Short-term Overreaction, Underreaction and Efficient Reaction:

Evidence from the London Stock Exchange

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Abstract

We examine short-term investor reaction to extreme events in the UK equity market for the period 1989 to 2004 and find that the market reaction to shocks for large capitalization stock portfolios is consistent with the Efficient Market Hypothesis, i.e., all information appears to be incorporated in prices on the same day. However, for medium and small capitalization stock portfolios our results indicate significant underreaction to both positive and negative shocks for many days subsequent to a shock. Furthermore, the underreaction is not explained by risk factors (e.g. Fama French 1996), calendar effects, bid-ask biases, or unique global financial crises.

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I. Introduction

In equity markets where prices react efficiently to information and incorporate news quickly and accurately investors should not be able to predict future returns and make abnormal profits, i.e. profits that are not a compensation of risk. However, since the mid 1980s the notion of informationally efficient equity markets has been challenged by many academic studies. For example, DeBondt and Thaler (1985) demonstrate that abnormal profits are possible in the long-run using historical return information. More specifically, they show that going long a portfolio consisting of stocks that have performed badly in the past (extreme prior losers) and going short a portfolio consisting of stocks that have performed very well in the past (extreme prior winners) will produce abnormal profits, in the long run. The authors argue that these "contrarian" profits are due to excessive investor optimism and pessimism, i.e. investor overreaction to information.

Subsequent studies demonstrate that contrarian profits are possible even when size, beta, and past returns are accounted for (see Chopra, Lakonishok and Ritter, 1992, among others), that this strategy may be profitable for very short horizons as well (Jegadeesh, 1990; Lehman, 1990), or that price reversals also exist in international markets (DaCosta and Newton 1994; Bowman and Iverson, 1998; Richards, 1997; Baytas and Cakici, 1999; Antoniou, Galariotis, Spyrou, 2005; among others). Whilst for the short- and the long-term contrarian profits and overreaction to information seems possible, the empirical results of a number of studies for the medium-term (see for example Jegadeesh and Titman, 1993; Conrad and Kaul, 1998; amongst others) suggest that prices underreact to information and that this underreaction produces profitable “momentum” profits, i.e. profits from a strategy where one goes long a portfolio consisting of stocks that have performed very well in the past (extreme prior winners) and goes short a portfolio consisting of stocks that have performed very bad in the past (extreme prior losers).

Several explanations have been put forward in the literature for these “anomalies”. For example, Conrad and Kaul (1993) argue that an explanation of contrarian profits may lie on bid-ask biases and infrequent trading, while Cox and Peterson (1994) examine market behaviour following large one-day price declines and present evidence consistent with the bid-ask bounce and liquidity as explanations of price reversals. Chan (1988) and Ball and Kothari (1989) argue that the apparent abnormal profits may be due to changes in the equilibrium required returns. Zarowin (1990) suggests that the winner-loser anomaly can be subsumed by the size-effect, a point consistent with the results for the UK market of Clare and Thomas (1995). However, Dissanaike (2002) finds no evidence that the winner-loser effect in the UK can be subsumed by the size effect, although he reports a size-effect within the sample of FT500 companies. Lo and MacKinlay (1990) point out that when some stocks react more quickly to information than others a contrarian strategy may still produce profits, even if neither stock overreacts to information, i.e. a lead-lag relationship among returns is an important factor that contributes to contrarian profits; although Jegadeesh and Titman (1995) demonstrate that delayed reactions cannot be exploited by contrarian strategies. Note that some authors argue that part of the anomalies may be explained within an efficient market framework; for example, Fama and French (1996, FF hereafter) argue that a three-factor model captures the long-term return reversals documented in DeBondt and Thaler but is unable to explain the evidence of return continuation presented in Jegadeesh and Titman. In their empirical model, that is in a sense an extended Capital Asset Pricing Model, FF employ as additional factors (a) the difference on the return on a portfolio of small stocks and the return on a portfolio of large stocks and (b) the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks.

In addition, a number of more recent studies attempt to explain return predictability within an overreaction and/or underreaction context employing behavioural models. For example, Daniel, Hirshleifer and Subrahmanyam (1998) assume that investors are overconfident and (in the case where self-attribution bias is also present) the subsequent arrival of information that either confirms or disconfirms investor private information will lead to asymmetric reaction. That is, in the short-term the overconfidence increases following the arrival of confirming news and that leads to further overreaction and return momentum; in the long run, as investors realize their errors, a return reversal is observed. Furthermore, since on average investors hold long positions an increase in market prices will result in higher overconfidence and greater return momentum. Hong and Stein (1999) assume two type of investors that either rely exclusively on their own private information (newswatchers) or rely exclusively on past price information (momentum traders) and develop a model that predicts initial underreaction to information and a subsequent overreaction. Barberis, Shleifer, and Vishny (1998) present and solve a one-asset one-investor model where the investor's beliefs reflect consensus forecasts (the investor also believes that earnings are either mean-reverting or trending) and where the solution generates both underreaction and overreaction for a wide range of parameter values.

The empirical literature on investor over- and underreaction is voluminous and the studies discussed above are only indicative of the focus of the relevant research. Methodologically, the majority of previous empirical studies examine the profitability of either contrarian or momentum portfolio strategies that attempt to take advantage of medium- and long-term investor over- and underreaction. Typically, portfolios are formed based on past returns and the performance of these portfolios is then evaluated for some following period; cross-sectional aspects such as market capitalisation, bid-ask spreads, thin trading, etc., are often employed to explain over- and underreaction.

Our approach is different. We examine short-term (daily) investor over- and underreaction to extreme events (market shocks) focusing on major and directly observable equity portfolios that contain the same firms on every "shock" day. Schnusenberg and Madura (2001) investigate this issue for six US indexes (the Dow Jones Industrial Average, the S&P500, the Nasdaq composite, the NYSE composite, the Russell 3000 and the Wilshire 5000) and report one-day underreaction following positive and negative market shocks (i.e. days on which an index experiences abnormally high or low returns). They argue that their results imply a model of investor psychology in which investors interpret extremely positive news releases pessimistically and extremely negative news releases optimistically (p. 203). They also report significant reversals over a 60-day period following negative market shocks a result consistent with the "uncertain information hypothesis" according to which prices react more strongly to bad news rather than good news (see for example, Brown, Harlow, Tinic, 1988), i.e. investors tend to overreact to bad news and thus we observe significant reversals but underreact (or not react) to good news. Lasfer, Melnik and Thomas (2003) use a similar methodology and investigate the same issue for 39 international markets and find that on average positive (negative) shocks are followed by subsequent large positive (negative) abnormal returns in both developed and emerging markets; this evidence is consistent with the short-term underreaction hypothesis. They also find that emerging markets respond much stronger to market shocks than developed markets, and that the cumulative abnormal returns following positive shocks are substantially larger in the emerging markets.

Our focus is the UK equity market, a major world equity market in terms of market capitalization and trading volume. We argue that concentrating in one equity market may highlight differences that are not apparent in large-scale studies. For example, Lasfer *et al* (2003) employ the FTSE All-Share as proxy for the UK market and their results consist of pooled data from all the sample countries. How can this result be interpreted from a practical point of view? Does this mean that UK investors in general underreact to information? As our results suggest this is the case only for investors in medium and small capitalization stocks, while investors in UK large capitalization stocks seem to react efficiently following market shocks.

Furthermore, in contrast to the above-mentioned studies, we investigate whether our results can be explained by risk factors that have been found to explain asset pricing anomalies in other major markets. For instance, FF report that in the US long-term return reversals are captured by a three-factor model. To this end, we construct with UK data and employ in the study three factors similar to the FF factors, i.e. apart from the excess returns on a broad market portfolio we employ the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, Small Minus Big) and the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks (HML, High Minus Low). We adjust portfolio returns for these three risk-factors and examine whether the adjusted returns exhibit reactions to shocks different to unconditional portfolio returns. Interestingly, our results are robust to this adjustment suggesting that the observed underreaction for medium and small stock portfolios remains even after risk is accounted for. In addition, we investigate whether the underreaction displayed is due to well-known calendar anomalies (such as the January-effect or the Monday-effect) or due to global financial market crises that took place during the 1990s.

The results we present and their implications are of particular interest to international institutional investors since the equity market portfolios employed in the study are represented by the well known FTSE indices which are often used as benchmarks against which institutional investor performance is measured Our findings are also of interest to professional fund managers and portfolio managers who track the performance of these indices and to arbitrageurs and derivatives traders since futures contracts trade with underlying instruments indices employed in the study. More specifically, the indices are the FT30, FTSE100, FTSE250 and FTSE SmallCap and consist of stocks that trade in the

London Stock Exchange (LSE), i.e. stocks that are followed by a large number of institutional and private investors all over the world. The FT30 and the FTSE100 consist of the largest market capitalization stocks; the FTSE250 consists of medium market capitalization stocks; the FTSE SmallCap consists of small market capitalization stocks.

