**Is there an index effect in frontier markets?**

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**Abstract**

This study examines stock market reactions to changes in the FTSE Frontier 50 index, focusing on abnormal returns, trading volume, firm size, institutional ownership, and liquidity across frontier markets in Africa, Asia, Europe, and South America. We differentiate between new, repeated, and reclassification additions and deletions, providing evidence of the index effect in these markets. Both new and repeated additions experience permanent stock price increases, while new deletions face permanent declines. Repeated deletions exhibit price declines that partially reverse. Reclassification additions and deletions, which involve larger firms, also exhibit significant stock price reactions. Although some proxies suggest a decline in liquidity for new and repeated additions, as well as for new and reclassification deletions, only dollar volume shows a significant relation with cumulative abnormal returns (CARs). Notably, pre-event institutional ownership is significantly associated with CARs, emphasizing its role in market reactions. These findings provide some support for the downward-sloping demand curve hypothesis.

*Keywords:* Frontier markets; FTSE Frontier 50; Event study; Abnormal return; Trading volume; Institutional ownership, Liquidity

*JEL Classification:* G11 · G12 · G14

**1. Introduction**

The addition or removal of stocks from a major index can trigger significant market reactions, commonly referred to as the index effect. This effect is primarily driven by the trading activities of institutional investors and index-tracking funds, which adjust their portfolios to align with the index composition. However, other factors, such as market inefficiencies, liquidity constraints, and supply-demand imbalances, also play a significant role in shaping these reactions (Afego and Biktimirov, 2024). These reactions, which include changes in stock prices, trading volumes, and institutional ownership, have been extensively studied in developed markets, particularly with indices such as the S&P 500 (e.g., Chen et al., 2004), Nasdaq 100 (e.g., Biktimirov and Xu, 2019a), and Russell 2000 (e.g., Chen, 2006). In contrast, emerging markets, and especially frontier markets, remain underexplored.

Emerging markets generally exhibit moderate levels of institutional and market efficiency compared to developed markets. In contrast, frontier markets—defined as “a set of countries with relatively illiquid and highly insulated stock markets” (Ngene et al., 2018, p. 182)—are typically small (Afego, 2015), characterized by inexperienced participants, low trading volumes, and underdeveloped institutional frameworks, often with weak enforcement of disclosure regulations (Economou et al., 2015). As a result, the trading environment in frontier stock markets hinders both the generation of information, due to limited investor participation and trading activity, and the quality of that information, due to insufficient transparency (Guney et al., 2017). Furthermore, while exceptions exist, frontier markets are often situated in economically or politically volatile countries, which prevents them from attaining the status of emerging markets (Mohti et al., 2019). Supporting these perspectives, Zaremba and Maydybura (2019) found that developed, emerging, and frontier market factors exhibit low correlations with one another. These distinctive characteristics of frontier markets, when compared to emerging and developed markets, give rise to unique institutional and microstructure dynamics that influence security pricing and trading behavior, potentially leading to heterogeneous impacts on market reactions to index reconstitutions. For example, Biktimirov and Afego (2022b) report significant differences in stock market reactions to FTSE Environmental Opportunities Index reconstitutions between developed and emerging market firms. Similarly, Afego and Biktimirov (2024) document notable differences in abnormal returns between firms from African equity markets and those from developed non-African markets removed from the S&P Africa 40 Index.

Regarding frontier markets, their relative resilience during the 2008 global financial crisis increased their appeal to fund managers seeking new investments to diversify risk (Ngene et al., 2018). Reflecting this heightened interest, 33 frontier market-focused equity funds have been launched since 2008, including 11 introduced after 2014.[[3]](#footnote-3) Despite this growing attention among fund managers, frontier markets have been largely disregarded by academics (Stereńczak et al., 2020). Most studies on the index effect have focused on stock indices in developed and emerging markets, leaving a significant gap in understanding how index changes impact frontier market stocks. This research gap is particularly important given the rising prominence of mutual funds and exchange-traded funds (ETFs) benchmarked to frontier markets (De Groot et al., 2012), and the growth of passive investing through index funds and ETFs in general, which has amplified demand for stocks listed in these markets.

This study investigates market reactions to index reconstitutions in global frontier markets and examines the role of country reclassification in shaping the reactions. Specifically, it addresses two key questions: (1) Does an index effect exist in frontier markets? (2) Do market reactions differ for various types of index additions and deletions, including reclassifications to or from frontier market status? To answer these questions, we analyze changes in stock prices, trading volumes, market size, institutional ownership, and liquidity for firms added to or removed from the FTSE Frontier 50 index between 2008 and 2021. The index tracks the 50 largest and most liquid stocks across 26 frontier markets in Africa, Asia, Europe, and South America.

We focus on the FTSE Frontier 50 index for two main reasons. First, unlike other frontier market indices, such as the S&P Africa 40 index, the FTSE Frontier 50 index provides a global perspective on frontier markets rather than being limited to a specific region or country. Second, the index is constructed using FTSE’s country classification methodology, which evaluates markets based on factors such as size, governance, and market infrastructure. This methodology classifies markets into categories such as Developed, Advanced Emerging, Secondary Emerging, and Frontier, with some countries designated as ‘Unclassified.’ This makes it possible to examine the impacts of country reclassification on market reactions to index changes.

Our study contributes to the literature in three ways. First, it is the first to comprehensively examine the index effect in global frontier equity markets, utilizing data from 26 stock markets. This not only enhances academic understanding of the index effect within frontier markets but also provides practical insights for international investors and fund managers. Second, it sheds light on the role of country reclassification in influencing firms’ sensitivity to index changes, an aspect previously overlooked in the literature. Third, by analyzing liquidity changes in the sample firms, this study addresses recent calls to investigate how market liquidity, particularly in less developed, illiquid markets, affects firms’ responses to index changes (Afego and Biktimirov, 2024).

**2. Literature Review**

*2.1. Theoretical predictions and empirical evidence in developed markets*

The index effect, first observed in seminal studies by Harris and Gurel (1986) and Shleifer (1986), refers to the abnormal stock price reactions following the addition or deletion of stocks from major indices. These studies, and subsequent research, have documented positive abnormal returns for stocks added to major indices and negative returns for those removed. For example, Patel and Welch (2017) report abnormal returns of up to 4% for additions and ‒5% for deletions for the S&P 500 index during 1979 to 2015, while Biktimirov and Xu (2019b) observe a 3.1% cumulative abnormal gain for additions to the Dow Jones Industrial Average and a ‒2.75% decline for deletions for the 1990‒2015 period. Similarly, Petajisto (2011) finds a 4.7% abnormal gain for additions to the Russell 2000 and a ‒4.6% loss for deletions. Despite the extensive literature, the underlying drivers behind the index effect remain debated, leading to competing hypotheses (Afego, 2017).

The **price pressure hypothesis** (Harris and Gurel, 1986) suggests that price changes following index rebalancing are temporary and result from supply and demand imbalances. This imbalance arises because index funds are required to buy or sell stocks based on index changes. However, price reversals often occur over time as the initial pressure subsides. Elliott and Warr (2003) and Shankar and Miller (2006) support this hypothesis, documenting price reversals for stocks added to the S&P 500 and S&P 600, respectively.

On the other hand, the **downward-sloping demand curve hypothesis** (Shleifer, 1986) and the **liquidity hypothesis** (Amihud and Mendelson, 1986) predict permanent price changes following index adjustments. The downward-sloping demand curve hypothesis posits that the demand shifts caused by index funds lead to a permanent price reaction. Fernandes and Mergulhão (2016) support this view, showing permanent price changes for additions to and deletions from the FTSE 100. The liquidity hypothesis suggests that inclusion in an index improves a stock's liquidity, thus raising its price, while exclusion worsens liquidity and leads to price declines. Becker-Blease and Paul (2006) document liquidity improvements for S&P 500 additions, and Biktimirov and Xu (2019b) find a significant relationship between liquidity changes and abnormal returns for additions to and deletions from the Dow Jones Industrial Average index.

The **information signaling hypothesis** (Jain, 1987) posits that index inclusion signals positive future prospects for a company, resulting in a permanent price increase. Supporting this theory, Denis et al. (2003) find that companies added to the S&P 500 experience increases in analysts’ earnings forecasts as well as in actual realized earnings. The **investor awareness hypothesis** (Chen et al., 2004) suggests asymmetric price reactions: permanent gains for additions and temporary losses for deletions. Consistent with the investor awareness hypothesis, Zhou (2011) and Biktimirov and Xu (2019a) find permanent stock price gains for first-time additions to the S&P 500 and Nasdaq 100 indices, respectively, while repeated additions and first-time deletions exhibit temporary price change.

Studies have also shown that stocks added to major indices, such as the S&P 500 (Chen et al., 2004) and Russell 2000 (Biktimirov et al., 2004), experience significant increases in institutional ownership, while deletions from these indices are typically associated with reductions in institutional ownership. However, the evidence for less prominent indices is more mixed. For instance, Biktimirov and Afego (2022a) do not observe significant changes in institutional ownership around the reconstitutions of the FTSE Environmental Opportunities 100 Index. In contrast, Kang et al. (2021) find that additions to the Dow Jones Sustainability Index North America lead to increased institutional ownership, but deletions do not result in significant changes.

*2.2. Empirical evidence in emerging markets*

The index effect is generally less pronounced in emerging markets compared to developed markets. Chakrabarti et al. (2005) provide one of the earliest comparative studies of index effects in developed and emerging markets, analyzing changes to MSCI country indices between 1998 and 2001. Their findings reveal significant price changes for stocks in developed markets, with additions experiencing a 3.29% increase and deletions a ‒4.51% decrease on the day following the announcement. In contrast, stocks in emerging market indices showed much smaller and statistically insignificant price changes of 1.06% and ‒0.91% for inclusions and exclusions, respectively.

Hacibedel and van Bommel (2006) confirm these findings in their study of the MSCI Emerging Markets Index, noting smaller price gains for inclusions (around 2%) compared to developed markets. Further research by Hacibedel (2014) reveals that stocks added to the MSCI Emerging Markets Index experience a cumulative average abnormal return of 1.8% over two months, while deletions exhibit a 1.6% decline. Notably, prices reverse after exclusions but not after inclusions, which is attributed to market segmentation and increased investor recognition around index inclusions in emerging markets.

Wang et al. (2015) examine the index effect in China’s CSI 300 Index from 2005 to 2012 and find smaller magnitudes of price and volume effects, consistent with earlier studies on emerging markets. Similarly, studies in South Africa by Kruger and Toerien (2013) and Pholohane et al. (2020) document significant but temporary effects for stocks added and removed from the FTSE/JSE Top 40 Index, reinforcing the notion that the index effect tends to be muted in emerging markets.

This smaller index effect in emerging markets is further highlighted by Biktimirov and Afego (2022b), who report significant differences in stock market reactions to FTSE Environmental Opportunities Index reconstitutions between developed and emerging market firms. Specifically, while firms in developed markets experience significant gains in returns around the qualification day—when market data used to determine upcoming index changes becomes available—and notable increases in trading volume around the effective day, firms in emerging markets show neither significant returns nor substantial changes in trading volume on these days.

*2.3 Frontier markets*

As mentioned, frontier markets are characterized by unique economic and market conditions that distinguish them from both developed and emerging markets. These markets tend to be less liquid (Ngene et al., 2018) and face greater challenges related to low investor participation (Guney et al., 2017), low informational transparency (Economou et al., 2015) and relatively volatile economic or political conditions (Mohti et al., 2019).

