Price, Earnings, and Revenue Momentum Strategies

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December, 2009

Preliminary and incomplete: Please do not cite

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Abstract

In view of the evidence of significant earnings and revenue drifts following firm announcement, this study examines the profitability and its behavior of revenue momentum strategy in conjunction with the previously documented price momentum and earnings momentum strategies. Several interesting and new results emerge from our tests. We first provide new evidence of significant revenue momentum profit and confirm the price and earnings momentum profits. Next, the comparison tests indicate that price momentum generates profit largest in size and then earnings momentum and revenue momentum, whereas none is found to dominate among these three strategies. This latter result implicates that each measure, being prior returns, earnings surprise or revenue surprise, offers investors unique firm-specific information to some extent. More interestingly, the momentum strategies based on multivariate sorts further indicate that the profitability of one momentum strategy (e.g., price momentum) depends on another (e.g., revenue momentum). That is, investors tend to evaluate these information jointly while react to them inefficiently, leading to significantly more improved profit from combined momentum strategies. In particular, a combined momentum strategy utilizing all three measures is found to yield a monthly return as high as 1.57%.

1. Introduction

Based upon efficient market hypothesis propose by Fama (1970), it was generally believed that securities markets can immediately and accurately reflect all information about individual stocks and the stock market as a whole. To achieve the hypothesis of market efficiency, a crucial assumption is information efficiency. That is, the new arising information is incorporated into the prices of securities without delay. However, financial economists have been puzzled by two robust and persistent anomalies in the stock market. One is that over short-term horizons of 3 to 12 months, future stock returns are positively related to past stock returns, which phenomenon is first documented by Jegadeesh and Titman (1993) and also known as the price momentum. Another is that stock prices continue to move in the direction of earnings surprise after the announcement, which finding is first documented by Ball and Brown (1968) and known as the post earnings announcement drift. More recently, Jegadeesh and Livnat (2006b) find significant abnormal returns during the post-announcement period for stocks with large revenue surprise after controlling for earnings surprises. In particular, the size of the drift following the earnings announcement is found to increase with the contemporaneous size of the revenue surprise when these two signals move in the same direction. They suggest that earnings surprises that are accompanied by revenue surprises signal more persistent earnings growth.

Several evidences show that, besides earnings, revenues also play an important role on revealing firm performance. Ertimur et al. (2003) and Ghosh et al. (2005) suggest that manipulations of revenue are more difficult and easier to detect than manipulations of expenses. Moreover, analysts usually provide revenue forecasts in additional to

earnings forecasts to their customers in security analysis. When reading earnings announcement reports, the performances of companies are usually revealed in terms of earnings and revenues. Such earnings and revenue reports are obtained by investors earlier than other performance-related information or other financial statement information. Based upon reasons discussed above, a growing body of recent literature focuses on the role of revenue. For example, Lee and Zumwalt (1981) find that both earnings and revenue information are important to determine price returns. Bagnoli et al. (2001) find that revenue surprises, but not earnings surprises, can explain stock prices both during and after the internet bubble. Swaminathan and Weintrop (1991) and Ertimur et al. (2003) suggest that market reactions to revenue surprises are significantly stronger than expenses surprises. Rees and Sivaramakrishnan (2001) and Jegadeesh and Livnant (2006b) also find that, conditional on earnings surprises, the market responses to the information conveyed by revenue surprises. These findings indicate that, though earnings and revenues share parts of their incremental information content, earnings and revenues still have their own incremental information content for investors and market adjustment.

In this study, we attempt to understand the information efficiency of different aspects of firm performance, including prior returns, earnings surprises, and revenue surprises. According to Jegadeesh and Livnat (2006a, 2006b), revenue surprise, provides an effective signal of a firm's earnings growth, though firm earnings is an important summary measure of firm operations. In an efficient market, stock price is expected to reflect all information relevant to the firm, including firm performance. Therefore, the information linkages from revenue to earnings, from earnings to stock price offer a venue for the analysis of profitability from momentum strategies based on revenue surprises,

earnings surprises and prior price performance. Based upon under-reaction assumption of Barberis et al. (1998) and Hong and Stein (1999), we propose that revenue surprises, earnings surprises or prior price return may successfully serve a reference measure for profitable investment strategies, say momentum strategies, if the following conditions hold. One is that each performance measure has additional information content different from the information content provided by the other two performance measures; and a second condition is that the stock price fails to incorporate such information in time, possibly arising from the investor under-reactions to revenue information. Moreover, Jegadeesh and Livnat (2006a and 2006b) find that stocks with largest revenue surprises experience higher abnormal returns than earnings surprises or revenue surprises do. Chan et al. (1996) find that when sorting prior price performances and earnings surprises together, the returns of zero investment portfolio are higher than those of single sorting. Such findings inspire us to investigate the market reaction toward the "joint information" among prior price return, earnings surprises, and revenue surprises. We suggest that these measures in pricing stocks may be contingent upon each other. That is, when it comes to security analysis, investors assess the information conveyed by each of these three performance measures jointly, instead of independently, with other performance measures. Testing the momentum returns based on the joint information of prior price returns, earnings surprises, and revenue surprises in comparison to the returns of single momentum strategies provides a venue to examine whether and how investors incorporate three performance measures jointly.

