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Earnings momentum strategies, such as buying stocks with positive estimate revisions and selling those with negative revisions, are popular among investment managers. This follows from a number of studies that have showed stock prices do not fully reflect the information in earnings surprises and estimate revisions (Givoly and Lakonishok [1979]; Bernard and Thomas [1989, 1990]; and Scott, Stumpp, and Xu [1999]). Bernard and Thomas found that earnings surprises tend to be followed by more surprises in the same direction, which explains why stocks with positive earnings surprises tend to continue to outperform while stocks with negative earnings surprises tend to underperform. Chan, Jegadeesh, and Lakonishok [1996] showed that estimate revisions and earnings surprises are positively autocorrelated and that a large portion of excess returns on price momentum can be explained by the persistence of estimate revisions. These findings are consistent with a much larger body of empirical evidence on investor underreaction to public information (Ikenberry, Lakonishok, and Vermaelen [1995]; Womack [1996]; Desai and Jain [1997]; and Daniel, Hirshleifer, and Subrahmanyam [1998]) and others have provided behavioral models to explain these and other market anomalies.

As earnings momentum strategies have gained popularity among investors, the positive correlation between estimate revisions and subsequent excess returns appears to have reversed. Bernstein [2004]; Jha [2004], and Zeng [2004] all found a breakdown of estimate revision models in recent years. Zeng, for example, showed that from 2000 to 2003 a long-short portfolio that buys stocks with positive estimate revisions and shorts stocks with negative estimate revisions would have lost 8% a year over that interval. Jha [2004] reported similar findings and concluded that the results were attributable to a gradual decrease in the ability of past revisions to explain future revisions and to a temporary decrease in market reaction to estimate revisions.

While a decrease in serial correlation and a decrease in market reaction to concurrent estimate revisions might explain a decrease in the payoff to earnings momentum strategies, they do not explain why excess returns and past estimate revisions have been negatively correlated in recent years. Jha [2004] showed that the serial correlation of estimate revisions, while lower, was still significantly positive over the recent interval even though the excess returns on estimate revisions were negative.

In this article, we investigate another hypothesis; that is, while revisions continued to be positively correlated over the last few years, stock prices more than adequately reflected the level of persistence of estimate revisions and thus resulted in subsequent reversals in stock prices. This hypothesis is motivated by the fact that estimate revision measures are now commonly used by investment managers, which has possibly caused the technique to lose its effectiveness.

Understanding the real culprit behind the failure of estimate revision strategies has important implications for investment management. If analysts' estimate revisions are no longer biased, perhaps reflecting better research and greater objectivity, or regulatory pressure, or both, then estimate revisions and other related measures should be dropped from investment managers' stock-picking models. If, however, analysts' revisions continue to be biased, then such bias remains a possible source for alpha and the key is to determine how much of the bias is already reflected in stock prices.

Using First Call analyst data from 1992 through 2004, we find that estimate revisions, whether measured using consensus or individual analyst data, exhibited positive serial correlation throughout this interval. In fact, when estimate revision is measured using the change in the most recent forecast, there is a significant increase in serial correlation after 1999. Our results suggest that over the last few years, investors overreacted to analysts' estimate revisions, possibly a result of over extrapolating the strategy's success in earlier periods. This overreaction by investors resulted in stock prices that more than adequately reflected the true sustainability of estimate revisions, causing stocks with positive estimate revisions to subsequently underperform and stocks with negative estimate revisions to outperform.

We first use a popular diffusion index to measure estimate revision and present evidence of the perverse estimate revision effect in recent years. We then present a model that measures the persistence of estimate revisions expected by investors. We compare this expected persistence of estimate revisions to the actual level of persistence warranted by analyst behavior. We replicate these procedures using the change in the most recent forecast as a measure of estimate revision.