Despite these distinct characteristics and their low correlations with both developed and emerging markets (Zaremba and Maydybura, 2019), frontier markets have been largely ignored in the context of studies on index changes. Recent work by Afego and Biktimirov (2024), however, begins to address this gap by examining stock market reactions to additions to and deletions from the S&P Africa 40 Index.[[4]](#footnote-4) Their study compares the market reactions of firms from several African frontier markets with those from developed non-African markets. Notably, they find significant differences in abnormal returns between African and non-African deletions. These findings underscore the unique dynamics of Africa’s frontier markets and highlight the need for more comprehensive research into global frontier markets, particularly given their geographic and economic diversity across regions such as Africa, the Americas, Asia, and Europe (Zaremba and Maydybura, 2019).

Furthermore, if inclusion in an index enhances a stock’s liquidity and investor awareness, this effect is likely to be more pronounced in frontier markets due to their high levels of market segmentation (Stereńczak et al., 2020). While frontier markets may have lower values of indexed asset—suggesting less pressure on prices and trading volumes during index events—their inherent liquidity challenges could amplify the price and volume reactions to these events (Afego and Biktimirov, 2024).

In addition, the broader implications of country reclassification on index effects remain unclear. Although studies like Saidi et al. (2012) have examined stock price reactions to country reclassifications by MSCI, they have not explored how these reclassifications influence market reactions to index reconstitutions.[[5]](#footnote-5) This gap is critical, as country classifications by major index providers like MSCI or FTSE Russell can expose stocks in reclassified markets to vulnerabilities, with investors facing shifts in their portfolios and in their investment strategies. This is especially true for frontier markets, which, due to instability in governance and economic conditions, are more prone to fluctuations in market status. Such fluctuations, driven by a market’s ability or inability to meet index providers’ classification criteria, can significantly affect the sensitivity of firms to index inclusion or exclusion. For international investors, understanding this dynamic is crucial for assessing potential risks and opportunities in frontier markets.

**3. Sample**

Launched in July 2008, the FTSE Frontier 50 index tracks the performance of the 50 largest and most liquid stocks from the eligible universe of FTSE frontier markets. The weights of the stocks in the index are adjusted for free float and foreign ownership limits. To reduce the index turnover, a stock is added to (or deleted from) the FTSE Frontier 50 index when its ranking based on full market capitalization rises to 40th or above (or declines to 61st or below). To prevent the dominance of individual countries, no country can have a weight higher than 20% in the index. Membership in the FTSE Frontier 50 index is reviewed quarterly, in March, June, September, and December, using data from the third Friday of February, May, August, and November, respectively. Therefore, we consider three event days:

* **QD – Qualification Day**: The day at the end of which market data used to determine index constituent changes becomes available.
* **AD – Announcement Day**: The day when index constituent changes are actually announced.
* **ED – Effective Day**: The first trading day when index changes become effective.

While the period between QD and ED has typically been a constant 20 trading days, the period between AD and ED has ranged from 3 to 12 trading days.

Our sample period starts with the first quarterly review implemented in December 2008 and extends to December 2021. The initial sample consists of 250 additions and 250 deletions. After the removal of 31 additions and 30 deletions that had more than 25 non-trading days during the event period (from ED–30 to ED+30 or QD–30 to ED+30), the final sample is reduced to 219 additions and 220 deletions.

In the final sample, we differentiate between different types of index changes. First, we distinguish between stocks added to (or deleted from) the index for the first time and those that are added to (or deleted from) the index repeatedly. According to the investor awareness hypothesis, investor awareness increases for stocks that enter an index for the first time, but does not change significantly for stocks that re-enter the index (Zhou, 2011). As a result, first-time additions experience a permanent stock price gain due to an increased investor awareness, while repeated additions show only transitory gains. In terms of deletions, since investor awareness does not easily decline following a stock’s removal from an index, both new and repeated deletions experience only temporary stock price losses.

Second, we distinguish index changes resulting from a country’s reclassification as a frontier market. Over the sample period, several reclassifications led to 17 additions to and 22 deletions from the FTSE Frontier 50 index.[[6]](#footnote-6)

Taken together, we analyze the following three groups of additions:

1. **New additions**: 127 firms added to the FTSE Frontier 50 index for the first time.

2. **Repeated additions**: 75 firms added to the FTSE Frontier 50 index more than once.

3. **Reclassification additions**: 17 firms added to the FTSE Frontier 50 index due to the inclusion of their countries in the Frontier Markets list.

Deletions from the FTSE Frontier 50 index are also divided into three groups:

1. **New deletions**: 125 firms removed from the FTSE Frontier 50 index for the first time.

2. **Repeated deletions**: 73 firms removed from the FTSE Frontier 50 index more than once.

3. **Reclassification deletions**: 22 firms removed from the FTSE Frontier 50 index due to their countries being reclassified out of the Frontier Markets list.

Table 1 summarizes the distribution of the sample firms across 26 countries in Africa, Asia, Europe, and South America. Vietnam has the largest representation, followed by Argentina and Bangladesh. Notably, most of Argentina’s changes are due to country reclassification, with 11 additions and 14 deletions due to this factor.

[Table 1 about here]

**4. Analyses**

*4.1. Abnormal returns*

In this section we examine and compare abnormal returns of the firms added to or deleted from FTSE Frontier 50 index. Similar to Chen et al. (2004), Chen (2006), Cai (2007), and Becker-Blease and Paul (2010), we use market-adjusted returns to calculate abnormal returns around the index changes[[7]](#footnote-7). We obtain all security and market data required for the abnormal return and subsequent analyses from the Thomson Reuters Datastream database. Following Campbell et al. (2010), we use national value-weighted market-index returns in local currencies as proxies for the market returns of the respective countries. To estimate the significance of abnormal returns, we use both parametric and non-parametric tests. Specifically, to address any potential cross-correlation of abnormal returns, we supplement a traditional parametric *t*-test with a modified *t*-test, proposed by Kolari and Pynnönen (2010) (henceforth, KP), which considers cross-correlation. In addition, we employ two nonparametric tests: a sign test (Corrado and Zivney, 1992; Cowan, 1992) and a rank test (Corrado, 1989), which do not require an assumption of the normal distribution.

Panels A and B of Table 2 present abnormal returns around the FTSE Frontier 50 index reconstitutions for index additions and deletions, respectively. As shown in Panel A, among the three groups of additions, repeated additions experience the most significant stock price reactions. Specifically, repeated additions experience a significant cumulative abnormal return (CARs) of 4.24% over the 30-day period before QD (QD–30, QD–1)[[8]](#footnote-8). As a possible indication of the market’s anticipation of the event, repeated additions show a gain of 0.39% one day prior to the qualification day (QD–1), which is significant under all four test statistics. Moreover, these gains do not show any reversal, as a CAR of 5.12% over the whole event period from QD–30 to QD+50 is significant at the 1 percent level under both parametric tests. In contrast, new additions and reclassification additions do not exhibit any significant price run-ups prior to QD. New additions show a significant gain of 3.43% over the whole event period (QD–30, QD+50) and reclassification additions experience a significant gain of 2.98% from ED–3 to ED+3.

[Table 2 about here]

Turning to Panel B, new deletions, repeated deletions, and reclassification deletions experience significant declines of –3.70%, –2.27%, and –4.22%, respectively, over the 30-day period before QD. However, for new deletions only, the initial stock price loss shows no sign of reversal, as their CAR of –4.04% remains significant from QD–30 to QD+50 across three tests. In contrast, reclassification deletions exhibit a series of significant stock price reversals. For example, their negative and significant CAR of –1.48% on QD is followed by positive CARs of 1.57% and 1.51% over the following two days. Similarly, positive CARs prior to ED are followed by a negative and significant CAR of –4.15% on ED+1, which is significant at the 1% level under three test statistics.

Figures 1 and 2 present the CARs for firms added to and deleted from the FTSE Frontier 50 index, respectively, from ED – 50 (QD – 30) to ED + 30. As shown in Figure 1, CARs for all three groups of additions rise steadily over the event period. In contrast, as depicted in Figure 2, both new deletions and repeated deletions experience a monotonic decline from ED – 50 (QD – 30) to ED. After ED, however, the CARs of new deletions remain at the same level, suggesting a permanent loss, while the CARs of reclassification deletions increase, indicating a stock price reversal.

[Figure 1 about here]

[Figure 2 about here]

Taken together, the abnormal return analysis shows that stock price behavior differs significantly between additions and deletions, as well as among different types of each. Specifically, additions are associated with gains, while deletions experience losses. Among additions, repeated additions exhibit the largest permanent gain, while among deletions, new deletions show the largest permanent loss.

*4.2. Trading volume*

Because complementing abnormal return analysis with trading volume analysis increases the power of the tests to detect market reaction (Cready and Hurtt, 2002), we analyze trading volume behavior of additions or deletions around the FTSE Frontier 50 index changes. We follow procedures similar to those in Chae (2005). Specifically, we define turnover as share trading volume divided by the number of outstanding shares. As proposed by Ajinkya and Jain (1989), we apply the log transformation to approximate a normal distribution and add one to accommodate zero daily volumes:

 (1)

where is the number of shares of firm *i* traded on day *t*, andis the total number of shares outstanding of firm *i* on day *t*. Abnormal trading volume for firm *i* on day *t* () is computed as the difference between turnover on day *t* and the average turnover over the 180-day estimation period, which runs from AD–210 to AD–31:

(2)

where (3)

To assess the significance of abnormal trading volume, we supplement *t*-test with the nonparametric rank and sign tests, as nonparametric test statistic is more powerful in detecting abnormal trading volume than the parametric test statistic (Campbell and Wasley, 1996).

Table 3 presents abnormal trading volume for firms added to (Panel A) or deleted from (Panel B) the FTSE Frontier 50 index. As shown in Panel A, only reclassification additions experience a significant increase in trading volume, with abnormal increases of 5.00% and 3.27% on QD–3 and AD+1, respectively.

[Table 3 about here]

Panel B reveals that new deletions experience significant decreases in trading volume every day from QD–1 to QD+3, while repeated deletions exhibit significant declines on QD, AD–1, and ED+3. Reclassification deletions are the only deletion group that shows significant increases in trading volume, occurring prior to AD (AD–2 and AD–1) and before ED (ED–3, ED–1, and ED). Moreover, abnormal increases in trading volume on ED–1 and ED are associated with significant CARs of 2.42% and 0.94%, respectively.

In summary, among the six groups, only reclassification additions and reclassification deletions experience significant increases in trading volume.

*4.3 Firm size*

Studies examining market reactions to changes in major stock indices often report asymmetrical results for large and small stocks. For example, a permanent increase in value has been observed for stocks added to large-cap indices like the S&P 500 (Chen et al., 2004; Becker-Blease and Paul, 2006) and Nikkei 225 (Hanaeda and Sarita, 2003; Liu, 2006). In contrast, studies analyzing small-cap indices, such as the Russell 2000 (e.g., Biktimirov et al., 2004) and S&P 600 (e.g., Shankar and Miller, 2006) tend to report a temporary change in value for affected stocks. In this section, we examine if additions to and deletions from the FTSE Frontier 50 index exhibit significant differences in firm size.

Because different measures capture different facets of firm size (Dang et al., 2018), we use three proxies: market value, total sales, and total assets. All three proxies are collected from the Thomson Reuters Datastream database for day QD–30. Table 4 shows some descriptive statistics for these size proxies and tests for significant differences between the means and medians of additions and deletions.