In this study, we first examine the correlations of earnings surprises, revenue surprises, and prior price performances. Results show that although earnings surprises, revenue surprises, and prior price performances share part of information content, there is

still a large portion of information content belong to their individual characteristics. Further, we use relative strength strategy (buy winner and sell loser) build by Jegadeesh and Titmen (1993) to obtain a price momentum strategy and use positive minus negative (PMN) strategy introduced by Chordia and Shivakumar (2006) to construct an earnings momentum strategy and a revenue momentum strategy. We find that the profits of three types of momentum strategies all exist persistently during the period 1974 to 2007. Based upon combined forecasting models developed by Granger and Newbold (1974), and Granger and Ramanathan (1984), we further introduce combined model to estimate momentum strategies.[1] After adjusted by market model or Fama-French three factor model, the effects of momentum strategies still exists. The findings indicate that, contrary to information efficiency, investors cannot fully reflect stock prices to the information of prior price returns, earnings surprises, and revenue surprises, especially for the stocks in the extreme deciles of prior price returns, earnings surprises, and revenue surprises.

In analysis of conditional and combined momentum profits, we find that the revenue momentum is no longer profitable among those loser stocks, indicating that investors jointly consider the information of prior price return, earnings surprises, and revenue surprises. We also introduce combined momentum strategies by two-way sorting and three-way sorting to consider three performance measures at the same time and implement them into tradable strategies. The results show that the profits of combined momentum strategies are improved, indicating that investors under-react toward both common and individual information contents of these three performance measures. It

[1] Lee et al. (1986) have developed a combined forecasting model to accounting beta and market beta. Lee and Cummins (1998) develop a combined model to estimate the cost of equity capital and find the combined model outperform the individual cost of equity capital estimates.

further confirms that the joint consideration of each additional information measures, whether it is prior returns, earnings surprises or revenue surprises, helps to significantly improve the performance of momentum strategies.

In the following paper, models and methodologies are developed in the section 2. Data and sample are described in the section 3. Empirical analysis and results are in the section 4. Finally, the summary and conclusion are in the section 5.

2 Models and Methodologies

2.1 Price Momentum Strategy

We construct price momentum strategies according to the approach suggested by Jegadeesh and Titman (1993). At the end of each month, we identify our sample as those stocks which have complete data available for their past J-month returns (J= 3, 6, 9, and 12) and subsequent K-month returns (K= 3, 6, 9, and 12). We rank those sampled stocks into deciles based on their prior J-month returns, and group the stocks into 10 equally weighted portfolios.[2] The top decile portfolio is called a "winner" and the bottom decile portfolio is called a "loser". We form a zero investment portfolio each month by having a long position in the winner portfolio and a short position in the loser portfolio, and we hold this portfolio for subsequent K months. The winner and loser portfolios are not rebalanced during the holding period. Under this strategy we revise 1/K of the stock holdings each month and the rest of stocks are carried over from the

[2] To construct combined strategies, we also group the sample firms into 5 portfolios. The results of single momentum strategies in 5 portfolio grouping are similar to the results of single momentum strategies in 10 portfolio grouping.

previous month. We thus obtain a series of zero investment portfolio returns, i.e., the returns to the price momentum strategy.[3]

2.2 Measures for Earnings Surprise and Revenue Surprise

The literature provides a selection of measures to estimate earnings and revenue surprises. There are generally two approaches to building the measures; one is based on historical earnings/revenue data and the other is based on analysts' forecasts. The empirical researches nonetheless demonstrate consistent post earnings announcement drift regardless of either method being applied to measure the earnings surprises.[4] On the other hand, the empirical literature offers inconsistent evidence as to whether revenues or expenses provide additional information content than earnings, mostly thanks to the different measures being applied.[5]

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[3] For example, toward the end of month *t*, the J=6, K=3 portfolio of winner consists of three parts: a position carried over from the investment at the end of month *t*-3 in the top deciles of firms with the highest past six-month performance, and two similar positions resulting from equal investments at the end of month *t*-2 and at the end of month *t*-1. At the end of month *t*, we liquidate the first position and create a new position which has the highest prior three-month price performance at time *t*.

[4] For examples, Foster et al. (1984) and Bernard and Thomas (1989) assume that the differences of quarterly EPS follow an AR(1) process and find that firms with highly unexpected earnings outperform firms with poorly unexpected earnings. Chen et al. (1996) analyze earnings momentum effects by applying three different earnings surprise measures, which are respectively built upon seasonal random walk model, cumulative abnormal stock return around the announcement date, and changes in earnings forecasts by analysts. Jegadeesh and Livnant (2006a) use a seasonal random walk model with a drift and analysts' forecasts model to estimate earnings surprises and find both approaches able to capture the drift following earnings surprises.

[5] For example, Wilson (1986), Hopwood and McKeown (1985), and Hoskin et al. (1986) estimated expected revenue and expenses based on historical data and find no additional information content in revenue and expenses. To the contrary, Jegadeesh and Livnant (2006b), also using historical data to estimate expected earnings/revenues, document evidence that earnings surprises and revenue surprises contain unique information when earnings/revenues are modeled to follow a seasonal random walk with a drift. Meanwhile, those studies measuring the surprises based on analyst forecasts do not necessarily share exactly the same conclusions. Swaminathan and Weintrop (1991) estimated expected revenue and expenses using Value Line forecasts and find that revenues offer incremental information content over earnings. Ertimur et al. (2003) find that the market reacts more to a dollar of revenue surprises than to a dollar of cost saving when using I/B/E/S analyst forecasts of revenue and earnings as basis to measure the surprises. Bagnoli et al. (2001) using First Call analyst forecasts find that revenue surprises, but not earnings surprises, can explain stock prices both during and after the internet bubble. Rees and Sivarakrishnan (2001) use I/B/E/S analyst forecasts and document that revenue surprises experience a

In measuring earnings/revenue surprises, there are respective advantages when it comes to estimating the expected earnings/revenues based on historical data or on analyst forecast data. The analyst forecast approach has the advantages that it does not suffer from the potential look-ahead bias problem,[6] and that it allows us to include in our sample those young firms which do not have sufficient historical accounting data required by the historical data approach. However, its major disadvantage is that we are forced to limit our sample to those firms with analyst forecast data available. Especially, our study requires not only the earnings forecast data but also the revenue forecast data, which are not available from I/B/E/S until year 1996, notwithstanding that even after 1996, many I/B/E/S sample firms still lack revenue forecasts. With such restrictions on our sample, the empirical results might be biased and lose their generality.

