The share market reaction to the arrival of unanticipated information – a test of the Uncertain Information Hypothesis to determine the efficiency of the Johannesburg Stock Exchange

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The objective of this study is to determine whether companies listed on the Johannesburg Stock Exchange (JSE) overreacted to the arrival of unanticipated information during the period 1975–1992. In this article, a modified version of the Efficient Market Hypothesis called the Uncertain Information Hypothesis (UIH) is tested in order to explain the response of rational, risk-averse investors to news of a dramatic financial nature. The findings demonstrate that regardless of whether the news was good or bad, the average pattern of price adjustments after the initial reaction was significantly positive. Because the volatility of the share prices was also shown to rise significantly after both unanticipated good and bad news, the incremental returns to shareholders can be interpreted as compensating investors for bearing the added risk associated with uncertainty. The results provide strong support for the UIH. The findings do not support the alternative hypothesis that investors consistently overreact to unexpectedly large price changes. It would appear that the JSE reacts to uncertain information in an efficient, if not instantaneous manner.

Die doelstelling van hierdie ondersoek is om te bepaal of die maatskappye wat op die Johannesburgse Effektebeurs genoteer is, oorgereageer het op onvoorsiene inligting gedurende die tydperk 1976–1991. In hierdie artikel word 'n gewysigde weergawe van die Doeltreffende Mark Hipotese (Efficient Market Hypothesis), genoem die Onseker Inligting Hipotese (Uncertain Information Hypothesis), getoets om die reaksie van rasionele, nie-risikonemende beleggers te verduidelik ten opsigte van nuus van 'n dramatiese finansiële aard. Die bevindinge wys dat, ongeag of die nuus gunstig of ongunstig was, die gemiddelde patroon van prysaanpassings na die aanvanklike reaksie beduidend positief was, omdat die onbestendigheid van aandelepryse skynbaar ook merkbaar gestyg het ná beide gunstige en ongunstige verrassingsnuus. Die verhoogde opbrengste aan aandeelhouers kan geïnterpreteer word as vergoeding aan beleggers vir die dra van die bykomende risiko wat met onsekerheid verband hou. Hierdie gevolgtrekkings ondersteun die Onseker Inligting Hipotese ten volle. Die bevindinge ondersteun nie die alternatiewe hipotese dat beleggers konsekwent oorreageer op onverwags hoë prysveranderinge nie. Dit wil voorkom asof die Johannesburge Effektebeurs doeltreffend, hoewel nie onmiddellik, reageer op onsekere inligting.

Introduction

For the past generation, the Efficient Market Hypothesis (EMH) has been one of the most dominant themes in financial research. While the efficiency of the stock market was once virtually taken for granted (Jensen, 1978: 95), it is now being seriously questioned again, primarily due to the recent evidence on the return reversal behaviour of share prices; i.e., the prior period's worst share-return performers (losers) outperform the prior period's best return performers (winners) in the subsequent period. This potential violation of the EMH is labelled the 'overreaction phenomenon', because it suggests that the market has overreacted in the initial period, and it subsequently corrects itself (Howe, 1986).

There is a burgeoning body of evidence indicating that share volatilities are not temporally constant. For example, French, Schwert & Stambaugh (1987) report that the estimates of volatilities shift substantially over time and that the *ex ante* return premiums on equity shares vary with the predictable level of volatility. While all the forces that drive volatility are not well understood, Brown, Harlow & Tinic (1988) have demonstrated that the arrival of 'uncertain' information – both favourable and unfavourable – tended to increase the volatilities and required rates of return of both individual shares and the stock market as a whole. Further, the authors showed how a failure to account for these changes can produce predictable patterns of *ex post* returns.

Brown, Harlow & Tinic (1988) developed and tested the Uncertain Information Hypothesis (UIH) as a means of explaining the response of rational risk-averse investors to the arrival of unanticipated information. They conclude that shares are priced rationally and there are no consistently exploitable opportunities for investors to earn abnormal returns. The purpose of this article is to determine whether or not the UIH is applicable to shares traded on the JSE. The methodological approach used in this study is similar to that of Brown, Harlow & Tinic (1988) who investigated the UIH for companies listed on the New York Stock Exchange (NYSE).

Previous studies

The predictability of share returns is one of the most controversial topics in financial research. Various research papers have documented predictable returns over long and short horizons for both individual securities and market indices. The most influential, and controversial, among these are two papers by De Bondt & Thaler (1985; 1987), who present evidence of economically-important return reversals over long intervals. In particular, shares that experience poor performance over the past three-to-five years (losers) tend substantially to outperform prior-period winners during the subsequent three-to-five years. De Bondt & Thaler interpret their evidence as a manifestation of irrational behaviour by investors, which they term 'overreaction'.