There are two more important reasons why we employ these specific indices. Firstly, each index can be considered as a value-weighted portfolio of stocks that represents a certain size-segment of the UK market. Thus, the analysis will highlight further issues related to possible explanations of the over- and underreaction "anomalies" and offer insight into the behavior of investors in each particular value segment of the market. For example, there is evidence that the momentum or contrarian behavior can be attributed to firm size (Zarowin 1990; Clare and Thomas 1995). Note that size may serve as a proxy for other factors (e.g. availability of information) thus it can be argued that investors do not react in an efficient manner only when it comes to stocks that are not widely followed by analysts and investors, or in other words, smaller stocks. Secondly, as Schnusenberg and Madura (2001) also discus the bid-ask effect on a portfolio of many stocks (e.g. a market index) is likely to be reduced thus potential biases due to bid-ask spreads and effects of cross-sectional differences in individual stocks are avoided to a large extent; this means that the results presented in this paper cannot be attributed to microstructure biases such as the bid-ask bias.

In what follows, we empirically investigate three main hypotheses related to investor behavior following extreme events. A market reaction consistent with the Efficient

Market Hypothesis (EMH) would be one where all information contained in a shock is incorporated immediately in equity prices and no return reversal is observed on the day (days) following the particular event. The Overreaction Hypothesis (OH) suggests that market participants will overreact to the arrival of new information and correct their behavior later: as a result a negative (positive) shock should be followed by an increase (decline) in prices the following day (days). The Underreaction Hypothesis (UH) suggests that market participants will underreact to the arrival of new information and correct their behavior later: as a result a large one day price decline (increase) should be followed by a decline (increase) in prices the following day (days). We present evidence consistent with the EMH as regards to firms that are included in the FT30 and the FTSE100 and evidence consistent with the UH as regards to firms that are included in the FTSE250 and the FTSE SmallCap.

II. Data and Methodology

For the empirical analysis daily closing prices on four major UK equity indices are employed for the 16-year period between December 1988 and January 2004 (3915 observations). The indices are the FT30, the FTSE100, the FTSE250 and FTSE SmallCap. Each index represents a certain segment of the market in terms of market value. For example, the FT30 and the FTSE 100 consist of the largest 30 and 100 UK companies respectively (in terms of market value) that are listed on the London Stock Exchange; the FTSE 250 consists of the next 250 UK companies ranked by market value outside the FTSE 100 (the FTSE 100 along with the FTSE 250 are a subset of the FTSE

350); the FTSE SmallCap consists of UK companies which satisfy the FTSE regulations as regards to investibility, price and liquidity to qualify for inclusion in the FTSE All-Share index, but which do not have sufficient size to be included in the FTSE 350. Thus, in effect each index can be considered as a portfolio of stocks representative of a specific size-segment, where size is measured in terms of market capitalization. All indices are market-value weighted and all data are collected from Datastream.

We compute the raw or unconditional return of index i on day t ($r_{i,t}$) as the difference between today's and previous day's closing price (P) as follows:

$$r_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \qquad (1)$$

For the purposes of this study a positive extreme event (market shock) is said to occur when the index return at any given day is above two standard deviations the average daily index return computed over the [-60 to -11] days before the given day. Similarly a negative shock is said to occur when the index return at any given day is below two standard deviations the average daily index return computed over the [-60 to -11] days before the day of the price shock. Note that Schnusenberg and Madura (2001) use a 60-day window immediately preceding day t (the event day) while Lasfer *et al* (2003) end their window 10 trading days prior to the event day in order to avoid possible price lead-up preceding the shocks. The abnormal return (AR) on the day of the shock and the following days is computed using a mean-adjusted returns model as follows:

$$AR_{i,t} = r_{i,t} - E(r_{i,t}) \qquad (2)$$

where $r_{i,t}$ is the return of stock index i on day t and E($r_{i,t}$) is the average return of the fifty day window ending ten trading days prior to the price shock. Next we compute the Cumulative Abnormal Returns (CAR) for the next 1, 2, 3,..., 20 days following each shock by summing the daily abnormal returns of the index:

$$CAR_{it} = \sum_{t=1}^{20} AR_{it} \qquad (3)$$

Finally, in order to investigate how the equity indices behave on average following a positive or negative shock we obtain Average Cumulative Abnormal Returns (ACAR) for each index and each type of shock as described in (4) and asses the statistical significance of the ACARs with the t-statistic $t = \frac{\overline{ACAR}}{s / \sqrt{N}}$, where s is the standard deviation of the CARs and N is the number of CARs from which the average CAR is estimated.

$$ACAR_{it} = \frac{1}{N} \sum_{n=1}^{N} CAR_{it} \qquad (4)$$

III. Results

Table 1 reports descriptive daily return statistics for the four stock indices that are included in the empirical analysis for the full sample period (Panel A) and two sub-periods. The first sub-period covers December 1988 to December 1996 (Panel B) and the second sub-period covers January 1996 to January 2004 (Panel B). For the full sample period the highest mean daily return is observed for the FTSE100 index (0.00028) and the lowest for the FT30 index (0.00011). Note that the mean daily return for the FTSE SmallCap is 0.00014, i.e. half the return of the FTSE100 index. This implies an annual mean return (assuming 261 trading days) of 7.308% for the FTSE100, 2.871% for the FT30 and 3.654% for the FTSE SmallCap index. This is consistent with the results of previous studies for the UK market where it is reported that the well documented in other markets size-effect is operating in the reverse direction (Dimson and Marsh, 1999). In addition, the lowest standard deviation is that of the FTSE SmallCap (0.00570) index while the highest is that of the FT30 index (0.01052) and the second highest that of the FT100 Index (0.01042). The most "efficient" portfolio seems to be the FTSE250 middle capitalization index with a mean daily return of 0.00027 (annualized 7.047%) and a standard deviation of 0.00708. Note that the situation is similar for both sub-periods.

Index reaction to market shocks

The market reaction to extreme events (defined as the daily abnormal return on the day of the market shock) is examined next and the results are reported in Table 2. Panel A reports results for the full sample period while Panels B and C report the results for the two respective sub-periods. As expected, all mean abnormal returns on the day of a shock are statistically significant at the 5% level of significance and there is not a considerable variation when one examines the maximum abnormal return on the day of a negative or a positive shock for each index. That is, for the full sample period, the maximum abnormal return on the day of a negative shock is -4.861% for the FTSE SmallCap closely followed by -4.645% for the FTSE100 and -4.057% for the FT30; the maximum abnormal return on the day of a positive shock is 5.829% for the FT30 closely followed by 5.075% for the FTSE100 and 4.878% for the FTSE SmallCap. It is interesting to note that the negative shocks are more frequent than the positive shocks for all indices and both sub-periods. For example, we observe 57 negative and 36 positive shocks for the FT30, 54 negative and 42 positive shocks for the FTSE100, 57 negative and 35 positive shocks for the FTSE250 and 62 negative and 39 positive shocks for the FTSE SmallCap index. For the full sample period, the mean reaction for the FT30 is -1.94% for negative shocks and 2.26% for positive shocks, for the FTSE100 it is -2.03% and 2.12% respectively, for the FTSE250 it is -1.39% and 1.62% respectively, while for FTSE SmallCap it is -1.05% and 1.118% respectively. The situation is similar for both sub-periods: for example, in the 2nd subperiod the mean reaction for the FT30 is -2.52% and 2.70% while the mean reaction for the FTSE SmallCap is -1.35% and 1.118%, for negative and positive shocks respectively. Note that Lasfer *et al* (2003) report for the UK market (using the FTSE All-Share Index until year 1998) 44 negative and 25 positive shocks, a mean positive reaction of 1.94% and a mean negative reaction of -1.73%.

However, the results in Table 2 suggest that there is considerable variation between reactions: the mean reaction for the two large capitalization indices is nearly double the magnitude of the mean reaction for the small capitalization index and much larger than the mean reaction of the middle capitalization index, irrespective of whether there is a positive or a negative shock. In order to investigate whether these apparent differences in reaction to shocks are statistically significant we test the Null Hypothesis that the mean reaction on the day of a shock for each index is equal to the mean reaction on the day of a shock for every other index, against the Alternative Hypothesis that that the mean reaction on the day of a shock across indices is different. We employ a pair-wise *t*-statistic calculated as $t = \frac{(\bar{x}_i - \bar{x}_j) - (m_i - m_j)}{\sqrt{(s_i^2 / N_i) + (s_j^2 / N_j)}}$, where $\bar{x}_i$ and $\bar{x}_j$ are the mean abnormal returns on the day of the shock, s_i^2 and s_j^2 are the variances, N_i and N_j are the sample sizes, and i = FT30, FTSE100, FTSE250, FTSE SmallCap, j = FT30, FTSE100, FTSE250, FTSE SmallCap. The results of the *t*-tests are presented in Table 3 and confirm that there are statistically significant differences across reactions: for nearly all cases we reject the null hypothesis of equality against the alternative. Only for the FT30 and the FTSE100 we can accept that reactions to positive and negative shocks are similar in magnitude. For all other cases the reactions appear statistically different to both positive and negative shocks. Thus, we can conclude that the average reaction to a shock for the small capitalization index is nearly half in magnitude to the average reaction of the large capitalization indices and that the average reaction for the medium capitalization index is much smaller in magnitude to that of the large capitalization indices, irrespective of whether we examine a positive or a negative shock.

