Stock Returns Following Profit Warnings: A Test of Models of Behavioural Finance.

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Abstract

Models in behavioural finance have been developed to explain apparent anomalies in stock returns. A property common to a number of these models is that agents under react in the short run to public signals about future earnings. This contrasts sharply with the popular informal belief that stock prices overreact to news. A behavioural model also predicts returns reversals over longer horizons. We examine stock returns following profit warnings to test which, if any, of these hypotheses stands up to scrutiny on a new data set which was generated by a process which corresponds closely to that assumed in the behavioural models.

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1. Introduction

It is widely agreed that cross-section stock returns can be forecast from public information. Variables like lagged returns, size of the company, dividend yield, price earnings ratio, and the ratio of the book to the market value of the company have all been shown to forecast excess returns (for a survey see Fama, 1998). Of these variables, the most difficult to explain in an efficient market is the role of lagged returns, where the evidence is that high frequency returns (one month or less) are positively autocorrelated. This is known as the momentum effect (Jegadeesh and Titman, 1993). However low frequency returns (one year or more) tend to be negatively autocorrelated (DeBondt and Thaler, 1985). For example Fama and French (1996) show that a portfolio constructed by buying stocks which were losers in the five years up to one year before it is formed and going short in winners over that same period is profitable. However buying winners over the last 12 months and going short in losers over the last 12 months is also profitable. It appears that short term momentum co-exists with long run reversals in returns.

Price scaled accounting variables may be interpreted as proxies for risk factors not captured by the variables specified in the standard models of asset pricing. Risky companies will *ceteris paribus* have a low price relative to any accounting measure of fundamental value. Therefore the forecasting power of price scaled accounting variables

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may be not a profit opportunity but rather reflect risk which has not been captured by the standard adjustments used to calculate excess returns, such as the CAPM (Berk, 1996). However, as Fama (1998) acknowledges, it is hard to find a risk proxy interpretation for the patterns of serial correlation found in the returns data.

It is therefore a particularly important and interesting challenge for behavioural finance to develop a theoretical explanation for both short term momentum and long run return reversals. Theoretical work in this relatively new area involves building models which are alternatives to the fully rational efficient markets model. The general approach is to construct quasi rational models which are grounded on sound psychological evidence on how individuals actually behave.

Daniel et al. (1998) employ one of the most enduring results from the psychological literature, which is that individuals overestimate their own ability in a wide variety of situations. This assumption is used in an otherwise rational framework to model learning and to derive implications for stock returns following the arrival of new information. Agents are assumed to use a Bayesian learning model but to give too little weight to public signals, and too much to their prior beliefs and/or private signals. This implies an initial under reaction to public signals. When the realisation of the random variable is finally observed, there will then be a "surprise", and hence excess returns that are of the same sign as the initial reaction. In this way, momentum will appear in returns data sets which span a public announcement.

Barberis et al. (1998) build on evidence of two judgement biases from cognitive psychology: a) Individuals give too much weight to recent patterns in the data and too little to the underlying population from which the data is drawn; b) individuals are slow to update their models in response to new information. Barberis et al. (1998) capture these two biases in a model where it is assumed that earnings follow a random walk with zero drift, but investors wrongly believe there are two regimes. One regime is mean reverting and the other is a time trend. In order to see how this may explain the data, suppose agents initially believe they are in the mean reverting regime. Stock prices will initially under react to new information, since agents believe earnings to be mean reverting. However since they are actually a random walk agents will in time receive a sequence of earnings announcements which all have the same sign of deviation from the expectation of the mean reverting model. They then switch beliefs to the trended earnings model and extrapolate the trend they believe they have identified. This produces returns of the same sign as the initial under reaction, resulting in the observed momentum. Eventually the error of believing in the trended model is exposed and there is then a reversal of long term returns.

The objective of this paper is to test these models by tracing returns following a profit warning. Both models imply negative returns in the months following a profit warning. This is a context which conforms closely to the assumptions of the overconfidence model of Daniel et al. (1998). Profit warnings are a public signal about an earnings realisation which will follow, usually within six months. It is therefore over this horizon that this model implies momentum should be detected.

