FTSE 100 Index revisions: Asymmetric price response?

Philip A. Hamill[a,*], Peter G. Dunne[b], Kwaku K. Opong[c]

[a]*School of Management & Economics, Queen's University, Belfast BT7 1NN, UK.*

[b]*School of Management & Economics, Queen's University, Belfast BT7 1NN, UK.*

[c]*Department of Accounting and Finance, University of Glasgow, Glasgow, G12 8LE, UK.*

Abstract

Equity market indices, such as the FTSE 100 and the S&P 500, provide a vehicle for passive investment strategies and act as performance benchmarks for active managers. This paper shows that the market capitalisation re-composition rules for the FTSE 100 produce price patters that differ depending on the benchmark chosen. Idiosyncratic risk is the dominant factor in explaining price patterns. Additions experience superior performance prior to entry only, whereas FTSE 100 deletions' performance continues to decline after exiting the index.

Keywords: Equity indices; FTSE 100; S&P 500; Investment; Index revisions

JEL classification: G11; G14

[*]Corresponding author: School of Management & Economics, 25 University Square, Queen's University, Belfast BT7 1NN, UK. Tel.: +44-028 9097 3278; fax: +44 028 9097 5156.
E-mail address: p.a.hamill@qub.ac.uk

1. Introduction

Benchmark equity market indices are a vehicle for passive investment strategies while at the same time acting as performance benchmarks for active fund managers. Consequently, their construction is of vital practical and economic importance. While there is a plethora of literature for the S&P 500, in comparison there is a dearth of literature for FTSE 100 re-compositions. This is surprising for two reasons. First, London is a major capital market eighty per cent of which is accounted for by FTSE 100 stocks. Second, the re-composition criteria for the FTSE 100 is based only on market capitalisation. Analysis of this natural experiment avoids the endogeneity issue and provides broader insights in an environment with alternative index construction criteria.

Inclusion in (deletion from) the FTSE 100 is determined entirely by market capitalisation. For a firm already in the FTSE 100 to be deleted, it must fall below the 110th in terms of market value of all the U.K firms listed on the London Stock Exchange. For a firm to be included in the FTSE 100, it must rise above being the UK's 90th largest company. Under this regime there is symmetry of information between market participants. In contrast, S&P 500 re-compositions are at the discretion of Standard and Poor's Index Committee who have the remit of constituting a representative market index. By necessity decisions to reconstitute the S&P 500 occur in an asymmetric information environment in compliance with SEC regulations to ensure that when changes are announced they're disseminated equally. What has emerged from the US literature is what could now be regarded as a number of stylized facts in relation to the S&P 500. Chen, Noronha and Vijay (2004), and references contained therein, provide a summary of the US literature in relation to price, volume and microstructure effects and explanations of empirical findings in relation to earnings expectations and investor awareness.

Our analysis of 162 additions and 160 deletions for the period from 1984 to September 2000 demonstrates that additions (deletions) experience a gradual price increase (decrease) up until the day they enter the FTSE 100, for all benchmarks. Additions (deletions) experience a sharp price increase (decline) the day before entry (exit). This can be explained in terms of speculative activity on the basis of passive funds unavoidable demand for (supply of) included (deleted) stocks to minimize tracking error on the day before entry (exit). The market model benchmark produces a post-entry decline for additions whereas deletions experience reversion. Analysis of the market model parameters suggests that additions to the FTSE 100 are driven by idiosyncratic risk resulting in larger market capitalisation which isn't sustained post-entry. In contrast, deletions suffer declining performance resulting in falling market capitalisation which results in their exit from the FTSE 100. Significantly, deletions deteriorating position persists post-exit. Our analysis explains the asymmetric nature of additions and deletions. The benchmark chosen reflects expectation. In the case of additions, if you expect firm performance to persist then, relative to past performance, FTSE 100 entrants perform poorly, Alternatively, relative to the market entrants perform well. For deletion, poor performance persists.