EXCESS RETURNS ON ESTIMATE REVISION

Previous researchers have used different measures of estimate revision. In this article, we start with a diffusion measure similar to that used in Scott, Stumpp, and Xu [1999, 2003], and Zeng [2004]. Specifically, at the beginning of each quarter from the first quarter of 1992 through the third quarter of 2004, we calculate the total number of net upward revisions made over the previous quarter of the 12-month forward earnings estimate and divide it by the total number of estimates. In calculating the total number of net upward revisions and the total number of estimates, we use the weighted averages for the current and next unreported fiscal years, with weights depending on how much of the next 12-month interval falls into each of the two fiscal years. Let UPY_1 and UPY_2 be the numbers of upward revisions over the previous quarter of earnings forecasts for fiscal years 1 and 2, respectively, and let DNY_1 and DNY_2 be the numbers of downward revisions. Let w_1 and w_2 be the weights, and let NY_1 and NY_2 be the numbers of estimates for the two fiscal years. Our diffusion measure of estimate revision is thus ($w_1 * UPY_1 + w_2 * UPY_2 - w_1 * DNY_1 - w_2 * DNY_2$) divided by ($w_1 * NY_1 + w_2 * NY_2$).

Our universe includes all constituents in the S&P 500 and the S&P Midcap indices in each quarter. We decided not to use a broader universe because smaller and more illiquid stocks outside of these two indices might skew our results.

To examine the payoff on estimate revisions, we rank all stocks into quartiles based on our diffusion measure and look at the average excess return for each group in the subsequent quarter. We define excess return as the difference between the return on a stock and the average return of all stocks in the sample in the same quarter. Since year 2000 is often cited as the year that the estimate revision strategies started to falter, we break our sample period into two subperiods: 1992 through 1999 and 2000 through 2004.

Exhibit 1 shows that estimate revisions worked well prior to 2000 but were perverse thereafter. Between 1992 and 1999, stocks in the top quartile of estimate revisions outperformed the average stock by 0.65% per quarter, while stocks in the bottom quartile underperformed by 0.68%. Between 2000 and 2004, however, stocks in the top quartile significantly underperformed, while stocks in the bottom two quartiles significantly outperformed. These results are consistent with other studies that also found a reversal of fortune for revisions-based investment strategies.

One possible explanation for this perverse estimate revision effect in recent years is that estimate revisions were negatively correlated over the interval (i.e., stocks with positive or negative revisions in one quarter were more likely to have revisions of opposite direction in the next quarter).

Exhibit 2 sorts stocks into quartiles based on both estimate revisions in the previous quarter and estimate

EXHIBIT 1

Average Quarterly Excess Returns on Estimate Revisions, 1992–2004

At the end of each quarter we rank all stocks in our sample into quartiles based on a diffusion measure of estimate revision. The measure is equal to the number of net upward revisions of the 12-month forward earnings estimate divided by the total number of estimates. Excess return is calculated as the return of a stock minus the average return of all stocks in the sample in the same quarter. The numbers of observations are in parentheses.

Estimate Revision Quartile	1992–1999	2000–2004	1992–2004
1 (low)	-0.68* (6704)	0.88* (4190)	-0.08 (10894)
2	-0.12 (6743)	1.11* (4187)	0.35 (10930)
3	0.14 (6718)	-0.43 (4187)	-0.08 (10905)
4 (high)	0.65* (6706)	-1.55* (4195)	-0.20 (10901)

* *Significantly different from zero at 99% level.*

revisions in the current quarter. First, the numbers of observations are highly concentrated on the diagonals for both intervals. For example, from 1992 through 1999, of the 6,706 observations in the top quartile based on estimate revisions in the previous quarter, more than half fall into the top quartile again next quarter. Similarly, most of the stocks in the bottom quartile in the previous quarter fall into the bottom quartile again next quarter. The results are similar for the latter subperiod. It is clear that estimate revisions are highly positively correlated in both periods.

Second, if the reason behind the perverse estimate revision effect in recent years was that investors had too high an expectation of the persistence of estimate revisions, then one should see a larger market reaction when investors were disappointed (i.e., when estimate revisions actually changed direction). This indeed seems to be the case. For example, over the interval from 2000 through 2004, the average excess return on stocks that were in the top-revision quartile in the previous quarter and fell to the bottom quartile in the current quarter was –18.66%, while stocks in the bottom quartile in the previous quarter that rose to the top quartile in the current quarter had an average excess return of 15.42%. These excess returns were larger in magnitude relative to those on similar stocks during the interval from 1992 through 1999. The findings suggest that investor expectations were too high and that prices more than adequately reflected the persistence of estimate revisions and thus resulted in subsequent reversals in stock prices.