Index over- and underreaction following market shocks

The findings thus far seem to indicate that, on average, there are more negative than positive shocks in the UK market and that large capitalization indices react much stronger to (positive and negative) shocks than small capitalization indices. These differences in reactions are also statistically significant. An important question that arises at this stage of the analysis is whether the weaker reaction of small and medium capitalization portfolios implies that the stocks included in these portfolios do not react in an efficient manner, i.e. that stock prices do not incorporate all information that is contained in a (positive and negative) shock on the same day. Of course, it could also imply that investors in large capitalization stocks react too much to the information that is contained in a (positive and negative) shock. As discussed above, the Overreaction Hypothesis predicts that investors will overreact on the day of a shock and correct the next day (days), i.e. we should observe a negative (positive) abnormal return following a positive (negative) shock. In contrast, the Underreaction Hypothesis predicts that investors will underreact on the day of a shock and correct the next day (days), i.e. we should observe a negative (positive) abnormal return following a negative (positive) shock. The issue of whether stocks overreact or underreact to information is investigated next.

Table 4 presents the mean abnormal return (day 1) and the cumulative abnormal returns (days 2 to 20) following a market shock, as discussed in the previous section. Panel A reports the mean abnormal return on the day after a negative market shock (AR-1) and the Average Cumulative Abnormal Return (ACAR) for 2, 3, 4, 5, 10, 15, 20 days following a negative market shock. Panel B reports the mean abnormal return on the day after a positive market shock (AR-1) and the Average Cumulative Abnormal Return

(ACAR) for 2, 3, 4, 5, 10, 15, 20 days following a positive market shock. A visual inspection of the ACARs following a market shock (Figures 1- 8) suggest that - with the exception of the reaction of the FTSE100 to negative shocks – investors initially underreact to both positive and negative shocks, that is, a negative (positive) abnormal return follows a negative (positive) shock. However, as the period under study is getting larger (i.e. for ACARs of 15 to 20 days subsequent to a shoc k) we also observe some evidence of a return reversal with respect to negative shocks.

Another interesting observation from the results in Table 4 is that for the two large capitalization indices (FT30, FT100) no AR or ACAR is statistically significant for either negative or positive shocks, whilst for the middle and small capitalization indices (FTSE250, FTSE SmallCap) nearly all AR and ACAR are statistically significant at the 5% level of significance. The implication is (when one also considers the results reported in Tables 2 and 3) that investors in UK large capitalization stocks react efficiently to market shocks and all information seems to be incorporated in share prices on the day of the shock, while investors in UK medium and small capitalization stocks incorporate information in share prices in a non-efficient manner during a market shock. For the FTSE SmallCap on the first day following a negative shock the average abnormal return is -0.35% and statistically significant (*t*-statistic: -4.20), which suggests underreaction to the negative shock. The second day following a negative shock the Average Cumulative Abnormal Return is -0.69% (*t*-statistic: -4.33), the third day -0.85% (*t*-statistic: -4.26), the fifth day -1.07% (*t*-statistic: -4.32). Two weeks after the shock the ACAR becomes -1.98% (*t*-statistic: -2.86). The situation is similar when one examines the reaction of the

FTSE SmallCap index on the first day following a positive shock: the average abnormal return is 0.32% (*t*-statistic: 3.52), which also suggests underreaction to the positive shock. The second day following a positive shock the Average Cumulative Abnormal Return is 0.65% (*t*-statistic: 4.29), the third day 1.02% (*t*-statistic: 5.57), the fifth day 1.55% (*t*-statistic: 5.56). Two weeks after the shock the ACAR grows to 3.51% (*t*-statistic: 4.47). The medium capitalization index reacts in the same manner, i.e. a negative (positive) shock is followed by negative (positive) abnormal returns.

Note that there is an apparent asymmetry in the underreaction following a negative and a positive shock. For example, for the FTSE SmallCap index two weeks after a negative shock the ACAR becomes -1.98% whilst two weeks after a positive shock the ACAR becomes 3.51%; for the FTSE250 two weeks after a negative shock the ACAR becomes -1.77 whilst two weeks following a positive shock the ACAR becomes 2.91%. In other words, we observe a stronger momentum following positive shocks than negative shocks. This confirms our suspicions from the visual examination of the ACARs. Finally, for the medium and small capitalization indices, the average magnitude of the underreaction over the 15 days subsequent to a market shock exceeds the initial reaction on the day of the shock. That is, for the FTSE SmallCap the average reaction to a negative and a positive shock is -1.05% and 1.18% respectively, whilst the respective ACARs fifteen days after the shock are -1.98% and 3.51%. For the FTSE250 the average reaction to a negative and a positive shock is -1.39% and 1.62% respectively, whilst the respective ACARs fifteen days after the shock are -1.77% and 2.91%. To recapitulate the results thus far, investors in large capitalization stocks in the UK appear to react efficiently to information while investors in medium and small capitalization stocks underreact to information. Furthermore, the underreaction is more pronounced following positive shocks and a reversal seems to take place following negative shocks, when we consider extended periods of 15 to 20 days after the shock.

Stability of the results over-time

In order to investigate whether these results are stable over time we re-estimated the ARs and ACARs following positive and negative shocks for the two sub-periods discussed above. Note that the sub-periods are selected in such a way that not only the sample period is split in half but also each sub-period contains at least a major global financial crisis. For example the first sub-period contains the peso-crisis (1994) and the Barings Bank collapse (1995), while the second sub-period contains the Asian Crisis (1997) and the Rouble devaluation crisis (1998). The results are reported in Table 5 and indicate that (a) for the FT30 index no AR or ACAR is statistically significant at the 5% level for either sub-period (b) for the FTSE100 only two ACARs are statistically significant only to positive shocks and only during the first sub-period (b) for the medium capitalization index (FTSE250) no return is statistically significant at the 5% level following a positive shock during the second sub-period and (d) for the FTSE SmallCap almost all ARs and ACARs are statistically significant at the 5% for both sub-periods. Overall, the results of the sub-period analysis do not display any significant difference with the findings of the previous sub-section; that is, the previous findings appear stable over time and do not seem to be sample-period dependent.

Can the results be explained by calendar effects or global financial crises?

The results thus far indicate that investors in small and medium firms underreact to market shocks and in addition this behavior is stable over-time. We now turn our attention to the two indices that exhibit this “anomalous” behavior and investigate whether it is related to well-known calendar anomalies. For example, many empirical studies have documented statistically significant and positive returns during the month of January and negative returns during the month of December, the well known “January-effect” (see for example, Rozeff and Kinney, 1976, Dyl, 1977, for early studies). Thus it could be argued that many of the market shocks in the sample occur around the turn of the year (i.e. between mid-December and mid-January) and as a result the underreaction that we detect is a manifestation of the January-effect. In order to investigate this issue further we re-estimate for the FTSE250 and the FTSE SmallCap all market shocks, the subsequent abnormal returns and the ACARs, excluding from the sample all shocks that occurred between 15 December and 15 of January. The results are displayed in Table 6 and indicate that the underreaction reported in the previous sub-section is not related in any manner with the January-effect, that is, there is virtually no change in the values reported in Tables 2 and 4. Note that, for the FTSE250, out of a total of 57 negative shocks and 35 positive shocks only 6 and 5 shocks respectively took place in December – January during the whole sample period; for the FTSE SmallCap out of a total of 62 negative shocks and 39 positive shocks only 5 and 6 shocks respectively took place in December – January.

Furthermore, an extensive body of empirical studies reports a day-of–the-week effect in security prices where asset returns are significantly negative on Mondays and (often) positive on Fridays (the "Monday effect" see for example, French, 1980, Lakonishok and Smidt, 1988, among others). Since this is a well documented behavior it could be the case that many of the market shocks in the sample occur on Monday or Friday and thus the behaviour we detect could be linked to the Monday-effect. In order to investigate this issue further, we re-estimate for the FTSE250 and the FTSE SmallCap all market shocks, the subsequent abnormal returns and the ACARs grouped by the day-of-the-week the initial shock occurred. The results, i.e. the week-day distribution of market shocks and the subsequent abnormal returns are displayed in Table 7 (FTSE250) and Table 8 (FTSE SmallCap) where we report (along with the number of shocks for each day of the week and the average reaction) the average abnormal return the day after the shock and the ACARs for 2, 3, 10 and 15 days.