Bhana (1989) has documented that companies listed on the JSE overreacted to unexpectedly unfavourable company-specific news events during the period 1970–1984. Bhana (1993) also provided evidence of investor overreaction to earnings announcements on the JSE during the period 1975–

1989. It was shown that a simple strategy of buying the shares of companies reporting negative earnings would have generated, on average, a positive abnormal return of 12.5% during the year following negative earnings. Page & Way (1992) replicated the De Bondt & Thaler (1985; 1987) studies to test the overreaction hypothesis for shares listed on the JSE. Page & Way (1992: 43) report that the loser portfolios outperformed the winner portfolios by 15%, which is significant at the 1% level. The empirical results of this study are consistent with the overreaction hypothesis propounded by De Bondt & Thaler.

Various authors (e.g., Chan, 1988; and Ball & Kothari, 1989), however, have argued that these return reversals are due primarily to systematic changes in equilibrium – required returns that are not captured by De Bondt & Thaler. One of the main arguments for explaining why required returns on extreme winners and losers vary substantially is related to pronounced changes in leverage. Since the equity beta of a company is a function of both asset risk and leverage, a series of negative abnormal returns will increase the equity beta of a company, thus increasing the expected return on the share (assuming that the asset beta is positive and does not decrease substantially, and that the company does not change its debt to fully offset the decline in the value of equity). Following the same logic, a decrease in equity beta is expected for winners. Consistent with the prediction of the leverage hypothesis, Ball & Kothari (1989) report that the betas of extreme losers exceed the betas of extreme winners by a full 0.76 following the portfolio formation period. Such a large difference in betas, coupled with historical risk premiums, can account for substantial differences in realized returns.

Zarowin (1989) examined the subsequent share return performances of companies that have experienced extreme earnings years and found that while the poorest earners outperform the best earners by a statistically significant amount over the subsequent 36 months, the poorest earners were also significantly smaller than the best performers at the time of portfolio formation. When the poorest earners were matched with best earners of equal size, there was virtually no evidence of differential share return performance, indicating that the market did not overreact to extreme earnings news, and suggesting that the size discrepancies between winners and losers may have been responsible for the apparent overreaction phenomenon.

Brown, Harlow & Tinic (1988) investigated the market reactions to the arrival of good and bad news for companies listed on the NYSE during the period 1962–1985. One of their findings is in agreement with De Bondt & Thaler – the tendency of large share price declines to be followed by a series of small upward adjustments. But they also reported a finding that contradicts the Overreaction Hypothesis: namely, that large share price increases were also accompanied by small positive (or at least non-negative) adjustments, and not by the negative adjustments predicted by De Bondt & Thaler.

On the basis of their findings Brown, Harlow & Tinic (1988: 357–360) developed the Uncertain Information Hypothesis (UIH). The EMH, in its traditional form, starts with the assumption that investors have 'complete' information and are thus able to adjust share prices quickly to their new equilibrium levels. The UIH model attempts to extend efficient market theory by showing how investors would respond 'rationally' in situations of major uncertainty – those in which the assumption of complete information does not hold.

The UIH begins with the assumption that investors often set share prices before the full ramifications of a dramatic financial event are known. The great uncertainty among investors leads, at least initially, to heightened price volatility and thus greater risk for investors. Because investors require higher returns for bearing greater risks, they respond to favourable as well as unfavourable surprise events by setting share prices, on average, below their expected values. As the uncertainty over the eventual outcome is gradually clarified, subsequent price changes will tend to be positive, on average, regardless whether the initial event was good or bad. In this sense, positive price adjustments following major shocks are better understood as rational responses to increased risk than as chronic overreactions by the investing public.

Uncertain Information Hypothesis

The standard version of the EMH is based on the clearly unrealistic assumption that investors have immediate access to all the information they need to revise security prices in a definitive, once-and-for-all manner (Fama, 1970). In the real world, of course, some events are so rarely anticipated and of such consequence that their ultimate effect on share prices cannot be immediately determined. In the face of such uncertainty, the UIH suggests that investors effectively form what economists refer to as 'conditional probability distributions'. Such distributions can be visualized as decision-tree-like diagrams that lay out a number of possible outcomes with probabilities assigned to each. By multiplying the value of each possible outcome by its probability, one arrives at an 'expected value' for the company's shares.

