Index revisions, systematic liquidity risk and the cost of equity capital

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Abstract

This study investigates the impact of FTSE100 index revisions on firms' systematic liquidity risk and the cost of equity capital. We show that index membership enhances all aspects of liquidity, whereas stocks that leave the index exhibit no significant liquidity change. We also show that the liquidity risk premium and the cost of equity capital decline significantly after additions, but do not exhibit any significant change following deletions. The control sample analysis indicates that observed decline in liquidity premium and the cost of equity capital is not driven by factors other than index revisions. Our evidence is consistent with Amihud and Mendelson's (1986) argument that since liquidity is priced, an increase in liquidity will result in lower expected returns. Furthermore, the asymmetric impact of additions and deletions on stock liquidity and cost of capital is consistent with the view that the benefits of index membership are permanent (see, e.g. Chen et al. 2004, 2006).

JEL Classification: G12, G32

Keywords: FTSE 100 index revision, stock liquidity, liquidity risk premium, cost capital

1. Introduction

Several studies (e.g. Shleifer, 1986; Harris and Gurel, 1986; Dhillon and Johnson, 1991) show that stocks experience significant liquidity increase (decrease) after joining (leaving) a major stock index. Others, including Amihud and Mendelso (1986), Chalmers and Kadlec (1998), report a positive association between individual stock liquidity and stock market returns. Chordia et al. (2000), Stambaugh (2003), Amihud (2002) and Liu (2006), among others, show that liquidity risk represents a source of non-diversifiable risk that needs to be reflected in expected asset returns. Thus, it can be argued that if index revisions affect stock liquidity and if liquidity is priced, the cost of equity capital may also be influenced by the revision events.

This study investigates the impact of the FTSE 100 index revisions on the systematic liquidity risk and the cost of equity capital. Its contributions to the literature is twofold. First, existing studies (e.g. Pruitt and Wei, 1989; Beneish and Whaley, 1996; Doeswijk, 2005; Vespro, 2006; Becker-Blease and Paul, 2006; Gregoriou and Nguyen, 2010) usually focus on the impact of index revisions on a single dimension of individual stock liquidity. Liu (2006) argues that since liquidity is multidimensional, conventional measures, such as trading volume, bid-ask spread and Amihud's (2002) illiquidity ratio, may not fully capture the liquidity risk. Kyle (1985) and Lesmond (2005) also argue that since liquidity is very difficult to define and even more difficult to estimate, a menu of measures would be required to capture the various aspects of liquidity. Given the uncertainties surrounding liquidity estimation, we use effective bid-ask spread, turnover ratio, Amihud's (2002) illiquidity ratio, and Lesmond et al.'s (1999) proportion of zero returns to capture the impact of index revisions on trading costs, trading quantity, price impact, and trading continuation dimensions of liquidity, respectively.

Second, we use Liu's (2006) liquidity-augmented capital asset pricing model (LCAPM) to measure, with greater precision, the effect of index revisions on both the liquidity risk premium and the cost of equity capital of the event firms. Existing studies on index revisions tend to use capital expenditure and investment opportunities as proxies for the cost of equity capital. Gegoriou and Nguyen (2010) and Becker-Blease and Paul (2006), for example, argue that if required returns rise (fall), and thus the cost of capital increases (decreases), one would expect, at the margin, a reduction (enhancement) in the capital expenditure and investment opportunity set. However, the authors do not directly investigate the changes in the cost of capital around additions and deletion events. Furthermore, several other studies posit that the cost of equity capital is not the only determinant of capital expenditure and investment opportunities. Milton and Raviv (1991) suggest that investment opportunities depends on many factors, including the relationship between managers and shareholders, accessibility to both debt and equity markets, financial constraints, the feasibility of investment projects and the default probability. Similarly, Stenbacka and Tombak (2002) argue that investment decisions are not only related to the cost of capital, but also to the levels of retained earnings, debt to equity ratio, the nature of capital markets, the availability of the internal funds and the characteristics of the investment opportunities available to the firm. Therefore, Gregoriou and Nguyen's (2010) finding that index deletions do not affect corporate investment opportunities, does not necessarily imply that index revisions have no impact on the cost of equity capital.

We begin our empirical analysis by examining the impact of index additions and deletions on different liquidity dimensions. We use effective spread, turnover ratio, Amihud's (2002) illiquidity ratio, and the proportion of zero returns to capture the different dimensions of liquidity. Then, we use a mimicking liquidity factor (LIQ hereafter) and the market return (MKT hereafter) to produce liquidity risk from the liquidity-augmented model (LCAPM) of Liu (2006). Subsequently, we use Lin et al.'s (2009) approach to estimate the cost of equity capital in the pre- and post-index revision periods. For robustness checks, we include Fama and French-three factors (1993) and momentum factor of Carhart (1994) as additional variables in the LCAPM. Finally, we use a control sample methodology to account for changes in liquidity risk and cost of equity capital which may be caused by factors other than index revisions.

Our results suggest that stock liquidity improves after additions, but does not diminish following deletions. We also show that the liquidity premium and the cost of equity capital decrease significantly after additions, but do not exhibit any significant change following deletions. Similar results are reported when Fama and French's (1996) factors and Carhat's (1997) momentum factor are used as additional explanatory variables in the LCAPM. Our findings are also robust to various liquidity measures and estimation methods. The control sample analysis indicates that observed decline in liquidity premium and the cost of equity capital are statistically significant even after accounting for other relevant factors. Thus, our results are consistent with Amihud and Mendelson's (1986) argument that since liquidity is priced, an increase in liquidity will result in lower illiquidity and, therefore, lower expected returns. The asymmetric effect of additions and deletions is consistent with Chen et al. (2004, 2006) finding that benefits of index membership are permanent, as investors' awareness increase after additions, but do not disappear after deletions.

The remainder of the paper is organised as follows. Section 2 provides a brief review of the related literature. Section 3 presents our empirical procedures. Section 4 presents our dataset. Section 5 presents and discusses the empirical results. Some robustness checks are presented in Section 6 and a conclusion in Section 7.