2. Sample and Methodology

Firms are deleted from the FTSE 100 due to events like mergers and takeover. These firms were deleted from the study. The process of including firms into, and deleting firms from the FTSE 100 by Steering Committee started in 1984. The sample consists of all those firms that have been deleted from or included in the FTSE-100 from March 1984 to September 2000. Over this period re-compositions totalled 439. Firms were deleted if they had interim or final earnings announcements during the test period to exclude confounding events. The final sample comprised 162 additions to the FTSE 100 and 160 deletions. The addition (deletions) dates and share price data were obtained from the Primark/Datastream. Initially, the ZD test reported in Hamill, Opong & McGregor (2002) is used to compute the significance of mean and cumulative abnormal returns. It uses the market model as the benchmark. It has the advantage of being capable of accounting for multiple mis-specification of the market, providing robust variance estimates when calculating the significance of Cumulative Abnormal Returns (CARs). The FT All Share Index is the market proxy. The estimation period returns are calculated from day -22 to -150 with day 0 entry into the index.

Daily logarithmic returns were calculated using:

$$y_{i,t} = \ln[(P_{i,t} + D_{i,t})/(P_{i,t-1})]$$

$$x_{i,t} = \ln(P_{m,t}) - \ln(P_{m,t-1})$$

where:

$P_{i,t}$ is the price of security *i* on day *t*,

$D_{i,t}$ is the dividends paid during period *t*,

$P_{i,t-1}$ is the price of security *i* at the end of period *t*-1, and

$P_{m,t}$ is the price of the market index on day *t*.

We have the single-index market model written in vector form as:

$$y_{it} = \mathbf{x}_{it}\,\beta_i + u_{it} \tag{1}$$

where $\mathbf{x}_{it}$ = $(1, x_{it})$ and β'_i = (α_i, β_i) or, in matrix form as

$$\mathbf{y}_i = \mathbf{X}_i\,\beta_i + \mathbf{u}_i \tag{2}$$

where $\mathbf{y}'_i = (y_{i1}, \ldots\ldots\ldots\ldots, y_{iT})$, $\quad \mathbf{u}'_i = (u_{i1}, \ldots\ldots, u_{iT})$, and

$$\mathbf{X}'_i = (\mathbf{x}'_{i1}, \ldots\ldots, \mathbf{x}'_{iT}) = \begin{bmatrix} 1, \ldots\ldots, 1 \\ x_{i1}, \ldots\ldots, x_{iT} \end{bmatrix}$$

The estimated model is used to forecast *m* future observations $y_i^{*\prime} = (y_{i,T+1,\ldots,}\, y_{i,T+m})$ using the matrix of future observations;

$$\mathbf{X}_i^{*\prime} = \left(\mathbf{x}_{i,T+1}^{*\prime}, \ldots\ldots, \mathbf{x}_{i,T+m}^{*\prime}\right) = \begin{bmatrix} 1, \ldots\ldots, 1 \\ x_{i,T+1,\ldots\ldots,}\, x_{i,T+m} \end{bmatrix}$$

and the OLS estimator $\hat{\beta}_i = (\mathbf{X}'_i \mathbf{X}_i)^{-1} \mathbf{X}'_i \mathbf{y}_i$.

The vector of prediction errors is then $\mathbf{u}_i^{*\prime} = (\hat{u}_{i,T+1}, \ldots\ldots, \hat{u}_{i,T+m})$, obtained from:

$$\mathbf{u}_i{*} = \mathbf{y}_i{*} - \mathbf{X}_i{*}\,\hat{\beta}_i \tag{3}$$

where $\mathbf{y}_i{*}$ is the return on the firm over the test period, $\mathbf{X}_i{*}$ is a typical $m \times 2$ OLS matrix of market returns over the test period and $\hat{\beta}_i$ is the vector of OLS estimated parameters. The cumulative sum of forecast errors over the event window ($T+m_1$, $T+m_2$) is:

$$\sum_{\tau=T+m_1}^{T+m_2} \hat{u}_{i\tau} = \mathbf{C}\mathbf{u}_i^* \tag{4}$$

where '$\mathbf{C}$' is an appropriately designed $1 \times n$ selection vector which has the elements taking the value unity if $\hat{u}_{i\tau}$ is contained in the event window and zero if it is not. The covariance matrix is given by:

$$\mathbf{D}_i = \left(\mathbf{X}'_i \mathbf{X}_i / T\right)^{-1} \mathbf{Q}_i \left(\mathbf{X}'_i \mathbf{X}_i / T\right)^{-1} \tag{5}$$

where $\mathbf{Q}_i$ is an estimate of $\mathbf{E}\left(\mathbf{X}'_i \mathbf{u}_i \mathbf{u}'_i \mathbf{X}_i / T\right)$ which can be approximated by:

$$\hat{\mathbf{Q}}_i = T^{-1} \sum_{t=1}^{T} \mathbf{x}'_{it} \mathbf{x}_{it} \hat{u}_{it}^2 + T^{-1} \sum_{s=1}^{p} \sum_{t=s+1}^{T} \left(\mathbf{x}'_{it} \mathbf{x}_{i,t-s} + \mathbf{x}_{i,t-s} \mathbf{x}_{it}\right) \hat{u}_{it} \hat{u}_{i,t-s} \tag{6}$$

for p chosen to be approximately $T^{1/3}$; p should be increased until the truncations become trivial. $\hat{\mathbf{Q}}_i$ is thus an estimate of the average of the variances of $\mathbf{x}'_{it} u_{it}$ plus a term that takes into account the covariances between $\mathbf{x}'_{it} u_{it}$ and $\mathbf{x}'_{i,t-s} u_{i,t-s}$, the number of covariances being truncated at $s=p$ through the assumption of mixing. In these circumstances we have:

$$\mathbf{E}\left(\mathbf{C}\mathbf{u}_i^* \mathbf{u}_i^{*\prime} \mathbf{C}'\right) = \sigma_i^2 \mathbf{C}\mathbf{C}' + \mathbf{C}\mathbf{X}_i^* \mathbf{D}_i \mathbf{X}_i^{*\prime} \mathbf{C}' / T = \mathbf{V}_{\mathbf{D}_i} \tag{7}$$

where:

$$\sigma_i^2 = \frac{\mathbf{u}'_i \mathbf{u}_i}{(T-2)}$$

The Cumulative Abnormal Return (CAR) over the event window is:

$$CAR_{m1,m2} = N^{-1}\sum_{i=1}^{N}\mathbf{C}\mathbf{u}^{*} \quad (8)$$

and using the expression in equations 7 and 8 we have:

$$Z_D = N \times CAR_{m_1,m_2} \times \mathbf{V}_\mathbf{D}^{-1/2} \sim N(0,1) \quad (9)$$

where:

$$\mathbf{V}_\mathbf{D} = \sum_{i=1}^{N}\mathbf{V}_{\mathbf{D}i}$$

The selection vector in equation 4 can be adjusted to compute the significance of mean and cumulative abnormal returns. The (O, 1) and (0, beta) benchmarks are also employed. Rubac’s (1982) standard error estimate is used to test the significance of mean and cumulative abnormal returns for these benchmarks.

3. Results

Table 1 reports the Mean Abnormal Returns (MARs) and Cumulative Abnormal Returns (CARs), and their significance, with the market model, Zero One and Zero Beta as benchmarks for additions to (deletions from) the FTSE 100. Prior to inclusion mean abnormal returns are predominantly positive whereas in the post-event period they’re negative, and vice versa for deletions. Day -1 experiences a price increase (decrease), which is 1.45 (-1.11) per cent for additions (deletions) with the market model benchmark. This relatively large price change can be accounted for by index funds buying (selling) stock immediately prior to their inclusion to (deletion from) the FTSE 100 to minimise tracking error. An anomaly appears on day 0 for additions. A significant partial price reversal only occurs for the market model. From days 1 to 5 the MARs are less with the market model benchmark than for the Zero One and Zero Beta benchmarks. The latter two provide consistent results. For example on day 4 the market model generates a mean abnormal return of -0.32 of a per cent whereas the alternative benchmark models generate a mean abnormal return of -0.19 of a per cent. The magnitude of this difference in MARs becomes apparent when they're cumulated.

