

**Do Investors Value Environmental Sustainability? Evidence from the FTSE  
Environmental Opportunities 100 Index**

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**Abstract**

To examine whether investors value environmental sustainability, we analyze stock market reactions of the firms added to or deleted from the FTSE Environmental Opportunities 100 index (FTSE EO 100). Firms added to the FTSE EO 100 that were not previously in the FTSE EO and firms removed from the FTSE EO index series altogether do not show significant stock price changes. In contrast, firms added to the FTSE EO 100 from the FTSE EO exhibit a sustained stock price gain, whereas deletions from the FTSE EO 100 that still stay in the FTSE EO show a sustained stock price decline.

**Keywords:** Environmental sustainability; FTSE EO 100 index; Event study; Abnormal return; Trading volume; Institutional ownership.

**JEL Classification:** G11 · G12 · G14 · Q50 · Q56

## 1. Introduction

We analyze stock returns, trading volume, and institutional ownership changes for firms that are added to or deleted from the FTSE Environmental Opportunities 100 (FTSE EO 100) index since its first reconstitution in June 2009 to December 2019. We have two main motivations. First, although a growing body of literature examines market reactions to changes in the corporate social responsibility (CSR) indexes, none of the studies analyze an index that focuses entirely on environmental sustainability, such as the FTSE EO 100 index. Therefore, this paper appears to be the first to analyze the effect of membership in the index that focuses exclusively on the companies that deliver solutions to environmental problems. Second, prior studies of the effects of membership changes in different CSR indexes present conflicting evidence.<sup>1</sup> To address this challenge, we distinguish between first-time and second-time additions (deletions), as they are expected to show different reactions to index changes. We also differentiate between the firms with prior and no environmental credentials, and consider three different types of event days.

Besides focusing on environmental activities, the FTSE EO 100 index offers several additional advantages for better understanding of the impact of the CSR index membership. Specifically, in contrast to the oldest and most frequently studied Dow Jones Sustainability Index (DJSI), the membership in the FTSE EO 100 is not determined based on any data or information provided by firms themselves. Also, being a part of the FTSE EO index, the FTSE EO 100 offers two types of index additions, firms with and without prior FTSE EO environmental credentials, and two types of index deletions, firms that still stay in the FTSE EO or are removed completely

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<sup>1</sup> For example, whereas Robinson et al. (2011) find a permanent price gain for US companies added to the DJSI, Cheung (2011) reports only a temporary stock price reaction. In contrast, Doh et al. (2010) and Becchetti et al. (2012) document marginal or no price reaction for US companies added to the Calvert Social Index and Domini 400 Social Index, respectively.

from the FTSE EO index series. Finally, the FTSE EO 100 index is transparent and publicly available. FTSE Russell company publicly announces index constituent changes and publishes the latest index membership list. These differences in selection criteria and eligibility rules are important because they can influence how investors assess and consequently react to index changes (Afego, 2017).

We do not find significant stock price reaction around the FTSE EO 100 index changes for firms added to the index without prior environmental credentials and for firms removed from the FTSE EO index series altogether. In contrast, firms added to the FTSE EO 100 index from the FTSE EO exhibit a sustained stock price gain, whereas deletions from the FTSE EO 100 that still stay in the FTSE EO show a sustained stock price decline. Moreover, market participants anticipate index changes, as evidenced by significant stock price increases (decreases) for index additions (deletions) prior to the announcement day. Importantly, we document pronounced differences in stock price reaction between repeated additions (deletions) and new additions (deletions). Specifically, in contrast to new additions, repeated additions exhibit only temporary price gains. Among three groups of deletions, repeated deletions show the largest stock price decline.

The main contribution of this paper is twofold. First, it provides the first examination of changes to a CSR index that focuses exclusively on environmental sustainability. Second, the paper documents significant differences in stock price and trading volume responses between additions (deletions) with and without prior (subsequent) environmental credentials, as well as between new additions (deletions) and repeated additions (deletions).

## **2. Sample**

Following the launch of the FTSE Environmental Opportunities (EO) All-Share index in June 2008, on November 17, 2008, FTSE announced an expansion of its Environmental Opportunities Index Series with nine new index offerings including the FTSE EO 100 index. The largest 100 companies of the FTSE EO All-Share index became the members of the newly created FTSE EO 100 index.