The UIH proceeds on the assumption that, because of the increased uncertainty and thus greater risk attending such events, investors also immediately discount the value of the company below the expected value of this probability distribution. This discount on the shares then disappears gradually, along with the uncertainty that gave rise to it.

For example, upon the unexpected death of a company's talented managing director, the shareholders will quickly mark down the value of the company's shares. But a more precise assessment of the consequences will not be possible until the market learns more about the company's plans for a successor. Therefore, in the immediate aftermath of the announcement, the best that investors will be able to do is to reset share prices based on a subjective 'guess' (or, more precisely, a probability distribution of guesses) about the long-term effect. And, given investors' aversion to risk, this first guess is more likely to fall below than above the eventual value.

The point of this example is to show that unanticipated information affects investors in two ways. First, as the bad news is initially received, projections of the fortunes of the company in question are immediately revised downward. Second, the level of uncertainty facing investors in this company increases, causing a further reduction in the value of the company's shares. Thus, even if this increase in uncertainty is not permanent, it nevertheless represents a potential source of risk for which investors will demand to be compensated (at least until the source of this risk is removed).

A similar market reaction can be envisioned in the case of unexpectedly good news. Suppose that a company announces that it has developed a new technology that promises to reduce its production costs significantly. As in the previous example, to the extent that this information takes investors by surprise, any immediate adjustments to the company's share price will be based on a crude forecast of the ultimate consequences of the event. While such an announcement should cause an overall increase in the share value of the company, it might also raise the level of uncertainty about its future performance – which would cause the share price increase to be less than otherwise.

Uncertain Information Hypothesis contrasted with Overreaction Hypothesis

In cases of bad news, the pattern of investors' responses predicted by the UIH will be indistinguishable from that predicted by the Overreaction Hypothesis (OH). That is, the initial decline in share prices will be followed, on average, by a price increase. The difference between the two theories becomes apparent only in the case of good news. In contrast to the Overreaction Hypothesis, the UIH predicts what would appear to be an underreaction; that is, an initial price increase followed, on average, by a further increase.

These propositions are demonstrated graphically in Figure 1. For purposes of comparison, Panel A shows the adjustment of share prices to bad news under the traditional EMH. The arrival of bad news drives the value of the security down from its previous level, P to P_B; and there is no further adjustment after the initial response. In this case, the share price moves immediately to its new 'intrinsic' value.

In contrast, Panel B shows the pattern of price changes that would accompany unfavourable surprises under the UIH (and under the Overreaction Hypothesis as well). According to the UIH model, the arrival of bad news would not only decrease the expected cash flows of the security but also increase their systematic risk. With this additional uncertainty, the present value of the 'certainty equivalents' of the risky cash flows is P_B^* which could be significantly less than P_B in a stock market dominated by risk-averse investors. However, as the uncertainty is resolved, the price increases to P_B from P_B^* to reflect the associated reduction of investor risk.

The effect of favourable surprises on share prices is shown in Panels C, D, and E. In the standard EMH, in which the consequences of the news are immediately and clearly known, the price of the share increases quickly from P to P_G; and there is no adjustment thereafter. The Overreaction Hypothesis (illustrated in Panel D) predicts that the price will overshoot the mark, rising to P_G^{OH} and then falling back to P_G.

The UIH model, in contrast to both the standard EMH and the OH, suggests that if the good news also increases the uncertainty about the share's future cash flows, then the price will initially rise only to P_G^* and then gradually adjust upward to P_G as the uncertainty is dispelled. As in the case of bad news, this delayed price adjustment is caused by investors' rational demand for higher expected returns to compensate them for the heightened uncertainty.

Although the preceding discussion is couched in terms of favourable and unfavourable surprises affecting the systematic risks of individual shares, the UIH model is equally relevant to market-wide surprises that affect the value of broad-based share indexes. The UIH claims that major favourable and unfavourable surprises about the economy will typically increase the risk of holding equity shares in general. Therefore, the returns on market portfolios following major shocks would also be expected to exhibit the same 'asymmetric' pattern (i.e., apparent overreaction to bad news, underreaction to good) shown in Panels, B and E in Figure 1. Moreover, the UIH implies that, when investors' preferences exhibit decreasing absolute risk aversion and broadly diversified portfolios of equities constitute very large fractions of investors' wealth, the price reaction to major unfavourable market-wide surprises will be more pronounced than the reaction to equally significant favourable surprises.

