.663***	-4.482***	19.53%	11.801***	5.575***
[ED-30,ED+25]	7.06%	4.170***	2.864**	-13.12%	-6.060***	-4.350***	19.58%	11.292***	5.749***
[ED-30,ED+30]	5.81%	3.286**	2.259*	-12.49%	-5.529***	-3.978***	19.68%	10.873***	5.150***
[ED-30,ED+35]	4.75%	2.582**	1.683$	-11.03%	-4.692***	-3.450***	20.39%	10.833***	4.910***
[ED-30,ED+40]	4.47%	2.346*	1.599	-12.00%	-4.923***	-3.339***	21.29%	10.901***	5.003***
[ED-30,ED+45]	3.55%	1.798$	1.346	-13.00%	-5.155***	-3.185**	21.46%	10.624***	4.726***
[ED-30,ED+50]	2.61%	1.281	1.013	-13.18%	-5.062***	-3.304**	20.75%	9.949***	4.249***
[ED-30,ED+55]	2.21%	1.055	0.996	-13.74%	-5.124***	-3.725***	20.41%	9.495***	3.883***
[ED-30,ED+60]	1.14%	0.529	0.984	-15.40%	-5.582***	-3.825***	19.98%	9.039***	3.625***

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

Table 19: Cumulative Abnormal Return for Deletions in the FTSE SmallCap Index Starting From ED-30.

This table shows the cumulative abnormal returns, CAR, for various periods which start from ED-30 to day *t* (up to ED+60) using the market-adjusted model and the FTSE SmallCap value-weighted index as the market index proxy. The day 0 is the effective day, and the day -6 is the announcement day. Three two statistics, *t*-test with CDA and Rank test are reported (As robustness check, I also check the Generalized Sign test statistic and find that the results are qualitatively the same).

	Pure deletions (N=30)			Downward deletions (N=299)			Upward deletions (N=203)		
Period	CAR	CDA t	rank z	CAR	CDA t	rank z	CAR	CDA t	rank z
[ED-30,ED-29]	0.03%	0.049	-0.109	-0.68%	-1.472	-1.08	1.02%	2.966**	1.587
[ED-30,ED-25]	-0.91%	-0.792	-1.896$	-1.89%	-2.381*	-2.814**	3.61%	6.062***	3.239**
[ED-30,ED-20]	-0.83%	-0.537	-1.313	-3.76%	-3.494***	-3.395***	6.76%	8.371***	4.701***
[ED-30,ED-15]	-2.09%	-1.119	-1.956$	-6.00%	-4.619***	-4.159***	8.38%	8.604***	5.183***
[ED-30,ED-10]	-4.26%	-1.993*	-2.916**	-9.63%	-6.473***	-4.868***	11.89%	10.661***	6.807***
[ED-30,ED-9]	-4.74%	-2.163*	-3.153**	-10.35%	-6.796***	-4.974***	12.41%	10.871***	6.878***
[ED-30,ED-8]	-4.99%	-2.227*	-3.304**	-11.99%	-7.698***	-5.426***	12.94%	11.087***	7.020***
[ED-30,ED-7]	-4.89%	-2.135*	-3.354***	-12.67%	-7.961***	-5.579***	13.06%	10.952***	6.943***
[ED-30,AD]	-5.57%	-2.384*	-3.491***	-13.74%	-8.460***	-5.791***	12.99%	10.674***	6.544***
[ED-30,ED-5]	-6.00%	-2.520*	-3.799***	-14.81%	-8.944***	-5.987***	12.96%	10.442***	6.281***
[ED-30,ED-4]	-7.24%	-2.982**	-4.092***	-16.07%	-9.522***	-6.165***	12.59%	9.956***	5.948***
[ED-30,ED-3]	-9.44%	-3.819***	-4.414***	-18.29%	-10.644***	-6.579***	12.51%	9.711***	5.873***
[ED-30,ED-2]	-10.98%	-4.367***	-4.534***	-18.25%	-10.432***	-7.056***	12.07%	9.208***	5.650***
[ED-30,ED-1]	-12.51%	-4.891***	-4.816***	-19.49%	-10.955***	-7.325***	11.35%	8.513***	5.200***
[ED-30,ED]	-16.54%	-6.361***	-5.267***	-22.67%	-12.536***	-7.860***	11.12%	8.206***	4.894***
[ED-30,ED+1]	-16.28%	-6.163***	-5.287***	-21.30%	-11.592***	-7.466***	10.69%	7.768***	4.624***
[ED-30,ED+2]	-15.94%	-5.942***	-5.182***	-21.03%	-11.269***	-7.353***	10.47%	7.490***	4.362***
[ED-30,ED+3]	-15.04%	-5.524***	-5.011***	-19.78%	-10.445***	-7.077***	10.41%	7.338***	4.232***
[ED-30,ED+4]	-15.22%	-5.507***	-5.006***	-19.34%	-10.066***	-6.993***	9.98%	6.931***	3.870***

Table 19 ***(continued)***

[ED-30,ED+5]	-15.30%	-5.458***	-5.136***	-18.30%	-9.391***	-6.783***	10.04%	6.877***	3.723***
[ED-30,ED+6]	-15.69%	-5.522***	-5.235***	-17.30%	-8.755***	-6.715***	9.97%	6.735***	3.564***
[ED-30,ED+7]	-15.71%	-5.456***	-5.439***	-17.01%	-8.494***	-6.795***	10.04%	6.691***	3.563***
[ED-30,ED+8]	-15.55%	-5.330***	-5.425***	-16.54%	-8.156***	-6.849***	9.95%	6.549***	3.435***
[ED-30,ED+9]	-14.35%	-4.859***	-5.102***	-15.71%	-7.648***	-6.647***	10.25%	6.661***	3.588***
[ED-30,ED+10]	-13.73%	-4.592***	-4.770***	-14.94%	-7.185***	-6.319***	10.14%	6.504***	3.430***
[ED-30,ED+15]	-14.83%	-4.681***	-4.845***	-12.82%	-5.819***	-5.620***	10.99%	6.659***	3.540***
[ED-30,ED+20]	-17.59%	-5.274***	-5.409***	-12.04%	-5.192***	-5.071***	11.16%	6.420***	3.196**
[ED-30,ED+25]	-16.80%	-4.808***	-4.655***	-11.84%	-4.871***	-4.670***	11.35%	6.233***	2.816**
[ED-30,ED+30]	-16.38%	-4.489***	-4.292***	-10.56%	-4.164***	-4.400***	12.42%	6.533***	2.664**
[ED-30,ED+35]	-17.26%	-4.549***	-4.391***	-10.42%	-3.950***	-4.417***	12.68%	6.414***	2.429*
[ED-30,ED+40]	-18.09%	-4.597***	-4.338***	-8.54%	-3.121**	-3.768***	12.74%	6.211***	2.300*
[ED-30,ED+45]	-19.07%	-4.684***	-4.306***	-9.36%	-3.305***	-3.633***	13.28%	6.257***	2.288*
[ED-30,ED+50]	-19.75%	-4.698***	-4.440***	-9.71%	-3.320***	-3.646***	14.49%	6.617***	2.486*
[ED-30,ED+55]	-20.21%	-4.665***	-4.387***	-11.35%	-3.769***	-3.699***	14.35%	6.357***	2.299*
[ED-30,ED+60]	-17.42%	-3.910***	-3.606***	-11.44%	-3.691***	-3.476***	14.16%	6.098***	2.302*

The symbols $, *,**, and *** denote statistical significance at the 10%, 5%, 1% and 0.1% levels, respectively, using a two-tail test

long-term strategic holdings by investment banks or institutions seeking a long-term return[28]. The data is only available since May 2002. To have two months available data prior to the event, only additions and deletions that occur on or after September 2002 Quarterly review are included in the institutional ownership analysis.