The FTSE EO 100 index identifies and measures investment opportunities in environmental markets companies, which provide products or services that deliver solutions to environmental problems or that improve the efficiency of natural resource use. Index constituents comprise the top 100 largest global companies that have significant involvement in environmental business activities in seven sectors: Renewable and alternative energy, Energy efficiency, Water infrastructure and technologies, Waste management and technologies, Pollution control, Environmental support services, and Food, agriculture and forestry.<sup>2</sup>

The membership of the FTSE EO 100 index is reviewed twice a year in June and December. To identify companies for addition to or removal from the FTSE EO 100 index, all constituents of the FTSE EO All-Share index are ranked based on full market capitalization. A company will be added to the index if its market capitalization has risen to 90<sup>th</sup> or above. Similarly, a company will be deleted from the index if its market capitalization has fallen to 111<sup>th</sup> or below. To calculate the market capitalization of a stock, FTSE uses stock market data at the close of business on the Monday four weeks before the effective date. Therefore, investors can predict future index changes about two weeks before an actual public announcement about FTSE 100 index changes is made, and about one month before the index changes become effective.

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<sup>2</sup> To be eligible for inclusion in the index, companies are required to have at least 20% of their business derived from environmental markets and technologies. The nature of a company's business and passing of the 20% threshold is determined through the analysis of the following parameters: (i) environmental market revenues against total revenues, (ii) environmental market invested capital against total invested capital, and, (iii) environmental market EBITDA against total EBITDA.

Thus, we consider three event days: QD – qualification day – is the day at the end of which investors can determine if a stock qualifies as an addition to or deletion from the FTSE EO 100 index; AD – announcement day – is the day of the actual announcement of index constituent changes; and ED – effective day – is the first trading day when index changes become effective. While the time period between QD and ED has been constant 20 trading days, AD preceded ED by 6 trading days until December 2013, and by 11 trading days since then.

Our sample period starts with the first semi-annual review implemented in June 2009 and extends to December 2019. The initial sample of 149 index additions and 148 index deletions, collected from the *FTSE Russell Environmental Opportunities Index Series Review* announcements, is reduced to a final, clean sample of 143 additions and 139 deletions.<sup>3</sup> Table 1 summarizes the three groups of additions and the three groups of deletions examined in this study (Panel A) and the country distribution of the final sample (Panel B).

[Table 1 here]

### 3. Analyses

#### 3.1. Abnormal returns

We collect all security and market data required for the abnormal return and subsequent analyses from the Thomson Reuters Datastream database. Table 2 Panel A presents abnormal returns for the three groups of additions to the FTSE EO 100 index.<sup>4</sup> Pure additions do not show statistically significant positive abnormal returns. In contrast, regular additions and repeated

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<sup>3</sup> A clean sample is created by applying three screens. The first screen removed four additions that were added to the FTSE EO 100 index more than two times. The second screen removed eight deletions that were excluded from the index following corporate spin-offs. The third screen removed two additions (one deletion) that were simultaneously added to (deleted from) both the FTSE EO 100 and FTSE EO indexes for the second time.

<sup>4</sup> Following Chen et al. (2004), and Becker-Blease and Paul (2010), we use market-adjusted returns to calculate abnormal returns around the FTSE EO 100 index changes. Similar to Campbell et al. (2010), national value-weighted market-index returns in local currencies are used as proxies for the market return for respective countries. To estimate the significance of abnormal returns, we use a parametric *t*-test and two nonparametric tests: a sign test (Corrado and Zivney, 1992; Cowan, 1992) and a rank test (Corrado, 1989). When QD falls on the Memorial Day holiday, QD is moved one day forward for US firms in the calculation of abnormal returns and abnormal trading volume.

regular additions show positive and significant CARs of 7.54% and 6.02%, respectively, in the 30-day period prior to QD (QD–30, QD–1).<sup>5</sup>

[Table 2 here]

Regular additions also gain abnormal 0.65% on QD. Most important, regular additions do not show any reversal of the accumulated gains, as the CAR of over 9% remain significant in the period from QD–30 to ED+30 under two tests. In contrast, the CAR of repeated regular additions is not significant over the same period.<sup>6</sup>

Figure 1 plots the CARs for the three groups of additions from ED – 50 (QD – 30) to ED + 30. As indicated by the results in Table 2, the graphs show a sustained stock price gain for regular additions, a temporary stock price increase for repeated regular additions, and no significant gains for pure additions.

[Figure 1 here]

Turning to the three groups of deletions in Panel B of Table 2, new deletions do not show any significant stock price changes in the 30-day period before QD. In contrast, regular deletions and repeated regular deletions experience significant negative CARs of –6.11% and –7.30%, respectively, in the same period. These losses grow to –7.72% and –12.71% over the following 50 days until ED+30 and remain significant at least at the 1% level under both the *t* test and the sign test.

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<sup>5</sup> This price run-up is consistent with significant pre-announcement gains for additions to other large-cap indexes, 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 determine new index additions.