[Table 4 about here]

As shown in Panel A, reclassification additions are significantly larger than both new additions and repeated additions according to all three proxies for firm size. Similarly, Panel B shows that reclassification deletions are significantly larger than both new deletions and repeated deletions under all three proxies. This result is expected, as reclassification additions and deletions stem from changes in country classification rather than changes in market values. In contrast, there are no significant size differences between new additions and repeated additions, nor between new deletions and repeated deletions.

*4.4. Institutional ownership*

Although researchers routinely find significant increases (decreases) in institutional ownership for firms added to (removed from) major stock indices, such as the S&P 500 (e.g., Chen et al., 2004), Russell 2000 (e.g., Biktimirov et al., 2004), and Nasdaq 100 (Biktimirov and Xu, 2019a), the evidence is less clear regarding the effects of institutional ownership associated with changes to less prominent indices. For example, while Biktimirov and Afego (2022a) observe no significant changes in institutional ownership for firms added to or removed from the FTSE Environmental Opportunities (EO) 100 index, their later study (Biktimirov and Afego, 2022b), which focuses on the broader FTSE EO index, finds some evidence of an increase in institutional ownership for developed market firms, but not for emerging market firms. In this section, we analyze and compare changes in institutional ownership around changes to the FTSE Frontier 50 Index.

We obtain the percentage of strategic shareholdings of at least 5% held by investment banks or institutions, as well as the total percentage of strategic holdings of at least 5% owned by government, institutions, individuals and foreign entities, from the Thomson Reuters Datastream database. The sample is reduced for the total percentage of strategic holdings due to missing data for some firms.

Similar to Shankar and Miller (2006) and Biktimirov and Li (2014), we calculate the mean percentage of institutional ownership over the two months before the month of the index change and the two months after the change. We then compute differences between these means and test for significant differences using a standard *t*-test, along with two non-parametric tests: a signed test and Wilcoxon signed rank sum test.

Table 5 presents descriptive statistics and test results for changes in institutional ownership, measured as the percentage of strategic shareholdings held by investment banks and the total percentage of strategic holdings, for additions to and deletions from the FTSE Frontier 50 index during the period from 2008–2021. Panel A shows that none of the addition groups experience significant changes in institutional ownership. New, repeated, and reclassification additions exhibit similar pre-event means for the total percentage of strategic shareholdings: 58.38%, 57.56%, and 58.82%, respectively. In contrast, the mean percentage of strategic shareholdings held by investment banks or institutions for new additions is 0.61%, less than half of the 1.40% mean for reclassification additions.

[Table 5 about here]

As shown in Panel B, neither new deletions nor repeated deletions experience significant changes in institutional ownership. In contrast, reclassification deletions show a significant increase of 0.77 in the total percentage of strategic shareholdings, which is significant under all three test statistics.

*4.6. Liquidity analysis*

Previous studies have documented significant improvements (declines) in liquidity for stocks added to (deleted from) major stock indices, such as the S&P 500 (e.g., Becker-Blease and Paul, 2006; Hedge and McDermott, 2003) and Nasdaq 100 (e.g., Biktimirov and Xu, 2019a). Therefore, in this section, we examine changes in liquidity for the sample stocks.

As each liquidity measure captures a different dimension of liquidity, we use seven liquidity measures, classified into three groups: volume-based, transaction cost-based, and price impact-based proxies.

* Two volume-based metrics are dollar volume and turnover ratio. Dollar volume is calculated as the natural logarithm of daily trading volume in dollars, while the turnover ratio represents the proportion of shares traded each day relative to the total shares outstanding. Increases in these two measures suggest an improvement in market liquidity.
* Two transaction cost-based measures are the zero-return ratio and the closing percent quoted spread. The zero-return ratio, introduced by Lesmond et al. (1999), is computed as the ratio of the number of zero-return days to the total number of trading days. The closing percent quoted spread, as suggested by Chung and Zhang (2014), is computed as the difference between the closing ask price and the closing bid price divided by the midpoint of the closing bid and ask prices. Higher values of the zero-return ratio and the closing percent quoted spread indicate higher transaction costs and lower liquidity.
* Three price impact-based proxies are the Amihud (2002) illiquidity ratio, the Amivest liquidity ratio, and the Florackis et al. (2011) price impact ratio. The Amihud illiquidity ratio is computed as the average of the daily ratio of the absolute stock return to its daily trading volume in local currency. The Amivest liquidity ratio is the average of the daily ratio of trading volume (in local currency) to the daily absolute stock return, calculated only on nonzero return days. The Florackis et al. (2011) price impact ratio is computed as the average of the daily ratio of the absolute stock return to its daily turnover ratio. The Amihud illiquidity ratio and Florackis et al. (2011) price impact ratio are expected to be lower for more liquid stocks, whereas the Amivest liquidity ratio is expected to be higher.

For all liquidity measures, we compute the average over a 40-day period before QD and after ED, and then test for significant differences.[[9]](#footnote-9) Thus, the pre-event period runs from QD–70 to QD–31 and the post-event period covers ED+31 to ED+70 for all groups.

Table 6 provides some descriptive statistics for the liquidity measures and tests for differences in mean and median between the pre- and post-event periods. Panel A (Panel B) reports results for additions (deletions). As shown in Panel A, significant decreases in dollar volume and turnover ratio, accompanied with increases in the Amihud and Florackis ratios, suggest a decline in liquidity for new additions following their inclusion in the FTSE Frontier 50 index. In contrast, repeated additions show only a significant decrease in trading volume, while reclassification additions do not exhibit any significant changes in liquidity.

[Table 6 about here]

Turning to deletions in Panel B, new deletions and reclassification deletions show some signs of deterioration in liquidity. Specifically, new deletions experience significant decreases in dollar volume and turnover ratio, while reclassification deletions show significant increases in the closing percent spread as well as Amihud and Florackis ratios.

*4.7. Regression analysis*

Previous analyses have documented significant differences among the groups in terms of abnormal returns, size, and liquidity proxies. In this section, we perform multivariate regression analysis to examine whether liquidity proxies, institutional ownership, and firm size are significantly related to CARs around FTSE Frontier 50 index changes, while controlling for other factors.

The dependent variable is the CAR from QD−30 to QD+50. The independent variables consist of stocks' changes in the seven liquidity proxies, pre-event institutional ownership, changes in institutional ownership, and market value on day QD–30. To control for factors related to how a firm is added to or removed from the index, we use five dummy variables. These are equal to one if a firm is a new addition, repeated addition, reclassification addition, repeated deletion, or reclassification deletion, respectively, and zero otherwise. To account for different liquidity proxies, Table 7 presents seven regression models with standardized coefficients and bootstrapped robust standard errors[[10]](#footnote-10) for stocks added to or deleted from the FTSE Frontier 50 index.

[Table 7 about here]

Among the liquidity proxies, only the change in dollar volume is statistically significant. In contrast, pre-event institutional ownership consistently exhibits a positive and significant relationship with CARs across all seven regressions. Focusing on the magnitude of the significant coefficients for new addition, repeated addition, and reclassification addition dummies, both new and repeated additions are associated with comparable positive CARs, while reclassification additions exhibit a relatively smaller positive relation across all models.

Taken together, these regression results suggest that, even after accounting for liquidity, size, and other control factors, pre-event institutional ownership remains a strong and significant predictor of CARs around FTSE Frontier 50 index changes. Combined with the permanent stock price gains and losses for new (repeated) additions and new deletions, this evidence offers some support for the downward-sloping demand curve hypothesis.

**5. Conclusion**

We analyze stock market reactions in terms of abnormal returns, trading volume, firm size, institutional ownership, and liquidity for firms from frontier markets in Africa, Asia, Europe, and South America that were added to or removed from the FTSE Frontier 50 index. Our study differentiates between new, repeated, and reclassification additions and deletions. The findings confirm that, as in developed and emerging markets, the index effect is present in frontier markets and that market reactions vary for different types of index additions and deletions. Specifically, both new and repeated additions experience permanent stock price increases. In contrast, whereas new deletions exhibit permanent stock price declines, repeated deletions show declines that partially reverse. Reclassification additions and deletions, which are significantly larger companies than the others, also experience significant stock price reactions. Positive abnormal returns for reclassification additions tend to concentrate within a seven-day window around the effective day. For reclassification deletions, the largest negative abnormal return occurs on the day after the effective day and is preceded by significant increases in trading volume over the two previous days.

Although new (repeated) additions and new (reclassification) deletions exhibit a decline in some liquidity proxies, none of these proxies—except for trading volume—show a significant relation with CARs from QD−30 to QD+50 after controlling for other factors. However, pre-event institutional ownership is significantly associated with CARs, highlighting its role in market reactions to index changes.

Overall, our findings lend some support for the downward-sloping demand curve hypothesis, which suggests that changes in demand from index funds lead to permanent stock price increases (decreases) for additions (deletions). This study not only contributes to the academic literature on index effects but also provides practical insights for individual investors, fund managers, and stock market index providers.

While this study enhances our understanding of stock market reactions to index changes in frontier markets, several avenues for future research remain open. First, a deeper analysis of investor behavior, particularly the role of passive versus active institutional investors, could shed light on the mechanisms driving abnormal returns. Additionally, future research could also incorporate high-frequency trading data to assess intraday liquidity shifts and market microstructure patterns around index rebalancing events. Lastly, investigating the impact of index fund flows and arbitrage activities on stock price movements could further enhance our understanding of the demand-driven effects underlying index changes.

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**Fig. 1.** Cumulative abnormal returns for three groups additions to the FTSE Frontier 50 index at quarterly reviews in 2008–2021. QD is the qualification day (the day at the close of which market data is used to determine next index changes) and ED is the effective day (the first trading day when index changes become effective). Trading days are numbered relative to the effective day.

**Fig. 2.** Cumulative abnormal returns for three groups of deletions from the FTSE Frontier 50 index at quarterly reviews in 2008–2021. QD is the qualification day (the day at the close of which market data is used to determine next index changes) and ED is the effective day (the first trading day when index changes become effective). Trading days are numbered relative to the effective day.