THE MODEL AND TEST RESULTS

We now present a model to estimate both the actual and expected persistence of estimate revisions. The actual persistence of estimate revisions is simply calculated by relating estimate revisions in one quarter to those in the previous quarter. The expected persistence of estimate revisions is estimated from market reactions to estimate revisions in the same quarter.

We assume that estimate revisions follow a simple first-order autoregressive process. Let V_t be estimate revision in quarter t, so that we have

$$V_t = c_1 + c_2 * V_{t-1} + e_t \tag{1}$$

where c_2 measures the portion of estimate revision that persists from one quarter to the next quarter. We have omitted subscript i, which typically denotes stock i, but assume that Equation (1) holds for all stocks.

Investors are assumed to know that estimate revisions are serially correlated in a process as illustrated in Equation (1), but they form their own estimates of c_1 and c_2, which we call c_1' and c_2'. Thus, in quarter t-1, investors' expected estimate revision for the next quarter is

$$E_{t-1}(V_t) = c_1' + c_2' * V_{t-1} \tag{2}$$

where c_2' measures the expected persistence of estimate revision.

We assume that in quarter t the excess return on a stock is simply a linear function of any unexpected estimate revision, namely, the difference between the actual and expected estimate revisions. Let XRTNt be the excess return in quarter t. We then have

$$XRTN_t = b * (V_t - E_{t-1}(V_t)) + e_t \tag{3}$$

Substituting Equation (2) into Equation (3), we have[1]

$$XRTN_t = b * (V_t - c_1' - c_2' * V_{t-1}) + e_t \tag{4}$$

We use pooled regression to estimate Equation (1) and a Gauss-Newton non-linear least squares procedure to estimate Equation (4).

EXHIBIT 2

Average Quarterly Excess Returns on Past and Current Estimate Revisions

At the end of each quarter we rank all stocks in our sample into quartiles based on 1) estimate revisions in the current quarter and 2) estimate revisions in the previous quarter. Estimate revision in any quarter is the number of net upward revisions of the 12-month forward earnings estimate divided by the total number of estimates. Excess return is calculated as the return of a stock minus the average return of all stocks in the sample in the same quarter. The numbers of observations are in parentheses.

Panel A. 1992–1999

Estimate Revision in Previous Quarter	Estimate Revision in Current Quarter				
	1 (low)	2	3	4 (high)	All
1 (low)	-6.73(3253)	2.32(1976)	5.88(974)	14.32(501)	-0.68(6704)
2	-9.37(1908)	-0.16(2180)	3.74(1646)	11.19(1009)	-0.12(6743)
3	-12.11(987)	-2.68(1676)	1.57(2368)	8.11(1687)	0.14(6718)
4 (high)	-15.40(542)	-6.34(991)	-1.79(1654)	6.22(3519)	0.65(6706)
All	-8.98(6690)	-0.96(6823)	1.91(6642)	8.05(6716)	0.00(26871)

Panel B. 2000–2004

Estimate Revision in Previous Quarter	Estimate Revision in Current Quarter				
	1 (low)	2	3	4 (high)	All
1 (low)	-6.56(1846)	3.64(1279)	8.17(720)	15.42(345)	0.88(4190)
2	-8.78(1203)	0.34(1370)	6.16(1023)	14.42(591)	1.11(4187)
3	-13.57(736)	-3.46(997)	2.27(1394)	8.03(1060)	-0.43(4187)
4 (high)	-18.66(409)	-9.07(541)	-3.30(1066)	4.37(2179)	-1.55(4195)
All	-9.61(4194)	-0.77(4187)	2.81(4203)	7.63(4175)	0.00(16759)

To test for any change in parameter estimates from the earlier to the more recent period, we could either include a dummy variable in the equations or separately estimate the equations for each subperiod. We choose to estimate separately for each subperiod because we think the equations are easier to read and interpretations of parameter estimates are more straightforward. To evaluate the statistical significance of any change in a parameter estimate, we use the simple *t*-test of difference in means based on the standard error and, in the case of the non-linear procedure, the asymptotic standard error of the estimate.