<sup>6</sup> This distinction in stock price behaviour between new additions and repeated additions is consistent with the results of Zhou (2011) and Biktimirov and Xu (2019a) in the context of the S&P 500 and Nasdaq 100 index changes, respectively.

Figure 2 plots the CARs for the three groups of deletions from ED–50 (QD–30) to ED+30. The graphs visually highlight sustained declines in value for both regular deletions and repeated regular deletions, and no significant changes for pure deletions.

[Figure 2 here]

Taken together, the evidence does not suggest a significant change in value for pure additions to and pure deletions from the FTSE EO 100 index. In other words, a firm’s addition to (or deletion from) the FTSE EO 100 index, when the firm has no prior FTSE EO series membership (or when it loses its FTSE EO series membership altogether), has no significant impact on the firm’s value. In contrast, members of the FTSE EO index added to (deleted from) the FTSE EO 100 index show a significant and sustained gain (loss) in value. The evidence also highlights differences in abnormal returns between the FTSE EO members added to (deleted from) the FTSE EO 100 for the first time and repeated additions (deletions). Specifically, repeated regular additions show a temporary stock price gain, and repeated regular deletions experience the largest and sustained stock price loss.

### *3.2. Trading volume*

To examine trading volume behavior of the firms around the FTSE EO 100 index changes, we use procedures similar to those in Chae (2005). Table 3 shows abnormal trading volume for FTSE EO 100 index additions and deletions. Except for pure deletions, all addition and deletion groups experience a significant increase in trading volume on ED–1, the last day before index changes become effective. This result is consistent with the trading behavior of



index fund managers who postpone their trades until ED–1 to minimize tracking errors.<sup>7</sup> Moreover, regular additions (deletions) seem to be affected by this trading pattern the most. Specifically, the abnormal trading volume of 3.26% on ED–1 for regular additions is the largest among the three groups of additions, whereas the abnormal trading volume of 2.86% for regular deletions is the largest among the three groups of deletions.

[Table 3 here]

### 3.3. *Institutional ownership*

We follow Biktimirov and Li (2014) to examine changes in institutional ownership. Table 4 shows some descriptive statistics and test results for the percentage of strategic share holdings owned by investment banks or institutions and the total percentage of strategic holdings for additions to and deletions from the FTSE EO 100 index for the period 1999–2019 collected from Thomson Reuters Datastream database. As presented in Panel A, among the three groups of additions, regular additions have the largest percentage of strategic shareholdings held by investment banks or institutions, while pure additions have the smallest one. None of the addition groups exhibit significant changes in strategic ownership around FTSE EO 100 Index changes.

[Table 4 here]

As shown in Panel B for deletions, similar to additions, pure deletions have the smallest percentage of strategic shareholdings held by investment banks or institutions among the three groups of deletions. Again, similar to additions, deletion groups do not show significant changes in strategic ownership around FTSE EO 100 Index changes.

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<sup>7</sup> Similar trading behavior is reported around reconstitutions of other large-cap indexes, such as S&P 500 (Kappou et al., 2010; and Geppert et al., 2011), Dow Jones Industrial Average (Biktimirov and Xu, 2019b) and Nasdaq 100 (Biktimirov and Xu, 2019a).

To explore the relation between strategic shareholdings held by investment banks or institutions and abnormal returns and trading volume, we run cross-sectional regressions of CARs and cumulative abnormal trading volume (CATV) on the pre-event percentage of strategic shareholdings held by investment banks or institutions. To control for the factors related to the way a firm is added to or removed from the index, we use five dummy variables. They are equal to one if a firm is a pure addition, regular addition, repeated regular addition, pure deletion, or repeated regular deletion, respectively, and zero otherwise. Table 5 presents four regressions with standardized coefficients and *p*-values in parentheses. Significant coefficients for institutional ownership in two regressions suggest that the percentage institutional ownership represented by investment banks or institutions has positive relations with abnormal returns on QD and with CATV from QD–30 to ED+30.

[Table 5 here]

#### **4. Concluding Discussion**

The absence of significant stock price changes for pure additions and pure deletions suggests that the firm's first-time addition to or complete removal from the environmental index does not affect investors' valuation of the firm. However, this observation does not imply that investors completely disregard firm's involvement in environmental activities. Indeed, regular additions, which consist of the firms that demonstrated their commitment to environmental issues by being members of the FTSE EO index, experience a significant stock price run-up prior to QD and gain an additional 0.65% on QD – the day that determines their qualification for the FTSE EO 100 membership. As another argument for investor reaction to changes in the FTSE EO 100 index, stock prices of both regular additions and repeated regular additions stop growing

shortly after QD, while stock prices of both regular deletions and repeated regular deletions slow down their decline after QD.<sup>8</sup> Moreover, trading volume increases significantly for all groups, except pure deletions, on ED-1 – the last day before index changes become effective. Taken together, these observations suggest that investors care more and therefore reward (punish) firms with both prior environmental credentials and strong (weak) stock performance (represented by an increase (decrease) in market capitalization), as opposed to pure additions (deletions) that lack previous environmental credentials (lose environmental credentials altogether). Hawn et al. (2018, p. 971) reach the same conclusion in the context of a wider concept of sustainability, reflected by the DJSI World index: “Simply being added to the index may not indicate sufficient ongoing attention to sustainability to warrant a market response, while being retained on the index may indicate more serious engagement.”