The main elements of the UIH model can be summarized by the following propositions:

1. on average, share return variability will increase following the announcements of major unanticipated events;
2. the average price adjustments following the initial market reactions to both 'negative' and 'positive' events will be positive (or, in the case of the latter, at least non-negative); and
3. to the extent that the market's risk-aversion decreases as the level of share prices increase, post-event price increases will be larger for negative events than for positive ones.

The important point here is that the portfolios are priced rationally in both situations, and there are no *ex ante* opportunities for investors to earn riskless profits by 'arbitraging' price overreactions or underreactions. Under this scenario, one only has the illusion that investors consistently overreact to bad news and underreact to good.

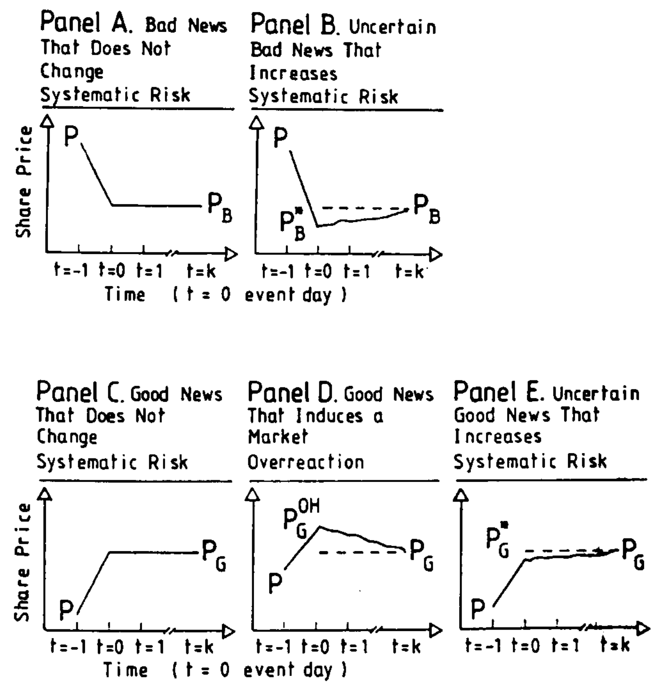

Figure 1 Share price changes to unfavourable and favourable uncertain information

Research methodology

The UIH attempts to explain investor reactions to major unanticipated events. In devising a test of the UIH, the first question that arises is, how do we know when a 'major' event has occurred? To avoid introducing any subjective bias on the part of the researcher, events were defined using strictly quantitative criteria. Furthermore, it was decided to choose the size of the companies included in the analysis, as well as the minimum levels for residual price-change, so as to exclude spurious events caused by the wide bid-ask price differentials that can result from thinly traded securities.

In the case of general market reactions, all daily price movements greater than 2% of the market index (JSE Overall Actuaries Index) were considered as events. More precisely, it was decided that an 'event' had occurred if the market return on a given day departed from its realizable daily return by more than 2%. A number as seemingly small as 2% was chosen on the assumption that, because of the natural diversification within the market portfolios, deviations from the expected daily returns would not have to be extremely large to be considered a surprise. Furthermore, daily market portfolio returns substantially exceeding 2% are too few and would not provide sufficient events to enable the results to be tested for statistical significance. The market index occasionally goes on a run and would record a change of more than 2% on succesive days. For analytical purposes the successive days are regarded as a single event.

A market-wide effect identified as an event was precluded from being again chosen as an event during the ensuing 60-day post-event period. This control measure ensured that one events' post-event volatility does not influence the volatility induced by the next event. The rationale for using the 60-day post-event period is that the market reaction to unexpected dramatic events is a short-term phenomenon (Bhana, 1989). Over the 18-year period 1975 through 1992, 60 such events were identified: 28 positive and 32 negative.

For individual companies a daily return of 5% is used to measure a surprise event. A return of this magnitude can be considered to surprise the market. If a larger daily return of say 10% is used, fewer events would be observed and will produce unreliable results. Dividend payouts produce a negative share price on the day the share becomes ex dividend. Such negative share price effects are ignored as they are not considered to surprise the market.

In the case of individual companies, events were identified by 'abnormal' returns (adjusted for risk and expected return) created according to the single index return-generating process represented in Equation (1). All abnormal returns greater than 5% by the largest 200 companies (measured by market capitalization) listed on the JSE were classified as events. The 200 companies were initially selected in the year 1975 and were used for the entire duration of the investigation. However, companies that were delisted for any reason were replaced by other companies in the year in which delistings occurred. The same procedure used for market-wide events was also employed for individual companies to ensure that one events' post-event beta coefficient does not influence the risk induced by the next event.