The results are shown in Exhibit 3. Panel A shows the estimated actual AR(1) process of estimate revisions, while Panel B shows the estimated AR(1) process that is expected by investors. So, Panel A describes analyst behavior and Panel B shows investor expectations. Panel B also shows the coefficient on concurrent, unexpected estimate revisions.

Our focus is on how the actual persistence of estimate revisions compares to that expected by investors, and how the persistence of estimate revisions in the recent period compares to that for the earlier period. First, there is a decrease in the persistence of estimate revisions in the more recent period. Over the interval from 1992 through 1999, 50% of estimate revision in one quarter persists into the next quarter, while the number is 48.2% for the more recent period. Although small in percentage terms, the decrease is statistically significant. As will be discussed in

EXHIBIT 3

Actual and Expected Persistence of Estimate Revisions

In Panel A, we regress estimate revision in one quarter (V_t) on estimate revision in the previous quarter (V_{t-1}) in a pooled time-series regression. The coefficient measures how much of the estimate revision in one quarter persists into the next quarter. Estimate revision is the number of net upward revisions of the 12-month forward earnings estimate divided by the total number of estimates. In Panel B, we regress excess return on unexpected estimate revision. Excess return is calculated as the return of a stock minus the average return of all stocks in the sample in the same quarter. The numbers in parentheses are standard errors (Panel A) and asymptotic standard errors (Panel B), respectively.

Panel A. Analyst Behavior

Time period	Model Estimates
1992–1999	$V_t = -0.028 + 0.500 * V_{t-1} + e_t$ (0.003) (0.005)
2000–2004	$V_t = -0.025 + 0.482 * V_{t-1} + e_t$ (0.004) (0.007)

Panel B. Investors Expectations

Time period	Model Estimates
1992–1999	$XRTN_t = 17.7 * (V_t + 0.033 - 0.436 * V_{t-1}) + e_t$ (0.22) (0.005) (0.011)
2000–2004	$XRTN_t = 15.9 * (V_t + 0.020 - 0.599 * V_{t-1}) + e_t$ (0.30) (0.009) (0.016)

more detail later, our measure of estimate revision is subject to the effect of nonsynchronous revision activity by analysts. Thus, a decrease in the serial correlation may not necessarily mean less-biased forecasts. It could simply be attributable to timelier forecasts by analysts, possibly as a result of Regulation Fair Disclosure (Reg FD).

Contrary to a decrease in the actual persistence of estimate revision, there is a large increase in the persistence expected by investors that is implied in the market reaction to concurrent estimate revisions. As shown in Panel B of Exhibit 3, the portion of estimate revisions that investors expected to persist from one quarter to the next increased from 43.6% to 59.9%, and the change was statistically significant. The expected persistence was lower than the actual level of persistence from 1992 through 1999, but higher than the actual persistence in the more recent subperiod.

If the level of persistence of estimate revision expected by investors in the more recent period was higher than the actual persistence level in the same interval but lower than the actual persistence level in the earlier interval, one could argue that investors formed their expectations in the more recent period based on what they observed from the earlier interval but were surprised when the actual estimate revisions in the recent period turned out to be less correlated. That the expected persistence in the more recent period was higher than the actual persistence level in both intervals implies, however, that these expectations were somewhat irrational, possibly a result of too many investors chasing stocks with positive estimate revisions.

Panel B of Exhibit 3 also shows that the coefficient on unexpected estimate revisions dropped to 15.9 in the recent period from 17.7 in the earlier period. The smaller reaction to unexpected estimate revisions is consistent with the claim by Jha [2004]. But, again, a decrease in the serial correlation of estimate revisions and a decrease in the market reaction to unexpected concurrent revisions would only have resulted in smaller, but not perverse excess returns. The results in Exhibit 3 suggest that investor overreaction was the real culprit behind the failure of positive estimate revisions as a predictor of above-average future returns.