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**Table 1**

Distribution of firms added to or deleted from the FTSE Frontier 50 Index by country in 2008–2021.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Additions | | | | | | Deletions | | | | | |
|  | New additions | | Repeated additions | | Reclassification additions | | New deletions | | Repeated deletions | | Reclassification Deletions | |
| Country | Number | % | Number | % | Number | % | Number | % | Number | % | Number | % |
| Argentina | 7 | 5.51 | 6 | 8.00 | 11 | 64.71 | 8 | 6.40 | 3 | 4.11 | 14 | 63.64 |
| Bahrain | 5 | 3.94 | – | – | – | – | 3 | 2.40 | 1 | 1.37 | – | **–** |
| Bangladesh | 15 | 11.81 | 10 | – | – | – | 12 | 9.60 | 7 | 9.59 | – | **–** |
| Botswana | 1 | 0.79 | – | – | – | – | 1 | 0.80 | – | – | – | **–** |
| Croatia | 1 | 0.79 | – | – | – | – | 3 | 2.40 | – | – | – | **–** |
| Cyprus | 2 | 1.57 | – | – | – | – | 2 | 1.60 | 1 | 1.37 | – | **–** |
| Estonia | 1 | 0.79 | 1 | 1.33 | – | – | 1 | 0.80 | 1 | 1.37 | – | **–** |
| Ghana | 1 | 0.79 | – | – | – | – | – | – | – | – | – | **–** |
| Iceland | 3 | 2.36 | – | – | – | – | – | – | – | – | – | **–** |
| Ivory Coast | 1 | 0.79 | – | – | – | – | – | – | – | – | – | **–** |
| Jordan | 4 | 3.15 | 1 | 1.33 | – | – | 6 | 4.80 | 2 | 2.74 | – | **–** |
| Kazakhstan | 4 | 3.15 | – | – | 2 | 11.76 | 2 | 1.60 | – | – | – | – |
| Kenya | 8 | 6.30 | 6 | – | – | – | 8 | 6.40 | 8 | 10.96 | – | **–** |
| Lithuania | 1 | 0.79 | 2 | – | – | – | 1 | 0.80 | 1 | 1.37 | – | **–** |
| Mauritius | 1 | 0.79 | – | – | – | – | 1 | 0.80 | – | – | – | **–** |
| Morocco | 8 | 6.30 | 3 | 4.00 | 4 | 23.53 | 5 | 4.00 | – | – | – | – |
| Nigeria | 7 | 5.51 | 8 | 10.67 | – | – | 12 | 9.60 | 8 | 10.96 | – | **–** |
| Oman | 6 | 4.72 | 5 | 6.67 | – | – | 13 | 10.40 | 7 | 9.59 | – | **–** |
| Peru | 7 | 5.51 | – | – | – | – | 3 | 2.40 | – | – | – | **–** |
| Qatar | 6 | 4.72 | 2 | 2.67 | – | – | 8 | 6.40 | 4 | 5.48 | 3 | 13.64 |
| Romania | 4 | 3.15 | 6 | 8.00 | – | – | 3 | 2.40 | 5 | 6.85 | 5 | 22.73 |
| Serbia | 1 | 0.79 | 1 | 1.33 | – | – | 1 | 0.80 | 1 | 1.37 | – | – |
| Slovenia | 4 | 3.15 | 2 | 2.67 | – | – | 8 | 6.40 | 4 | 5.48 | – | – |
| Sri Lanka | 2 | 1.57 | 2 | 2.67 | – | – | 2 | 1.60 | 2 | 2.74 | – | – |
| Tunisia | 4 | 3.15 | 4 | 5.33 | – | – | 4 | 3.20 | 4 | 5.48 | – | – |
| Vietnam | 23 | 18.11 | 16 | 21.33 | – | – | 18 | 14.40 | 14 | 19.18 | – | – |
| Total | 127 | 100.00 | 75 | 100.00 | 17 | 100.00 | 125 | 100.00 | 73 | 100.00 | 22 | 100.00 |

**Table 2**

Cumulative average abnormal returns (CARs) for stocks added to or deleted from the FTSE Frontier 50 index in 2008–2021.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A: Additions** | | | | | |  | | | | |  | | | | |
|  | New additions (*N* = 127) | | | | | Repeated additions (*N* = 75) | | | | | Reclassification additions (*N* = 17) | | | | |
|  | CARs | *t* test | KP | Rank | Sign | CARs | *t* test | KP | Rank | Sign | CARs | *t* test | KP | Rank | Sign |
| QD–30, QD–1 | 1.49% | 1.47 | 1.53 | 0.14 | –0.46 | 4.24% | 3.79\*\*\* | 3.87\*\*\* | 2.00\*\* | 2.58\*\*\* | 2.39% | 1.11 | 0.59 | 1.09 | 0.71 |
| QD–2 | –0.07% | –0.41 | –0.71 | –0.95 | –1.18 | –0.06% | –0.28 | –0.15 | –0.39 | –1.13 | 0.00% | 0.00 | –0.18 | –0.29 | 0.22 |
| QD–1 | 0.02% | 0.12 | 0.08 | 0.00 | –0.82 | 0.39% | 1.89\* | 2.72\*\*\* | 2.03\*\* | 1.66\* | 0.06% | 0.15 | 0.06 | 0.01 | –0.75 |
| QD | 0.05% | 0.28 | 0.11 | –0.90 | –0.82 | 0.12% | 0.60 | 1.25 | 0.29 | 0.73 | –0.08% | –0.20 | –0.12 | –0.26 | –0.26 |
| QD+1 | 0.28% | 1.51 | 1.22 | 0.88 | –0.29 | 0.15% | 0.74 | 0.30 | 0.54 | 1.19 | –0.49% | –1.24 | –1.18 | –1.23 | –1.23 |
| QD+2 | –0.22% | –1.17 | –1.20 | –0.86 | –1.18 | –0.12% | –0.60 | –0.61 | –0.73 | –0.66 | 0.00% | –0.01 | –0.27 | –0.41 | 0.22 |
| QD–1, QD+1 | 0.35% | 1.10 | 1.04 | –0.01 | –1.54 | 0.66% | 1.87\* | 2.67\*\*\* | 1.66\* | 0.96 | –0.51% | –0.75 | –0.62 | –0.86 | –1.23 |
| QD–3, QD+3 | 0.17% | 0.36 | 0.18 | –0.54 | –2.79\*\*\* | 0.98% | 1.81\* | 2.63\*\*\* | 1.39 | 1.89\* | –0.66% | –0.63 | –0.65 | –1.11 | –2.20\*\* |
| QD–5, QD+5 | 0.53% | 0.87 | 0.32 | –0.88 | –1.36 | 0.49% | 0.72 | 0.87 | 0.53 | 0.73 | 0.42% | 0.32 | 0.00 | –0.40 | –1.23 |
| QD, QD+5 | 0.01% | 0.02 | –0.35 | –1.33 | –1.90\* | 0.02% | 0.04 | 0.13 | 0.02 | 0.03 | 0.17% | 0.18 | 0.08 | –0.37 | –1.23 |
| AD–2 | 0.14% | 0.75 | 0.57 | –0.60 | –2.14 | –0.13% | –0.64 | –0.34 | –1.58 | –1.85\* | 0.69% | 1.73\* | 0.77 | 0.86 | 0.73 |
| AD–1 | –0.15% | –0.83 | –0.87 | –0.57 | –0.17 | –0.14% | –0.68 | –1.01 | –1.29 | –1.15 | –0.02% | –0.05 | –0.02 | 0.00 | 1.70\* |
| AD | 0.16% | 0.88 | 1.26 | 0.38 | –0.53 | 0.03% | 0.16 | 0.14 | –0.09 | –0.92 | –0.59% | –1.49 | –0.75 | –1.36 | –1.21 |
| AD+1 | –0.01% | –0.06 | –0.18 | –0.34 | 0.01 | 0.16% | 0.78 | 0.36 | 0.49 | 0.01 | –0.09% | –0.22 | –0.16 | 0.11 | –0.24 |
| AD+2 | 0.22% | 1.16 | 0.54 | 0.20 | –0.53 | 0.12% | 0.57 | 1.12 | 0.99 | 1.17 | 0.23% | 0.59 | 0.30 | –0.16 | 0.25 |
| AD–1, AD+1 | 0.00% | 0.00 | 0.19 | –0.31 | –1.60 | 0.05% | 0.15 | –0.27 | –0.52 | –0.46 | –0.70% | –1.01 | –0.42 | –0.72 | –0.24 |
| AD–3, AD+3 | 0.37% | 0.76 | 0.47 | –0.53 | 0.19 | 0.45% | 0.83 | 0.91 | 0.00 | –1.38 | –0.30% | –0.28 | –0.19 | –1.06 | 0.25 |
| AD–5, AD+5 | 0.29% | 0.47 | 0.43 | –1.16 | –0.17 | –0.25% | –0.36 | –0.26 | –1.32 | –2.54\*\* | –0.48% | –0.36 | –0.19 | –0.89 | –1.21 |
| AD, AD+5 | 0.43% | 0.95 | 0.80 | –0.10 | 0.90 | 0.15% | 0.29 | 0.46 | 0.31 | –0.92 | –0.20% | –0.21 | –0.14 | –0.48 | –0.72 |
| ED–2 | 0.09% | 0.47 | 0.26 | 0.16 | –0.31 | –0.05% | –0.25 | 0.10 | –0.37 | –1.36 | 0.59% | 1.45 | 1.15 | 1.34 | 1.22 |
| ED–1 | 0.13% | 0.70 | 0.60 | 0.62 | –0.13 | –0.45% | –2.18 | –1.15 | –1.01 | –1.13 | 0.60% | 1.48 | 0.76 | 1.00 | 1.70\* |
| ED | 0.17% | 0.92 | 0.31 | –0.68 | –1.20 | 0.16% | 0.78 | –0.43 | 0.47 | 0.73 | 0.13% | 0.32 | 0.27 | 0.11 | –0.72 |
| ED+1 | 0.10% | 0.54 | –0.11 | –0.22 | –1.38 | 0.23% | 1.09 | 0.73 | 0.07 | –0.89 | –0.35% | –0.86 | –0.45 | –1.17 | –1.21 |
| ED+2 | 0.02% | 0.12 | 0.45 | 0.47 | 0.23 | –0.12% | –0.56 | –0.54 | –1.49 | –1.82\* | 1.03% | 2.56\*\*\* | 0.68 | 1.13 | 1.22 |
| ED–1, ED+1 | 0.40% | 1.25 | 0.60 | –0.16 | –0.84 | –0.07% | –0.18 | –0.54 | –0.27 | –1.82\* | 0.37% | 0.54 | 0.28 | –0.04 | –0.24 |
| ED–3, ED+3 | 0.81% | 1.67 | 0.91 | 0.38 | –0.31 | –0.23% | –0.41 | –0.35 | –1.03 | –1.36 | 2.98% | 2.79\*\*\* | 1.14 | 1.75\* | 1.70 |
| ED–5, ED+5 | 1.05% | 1.72\* | 1.24 | 0.21 | 0.41 | –0.55% | –0.80 | –0.81 | –1.15 | –2.05\*\* | 3.34% | 2.49\*\* | 0.99 | 1.37 | 1.22 |
| ED, ED+5 | 0.30% | 0.66 | 0.52 | –0.49 | –0.13 | 0.19% | 0.37 | –0.48 | –1.17 | –1.13 | 2.17% | 2.19\*\* | 0.85 | 0.85 | 1.22 |
| ED–50, ED–1 | 2.04% | 1.56 | 1.46 | –0.75 | –0.46 | 4.77% | 3.30\*\*\*\* | 3.65\*\*\* | 0.90 | 2.12\*\* | 2.40% | 0.86 | 0.42 | 0.42 | –0.26 |
| QD, ED+30 | 1.94% | 1.48 | 1.28 | –1.65\* | 0.07 | 0.88% | 0.60 | 0.51 | –1.82\* | –2.05\*\* | 4.54% | 1.62 | 0.78 | 0.30 | 1.19 |
| QD–30,QD+50 | 3.43% | 2.07\*\* | 1.99\*\* | –1.22 | –0.64 | 5.12% | 2.78\*\*\*\* | 2.88\*\*\* | –0.22 | 1.19 | 6.93% | 1.96\*\* | 0.94 | 0.90 | 0.22 |