First, I calculate the mean percentages of institutional shareholdings over the two months before and after the month in which the addition or deletion occurs (denote as $\overline{NOSHIC}_{j,pre}$ and $\overline{NOSHIC}_{j,post}$ respectively). I then test for significant differences using the standard *t*-test and non-parametric generalized sign test. The two-month period is sufficient because it is enough time for investors to adjust their portfolio and a longer period is likely to introduce unnecessary noise. Datastream also provides the percentage of total shares in issue available to ordinary investors[29]. This number is calculated by subtracting strategic holdings by one company in another, employee/family, a government or government institution, investment banks or institutions, and pension funds or endowment funds. The sample size reduced because the data for some is not complete. To get an overview of the pre-change and post-change levels, Table 20 presents descriptive statistics for the percentages of institutional shareholdings and percentage of total shares in issue available to ordinary investors before and after the changes to FTSE SmallCap index for all six sub-groups of changes.

As shown in Table 20, firms that are newly added to the index (pure additions) and firms that are completely deleted from the index (pure deletions) experience relative larger change in percentage institutional shareholdings than other sub-groups. The mean institutional shareholdings of pure additions rises from 12% to 16% and the mean percentage of total shares available to ordinary investors declines from 69% to 66%. Pure deletions experience a decline of 5% in the mean percentage institutional shareholdings and an increase of 5% in the mean percentage of total shares available to ordinary investors. For other sub-groups, the pre-event and post-event levels are almost the same.

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[28] Datastream defines the variable NOSHIC as "the percentage of institutional shareholding as the percentage of total shares in issue held as long term strategic holdings by investment banks or institutions seeking a long term return."

[29] Datastream defines the variable NOSHFF as "the percentage of total shares in issue available to ordinary investors. The total number of shares less the strategic holdings. In general, only holdings of 5% or more are counted as strategic."
Source: http://extranet.datastream.com/Products_Data/Content_factsheets/documents/Freefloat.pdf

Table 20: Descriptive Statistics for Percentages of Institutional Shareholdings and Percentage of Total Shares Available to Ordinary Investors before and after the Changes to FTSE SmallCap Index from Jul 2002 to Dec 2008.

This table provides the descriptive statistics for pre-change and post-change levels of the percentages of institutional shareholdings and the percentage of total shares in issue available to ordinary investors for all addition and deletions that occur in or after July 2002. The month, denote as m, 0 represents the event month (the month in which the addition or deletion occurs).

	Percentages of institutional shareholdings						Percentage of total shares in issue available to ordinary investors				
	m	Mean	Median	Max	Min		m	Mean	Median	Max	Min
Pure additions n=112	-2	12	0	62	0	Pure additions n=72	-2	69	72	100	11
	-1	13	7	62	0		-1	68	69	100	23
	0	14	8	62	0		0	67	70	100	23
	1	16	12	93	0		1	65	70	100	7
	2	16	13	93	0		2	66	70	100	7
Upward additions n=107	-2	20	17	62	0	Upward additions n=103	-2	63	65	100	17
	-1	21	17	62	0		-1	62	64	100	7
	0	20	19	61	0		0	63	65	100	7
	1	21	19	61	0		1	63	64	100	11
	2	21	19	61	0		2	63	63	100	11
Downward additions n=120	-2	23	20	72	0	Downward additions n=116	-2	62	66	100	12
	-1	23	18	76	0		-1	62	67	100	12
	0	23	18	79	0		0	62	64	100	12
	1	23	19	72	0		1	63	66	100	10
	2	22	20	71	0		2	64	67	100	10
Pure deletions n=9	-2	31	26	66	3	Pure deletions n=9	-2	61	59	96	33
	-1	30	21	62	3		-1	62	60	96	36
	0	26	21	62	3		0	66	68	96	36
	1	26	24	62	2		1	66	68	97	36
	2	26	19	62	2		2	66	71	97	36
Upward deletions n=84	-2	22	19	69	0	Upward deletions n=82	-2	67	71	100	22
	-1	22	19	69	0		-1	67	71	100	23
	0	22	19	69	0		0	66	68	100	24
	1	22	19	70	0		1	67	70	100	22
	2	21	19	74	0		2	67	71	100	24
Downward deletions n=138	-2	27	26	67	0	Downward deletions n=137	-2	60	62	100	13
	-1	27	27	68	0		-1	60	60	100	13
	0	26	26	65	0		0	61	61	100	13
	1	26	25	65	0		1	60	62	100	13
	2	25	25	65	0		2	60	61	100	13

To examine the significance of the changes in Table 20, I compare the difference between the mean percentages of institutional shareholdings of two months before the event month (the month in which the addition or deletion occurs) and the mean

percentage of institutional shareholdings of two months after the event month for each firm in all sub-groups of changes, then average across all firms with each sub-group of changes. A parametric t-test and a non-parametric Wilcoxon Signed Rank Sum test are used to evaluate the significance of the percentage changes. A non-parametric generalized sign test is used to evaluate the number of firms that experienced an increase in percentage institutional shareholdings. The number expected is based on a comparison of the difference between the mean percentage of institutional shareholdings of month+1 and month+2 with the mean percentage of institutional shareholdings of month+3 and month+4. The results are reported in Panel A of Table 21. I also apply the same methodology to test the changes in percentage of total shares available to ordinary investors. The results are reported in Panel B of Table 21.

For firms that are newly added to the index (pure additions), Panel A of Table 21 reports that the average increase of 3.317% in the percentage institutional shareholdings is significant at 1% level and significantly more firms that experienced increase in percentage institutional shareholdings than expected. For firms that are shifted from the FTSE SmallCap index to the FTSE Fledgling index (downward deletions), Panel A of Table 21 reports that the average decrease of 1.435% in the percentage institutional shareholdings is significant at 5% level, but the generalized sign test indicates that firms experienced increase in percentage institutional shareholdings are not significantly different from expected. For firms in the other four sub-groups of changes, both test statistics are insignificant.

As shown in Panel B of Table 21, the only sub-group experiences significant change in percentage of total shares in issue available to ordinary investors is pure additions. There is a 3% decline for pure additions and significantly less stocks that experience increase in percentage of total shares in issue available to ordinary investors.

4.5 Liquidity Tests

Under the liquidilty hypothesis, index additions are valuable because of the improvement in the trading environment of stocks while index deletions are the opposite. To examine the trading environment, I construct four proxies for stock liquidity: the illiquidity ratio, dollar volume, relative spread, and zero returns ratio.

Table 21: Mean Difference of Percentages Institutional Shareholdings and Percentage of Total Shares Available to Ordinary Investors for Changes Following the FTSE SmallCap index additions and deletions from May 2002 to Dec 2008.

In Panel A, the mean difference is defined as stock's average percentage investment company shareholdings in the two-month pre-event period subtracted from the average percentage investment company shareholdings in the two-month post-event period. In Panel B, the mean difference is defined as the stock's average percentage of total shares available to ordinary investors in the two-month pre-event period subtracted from the average percentage of total shares available to ordinary investors in the two-month post-event period. N is the sample size, N(+) is the number of increases, and N(0) is the number of non-changes. Pr > |t|, Pr > |S|, and Pr > |z| are p-values for standard t-test, Wilcoxon Signed Rank Sum test, and Sign test, respectively.