Because the primary prediction of the UIH is that major surprises will tend to increase investor uncertainty, the first task was to compare the level of price volatility before and after the events. To allow for direct comparison of events that took place over a 18-year period, it was decided to define the event to be 'Day 0' for all cases in both samples regardless of where it fell in calendar time. Then, a subsequent period running from Day +1 to Day +60 was examined in order to estimate the appropriate measure of 'post-event' volatility.

In measuring pre-event (or, 'normal') volatility, it was decided to use different measures for the two different samples. For the sample of market-wide surprises, risk was measured as a variance of the observed share price returns. The analysis compared the level of post-event variance to the same measure calculated by using all 'non-event' days, that is, all days during the 1975–1992 sample period that did not fall in one of the 60-day periods that followed the 60 surprises.

For the sample of individual companies, risk was measured as the share price 'betas' (or covariances) over the period 200 days prior to the event (Day –200 to Day –1), and then compared those to the betas calculated over the 60-day period following the event (Day +1 to Day +60). To test for the possibility that the event itself may have altered the risk of the securities, I calculate the post-event residual responses using the parameters estimated in a 200-day interval following the 60-day response period (Day +61 to Day +260).

One of the features of the JSE is that a large proportion of securities are thinly traded. The price quoted for a share is based on the price at the last transaction. Consequently shares which are traded infrequently will be positively autocorrelated and the estimated beta value will be underestimated (Stoll & Whaley, 1983).

Two methods were used to calculate the beta values for companies identified as events. The first method was the standard ordinary least squares (OLS) method that is normally used to derive values of beta. The second method employed the technique developed by Dimson (1979) and refined by Cohen, Hawawini, Maier, Schwartz & Whitcomb (1983) to overcome the problems of beta underestimation caused by serial correlation. Bradfield & Barr (1989) conducted a sensitivity study on the JSE and they showed that there is a statistical significance for two lagged terms, the contemporaneous term and one leading term. Their procedure was therefore adopted to calculated beta values.

For individual companies, a good or bad news event is defined in terms of change in residual value occurring on a particular day. These residuals are created according to the single index return-generating process developed by Bowman (1983):

$$U_{jt} = R_{jt} - (\alpha_j + b_j R_{mt}) \qquad (1)$$

where:

R_{jt} = return for company j on day t,

R_m = the daily return for the market portfolio represented by the JSE Overall Index on day t;

α_j, b_j = regression parameters of the market model.

The hypotheses tested in this study can be stated as:

H_0: Investors 'rationally' increase their expected returns to compensate for the increased risk associated with an unanticipated event. Therefore, the stock market should provide no consistent opportunities for investors to earn more than normal rates of returns.

H_1: Investors systematically exaggerate the economic consequences of major events by raising prices too high when the news is good and reducing prices too sharply when the news is bad. Therefore, capital markets are providing investors with consistently exploitable opportunities for abnormal profits.

Results and discussion

Effect of surprises on volatility

To test the proposition that major surprises are typically followed by increased uncertainty, I first compare the daily return variances of the market index during the post-event (Day +1 to Day +60) and non-event intervals. Panel A of Table 1 reports the results of the return variance analysis on the market-wide sample in the form of three different sets of data: (1) all non-event days; (2) all post-event days following favourable surprises; and (3) all post-event days following unfavourable surprises. As shown in Table 1, major surprises appear to affect investor risk precisely as the UIH predicts. The F-statistic is used to test for equality of the average beta coefficients in the pre-event and the post-event intervals. The F-statistics are measures of the statistical significance of the difference between the non-event risk-level and the two post-event risk levels; and they suggest that we can be quite confident in concluding that the events in question are consistently followed by a measurable increase in general market volatility. The analysis also suggests that, although negative events had a somewhat larger impact on risk than positive ones, the difference was not statistically significant. Thus, the data support the UIH's claim that major surprises tend to be followed by increased uncertainty in the stock market.