*Table 2 continues*

**Table 2** continued

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel B: Deletions** | | | | | |  | | | | |  | | | | |
|  | New deletions (*N* = 125) | | | | | Repeated deletions (*N* = 73) | | | | | Reclassification deletions (*N* = 22) | | | | |
|  | CARs | *t* test | KP | Rank | Sign | CARs | *t* test | KP | Rank | Sign | CARs | *t* test | KP | Rank | Sign |
| QD–30, QD–1 | –3.70% | –3.61\*\*\* | –2.86\*\*\* | –1.91\* | –4.11\*\*\* | –2.27% | –1.90\* | –1.63\* | –0.84 | –2.05\*\* | –4.22% | –1.44 | –0.84 | –1.93\* | –1.97\*\* |
| QD–2 | 0.03% | 0.18 | 0.26 | 0.27 | 0.55 | 0.13% | 0.59 | 1.57 | 2.09\*\* | 2.40\*\* | –0.74% | –1.39 | –0.72 | –1.20 | –1.55 |
| QD–1 | –0.24% | –1.28 | –0.97 | –0.35 | 0.19 | –0.26% | –1.18 | –1.21 | –0.95 | –1.59 | 0.65% | 1.21 | 0.57 | 0.58 | 0.59 |
| QD | –0.13% | –0.69 | –0.38 | –0.84 | –0.17 | –0.12% | –0.53 | –0.32 | 0.20 | 0.99 | –1.48% | –2.76\*\*\* | –1.21 | –2.04\*\* | –2.83\*\*\* |
| QD+1 | –0.24% | –1.28 | –1.13 | –0.85 | –1.78 | 0.05% | 0.22 | 0.09 | 0.88 | 0.99 | 1.57% | 2.95\*\*\* | 0.73 | 1.07 | 1.02 |
| QD+2 | –0.08% | –0.45 | –0.13 | 0.34 | 0.01 | –0.08% | –0.35 | –0.64 | –0.40 | –1.12 | 1.51% | 2.83\*\*\* | 1.10 | 1.33 | 0.16 |
| QD–1, QD+1 | –0.61% | –1.88\* | –1.35 | –1.18 | –1.24 | –0.33% | –0.86 | –0.90 | 0.08 | –1.59 | 0.74% | 0.81 | 0.19 | –0.22 | –0.27 |
| QD–3, QD+3 | –0.68% | –1.38 | –1.49 | –0.68 | –1.96 | –0.81% | –1.40 | –0.73 | 0.24 | –0.42 | –0.73% | –0.52 | –0.21 | –0.84 | –1.97\*\* |
| QD–5, QD+5 | –1.49% | –2.40\*\* | –2.13\*\* | –0.81 | –2.50 | –1.01% | –1.38 | –1.12 | –0.18 | –1.35 | –1.28% | –0.72 | –0.37 | –0.95 | –2.40\*\* |
| QD, QD+5 | –0.64% | –1.39 | –1.30 | –0.37 | –1.06 | –0.45% | –0.83 | –0.83 | –0.21 | –0.42 | –0.07% | –0.05 | –0.03 | –0.35 | –0.69 |
| AD–2 | 0.12% | 0.62 | 1.15 | 1.07 | 1.11 | –0.39% | –1.78\* | –0.61 | –1.21 | –0.87 | –0.16% | –0.30 | 0.01 | 0.18 | 0.65 |
| AD–1 | 0.06% | 0.31 | –0.18 | –0.30 | –0.69 | 0.14% | 0.64 | 0.75 | 1.00 | 1.71\* | –1.87% | –3.52\*\*\* | –0.92 | –1.74\* | –2.76\*\*\* |
| AD | –0.05% | –0.27 | 0.09 | –0.01 | –0.86 | –0.06% | –0.26 | –0.22 | –0.80 | –0.64 | 1.07% | 2.02\*\* | 0.45 | 0.96 | 0.65 |
| AD+1 | –0.09% | –0.48 | 0.09 | 0.26 | 0.39 | –0.05% | –0.24 | –0.64 | –0.22 | 0.07 | –0.98% | –1.85\* | –0.36 | –0.49 | –0.20 |
| AD+2 | –0.11% | –0.57 | –0.32 | –0.68 | –0.86 | 0.15% | 0.69 | 0.46 | 0.71 | –0.17 | –1.34% | –2.53\*\* | –0.50 | –0.88 | –1.06 |
| AD–1, AD+1 | –0.08% | –0.25 | 0.01 | –0.03 | –1.22 | 0.03% | 0.08 | –0.15 | –0.01 | –1.10 | –1.78% | –1.94\* | –0.46 | –0.73 | –0.20 |
| AD–3, AD+3 | 0.30% | 0.60 | 0.88 | 0.51 | –0.33 | –0.36% | –0.62 | –0.61 | –0.33 | –0.87 | –0.54% | –0.39 | –0.20 | –0.54 | –1.91\* |
| AD–5, AD+5 | 0.60% | 0.95 | 1.03 | 0.65 | 0.21 | –0.47% | –0.64 | –0.59 | –0.42 | –1.10 | 2.90% | 1.65 | 0.39 | 0.21 | –0.20 |
| AD, AD+5 | 0.15% | 0.31 | 0.76 | 0.21 | –1.94\* | –0.15% | –0.28 | –0.69 | –0.44 | –0.40 | 4.75% | 3.66\*\*\* | 0.81 | 1.16 | 1.08 |
| ED–2 | 0.19% | 1.01 | 0.80 | 1.45 | 1.31 | –0.16% | –0.71 | –0.78 | –0.69 | –0.17 | 2.42% | 4.59\*\*\* | 0.83 | 0.69 | 0.67 |
| ED–1 | 0.08% | 0.43 | 0.64 | 1.06 | 0.42 | –0.19% | –0.85 | –0.43 | –0.21 | 0.30 | 2.99% | 5.65\*\*\* | 1.38 | 2.21\*\* | 2.38\*\* |
| ED | 0.25% | 1.32 | 0.42 | 0.54 | 0.06 | –0.07% | –0.33 | –0.21 | 0.12 | 0.53 | 0.94% | 1.78\* | 0.55 | 1.31 | 1.95\*\* |
| ED+1 | 0.00% | 0.02 | 0.45 | 0.64 | –1.02 | 0.06% | 0.28 | –0.08 | –0.16 | 0.06 | –4.15% | –7.86\*\*\* | –1.70 | –3.00\*\*\* | –4.02\*\*\* |
| ED+2 | –0.12% | –0.62 | –0.29 | –0.02 | 0.06 | –0.04% | –0.17 | –0.06 | 0.43 | 1.00 | 1.59% | 3.01\*\*\* | 0.74 | 0.70 | 0.67 |
| ED–1, ED+1 | 0.34% | 1.02 | 0.90 | 1.29 | 0.24 | –0.20% | –0.52 | –0.47 | –0.15 | –0.41 | –0.23% | –0.25 | –0.02 | 0.30 | –0.18 |
| ED–3, ED+3 | 0.60% | 1.19 | 1.16 | 1.84 | 1.13 | –0.31% | –0.53 | –0.58 | –0.20 | –0.41 | 2.30% | 1.65\* | 0.79 | 0.71 | 1.52 |
| ED–5, ED+5 | 0.77% | 1.22 | 0.90 | 0.90 | –1.02 | –0.72% | –0.99 | –1.14 | –0.95 | –1.81 | 2.07% | 1.18 | 0.59 | 0.68 | 0.67 |
| ED, ED+5 | 0.37% | 0.80 | 0.63 | 0.58 | –1.02 | 0.00% | 0.00 | –0.40 | –0.39 | –1.11 | –2.86% | –2.21\*\* | –0.67 | –0.75 | –0.61 |
| ED–50, ED–1 | –3.64% | –2.75\*\*\*\* | –1.75\* | –1.16 | –2.32\*\* | –3.29% | –2.13\*\* | –1.96\*\* | –1.07 | –2.76\* | –3.28% | –0.87 | –0.30 | –1.70\* | –1.97\*\* |
| QD, ED+30 | –0.34% | –0.26 | –0.36 | 0.51 | –1.06 | –0.35% | –0.23 | –0.42 | –0.30 | –1.35 | 7.37% | 1.93\* | 0.54 | 0.50 | 1.02 |
| QD–30,QD+50 | –4.04% | –2.40\*\* | –1.69\* | –0.76 | –1.78\* | –2.63% | –1.33 | –1.35 | –0.75 | –1.35 | 3.15% | 0.66 | 0.17 | –0.78 | 0.59 |

*Notes:* Abnormal returns are estimated using the market-adjusted model. Datastream country value–weighted market indices are used as proxies for the market return. QD is the qualification day (the day at the close of which market data is used to determine next index changes), AD is the announcement day (the day of the public announcement about index changes), and ED is the effective day (the first trading day when index changes become effective).

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

**Table 3**

Daily abnormal trading volume for stocks added to or deleted from the FTSE Frontier 50 index in 2008–2021.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A: Additions** | | | | |  | | | |  | | | |
|  | New additions (*N* = 127) | | | | Repeated additions (*N* = 75) | | | | Reclassification additions (*N* = 17) | | | |
|  | AV | *t* test | Rank test | Sign test | AV | *t* test | Rank test | Sign test | AV | *t* test | Rank test | Sign test |
| QD–3 | 0.31% | 0.39 | 0.20 | –1.28 | 0.23% | 0.26 | –0.18 | –0.39 | 5.00% | 2.69\*\*\* | 2.70\*\*\* | 2.60\*\*\* |
| QD–2 | –0.01% | –0.02 | –0.11 | –1.81\* | –1.70% | –1.88\* | –2.14 | –1.55 | –3.63% | –1.95\*\* | –0.41 | 1.14 |
| QD–1 | –1.02% | –1.29 | –0.92 | –1.99\*\* | –0.33% | –0.36 | –0.29 | –0.16 | 0.44% | 0.24 | 0.28 | 0.66 |
| QD | –0.07% | –0.09 | 0.31 | –1.28 | –1.18% | –1.30 | –1.59 | –0.86 | –1.01% | –0.54 | –0.84 | –1.28 |
| QD+1 | –1.34% | –1.70\* | –0.68 | –1.10 | –1.38% | –1.52 | –1.18 | 0.30 | –5.17% | –2.78\*\*\* | –1.67\* | 1.63 |
| QD+2 | –0.15% | –0.19 | 0.30 | –1.63 | 0.14% | 0.16 | 0.84 | 0.76 | –2.41% | –1.30 | –0.39 | 0.17 |
| QD+3 | 0.34% | 0.43 | 0.76 | –0.38 | –1.11% | –1.23 | –0.93 | –1.55 | –1.56% | –0.84 | –0.51 | –0.31 |
| AD–3 | –0.08% | –0.10 | 0.10 | –1.38 | 0.16% | 0.17 | 0.72 | 0.56 | –2.93% | –1.59 | –1.17 | –1.26 |
| AD–2 | –0.22% | –0.28 | 0.08 | –1.56 | 0.32% | 0.35 | –0.01 | 1.03 | 1.01% | 0.55 | 1.05 | 0.19 |
| AD–1 | 0.00% | 0.00 | –0.07 | –0.85 | –1.11% | –1.22 | –0.17 | –0.13 | –1.85% | –1.00 | –1.63 | 0.68 |
| AD | –0.29% | –0.38 | 0.03 | –1.92\* | –1.42% | –1.56 | –1.92\* | –1.98\*\* | –1.10% | –0.60 | –0.32 | –0.29 |
| AD+1 | –0.62% | –0.79 | –0.17 | –1.03 | 0.34% | 0.37 | 0.50 | 0.10 | 3.27% | 1.77\* | 1.30 | 2.13\*\* |
| AD+2 | –0.56% | –0.72 | 0.02 | –1.56 | 0.30% | 0.33 | 0.50 | 0.33 | 0.41% | 0.22 | 0.18 | 0.19 |
| AD+3 | –1.09% | –1.39 | –0.42 | –2.27\*\* | –1.77% | –1.95 | –1.27 | –1.75\* | –2.25% | –1.22 | –0.58 | 0.19 |
| ED–3 | 0.57% | 0.73 | 0.66 | –1.51 | 0.74% | 0.81 | 0.23 | 0.55 | 1.83% | 0.99 | 0.67 | 1.16 |
| ED–2 | 0.09% | 0.11 | 0.39 | 0.80 | 0.56% | 0.61 | 1.21 | 0.55 | 1.93% | 1.04 | 0.58 | 0.67 |
| ED–1 | 1.05% | 1.35 | 1.65 | 0.09 | –1.05% | –1.14 | 0.25 | –0.37 | 1.14% | 0.61 | 0.42 | 1.16 |
| ED | –1.45% | –1.86\* | –0.74 | –1.87\* | –0.32% | –0.36 | –0.56 | –0.37 | –0.23% | –0.12 | –0.36 | –0.78 |
| ED+1 | 0.21% | 0.28 | 0.82 | –0.44 | –0.16% | –0.17 | –0.23 | –0.60 | –0.47% | –0.25 | –0.12 | 0.19 |
| ED+2 | –0.39% | –0.50 | –0.02 | 0.09 | 0.24% | 0.26 | 0.60 | 0.78 | 1.23% | 0.66 | 0.50 | 0.67 |
| ED+3 | –0.95% | –1.22 | 0.10 | –0.44 | 1.66% | 1.82 | 1.69\* | 1.48 | –1.20% | –0.64 | –0.63 | 0.19 |