	N	N(+)	N(0)	Mean Diff	Pr > |t|	Pr > |S|	%(+)/ %(+)est	Pr > |z|
Panel A: Percentages of institutional shareholdings								
Pure additions	112	44	48	3.317	0.005	0.001	39%/27%	0.001
Upward additions	107	44	19	0.565	0.376	0.449	41%/37%	0.212
Downward additions	120	43	28	-0.938	0.301	0.152	36%/35%	0.424
Pure deletions	9	2	1	-4.556	0.303	0.336	22%/44%	0.090
Upward deletions	84	32	19	-0.625	0.509	0.674	38%/35%	0.246
Downward deletions	138	41	29	-1.435	0.044	0.012	30%/27%	0.221
Panel B: Percentage of total shares in issue available to ordinary investors								
Pure additions	72	21	14	-3.063	0.092	0.028	29%/43%	0.017
Upward additions	103	48	14	0.340	0.726	0.441	47%/53%	0.167
Downward additions	116	48	19	1.267	0.236	0.166	41%/42%	0.829
Pure deletions	9	6	1	4.889	0.383	0.336	67%/56%	0.502
Upward deletions	82	35	16	-0.244	0.866	0.640	43%/35%	0.166
Downward deletions	137	68	20	0.639	0.395	0.092	50%/47%	0.608

The illiquidity ratio, called *ILLIQ*, is the daily ratio of absolute stock return to its daily trading volume in dollars:

$$ILLIQ_i = \frac{1}{T_i}\sum_{t=1}^{T_i}\frac{|R_{i,t}|}{VOLD_{i,t}} \tag{10}$$

where $R_{i,t}$ is the return of stock i on day t, $VOLD_{i,t}$ is the daily trading volume in dollars for stock i, and T_i is total number of days for stock i during the pre-event and post-event period. Amihud (2002) first suggests the illiquidity ratio as a rough measure of price impact, which can be interpreted as the daily price reaction associated with a dollar of daily trading volume. A more liquid stock should be the one with a smaller *ILLIQ*.

Dollar volume is the natural logarithm of the average of product of daily trading volume in dollars. A higher dollar volume indicates improved liquidity.

Relative spread is the average of the difference between the daily closing ask and bid prices divided by the mid-point of closing ask and bid prices. A decline in the relative spread is an indication of improved liquidity.

Zero returns ratio is the ratio of the number of zero return days to the total number of trading days. Lesmond, Ogden, and Trzcinka (1999) first suggest this measurement as a proxy for transaction costs. They modeled the transaction costs through the incidence of zero returns. The major premise on which their model is based on is the following: "*If the value of the information signal is insufficient to exceed the costs of trading, then the marginal investor will either reduce trading or not trade, causing a zero return.*" It is expected that a stock with low transaction costs will have less zero return days and is more liquid than a stock with high transaction costs.

I eliminate all overlaps and infrequently traded stocks to prevent biased liquidity proxies. Therefore, I applied two screens discussed in trading volume analysis over 180-day pre- and post-event windows at the same time for all stocks.

Table 22 shows the mean (median) pre-event levels, changes, percent changes, and percent of stocks that experience positive reaction in stock's liquidity following addition to and deletion from the FTSE SmallCap Index. Pre-event levels are estimated over a 180-day period of [ED-210, ED-31], and Post-event levels are estimated over a 180-day

period of [ED+61, ED+240][30]. Since I compare the pre-event and post-event levels for the each of the six sub-groups of index changes, I use a parametric test, Paired *t*-Test, and a non-parametric test, Wilcoxon-Signed-Rank-Sum Test, to test whether the pre-event pre- and post- event levels are significantly different. For robustness checks, I use different lengths for the estimation windows. Table 23 and Table 24 show the results using 90-day and 45-day estimation window, respectively. As shown in those two tables, a shorter estimation window does not affect the major results. Since my goal is to capture permanent changes in stocks liquidity, the estimation window with a length of 180 days provides results that are more reasonable.

As shown in table 22, the results for pure additions show an unexpected and significant increase in illiquidity ratio and relative spread while significantly more stocks experience positive reaction in dollar volume and negitive reaction in zero returns ratio at the same time. For upward additions, the mean percent changes of dollar valume, illiquidity ratio and relative spread experience a significant increase. But the mean and median percent changes are quite different. It is possible that the mean is driven by some extreme values, so that the t-Test, which requires normality assumption, is less powerfull than non-parametric tests. The sign test, which is insensitive to outliers, shows that there is an increase in liquidity, which is consistent among all four measurements. The results for downward additions are clear. All tests consistently show that stocks in this sub-group become less liquid after the shift from FTSE 250 index to the FTSE SmallCap index.

For pure deletions, test statistics consistently show that there is a significant increase in dollar volume, which is opposite to expectation, and in illiquidity ratio. I do, however, caution that pure deletion is a noisy event to examine the impact of index changes on liquidity as stock can only be deleted completely from FTSE SmallCap index because of reasons based on liquidity. The results for the other two deletions sub-group is obvious. All tests consistently show that upward deletions experience a signficant increase in liqudity and downward deletions experience a significant decrease in liqudity.

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[30] Chen, Noronha, and SIngal (2004) and Becker-Blease and Paul (Forthcoming) measure post-addition liquidity begins 61 days after the effective date to ensure that any temporary upward bias induced by index fund and arbitrage trading does not influence the measurement of long-term shifts in liquidity.

Table 22: Changes in Stocks Liquidity (180-Day Window)

This table shows mean (median) levels, changes, percent changes, and percent of stock experience positive reaction in stock liquidity following addition to and deletion from the FTSE SmallCap Index. Pre-event levels are the average over the 180-day period that ends at ED-31. Post-event levels are the average over the 180-day period that starts at ED+61. Dollar volume, $Vol, is the natural logarithm of the average of the product of daily trading volume and daily closing price. Illiquidity ratio, ILLIQ, is the average of the absolute value of the daily return divided by the daily trading volume in dollars. Relative spread, %Spd, is the average of the difference between the daily closing ask and bid prices divided by the mid-point of closing ask and bid prices. Zero returns ratio, Zeros, is the ratio of the number of zero return days to the total number of trading days. I used Paired *t*-Test to test whether the mean of the post-event level is significant different from the mean of the pre-event level, Wilcoxon signed rank sum test to test whether the median of the post-event level is significant different from the median of the of the pre-event level, and Sign test to evaluate the significance of percent of stock experience positive reaction. [a]Units are 10^{-6}

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure additions (N=86)															
2.3780	0.3943	0.0257	0.3534	0.0166	0.3105	0.0064	-0.0294	0.86	175.56	33.57	11.30	66.28%	55.81%	59.30%	39.53%
(2.3865)	(0.1734)	(0.0232)	(0.3833)	(0.0188)	(0.0192)	(0.0032)	(-0.0278)	(0.80)	(35.59)	(13.47)	(-8.60)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.1870*	*0.1164*	*0.0035*	*0.2149*	*0.1287*	*0.0001*	*<.0001*	*0.2557*	*0.0025*	*0.2809*	*0.0845*	*0.0523*
Wilcoxon signed-rank-sum Test Pr > |S|:				*0.0706*	*0.4276*	*0.0025*	*0.2781*	*0.0653*	*0.0024*	*0.0002*	*0.9331*				
Upward additions (N=167)															
2.3864	0.3155	0.0321	0.3362	0.0321	0.0217	-0.0014	-0.0321	1.48	73.67	13.31	10.51	58.68%	39.52%	42.51%	42.51%
(2.4006)	(0.1781)	(0.0273)	(0.3389)	(0.0151)	(-0.0315)	(-0.0017)	(-0.0167)	(0.62)	(-19.33)	(-6.60)	(-6.32)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.0001*	*0.6282*	*0.4507*	*0.0136*	*<.0001*	*0.0002*	*0.0308*	*0.2026*	*0.0248*	*0.0068*	*0.0530*	*0.0530*
Wilcoxon signed-rank-sum Test Pr > |S|:				*0.0004*	*0.2485*	*0.0698*	*0.0554*	*0.0003*	*0.7588*	*0.6342*	*0.3685*				
Downward additions (N=151)															
2.6060	0.0556	0.0198	0.1155	-0.0916	0.2041	0.0145	0.0840	-3.40	1274.62	127.13	157.33	8.61%	86.09%	87.42%	80.97%
(2.6125)	(0.0305)	(0.0174)	(0.0722)	(-0.0795)	(0.0583)	(0.0090)	(0.0611)	(-3.03)	(249.03)	(66.20)	(74.42)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*0.0002*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*				