In addition, the presence of institutional investors, namely investment banks and institutions, – or the lack of them – seem to affect the magnitude of stock market reactions. Specifically, regular additions and repeated regular deletions, which have the largest levels of the pre-event ownership by investment banks or institutions, experience the largest gains (losses) around the FTSE EO 100 index changes. In contrast, both pure additions and pure deletions, which have the smallest levels of the pre-event ownership by investment banks or institutions, do not show any significant stock price reactions. Moreover, the level of the pre-event ownership by investment banks or institutions is significantly related to abnormal returns on QD and to CATV from QD-30 to ED+30.

Given the conflicting evidence reported in past studies which have ignored the salience of first-time and repeated changes, another important observation of this study is that market

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<sup>8</sup> As insightfully suggested by one of the reviewers, if stock price gains (losses) of regular additions and repeated regular additions (regular and repeated regular deletions) were mainly due to their superior (inferior) non-environmental performance, these stock price gains (losses) would be expected to continue after QD, not to stop.

participants seem to clearly differentiate between new and repeated index changes, and reward the second-time additions to the index less and penalize the second-time deletions from the index more. As a limitation, however, this study does not examine any potential differences in stock market reactions across countries and time periods.

Overall, the presented evidence suggests that investors do not react to the news about addition to the index for firms without prior environmental credentials. Similarly, they ignore the news about firms that lose environmental credentials altogether. However, investors seem to reward (punish) firms with both prior environmental credentials and superior (declining) stock performance (represented by an increase (decrease) in market capitalization), and also to differentiate between first-time and repeated additions (deletions). In addition, the presence of institutional investors, specifically investment banks and institutions, seems to determine the magnitude of stock market reactions.