The results on the daily distribution of shocks indicate that, as expected, the day with the most negative shocks for both indices is Monday with 16 shocks for both the FTSE250 index and the FTSE SmallCap index. However, as suggested by the insignificant *t*-statistics, for the FTSE SmallCap there is no underreaction following a (positive or negative) shock that occurred on a Monday whilst for the FTSE250 there is no first day underreaction following a (positive or negative) shock that occurred on a Monday. In other words, the market seems to react relatively efficiently on shocks that occur on Mondays. This can be said for positive shocks that occurred on Fridays: for neither index are the ARs and ACARs statistically significant following a positive Friday shock.

Overall, investors seem to react efficiently around the weekend and investors seem to underreact primarily to shocks that occur within the week.

Next, we investigate whether our results are due to unique extreme events such as global financial crises. The reason is that the underreaction behavior documented above may well be investor reaction to such one-time events and not consistent underreaction to all market shocks throughout the whole sample period. For example, in December 1994 the new government in Mexico announced a controlled devaluation of the peso, a fact that triggered a financial crisis that soon spilled over in the rest of the world; in July 1997 Thailand floated the baht after a 13-year link to the dollar and within the day the currency declined by 17% resulting to yet another global financial crisis; in August 1998 Russia devalued the rouble and announced a moratorium on external debt servicing; triggering a global crisis of such an extent that the Federal Reserve had to rescue a hedge fund called Long-Tern Capital Management in order to avoid further defaults. Finally on the 11th September of 2001 the terrorist attack right in the centre of the world's financial community resulted in turmoil in financial markets. In order to investigate whether these four major and unique events are responsible for the behavior evidenced above we re-estimate shocks, abnormal returns and ACARs excluding from the sample the 6-month period following each of these events. The results (not reported here but available upon request from the authors) indicate that market reaction to global crises is not the reason behind UK investor underreaction. The results again are very close to the results reported in Tables 2 and 4.

Can systematic risk factors explain the results?

Having ruled out a connection of our results to calendar anomalies and global crises we now turn our attention to risk-related explanations. For instance, it may be argued that the abnormal returns evidenced in the previous sub-sections for the medium and small firm portfolios are due to the fact that risk is not accounted for in our study. To address this point, in this sub-section we adjust portfolio returns on risk factors similar to factors that have been found to explain similar anomalies in the US and then proceed with these conditional returns to investigate investor reaction to extreme events.

More specifically, FF argue that expected returns are better depicted by three factors: (a) the excess returns on a broad market portfolio; (b) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, Small Minus Big); and (c) the difference between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks (HML, High Minus Low). Algebraically:

$$E(r_i) - r_f = b_i[E(r_m) - r_f] + s_i E(SMB) + h_i E(HML) \qquad (5)$$

In (5) r_f is the risk free rate of return, [E$(r_m) - r_f$], E(SMB), and E(HML) are expected premiums and the factor sensitivities are the slopes in a time-series regression:

$$r_i - r_f = a_i + b_i(r_m - r_f) + s_i SMB + h_i HML + e_i \qquad (6)$$

Thus, in this sub-section, we first regress the returns of the FTSE250 and the FTSE Small Cap index on the returns of a market portfolio (the FTSE ALL SHARE Index), the SMB factor and the HML factor and then employ the residuals ($e_{i,t}$) as the conditional returns (adjusted for risk) for the calculations described in section II:

$$r_{it} = a_i + b_m r_{m,t} + b_{SMB} SMB_t + b_{HML} HML_t + e_{i,t} \qquad (7)$$

The SMB factor is constructed as follows: every year all stocks listed in the LSE are ranked according to the previous year's market capitalization and the top and bottom 20% of stocks are then selected to form two equally weighted portfolios of high and low capitalization stocks respectively. The factor is constructed as the difference of the returns between these two portfolios. A similar procedure is followed for the *HML* factor, i.e. all stocks are ranked according to the book-to-market ratio and the top and bottom 20% are then selected to form two equally weighted portfolios of high and low book-to-market stocks respectively. The factor is constructed as the difference of the returns between these two portfolios.

The results are displayed in Table 9 and suggest that the effects detected in the previous sub-sections are robust to conditioning returns on risk factors. That is, in all cases the ARs and ACARs are statically significant and yield the same implications as before: medium and small stock investors in the UK underreact to the information contained in extreme market events.

IV. Conclusion

We examine short-term (daily) investor reaction to extreme events (market shocks) employing major UK equity portfolios that contain the same firms on every "shock" day. Our results indicate that investors in large capitalization stocks in the UK react efficiently to information contained in market shocks. That is, market prices on the day of the shock incorporate all information related to the event and no statistically significant abnormal returns are evidenced on the day (days) following the extreme event. However, investors in medium and small capitalization stocks in the UK exhibit a very different behavior by reacting less strongly to market shocks; in some cases the reaction is half in magnitude to that of the large market value portfolios. Further analysis indicates that investors in medium and small size stocks underreact to information contained in extreme events and that the underreaction and return momentum is more pronounced following positive shocks; also a reversal seems to take place following negative shocks (for extended periods of 15 to 20 days after the shock).

The underreaction cannot be explained by calendar effects such as the January-effect or the Monday effect, by bid-ask biases, or by unique global financial crises. In addition, adjusting portfolio returns for risk factors such as the three factors proposed by Fama and French (1996) yields the same implications: investors in medium and small capitalization stocks underreact following extreme events. The results for the medium and small market capitalization portfolios are consistent with US evidence on short-term underreaction

(Schnusenberg and Madura, 2001) where investors appear to interpret extremely positive news releases pessimistically and extremely negative news releases optimistically. As regards the reaction to extreme negative news the results are also to some extent consistent with behavioral models that predict initial underreaction to information and a subsequent overreaction (for example Hong and Stein 1999, Brown, Harlow, Tinic 1988). We believe that size here proxies for factors such as availability of information to holders of medium and small capitalization equity securities and/or a reduced number of analysts covering these stocks (compared to stocks included in the FT30 or the FTSE100 index). The stocks that are included in the two large portfolios are indeed followed by a much larger number of stock analysts, institutional and private investors worldwide and as a result all relevant information contained in extreme market events is incorporated in share prices in a more efficient way.

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Table 1
Descriptive Daily Return Statistics of UK Indices

	Stock Portfolios [a]			
	FT30	**FT100**	**FT250**	**FTSE SmallCap**
	Panel A: Full sample (December 1988 – January 2004)			
Mean Return [b]	0.00011	0.00028	0.00027	0.00014
Deviation [c]	0.01052	0.01042	0.00708	0.00570
Min	-0.06243	-0.05716	-0.06169	-0.09376
Max	0.06411	0.06080	0.07406	0.04416
	Panel B: 1st sub period (December 1988 – December 1996)			
Mean Return [b]	0.00034	0.00042	0.000366	0.00021
Deviation [c]	0.00831	0.00783	0.00632	0.00495
Min	-0.03951	-0.04055	-0.06169	-0.09376
Max	0.06119	0.05590	0.07406	0.04416
	Panel C: 2nd sub period (January 1996 – January 2004)			
Mean Return [b]	-0.00015	0.00013	0.00016	7.85E-05
Deviation [c]	0.01260	0.01277	0.00786	0.00645
Min	-0.06243	-0.05716	-0.05017	-0.04801
Max	0.06411	0.06080	0.03239	0.03083

[a] All data are collected from Datastream.

[b] Refers to the mean unconditional return computed as $r_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$

[c] Refers to the standard deviation of the unconditional return series

Table 2
Extreme Events (Shocks) in Unconditional UK Index Returns

	Negative shocks			Positive shocks		
	Number of Shocks (N)	**Mean Reaction[a]**	**Max Reaction (%)**	**Number of Shocks (N)**	**Mean Reaction[a]**	**Max Reaction (%)**
			Panel A: Full sample (December 1988 – January 2004)			
FT30	57	-0.0194 (-12.54)*	-4.057	36	0.0226 (13.65)*	5.829
FTSE 100	54	-0.0203 (-12.94)*	-4.645	42	0.0212 (14.99)*	5.075
FTSE 250	57	-0.0139 (-22.98)	-2.866	35	0.0162 (14.49)*	3.076
FTSE SmallCap	62	-0.0105 (-8.45)*	-4.861	39	0.0118 (8.170)*	4.878
			Panel B: 1st sub period (December 1988 – December 1996)			
FT30	31	-0.0146 (-6.70)*	-3.946	20	0.0192 (11.79)*	4.130
FTSE 100	30	-0.0158 -(7.36)*	-4.118	19	0.0166 (18.80)*	2.414
FTSE 250	32	-0.0133 (-17.02)*	-2.539	18	0.0143 (10.89)*	2.334
FTSE SmallCap	33	-0.0078 (-4.46)*	-2.615	18	0.0119 (4.09)*	4.878
			Panel C: 2nd sub period (January 1996 – January 2004)			
FT30	26	-0.0252 (-15.76)*	-4.057	16	0.0270 (9.42)*	5.829
FTSE 100	24	-0.0260 (-15.00)*	-4.645	23	0.0250 (11.32)*	5.075
FTSE 250	25	-0.0147 (-15.79)	-2.866	17	0.0182 (10.41)*	3.076
FTSE SmallCap	29	-0.0135 (-8.46)*	-4.861	21	0.0118 (10.57)*	2.320