The model of Barberis et al. (1998) also implies agents will initially under react to the warning, because in their model agents cling to the mean reverting beliefs. However as more bad news accumulates over the following months they switch to the (negative) time trend model for earnings, resulting in negative returns and hence momentum. However eventually they realise they were mistaken to extrapolate the downward trend and prices rebound strongly. In this way Barberis et al. (1998) has the further implication that earnings in the year after the bad news year, when the warning was issued, will on average be a positive surprise for agents who had extrapolated from the bad news year using a declining time trend. We should then expect positive returns as agents realise they were wrong to extrapolate a downward earnings trend.

It is surprising that returns following profit warnings have not been examined already in the literature, given the intensive study of returns following an earnings announcement on both US and UK data. Even apart from the fact that they conform closely to the over confidence model, profit warnings merit study simply on the grounds of the size of returns response they engender. They result in a much larger one day price response, on average minus 16%, than earnings announcements, where 80% of earnings announcements result in an absolute returns response of less than 5% on the day (Kandel and Pearson, 1995). One of the problems in measuring excess returns is that there is no universally agreed model of asset pricing. Given the volatility of stock returns it is very useful to have a strong signal, so that results may be robust with respect to the method used to calculate excess returns.

It is interesting to observe that formal models, based on evidence from psychology, give rise to the exactly opposite prediction to the informal view that markets over react to news in the short run. This latter view seemed to many observers to be a natural way to explain the evidence of excess volatility in financial markets, but it was not supported by formal reasoning. The informal overreaction story and the quasi rational learning models have diametrically opposed predictions about the sign of excess returns in the one to six months following a profits warning.

In the following section we describe the data and in section 3 we examine the evidence for the momentum hypothesis. Section 4 investigates the long-run returns data following profit warnings and section 5 studies the history of returns of stocks prior to the profit warning. Finally section 6 concludes.

2. Profit Warnings and Returns Data

Profit warnings are the discretionary disclosure of bad news by companies prior to earnings announcements. They may take the form of a specific revised earnings forecast or may be a qualitative statement that simply states, or implies, that earnings will be significantly less than current brokers' expectations. Approximately half of all companies whose earnings announcements are going to be "bad news" warn in advance (Kasznik and Lev 1995).

Why companies warn is an interesting question which has received considerable attention. It has been argued that investors punish companies for not warning them, lose confidence in management that does not communicate, and that companies who do not communicate news in a timely way could be exposed to legal action, see for example Libby and Tan (1999). However Shin (2001) develops a model of information transmission and obtains the result that companies will not warn. Clearly then there are forces working for and against issuing profit warnings so we should not be surprised that only a subset of firms warn.

The source of data on profit warnings is the news section of Bloomberg database. Companies were identified using the code words "warn" and "UK", to select profit warnings from United Kingdom only. This data is only available since August 1997. This classification produced nearly 2800 news items in the period August 12th, 1997 to December 31st 1999. This is the latest date we collect profits warning data since we want to be able to trace returns for two years from the date of the warning and at the time of writing we have data on returns up to December 31st 2001. Fama (1998) suggests that many reported anomalies may be the product of extensive data mining. It therefore may be worth noting that in this paper these two constraints meant that no discretion was possible in the choice of the data set.

We manually inspected the text of each of the statements picked up by the code word search. Many statements turned out to be trading updates which had no specific profit implications, and others merely confirmed current analyst expectations or reported good news. Companies were selected for our sample when we confirmed that the statement was unambiguously bad news. This statement might be either a qualitative statement that the earnings news would be disappointing relative to expectations or a specific revised forecast of earnings. This left 455 companies that unambiguously reported bad news.

Returns data was taken from Datastream. Out of 455 companies which issued negative warnings 450 survived for six full months after the warning. Of those that died within six months, three were reported by Datastream to have been liquidated and two merged or were taken over. In the case of firms which went into liquidation we assumed all shareholder value was lost. In the case of delisting because of merger or takeover we assumed the value of the shareholders funds on the last trading day were invested in the FTSE All Share Index for the remainder of the period after the day of delisting.