TESTS USING INDIVIDUAL ANALYST DATA

One disadvantage of the diffusion revision measure used in Exhibit 3 is that it is subject to the nonsynchronous bias in analysts' revision activity. Consider, for example, a stock followed by 10 analysts, who all forecast the current fiscal year earnings per share at $1.00. Suppose that the firm announces some good news, so that the new unbiased expected earnings are $1.05 per share. Suppose, however, that only 5 of the 10 analysts revise their forecasts to the new unbiased level, while the others, even though they agree on the new earnings forecast, do not submit their new forecasts until next quarter. This clearly results in a spurious positive serial correlation of our revision measure when, in fact, there is no bias on the part of the analysts. This explains why the serial correlation of our diffusion index and, for that matter, any consensus-based measure is always quite high. In this particular study, the spurious serial correlation makes it difficult to pick up any subtle change in analyst behavior.

In this section, we replicate the previous analyses using a new measure of estimate revision that is not biased by analysts' nonsynchronous revision activity. Specifically, we only look at the most recent forecast at the end of each quarter and test whether the changes in its value are serially correlated. Unlike the diffusion measure, which is a weighted average of revisions for two unreported fiscal years, we use only the latest earnings forecast for the fiscal year that is the current unreported fiscal year as of the end of the current quarter. This avoids getting non-zero revisions solely due to changes in the weights on different fiscal years. It is worth noting that the most recent estimates this quarter and the previous quarter may be from different brokers, and the current unreported fiscal year this quarter may have been the next unreported fiscal year one or two quarters ago. We normalize the change in this single estimate by the stock price at the end of each quarter.

Exhibit 4 shows the excess returns on the quartiles formed based on this new revision measure. There are clearly some differences from the results in Exhibit 1. Although there seems to be a positive payoff on the new revision measure over the period from 1992 through 1999, the excess returns are smaller than those using the diffusion measure and are no longer monotonic from the lowest to the highest quartile. Similar to the former revision metric, however, the payoff after 1999 is negative.

Exhibit 5 reports the actual and expected persistence of estimate revisions using the new measure. These are parameter estimates from the same tests used in Exhibit 3. As shown in Panel A of Exhibit 5, from 1992 through 1999, the coefficient on the previous quarter's revision was 0.054, meaning that, on average, 5.4% of the estimate revision in one quarter persists into the next quarter. This is substantially lower than for the diffusion measure because the new measure of estimate revision is not affected by the nonsynchronous bias in revision activity. During the same period, the investors' expected persistence of estimate revision is 3.4%. It is slightly lower than the actual level of persistence which is consistent with a positive but weak payoff on the revision quartiles reported in Exhibit 4.

Contrary to the results based on the diffusion measure, which showed a slight decrease in the persistence of estimate revisions, there is a significant increase in the persistence of estimate revisions from the earlier to the more recent interval based on the new measure. From 2000 through 2004, 19.9% of estimate revision in one quarter persists into the next quarter, compared to only 5.4% for the earlier interval. Judged by the much smaller asymptotic standard errors of the estimates, this increase in the level of persistence is relatively large.

EXHIBIT 4

Average Quarterly Excess Returns on Individual Analyst Estimate Revisions

At the end of each quarter, for each stock we take the difference between the most recent earnings forecast this quarter for the current unreported fiscal year and the most recent forecast for the same fiscal year one quarter ago, and divide it by the current stock price. We then rank all stocks in our sample into quartiles based on this measure of estimate revision. Excess return is calculated as the return of a stock minus the average return of all stocks in the sample in the same quarter. The numbers of observations are in parentheses.

Estimate Revision Quartile	1992–1999	2000–2004	1992–2004
1 (low)	-0.07 (6702)	1.03* (4181)	0.35 (10883)
2	-0.63* (6146)	-0.02 (4283)	-0.38 (10429)
3	-0.02 (7310)	-0.56 (4106)	-0.21 (11416)
4 (high)	0.67* (6713)	-0.45 (4189)	0.24 (10902)

* *Significantly different from zero at 99% level.*

EXHIBIT 5

Actual and Expected Persistence of Individual Analyst Estimate Revisions

In Panel A, we regress estimate revision in one quarter (V_t) on estimate revision in the previous quarter (V_{t-1}) in a pooled time-series regression. The coefficient measures how much of the estimate revision in one quarter persists into the next quarter. Estimate revision is calculated as the difference between the most recent earnings estimate this quarter for the current unreported fiscal year and the most recent estimate for the same fiscal year one quarter ago, divided by the current stock price. In Panel B, we regress excess return on unexpected estimate revision. Excess return is calculated as the return of a stock minus the average return of all stocks in the sample in the same quarter. The numbers in parentheses are standard errors (Panel A) and asymptotic standard errors (Panel B), respectively.