Table 22 ***(continued)***

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure deletions (N=24)															
2.2109	1.3423	0.0368	0.4523	0.0679	0.0017	-0.0031	0.0069	3.49	85.94	5.84	10.29	75.00%	58.33%	41.67%	50.00%
(2.2390)	(0.3632)	(0.0282)	(0.4556)	(0.0396)	(0.0370)	(-0.0018)	(0.0028)	(1.76)	(6.03)	(-6.77)	(0.57)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*0.0106*	*0.9972*	*0.5397*	*0.7643*	*0.0199*	*0.0352*	*0.5882*	*0.1746*	*0.0143*	*0.4142*	*0.4142*	*1.0000*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*0.0003*	*0.5411*	*0.5597*	*0.7237*	*0.0002*	*0.1661*	*0.8464*	*0.3339*				
Upward deletions (N=106)															
2.5048	0.1528	0.0193	0.2142	0.0783	-0.0857	-0.0043	-0.0662	3.36	-23.60	-8.18	-5.14	87.74%	16.04%	32.08%	28.30%
(2.5234)	(0.0592)	(0.0158)	(0.1694)	(0.0653)	(-0.0232)	(-0.0021)	(-0.0500)	(2.58)	(-54.00)	(-15.46)	(-31.93)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*<.0001*	*0.0020*	*0.0007*	*<.0001*	*<.0001*	*0.0645*	*0.1112*	*0.5690*	*<.0001*	*<.0001*	*0.0002*	*<.0001*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*0.0009*	*0.0004*				
Downward deletions (N=250)															
2.3386	3.1080	0.0549	0.3656	-0.0438	1.1341	0.0340	0.0267	-1.71	675.51	78.23	34.07	34.80%	60.40%	65.20%	61.60%
(2.3462)	(0.6500)	(0.0478)	(0.3778)	(-0.0415)	(0.1881)	(0.0078)	(0.0389)	(-1.77)	(51.27)	(24.30)	(10.18)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*<.0001*	*0.6018*	*0.0005*	*0.0069*	*<.0001*	*0.0006*	*<.0001*	*<.0001*	*<.0001*	*0.0010*	*<.0001*	*0.0002*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*<.0001*	*<.0001*	*<.0001*	*0.0009*	*<.0001*	*<.0001*	*<.0001*	*<.0001*				

Table 23: Changes in Stocks Liquidity (90-Day Window)

This table shows mean (median) levels, changes, percent changes, and percent of stock experience positive reaction in stock liquidity following addition to and deletion from the FTSE SmallCap Index. Pre-event levels are the average over the 90-day period that ends at ED-31. Post-event levels are the average over the 90-day period that starts at ED+61. Dollar volume, $Vol, is the natural logarithm of the average of the product of daily trading volume and daily closing price. Illiquidity ratio, ILLIQ, is the average of the absolute value of the daily return divided by the daily trading volume in dollars. Relative spread, %Spd, is the average of the difference between the daily closing ask and bid prices divided by the mid-point of closing ask and bid prices. Zero returns ratio, Zeros, is the ratio of the number of zero return days to the total number of trading days. I used Paired t-Test to test whether the mean of the post-event level is significant different from the mean of the pre-event level, Wilcoxon signed rank sum test to test whether the median of the post-event level is significant different from the median of the of the pre-event level, and Sign test to evaluate the significance of percent of stock experience positive reaction. [a]Units are 10^{-6}

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure additions (N=86)															
2.3716	0.4687	0.0255	0.3820	0.0310	0.0784	0.0035	-0.0537	1.78	143.72	27.74	-0.44	61.63%	50.00%	56.98%	38.37%
(2.3816)	(0.1963)	(0.0216)	(0.4278)	(0.0258)	(-0.0018)	(0.0030)	(-0.0333)	(1.07)	(-3.11)	(13.94)	(-9.80)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.0377*	*0.6521*	*0.0129*	*0.0152*	*0.0656*	*0.0114*	*<.0001*	*0.9600*	*0.0310*	*1.0000*	*0.1957*	*0.0310*
Wilcoxon signed-rank-sum Test Pr > |S|:				*0.0080*	*0.5483*	*0.0122*	*0.0588*	*0.0062*	*0.0524*	*0.0005*	*0.1153*				
Upward additions (N=167)															
2.3949	0.3223	0.0301	0.3308	0.0333	-0.0684	-0.0007	-0.0268	1.48	37.30	13.96	13.64	64.67%	35.93%	41.92%	47.31%
(2.3996)	(0.1854)	(0.0259)	(0.3333)	(0.0260)	(-0.0433)	(-0.0020)	(0)	(1.10)	(-30.22)	(-7.80)	(0)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*<.0001*	*0.0760*	*0.6816*	*0.0331*	*<.0001*	*0.0155*	*0.0341*	*0.0929*	*0.0001*	*0.0003*	*0.0367*	*0.4862*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*0.0084*	*0.0744*	-	*<.0001*	*0.3987*	*0.6467*	-				
Downward additions (N=151)															
2.5976	0.0630	0.0219	0.1212	-0.0738	0.1494	0.0116	0.0656	-2.69	714.32	92.29	106.97	15.23%	82.78%	81.46%	77.48%
(2.6083)	(0.0336)	(0.0186)	(0.0889)	(-0.0758)	(0.0585)	(0.0071)	(0.0556)	(-2.92)	(193.46)	(46.86)	(66.67)		Sign Test Pr > |z|		
Paried *t*-Test Pr > |*t*|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*				

Table 23 ***(continued)***

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ[a]	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure deletions (N=24)															
2.1964	1.7128	0.0401	0.4847	0.0923	0.0889	-0.0031	-0.0199	4.49	151.27	-1.24	10.27	95.83%	45.83%	45.83%	37.50%
(2.2159)	(0.3857)	(0.0280)	(0.5056)	(0.0649)	(-0.0539)	(-0.0019)	(-0.0222)	(2.89)	(-12.50)	(-7.44)	(-4.26)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.0005*	*0.9041*	*0.5291*	*0.5010*	*0.0016*	*0.2527*	*0.8788*	*0.4130*	*<.0001*	*0.6831*	*0.6831*	*0.2207*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*0.4693*	*0.3277*	*0.3651*	*<.0001*	*0.8681*	*0.5046*	*0.7911*				
Upward deletions (N=106)															
2.5179	0.1427	0.0183	0.2091	0.0632	-0.0776	-0.0032	-0.0584	2.73	-9.51	-4.68	-4.86	83.02%	17.92%	37.74%	32.08%
(2.5261)	(0.0440)	(0.0156)	(0.1556)	(0.0526)	(-0.0184)	(-0.0012)	(-0.0444)	(2.03)	(-49.10)	(-10.54)	(-30.65)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*<.0001*	*0.0041*	*0.0062*	*<.0001*	*<.0001*	*0.5177*	*0.3180*	*0.5370*	*<.0001*	*<.0001*	*0.0116*	*0.0002*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*<.0001*	*0.0021*	*<.0001*	*<.0001*	*<.0001*	*0.0114*	*0.0514*				
Downward deletions (N=250)															
2.3001	5.5303	0.0638	0.3873	0.0057	-1.6632	0.0182	0.0145	0.83	276.24	46.07	29.09	50.80%	49.60%	55.60%	56.40%
(2.3116)	(0.8077)	(0.0527)	(0.4389)	(0.0015)	(-0.0085)	(0.0027)	(0.0278)	(0.06)	(-3.01)	(8.28)	(7.06)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.5655*	*0.6755*	*0.0168*	*0.1365*	*0.2594*	*0.0014*	*<.0001*	*<.0001*	*0.8003*	*0.8993*	*0.0766*	*0.0430*
Wilcoxon signed-rank-sum Test Pr > |S|:				*0.8090*	*0.6259*	*0.0757*	*0.0426*	*0.9143*	*0.0060*	*0.0002*	*0.0001*				

Table 24: Changes in Stocks Liquidity (45-Day Window)