INSERT TABLE 1 HERE

Cumulative Abnormal Returns (CARs) from (-21, -1) range from 3.32 to 6.06 per cent depending on the benchmark adopted[1]. The choice of benchmark drastically alters the measured impact of FTSE 100 re-compositions. The CAR from (4, 60) goes from being a -4.63 per cent decline with the market model benchmark to being positive and insignificant. Likewise, the CAR from (-21, 60), which measures the permanent effect, is a significant -5.22 per cent whereas for the alternative benchmarks is now positive in the region of 5 per cent and significant. In contrast, for the same CAR deletions now experience a return of -5.86 per cent if a Zero One benchmark is adopted.

INSERT FIGURE 1 HERE

Figure 1 graphically illustrates the impact of alternative benchmarks. The cumulative abnormal returns are plotted for additions and deletions with the market model and Zero One model as benchmarks. We exclude the Zero Beta for clarity of exposition as it doesn't materially alter the results. Additions experience a price increase followed

[1] CARs from (0,3) for additions and (0,4) for deletions are the period after which index funds have completed their trades which is when trading volume has returned to its post-change level (Lynch and Mendenhall, 1997; Keim and Madhavan, 1996).

by an immediate reversal with the market model benchmark (Add MM). With the Zero One benchmark (Add Zero One) additions experience a partial reversal. Deletions appear to return to their pre-event period level with a market model (Del MM) whereas with the Zero One benchmark there is partial reversal with, what appears to be, a continued decline.

These findings can be attributed to idiosyncratic risk. Table 2 reports an analysis of market model parameters estimated in the pre-event period (-150 to -22) and the post-event period (+22 to 150).

INSERT TABLE 2 HERE

Additions to the FTSE 100 have a mean alpha of 0.136 (median 0.113) of a percent per day, which is significantly different from 0(*p*-value<0.01). In the post event period alpha is insignificantly different from 0. Economically this indicates that entrants are being driven by idiosyncratic factors, which then dissipate upon entry. If you expect the same level of performance post entry your expectations will not be realized resulting in declining performance (Fig. 1. Add MM). If we exclude idiosyncratic factors, it appears that entrants experience a level of performance higher than the market average (Fig. 1. Add Zero One). Alpha for deletions is negative and significantly less than zero both before and after leaving the FTSE 100, suggesting that firms with declining market capitalisation have declining performance which leads to their exit which persists. In relation to the market (Fig.1. Del Zero One), deletions experience a post exit decline whereas in relation to their own past performance and the market (Fig.1. Del MM) deletions appear to revert.

4. Conclusion

This paper highlights the importance of benchmark choice when examining price performance of re-compositions for the FTSE 100. Price response to additions and deletions is asymmetric and can be attributed to the nature of idiosyncratic risk when assessing performance. Whereas idiosyncratic risk is important in determining a firm's market capitalisation to gain entry, it appears that this level of performance cannot be sustained. In contrast, deletions' poor performance, as evidenced by declining market capitalisation, persists after exit. These findings illustrate the nature of mechanical re-compositions criteria for the FTSE 100 which is exogenous. The results reported here provide an interesting contrast to the results reported for the S&P 500. Alteration to its composition are announced in an asymmetric information environment where the issue of endogenity arises. These findings have significant policy implications. Whereas the S&P Index committee actively excluded some dot.coms from the S&P 500 under their financial viability criteria this was not the case for the FTSE 100.