Weighing the pros and cons, this study elects to borrow the approach of Jegadeesh and Livnant (2006a and 2006b) and measure earnings surprises and revenue growth surprises based on historical earnings and revenues. Specifically, the earnings surprises for firm *i* in quarter *t*, measured as standardized unexpected earnings (SUE), is defined as

$$SUE_{i,t} = \frac{Q_{i,t} - E(Q_{i,t})}{\sigma_{i,t}} \quad (1)$$

where $Q_{i,t}$ is the quarterly earnings per share from continuing operations, $E(Q_{i,t})$ is the expected quarterly earnings per share prior to earnings announcement, and $\sigma_{i,t}$ is the standard deviation of quarterly earnings growth.

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significant positive relation to announcement-period returns.

[6] Historical data of earnings/revenues might suffer a look-ahead bias to the extent that some input data are not available at the time we calculate earnings and revenue surprises, considering that Compustat only reports restated accounting data.

Considering both the seasonality and the trend in firm earnings, we follow Jegadeesh and Livnat (2006b) and assume that the quarterly earnings per share follow a seasonal random walk with a drift. In particular, we use the earnings per share in the same quarter of previous year, instead of earnings per share in the previous quarter, as a component to proxy for the earnings expectation, which approach takes into account the seasonality of earnings. In addition, we accommodate possible trend in earnings growth by including a drift term in the expected earnings. The drift term, $\partial_{i,t}$, is calculated from the average growth of previous eight quarters. In particular, the expected quarterly earnings per share for firm *i* and quarter *t* is estimated by

$$E(Q_{i,t}) = Q_{i,t-4} + \partial_{i,t} \tag{2}$$

and

$$\partial_{i,t} = \frac{\sum_{j=1}^{8}\left(Q_{i,t-j} - Q_{i,t-j-4}\right)}{8}. \tag{3}$$

The estimator for the standard deviation of quarterly earnings growth, $\sigma_{i,t}$, for computing SUE is

$$\sigma_{i,t} = \frac{1}{7}\sqrt{\sum_{j=1}^{8}\left(Q_{i,t-j} - Q_{i,t-j-4} - \partial_{i,t}\right)^2}. \tag{4}$$

The same method is applied to measure revenue surprises, specifically standardized unexpected revenue growth (SURGE), which is defined as

$$SURGE_{i,t} = \frac{REV_{i,t} - E(REV_{i,t})}{\xi_{i,t}}, \tag{5}$$

where $REV_{i,t}$ is the quarterly revenue of firm *i* in quarter *t*, $E(REV_{i,t})$ is the expected quarterly revenue prior to earnings announcement, and $\xi_{i,t}$ is the standard deviation of quarterly revenue growth. To deal with possible seasonal effects and trend effects in quarterly revenues, we again assume the quarterly revenue to follow a seasonal random walk with a drift. That is, the expected quarterly revenue per share and the drift term are estimated as follows:

$$E(REV_{i,t}) = REV_{i,t-4} + \delta_{i,t} \tag{6}$$

and

$$\delta_{i,t} = \frac{\sum_{t=1}^{8}\left(REV_{i,t-j} - REV_{i,t-j-4}\right)}{8}. \tag{7}$$

For computing SURGE, the standard deviation of quarterly revenue growth is estimated by the year-to-year growth of revenue for the prior eight quarters, i.e.,

$$\xi_{i,t} = \frac{1}{7}\sqrt{\sum_{j=1}^{8}\left(REV_{i,t-j} - REV_{i,t-j-4} - \delta_{i,t}\right)^2} \tag{8}$$

2.3 Measuring the Profitability of Earnings Momentum and Revenue Momentum Strategies

In order to evaluate the information effect of earnings surprises and revenue surprises on stock returns in comparison to that of prior price performance, we construct an earnings momentum strategy as designed by Chordia and Shivakumar (2006). At the end of each month, we sort sample firms by SUE and group firms into 10 deciles[7]. Dec

[7] Note that we sort the sample firms into 5 quintile portfolios on each criterion in our later construction of combined momentum strategies. To conform to the same sorting break points, we also test the single momentum strategies based on quintile portfolios and find the results remain similar to those based on decile portfolios.

1 includes those stocks with the most negative earnings surprises, and Dec 10 includes those with the most positive earnings surprises. The SUEs used in every formation month are obtained from the most recent earnings announcements that were made within 3 months before the formation date. Similar to the price momentum strategy, we hold a zero investment portfolio, long the most positive earnings surprises portfolio and short the most negative earnings surprises portfolio, for K (K= 3, 6, 9, and 12) subsequent months and the portfolios are not rebalanced during the holding period. Such positive minus negative strategy (PMN) holds K different long-positive and short-negative portfolios each month. Accordingly, we obtain a series of zero investment portfolio returns, which are the monthly returns to this earnings momentum strategy.

Similarly, we apply this positive-minus-negative method to construct a revenue momentum strategy. At the beginning of each formation period, we hold long positions in those stocks with the most positive revenue surprises and short positions in those with the most negative revenue surprises, and we keep the zero investment portfolio for K subsequent months. A series of monthly returns from revenue momentum strategy is obtained as a result.