[a] Refers to Mean Abnormal Shock, i.e. the Abnormal Return (*AR*) on the day of the shock and the following days is computed using a mean-adjusted returns model as follows:, $AR_{i,t} = r_{i,t} - E(r_{i,t})$ where $r_{i,t}$ is the return of stock index i on day t and $E(r_{i,t})$ is the average return of the fifty day window ending ten trading days prior to the price shock.
t-statistics appear in parentheses
* denotes statistical significance at the 5% level

Table 3

A *t*-test for the Null Hypothesis that the mean reaction[a] on the day of a shock is equal across indices against
the Alternative Hypothesis that that the mean reaction on the day of a shock across indices is different

Testing the Null Hypothesis for positive shocks	***t*-test**[b]
The positive reaction of FT30 (0.0226) = The positive reaction of FT100 (0.0212)	0.64
The positive reaction of FT30 (0.0226) = The positive reaction of FT250 (0.0162)	3.19*
The positive reaction of FT30 (0.0226) = The positive reaction of FTSMALL (0.0118)	4.88*
The positive reaction of FT100 (0.0212) = The positive reaction of FT250 (0.0162)	2.76*
The positive reaction of FT100 (0.0212) = The positive reaction of FTSMALL (0.0118)	4.62*
The positive reaction of FT250 (0.0162) = The positive reaction of FTSMALL (0.0118)	2.39*
Testing the Null Hypothesis for negative shocks	***t*-test**
The negative reaction of FT30 (-0.0194) = The negative reaction of FT100 (-0.0203)	0.40
The negative reaction of FT30 (-0.0194) = The negative reaction of FT250 (-0.0139)	-3.30*
The negative reaction of FT30 (-0.0194) = The negative reaction of FTSMALL (-0.0105)	-4.47*
The negative reaction of FT100 (-0.0203) = The negative reaction of FT250 (-0.0139)	-3.79*
The negative reaction of FT100 (-0.0203) = The negative reaction of FTSMALL (-0.0105)	-4.88*
The negative reaction of FT250 (-0.0139) = The negative reaction of FTSMALL (-0.0105)	-2.45*

[a] Refers to Mean Abnormal Shock, i.e. the Abnormal Return (*AR*) on the day of the shock and the following days is computed using a mean-adjusted returns model as follows:, $AR_{i,t} = r_{i,t} - E(r_{i,t})$ where $r_{i,t}$ is the return of stock index *i* on day *t* and $E(r_{i,t})$ is the average return of the fifty day window ending ten trading days prior to the price shock.

[b] The *t*-statistic is calculated as $t = \frac{(\bar{x}_i - \bar{x}_j) - (m_i - m_j)}{\sqrt{(s_i^2 / N_i) + (s_j^2 / N_j)}}$, where $\bar{x}_i$ and $\bar{x}_j$ are the mean abnormal returns on the day of the shock, s_i^2 and s_j^2 are the variances, N_i and N_j are the sample sizes, and *i* = FT30, FTSE100, FTSE250, FTSE SmallCap, *j* = FT30, FTSE100, FTSE250, FTSE SmallCap.
* denotes statistical significance at the 5% level

Table 4
Cumulative Abnormal Returns Following a Shock

ACAR[a]	FT30	FTSE 100	FTSE 250	FTSE SmallCap
	Panel A: Cumulative Abnormal Returns Following a Negative Shock			
AR-1	-0.0016	-0.0006	-0.0038	-0.00350
	(-1.26)	(-0.33)	(-4.12)*	(-4.20)*
ACAR-2	-0.0021	0.0010	-0.0086	-0.0069
	(-0.99)	(0.38)	(-5.51)*	(-4.33)*
ACAR-3	-0.0013	0.0015	-0.0105	-0.0085
	(-0.46)	(0.40)	(-4.79)*	(-4.26)*
ACAR-4	-0.0031	0.0038	-0.0120	-0.0102
	(-0.91)	(0.95)	(-5.23)*	(-4.19)*
ACAR-5	-0.0054	0.0019	-0.0126	-0.0107
	(-1.51)	(0.44)	(-5.27)*	(-4.32)*
ACAR-10	-0.0093	0.0035	-0.0172	-0.0163
	(-1.77)	(0.58)	(-3.43)*	(-3.59)*
ACAR-15	-0.0073	0.0014	-0.0177	-0.0198
	(-0.94)	(0.21)	(-2.49)*	(-2.86)*
ACAR-20	-0.0008	0.0066	-0.0106	-0.0131
	(-0.09)	(0.87)	(-1.32)	(-1.62)
	Panel B: Cumulative Abnormal Returns Following a Positive Shock			
AR-1	0.0011	-6.3E-06	0.0069	0.0032
	(0.54)	(-0.00)	(2.66)*	(3.52)*
ACAR-2	0.0042	0.0025	0.0086	0.0065
	(1.51)	(1.04)	(2.90)*	(4.29)*
ACAR-3	0.0038	0.0029	0.0093	0.0102
	(1.08)	(1.03)	(2.55)*	(5.57)*
ACAR-4	0.0064	0.0047	0.0112	0.0133
	(1.33)	(1.16)	(2.43)*	(6.34)*
ACAR-5	0.0057	0.0032	0.0127	0.0155
	(1.07)	(0.70)	(2.41)*	(5.56)*
ACAR-10	0.0037	0.0040	0.0205	0.0270
	(0.59)	(0.69)	(2.85)*	(5.26)*
ACAR-15	0.0045	0.0083	0.0291	0.0351
	(0.57)	(1.16)	(2.88)*	(4.47)*
ACAR-20	0.0090	0.0109	0.0316	0.0367
	(1.05)	(1.30)	(2.79)*	(3.72)*

[a] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The t-statistic is: $t = \frac{\overline{ACAR}}{s / \sqrt{N}}$.

* denotes statistical significance at the 5% level

Table 5
Stability of the results overtime

ACAR[a]	Negative shocks FT30	FTSE 100	FTSE 250	FTSE SmallCap	Positive Shocks FT30	FTSE 100	FTSE 250	FTSE SmallCap
				Panel A: 1st sub period (December 1988 – December 1996)				
AR-1	-0.0004	-0.0007	-0.0041	-0.0024	0.0030	0.0041	0.0101	0.0034
	(-0.29)	(-0.42)	(-3.71)*	(-2.62)*	(0.89)	(1.31)	(2.17)*	(3.19)*
ACAR-2	-0.0013	0.0002	-0.0071	-0.0046	0.0063	0.0080	0.0141	0.0078
	(-0.60)	(0.09)	(-3.90)*	(-2.74)*	(1.62)	(2.16)*	(3.05)*	(3.65)*
ACAR-3	-0.0015	0.0007	-0.0075	-0.0049	0.0056	0.0083	0.0142	0.0116
	(-0.51)	(0.25)	(-3.69)*	(-2.28)*	(1.08)	(1.84)	(2.50)*	(4.25)*
ACAR-4	-0.0018	0.0015	-0.0086	-0.0066	0.0098	0.0105	0.0167	0.0150
	(-0.58)	(0.43)	(-3.45)*	(-2.49)*	(1.57)	(1.95)	(2.62)*	(5.04)*
ACAR-5	-0.0032	-0.0003	-0.0095	-0.0076	0.0098	0.0102	0.0200	0.0166
	(-0.82)	(-0.08)	(-3.39)*	(-2.72)*	(1.51)	(1.94)	(2.92)*	(5.08)*
ACAR-10	-0.0025	0.0015	-0.0120	-0.0132	0.0044	0.0079	0.0321	0.0302
	(-0.41)	(0.24)	(-2.25)*	(-2.72)*	(0.58)	(1.34)	(4.12)*	(5.82)*
ACAR-15	-0.0003	0.0039	-0.0119	-0.0184	0.0110	0.0180	0.0471	0.0470
	(-0.03)	(0.50)	(-1.27)	(-2.05)*	(1.16)	(2.18)*	(4.52)*	(5.25)*
ACAR-20	0.0063	0.0077	-0.0022	-0.011	0.01352	0.0175	0.0502	0.0544
	(0.610)	(0.86)	(-0.21)	(-1.14)	(1.23)	(1.90)	(4.22)*	(4.77)*
				Panel B: 2nd sub period (January 1996 – January 2004)				
AR-1	-0.0030	-0.0005	-0.0033	-0.0047	-0.0012	-0.0034	0.0035	0.0031
	(-1.38)	(-0.14)	(-2.16)*	(-3.33)*	(-0.56)	(-1.71)	(1.81)	(2.10)*
ACAR-2	-0.0031	0.0021	-0.0105	-0.0095	0.0016	-0.0020	0.0029	0.0054
	(-0.78)	(0.38)	(-3.96)*	(-3.43)*	(0.38)	(-0.69)	(0.88)	(2.50)*
ACAR-3	-0.0011	0.0026	-0.0142	-0.0127	0.0015	-0.0014	0.0041	0.0090
	(-0.20)	(0.32)	(-3.42)*	(-3.73)*	(0.31)	(-0.39)	(0.95)	(3.59)*
ACAR-4	-0.0046	0.0066	-0.0163	-0.0143	0.0022	2.58E-05	0.0054	0.0119
	(-0.70)	(0.84)	(-4.08)*	(-3.42)*	(0.28)	(0.00)	(0.81)	(3.98)*
ACAR-5	-0.0081	0.0049	-0.0166	-0.0143	0.0004	-0.0026	0.0050	0.0145
	(-1.25)	(0.57)	(-4.16)*	(-3.39)*	(0.05)	(-0.37)	(0.64)	(3.28)*
ACAR-10	-0.0173	0.0060	-0.0237	-0.0198	0.0030	0.0008	0.0083	0.0243
	(-1.99)	(0.52)	(-2.63)*	(-2.47)*	(0.26)	(0.09)	(0.70)	(2.85)*
ACAR-15	-0.0158	-0.0016	-0.0252	-0.0214	-0.0035	0.0003	0.0101	0.0249
	(-1.16)	(-0.13)	(-2.34)*	(-1.96)*	(-0.25)	(0.03)	(0.60)	(2.05)*
ACAR-20	-0.0094	0.0052	-0.0213	-0.0156	0.003	0.0054	0.0119	0.0216
	(-0.63)	(0.40)	(-1.74)	(-1.15)	(0.24)	(0.40)	(0.63)	(1.44)