This table shows mean (median) levels, changes, percent changes, and percent of stock experience positive reaction in stock liquidity following addition to and deletion from the FTSE SmallCap Index. Pre-event levels are the average over the 45-day period that ends at ED-31. Post-event levels are the average over the 45-day period that starts at ED+61. Dollar volume, $Vol, is the natural logarithm of the average of the product of daily trading volume and daily closing price. Illiquidity ratio, ILLIQ, is the average of the absolute value of the daily return divided by the daily trading volume in dollars. Relative spread, %Spd, is the average of the difference between the daily closing ask and bid prices divided by the mid-point of closing ask and bid prices. Zero returns ratio, Zeros, is the ratio of the number of zero return days to the total number of trading days. I used Paired t-Test to test whether the mean of the post-event level is significant different from the mean of the pre-event level, Wilcoxon signed rank sum test to test whether the median of the post-event level is significant different from the median of the of the pre-event level, and Sign test to evaluate the significance of percent of stock experience positive reaction. [a]Units are 10^{-6}

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure additions (N=86)															
2.3917	0.0000	0.0260	0.3530	0.0187	-0.2735	0.0025	-0.0207	0.87	93.57	28.90	15.63	59.30%	52.33%	60.47%	44.19%
(2.3904)	(0.0000)	(0.0205)	(0.3556)	(0.0162)	(0.0066)	(0.0024)	(0)	(0.72)	(15.81)	(11.06)	(0)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*0.0617*	*0.2658*	*0.0609*	*0.3852*	*0.0408*	*0.0027*	*0.0001*	*0.2003*	*0.0845*	*0.6662*	*0.0523*	*0.2809*
Wilcoxon signed-rank-sum Test Pr > |S|:				*0.0453*	*0.5270*	*0.0350*	-	*0.0360*	*0.0411*	*0.0014*	-				
Upward additions (N=167)															
2.4099	0.0000	0.0294	0.3132	0.0303	-0.1386	-0.0001	-0.0350	1.31	30.44	18.10	16.04	62.87%	41.32%	41.92%	41.32%
(2.4125)	(0.0000)	(0.0252)	(0.3111)	(0.0225)	(-0.0183)	(-0.0020)	(-0.02)	(0.94)	(-18.57)	(-9.17)	(-10.53)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*<.0001*	*0.0152*	*0.9410*	*0.0127*	*<.0001*	*0.0280*	*0.0196*	*0.0830*	*0.0009*	*0.0248*	*0.0367*	*0.0248*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*0.0243*	*0.1258*	*0.0189*	*<.0001*	*0.5089*	*0.7636*	*0.4852*				
Downward additions (N=151)															
2.5975	0.0000	0.0237	0.1158	-0.0648	0.1156	0.0086	0.0602	-2.43	480.37	74.49	72.66	18.54%	76.82%	78.15%	68.87%
(2.6014)	(0.0000)	(0.0191)	(0.0667)	(-0.0703)	(0.0396)	(0.0047)	(0.0444)	(-2.67)	(143.09)	(37.97)	(22.22)		Sign Test Pr > |z|		
Paired *t*-Test Pr > |*t*|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*
Wilcoxon signed-rank-sum Test Pr > |S|:				*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*	*<.0001*				

Table 24 ***(continued)***

Pre-event levels				Changes				Percent changes				Percent of increases			
$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros	$Vol	ILLIQ	%Spd	Zeros
Pure deletions (N=24)															
2.1733	0.0000	0.0421	0.4639	0.1316	-1.3681	-0.0058	-0.0037	6.69	31.85	-7.05	18.41	100.00%	37.50%	41.67%	41.67%
(2.2051)	(0.0000)	(0.0287)	(0.4778)	(0.1168)	(-0.1651)	(-0.0032)	(0)	(5.13)	(-50.50)	(-12.02)	(0)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*<.0001*	*0.1407*	*0.3507*	*0.9145*	*0.0007*	*0.3486*	*0.3715*	*0.1986*	*<.0001*	*0.2207*	*0.4142*	*0.4142*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*<.0001*	*0.1111*	*0.1948*	-	*<.0001*	*0.9338*	*0.2870*	-				
Upward deletions (N=106)															
2.5391	0.0000	0.0176	0.1966	0.0449	-0.0951	-0.0022	-0.0512	1.80	1.32	-0.74	-2.96	79.25%	28.30%	41.51%	26.42%
(2.5384)	(0.0000)	(0.0143)	(0.1556)	(0.0388)	(-0.0134)	(-0.0008)	(-0.0222)	(1.52)	(-48.41)	(-8.63)	(-17.69)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*<.0001*	*0.0100*	*0.0208*	*0.0004*	*<.0001*	*0.9356*	*0.8765*	*0.7204*	*<.0001*	*<.0001*	*0.0804*	*<.0001*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*<.0001*	*<.0001*	*0.0274*	*0.0003*	*<.0001*	*<.0001*	*0.1059*	*0.0609*				
Downward deletions (N=250)															
2.3092	0.0000	0.0702	0.3592	0.0081	1.3562	0.0047	0.0316	0.52	137.92	21.63	45.57	54.40%	35.60%	49.60%	54.40%
(2.3201)	(0.0000)	(0.0563)	(0.4000)	(0.0126)	(-0.1868)	(-0.0000)	(0.0222)	(0.55)	(-27.78)	(-0.12)	(9.23)		Sign Test Pr > |z|		
		Paired *t*-Test Pr > |*t*|:		*0.3012*	*0.1893*	*0.3682*	*0.0064*	*0.1577*	*0.0004*	*0.0001*	*<.0001*	*0.1641*	*<.0001*	*0.8993*	*0.1641*
		Wilcoxon signed-rank-sum Test Pr > |S|:		*0.3016*	*<.0001*	*0.6011*	*0.0028*	*0.2473*	*0.4579*	*0.0760*	*<.0001*				

4.6 Regression Analysis of Stock Price Effects of Index Changes

In this section, I investigate whether changes in liquidity explain permanent index price effects by estimating the Ordinary Least Square (OLS) regressions of the 90-day cumulative abnormal return on raw changes in the liquidity proxies. The dependent variable is the abnormal stock return from 30 days before the effective day to 60 days after the effective day. Independent variables are raw changes in four liquidity measures. I also include stock's market value as a control variable. Panel A of Table 25 shows the results of the regression for each of the six sub-groups of index changes. In Panel B of Table 25, I introduce sub-group dummy variables and regress all data as a whole.

Since four independent variables are changes in liquidity proxies, multicollinearity may become an issue. Typically, multicollinearity has the effect of increasing the standard errors of the independent variables. I examine multicollinearity by calculating the variance inflation factors (VIFs) for the regression coefficients. The VIF for variable x_i is given by:

$$VIF(x_i) = \frac{1}{1-R_i^2} \tag{11}$$

where R_i^2 is the square of the multiple correlation coefficient that results when x_i is regressed against all the other explanatory variables. Usually, a VIF greater than five or ten implies a potential multicollinearity problem. Given that all VIFs are less than 4.6, multicollinearity is not a problem in these regressions.

Table 25, Panel A, reports estimates for each of the six sub-groups of index changes. The results indicate that increased dollar volume and declined relative spread are two important sources of value gains for index changes to the FTSE SmallCap index.

Panel B in Table 25 contains coefficient estimates for the full sample that includes all six sub-groups. I find a significantly positive relation between change in dollar volume and cumulative abnormal returns and negative relation between changes in relative spread and zero returns ratio on one side and the cumulative abnormal returns on the other side. All dummy variables, except downward addition, are significant in the regression. These results suggest that sub-groups perform significantly different from the pure additions group. Overall, regression results provide support for the relationship between changes in stocks' liquidity and permanent price effects around index changes.

Table 25: OLS Analysis of Stock Price Effects of Index Changes

The dependent variable is the market-adjusted CARs from 30 trading days before the ED to 60 trading days following the ED. In Panel A, regression are tested for each of the six sub-groups of index changes; independent variables including changes in each of the four liquidity proxies and market value on 30 trading days before the ED. In Panel B, regression is performed on the whole data set with sub-group dummy variables included.