3 Data and Sample

3.1 Data

We collect from COMPUSTAT the basic firm information, the earnings announcement date, and the firm accounting data. Stock prices, stock returns, share codes, and exchange codes are retrieved from the Center of Research in Security Prices

(CRSP) files. The sample period is from 1974 to 2007. Only common stocks (SHRCD = 10, 11) and firms listed on NYSE, AMEX, or NASDAQ (EXCE = 1, 2, 3, 31, 32, 33) are included in our sample. We exclude regulated industries (SICH=4000-4999) and financial institutions (SICH = 6000-6999)[8]. We also exclude firms with stock price below $5 on the formation date, considering that investors generally only have limited attentions paid to such stocks.[9] For the purpose of estimating their SUE, SURGE and prior price performance, firms in our sample should have at least 8 consecutive quarterly earnings announcements and 6 consecutive monthly returns before each formation month. To examine the return drift following the estimated earnings surprises, revenue surprises and prior price performance, firms in our sample need to have at least 12 consecutive monthly returns after each formation month. Firms in our sample should also have their corresponding SUE, SURGE, size and book-to-market factors available in each formation month.[10]

3.2 Description of Sample

Table 1 presents the summary statistics for firm size, estimates of SUE and estimates of SURGE for our sample firms during the period between year 1997 and year 2007. Panel A shows that there are 217,361 firm-quarters during the sample period.[11]

[8] We filter out those financial institutions and regulated industries based on historical SIC code (SICH) available from COMPUSTAT. When a firm's historical SIC code is unavailable for a particular year, the next available historical SIC code is applied instead. When a firm's historical SIC code is unavailable for a particular year and all the years after, we use current SIC code (SIC) from COMPUSTAT as a substitute.

[9] We also repeat our analyses by including stocks below $5 in our sample. The unreported results are similar to those that exclude stocks below $5.

[10] When calculating SUE (or SURGE), we replace the zero variation of earnings per share (or revenue) with 0.000001 to avoid the problem of infinity.

[11] As partitioning the data by years (not reported in Table 1), it shows that the sample size increases from 4,167 firm-quarters in 1974 to 9,077 firm-quarters in 1998 and then slightly declines to 7,689 firm-quarters in 2006. And, we only get 3,668 firm-quarters in 2007 due to the lack of ex post price and return data after the sample filtration conditions.

The median market capitalization is 208 million dollars.

Panel B and Panel C of Table 1 describe the distributions of the earnings surprises (SUE) and the revenue surprises (SURGE) across firms of different market capitalizations and different book-to-market ratios.[12] We find that around 51% of earnings surprises and 55% of revenue surprises are positive.[13] Such positively skewed distributions suggest either that firms tend to outperform the expectations in terms of their earnings and surprises or that our models do not well capture the expected earnings and revenues.

(Insert Table 1 Here)

It is reasonable to expect SUE and SURGE to be significantly correlated. After all, a firm's income statement starts with revenue (sales) and ends with earnings; these two attributes may well share common firm operational information to a great extent. With the finding of earnings momentum profitability in previous studies, if the information content in revenue surprises is similar to that in earnings surprises, it is not surprised that we also observe significant returns to revenue momentum strategies.

We calculate both Pearson's correlations and Spearman's rank correlations among earnings surprises, revenue surprises and prior returns at the end of each month.[14] Table

[12] To ensure that the firm accounting information is available to the public investors at the time the stock returns are recorded, we follow the approach of Fama and French (1992) and match the accounting data for all fiscal year ending in calendar year t-1 with the returns for July of year t to June of t+1. The market capitalization is calculated by the closing price of the last trading day of June of that year times the number of outstanding shares at the end of June of that year.

[13] To reduce the impact from outliers, we winsorize SUE and SURGE at the 5% and 95% levels based on the cross-sectional distributions of these variables obtained for each given six-month period. We obtained similar results by winsorizing SUE and SURGE at the 2.5% and 97.5% levels.

[14] The measures of SUE, SURGE and prior price performance are aligned at the end of each month based on their most recently available data. To obtain the rank values, we group sample firms into 10 decile

2 shows the time-series average of those cross-sectional correlations over the period between 1974 and 2007. Panel A and Panel B present respectively the Pearson's correlations and Spearman's rank correlations, which results are general similar. The average correlation between SUE and SURGE is 0.32, while the prior price performance is not as much correlated with SUE or SURGE, with correlations equal to 0.19 and 0.14 respectively. We further partition the sample by B/M ratio and size. Value firms and small firms are shown to have higher correlations among SUE, SURGE, and prior price performance when compared to growth firms and large firms. Though the larger correlations found in value firms and small firms, due to small differences from all sample averages, we cannot conclude that SUE, SURGE, and prior price performance are highly correlated in particular B/M ratio or size categories.

Table 2 also shows the fractions of months with non-zero correlations significant at 1% level. These numbers again confirm that the correlations between SUE and SURGE tend to be most strongly correlated, followed by those between SUE and prior returns, and then those between SURGE and prior returns. The preliminary results of Table 2 support the conclusion of Swaminathan and Weintrop (1991) and Jegadeesh and Livnant (2006b) that earnings surprises and revenue surprises contain unique incremental information for the firm. Meanwhile, the information content of prior price performance is distinctive from that of revenue surprises or earnings surprises.

(Insert Table 2 Here)

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portfolios by SUE. Those firms with the lowest SUEs are assigned to decile 1 and those with the highest SUEs are assigned to decile 10. Similarly, we separately sort sample firms on their SURGEs and on their prior 6 month returns.

4 Results

This section discusses the empirical results of momentum strategies exercised according to firms' earnings surprises, revenue surprises and prior price performance. With the identified profits from these momentum strategies, we will further attempt to find connections among these three momentum returns, considering that a firm's revenue, earnings and market price are fundamentally related attributes.