Excess returns are calculated in the evidence for momentum as, for example, the difference between the returns on a portfolio which consists of the 10% best performing stocks over the previous three months and a portfolio which consists of the 10% worst performing stocks over the previous three months. This corresponds to the experience of an investor who goes long in the top 10% portfolio and shorts the bottom 10% portfolio. We apply the same principle here, calculating excess returns as the difference between the returns of a stock which has issued a profit warning and the FTSE all share index.

$$ER_{it} = R_{it} - R_{mt} ,$$

where ER_{it} is the excess return of stock i on day t, R_{mt} is the return of stock i on day t and R_{mt} is the return on the FTSE all share index on day i.

In principle one would like to adjust excess returns for the difference between the risk of the firms which have issued warnings and the risk of the average firm in the FTSE all share index. However since the seminal paper of Fama and French (1992) has discredited the use of the CAPM model there is no widely agreed model of asset pricing to apply. Fama (1998) observes that use of an incorrect model to adjust returns can lead to substantial biases in measurement of multi-period returns. We observe that companies which have recently issued warnings are surely more risky than the average so that when excess returns are calculated relative to the all share index we can be almost sure of the sign of any measurement error. It will be seen below that this is useful in interpreting the significance of our results.

Multi period returns were obtained by cumulating daily returns from any date T_1 until τ:

$$CER_{i\tau} = \sum_{t=T_1}^{t=\tau} ER_{it}$$

Compounding returns would correspond to the actual experience of an investor who bought and held the stocks. However Fama (1998) argues that inferences about long term returns should be based on averages, or sums, of short horizon returns. He argues that compound returns should not be used because they also compound any error in measuring excess returns. This exacerbates any biases in estimates of long run excess returns which result from the use of the wrong model to measure excess returns. We therefore report cumulated returns.

3. Evidence of Momentum

In tables 1 and 2 and figure 1, we see results for market adjusted returns. On the day of the warning the average company loses 16.6% of its value. In the 5 days immediately after the warning there is, on average, no sign of any further price reaction. As explained earlier, subsequent excess returns accrue as the market comes to realise the true situation, to which it initially under reacted. Profit warnings are never issued within days of the final results and we should not be surprised that there is no further information within days of the warning.

The results are a significant rejection of the hypothesis that markets over react in the short term. Over the next 6 months, a window that will normally include the actual earnings announcement, cumulated average excess returns are –3.9% with a 't' statistic for a test of the null hypothesis that excess returns are zero equal to –1.75 (Table 1). Excess returns of almost 8% per annum are on the same scale as some of the larger anomalies surveyed in Fama (1998). Although this is of marginal statistical significance

note that in calculating excess returns relative to the all share index we are implicitly assuming that expected returns, and hence risk, for these stocks which have issued profit warnings is the same as for the average in the market. However companies which have issued profit warnings are almost surely more risky than the average. For example their gearing will certainly have increased so the sensitivity of equity returns to new information about shocks to earnings will have increased. Thus we would argue that the benchmark expected return will be greater than our measure. This implies that the excess returns of firms which have issued profits warnings will be even more negative than we calculated above.

Table 1

Excess Returns, "Market Adjusted"

Day	**0**	**1**	**2**	**3**	**4**	**5**
Excess Return	-16.65%	-0.14%	0.10%	-0.04%	-0.09%	0.09%
St. Deviation	13.54%	7.24%	4.30%	3.77%	3.41%	4.41%
T Stat	-26.233	-0.403	0.478	-0.252	-0.532	0.450

t = 0 , day of the profit warning
H_0 : Excess return in day *t* <> from 0

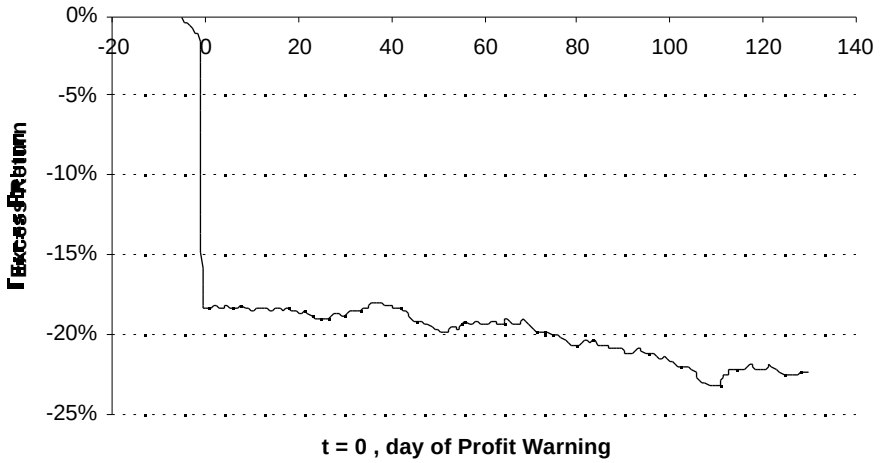
Table 2

Cumulated Excess Returns, "Market Adjusted"