Panel A												
	Regression											
Group	c	*p*	△$Vol	*p*	△ILLIQ	*p*	△%Spd	*p*	△Zeros	*p*	MV	*p*
Stocks that shifted between the FTSE 250 and FTSE SmallCap indices												
Downward additions	5.581	*0.02%*	0.806	*1.92%*	140286	*6.56%*	-5.092	*1.68%*	-0.339	*24.28%*	-0.291	*0.02%*
Upward deletions	1.821	*26.65%*	0.860	*4.74%*	-23135	*84.74%*	3.922	*22.03%*	-0.222	*44.13%*	-0.087	*29.62%*
Stocks that shifted between the FTSE SmallCap and FTSE Fledgling indices												
Upward additions	4.450	*0.02%*	0.970	*0.04%*	-1503	*97.46%*	-3.809	*0.05%*	-0.520	*0.05%*	-0.238	*0.02%*
Downward deletions	2.712	*0.06%*	0.368	*9.76%*	-143	*84.99%*	-1.131	*<0.01%*	-0.272	*11.11%*	-0.158	*0.05%*
Stocks that are new to the FTSE SmallCap index and deleted from the FTSE family of indices												
Pure additions	1.642	*17.91%*	0.884	*0.19%*	26373	*12.32%*	-4.675	*0.46%*	-0.089	*50.18%*	-0.090	*16.89%*
Pure deletions	-0.212	*91.96%*	-1.422	*4.15%*	-30241	*42.18%*	-3.095	*33.95%*	-0.193	*78.61%*	0.009	*94.03%*

Panel B	c	*p*	△$Vol	*p*	△ILLIQ	*p*	△%Spd	*p*	△Zeros	*p*	MV	*p*
Regressors	3.039	*<0.01%*	0.582	*<0.01%*	44	*94.70%*	-1.141	*<0.01%*	-0.310	*0.03%*	-0.166	*<.0001*

Dummy variables	Pure deletions dummy	*p*	Downward additions dummy	*p*	Upward deletions dummy	*p*	Upward additions dummy	*p*	Downward deletions dummy	*p*
	-0.187	*1.68%*	0.060	*23.59%*	0.326	*<0.01%*	0.112	*1.43%*	-0.189	*0.05%*

4.7 Discussion

In an effort to disentangle the competing hypotheses, I examine the changes in stock price, trading volume, institutional ownership, and liquidity following the changes to the FTSE SmallCap index. The six sub-groups of index changes can be grouped as the following pairs:

1. Downward additions and upward deletions consist of all stocks that shifted between the FTSE 250 and FTSE SmallCap indices.
2. Upward additions and downward deletions consist of all stocks that shifted between the FTSE SmallCap and FTSE Fledgling indices.
3. Pure additions and deletions consist of all stocks that are new to the FTSE SmallCap index and deleted from the FTSE family of indices.

Table 26 presents a summary of results for these three pairs of sub-groups.

For downward additions and upward deletions, I find a permanent change in abnormal return and liquidity. Downward additions experience a downward trend and lose as much as 15.8% over the pre-event period of [ED-30, ED-1]. The positive abnormal return on the effective day is the sign of a small reversal. In contrast to downward additions, upward deletions experience an upward trend and gain as much as 12.61% over the pre-event period of [ED-30, AD-1]. Limited price reversal for upward deletions happens starting on the announcement day, which is earlier than for downward additions. However, abnormal price reaction does not revert completely for this pair of sub-groups. Both sub-groups experience significant and positive abnormal trading volume on the effective day. None of these two sub-groups experience significant change in institutional shareholdings. One possible reason is that institutional investors tracking the FTSE SmallCap index buy (sell) shares while institutional investors tracking the FTSE 250 index sell (buy) shares when a stock shifts from one index to the other given that both FTSE 250 and FTSE SmallCap indices are real-time calculated indices and widely followed by institutional investors. Finally, I find that stocks that were promoted to the FTSE 250 index experience significant increase in liquidity while stocks that were demoted from the FTSE 250 index experience a significant decline in liquidity. Before further discussion on liquidity changes, I look at another pair of sub-groups that shows similar results.

Table 26: Summary of Results for UK sample

This table presents a summary of results for my UK sample. Significant increase are denote as " ↑ " while significant decrease are denote as " ↓ ". Trading volume results on the announcement day (AD) and effective day (ED) are reported. IO stands for Institutional Ownership. SO stands for Share available to ordinary investors. Four liquidity measures, dollar volume ($Vol), illiquidity ratio (ILLIQ), relative spread (%Spd), and zero returns ratio (Zeros) are reported.

Group	Abnormal Return	Trading volume		IO/ SO	Liquidity				Support hypothesis
		AD	ED		$Vol	ILLIQ	%Spd	Zeros	
Stocks that shifted between the FTSE 250 and FTSE SmallCap indices									
Downward additions	permanent price decrease	-	↑	-/-	↓	↑	↑	↑	Liquidity hypothesis
Upward deletions	permanent price increase	-	↑	-/-	↑	↓	↓	↓	Liquidity hypothesis
Stocks that shifted between the FTSE SmallCap and FTSE Fledgling indices									
Upward additions	permanent price increase	-	↑	-/-	↑	↓	↓	↓	Liquidity hypothesis
Downward deletions	permanent price decrease	-	↑	↓/-	↓	↑	↑	↑	Liquidity hypothesis
Stocks that are new to the FTSE SmallCap index and deleted from the FTSE family of indices									
Pure additions	Complete reversal	-	↑	↑/↓	↑	↑	↑	↓	Price pressure hypothesis
Pure deletions	permanent price decrease	-	↑	-/-	↑	↑	-	-	-

Results of upward additions and downward deletions also indicate that there is a permanent change in abnormal return and liquidity. Upward additions (downward deletions) experience an upward (downward) trend and gain as much as 21.55% (22.45%) over the pre-event period of [ED-30, ED]. Limited price reversal begins on the first trading day after the effective day but does not stay for long. Both sub-groups experience significant and positive abnormal trading volume on the effective day. There is no

significant change in institutional shareholdings for upward additions, but downward deletions experience significant decrease of 1.43% in institutional shareholdings. Again, a possible reason is buy and sell orders from institutional investors who take a long position and a short position offset each other when one stock shifts from one index to the other. Finally, I also find that stocks that were promoted from the FTSE Fledgling index experience a significant increase in liquidity while stocks that were demoted to the FTSE Fledgling index experience a significant decrease in liquidity.

For the above two pairs of sub-groups, the permanent and significant change in stock liquidity explains the question: why abnormal price reaction does not revert completely? Investors anticipate the event and expect the stock liquidity to change. To be specific, investors expect that stock liquidity increases for stocks promoted to the FTSE 250 index (upward deletions) and to the FTSE SmallCap index (upward additions). Investors, therefore, start to trade prior to the event. This is consistent with the upward pre-event trend I find for upward deletions and upward additions. The same argument is also true for stocks demoted from the FTSE 250 index and the FTSE SmallCap index. In addition, significant abnormal trading volume over the period of [AD, ED] is followed by the short-lived price reversal. It is, therefore, not a surprise that the permanent increase (decrease) in stock price is actually the pricing of increases (decline) in liquidity.

For pure additions and deletions, I find significant abnormal return and trading volume. Pure additions experience a complete price reversal. I seriously do, however, caution that pure deletion from the FTSE SmallCap index is a noisy and inappropriate event to examine the impact of index changes on stock liquidity as the only reason for pure deletion is based on stock liquidity. Therefore, I discuss only pure additions and the difference between pure additions and upward additions next.