2. Related literature

It has been widely documented that stocks become more (less) liquid after joining (leaving) a major stock index. Some studies, including Pruitt and Wei (1989), Beneish and Whaley (1996), Doeswijk (2005) and Vespro (2006), find that the effect of index revisions on the underlying stock liquidity is short-lived. The temporary improvement in stock market liquidity is commonly attributed to the trading effects of index funds and arbitrageurs. Vespro (2006) and Doeswijk (2005) argue that the demand for index stocks tends to exhibit a temporary increase due to index fund managers actions to minimise their tracking errors by rebalancing their portfolios in period immediately before the effective date of inclusions. Once the index rebalancing process is completed, demand curves and prices revert to their original levels. However, Beneish and Whaley (1996) attribute the reverse in liquidity improvements following additions to the price pressure of arbitrageurs who tend to buy potential additions beforehand and sell them to the index funds on the effective dates.

However, other researchers (e.g. Shleifer, 1986, Harris and Gurel, 1986; Beneish and Whaley, 1996) argue that the behaviour of active managers and arbitrageurs should result in a permanent rather than a temporary liquidity change around index revision. Harris and Gurel (1986) find that trading volume increases (decreases) permanently following additions to (deletions from) the S&P 500.

Mazouz and Saadouni (2007) report the same volume patterns around the FTSE 100 index revisions. They attribute their results to the presence of funds, which invest in constituents of major indexes. Shleifer (1986) shows that when stocks are added to the S&P 500 index, their bid-ask spread declines significantly. Beneish and Whaley (1996) examine the changes in liquidity proxies following the S&P 500 index revisions using trading volume, trade size and market bid-ask spread as measures of trading activity. They show that trading volume increases permanently following additions to the S&P 500 and the quoted bid-ask spread decreases temporarily. They attribute their findings to the behaviour of index funds and arbitrageurs around the revision events. Specifically, they argue that index fund managers tend to delay the rebalancing their portfolios until the effective day and this induces permanent increases in the trading volume. They also maintain that the improvement in the bid-ask spread[1] is reversed due to the price pressure of index arbitrageurs that purchase stocks early and sell them to the index funds on the effective dates.

A number of other studies attribute the permanent liquidity effects associated with the index revision events to the contemporaneous changes in firms' fundaments. Dhillon and Johnson (1991) and Beneish and Gardner (1995) argue that since investors become more (less) aware of a stock when it joins (leaves) a major stock index, additions (deletions) could convey good (bad) news about the firms' fundamentals. Similarly, Dhillon and Johnson (1991) and Edmister et al. (1996) show that stocks attract more attention from analysts and investors when they are included in the S&P 500. This, in turn, increases their trading volume and lowers their bid-ask spreads. Beneish and Gardner (1995) find that the adverse selection cost component of the bid-ask spread increases for stocks that are less widely followed by analysts after delisting from the DJIA[2]. Gregoriou and Ioannidis (2003) show that additions to (deletions from) the FTSE 100 increase (decrease) trading volume and the quantity of available information about the added (deleted) stock. Their result is attributed to the fact that investors hold (leave) a stock with more (less) available information, consequently implying lower (higher) trading costs.

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[1] The temporary reduction in bid/ask spread can arise for at least two reasons. First, the specialist may temporarily reduce the size of bid-ask spread to increase the trading volume during this period. Second, the size of the spread may be reduced as a result of index funds using limit orders to acquire the newly added firm's shares. When index fund demand fulfils after the effective day, spreads return to original levels.

[2] However, additions to DJIA have little change because the editors of the Wall Street Journal make DJIA changes to include actively traded stocks which are associated with lower adverse selection costs. They also attributed their result to the absence of index funds in the DJIA market.

Hegde and McDermott (2003) attribute the permanent liquidity effect of index revisions to the changes in ownership structure, transaction cost, and trading activity. Harris and Gurel (1986) and Pruitt and Wei (1989) argue that the price changes around index revision can be, at least partly, explained by the heavy trading of index-fund managers. Pruitt and Wei (1989) provide evidence that institutional investors cause demand changes by tracking the index changes. Lynch and Mendenhall (1997) argue that index funds and arbitrageurs are potentially the main buyers of index stocks. Active funds generally buy and hold shares to construct a portfolio that mimics the return and risk of the stock index at the lowest possible cost. However, arbitrageurs buy when additions are announced with the expectation of selling to the indexers at a higher price on the effective dates. Index revisions *per se* signal information that may make a considerable long-term shift in the composition of equity ownership to uninformed index traders. Moreover, additions invite more uninformed traders which may further increase the awareness of a stock (see also Beneish and Whaley, 1996). According to the information based-models, the presence of informed and uninformed traders improves the different dimensions of stock market liquidity. Kyle (1985) and Easley et al. (2008) argue that if there is an increase in the variance and the frequency of uninformed traders relative to informed traders in a particular stock, the microstructure models imply an improvement in the dimensions of stock market liquidity[3]. However, if the variance and the frequency of uniformed traders decrease, we may observe an increase in the asymmetric information component of the bid-ask spread. Chen et al., (2004, 2006) relates the permanent increase in the trading volume of the added firms to the increase in the number of individual shareholders and index fund traders in the post-addition period. However, they do not find any change in the median number of individual shareholders following deletions. Rigamonti and Barontini (2000), Shu et al. (2004) and Biktimirov et al. (2004) show that institutional ownership increases following additions to the Mib30, Taiwanese market (MSCI) and Russell 2000 indices, respectively.

In this study, we argue if index revisions affect stock liquidity, it should also affect the liquidity risk premium and the cost of equity capital for several reasons.

[3] Kyle (1985) argues that liquidity dimensions include tightness which refers to the cost of turning over a position in a short period of time; depth which refers to the ability of the market to absorb quantities without having a large effect on price; and resiliency which refers to the speed with which prices tend to converge towards the underlying liquidation value of the commodity.

First, Roll (1981), Arbel and Strebel (1982) and Barry and Brown (1985) argue that investors demand a positive premium for the greater uncertainty resulting from the lack of information on illiquid stocks. Second, the seminal work of Amihud and Mendelson (1986) suggests that expected return is a decreasing function of liquidity. In other words, investors tend to require higher compensation for the higher transaction costs which they bear in less liquid markets. Third, Chordia et al. (2000, 2001), Hasbrouck and Seppi (2001), and Huberman and Halka (2001) argue that liquidity risk represents a source of non-diversifiable risk that needs to be reflected in expected asset returns. Finally, Amihud (2002) shows that across stocks and over time, the expected return on a stock is positively associated with its illiquidity. The greater sensitivity of small stocks to illiquidity means that these stocks are subject to greater illiquidity risk, which, if priced, should result in higher illiquidity risk premium.