	- 6 Months	**1 Month**	**3 Months**	**6 Months**
Mean CERt	-23.1%	-0.4%	-1.0%	-3.9%
St. Deviation	56.6%	17.8%	31.2%	48.0%
T Stat.	-8.711	-0.498	-0.653	-1.745

-6 Months: From t_1=-130 to t_2=-1 trading days
1 Month: From t_1= 1 to t_2= 22 trading days
3 Months: From t_1= 1 to t_2= 65 trading days
6 Months: From t_1= 1 to t_2= 130 trading days

Figure 1
Average Cumulated Excess Return from *t = -5* to *t = 130*



4. Evidence of long run returns reversal

In the six to twelve months after the warning, by which time the typical firm will have made its earnings announcement, stock prices drift, with small positive returns. However it is after approximately a year, 260 trading days, that the striking return reversal predicted by the Barberis et al. model is observed. This is approximately the time the reversal might be expected under their model, since 12 months after the warning takes the market to the point where signals about the subsequent full year's earnings might be expected to start to arrive. The market comes to realise that, for the typical stock, last year's fall in earnings should not have been extrapolated, and hence positive returns follow. Over the 12-24 months after the warning cumulated daily excess returns are approximately 23% relative to the market (Figure 2 and table 3). Of course compounding daily returns to obtain the buy and hold excess return of an investor yields an even larger percentage figure. We have argued above that these companies are surely more risky and therefore the excess returns calculated here are overestimated. However it seems implausible that risk adjustment can explain such large excess returns.

Figure 2
Average Cumulated Excess Return from *t = -5* to *t = 520*

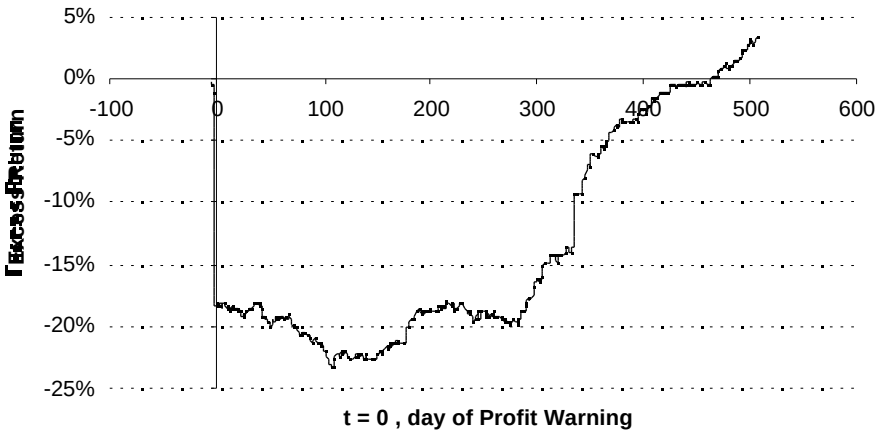


Table 3
Cumulated Excess Returns, "Market Adjusted"

	1 Year	2 Years	6 M - 2 years	1 - 2 years
Mean CERt	-0.7%	21.4%	25.7%	22.4%
St. Deviation	67.4%	114.1%	112.0%	103.4%
T Stat.	-0.216	4.001	4.889	4.625