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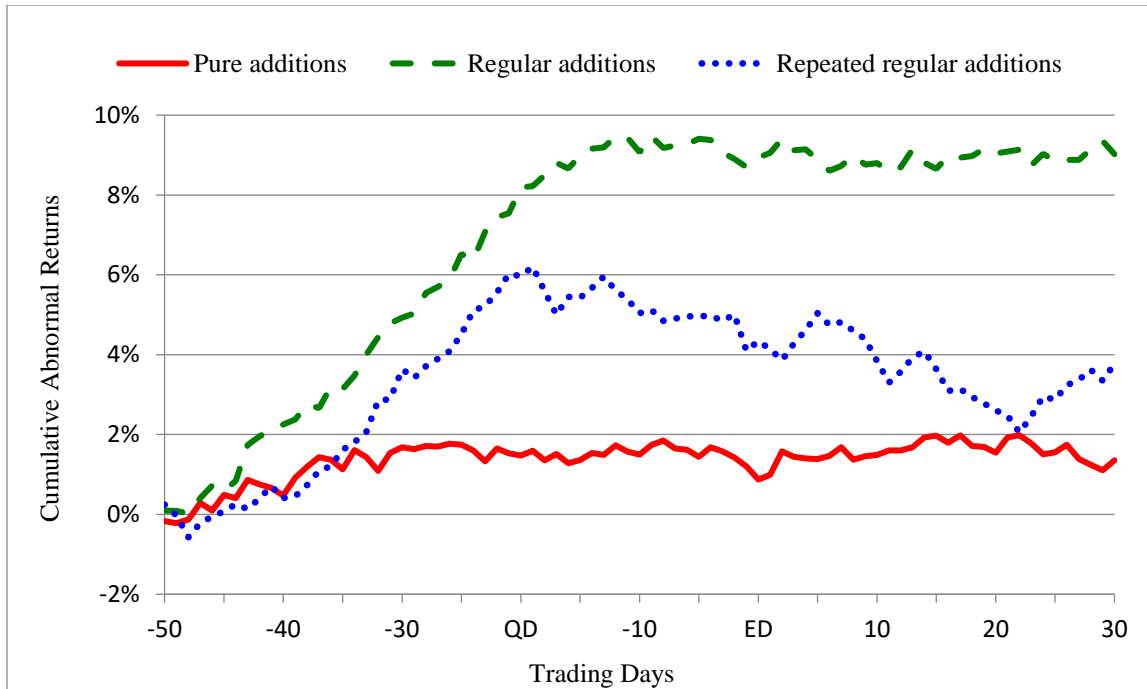
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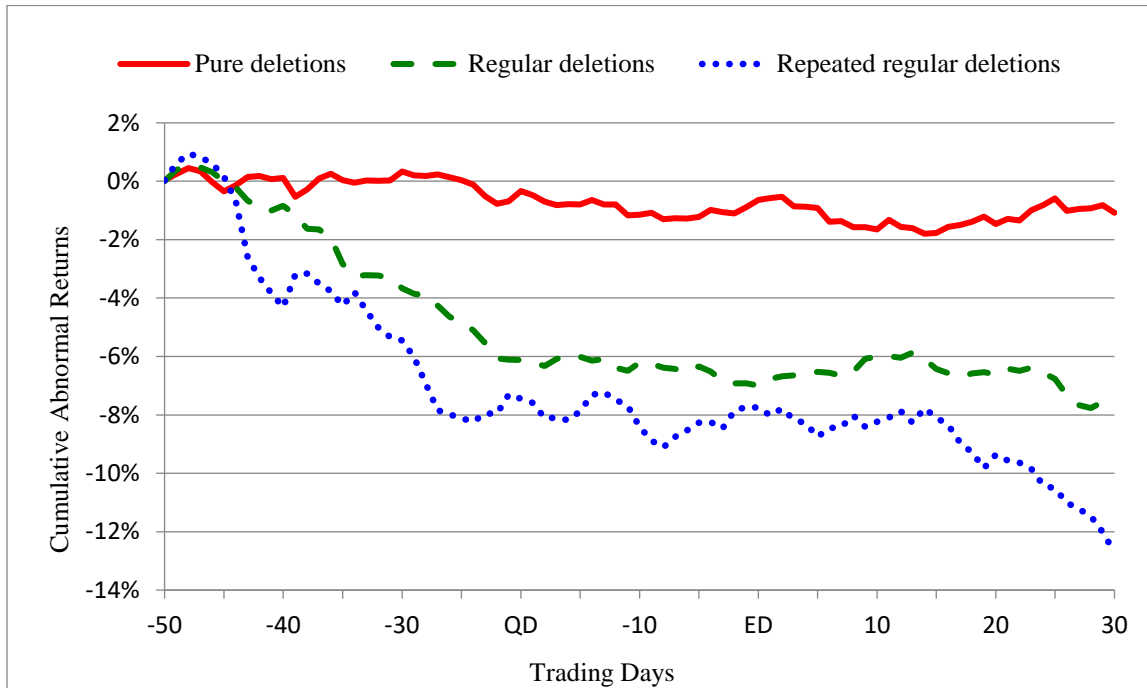
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**Fig. 1.** Cumulative abnormal returns for three groups of additions to the FTSE EO 100 index. QD is the qualification day (the day at the close of which market data is used to determine next index changes) and ED is the effective day (the first trading 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 EO 100 index. 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.



**Table 1**

Sample summary and country distribution of firms added to or deleted from the FTSE EO 100 index (2009 – 2019)

Panel A: Sample summary				
Sample	No. of firms	Definition of sample		
Additions:				
Pure additions	39	Firms added to the FTSE EO 100 index that were not previously in the FTSE EO index. Thus, these firms meet the FTSE EO criteria for the first time.		
Regular additions	78	Firms added to the index from the FTSE EO members		
Repeated regular additions	26	Firms added to the index from the FTSE EO members for the second time		
Deletions:				
Pure deletions	35	Firms removed from the index that were also simultaneously removed from the FTSE EO index. Thus, these firms fail to meet the FTSE EO criteria.		
Regular deletions	86	Firms removed from the index but remain members of the FTSE EO index		
Repeated regular deletions	18	Firms removed from the index for the second time but remain members of the FTSE EO index		
Panel B: Country distribution				
Country	Additions		Deletions	
	No. of firms	Percent	No. of firms	Percent
Australia	2	1.40	2	1.44
Austria	2	1.40	3	2.16
Belgium	2	1.40	3	2.16
Brazil	6	4.20	8	5.76
Chile	1	0.70	1	0.72
China	13	9.09	12	8.63
Denmark	3	2.10	1	0.72
Finland	2	1.40	3	2.16
France	4	2.80	5	3.60
Germany	1	0.70	2	1.44
Hong Kong	4	2.80	3	2.16
India	6	4.20	6	4.32
Japan	12	8.39	12	8.63
Norway	–	–	3	2.16
Philippines	3	2.10	2	1.44
South Korea	7	4.90	8	5.76
Spain	4	2.80	7	5.04
Sweden	5	3.50	4	2.88
Switzerland	3	2.10	2	1.44
UK	9	6.29	10	7.19
USA	44	30.77	34	24.46
Others	10	6.99	8	5.76
Total	143	100.00	139	100.00