3. Empirical procedures

This section provides a brief description of liquidity measures used in our analysis. It also explains LCAPM, which is used to investigate the change in the liquidity risk premium and the cost of equity capital of the event stocks across pre- and post-index revision periods.

3.1. Liquidity measures

This study uses four liquidity measures, namely effective bid-ask spread ($Spread$), turnover ratio ($Turnover$), Amihud's illiquidity ($Amihud$) and the proportion of zero returns ($Zero$), to capture the impact of index revisions on the various dimensions of liquidity. We compare values of this measures across pre- and post-index revision periods, which are defined as the [-261, -31] and [+31, +261] windows around the effective date, respectively[4]. The [-30, +30] window is exclude from the analysis in order to avoid the temporary liquidity changes induced by the trading activities of index fund managers and arbitrageurs.

[4] In unreported results, we determine which window to exclude by estimating cumulative average abnormal returns (CARs) over several event windows. We find that CARs are statistically significant only in the windows within $\pm$ 30 days around the index revision dates. We therefore estimate the liquidity measures within the windows [-261, -31] and [+31, +260].

3.1.1. Effective spread

We use the effective spread, defined as twice the absolute value of the difference between the execution price and the midpoint of the closing bid and ask quotes, to examine the impact of index revision on the trading cost dimension of liquidity. Specifically, we calculate the effective spread as

$$Spread_t = 2 \text{ x} \left| P_t^E - \frac{(P_t^A + P_t^B)}{2} \right|, \tag{1}$$

where P_t^E, P_t^A and P_t^B are the execution price, ask price and bid price at time *t*. The higher the $Spread_t$, the higher the transaction cost, and the lower the stock market liquidity.

While other spread measures, including quoted spread and relative spread, are widely used in the literature, the effective spread is arguably the best trading cost measure as many trades occur at prices with the bid and ask quotes (see, e.g. Lin et al., 1995).[5]

3.1.2. Turnover ratio

We use average daily turnover ratio to investigate the impact of index revisions on the trading quantity dimension of liquidity. This measure is specified as follow

$$Turnover_t = \frac{1}{N} \sum_{t=1}^{N} \frac{VO_t}{SO_t}, \tag{2}$$

where $Turnover_t$ is the turnover ratio on day t; N denotes the number of days in the given period; Vol_t is number of shares traded on day *t* and SO_t is the number of shares outstanding on day *t*. A higher $Turnover_t$ implies higher stock market liquidity. Despite its popularity (see, e.g. Rouwenhorst, 1999; Bekaet et al., 2003; Levine and Schmukler; 2003), this measure does not account for the cost per trade, which varies considerably across assets. Summers (2000) and Froot et al. (2001) argue that turnover is likely to increase in liquidity crunches rather than decrease to reflect the decline in market liquidity.

[5] Our conclusions are not sensitive to choice of spread measures. Similar results are produced from using proportional spread and effective spread as proxies of trading costs. The details of these results are available upon request.

3.1.3. Amihud's illiquidity

Amihud (2002) develops a temporary price impact measure called Amihud's illiquidity ratio. This measure is based on Kyle's (1985) model on the daily price response to order flows and is defined as

$$Amihud_t = \text{Average}\left(\frac{|r_t|}{Volume_t}\right), \tag{3}$$

where r_t and $Volume_t$ represent the stock returns and its dollar volume on day *t*, respectively.

Lesmond (2005) argues that one practical limitation of Amihud's illiquidity is the presence of zero volume days, which leaves the measure undefined. He also shows that Lesmond et al.'s (1999) liquidity measure outperform Amihud's illiquidity in the context of emerging markets.

3.1.4. Zero returns

Lesmond et al. (1999) introduce an indirect liquidity measure based on the occurrence of zero returns. This measure is a time series-based with low-frequency data and is rooted from the adverse selection framework of Glosten and Milgrom (1985) and Kyle (1985). In this measure the marginal informed investor trades on new information not reflected in the price of a security only if the net trade profit exceeds the net of transaction costs. The cost of transacting constitutes a threshold that must be exceeded before a security's return will reflect new information. A security with high transaction costs has infrequent price movements and more zero returns than a security with low transaction costs. This measure is specified as

$$Zero_t = \frac{\text{(the number of days with zero reurns)}}{T} \tag{4}$$

where *T* is the number of trading days in a month. High transaction costs imply more zeros and, therefore, low liquidity.

Lesmond et al. (1999) argue that their zero return model is a comprehensive estimate of liquidity that does not only include spread, but also commission costs, a proportion of the expected price impact costs, and the possible opportunity cost of informed trade. However, Bekaert et al. (2007) argue that the zero returns may not necessarily imply the lack of liquidity, as uninformed trades, such as trades by index funds, may not give rise to price changes in liquid markets.

Because of the strengths and weaknesses of each liquidity measure, we employ all four estimators to investigate the impact of index revision on the liquidity of the underlying stocks.

3.2. Liquidity risk premium

We use the following modified version of Liu's LCAPM to estimate the impact of index revisions on the liquidity risk premium of the underlying stocks[6]

$$r_{it} - r_{ft} = \alpha_{i,0} + \alpha_{i,1} D_t + (\beta_{im,0} + \beta_{im,1} D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1} D_t)\, LIQ_{t,i} + \varepsilon_{it} \qquad (5)$$

where r_{it}, r_{ft} and $r_{mt,i}$ are the monthly returns of firm i, the 1-month UK T-bill and the FTSE All Shares index (FTSEALL), respectively. D_t is a dummy variable with a value of one if *t* is in the post-event period and zero otherwise. *LIQ* is the mimicking liquidity factor, defined as the monthly profits from buying one pound of equally weighted low liquidity portfolio (*LL*) and selling one pound of equally weighted high liquidity portfolio (*HL*). At the beginning of each month from July 1985 to July 2010, we sort all the constituents of the FTSEALL in ascending order based on a given liquidity measures (i.e. Zeros)[7] and define *LL* (*LH*) as the portfolio that contains 35% of the lowest (highest) liquidity stocks[8]. The parameter $\alpha_{i,0}$ is the pre-event abnormal return and $\alpha_{i,1}$ is the difference between the post-and pre-event abnormal return. $\beta_{im,0}$ and $\beta_{il,0}$ are the pre-event factor loadings on the market portfolio and the liquidity factor, respectively. $\beta_{im,1}$ and $\beta_{il,1}$ capture the change, across the post- and pre-index revision periods, in factor loading on the market portfolio and the liquidity variable, respectively.