[a] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The t-statistic is: $t = \frac{\overline{ACAR}}{s/\sqrt{N}}$.

* denotes statistical significance at the 5% level

Table 6
Shocks in FT250 and FTSE SmallCap
(Excluding December –January Shocks)

	FTSE 250		FTSE SmallCap	
Returns [a]	**Positive Shocks**	**Negative Shocks**	**Positive Shocks**	**Negative Shocks**
N	30	51	33	57
Shock	0.0162 (12.45)*	-0.0138 (-21.46)*	0.0122 (7.23)*	-0.0105 (-7.82)*
AR-1	0.0074 (2.47)*	-0.0037 (-3.74)*	0.0034 (3.31)*	-0.0036 (-4.14)*
ACAR-2	0.0090 (2.67)*	-0.0088 (-5.30)*	0.0067 (4.19)*	-0.0071 (-4.14)*
ACAR-3	0.0103 (2.49)*	-0.0116 (-5.00)*	0.0104 (5.35)*	-0.009 (-4.19)*
ACAR-10	0.0214 (2.57)*	-0.0176 (-3.19)*	0.0262 (5.07)*	-0.0170 (-3.50)*
ACAR-15	0.0299 (2.54)*	-0.0198 (-2.59)*	0.0356 (4.55)*	-0.0216 (-2.90)*

[a] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The *t*-statistic is: $t = \frac{\overline{ACAR}}{s / \sqrt{N}}$.

* denotes statistical significance at the 5% level

Table 7
Day of the week underreaction FTSE 250

Day of the week distribution of shocks for FTSE250

Panel A: Negative shocks

Returns [a]	**Monday**	**Tuesday**	**Wednesday**	**Thyrsday**	**Friday**
N	**16**	**9**	**12**	**7**	**13**
shock	-0.0143	-0.0147	-0.0122	-0.0171	-0.0128
	(-11.08)*	(-9.47)*	(-10.46)*	(-11.01)*	(-11.77)*
AR-1	-0.0018	-0.0034	-0.0014	-0.0088	-0.0058
	(-1.00)	(-1.27)	(-1.01)	(-4.03)*	(-3.16)*
ACAR-2	-0.0097	-0.00822	-0.0051	-0.0205	-0.0043
	(-2.86)*	(-2.86)*	(-2.00)*	(-4.44)*	(-1.51)
ACAR-3	-0.00964	-0.00705	-0.0055	-0.0322	-0.0069
	(-2.67)*	(-1.45)	(-1.55)	(-3.65)*	(-2.08)*
ACAR-10	-0.0186	-0.0189	-0.0158	-0.0446	-0.0007
	(-2.65)*	(-1.33)	(-2.28)*	(-1.81)	(-0.07)
ACAR-15	-0.0142	-0.0244	-0.0217	-0.0531	0.0052
	(-1.67)	(-1.11)	(-1.58)	(-1.63)	(0.42)

Panel A: Positive shocks

	Monday	**Tuesday**	**Wednesday**	**Thyrsday**	**Friday**
N	**4**	**2**	**9**	**12**	**8**
shock	0.0193	0.0074	0.4392	0.0175	0.0175
	(5.52)*	(9.95)*	(1.02)	(8.40)*	(6.31)*
AR-1	0.0028	0.0006	0.0023	0.0119	0.0067
	(0.88)	(0.87)	(0.87)	(2.05)*	(1.03)
ACAR-2	0.0072	0.0072	0.0065	0.0136	0.0041
	(1.30)	(3.42)*	(1.56)	(2.09)*	(0.58)
ACAR-3	0.0187	0.0159	0.0038	0.0143	0.0009
	(2.30)*	(5.20)*	(0.73)	(1.85)	(0.12)
ACAR-10	0.0459	0.0265	0.0107	0.0277	0.0056
	(2.05)*	(1.38)	(1.58)	(1.86)	(0.32)
ACAR-15	0.0670	0.0259	0.0193	0.0446	-0.0027
	(1.82)	(0.79)	(1.72)	(2.39)*	(-0.11)

[a] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The *t*-statistic is: $t = \frac{\overline{ACAR}}{s / \sqrt{N}}$.

* denotes statistical significance at the 5% level

Table 8
Day of the week underreaction FTSE Small Cap

Day of the week distribution of shocks for FTSE Small Cap

Panel A: Negative shocks

Returns [a]	**Monday**	**Tuesday**	**Wednesday**	**Thyrsday**	**Friday**
N	**16**	**11**	**14**	**8**	**12**
shock	-0.0151	-0.0078	-0.0099	-0.0149	-0.0087
	(-5.46)*	(-9.82)*	(-9.52)*	(-6.39)*	(-7.46)*
AR-1	-0.0002	-0.0055	-0.0047	-0.0033	-0.0054
	(-0.17)	(-2.63)*	(-2.40)*	(-1.54)	(-4.02)*
ACAR-2	0.0004	-0.0097	-0.0107	-0.0139	-0.0066
	(0.14)	(-2.24)*	(-3.03)*	(-2.80)*	(-4.60)*
ACAR-3	0.00036	-0.0091	-0.0109	-0.0248	-0.0090
	(0.12)	(-2.15)*	(-3.10)*	(-3.03)*	(-4.54)*
ACAR-10	-0.0016	-0.0200	-0.0188	-0.0440	-0.0172
	(-0.18)	(-2.03)*	(-3.31)*	(-2.22)*	(-2.43)*
ACAR-15	0.00439	-0.0349	-0.0283	-0.0451	-0.0203
	(0.34)	(-2.06)*	(-2.80)*	(-1.64)	(-1.55)

Panel A: Positive shocks

	Monday	**Tuesday**	**Wednesday**	**Thyrsday**	**Friday**
N	**8**	**6**	**6**	**9**	**10**
shock	0.0170	0.0137	0.0101	0.010	0.0118
	(3.49)*	(2.49)*	(5.55)*	(5.48)*	(3.26)*
AR-1	-0.0002	0.0059	0.0043	0.0055	0.0015
	(-0.11)	(3.49)*	(2.21)*	(4.06)*	(0.80)
ACAR-2	0.0022	0.0103	0.0087	0.0083	0.0036
	(0.51)	(3.03)*	(2.50)*	(3.51)*	(1.28)
ACAR-3	0.0076	0.0146	0.0124	0.0124	0.0061
	(1.42)	(3.63)*	(3.19)*	(4.25)*	(1.50)
ACAR-10	0.0218	0.0254	0.0271	0.0425	0.0207
	(1.57)	(9.25)*	(1.69)	(3.22)*	(2.41)*
ACAR-15	0.0322	0.0243	0.0294	0.0618	0.0256
	(1.62)	(3.18)*	(1.46)	(2.95)*	(1.74)

[a] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The *t*-statistic is: $t = \frac{\overline{ACAR}}{s/\sqrt{N}}$.