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Table 1
Abnormal returns surrounding FTSE 100 re-compositions

	Additions				Deletions		
	Market Model	Zero One	Zero Beta		Market Model	Zero One	Zero Beta
Panel A: Mean abnormal returns (%)							
[-5]	-0.25	-0.12	-0.12		-0.01	-0.04	-0.08
[-4]	0.09	0.19	0.22		-0.31	-0.41*	-0.38*
[-3]	0.10	0.16	0.23		0.17	0.16	0.09
[-2]	0.31	0.45**	0.44**		-0.39*	-0.42*	-0.47**
[-1]	1.45**	1.61**	1.58**		-1.11**	-1.13**	-1.18**
[0]	-0.40*	-0.31	-0.27		0.72**	0.70**	0.66**
[1]	-0.79**	-0.64**	-0.66**		0.61**	0.58**	0.54**
[2]	-0.37*	-0.33**	-0.24		-0.14	-0.23	-0.22
[3]	-0.63**	-0.47**	-0.50**		0.09	0.01	0.02
[4]	-0.32*	-0.19	-0.19		0.21	0.13	0.14
[5]	-0.18	-0.05	-0.05		0.40*	0.28	0.33*
Panel B: Cumulative abnormal returns (%)							
[-21,-1]	3.32**	6.06**	6.04**	[-21,-1]	-5.15**	-6.40**	-6.07**
[0, 3]	-2.24**	-1.75**	-1.68**	[0, 4]	1.48**	1.17**	1.14**
[4, 60]	-4.63**	0.68	0.86	[5, 60]	3.24*	-0.51	-1.05
[-21,3]	1.09	4.31**	4.36**	[-21,4]	-3.67**	-5.22**	-6.00**
[-21, 60]	-5.22**	4.99**	5.22**	[-21, 60]	2.16	-5.86**	-6.65**

*significant at p<0.05 (two-tailed test)
**significant at p<0.01 (two-tailed test)

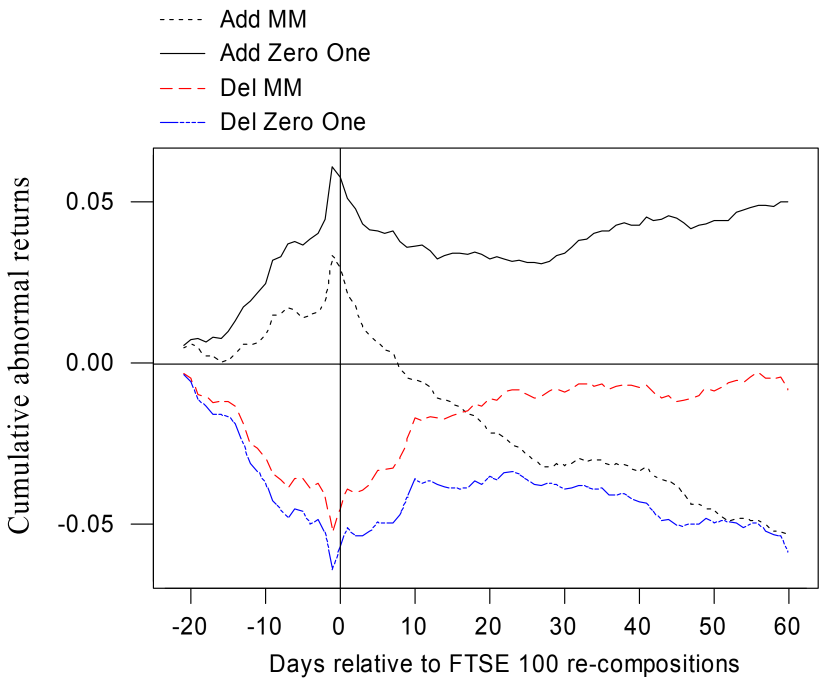

Fig. 1. Cumulative abnormal returns

Table 2
Market model parameter estimates

	Additions		Deletions	
	Pre-event	Post-event	Pre-event	Post-event
Mean alpha	0.136	0.013	-0.071	-0.042
	(0.01)	(0.25)	(0.01)	(0.01)
Median alpha	0.113	0.003	-0.072	-0.010
	(0.01)	(0.21)	(0.01)	(0.01)
Mean Beta	0.91	1.05	1.00	0.79
Median Beta	0.90	1.03	0.97	0.84
N	162	162	160	160

Figures in parentheses are p-values