4.1 Earnings, Revenue, and Price Momentum Strategies

In this section, we will first examine the profitability of momentum strategies based on firms' earnings surprises, revenue surprises or prior price performance. Table 3 presents the monthly returns to such momentum strategies based on single sorts, which are termed as earnings momentum, revenue momentum and price momentum strategies respectively. Panel A shows the performance of price momentum strategies, which use previous six-month returns of common stocks to rank the portfolios and hold the momentum portfolios for 3, 6, 9 or 12 months. Similar to the results of Jegadeesh and Titman (1993), price momentum strategies are profitable and robust for all the tested holding periods. These strategies yield an average monthly return of 1.06%, 1.09%, 0.98%, and 0.73% respectively for holding the relative-strength portfolios for 3, 6, 9, and 12 months; these returns are both statistically and economically significant.

Panel B of Table 3 reports the results for the earnings momentum strategies. We again find that these PMN zero-investment portfolios yield significantly positive returns for holding periods ranging from 3 to 12 months. The profit is strongest when the PMN portfolios are held for 3 months, leading to an average monthly return of 1.07% at a 1%

significance level. The results are consistent with those of Bernard and Tomas (1989) and Chordia and Shivakumar (2006). For example, Chordia and Shivakumar (2006) find a significant monthly return of 0.96% on a 6 month holding period earnings momentum strategy executed from 1972 to 1999, while our results show a significant monthly return of 0.77% with sample period being extended into year 2000s. Furthermore, in comparison to price momentum portfolios, the profitability of these earnings momentum portfolios tends to drop faster as the holding period extends from 3 to 12 months. However, the persistence of these momentum strategies into longer terms will be further examined later in this study.

The price momentum and earnings momentum strategies have been previously tested by other studies. This research attempts to offer further evidence on the profitability of revenue momentum. In particular, we are interested to know whether the finding of post-announcement revenue drift also offers a base for constructing a profitable strategy. Following a similar strategy of earnings momentum suggested by Chordia and Shivakumar (2006), we define a revenue momentum portfolio as a zero investment portfolio by buying stocks with the most positive revenue surprises and selling stocks with the most negative revenue surprises, where revenue surprises are proxied by SURGE. Panel C of Table 3 reports the results, indicating significant returns to the revenue momentum strategies. However, in comparison to price momentum and earnings momentum portfolios, the revenue momentum strategy yields profits that are smaller in magnitude and relatively short lived, with the returns diminishing to an insignificant level when the holding period is extended to 12 months.

(Insert Table 3 Here)

We next examine whether the profitability of momentum strategies vary with firm size and B/M ratios, which attributes may proxy for other firm characteristics in the literature. Table 4 reports the results. Panel A lists the momentum returns when the sample firms are partitioned into three groups by market capitalization. The profits of all three momentum strategies are found to decrease with firm size and to be most robust for the small sized firms. This pattern holds for any cases of holding period lengths from 3 to 12 months. Indeed, the large sized firm group (top 30%) is shown to have significant price momentum returns while only insignificant earnings and revenue momentum returns. Such finding can be explained by transaction cost. Since large firms tend to have lower transaction costs for investors, Jegadeesh and Titman suggest that, when investors find any momentum profitability, these larger firms tend to be targeted by investors due to their lower transaction costs. As a result, any momentum returns in the very short term will be wiped out much faster for large firms than small firms.[15] The other reason is that investors usually focus on large and famous stocks. Once price, earnings, or revenue related information of large firms released, the prices of large firms will response such information more quickly and more precisely.[16] The level of under-reaction is relatively small for large firms. Therefore, momentum effect is relatively weak for large firms. This finding of the size effect is already well documented by Jegadeesh and Titman (1993), Hong et al. (2000), and Rouwenhorst (1998) for price momentum and by Banz (1981), Reinganum (1981), Keim (1983), Ball

[15] Whaley (1983) find that transaction costs associated with small firms are consistently larger than transaction cost associated with large firms.

[16] Atiase (1980) proposes a "firm size-related differential information hypothesis" that the amount of private predisclosure information is an increasing function of firm size. Based on this notion, Atiase (1985) show that large firms have less unexpected information conveyed to the market by the earnings announcement, which in turn decrease the magnitude of both price and volume reaction.

and Kothari (1991), and Chordia and Shivakumar (2006) for post earnings announcement drift or earnings momentum.

Panel B of Table 4 lists the momentum returns when sample firms are partitioned by their book-to-market ratios. High B/M or value firms (top 30%) are found to exhibit the strongest returns to price momentum, earnings momentum and revenue momentum strategies. On the other hand, those low B/M or growth firms (bottom 30%) only demonstrate weaker or even insignificant profits to these momentum strategies. This observation suggests that growth firms tend to react to information, whether being prior price performance, earnings surprises or revenue surprises, more efficiently compared to value firms.[17] Under such circumstance, value firms suffer under-reaction to information of prior price performance, earnings surprises, and revenue surprises and momentum effects can be observed.

(Insert Table 4 Here)

4.2 Risk Adjustment for Asset Pricing Model

With the significant profits found from revenue momentum strategies, the next question will then be whether this evidence suggests another asset pricing factor that can be proxied by revenue surprises. Following a similar approach by Fama and French (1996) and Jegadeesh and Titman (2001), we implement the simple market model and Fama-French three factor model to examine whether the momentum returns can be

[17] This implication is derived under the assumption that the under-reaction explanation for momentum returns holds. Barberis et al. (1998) propose that, due to the conservatism bias and the representativeness bias of investors, the market has characteristics of initial under-reaction and subsequent overreaction. Lee and Swaminathan (2000) show that high trading volume stocks, more like growth stocks, experience fast momentum reversal. Under the assumption of Bareris et al. (1998) and observation of Lee and Swaminathan (2000), growth firms tend to react to new information more efficiently.

explained by existing pricing factors. We perform the following regressions for this purpose.[18]

$$Mom_{i,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + e_{i,t} \quad (1)$$

$$Mom_{i,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + e_{i,t} \quad (2)$$

Here, Mom_t denotes the monthly returns obtained from price momentum, earnings momentum and revenue momentum strategies.