**Table 2**

Cumulative average abnormal returns (CARs) for firms added to or deleted from the FTSE EO 100 index

Panel A: Addition groups												
	Pure additions ( $N = 39$ )				Regular additions ( $N = 78$ )				Repeated regular additions ( $N = 26$ )			
	CARs	$t$ test	Rank test	Sign test	CARs	$t$ test	Rank test	Sign test	CARs	$t$ test	Rank test	Sign test
QD–30, QD–1	1.53%	1.27	0.62	1.59	7.54%	5.87***	2.69***	5.68***	6.02%	3.06***	2.34**	2.55***
QD–1	–0.12%	–0.55	–0.98	–1.61	0.10%	0.43	0.37	0.70	0.47%	1.29	1.13	0.59
QD	–0.05%	–0.24	–0.47	–0.97	0.65%	2.76***	2.12**	1.38	–0.05%	–0.14	0.04	0.20
QD+1	0.12%	0.54	0.65	0.95	0.03%	0.11	–0.20	–0.66	0.23%	0.64	0.74	1.77*
AD–1	–0.05%	–0.23	0.03	0.27	–0.15%	–0.64	–0.78	–0.86	0.10%	0.28	–0.40	–0.65
AD	–0.24%	–1.06	–0.90	–0.37	0.07%	0.28	–0.60	0.05	0.17%	0.46	0.45	0.92
AD+1	–0.23%	–1.03	–2.28**	–2.62***	0.15%	0.62	0.55	0.50	0.22%	0.62	0.58	0.53
QD+1, ED–1	–0.27%	–0.28	–0.26	0.95	0.50%	0.49	–1.01	0.70	–1.88%	–1.20	–1.44	–2.16**
ED–1	–0.17%	–0.75	–0.91	–1.00	–0.30%	–1.30	–2.15**	–2.00**	–0.62%	–1.75*	–1.60	–1.10
ED	–0.52%	–2.31**	–2.19**	–1.96**	0.28%	1.21	1.38	1.17	–0.24%	–0.67	–0.28	0.08
ED+1	0.15%	0.68	0.86	–1.32	0.11%	0.46	0.44	0.49	–0.21%	–0.60	–0.97	–1.10
ED+1, ED+30	0.57%	0.46	–0.28	0.60	0.11%	0.08	–2.69***	–0.19	–0.45%	–0.23	–1.42	–1.10
QD–30, ED+30	1.35%	0.69	–0.09	1.59	9.02%	4.27***	–0.08	4.10***	3.78%	1.17	0.03	1.37

Panel B: Deletion groups												
	Pure deletions ( $N = 35$ )				Regular deletions ( $N = 86$ )				Repeated regular deletions ( $N = 18$ )			
	CARs	$t$ test	Rank test	Sign test	CARs	$t$ test	Rank test	Sign test	CARs	$t$ test	Rank test	Sign test
QD–30, QD–1	–0.68%	–0.42	0.08	0.45	–6.11%	–5.32***	–1.87*	–4.56***	–7.30%	–3.12***	–1.26	–1.97**
QD–1	0.09%	0.32	1.04	0.11	–0.04%	–0.19	0.46	0.21	0.66%	1.54	1.80*	0.87
QD	0.35%	1.19	1.70*	1.80*	–0.02%	–0.10	0.21	1.07	–0.15%	–0.36	0.23	–0.55
QD+1	–0.14%	–0.48	–0.48	0.45	–0.07%	–0.34	0.45	0.86	–0.14%	–0.32	–0.54	–0.08
AD–1	0.02%	0.07	0.53	0.78	–0.36%	–1.74*	–0.99	–1.51	–0.33%	–0.74	–0.18	0.39
AD	0.07%	0.23	0.19	0.44	0.13%	0.64	1.29	1.30	0.08%	0.18	0.50	0.87
AD+1	–0.33%	–1.14	–0.92	–1.25	0.10%	0.50	1.85*	1.52	–0.45%	–1.03	–1.21	–0.55
QD+1, ED–1	–0.55%	–0.42	–0.43	0.78	–0.80%	–0.87	0.88	0.64	–0.27%	–0.14	0.67	–1.03
ED–1	0.19%	0.65	0.61	0.07	0.02%	0.08	0.99	1.76*	0.14%	0.32	1.42	1.87*
ED	0.09%	0.31	0.59	0.75	–0.10%	–0.45	0.16	0.25	–0.03%	–0.07	0.52	0.45
ED+1	0.11%	0.36	0.13	–0.27	0.21%	0.99	1.74*	1.76*	–0.27%	–0.61	–0.96	–1.45
ED+1, ED+30	–0.36%	–0.22	–0.34	–0.27	–0.98%	–0.83	0.93	0.25	–4.96%	–2.03**	–0.59	–1.92*
QD–30, ED+30	–1.08%	–0.40	–0.30	0.45	–7.72%	–4.09***	0.02	–3.69***	–12.71%	–3.31***	–0.66	–2.92***