Table 1 Changes in risk induced by unanticipated events for market-index and individual companies during 1976–1991

Panel A: Market-wide events

Sample	Number of observations	Variance	F-Statistic for difference with (1)
1. Non-event days	879	0.00004974	–
2. Post-event days: positive events	1 680	0.00007436	1.74[a]
3. Post-event days: negative events	1 920	0.00007945	1.87[a]

a denotes significance at the 1% critical level

Panel B: Individual company events

Period	Positive events	Negative events
Average beta coefficient:		
Pre-event (Day –200 to –1)	0.9743	0.9658
Post-event (Day +1 to +60)	1.0435	1.0450
Subsequent Days (Day +61 to +260)	0.9985	0.9967
F-statistics:		
Pre-event – Post-event	22.61[b]	33.74[b]
Pre-event – Subsequent	5.12[c]	7.28[c]
Post-event – Subsequent	8.35[b]	13.43[b]

b and c denote significance at 5% and 10% critical levels, respectively

We need to take into account the possibility that an event itself can substantially change the nature of the subsequent expected returns. The effects of favourable and unfavourable surprises on the uncertainty about post-event returns for the largest 200 companies listed on the JSE are shown in Panel B of Table 1. A comparison of the company's beta before and after the event was made for each of the 2 173 identified events. Furthermore, in order to get a better understanding of whether these company-specific volatility changes were permanent, a third beta was computed for each event over a time period judged to be well beyond the event itself (from Day +61 to Day +260).

Two conclusions can be drawn from these findings. First, as with the market-wide sample, unanticipated events result in a sharp increase in the systematic risk of individual companies. The increases averaged 7.2% (1.044/0.974) for favourable surprises and 8.2% (1.045/0.966) for negative events. Second, it is also clear that much of this risk increase is temporary. As shown in the column labelled 'Subsequent days' the average betas for both positive and negative events trend back towards their pre-event levels. Specifically, the level of risk in the Day +61 to Day +260 interval retains only 35% of the build-up accumulated during the post-event period for positive events and 39% for negative surprises. Nevertheless, they continue to remain somewhat above their values prior to the surprise. Thus, it appears that unanticipated events have both a permanent and a temporary effect on investors' perception of company risk.

Transitory risk increase is, of course, consistent with the notion that major informational surprises create uncertainty about the company's prospects that requires time to resolve. These findings about the volatility are consistent with the primary prediction of the UIH namely, a large increase in uncertainty (as reflected in price volatility) is followed by a gradual resolution of that uncertainty. Whether investors receive additional compensation for bearing this additional risk, as the UIH also predicts, is the question which will be investigated in the following section.

Effect of surprises on prices

The second testable implication of the UIH is that the required rates of return will rise concomitantly with increase in risk. Thus the average post-event excess returns will appear to be positive (or at least non-negative) after both favourable and unfavourable surprises when the increases in expected returns are ignored. Consequently the company-specific sample was separated into positive and negative events, depending on the sign of the day 0 residual. For a typical post-event response, the average daily residual is calculated:

$$AR_{st} = ({}_{j}\Sigma U_{sjt}) \div N_{st}, \quad t = +1, +2, \ldots +60$$

The subscript s represents the sign of the day 0 residual and N is the number of observations within that subsample. The cumulative average returns can be defined as:

$$CAR_{st} = CAR_{st-1} + AR_{st}, \quad t = +1, +2, \ldots +60$$

The t-statistic is based on the standard error of the average daily residual and the standard deviations for this test were estimated according to the procedure developed by Brown & Warner (1980; 1985).

The daily 'abnormal' share price returns were calculated for company-specific surprises and then averaged 'cross-sectionally' over the 60-day period trailing the events. Separate averages were calculated for reactions to negative and positive initial events. In each partition, the cumulative average residual (CAR) is calculated for the period from Day +1 to various points in the 60-day response interval.

Table 2 displays a representative portion of the post-event CARs along with the associated significance tests. What the CAR values make clear is that, on average, investors did indeed receive additional compensation, in the wake of major surprises both favourable and unfavourable. And this point is reinforced by the statistical observation that only the positive CARs in Table 2 were statistically significant.

What is clear, however, is that the positive price adjustments were considerably higher after bad news than after good news. In the cases of good news about individual companies, the CARs displayed in Table 2 seem to suggest that the uncertainty is resolved very quickly (in as short a period as five days), and that share returns fluctuate randomly around zero thereafter (in a pattern much like the one predicted by the standard EMH). The results represented in Table 2 provide considerable empirical support for all three of the testable implications of the UIH. In particular, the results show that in the aftermath of an unanticipated information shock, both the risk level and the expected return of the affected security tend to increase. These findings hold regardless of the direction of the initial price movement.