[6] Similar methodology is used by Lin et al (2009) in the context of stock split.

[7] We also use Amihud and the inverse of trading volume by value to construct *LIQ*. Our conclusions remain unchanged (details are available upon request).

[8] According to Liu (2006), the 6-month holding period is chosen because it gives a moderate liquidity premium compared to the 1- and 12-month holding periods, which seems plausible for estimating liquidity factor.

To account for the possible impact of factors other than index revisions on our findings, we use a control sample methodology. We construct our control sample by matching each event stock with a control stock (i) with the closest market capitalisation to the event stock at one month before revision[9]; (ii) has never been a member of the FTSE 100 index and (iii) has a full set of ± 480 daily price observations available around the event date from DataStream. The benchmark-adjusted return is incorporated in our analysis as follows

$$r_{it} - r_{bit} = \alpha_{ib,0} + \alpha_{ib,1} D_t + (\beta_{im,\mathrm{b0}} + \beta_{im,\mathrm{b1}} D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,\mathrm{b0}} + \beta_{il,\mathrm{b1}} D_t) LIQ_{t,i} + \varepsilon_{it} \quad (6)$$

where r_{it} is the monthly return of event firm i at time t; r_{bit} is the monthly return of the event firm i's benchmark firm; $\alpha_{i,\mathrm{b},0}$ and $\alpha_{i,\mathrm{b},1}$ are firm i's excess alphas (excess with respect to the benchmark firm); $\beta_{im,b0}$, $\beta_{il,b0}$, $\beta_{im,b1}$ and $\beta_{il,b1}$ are its excess betas. A significant positive (negative) $\beta_{il,1}$ would suggest that the liquidity risk premium of an event firm increases (decreases) significantly more than that of its benchmark.

3.3. The cost of equity capital

Following Lin et al. (2009), we estimate the cost of equity capital (CEC hereafter) for each event stock in the pre- and post-index revision using the following LCAPM equation

$$\mathrm{E}(r_i) - r_f = \beta_{im} \left(\mathrm{E}(r_m) - r_f\right) + \beta_{il} \mathrm{E}(\mathrm{LIQ}) \quad (7)$$

where r_f is the risk-free rate at time t, $E(r_m)$ is the expected return on the market portfolio and E(LIQ) is the expected value of the mimicking liquidity factors. We use the long-term historical average of $r_m - r_f$ and LIQ as proxies for $E(r_m - r_f)$ and $E(LIQ)$, respectively. The pre-event CEC is estimated by replacing β_{im} and β_{il} in Eq.(7) with $\beta_{im,0}$ and $\beta_{il,0}$ from Eq.(5), respectively. Similarly, the post-event CEC is estimated by substituting β_{im} and β_{il} in Eq.(7) with ($\beta_{im,0}$+ $\beta_{im,1}$) and ($\beta_{il,0} + \beta_{il,1}$)

[9] Recall that stocks are included to and excluded from the FTSE 100 index solely on the basis of their market capitalization.

from Eq.(5), respectively. The average effect of index revision on the CEC is then computed as the difference in the average of the CEC between the post- and the pre-addition (deletion) periods. Finaly, to account for the possible impact of factors other than index revisions on the CEC, we adjust our results using the values of benchmark firms. Specifically, we define the benchmark-adjusted CEC (Adj.CEC hereafter) as the CEC of the event firm minus the CEC of its benchmark.

4. Data

Our study is based on the revision events of the FTSE 100 index, which consists of 100 UK companies with the largest market capitalization. The FTSE Steering Committee is conducting a quarterly review of the FTSE 100 constituents list. Stocks listed on the London Stock Exchange are ranked by their market capitalization at the close of business on the day before the index revisions. Any company in the FTSE 100 list falling below (rising to) 111^{th} (90^{th}) position will be automatically excluded from (included in) the index. To ensure that the index always represents exactly 100 members, the highest (lowest) market capitalization stocks outside (inside) the index are added (removed) if the number of automatic deletions exceeds (is less than) the number of automatic inclusions.[10] Any constituent change is implemented on the third Friday of the same month, so that there are currently seven working days between the announcement and effective change dates. We obtain 367 FTSE 100 index revision events from the DataStream from January 1984 to June 2009. We drop from our sample stocks that were added (deleted) due to events such as spin offs, mergers and takeovers. The data related to spin offs, mergers and takeover is obtained from different resources, including DataStream, Ft.com, Thomson One Bank and the media coverage of each firm. We obtain daily, weekly and monthly closing price, market capitalization, book-to-market value, trading volume, bid and ask quotes, the number of shares outstanding and UK T-bill rate from DataStream. The data on the Fama and French's (1993) three factors and Carhart's (1997) momentum factor are obtained from Xfi Centre for Finance and

[10] A detailed description of the construction of the FTSE 100 can be found in the Ground Rules for the Management 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; accessed 20 May 2011).

Investment website[11], University of Exeter. The final sample consists of 432 stock, 212 additions and 210 deletions, including both surviving and dead stocks. The same variables and data sources are used to construct the control sample. Table 1 provides the yearly distribution of additions and deletions across the study period.

Insert Table 1 about here

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5. Empirical analysis

This section reports results on the impact of index revisions on the liquidity level, the liquidity risk premium and the cost of equity capital of the event stocks.

5.1. Does index revision affect stock liquidity?

Table 2 reports descriptive statistics of the event stocks and their control pairs. Panel A of Table 2 presents the pre-index addition liquidity characteristics, namely, turnover ratio, effective bid-ask spread, Amihud's illiquidity ratio and Zeros, of the added stocks and their control pairs. The paired t-test suggests that the pre-revision liquidity levels associated with the sample of additions is not statistically significant from that of the control sample. With the exception of the turnover ratio, which significant at 10% level, the non-parametric Mann-Whitney test also indicates that the pre-index revision liquidity measures associated with the additions and their benchmarks belong to the same distribution. Panel B of Table 2 presents the cross-sectional descriptive statistics of deleted stocks and their control pairs in the pre-deletion period. The t-test and Mann-Whitney test indicate that the mean and median values of turnover ratio are higher for the event stocks than their control pairs. Moreover, the deleted stocks exhibit lower Amihud's illiquidity ratio and Zeros than their control pairs[12].