Notes: Abnormal returns are estimated using the market-adjusted model. Datastream country value-weighted market indexes 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), 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 (ATV) for firms added to or deleted from the FTSE EO 100 index

Panel A: Addition groups												
	Pure additions ( $N = 39$ )				Regular additions ( $N = 78$ )				Repeated regular additions ( $N = 26$ )			
	ATV	$t$ test	Rank test	Sign test	ATV	$t$ test	Rank test	Sign test	ATV	$t$ test	Rank test	Sign test
QD-1	-1.34%	-1.99**	-1.16	-0.24	0.44%	0.90	0.58	0.70	-0.85%	-1.08	-0.73	-0.41
QD	-0.94%	-1.40	-1.29	-1.20	-0.36%	-0.74	-0.71	-1.34	-2.28%	-2.89***	-2.10**	-1.98**
QD+1	-0.46%	-0.69	-0.42	-0.88	1.30%	2.65***	0.68	-1.11	-0.79%	-1.00	-0.42	-0.81
AD-1	0.23%	0.35	0.75	1.07	2.60%	5.33***	0.83	-0.22	0.02%	0.02	0.16	-0.79
AD	-0.44%	-0.66	-0.76	-1.81	1.48%	3.02***	0.21	-1.36	-0.49%	-0.62	-0.92	-1.18
AD+1	-1.76%	-2.65***	-1.52	-2.77***	0.05%	0.11	-1.44	-2.72***	-0.90%	-1.15	-1.36	-2.36
ED-1	2.09%	3.11***	2.47**	3.06***	3.26%	6.61***	2.69***	2.95***	1.95%	2.47**	2.30**	1.53
ED	-0.51%	-0.75	-0.03	-0.46	-1.06%	-2.16**	-1.89*	-2.25**	-1.58%	-2.00**	-1.27	-1.61
ED+1	-3.03%	-4.51***	-1.60	-1.43	-0.74%	-1.51	-1.86*	-2.02*	-2.41%	-3.06***	-2.31**	-1.61

Panel B: Deletion groups												
	Pure deletions ( $N = 35$ )				Regular deletions ( $N = 86$ )				Repeated regular deletions ( $N = 18$ )			
	ATV	$t$ test	Rank test	Sign test	ATV	$t$ test	Rank test	Sign test	ATV	$t$ test	Rank test	Sign test
QD-1	-0.50%	-0.81	-0.39	-0.25	0.06%	0.14	-0.25	0.68	0.49%	0.54	1.16	0.99
QD	-1.47%	-2.37**	-1.55	-1.60	-1.45%	-3.29***	-1.45	-1.70*	-0.95%	-1.03	-0.76	0.04
QD+1	-0.65%	-1.05	-0.98	-1.94*	0.87%	1.97**	0.95	2.19**	0.43%	0.47	0.64	0.52
AD-1	-0.19%	-0.31	0.10	-0.26	0.83%	1.89*	1.15	0.46	1.13%	1.23	1.44	0.97
AD	-0.74%	-1.19	-0.64	-0.94	0.63%	1.43	0.64	0.25	-0.40%	-0.43	0.53	1.92*
AD+1	-1.48%	-2.38**	-1.73*	-3.64***	0.08%	0.18	-0.09	-0.18	-0.32%	-0.35	0.08	0.03
ED-1	0.95%	1.54	1.45	1.09	2.86%	6.51***	3.50***	4.61***	2.40%	2.61***	2.57***	2.38**
ED	-1.96%	-3.19***	-1.47	-2.29**	-0.88%	-2.01**	-1.05	-1.00	-0.38%	-0.41	-0.05	0.02
ED+1	-1.77%	-2.87***	-1.30	-1.27	-1.35%	-3.07***	-1.42	-0.78	-1.08%	-1.18	-0.74	-0.92

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**

Changes in institutional ownership for firms added to or deleted from the FTSE EO 100 Index in 2009–2019.