Table 2 Cumulative Average Residual (CAR) following unanticipated events for company-specific events during 1975–1992

	Positive events (N = 1 197)		Negative events (N = 976)	
Event day	CAR(%)	T-statistic	CAR(%)	T-statistic
+1	0.157	3.45[a]	0.052	1.30
+2	0.234	3.15[a]	0.117	1.92[b]
+3	0.126	1.84[b]	0.180	2.51[a]
+4	0.117	1.33	0.294	3.04[a]
+5	0.097	1.20	0.415	3.52[a]
+10	−0.030	−0.36	0.564	3.75[a]
+20	−0.019	−0.421	0.398	2.73[a]
+30	−0.054	−0.27	0.254	1.28
+40	0.038	0.28	0.328	1.17
+50	0.070	0.38	0.447	1.40[c]
+60	−0.105	−0.62	0.526	1.66[c]

a: significant at the 1% critical level
b: significant at the 5% critical level
c: significant at the 10% critical level

Relationship between risk and return

Having established that major surprises increase both risk and return in the stock market, the final objective of this study was to investigate the strength of the relationship between the two. All models of rational investor behaviour assume that investors require greater returns for bearing risk. Consequently, in evaluating the initial price shocks and subsequent adjustments in our sample of events, we would expect to find that the level of increases in the CARs is positively related to the level of increase in volatility.

The credibility of the UIH will be enhanced if it can be shown that the increase in post-event expected return is commensurate with the increase in risk. To test the relationship between risk and return with any degree of precision would have required the use of a formal model such as the capital asset pricing model (CAPM). The CAPM has been found to be inadequate in providing a consistently positive linear relationship between risk and return (Tinic & West, 1984). Therefore, it was decided to use two relatively informal tests to examine certain aspects of this risk-return relationship using the methodology developed by Merton (1980).

The first of these tests focussed on the market-wide surprises. Merton (1980) demonstrated that if investors exhibit what is known as 'constant relative-risk aversion' – that is; if the amount of additional return needed to compensate an added unit of risk remains roughly the same regardless of the relative level of share prices – then the expected risk premium on the market index should be directly proportional to the variance of market returns. This, in turn, implies that the percentage increase in post-event expected returns should be roughly equal to the percentage increase in post-event risk.

The expected daily returns of the JSE Overall Index are used to represent expected return changes for market-wide events. The percentage increase in daily returns for the market-wide portfolio for the post-event interval (Day +1 to

Table 3 The relationship between post-event risk and return during 1976–1991

Panel A: Risk and expected return changes for market-wide events

Sample Day	% increase in daily returns during post-event interval (Day +1 to Day +60)	% increase in daily variance during during post-event interval (Day +1 to Day +60)	Ratio
All events	37.66	24.61	1.53
Positive events only	44.45	31.75	1.40
Negative events only	48.76	29.73	1.64

Panel B: Event magnitudes and risk changes for individual company events

Sample	Dependent variable	Estimated coefficient α_0	Estimated coefficient α_1	F-statistic
Positive events	β	0.8974	3.3625	63.21[a]
(N = 1 197)	σ_j^2	0.0003	0.0054	310.35[a]
Negative events	β	0.9162	−3.2713	57.43[a]
(N = 976)	σ_j^2	0.0004	−0.0067	321.68[a]

a indicates significance at the 1% critical level

Day +60) was calculated. The change in market-wide risk is measured by variance. The percentage increase in daily variance during the post-event interval (Day +1 to Day +60) is used to measure the change in volatility associated with change in market return.

The percentage increases in the post-event mean daily market-wide risks and returns are reported in Panel A of Table 3. The increases in post-event returns tended to be somewhat larger than the increases in risk. The 'elasticity coefficient' for the whole sample was 1.53. However, without a more precisely formulated model of risk and return, it is difficult to say whether this represents 'excessive' compensation for increased risk. What is important for our purposes is that the findings in Panel A are consistent with the direction of the relationship that would be expected in an efficient market.

In the case of company-specific surprises, regression analysis was used to determine whether the size of the initial price change was highly corrrelated with the subsequent increase in risk. Two measures of risk were tested, systematic risk (as measured by a company's beta) and total risk (as measured by total variance). The following regression equations are estimated separately for 1 197 positive and 976 negative events:

$$\beta_j = \alpha_0 + \alpha_1 U_{j0} + V_j \qquad (2)$$

$$\sigma^2(R_j) = \alpha_0 + \alpha_1 U_{j0} + W_j \qquad (3)$$

where β_j and $\sigma^2(R_j)$ are the beta coefficient and the daily return variance, respectively, of share j during the post-event interval (Day = +1 to Day +60). U_{j0} is the abnormal return of the share on day 0 (i.e. $U_{j0} < 0$ for negative events and $U_{j0} > 0$ for positive events). The variance of daily share returns is also used to measure risk, and the same number of daily returns are used in determining the variance before and after the event.