The results are listed in Table 5. First, the results for price momentum and earnings momentum in Panels A and B are not new to the literature (e.g., see citations…) and generally confirm the conclusion of Fama (1998) that price momentum profits and post earnings announcement drift remain significant with reasonable changes in model specifications. The intercept terms from the above regressions indicate that the excess returns of price momentum and earnings momentum portfolios remain significant after proper risk adjustment, whether through a simple market model or a Fama-French three-factor model. Next, Panel C lists the results for revenue momentum, which were not previously reported in the literature. We find that these risk-adjusted returns from revenue momentum strategies still remain significant. The market risk premium, size factor, and book-to-market factor, though serving to capture partial effects from revenue momentum strategy, are still unable to explain away the returns entirely. The FF-3 factor adjusted return still remains strong at 0.82% with a *t* statistic equal to 7.29.

(Insert Table 5 Here)

[18] We obtain monthly data of market return, risk free rate, SMB, and HML from Kenneth R. French's Homepage (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/).

4.3 Persistence of Momentum Effects

In this section, we compare the persistence of momentum effects driven by prior price performance, earnings surprises and revenue surprises. If the momentum effects arise from investor under-reactions, it is an interesting issue to explore how long it takes investors to adjust their valuation in accordance with proper information. Table 6 presents the cumulative returns of these momentum strategies. The formation period is kept at 6 months, and the cumulative returns are calculated up to 36^{th} month. Panel A shows that the profits of price momentum portfolios remain drifting upward for 11 months since the portfolio formation and start to reverse thereafter. The cumulative returns remain significant at 2.85% on monthly terms over 36 months after the portfolio formation. This suggests that the under-reaction toward prior price performance is still not fully adjusted or reversed even after three years. In Panel B, the profits of momentum portfolios based on earnings surprises, though are not as large in magnitude as price momentum in short term, demonstrate greater persistency than price momentum, with the cumulative returns continuing to drift upward for 23 months since the portfolio formation. The cumulative returns still remain significant at 4.86% three years after the portfolio formation. In comparison, Panel C shows that the zero investment portfolios built upon revenue surprises only maintain its return momentum for 7 months. The buy and hold returns diminish to be insignificant 19 months after the portfolio formation.

Figure 1 depicts the above patterns of the average cumulative returns under three independent momentum strategies. Among these momentum strategies, the price momentum generates the largest cumulative returns when the portfolio is held for about one year, while earnings momentum demonstrates the most persistent performance, with

returns growing up to 2 years after the portfolio formation. That is, if momentum profits arise from investors' under-reactions toward the information carried by earnings surprises, it takes approximately 2 years for investors to fully adjust their stock valuation. On the other hand, the momentum profit built upon revenue surprises, by itself, seems to be neither as persistent nor as strong as the other two strategies. This then leads to our next research issue, i.e., the incremental information content carried by revenue surprises is contingent upon other factors. Or, the importance of revenue surprises is circumstantial in that it depends on a firm's prior price performance or its earnings. => 4.5 (will do it later - cw)

(Insert Table 6 Here)

(Insert Figure 1 Here)

4.4 Comparison of Three Momentum Strategies

Price momentum and earnings momentum have long posed big puzzles in the areas of finance and accounting. Recent studies have examined the pricing sources of returns to these momentum strategies,[19] and some suggested that price momentum and earnings momentum may well each proxy for a pricing factor in addition to the Fama-French three factors [e.g., see Carhart (1997) and Chordia and Shivakumar (2006)]. A handful of other studies have looked into the possibility that the returns to these momentum strategies may share similar pricing sources [e.g., see Chan et al., (1996), Chordia and Sivakumar (2006) and Jegadeesh and Livant (2006b)]. These interesting findings

[19] For example, Moskowitz and GrinBlatt (1999), Lee and Swanminathan (2000), Griffin et al. (2003), and Chordia and Shivakumar (2002) have respectively found that price momentum can be partially explained by industries, trading volume, and business cycle. Chordia and Shivakumar (2005) suggest that post earnings announcement may result from inflation illusion.

inspire us to explore whether one of these three momentum strategies dominates the other two momentum strategies or subjects to the other two momentum strategies..

Indeed, stock price represents the firm value evaluated by investors in the aggregate based upon their available information; whilst the most important information for investors is undoubtedly firm earnings, which summarizes firm performance; moreover, Jegadeesh and Livnat (2006) point that an important reference for investors regarding the persistence of firm earnings is offered by firm revenue information. Obviously, these three members of firm-specific information, stock price, firm earnings and firm revenues, are fundamentally inter-related and should have significant implications toward each other. It follows that the momentum returns driven by the corresponding innovation measures, prior returns, earnings surprises and revenue surprises, may well share similar sources. Specifically, price momentum, earnings momentum and revenue momentum returns may simply be results of under-reactions toward the common information. If this is the case, we expect to see these momentum strategies conditional on other performance measures will be not profitable. In this section, we apply pairwise nested comparison model introduced by George and Hwang (2004) and test whether a particular momentum strategy can dominate the other strategies.