*Table 3 continues*

**Table 3** continued

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel B: Deletions** | | | | |  | | | |  | | | |
|  | New deletions (*N* = 125) | | | | Repeated deletions (*N* = 73) | | | | Reclassification deletions (*N* = 22) | | | |
|  | AV | *t* test | Rank test | Sign test | AV | *t* test | Rank test | Sign test | AV | *t* test | Rank test | Sign test |
| QD–3 | –1.48% | –1.87\* | –0.92 | –0.17 | –0.45% | –0.51 | –0.08 | –1.05 | –3.64% | –3.15\*\*\* | –1.84\* | –2.42\*\* |
| QD–2 | –1.25% | –1.58 | –0.88 | –0.52 | –0.51% | –0.58 | –0.16 | 0.12 | –2.47% | –2.13\*\* | –1.44 | –1.56 |
| QD–1 | –1.83% | –2.30\*\* | –1.08 | –1.60 | 0.10% | 0.11 | 0.10 | 0.36 | –2.26% | –1.96\*\* | –1.24 | –2.42\*\* |
| QD | –2.44% | –3.08\*\*\* | –1.60 | –1.96\*\* | –2.68% | –3.03\*\*\* | –2.49\*\* | –2.93\*\*\* | –2.86% | –2.48\*\* | –1.85\* | –2.85\*\*\* |
| QD+1 | –3.63% | –4.58\*\*\* | –2.82\*\*\* | –2.68\*\*\* | –0.66% | –0.74 | –0.79 | –0.82 | –1.11% | –0.96 | –0.55 | –0.28 |
| QD+2 | –2.55% | –3.22\*\*\* | –1.68\* | –2.86\*\*\* | –0.20% | –0.22 | 0.01 | –0.11 | –3.67% | –3.18\*\*\* | –1.77 | –1.56 |
| QD+3 | –2.97% | –3.75\*\*\* | –2.37\*\* | –3.57\*\*\* | –0.15% | –0.17 | 0.55 | 0.36 | –1.70% | –1.47 | –0.91 | –1.14 |
| AD–3 | –1.63% | –2.06\*\* | –1.45 | –2.10\*\* | 0.37% | 0.42 | 0.27 | –1.07 | 1.19% | 1.04 | 0.58 | –0.27 |
| AD–2 | –1.75% | –2.20\*\* | –1.91\* | –2.10\*\* | –0.20% | –0.22 | –0.23 | –0.36 | 4.59% | 4.02\*\*\* | 2.31\*\* | 3.15\*\*\* |
| AD–1 | –1.97% | –2.48\*\* | –1.77\* | –2.46\*\* | –2.05% | –2.31\*\* | –1.84\* | –1.54 | 1.89% | 1.65\* | 0.79 | 1.02 |
| AD | –0.90% | –1.13 | –0.65 | –1.38 | –0.50% | –0.56 | –0.83 | –0.60 | 1.06% | 0.93 | 0.73 | 0.59 |
| AD+1 | –1.88% | –2.37\*\* | –1.40 | –2.10\*\* | 0.94% | 1.05 | 0.71 | –0.13 | –0.81% | –0.71 | 0.02 | 0.16 |
| AD+2 | –0.92% | –1.15 | –0.81 | –1.38 | 0.37% | 0.41 | –0.13 | –0.83 | 1.87% | 1.64 | 0.68 | 0.16 |
| AD+3 | –0.91% | –1.15 | –0.49 | –0.49 | –1.15% | –1.29 | –1.52 | –1.77\* | 1.03% | 0.91 | 0.68 | –0.27 |
| ED–3 | –0.24% | –0.30 | –0.49 | –1.73\* | –0.35% | –0.40 | 0.25 | 0.37 | 2.87% | 2.54\*\* | 1.78\* | 1.45 |
| ED–2 | –0.52% | –0.65 | –0.30 | –1.91\* | –1.00% | –1.13 | –0.57 | –0.57 | 1.63% | 1.44 | 1.26 | 1.02 |
| ED–1 | 0.47% | 0.60 | 0.34 | –0.47 | 1.29% | 1.45 | 1.75\* | 1.07 | 4.32% | 3.83\*\*\* | 1.54 | 1.02 |
| ED | –0.74% | –0.94 | –0.79 | –2.44\*\* | –1.34% | –1.50 | –0.89 | –0.57 | 4.09% | 3.63\*\*\* | 1.90\*\* | 2.73\*\*\* |
| ED+1 | 1.01% | 1.27 | 0.95 | 0.07 | 0.50% | 0.56 | 0.65 | 1.54 | –1.48% | –1.31 | –0.61 | 0.60 |
| ED+2 | –0.26% | –0.33 | –0.13 | –0.65 | 0.26% | 0.29 | 0.56 | 0.60 | 0.27% | 0.24 | 0.08 | –0.26 |
| ED+3 | –0.65% | –0.82 | –0.62 | –0.11 | –2.67% | –2.99\*\*\* | –2.34\*\* | –2.92\*\*\* | 0.02% | 0.02 | –0.17 | –1.11 |

*Notes:* The abnormal trading volume is computed as the difference between log turnover and average log turnover estimated from AD–210 to AD–31, where turnover is share trading volume divided by the number of shares outstanding. QD is the qualification day (the day at the close of which market data is used to determine next index changes), AD is the announcement day (the day of the public announcement about index changes), and ED is the effective day (the first trading day when index changes become effective).

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

**Table 4**

Size of firms added to or deleted from the FTSE Frontier 50 Index in 2008–2021.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A. Additions** | | |  | |  | | Tests for difference | | | | | | |
| Between (1) and (2) | | Between (1) and (3) | | Between (2) and (3) | | |
|  | (1)  New additions | | (2)  Repeated additions | | (3)  Reclassification additions | | *t* test  (*p-*value) | Median test  (*p*-value) | *t* test  (*p-*value) | Median test  (*p*-value) | *t* test  (*p-*value) | | Median test  (*p*-value) |
|  | Mean | Median | Mean | Median | Mean | Median |
| Market Value | 1,862 | 1,018 | 1,543 | 1,037 | 3,656 | 2,586 | –1.11  (0.27) | 0.02  (0.88) | 2.34\*\*  (0.03) | 8.07\*\*\*  (0.00) | 2.76\*\*\*  (0.01) | | 8.73\*\*\*  (0.00) |
| Sales | 1,133,529 | 567,266 | 1,027,295 | 549,928 | 3,046,232 | 2,413,377 | –0.44  (0.66) | –0.01  (0.93) | 2.10\*\*  (0.05) | 12.92\*\*\*  (0.00) | 2.23\*\*  (0.04) | | 9.68\*\*\* (0.00) |
| Total Assets | 4,255,487 | 2,197,218 | 4,678,504 | 2,249,044 | 11,454,919 | 6,089,502 | 0.43  (0.67) | 0.09 (0.77) | 2.16\*\*  (0.05) | 9.28\*\*\*  (0.00) | 2.01\*  (0.06) | | 10.00\*\*\* (0.00) |
| **Panel B. Deletions** | | |  | |  |  | Tests for difference | | | | | | |
| Between (1) and (2) | | Between (1) and (3) | | Between (2) and (3) | | |
|  | (1)  New deletions | | (2)  Repeated deletions | | (3)  Reclassification deletions | | *t* test  (*p-*value) | Median test  (*p*-value) | *t* test  (*p-*value) | Median test  (*p*-value) | *t* test  (*p-*value) | Median test  (*p*-value) | |
|  | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Mean | | Median |
| Market Value | 1,230 | 833 | 1,414 | 816 | 5,775 | 2,858 | 0.77  (0.44) | –0.02  (0.88) | 2.84\*\*\* (0.01) | 21.70\*\*\* (0.00) | 2.71\*\*\* (0.01) | | 24.22\*\*\* (0.00) |
| Sales | 1,005,698 | 617,245 | 940,795 | 493,581 | 3,874,729 | 2,634,833 | –0.30  (0.76) | –1.42  (0.23) | 3.10\*\*\* (0.01) | 10.54\*\*\* (0.00) | 3.14\*\*\* (0.01) | | 15.19\*\*\* (0.00) |
| Total Assets | 5,092,728 | 2,206,102 | 4,350,162 | 2,236,129 | 20,947,097 | 11,112,530 | –0.70  (0.49) | 0.00  (1.00) | 1.82\* (0.08) | 13.77\*\*\* (0.00) | 1.91\* (0.07) | | 19.23\*\*\* (0.00) |

*Notes:* Market Value is in US$ millions, Sales and Total Assets are in US$ thousands. All values are collected at QD–30, where QD is the qualification day (the day at the close of which market data is used to determine next index changes).