As reported in Panel B of Table 3, the estimated coefficients of the regression equations demonstrate rather convincingly that, regardless of the risk measure used, post-event uncertainty is an increasing function of the size of the initial change. The larger the initial market reaction to a surprise, the greater the subsequent level of investor uncertainty and thus the higher the measure of risk.

The findings of these two tests, together with the earlier results, provide strong support for the UIH proposition that investors 'rationally' increase their expected returns to compensate for the increased risk associated with unanticipated events. When the relationship between the initial price decline and subsequent increase in uncertainty is ignored, the post-event price fluctuations may give the deceiving impression of investor overreaction to bad news.

Summary and conclusions

The efficient market hypothesis (EMH) is based, in part, on the assumption that reliable information is instantly and costlessly available to investors. In this artificial world of relative certainty, share prices are expected to adjust to major events quickly and accurately (or at least, in an unbiased way, neither systematically overshooting or undershooting the equilibrium). The UIH discards this assumption of 'complete information' and shows how the introduction of uncertainty changes rational investors' responses to new information.

The evidence of this South African study of investors on the JSE responding to surprises – which examines all 60 market-wide daily (unexpected) price changes greater than 2% and 2 173 company-specific price movements greater than 5% over the period 1975–1992 – provides strong support for the UIH. The findings demonstrate that regardless of whether the news was good or bad, the average pattern of price adjustments after the initial reaction was significantly positive. Because the volatility of prices was also shown to rise significantly after both good and bad surprises these incremental returns to shareholders can be interpreted as compensating investors for bearing the added risk associated with uncertainty.

Previous studies by Page & Way (1992) and Bhana (1989) have concluded that companies listed on the JSE display a tendency to overreact to favourable and unfavourable company-specific news events. The results of this investigation related to the 200 largest companies listed on the JSE support the hypothesis based on the propositions of the UIH. The findings do not support the alternative hypothesis that investors consistently overreact to new information. It can be concluded that the short-term behaviour of share prices on the JSE for unexpected and substantial news announcements does not reveal evidence of anything but rational judgement by investors. It would appear that the JSE reacts to uncertain information in an efficient, if not instantaneous manner. It can also be concluded that the earlier findings supporting the Overreaction Hypothesis did not allow for the possibility that dramatic financial events might increase the variability and risk of share returns, and thereby erroneously suggesting that predictable patterns of share returns emerge in the post-event period.

While the findings of this investigation can be construed as evidence of market overreaction to large negative shocks, it is suggested that such apparent overreaction could equally be viewed as reflecting a large increase in investors' required returns and, thus arguably, in the marketwide risk premium. In fact, the results show that the level of volatility after major surprises is composed of a small permanent, as well as a large transitory, component.

What is the importance of these findings for efficient market theory? One immediate implication concerns the number of recent studies that claim to find a seemingly predictable pattern in share returns following the arrival of uncertain information. In particular, the results of this investigation contradicts the Overreaction Hypothesis propounded by De Bondt & Thaler (1985; 1989) that investors consistently overreact to news of a dramatic and unexpected nature. The main prediction of market efficiency is that the stock market should provide no consistent opportunities for investors to earn more than normal rates of return (adjusted for risk). For this principle to hold, any apparently predictable trend in share prices that is, any 'trading rule' based on systematic market 'overreaction' to bad news or 'underreaction' to good – must turn out, on close inspection, to be an illusion.

In this case, the illusion is created by the process of averaging the responses by investors (many of which overshoot, while others undershoot their expected share value) to a large number of events. It is true that if you purchased all the individual shares on the day following a daily price movement of more than 5%, you would earn what appears to be an 'excess' rate of return over a very few days. But, if you then adjusted that rate of return for the increased price volatility, you would likely discover that you had earned what finally amounts to nothing more than a normal rate of return.

The support for the UIH provided by companies listed on the JSE is consistent with the findings of Brown, Harlow & Tinic (1988) for shares listed on the NYSE. Nevertheless, the debate over market efficiency will continue for some time. The findings of this investigation suggests that abandoning the assumptions of investor rationality and market efficiency in favour of losely formulated alternatives may be premature.

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