Panel A. Analyst Behavior

Time period	Model Estimates
1992–1999	$V_t = -0.0027 + 0.054 * V_{t-1} + e_t$ (0.0001) (0.006)
2000–2004	$V_t = -0.0035 + 0.199 * V_{t-1} + e_t$ (0.0002) (0.009)

Panel B. Investor Expectations

Time period	Model Estimates
1992–1999	$XRTN_t = 185.0 * (V_t + 0.0028 - 0.034 * V_{t-1}) + e_t$ (4.87) (0.0005) (0.026)
2000–2004	$XRTN_t = 185.8 * (V_t + 0.0033 - 0.271 * V_{t-1}) + e_t$ (5.40) (0.0008) (0.032)

The increase in the persistence of estimate revisions suggests that the perverse payoff on this estimate revision measure in the recent period could only be a result of excessive anticipation and overreaction by investors. Panel B of Exhibit 5 shows that over the period from 2000 through 2004, investors anticipated that 27.1% of estimate revision would persist from one quarter to the next and were disappointed when the actual level of persistence was lower.

The large increase in the serial correlation of estimate revisions from the earlier to the recent subperiod was surprising to us. Although we expected the serial correlation to continue to be positive, we thought its magnitude for the two periods would be similar. We believe that this large increase in the serial correlation does not mean that analyst estimates became more biased in the last few years. Because the parameters are estimated over fairly short intervals, they are affected by the unique macroeconomic trends that prevailed over each interval. Over a longer time period, we expect the serial correlation of estimate revisions to be a good measure of the bias in analyst estimates.

The increase in the persistence of estimate revisions based on individual analyst data does not necessarily contradict the slight decrease in the persistence using the consensus-based diffusion measure. As discussed earlier, the diffusion measure is affected by the nonsynchronous bias in revisions. Thus, the decrease in the persistence of estimate revisions using the diffusion measure could be entirely due to analysts revising their estimates in a timelier manner in the latter, or more recent, subperiod.

SUMMARY

In this article, we have shown that estimate revisions continue to exhibit positive serial correlation. We have also shown that, depending on how estimate revision is measured, the level of persistence of estimate revisions in recent years may have increased. Our results suggest that the failure of estimate revision strategies over the last few years was likely caused by investor overreaction, possibly as a result of over extrapolating the success of those strategies in earlier periods.

For investment managers who use estimate revisions to select stocks, the past few years have been disappointing. That does not mean, however, they should now ignore estimate revisions or switch sides to bet against stocks with positive estimate revisions. Just as the success of estimate revision strategies in earlier years attracted more investors, likely causing these strategies to lose profitability, their recent failure may have persuaded enough investors to abandon them, thus paving the way for a possible renaissance. As experience shows, investors who chase the investment style currently in fashion tend to be whipsawed by the constantly changing forces in the stock markets.

Not abandoning estimate revisions does not mean, however, that changes should not be made in how estimate revisions are used. As we have shown, estimate revisions continue to be serially correlated and thus remain a possible source for alpha. The critical task is to determine how much of the information in past estimate revisions is already reflected in stock prices and then to act accordingly. Clearly, a sound stock selection method should properly balance valuation against earnings momentum.

ENDNOTES

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[1]We chose excess return as the dependent variable to be consistent with Exhibits 1 and 2; that is, we are using surprise estimate revision as the only explanatory variable for excess returns. Alternatively, we could estimate equation $RTN_t = c_0 + b * (V_t - c_1' - c_2' * V_{t-1}) + e_t$, where RTN_t is the raw return on a stock. However, such an equation is intractable because c_0 and c_1' are somewhat redundant. If one views c_0 as the average return attributable to all other non-revision-related factors, then the equation is equivalent to Equation (4).

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