Table 7 reports the results of pairwise nested comparisons in three panels. Panel A compares revenue momentum strategy against earnings momentum strategy. There are two groups in the pairwise nested comparison. In the first group, stocks are sorted by earnings surprises, then each of those quintiles is further subdivided by revenue surprises. We can find that, conditional on earnings surprises, revenue momentum strategy is still profitable significantly in all quintile levels of earnings surprises. The zero investment

returns with six months holding period are from 0.25% to 0.38%. However, the insignificant F-statistics cannot reject the hypothesis that revenue momentum profits are all equal in different level of earnings surprises. In the second group, stocks are first grouped by revenue surprises, the by earnings surprises. The returns of earnings momentum strategy conditional on revenue surprises are also significantly profitable. Moreover, the insignificant F-statistics cannot reject the hypothesis of equal earnings momentum profits in all level of revenue surprises. The results indicate that neither earnings momentum strategy can dominate revenue momentum strategy nor revenue momentum strategy can dominate earnings momentum strategy. The existence of earnings momentum (revenue momentum) profits is probably from the under-reaction to the information content belong to earnings surprises (revenue surprises).

In comparing earnings momentum strategy against price momentum strategy, Panel B presents similar results that the nesting returns of price momentum strategy and earnings momentum strategy are still significantly profitable. Due to the large earnings momentum profits in winner portfolio (0.79%), the hypothesis of equal earnings momentum profits in all level of prior price performance is rejected. However, the significant earnings momentum (price momentum) profits in all level of prior price performance (earnings surprises) still suggest that earnings surprises (prior price performance) has its own information content independent to prior price performance (earnings surprises). Such information content cannot be fully reacted by the market immediately and contributes earnings momentum (price momentum) effect.

Panel C of Table 7 shows that returns of revenue momentum strategy conditional on prior price performance are still profitable except in the group of loser. Although one

insignificant profit occurs in loser group, we cannot conclude that revenue momentum strategy is dominated by price momentum strategy. Above all, the pairwise nested comparisons from Table 7 show that three performance measures have their individual information contents which are not fully reflected by the market. It also indicates that combining such individual information contents will improve the profitability of momentum strategies. Moreover, the different magnitudes of momentum returns in different sorting groups imply that investors jointly consider three performance measures at the same time. In the following section, we will further examine the issue of joint information and the profits of combined momentum strategies.

(Insert Table 7 Here)

4.5 Combined Momentum Strategies

As discussed earlier, the significance of information content carried by prior price performance, by earnings surprises and by revenue surprises may well be contingent upon each other. Our next primary objective is therefore to examine this issue by testing whether the additional information of earnings surprises, revenue surprises or prior returns serves to improve the performance of single momentum strategies based on single characteristic. Indeed, the literature has offered some empirical evidence in support of this suggestion. For example, Jegadeesh and Livnat (2006a and 2006b) find that post earnings announcement drift tends to be stronger when earnings surprises and revenue surprises are in the same direction. Chan et al. (1996) find that when sorting stocks on both prior price performance and earnings surprises, the returns of zero investment portfolio improve over those based on single sorting. After all, prior stock returns, earnings surprises and revenue surprises all represent a particular aspect of the

performance of a commons stock. Stock returns represent the firm value assessed by investors. Earnings is a summary measure of firm operating performance. Revenue is the basis and primary component of earnings and more importantly, it contains important implications on the persistence of a firm's future earnings (Jegadeesh and Livnat, 2006). Considering the fundamental linkages among these three measures and the existing empirical findings, this study further explores the profitability of portfolios formed on, not just one single measure, but multiple performance measures of a firm, i.e., prior returns, earnings surprises and revenue surprises.

Starting with the combined effects from price momentum and earnings momentum, we sort stocks into quintiles based on six-month prior returns and then independently into quintiles based on earnings surprises during the six-month formation period on each portfolio formation date. We label these prior return quintiles P1-P5, where P1 is the loser quintile and P5 is the winner quintile. Similarly, those independently sorted SUE quintiles are labeled as E1-E5, with E1 representing the most negative SUE quintile and E5 the most positive SUE quintile. Panel A of Table 8 presents the returns of these 25 2-way sorted portfolios.[20] The intersection of P1 and E1 is the portfolio formed by the most losing stocks and stocks with the lowest SUE, while the intersection of P5 and E5 represents the portfolio formed by the most winning stocks and stocks with the highest SUE. The returns to the combined momentum strategies are listed in the right-most column and the bottom row of the panel.

The results in Panel A of Table 8 show that the combinatory momentum strategies,

[20] To ensure a minimum of 10 stocks for each portfolio, we sort our stocks into quintiles, instead of deciles in the earlier one-way sorting, on each characteristic in these 2-way sorts. This thus leads to 25 2-way sorted portfolios on each formation date.

based on prior price performance and earnings surprises, all generate significantly positive returns. For example, the price momentum strategies executed among those lowest SUE stocks yield a monthly return of 0.56%, while the price momentum executed among the highest SUE stocks yield a monthly return as high as 1.04%. On the other hand, the earnings momentum executed among the loser stocks yield a monthly return of 0.34%, while the earnings momentum executed among the winner stocks yield a monthly return of 0.82%.