* denotes statistical significance at the 5% level

Table 9
Shocks and Cumulative Abnormal Returns following a shock in UK Index returns (Conditional Returns)

	FTSE 250		FTSE Small Cap	
	Negative shocks	**Positive shocks**	**Negative shocks**	**Positive shocks**
No of shocks	**59**	**43**	**57**	**40**
Mean Reaction[a]	-0.0085 (-11.86)*	0.0089 (9.77)*	-0.0085 (-12.39)*	0.0075 (10.02)*
AR-1	-0.0012 (-1.75)**	0.0010 (1.36)**	-0.0011 -(1.87)**	0.0030 (4.91)*
ACAR-2 [b]	-0.0031 (-2.96)*	0.0024 (1.91)*	-0.0036 (-3.15)*	0.0051 (5.96)*
ACAR-3	-0.0035 (-2.94)*	0.0038 (2.82)*	-0.0047 (-3.80)*	0.0077 (6.15)*
ACAR-4	-0.0041 (-2.98)*	0.0049 (3.17)*	-0.0057 (-4.21)*	0.0087 (5.03)*
ACAR-5	-0.0048 (-2.90)*	0.0059 (3.69)*	-0.0070 (-4.34)*	0.0097 (4.90)*
ACAR-10	-0.0074 (-2.76)	0.0086 (3.76)*	-0.0135 (-4.48)*	0.0171 (5.62)*
ACAR-15	-0.0077)* (-2.26)	0.0097 (2.76)*	-0.0183 (-4.07)*	0.0240 (5.50)*
ACAR-20	-0.0080 (-2.23)*	0.0116 (2.70)*	-0.0182 (-3.50)*	0.0297 (5.06)*

[a] Refers to Mean Abnormal Shock, i.e. the Abnormal Return (*AR*) on the day of the shock and the following days is defined as the residual from the regression: $r_{it} = a_i + b_m r_{m,t} + b_{SMB} SMB_t + b_{HML} HML_t + e_{i,t}$.

[b] The Cumulative Abnormal Returns are estimated as $CAR_{it} = \sum_{t=1}^{20} AR_{it}$ the Average Cumulative Abnormal Returns (ACAR) as $ACAR_{it} = \frac{1}{N}\sum_{n=1}^{N} CAR_{it}$. The *t*-statistic is: $t = \frac{\overline{ACAR}}{s/\sqrt{N}}$.

* denotes statistical significance at the 5% level.