The first time a stock is added to an index is equivalent to a promotion. Consequently, price reactions associated with pure additions should behave similar to those of upward additions. Figure 8 plots the CARs for pure additions and upward additions from ED-30 to ED+60. The Pure additions experience an upward pre-event trend similar to upward additions except the trend happens much closer to the effective day. The main difference between pure additions and upward additions appears during the post event period up to ED+60. As I discussed previously, a permanent increase in stock

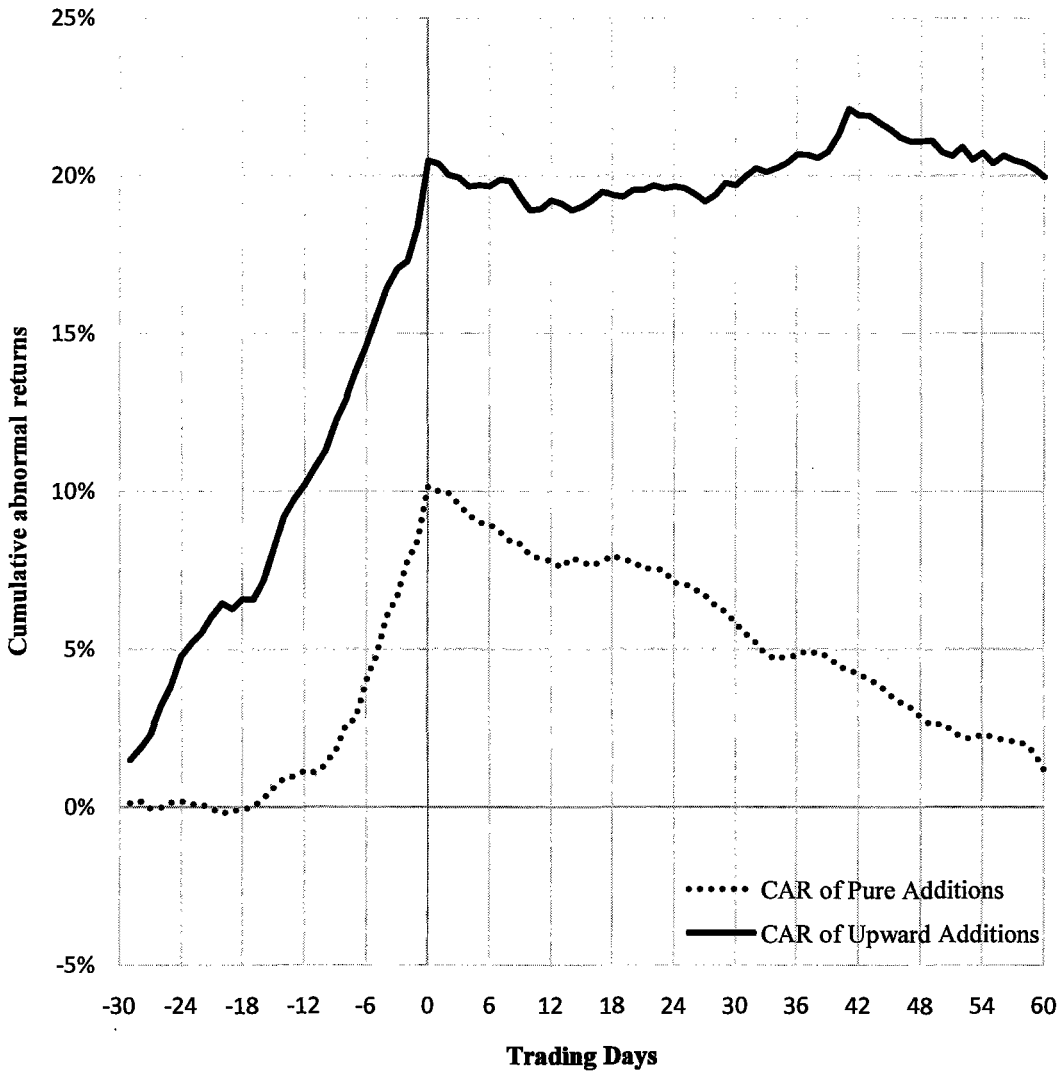

Figure 8: Cumulative abnormal returns for pure additions and upward additions in the FTSE SmallCap Index over the period of [ED-30, ED+60]. The trading day 0 is the effective day and the trading day -6 is the announcement day.

price for upward additions is the pricing of the increase in stock liquidity. Therefore, the complete price reversal for pure additions is because of the opposite changes in liquidity.

Since I find that pure additions is the only sub-group that experience significant increase in percentage of institutional shareholdings and significant decrease in percentage of total shares in issue available to ordinary investors, one possible

explanation for this situation is related to strategic investors. When a stock is newly added to the FTSE SmallCap index, strategic investors buy the shares and hold them as a long-term investment. In addition, the four measurements of liquidity measure different aspects of liquidity. Therefore, when a stock is newly added to the index, more and more attention from the market results in higher dollar volume and lower zero returns ratio. However, at the same time, the holding of strategic investors result in a larger illiquidity ratio and bid-ask spread.

The observed results for the four sub-groups of shifts between indices do not support the investor awareness hypothesis, because they exhibit symmetrical and permanent price reaction. In contrast, according to the investor awareness hypothesis, additions should experience a permanent increase in value, while deletions should show a temporary price decline. This is not surprising given the absence of significant changes in institutional ownership for two additions groups (upward and downward additions).

The results for the pure additions and pure deletions sub-groups are not consistent with the investor awareness hypothesis as well. For example, despite the fact that pure additions experience significant increase in institutional shareholdings, they show a complete price reversal. This is not consistent with the investor awareness hypothesis, which predicts a permanent price effect for additions.

For stocks shifted between the FTSE SmallCap and FTSE 250 indices (upward deletions and downward additions) and between the FTSE SmallCap and FTSE Fledgling indices (downward deletions and upward additions), there is a permanent and symmetrical price effect. According to the downward sloping demand curve hypothesis, a significant change in the number of shares available to ordinary investors causes the permanent price effect. However, none of these four sub-groups experience a significant change in the number of shares available to ordinary investors. Therefore, it is more reasonable to conclude that the permanent price effect is caused by changes in liquidity.

Overall, results from my UK sample provide support for the liquidity hypothesis, indicating that the effect of index additions is permanent. The results also indicate that promotions to the FTSE 250 index and from the FTSE Fledgling index is a beneficial event for the promoted stock and that the added value is associated with a permanent increase of stock liquidity, and vice versa.

As a comparison, I examine the changes in stock price and trading volume following the changes to the S&P/TSX SmallCap index. The four sub-groups of index changes can be grouped as following pairs:

1. Pure additions and deletions consist of all stocks that were new to the S&P/TSX SmallCap index and deleted from the S&P/TSX family indices.
2. Downward additions and upward deletions consist of all stocks that shifted between the S&P/TSX MidCap index and S&P/TSX SmallCap index.

For pure additions and deletions, significant abnormal returns are found on the announcement day and effective day. But, these abnormal returns fully reverted in 30 days. In trading volume analysis, I found that two trading volume spikes occur on the announcement day and effective day. Similar to abnormal returns, these spikes returns to near normal after the event. Evidence, therefore, supports the price pressure hypothesis. In downward additions and upward deletions sub-groups, trading volume are much less affected when compared to pure additions and deletions. Upward deletions do not experience economically significant abnormal returns around the event. In contrast, I found that downward additions experience volatile and significant abnormal returns around the event. Similar to pure additions and deletions, the abnormal gain over the period of [AD, ED] is reverted completely within 10 days. Overall, results from my Canadian sample provide support for the price pressure hypothesis.

The biggest difference between the FTSE SmallCap index and the S&P/TSX SmallCap index is the method to determine the constitution stocks. The FTSE SmallCap index uses a very transparent method, which means the dates and changes to the index are generally predictable. In contrast, the changes to the S&P/TSX SmallCap are generally considered an unexpected event.