Measure	Pre-Event	Post-Event	Change	Increases/ Decreases/ No Change	<i>t</i> test ( <i>p</i> -value)	Sign test ( <i>p</i> -value)	Wilcoxon signed-rank test ( <i>p</i> -value)
Panel A. Additions							
Pure additions							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 39)							
Mean	3.06	3.32	0.26	6 / 4 / 29	0.85 (0.40)	0.32 (0.75)	0.77 (0.44)
Median	0.00	0.00	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 30)							
Mean	33.60	34.63	1.03	9 / 4 / 17	1.42 (0.16)	1.11 (0.27)	1.52 (0.13)
Median	27.00	27.00	0.00				
Regular additions							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 77)							
Mean	6.42	6.23	-0.19	15 / 17 / 45	-0.67 (0.51)	-0.18 (0.86)	-0.41 (0.68)
Median	5.00	5.00	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 68)							
Mean	31.47	31.86	0.39	19 / 24 / 25	0.49 (0.63)	-0.61 (0.54)	-0.27 (0.79)
Median	23.00	22.00	0.00				
Repeated regular additions							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 26)							
Mean	5.87	6.52	0.65	6 / 4 / 16	1.53 (0.14)	0.32 (0.75)	1.59 (0.11)
Median	0.00	2.50	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 24)							
Mean	38.73	39.35	0.63	5 / 4 / 15	1.13 (0.27)	0.00 (1.00)	1.13 (0.26)
Median	26.00	28.50	0.00				

*Table 4 continues*

**Table 4** continued

Panel B. Deletions							
Measure	Pre-Event	Post-Event	Change	Increases/ Decreases/ No Change	<i>t</i> test ( <i>p</i> -value)	Sign test ( <i>p</i> -value)	Wilcoxon signed-rank test ( <i>p</i> -value)
<b>Pure deletions</b>							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 34)							
Mean	3.12	3.22	0.10	3 / 6 / 25	0.26 (0.80)	-0.67 (0.51)	-0.06 (0.95)
Median	0.00	0.00	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 21)							
Mean	25.48	25.98	0.50	5 / 5 / 11	1.06 (0.30)	0.00 (1.00)	0.00 (1.00)
Median	22.00	22.00	0.00				
<b>Regular deletions</b>							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 86)							
Mean	4.35	4.13	-0.22	12 / 13 / 61	-0.73 (0.47)	0.00 (1.00)	-0.38 (0.71)
Median	0.00	0.00	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 78)							
Mean	35.86	35.83	-0.03	17 / 18 / 43	-0.05 (0.96)	0.00 (1.00)	-0.50 (0.62)
Median	33.50	32.50	0.00				
<b>Repeated regular deletions</b>							
Percentage of strategic shareholdings held by investment banks or institutions ( <i>N</i> = 18)							
Mean	6.78	7.11	0.33	2 / 1 / 15	1.19 (0.25)	0.00 (1.00)	1.07 (0.28)
Median	0.00	0.00	0.00				
Total percentage of strategic shareholdings ( <i>N</i> = 17)							
Mean	36.91	37.29	0.38	4 / 3 / 10	0.78 (0.45)	0.00 (1.00)	0.59 (0.55)
Median	28.00	31.00	0.00				

Pre-event values show strategic shareholdings in the two-month period before the month of the index change, and post-event values report 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 5.**

Regressions on cumulative abnormal returns (CARs) and cumulative abnormal trading volume (CATV) for firms added to or deleted from the FTSE EO 100 Index in 2009–2019.

	(1)	(2)	(3)	(4)
	AR on QD	CAR (QD–30, ED+30)	ATV on ED–1	CATV (QD–30, ED+30)
Pre-event institutional ownership	0.152*** (0.01)	–0.002 (0.97)	0.065 (0.29)	0.114* (0.06)
Control variables				
Pure addition dummy	0.003 (0.97)	0.175*** (0.01)	–0.034 (0.62)	–0.102 (0.13)
Regular addition dummy	0.152** (0.03)	0.425*** (0.00)	–0.063 (0.38)	–0.048 (0.50)
Repeated regular addition dummy	–0.016 (0.81)	0.189*** (0.00)	–0.061 (0.35)	–0.081 (0.21)
Pure deletion dummy	0.084 (0.20)	0.123** (0.05)	–0.131** (0.05)	–0.128** (0.05)
Repeated regular deletion dummy	–0.033 (0.60)	–0.071 (0.23)	–0.030 (0.64)	–0.030 (0.64)
Constant	–0.002 (0.34)	–0.076*** (0.00)	0.027*** (0.00)	–0.060 (0.79)
<i>N</i>	280	280	278	280
<i>R</i> <sup>2</sup>	5.5%	17.1%	2.0%	3.5%

Notes: Abnormal returns are estimated using the market-adjusted model. Datastream country value-weighted market indexes are used as proxies for the market return for respective countries. 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). 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.

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