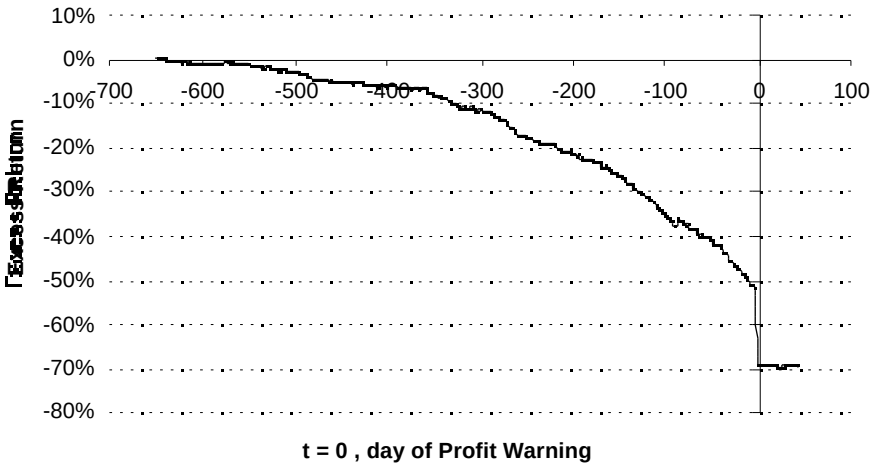
1 Year: From t_1= 1 to t_2= 260 trading days
2 Years: From t_1= 1 to t_2= 520 trading days
6 M – 2 Years: From t_1= 130 to t_2= 260 trading days
1 – 2 Years: From t_1= 260 to t_2= 520 trading days

5. Returns Prior to Profit Warnings

In Figure 3 we trace returns in the months before a warning. In terms of a "life cycle" of stock pricing it may be of interest to look at how far ahead the market started to get an indication of a bad earnings result to come. This looks like approximately two years before the warning. It is also interesting to see how much on average companies' stock prices fell since that time. The average daily rate over 650 days before the warning to one day before is –0.08%. Compounding this gives a loss in value for the average company of 41% until one day before the warning. By the time, companies reach their low point six months after the warning they have lost on average 51% of their value since two years before the warning.

Figure 3

Average Cumulated Excess Return from *t = -650* to *t = 50*



Although these results relating to returns prior to warnings may be of interest as descriptive statistics they cannot in principle offer evidence for or against the efficient markets hypothesis. Whilst the pattern in these returns is certainly consistent with momentum it is also entirely consistent with a rational expectations model of learning with noisy private signals about future earnings. We have conditioned the selection of this sample on the retrospective criterion that the firms finally delivered a bad earnings outcome (they never warn unless the outcome is actually bad). On this rational expectations interpretation there should be a universe of companies which also received "bad " signals and hence experienced negative returns of a cumulative –53% relative to the market, but subsequently turned out not to have a bad earnings realisation, so that their returns bounced back.

Although markets had been gradually learning that it was increasingly likely that these companies would deliver a bad earnings outcome there is evidence of insider trading in the two days immediately before the warning (see table 4). On average stocks lose approximately 0.3% percent of their value in each of the two days before the warning, against average daily returns of –0.18% over the previous six months. These are statistically significantly lower returns than daily returns over the previous six months. We can therefore reject the hypothesis that warnings are unanticipated.

Table 4

Excess Return compared with previous 6 months average daily return, "Market Adjusted"

Day	-5	-4	-3	-2	-1	0
Excess Return	-0.08%	-0.10%	0.15%	-0.34%	-0.32%	-16.47%
St. Deviation	2.48%	3.12%	2.91%	3.39%	3.07%	13.49%
T Stat	-0.710	-0.714	1.134	-2.137	-2.205	-26.049

H_0 : Excess return in day t <> from the average daily excess return of the six months before the day of warning

6. Conclusions

Fama (1998) has criticised the behavioural models we have tested here on the grounds that they do well on the anomalies which they were specifically designed to explain. Here we have subjected them to an "out of sample" test on data that was not available when they were developed. Both models imply short term momentum following new public information. This is exactly what we have reported above for the case of profit warnings. We also found strong evidence of long term reversals, following warnings, over the horizon which one would expect from the model of Barberis et al. Surveying the evidence on anomalies, Fama (1998) argued that all are fragile with respect to the method used to calculate excess returns. To this one could add that the size of many anomalies is such that, once a realistic value for transactions costs is allowed, the anomaly cannot be profitably exploited. We would argue that the scale of the evidence on returns reported in this paper is robust evidence against the efficient markets model in general and consistent with specific alternatives proposed in behavioural finance.

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