Insert Table 2 about here

Table 3 outlines the changes, across pre- and post-index revision periods, in the liquidity characteristics of additions and deletions. The results suggest that the average daily turnover ratio experience increase by 0.0023% following additions. However, the standard t-statistics suggest that the increase is indistinguishable from

[11] The data of Fama and French three-factor model (1993) and momentum factor of Carhart (1997) are obtained from http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php.

[12] Note that deleted stocks form part of the FTSE 100 constituent in the pre-deletion period. Thus, it is not surprising that the deleted stocks are more liquid than their pairs before the revision events.

zero and Wilcoxon Singed Rank test indicate that the change in turnover ratio between pre- and post-addition periods is significant only at 10% level. Our results also suggest that the effective bid-ask spread, Amihud's illiquidity ratio and Zeros decline significantly by -1.22, 1.528 and 4, respectively. This finding suggests that additions to major index improve the various dimensions of stock liquidity. Table 3 also shows that, apart from Zeros, the various liquidity measures remain largely unchanged after deletions. Our results are consistent with Dhillon and Johnson(1991) and Hegde and McDermott (2003), who report a significant liquidity increase following additions to a major index. The asymmetric liquidity reaction to additions and deletions implies that index membership has a permanent effect of stock liquidity.

Insert Table 3 about here

5.2. Does index revision affect the liquidity risk premium?

Table 4 summarises the monthly estimates of the LCAPM around each addition and deletion event. Panel A of Table 4 reports the monthly time-series regression, which is run for each addition from -24 month to month -1 prior to the effective date of the revision month and from month +1 to month +24 after the addition. It shows that the mean of pre-addition market beta (or $\beta_{im,0}$) associated with the event sample is 1.015. The t-test value of 0.495 associated with the average of $\beta_{im,b0}$ implies that the average market beta of the added stocks is not significantly different from that of the control pairs. Similarly, the t-value of 1.15 associated with average of $\beta_{il,b0}$ indicates that, on average, the pre-addition liquidity beta of the added stocks is not significant different from that of the benchmark firms. Panel A of Table 4 also shows that the post-revision liquidity risk of added stocks is declined significantly by 0.462 (t-value is -2.571). We also find that 57% of these stocks exhibit a drop in their liquidity risk in the post-addition periods, suggesting that decline is unlikely to be driven by outliers. The average benchmark-adjusted excess liquidity risk also exhibits a significant decrease of 0.468 (t-value is 1.831) in the post–addition periods. We observe a decline in the benchmark-adjusted liquidity risk in 59% of the added stocks. These results indicate that the majority of additions experience greater decline in their liquidity betas when they join the FTSE 100 index. Our findings are consistent with Amihud and Mendelson (1986), Pastor and Stambaugh (2003), Amihud (2002) and Liu (2006), who show that firms with higher market liquidity exhibit lower liquidity risk premium.

Panel A of Table 4 also shows that market betas decrease significantly by 0.398 (t-value is -2.848) when stocks join the FTSE 100 index. This decline does not seem to be driven by outliers as a decline in market betas is reported in 60% of the cases. The average value of $\beta_{im,b1}$ is -0.406 with t-statistic of -1.672 suggests that the added stocks experience greater decrease in their betas relative to their matched pairs. This decline is unlikely to be driven by outliers since the benchmark-adjusted market betas are dropped in 60% of the added stocks. The negative sign associated with $\beta_{im,1}$ could be attributed to the presence of a large number of non-FTSE 100 stocks in our proxy for the market portfolio (i.e. the FTSEALL index). Consistent with this view, Coakley and Kougoulis (2005) show that the UK stocks commove by -0.872 with non-FTSE100 stocks when they are added to the FTSE 100 index. The decrease in the average market beta may also be due to its mean-reverting tendency (see, e.g. Blume, 1975 and Lin et al., 2009).

Panel B of Table 4 presents the monthly LCAPM estimates around deletion events. The result shows that the average $\beta_{im,0}$ is not significantly different from zero, indicating that deleted stocks have the same pre-deletion market beta as their control pairs. Similarly, the finding that the mean of $\beta_{il,b0}$ is -0.106 with t-value of -1.203 also suggests that the deleted stocks have the same level of pre-deletion liquidity beta as their control pairs. The mean of $\beta_{im,1}$ is also not significantly different from zero, implying that deleted stocks experience the same change in the average market betas as their control pairs. Similarly, the absence of statistical significant on the average $\beta_{il,b1}$ suggests that the sample of deleted stocks and their control pairs experience the same level of change in their liquidity betas following deletions. Thus, our results indicate that the majority of deletions experience no change in their liquidity beta when they leave the FTSE 100.

Insert Table 4 about here

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5. 3. Does index revision affect the cost of equity capital?

How much would the cost of equity capital be reduced for additions due to decline and liquidity risk premium? To estimate the cost of capital, we first estimate $E(r_m - r_f)$ and $E(LIQ)$. Following Lin et al. (2009), the average monthly historical values of the variables $r_m - r_f$ and LIQ over the period from Jan 1987 to Dec 2009 are 0.58% and 0.05%, respectively[13]. Table 5 presents the changes in the CEC following index revisions. Panel A shows that additions are associated with a significant average (median) drop in CEC of 0.25% (0.11%) per month, which equivalent to 2.95% (1.53%) per annum. This drop is unlikely to be driven by outliers as 59.45% of individual stocks exhibit a decline in their CEC in the post-addtion periods. The Adj.CEC also exhibits a significant average (median) decrease of 0.259% (0.19%) per month which also equivalent to 3.02% (2.2%) per annum in the post-addition periods. Again this decrease is observed in 55.6% of the added stocks.

Panel B of Table 5 suggests that the deleted stocks exhibit a mean (median) increase of 0.02% (0.09%) per month and equivalent to 0.38% (0.89%) per annum in the CEC following deletions. These figures are not significantly different from zero, implying that deletions do not affect the cost of equity capital. Thus, our evidence suggests that the benefit of index membership is permanent and does not disappear even when a stock is removed from the index[14].