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

**Table 5**

Changes in institutional ownership for firms added to or deleted from the FTSE Frontier 50 index in 2008–2021.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Panel A. Additions |  |  |  |  |  |  |  |
| Measure | Pre-Event | Post-Event | Change | Increases/  Decreases/  No Change | *t* test  (*p-*value) | Sign test  (*p-*value) | Wilcoxon signed-rank test  (*p-*value) |
| New additions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 119) | |  |  |  |  |  |  |
| Mean | 0.61 | 0.64 | 0.03 | 1 / 1 / 117 | 0.54  (0.59) | 0.00  (1.00) | 0.45  (0.65) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 80) | |  |  |  |  |  |  |
| Mean | 58.38 | 58.88 | 0.50 | 9 / 7 / 64 | 1.46  (0.15) | 0.25  (0.80) | 1.22  (0.22) |
| Median | 62.50 | 62.50 | 0.00 |  |  |  |  |
| Repeated additions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 73) | |  |  |  |  |  |  |
| Mean | 1.11 | 1.38 | 0.27 | 2 / 1 / 70 | 1.05  (0.30) | 0.00  (1.00) | 1.07  (0.29) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 50) | |  |  |  |  |  |  |
| Mean | 57.56 | 57.78 | 0.22 | 5 / 4 / 41 | 0.35  (0.73) | 0.00  (1.00) | 0.42  (0.68) |
| Median | 60.00 | 60.00 | 0.00 |  |  |  |  |
| Reclassification additions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 15) | |  |  |  |  |  |  |
| Mean | 1.40 | 1.40 | 0.00 | 0 / 0 / 15 | 0.00  (1.00) | 0.00  (1.00) | 1.00  (1.00) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 11) | |  |  |  |  |  |  |
| Mean | 58.82 | 58.73 | ‒0.09 | 0 / 1 / 10 | ‒1.00  (0.34) | 0.00  (1.00) | ‒1.00  (0.32) |
| Median | 61.00 | 61.00 | 0.00 |  |  |  |  |

*Table 5 continues*

**Table 5** continued

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Panel B. Deletions |  |  |  |  |  |  |  |
| Measure | Pre-Event | Post-Event | Change | Increases/  Decreases/  No Change | *t* test  (*p-*value) | Sign test  (*p-*value) | Wilcoxon signed-rank test  (*p-*value) |
| New deletions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 120) | |  |  |  |  |  |  |
| Mean | 1.08 | 1.24 | 0.16 | 2 / 1 / 117 | 1.29  (0.20) | 0.00  (1.00) | 1.07  (0.29) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 76) | |  |  |  |  |  |  |
| Mean | 58.81 | 57.39 | –1.42 | 7 / 12 / 57 | –1.61 (0.11) | –0.92  (0.36) | –1.69\*  (0.09) |
| Median | 60.50 | 59.75 | 0.00 |  |  |  |  |
| Repeated deletions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 73) | |  |  |  |  |  |  |
| Mean | 2.00 | 1.97 | –0.03 | 0 / 1 / 72 | –1.00  (0.32) | 0.00  (1.00) | –1.00  (0.32) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 52) | |  |  |  |  |  |  |
| Mean | 54.70 | 55.28 | 0.58 | 4 / 6 / 42 | 0.71  (0.48) | –0.32  (0.75) | –0.15  (0.88) |
| Median | 59.50 | 59.50 | 0.00 |  |  |  |  |
| Reclassification deletions |  |  |  |  |  |  |  |
| Percentage of strategic shareholdings held by investment banks or institutions (*N* = 22) | |  |  |  |  |  |  |
| Mean | 0.32 | 0.45 | 0.13 | 1 / 0 / 21 | 1.00  (0.33) | 0.00  (1.00) | 1.00  (0.32) |
| Median | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Total percentage of strategic shareholdings (*N* = 21) | |  |  |  |  |  |  |
| Mean | 55.71 | 56.48 | 0.77 | 6 / 0 / 15 | 2.03\*  (0.06) | 2.04\*\*  (0.03) | 2.21\*\*  (0.03) |
| Median | 60.00 | 61.00 | 0.00 |  |  |  |  |

*Notes:* Pre-event values report strategic shareholdings in the two-month period before the month of the index change, and post-event values show strategic shareholdings in the two-month period after. Only holdings of 5% or more are counted as strategic. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

**Table 6**. Changes in liquidity for stocks added to or deleted from the FTSE Frontier 50 index in 2008–2021.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A: Additions** | | | | | | | |
| New additions | Mean  (Median) | | Mean  (Median)  difference | Increases/  Decreases/ No change | *t* test  (*p–*value) | Sign test  (*p–*value) | Wilcoxon signed–rank test (*p–*value) |
|  | Pre–event | Post–event |
| Dollar volume  (*N* = 127) | 6.5325  (6.1631) | 6.2583  (5.7939) | –0.2742  (–0.2585) | 45 / 82 / 0 | –4.22\*\*\*  (0.00) | –3.19\*\*\*  (0.00) | –4.04\*\*\*  (0.00) |
| Turnover ratio  (*N* = 127) | 0.0090  (0.0006) | 0.0070  (0.0004) | –0.0020  (–0.0001) | 45 / 82 / 0 | –2.40\*\*  (0.02) | –3.19\*\*\*  (0.00) | –3.80\*\*\*  (0.00) |
| Zero return ratio  (*N* = 127) | 0.1947  (0.1500) | 0.1856  ().1500) | –0.0091  (0.0000) | 51 / 60 / 16 | –0.83  (0.41) | –0.76  (0.45) | –0.48  (0.63) |
| Closing percent spread (*N* = 104) | 0.0151  (0.0078) | 0.0150  (0.0084) | –0.0001  (–0.0001) | 51 / 53 / 0 | –0.22  (0.83) | –0.10  (0.92) | –0.19  (0.85) |
| Amihud ratio  (*N* = 127) | 0.0001  (0.0000) | 0.0003  (0.0000) | 0.0002  (0.0000) | 75 / 52 / 0 | 2.03\*\*  (0.04) | 1.95\*\*  (0.05) | 2.53\*\*  (0.02) |
| Amivest ratioa  (*N* = 127) | 2.4996  (0.0033) | 2.7144  (0.0039) | 0.2148  (0.0000) | 61 / 66 / 0 | 0.41  (0.68) | –0.36  (0.72) | –0.09  (0.93) |
| Florackis ratio  (*N* = 127) | 342.1611  (39.8495) | 426.4415  (50.4525) | 84.2804  (4.2359) | 78 / 49 / 0 | 0.93  (0.36) | 2.49\*\*  (0.02) | 3.13\*\*\*  (0.00) |
| Repeated additions | | | | | | | |
| Dollar volume  (*N* = 75) | 6.9434  (6.8066) | 6.8140  (6.6382) | –0.1294  (–0.1959) | 23 / 52 / 0 | –1.61  (0.11) | –3.23\*\*\*  (0.00) | –2.06\*\*  (0.04) |
| Turnover ratio  (*N* = 75) | 0.0059  (0.0007) | 0.0057  (0.0006) | –0.0002  (0.0000) | 29 / 46 / 0 | –0.19  (0.85) | –1.85\*  (0.07) | –1.37  (0.17) |
| Zero return ratio  (*N* = 75) | 0.2107  (0.1500) | 0.2127  (0.1750) | 0.0020  (0.0000) | 36 / 32 / 7 | 0.12  (0.91) | 0.36  (0.72) | 0.40  (0.69) |
| Closing percent spread (*N* = 63) | 0.0178  (0.0074) | 0.0166  (0.0070) | –0.0013  (–0.0001) | 29 / 34 / 0 | –1.05  (0.30) | –0.50  (0.61) | –0.50  (0.62) |
| Amihud ratio  (*N* = 75) | 0.0002  (0.0000) | 0.0010  (0.0000) | 0.0008  (0.0000) | 36 / 39 / 0 | 0.85  (0.40) | –0.23  (0.82) | 0.26  (0.80) |
| Amivest ratioa  (*N* = 75) | 4.7276  (0.0056) | 6.3929  (0.0065) | –1.6653  (–0.0000) | 37 / 38 / 0 | 1.19  (0.24) | 0.00  (1.00) | 0.63  (0.53) |
| Florackis ratio  (*N* = 75) | 222.8186  (33.7412) | 386.0618  (38.6067) | 163.2432  (–0.0245) | 37 / 38 / 0 | 0.62  (0.54) | 0.00  (1.00) | 0.14  (0.89) |
| Reclassification additions | | | | | | | |
| Dollar volume  (*N* = 17) | 6.5332  (6.3464) | 6.6761  (6.5272) | 0.1430  (0.1678) | 12 / 5 / 0 | 1.02  (0.33) | 1.46  (0.14) | 1.16  (0.25) |
| Turnover ratio  (*N* = 17) | 0.0005  (0.0003) | 0.0007  (0.0004) | 0.0002  (0.0000) | 10 / 7 / 0 | 1.50  (0.15) | 0.49  (0.63) | 0.78  (0.44) |
| Zero return ratio  (*N* = 17) | 0.0971  (0.0750) | 0.1294  (0.1250) | 0.0324  (0.0000) | 8 / 2 / 7 | 1.86\*  (0.08) | 1.58  (0.11) | 1.60  (0.11) |
| Closing percent spread (*N* = 17) | 0.0078  (0.0070) | 0.0068  (0.0069) | –0.0010  (–0.0004) | 6 / 11 / 0 | –1.37  (0.19) | –0.97  (0.33) | –1.02  (0.31) |
| Amihud ratio  (*N* = 17) | 0.00003  (0.0000) | 0.00002  (0.0000) | –0.00001  (0.0000) | 6 / 11 / 0 | –1.50  (0.15) | –0.97  (0.33) | –1.40  (0.16) |
| Amivest ratiob  (*N* = 17) | 2.5166  (0.8618) | 4.9197  (0.8536) | 2.4031  (0.1756) | 12 / 5 / 0 | 1.70  (0.11) | 1.46  (0.14) | 1.59  (0.11) |
| Florackis ratio  (*N* = 17) | 137.0281  (93.1877) | 114.2421  (51.3893) | –22.7860  (1.1421) | 9 / 8 / 0 | 1.41  (0.18) | 0.00  (1.00) | –0.50  (0.62) |