Since the changes to the FTSE SmallCap index are predictable, I examine cumulative abnormal returns (CAR) over the entire event window [ED-30, ED+60] to determine whether the price reactions are permanent when examining my UK sample. This is consistent with Biktimirov, Cowan, and Jordan (2004) who examine CAR of the period of [ED-40, ED+40] and Mase (2007) who examines CAR of the period of [ED-17, ED+30]. The price reactions observed before the announcement of the event may also reflect investors' expectation regarding the stocks that are added to (deleted from) the

index. In addition, in my further analysis about my UK sample, I found that there is a permanent change in stock liquidity. According to the liquidity hypothesis, the reduced (increased) future trading costs should translate into a permanent increase (decrease) in stock price.

In contrast, since investors are unlikely to predict the changes to the S&P/TSX SmallCap index, I examine the CAR over the period of [AD, ED+60]. This is consistent with other studies that examine Standard and Poor's series of indices. For example, Shankar and Miller (2006) examine CAR over the period of [AD, ED+60] for firms added to (deleted from) the S&P 600 index. Therefore, only the price reactions observed over the period between the announcement day and effective day reflect investors' expectation regarding the stocks that are added to (deleted from) the index. In my examination about my Canadian sample, the evidence seems to support the price pressure hypothesis.

Suggestions for future research are twofold. First, future research may include obtaining and analyzing additional data. For example, using intraday bid-ask spread data for liquidity test. In this study, one of the liquidity proxies, relative spread, is calculated from the closing bid-ask spread, which may not be able to reflect the real bid-ask spread. Furthermore examining the change in number of analysts following the stocks could provide additional evidence on the amount of information available about the stocks.

In addition, the current institutional ownership analysis could be extended by using additional data. For example, if the number of investors data is available, changes in "shadow cost", which provides direct test for the investor awareness hypothesis, could be calculated. Information on trade size around the event could provide evidence on institutional and small investors' trades around the event.

Second, additional cross-sectional regression analysis could be conducted. For example, regressions where the dependent variable is abnormal trading volume, institutional ownership variables or liquidity proxies and independent variables include control variables and dummy variables for various types of index changes would be helpful.

Lastly, future research should conduct institutional ownership and liquidity analyses for changes to the S&P/TSX SmallCap index. In this study, I only compare the price and

volume effects between the FTSE SmallCap and S&P/TSX SmallCap indices. It is interesting to see the results of a more comprehensive comparison between these two indices.

Chapter 5 Summary and Conclusions

A significant body of research documents that there is a positive price reaction associated with the announcement of index additions and vice versa. Different hypotheses are developed to explain this reaction. But the evidence is primarily from examining US indices and large cap indices.

In an effort to disentangle the competing hypothesis, I investigate price, trading volume, institutional ownership, and liquidity reactions for firms added to or deleted from the FTSE SmallCap index. In addition, I also investigate price and trading volume reactions for firms added to or deleted from the S&P/TSX SmallCap index as a comparison. These two indices differ in this context. First, additions and deletions in the S&P/TSX SmallCap index occur irregularly, but additions and deletions in the FTSE SmallCap index are reviewed on quarterly basis on fixed dates. Second, the FTSE SmallCap index is reviewed primarily according to a ranking based on market capitalization, but the S&P/TSX SmallCap index uses a method that is much more complicated. Furthermore the construction of the FTSE UK indices allows me to study three different types of additions and deletions: pure additions and deletions, shifts between the FTSE 250 index and FTSE SmallCap index, and shifts between the FTSE SmallCap index and the FTSE Fledgling index.

The examination of my UK sample shows that firms promoted to the FTSE SmallCap index (upward additions) and the FTSE 250 index (upward deletions) have positive cumulative returns prior to the announcement day and permanent increase in stock liquidity. In contrast, I find that firms demoted from the FTSE 250 index (downward additions) and the FTSE SmallCap index (downward deletions) have negative cumulative return prior to the announcement day and permanent decrease in stock liquidity. Similar to firms promoted from the FTSE Fledgling index, firms newly added to the FTSE SmallCap index (pure additions) have a positive cumulative return prior to the

announcement day. But, in contrast to the permanent abnormal return and improved liquidity found for firms promoted from the FTSE Fledgling index, the excess cumulative return for pure additions reverted completely over the post-event period and there are opposite changes in stock liquidity. My findings discussed above support the liquidity hypothesis. This indicates that the effect of index inclusion or deletions is permanent because of the future changes in stocks liquidity.

The examination of my Canadian sample shows that new additions have positive returns and firms shifted to the S&P/TSX SmallCap index from other S&P/TSX indices have negative returns on the announcement day and the effective day, but the cumulative return over the period from the announcement day to the effective day are fully reverted in both cases. Similarly, I find negative returns on the announcement day and the effective day for firms deleted from all S&P/TSX family indices and positive returns for firms promoted to the larger cap S&P/TSX indices, but these returns are also completely reverted. In addition, the daily trading volumes in all four sub-groups in my Canadian sample are significantly higher than normal on the announcement day and the effective day. These results are similar to those reported by Biktimirov, Cowan, and Jordan (2004) for changes in the Russell 2000 index and Shankar and Miller (2006) for changes in S&P 600 index. Consistent with the price pressure hypothesis, I find that firms added to or deleted from the S&P/TSX SmallCap index experience temporary effects on the price and trading volume.

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Appendix: Significance Testing

I use *t*-test, rank test, and sign test to test the significance. As a parametric test, the standard *t*-test is given by:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}},$$

where $\bar{x}$ is the sample average, s is the sample standard deviation of the sample, and n is the sample size. In my thesis, most of the time μ_0 is equal to zero as the null hypothesis is to test whether the difference is significant differ from zero.

Brown and Warner (1980) extend the standard t-test with the Crude Dependence Adjustment. When employed with testing abnormal returns[31], the test statistic using a 150-day estimation period is given by:

$$t(\overline{AR}_t) = \overline{AR}_t \Big/ \sqrt{\frac{1}{149}\left(\sum_{t=-180}^{t=-31}\left(\overline{AR}_t - \frac{1}{150}\sum_{t=-180}^{t=-31}\overline{AR}_t\right)^2\right)}.$$

The rank test, described in Corrado (1989), is a non-parametric test of significance of abnormal returns and trading volumes. Use abnormal as an example, it transforms each stock's time series of abnormal returns, $AR_{j,t}$, into corresponding ranks:

$$K_{j,t} = rank(AR_{j,t}), \quad t = -119, \dots, +30,$$

where $AR_{j,\tau_1} \geq AR_{j,\tau_2}$ implies $K_{j,\tau_1} \geq K_{j,\tau_2}$ and $150 \geq K_{j,t} \geq 1$. For any day t, the test statistic is give by:

[31] This test statistic is also used when testing abnormal trading volumes.

$$z_{rank,t} = \frac{1}{N}\left(\frac{1}{S(K)}\sum_{j=1}^{N}(K_{j,t} - 75.5)\right),$$

where the sample standard deviation is given by:

$$S(K) = \sqrt{\frac{1}{150}\sum_{-119}^{+30}\left(\frac{1}{N}\sum_{j=1}^{N}(K_{j,t} - 75.5)\right)^2},$$

where N is the sample size.

Another non-parametric test employed to test significance is the sign test, as known as binomial proportionality test. The sign test examines whether the proportion of positive abnormal reactions is larger than one-half. Since the sign test is insensitive to the magnitude, it can eliminate the impact of outliers in the sample. If the observed number of stock with positive (abnormal) reactions, N_t^+, on any day t, the test statistic is given by:

$$z_{sign,t} = \left(\frac{N_t^+}{N} - 0.5\right)\frac{\sqrt{N}}{0.5}.$$

An extension of sign test is the generalized sign test. The generalized sign test examine whether the number of positive changes exceeds the number expected in the absence of abnormal performance. The test statistic is given by:

$$Z_{G-sign,t} = \frac{N_t^+ - N\hat{p}}{\sqrt{N\hat{p}(1-\hat{p})}}$$

where N_t^+ is the observed number of stock with positive (abnormal) reactions on any day t and $\hat{p}$ is the expected proportion of stock with positive (abnormal) reactions in the absence of abnormal performance.