6. Robustness Checks

For robustness purposes, a liquidity-auguemented multivariate asset pricing model approach (LMCAPM hereafter) of the following form is used to investigate the impact of index revision on the various components of the CEC

$$r_{it} - r_{ft} = \alpha_{i,0} + \alpha_{i,1} D_t + (\beta_{im,0} + \beta_{im,1} D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1} D_t)\, LIQ_{t,i} + (\beta_{is,0} + \beta_{is,1} D_t)\, SMB_{t,i} + (\beta_{ih,0} + \beta_{ih,1} D_t)\, HML_{t,i} + (\beta_{iu,0} + \beta_{iu,1} D_t) MOM_{t,i} + \varepsilon_{it} \quad (8)$$

where $\beta_{im,0}$, $\beta_{il,0}$, $\beta_{is,0}$, $\beta_{ih,0}$ and $\beta_{iu,0}$ are loading factors on MKT, LIQ, SMB, HML and MOM, respectively; SMB_t is calculated as the difference between the returns of

[13] Our estimation of the cost of capital is very similar to Lin et al. (2009) who investigate the impact of stock split on the cost of equity capital over the period 1975 to 2004. Specifically, Lin et al. (2009) use the monthly historical average of $r_m - r_f$ and LIQ over the period 1964-2003 to estimate the $E(r_m - r_f)$ and $E(LIQ)$, which they then used to calculate the change equity capital between month -24 to month -2 prior the stock split and from month + 2 to month + 24 after the ex-distribution.

[14] Our result is not changed by using LIQ estimated by Amihud. Details of the results are available upon request.

a portfolio of small firms and those of large firms; HML_t is the difference in returns of a portfolio of high and low book-to-market stocks; MOM_t is the difference in returns between a portfolio of winner stocks with high prior returns and loser stocks; the rest of the variables are previously defined in Section 3.2.

Table 6 presents the parameter estimates of Eq.(8). It reports the firm by firm time-series regressions, which are run for each event stock over [-24 month, -1 month] and [+1 month, +24 month] windows around index revision periods. The results suggest that $\beta_{il,1}$ and $\beta_{im,1}$ exhibit a significant drop of 0.450 and 0.463, respectively. This decline is unlikely to be driven by outliers, as 56% and 60% of individual stocks exhibit a decline in their liquidity risk and market beta after additions, respectively. Furthermore, the average $\beta_{il,\mathrm{b}1}$ drops significantly by 0.465 and the decline is reported in 53% of additions. Similarly, the average $\beta_{im,b1}$ declines significantly by 0.598 and the decrease is observed in 59% of the addition events. These findings imply that the liquidity risk and market betas of additions drop significantly more than that of the control stocks. The loading factors of $\beta_{is,1}$, $\beta_{ih,1}$ and $\beta_{iu,1}$ are not significant from zero implying that the change in the CEC, across pre- and post-addition periods, is mainly driven by liquidity risk and market beta.

Insert Table 6 about here

Panel B of Table 6 presents the results of LMCAPM for the sample of deleted stocks. The means of $\beta_{im,0}$ and $\beta_{il,0}$ are 1.027 and -0.118, respectively. These figures are not significantly different from zero, implying that the deleted stocks have the same pre-deletion risk characteristics as their control pairs. The averages associated with $\beta_{il,1}$ and $\beta_{im,1}$ are not significantly different from zero, suggesting that deletions do not affect the liquidity premium and market risk. The loading factors of $\beta_{is,1}$, $\beta_{ih,1}$, and $\beta_{iu,1}$ also do not exhibit any significant change following the deletions. Thus, our results suggest that liquidity premium experience significant drop following additions, but do not change after deletions.

Insert Table 7 about here

Table 7 reports the LMCAPM-based CEC estimates. Panel A of Table 7 shows that the CEC and the Adj.CEC experience a stastically significant decline of

0.36% and 0.45% per month[15] following additions to the FTSE 100, respectively. The results in Panel B of Table 7 suggest that neither the CEC nor the Adj.CEC expericence any change in the post-deletion periods. These results, which are similar to those reported in Table 5, indicate index membership has a permanent effect on the cost of equity capital[16]. In other words, our evidence implies that the liquidity risk premium and the cost of equity capital exhibit significant reductions following additions, but do not change after deletions.

7. Conclusion

This study investigates the impact of index revision on stock liquidity, liquidity risk premium and the cost of equity capital. We show that the various dimensions of stock liquidity improve significantly following additions, but remain largely unchanged following deletions. We also use a modified version of Liu's (2006) LCAPM to examine the impact of index revision on the liquidity risk premium. Our results suggest that the majority of the added stocks experience reductions in liquidity beta relative to their benchmark firms. However, we find no evidence that index deletions affect the liquidity risk premium of the underlying stocks. We also examine the impact of index revision on the CEC. We report a significant decline in the CEC in the sample of additions, but the CEC does not seem to be affected by deletions. The asymmetric reaction of liquidity risk premium and cost of capital to the addition and deletion events is robust to the various estimation methods. This asymmetry implies that the benefit of index membership is permanent and does not disappear even when a stock is removed from the index. Thus, index membership improves the stock's trading environment and reduces the cost of the equity capital.

[15] This is equivalent to 7.3% and 5.2% per annum, respectively.

[16] To decide which model is more pronounced, we compare between the LCAPM and LMCAPT by using R-squared, % of stock with non-significant alpha, and Akaike information criteria (AIC). The AIC results imply that the LCAPM performs slightly better than the LMCAPM. However, the Adj. R^2 and %Non-sign α indicate that the LMCAPM is a better model. The detail of these results are available upon request.

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Table 1: The yearly distribution of additions and deletions events

Year	The sample of additions	The sample of Deletions
1984	4	8
1985	9	9
1986	13	7
1987	5	7
1988	8	5
1989	8	8
1990	3	6
1991	7	10
1992	15	17
1993	9	11
1994	3	4
1995	11	8
1996	5	8
1997	7	9
1998	7	13
1999	8	9
2000	17	18
2001	12	9
2002	12	4
2003	5	6
2004	7	4
2005	6	5
2006	7	2
2007	9	11
2008	12	10
2009	3	2
Total	212	210

Table 2: Descriptive Statistics

This table reports the means and medians of firm characteristics over the [-261, -30] window around index revision events. *Turnover* is average the daily turnover ratio computed as the average ratio of the number of shares traded on day t divided by the number of shares outstanding on that day; *Spread* is the effective spread, which is defined as twice the absolute value of the difference between execution price and the midpoint of the closing bid and ask quotes; *Amihud* is the average ratio of the daily absolute return to the pound trading volume on that day; and *Zeros* is the proportion number of days with zero daily return over 12 months. The control sample is constructed by matching each event stock with non-event stock with the closest pre-revision market capitalization. The paired t-test and Mann-Whitney tests are used to judge the statistical significance of the changes, across pre- and post-revision periods. The asterisks ***, **, and * indicate significance at a 1%, 5%, and 10% level, respectively.