*Table 6 continues*

**Table 6** continues

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel B: Deletions** | | | | | | | |
| New deletions | Mean  (Median) | | Mean  (Median)  difference | Increases/  Decreases/ No change | *t* test  (*p–*value) | Sign test  (*p–*value) | Wilcoxon signed–rank test (*p–*value) |
|  | Pre–event | Post–event |
| Dollar volume  (*N* = 125) | 6.0013  (5.7590) | 5.8427  (5.5069) | –0.1586  (–0.2328) | 48 / 77 / 0 | –2.36\*\*  (0.02) | –2.50\*\*\*  (0.01) | –3.24\*\*\*  (0.00) |
| Turnover ratio  (*N* = 125) | 0.0069  (0.0006) | 0.0051  (0.0005) | –0.0018  (0.0000) | 51 / 74 / 0 | –1.54  (0.12) | –1.97\*\*  (0.05) | –2.90\*\*\*  (0.00) |
| Zero return ratio  (*N* = 125) | 0.1938  (0.1500) | 0.2120  (0.1750) | 0.0182  (0.0000) | 61 / 47 / 17 | 1.89\*  (0.06) | 1.25  (0.21) | 1.83\*  (0.07) |
| Closing percent spread (*N* = 103) | 0.0163  (0.0090) | 0.0159  (0.0094) | –0.0004  (0.0002) | 53 / 50 / 0 | –0.54  (0.59) | 0.20  (0.84) | –0.09  (0.92) |
| Amihud ratio  (*N* = 125) | 0.0009  (0.0000) | 0.0004  (0.0000) | –0.0004  (0.0000) | 63 / 62 / 0 | –1.62  (0.11) | 0.00  (1.00) | 0.00  (1.00) |
| Amivest ratioa  (*N* = 125) | 0.8472  (0.0012) | 1.1300  (0.0013) | 0.2828  (–0.0000) | 59 / 66 / 0 | 1.18  (0.24) | –0.54  (0.59) | 0.02  (0.99) |
| Florackis ratio  (*N* = 125) | 457.1587  (58.6621) | 302.9191  (57.5699) | –154.2395  (–0.0635) | 61 / 64 / 0 | –1.25  (0.21) | –0.18  (0.86) | –0.67  (0.50) |
| Repeated deletions | | | | | | | |
| Dollar volume  (*N* = 73) | 5.8971  (5.3503) | 5.8039  (5.3105) | –0.0932  (–0.2263) | 30 / 43 / 0 | –1.17  (0.24) | –1.40  (0.16) | –1.55  (0.12) |
| Turnover ratio  (*N* = 73) | 0.0026  (0.0004) | 0.0023  (0.0004) | –0.0003  (0.0000) | 33 / 40 / 0 | –0.96  (0.34) | –0.70  (0.48) | –1.14  (0.25) |
| Zero return ratio  (*N* = 73) | 0.2370  (0.1750) | 0.2332  (0.1750) | –0.0038  (0.0250) | 37 / 30 / 6 | –0.24  (0.81) | 0.73  (0.46) | 0.23  (0.82) |
| Closing percent spread (*N* = 66) | 0.0185  (0.0076) | 0.0183  (0.0088) | –0.0002  (0.0000) | 34 / 32 / 0 | –0.08  (0.94) | 0.12  (0.90) | –0.12  (0.90) |
| Amihud ratio  (*N* = 73) | 0.0012  (0.0000) | 0.0004  (0.0000) | –0.0008  (0.0000) | 37 / 36 / 0 | –0.85  (0.40) | 0.00  (1.00) | –0.43  (0.67) |
| Amivest ratioa  (*N* = 73) | 1.8248  (0.0028) | 2.0972  (0.0020) | 0.2724  (–0.0000) | 31 / 42 / 0 | 1.06  (0.29) | –1.17  (0.24) | –0.81  (0.42) |
| Florackis ratio  (*N* = 73) | 602.7470  (61.5569) | 269.2546  (62.6909) | –333.4924  (0.0732) | 37 / 36 / 0 | –1.23  (0.22) | 0.00  (1.00) | –0.71  (0.48) |
| Reclassification deletions | | | | | | | |
| Dollar volume  (*N* = 22) | 7.0314  (6.2388) | 7.0317  (6.3968) | 0.0003  (0.0018) | 11 / 11 / 0 | 0.00  (1.00) | 0.00  (1.00) | 0.08  (0.94) |
| Turnover ratio  (*N* = 22) | 0.0010  (0.0003) | 0.0012  (0.0003) | 0.0002  (0.0000) | 13 / 9 / 0 | 1.42  (0.17) | 0.64  (0.52) | 1.25  (0.21) |
| Zero return ratio  (*N* = 22) | 0.1114  (0.1250) | 0.0898  (0.0750) | –0.0216  (–0.0250) | 4 / 12 / 6 | 1.66  (0.11) | –1.75\*  (0.08) | –1.43  (0.15) |
| Closing percent spread (*N* = 22) | 0.0047  (0.0045) | 0.0052  (0.0050) | 0.0005  (0.0003) | 15 / 7 / 0 | 2.46\*\*  (0.02) | 1.49  (0.13) | 1.96\*\*  (0.05) |
| Amihud ratioc  (*N* = 22) | 3.8997  (1.7974) | 6.5183  (3.5300) | 2.6186  (0.5303) | 20 / 2 / 0 | 2.65\*\*  (0.02) | 3.62\*\*\*  (0.00) | 3.52\*\*\*  (0.00) |
| Amivest ratiob  (*N* = 22) | 9.3722  (1.4369) | 8.4999  (0.8663) | –0.8724  (–0.1156) | 9 / 13 / 0 | 0.66  (0.51) | –0.64  (0.52) | –1.15  (0.25) |
| Florackis ratio  (*N* = 22) | 76.4533  (73.0881) | 98.3620  (77.0933) | 21.9086  (2.6678) | 17 / 5 / 0 | 2.09\*\*  (0.05) | 2.35\*\*  (0.02) | 2.29\*\*  (0.02) |

*Notes:* Dollar volume is the natural logarithm of daily trading volume in dollars. Turnover ratio is the proportion of shares traded each day relative to the total shares outstanding. Zero-return ratio is the ratio of the number of zero-return days to the total number of trading days. The closing percent spread is the difference between the closing ask price and the closing bid price divided by the midpoint of the closing bid and ask prices. Amihud ratio is the average of the daily ratio of the absolute stock return to its daily trading volume in local currency. Amivest ratio is the average of the daily ratio of trading volume (in local currency) to the daily absolute stock return. Florackis ratio is the average of the daily ratio of the absolute stock return to its daily turnover ratio. Pre-event values of each

liquidity proxy are computed over a 40-day period that ends at QD–31, where QD is the qualification day (the day at the close of which market data is used to determine next index changes). Post-event values are computed over a 40-day period that starts at ED+31, where ED is the effective day (the first trading day when index changes become effective). aUnits are 109; bunits are 106; cunits are 10−6. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

**Table 7.** Regressions on CAR (QD–30, QD+50) for firms added to or deleted from the FTSE Frontier 50 index in 2008–2021.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Δ Dollar volume | 0.157\*\* |  |  |  |  |  |  |
|  | (0.02) |  |  |  |  |  |  |
| Δ Turnover ratio |  | –0.054 |  |  |  |  |  |
|  |  | (0.36) |  |  |  |  |  |
| Δ Zero return |  |  | –0.002 |  |  |  |  |
|  |  |  | (0.97) |  |  |  |  |
| Δ Closing percent spread |  |  |  | 0.045 |  |  |  |
|  |  |  |  | (0.54) |  |  |  |
| Δ Amihud ratio |  |  |  |  | 0.006 |  |  |
|  |  |  |  |  | (0.95) |  |  |
| Δ Amivest ratio |  |  |  |  |  | 0.029 |  |
|  |  |  |  |  |  | (0.69) |  |
| Δ Florackis ratio |  |  |  |  |  |  | –0.007 |
|  |  |  |  |  |  |  | (0.91) |
| Pre–event institutional ownership | 0.094\* | 0.112\*\* | 0.109\*\* | 0.112\*\* | 0.111\*\* | 0.110\*\* | 0.107\*\* |
|  | (0.09) | (0.03) | (0.04) | (0.03) | (0.04) | (0.04) | (0.05) |
| Δ Institutional ownership | 0.031 | 0.026 | 0.026 | 0.030 | 0.026 | 0.026 | 0.026 |
|  | (0.49) | (0.56) | (0.57) | (0.60) | (0.57) | (0.56) | (0.56) |
| Market value | –0.003 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 |
|  | (0.93) | (0.97) | (0.97) | (0.98) | (0.97) | (0.99) | (0.97) |
| Control variables |  |  |  |  |  |  |  |
| New addition dummy | 0.207\*\*\* | 0.197\*\*\* | 0.197\*\*\* | 0.195\*\*\* | 0.197\*\*\* | 0.197\*\*\* | 0.197\*\*\* |
|  | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Repeated addition dummy | 0.178\*\*\* | 0.182\*\*\* | 0.179\*\*\* | 0.162\*\*\* | 0.178\*\*\* | 0.177\*\*\* | 0.179\*\*\* |
|  | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Reclassification addition dummy | 0.098\*\* | 0.115\*\* | 0.113\*\* | 0.118\*\* | 0.113\*\* | 0.113\*\* | 0.113\*\* |
|  | (0.05) | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) | (0.03) |
| Repeated deletion dummy | 0.018 | 0.024 | 0.021 | 0.031 | 0.022 | 0.022 | 0.021 |
|  | (0.74) | (0.66) | (0.70) | (0.60) | (0.70) | (0.70) | (0.70) |
| Reclassification deletion dummy | 0.084 | 0.093 | 0.090 | 0.093 | 0.090 | 0.091 | 0.090 |
|  | (0.18) | (0.14) | (0.15) | (0.18) | (0.15) | (0.15) | (0.15) |
| Constant | –0.039\* | –0.049\*\* | –0.047\*\* | –0.046\*\* | –0.047\*\* | –0.047\*\* | –0.047\*\* |
|  | (0.06) | (0.02) | (0.02) | (0.05) | (0.02) | (0.02) | (0.02) |
| *N* | 418 | 418 | 418 | 371 | 418 | 418 | 418 |
| *R2* | 0.082 | 0.061 | 0.058 | 0.056 | 0.058 | 0.059 | 0.058 |

*Notes:* Abnormal returns are estimated using the market–adjusted model. Datastream country value–weighted market indices are used as proxies for the market return for respective countries. QD is the qualification day (the day at the close of which market data is used to determine next index changes). Dollar volume, turnover ratio, zero-return ratio, closing percent spread, Amihud ratio, Amivest ratio, and Florackis ratio are defined in Table 6. Pre-event institutional ownership is the percentage of strategic share holdings owned by investment banks or institutions in the two-month period before the month of the index change. Δ Institutional ownership is the change in the percentage of strategic share holdings owned by investment banks or institutions computed as the difference between the average of two months before and the average of two months after the index change. Market value is stock’s market value on day QD–30. Bootstrapped robust standard errors with 1000 replications (set seed 12345) are used to estimate significance levels. Two-tailed *p*-values are in parentheses. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively, using a two–tail test.

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   [↑](#footnote-ref-1)
2. Goodman School of Business, Brock University, 1812 Sir Isaac Brock Way, St. Catharines, Ontario, Canada L2S 3A1 [↑](#footnote-ref-2)
3. See https://frontiermarketnews.org/list-of-frontier-market-funds/ [↑](#footnote-ref-3)
4. The S&P Africa 40 index is limited to constituents from the S&P Frontier BMI in African countries such as Egypt, Ghana, Kenya, Morocco, Nigeria, South Africa, and Tunisia, as well as developed market listings of companies domiciled in Africa or with significant operations on the continent (S&P Dow Jones Indices, 2024). [↑](#footnote-ref-4)
5. Specifically, Saidi et al. (2012) analyze market reactions to the reclassification of Egypt and Morocco as emerging markets by Morgan Stanley Capital International (MSCI). They find a temporary gain for Egypt's Hermes Financial Index and no significant reaction for Morocco's All Shares Index. [↑](#footnote-ref-5)
6. The following three country reclassifications resulted in 17 additions to the index:

   17 Sept 2010 – Argentina demoted from Secondary Emerging to Frontier (8 new additions firms).

   19 June 2015 – Morocco demoted from Secondary Emerging to Frontier (4 new additions).

   15 September 2017 - Argentina (1 new addition and 2 repeated additions) and Kazakhstan (2 new additions) added to Frontier from Unclassified.

   The following four country reclassifications resulted in 22 deletions from the index:

   19 June 2015 – Argentina demoted from Frontier to Unclassified (5 new deletions and 1 repeated deletion).

   16 September 2016 – Qatar promoted from Frontier to Secondary Emerging (3 new deletions).

   26 September 2019 – Romania (4 new deletions and 1 repeated deletion) promoted from Frontier to Secondary Emerging (effective from the close on 18 September 2020).

   31 March 2020 – Argentina demoted from Frontier to Unclassified (3 new deletions and 5 repeated deletions), subject to capital controls not being removed (effective from the close on 30 September 2020). [↑](#footnote-ref-6)
7. The use of a pre-event estimation period may lead to biased results, because stocks added to (deleted from) the FTSE Frontier 50 index usually experience superior (inferior) performance before entering (exiting) the index. [↑](#footnote-ref-7)
8. This gain is consistent with significant pre-announcement price increases for additions to other major stock indices, such as the US’ Nasdaq 100 (e. g., Biktimirov and Xu, 2019a), German DAX (e.g., Mama et al., 2017), and UK’s FTSE 100 (e.g., Mase, 2007), that use market capitalization to identify index additions. [↑](#footnote-ref-8)
9. The use of a 40-day pre-event and post-event periods avoids overlapping with another quarterly index rebalancing. [↑](#footnote-ref-9)
10. Bootstrapped robust standard errors were computed using 1,000 replications with a fixed seed (12345) to ensure reproducibility. [↑](#footnote-ref-10)