Figure I
FT30 – Reaction to negative shocks

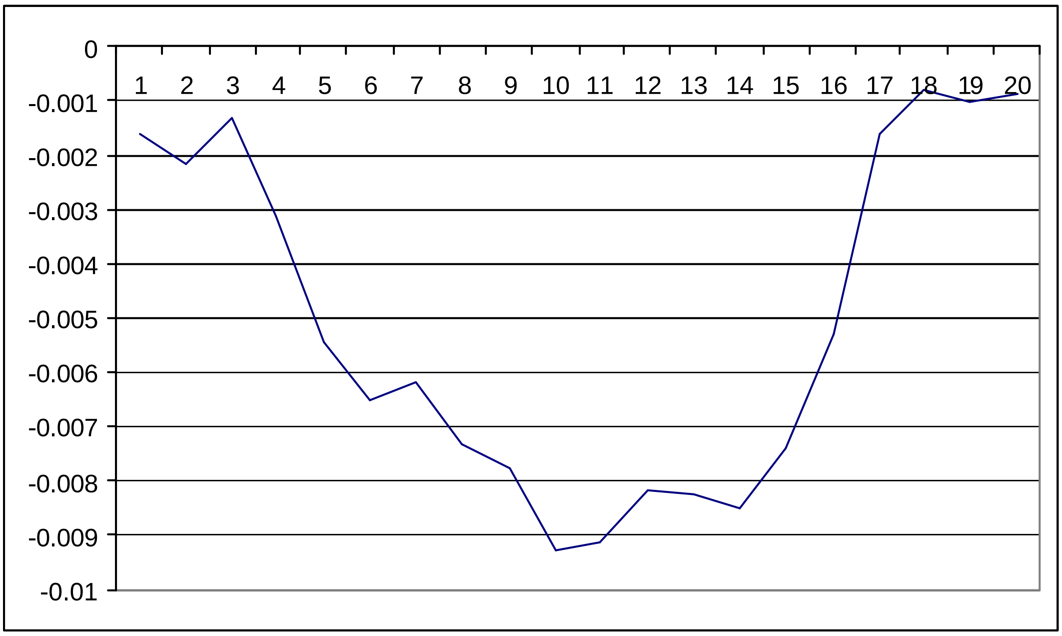

Figure II
FT30 – Reaction to positive shocks

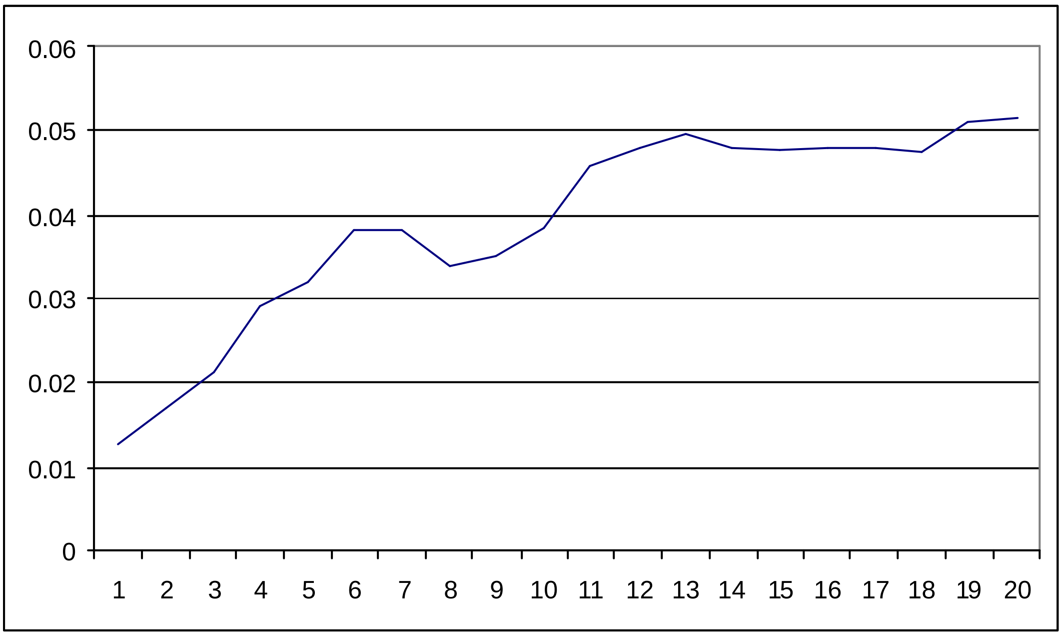

Figure III
FTSE-100 – Reaction to negative shocks

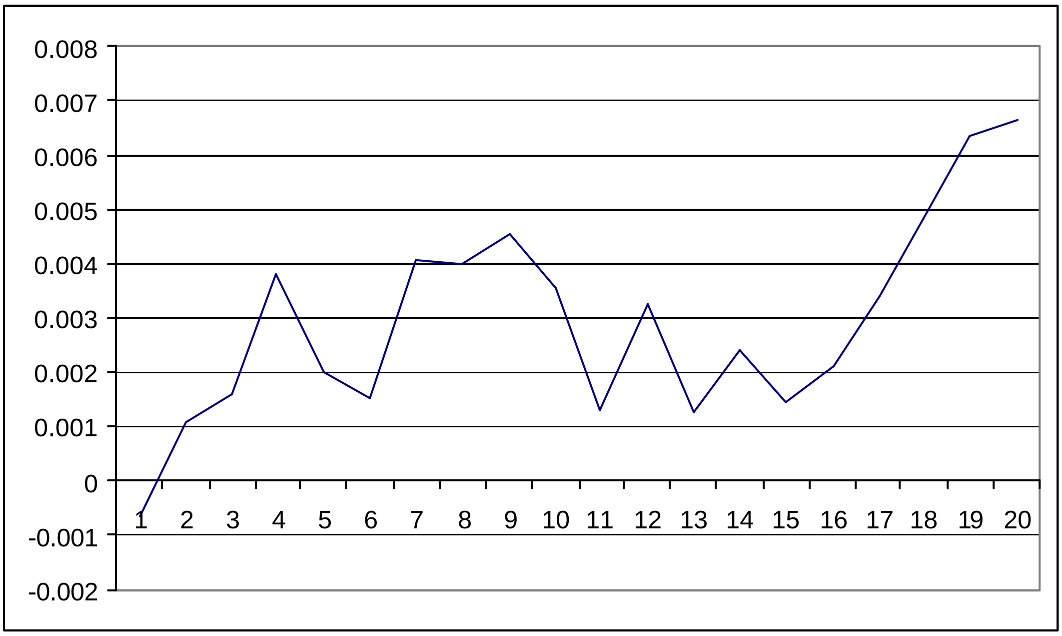

Figure IV
FTSE-100 – Reaction to positive shocks

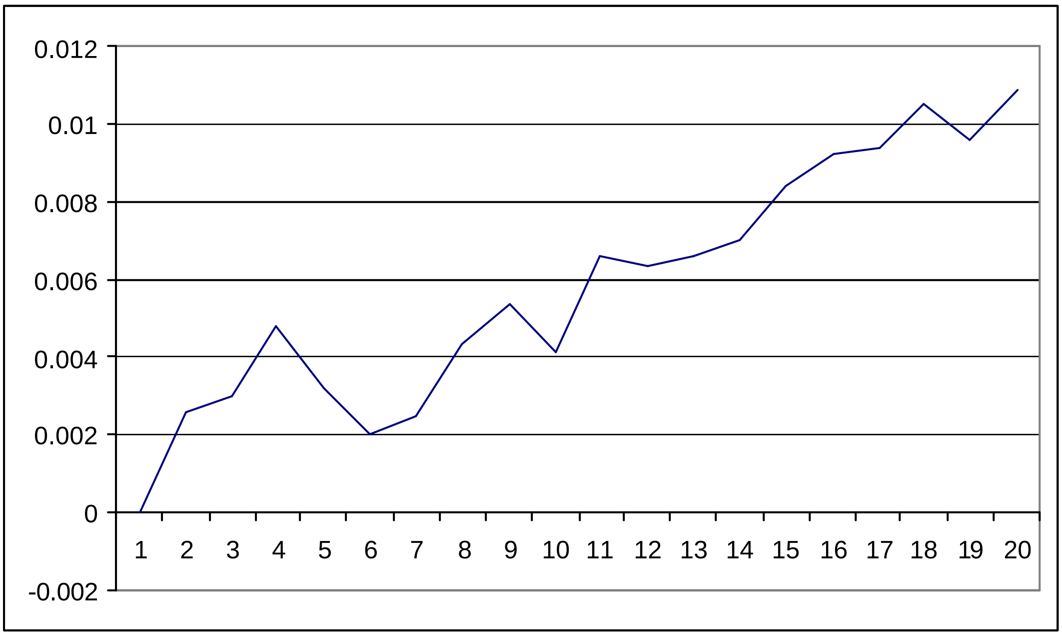

Figure V
FTSE-250 – Reaction to negative shocks

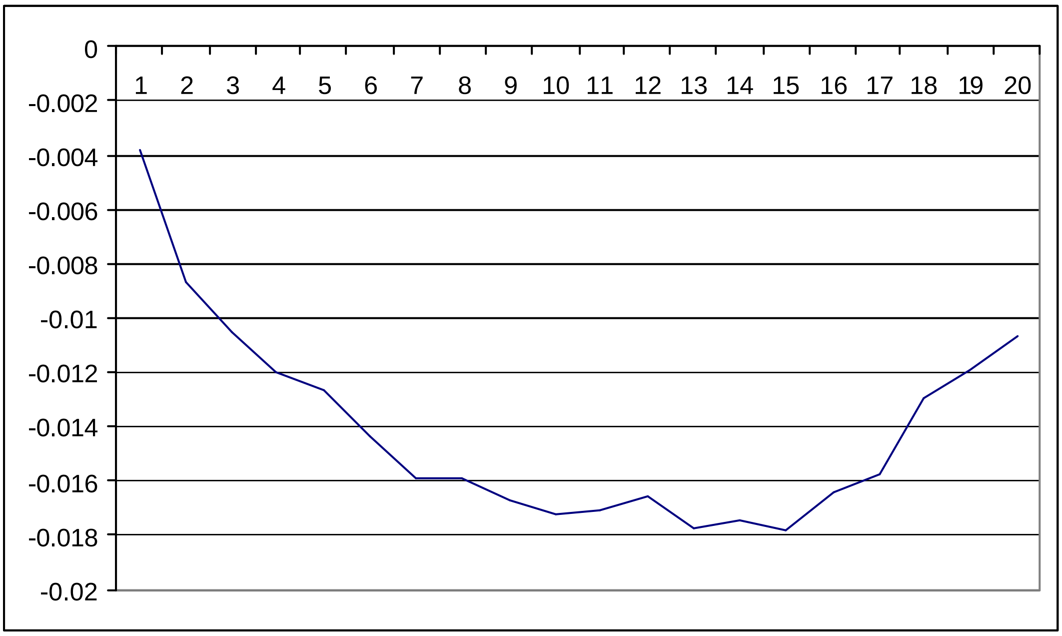

Figure VI
FTSE-250 – Reaction to positive shocks

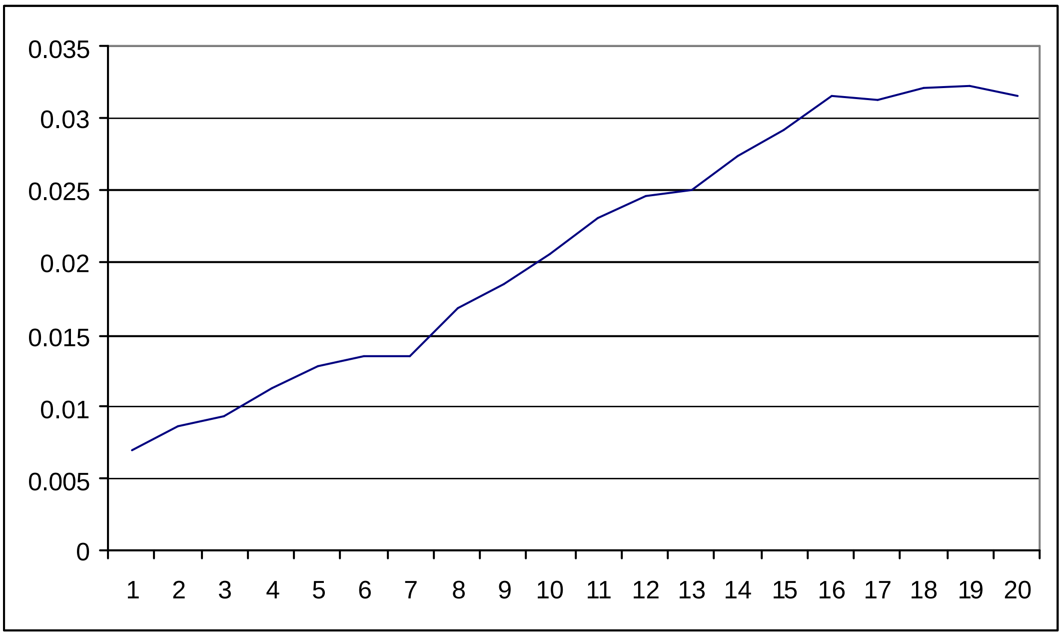

Figure VII
FTSE SmallCap – Reaction to negative shocks

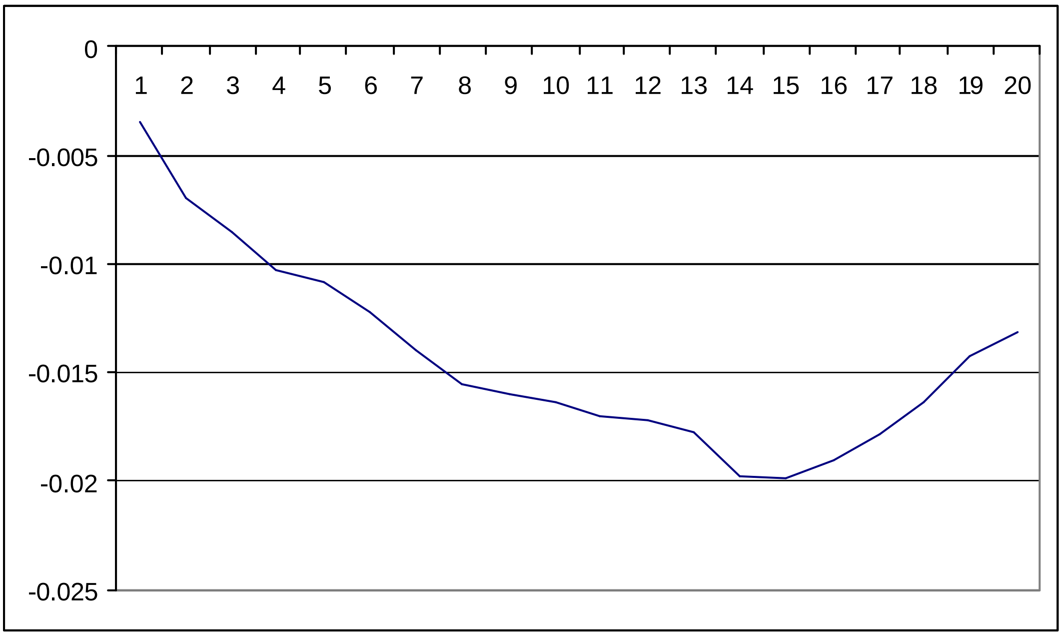

Figure VIII
FTSE SmallCap – Reaction to positive shocks