Panel A: The criteria of pre-additions and control sample

	Additions		Control		The Differences between Additions and Control	
	Mean	Median	Mean	Median	t-Stat	Mann Whitney
Turnover(10^{-2})	0.6471	0.4993	0.5653	0.4002	1.426	1.790*
Spread	0.2921	0.1752	0.2306	0.1073	0.983	1.368
Amihud(10^{-6})	9.175	3.320	5.736	3.270	1.193	-0.322
Zeros	29	22	29	23	-0.032	-0.048

Panel B: The criteria of pre-deletions and control sample

	Deletions		Control		The Differences between deletions and Control	
	Mean	Median	Mean	Median	t-Stat	Mann Whitney
Turnover(10^{-2})	0.6253	0.4376	0.4712	0.3251	2.604**	3.299***
Spread	0.2775	0.2188	0.3011	0.2564	-0.329	-0.747
Amihud(10^{-6})	4.189	2.615	24.2	4.760	-1.671*	-5.275***
Zeros	28	22	38	31	-3.744***	-4.269***

Table 3: Changes in stock market liquidity

This table presents summary statistics for the changes in the measures of stock market liquidity. *Turnover* is average the daily turnover ratio computed as the average ratio of the number of shares traded on day t divided by the number of shares outstanding on that day; *Spread* is the effective spread, which is defined as twice the absolute value of the difference between execution price and the midpoint of the closing bid and ask quotes; *Amihud* is the average ratio of the daily absolute return to the pound trading volume on that day; and *Zeros* is the proportion number of days with zero daily return over 12 months. Cross-sectional means and medians of *Turnover*, *Spread*, *Amihud*, and *Zeros* are computed over the [-261, -30] and [+30, +260] windows around the revision events. The paired t-test and Wilcoxon Signed Rank test are then used to judge the statistical significance of the changes, across pre- and post-revisions periods, in the different liquidity proxies. The ***, **, * indicate significance at 1%, 5%, and 10% respectively.

	Changes following Additions				Changes following Deletions			
	Mean	Median	t-test	Wilcoxon	Mean	Median	t-test	Wilcoxon
Turnover (%)	0.0023	0.036	0.1038	-1.855*	-0.0022	0.0015	-0.083	-0.609
Spread	-0.122	0.01	0.4287	-1.803*	0.0332	-0.008	0.685	-2.259**
Amihud(10^{-6})	-1.528	-1.230	1.929**	-6.574***	10.916	1.365	-1.001	-5.540***
Zeros	-4	-5	2.616***	-6.137***	9	4	-3.785***	-3.795***

Table 4: The estimation of LCAPM

This Table estimates the factors of LCAPM using firm-by-firm time series regression. We apply the monthly time-series regression of 24 months (260 days) around the index additions. We estimate LCAPM for each event stock for the periods from month -24 to month -1 prior to the event and from month +1 to month +24 after the event. We use the procedures explained by Lin et al. (2009) as in Eqs.(5) and (6). β_{im} and β_{il} are firms i's factor loadings for the FTSE ALL SHARES return and mimicking liquidity factors LIQ, respectively. $\beta_{im,0}$ and $\beta_{il,0}$ are the loading factors of FTSE ALL SHARES return and liquidity in the pre-event, respectively. , $\beta_{im,1}$ and $\beta_{il,1}$ are the difference in the loading factors in the post- relative to pre-event of FTSE ALL SHARES return and liquidity, respectively. %Inc(Dec) is the percentage of firms in the sample that experience a beta increase (decrease) after the revision event. The parameters $\beta_{im,b0}$, $\beta_{il,b0}$, $\beta_{im,b1}$ and $\beta_{il,b1}$ of Eq.(6) are the event firm's excess betas. A significant positive (negative) $\beta_{il,1}$ would suggest that the liquidity risk premium of an event firm increases (decreases) significantly more than that of its benchmark. The t-values with autoregressive error correction standard error, assuming that the errors of the coefficient estimates follow AR (1) process. The asterisks ***, ** and * indicate significance at a 1%, 5% and 10% level, respectively.

Monthly estimation of LCAPM								
Panel A: Additions								
	$\beta_{im,0}$	$\beta_{im,1}$	$\beta_{il,0}$	$\beta_{il,1}$	$\beta_{im,b0}$	$\beta_{im,b1}$	$\beta_{il,b0}$	$\beta_{il,b1}$
Mean	1.015	-0.398	-0.002	-0.462	0.06	-0.406	0.241	-0.468
t-value	11.398	-2.848***	0.025	-2.571***	0.495	-1.672*	1.15	-1.831**
%Inc(Dec)	40 (60)		43 (57)		40 (60)		31 (59)	
Panel B: Deletions								
	$\beta_{im,0}$	$\beta_{im,1}$	$\beta_{il,0}$	$\beta_{il,1}$	$\beta_{im,b0}$	$\beta_{im,b1}$	$\beta_{il,b0}$	$\beta_{il,b1}$
Mean	1.047	0.047	-0.106	0.022	0.012	0.085	-0.0001	0.024
t-value	2.435***	0.42	-1.203	0.169	0.108	0.534	-0.007	0.136
%Inc(Dec)	54 (46)		55 (45)		50 (50)		54 (46)	

Table 5: The LCAPM estimates of the changes in the cost of equity capital (CEC)

This table reports the changes in the CEC estimated from LCAPM (see Lin et al., 2009). We use Eq.(5) to estimate the CEC for each event in the pre- and post-index revisions, seperately. Then, we calculate the changes in the CEC as post minus pre for each event. Finally, we adjusted CEC (Adj.CEC) as the cost of capital for the main sample minus the cost of capital for the control sample. The paired t-test, Wilcoxon Signed Rank test, and Mann Whitney (for independent observations) are then used to judge the statistical significance of the changes, across pre- and post- additions periods. %Inc(Dec) represent the percentage of firms that experience increase (decrease) in the CEC following the revision events. The asterisks ***, ** and * indicate significance at a 1%, 5% and 10% level, respectively.

Panel A: Additions

	CEC						Adj.CEC					
	Pre	Post	Ch	%Inc(Dec)	t-test	Wilcoxon	Pre	Post	Ch	%Inc(Dec)	t-test	Mann Whitney
Mean %	0.58	0.33	-0.25***	40.53 (59.47)	-2.857***	-2.719**	0.046	-0.21	-0.259**	44.4 (55.6)	-1.975**	-2.344**
Median %	0.61	0.49	-0.11				0.04	-0.15	-0.19			

Panel B: Deletions

	CEC						Adj. CEC					
	Pre	Post	Ch	%Inc(Dec)	t-test	Wilcoxon	Pre	Post	Ch	%Inc(Dec)	t-test	Mann Whitney
Mean %	0.6	0.63	0.02	54.00 (46.00)	-0.409	-1.205	0.00	0.05	0.05	51.33 (48.67)	-0.512	-0.408
Median %	0.57	0.64	0.09				-0.06	0.03	0.03			

Table 6: The LMCAPM estimates of the changes in the CEC

This table reports the changes in the CEC estimated from LMCAPM. We estimate the LMCAPM by adding SMB, HML, and MOM to Eq.(5), where SMB_t is the size risk factor in month t and is calculated as the difference between the returns of a portfolio of small vs. large firms; HML_t is the difference in returns of a portfolio of high and low book-to-market stocks; MOM_t is the difference in returns between a portfolio of winner stocks (with the highest prior returns) and loser stocks (with the lowest prior returns); %Inc(Dec) is the percentage of sample stocks with a increase (decrease) in loading factors in the post-revision period. The t-values with autoregressive error correction standard error, assuming that the errors of the coefficient estimates follow AR (1) process. The asterisks ***, ** and * indicate significance at a 1%, 5% and 10% level, respectively.

Panel A: Additions

	$\beta_{im,0}$	$\beta_{im,1}$	$\beta_{il,0}$	$\beta_{il,1}$	$\beta_{is,0}$	$\beta_{is,1}$	$\beta_{ih,0}$	$\beta_{ih,1}$	$\beta_{iu,0}$	$\beta_{iu,1}$
Mean	1.114	-0.463	0.031	-0.450	-0.007	0.073	-0.001	-0.013	-0.073	0.087
t-value	11.335***	-3.422***	0.317	-2.501***	-0.681	1.252	0.369	-0.656	-0.247	-0.030
%Inc(Dec)		40 (60)		44 (56)		45 (55)		51 (49)		48 (52)

	$\beta_{im,b0}$	$\beta_{im,b1}$	$\beta_{il,b0}$	$\beta_{il,b1}$	$\beta_{is,b0}$	$\beta_{is,b1}$	$\beta_{ih,b0}$	$\beta_{ih,b1}$	$\beta_{iu,b0}$	$\beta_{iu,b1}$
Mean	0.274	-0.598	0.282	-0.465	-0.094	0.131	-0.089	-0.019	-0.020	0.164
t-value	1.949**	-3.158***	1.713**	-1.815**	-1.185	0.848	-0.343	-0.467	0.411	-0.036
%Inc(Dec)		41 (59)		47 (53)		42 (58)		46 (54)		50 (50)

Panel B: Deletions

	$\beta_{im,0}$	$\beta_{im,1}$	$\beta_{il,0}$	$\beta_{il,1}$	$\beta_{is,0}$	$\beta_{is,1}$	$\beta_{ih,0}$	$\beta_{ih,1}$	$\beta_{iu,0}$	$\beta_{iu,1}$
Mean	1.027	-0.065	-0.118	-0.090	-0.012	-0.021	0.092	0.154	-0.062	-0.052
t-value	12.13***	-0.529	-1.151	-0.633	-0.183	-0.233	0.963	1.143	-0.846	-0.483
%Inc(Dec)		52 (48)		49 (51)		46 (54)		52 (48)		48 (52)

	$\beta_{im,b0}$	$\beta_{im,b1}$	$\beta_{il,b0}$	$\beta_{il,b1}$	$\beta_{is,b0}$	$\beta_{is,b1}$	$\beta_{ih,b0}$	$\beta_{ih,b1}$	$\beta_{iu,b0}$	$\beta_{iu,b1}$
Mean	0.202	-0.260	0.126	-0.282	-0.247	0.276	-0.117	0.319	-0.151	0.143
t-value	1.601	-1.563	0.795	-1.508	-1.772*	1.897**	-0.841	1.919***	-1.040	0.812
%Inc(Dec)		44 (56)		48 (52)		56 (44)		50 (50)		47 (53)

Table 7: The change in the CEC by using the LMCAPM

The CEC and Adj. CEC are estimated for the LMCAPM. We calculate the changes in the CEC as post minus pre for each event. We adjusted CEC (Adj. CEC) as the cost of capital for the main sample minus the cost of capital for the control sample. Panels A and B reports the firm by firm time-series regressions for each event stock for the periods from -24 month to month -1 prior to the effective date of the revision month and from month +1 to month +24 after the addition and deletion, respectively. The paired t-test, Wilcoxon Signed Rank test, and Mann Whitney (for independent observations) are then used to judge the statistical significance of the changes, across pre- and post- additions periods, in the different liquidity proxies. %Inc (Dec) refers to the percentage of firms with an increase (decrease) in the CEC following the revision events. The asterisks ***, ** and * indicate significance at a 1%, 5% and 10% level, respectively.

Panel A: Additions

	CEC						Adj. CEC					
	Pre	Post	Ch	%Inc(Dec)	t-test	Wilcoxon	Pre	Post	Ch	%Inc(Dec)	t-test	Mann Whitney
Mean%	0.67	0.27	-0.36	46.5 (53.5)	2.443***	1.644*	0.22	-0.23	-0.45	45.9 (54.1)	-2.145**	1.803*
Median%	0.53	0.15	-0.12				0.20	-0.17	-0.12			

Panel B: Deletions

	CEC						Adj. CEC					
	Pre	Post	Ch	%Inc(Dec)	t-test	Wilcoxon	Pre	Post	Ch	%Inc(Dec)	t-test	Mann Whitney
Mean%	0.54	0.52	-0.01	49.00(51.00)	0.082	-0.124	-0.01	0.09	0.09	50.34 (49.66)	0.489	-0.223
Median%	0.48	0.50	0.02				0.02	0.04	-0.06			