Most interestingly, if we buy those stocks with the highest prior returns and the highest SUE (P1|E1) while sell those stocks with the lowest prior returns and the lowest SUE (P5|E5), the portfolio yields a monthly return as high as 1.33%, which is greater than the (single) momentum return earned on the basis of prior price performance only (0.83%) or on the basis of earnings surprises only (0.63%). This provides additional evidence in support of the suggestion that prior price performance and earnings surprises each plays a unique informational role. In particular, the result of improved profits from combined momentum strategies suggests that prior price performance (earnings surprise) carries incremental information beyond those inferred from earnings surprises (prior price performance) and that such incremental information is not fully and timely reflected from market prices.[21]

Next, we apply similar sorting procedures to perform the combined momentum strategies based on prior price performance and SURGE. The results are presented respectively in Panel B of Table 8. Panel B shows that the price momentum strategies

[21] Strictly speaking, this inference requires a statistical significance between the returns from combined momentum strategies (P5|E5 – P1|E1) and the returns from single momentum strategies (P5-P1 or E5-E1). The results are confirmed in our later analysis in Table 8. Similar requirements are applicable for the later two combined strategies.

yield an average monthly return from 0.41% to 1.19% contingent upon different levels of SURGE, and that the revenue momentum strategies yield a return ranging from merely 0.02% to 0.83% per month. In addition, investors earn an average monthly return of 1.21% by buying those stocks with both the most winning prior returns and the highest SURGE (P5|R5) and selling those stocks with both the most losing prior returns and the lowest SURGE (P1|R1). This combined strategy again outperforms either the stand-alone price momentum (0.83%) or revenue momentum strategy (0.49%), suggesting that prior price performance (earnings surprise) carries additional information compared to those inferred from revenue surprises (prior price performance) and that such incremental information is not fully and timely reflected from market prices.

Finally, Panel C shows the results for the combined earnings momentum and revenue momentum strategies. The revenue momentum generates a monthly return of 0.32% to 0.42% for varying levels of earnings surprises. The earnings momentum leads to a monthly return of 0.45% to 0.60%. Investors earn an average monthly return of 0.89% buying those stocks with both the highest SUE and the highest SURGE (E5|R5) and selling those stocks with both the lowest SUE and the lowest SURGE (E1|R1). This again outperforms either the stand-alone earnings momentum (0.63%) or revenue momentum strategy (0.49%). Similarly, that the momentum strategies based on double information outperforms those based on single information indicates that revenue surprises (earnings surprises) carry incremental information beyond those inferred from earnings surprises (revenue surprises) and that such incremental information is not fully and timely reflected from market prices.

This study attempts to understand the information content and information

efficiency of different aspects of firm performance, which could be prior returns, earnings surprise or revenue surprise, and their inter-relationships, when it comes to stock valuation. The above results suggest i) that the implication of each performance measure for firm intrinsic value is contingent upon other measures, ii) that investors assess the information conveyed by each performance measure jointly with other performance measures, and iii) that each performance measure carries unique information beyond those inferred from another measure and that such incremental information is not fully and timely reflected from market prices.

(Insert Table 8 Here)

Following similar procedure as above, we further sort stocks into quintiles based on prior price performance, SUE, and SURGE independently and simultaneously to obtain 3-way sorted portfolios. Those results for paired momentum strategies in Table 8 have indicated that the consideration of each additional measure helps to improve the performance of momentum portfolios. If we buy those stocks with the best of each measure and sell those stocks with the worst of each measure, we have 'price-earnings momentum strategy' to earn a monthly return of 1.33%, 'earnings-revenue momentum strategy' to earn a monthly return of 0.89%, and 'price-revenue momentum strategy' to earn a monthly return of 1.21%. Based on the 3-way sorts, we may now construct a 'price-earnings-revenue combined momentum' strategy by buying those stocks with the highest prior returns, the most positive earnings surprises and the most positive revenue surprises (P5|E5|R5), and selling those stocks with the lowest prior returns, the most negative earnings surprises and the most negative revenue surprises (P1|E1|R1). This then leads to a monthly momentum return of 1.57%, which is higher than any of those

paired momentum strategies discussed above. Table 9 summarizes the returns on all these momentum strategies based on 1-way sorts, 2-way sorts or 3-way sort. We also test for the significance of the differences in the portfolio performance. The result is strikingly straightforward. The joint consideration of each additional information measures, whether it is prior returns, earnings surprises or revenue surprises, helps to significantly improve the performance of momentum strategies.

(Insert Table 9 Here)

4.6 Seasonality

Jegadeesh and Titman (1993) find that winners outperform losers in all months except January and losers outperform winners in January, leading positive profits for price momentum strategy in all month except January and negative profits for price momentum strategy in January. Chordia and Shivakumar (2006) also find a significant seasonality in returns to earnings momentum strategy. Here, we try to examine whether revenue momentum strategy and the combined momentum strategies also exhibit similar seasonality as in the case of price momentum and earnings momentum strategies.

Table 10 documents the seasonality in returns to univariate momentum strategies as well as the combined momentum strategies. The results show that, for all types of momentum strategies, momentum profits in January are either negative or insignificantly different from zero. F-tests reject the hypothesis that the returns to momentum strategies are equal in January and in non-January months. Therefore, our results conclude that the momentum strategies based on either the univariate information or the joint information of prior returns, earnings surprise and revenue surprise all yield positive non-January returns and insignificant January returns.

(Insert Table 10 Here)

4.7 Momentum strategies using dependent sorts versus independent sorts

The preceding results of combined momentum strategies are based on portfolios formed by independent sorts. If those measures are independent from each other, the grouping results from dependent sorts will be the same as those from independent sorts. The correlation analysis in Table 2 however indicates the case otherwise. The advantage of independent sorts is that it offers the same break points for all partitions. This also makes the presentation easier. However, a possible ill consequence of independent sorts is that one cannot fairly analyze the momentum returns to one measure contingent upon a given level of another measure, if these two measures are highly correlated. For example, if SUE and SURGE are highly positively correlated, those stocks assigned to the highest SUE quintile also tend to have large SURGE. Independent sorts will thus leave few component stocks in the portfolio with both the highest SUE and the lowest SURGE. Such unbalanced and insufficiently diversified grouping makes one unable to fairly evaluate the effect of SURGE on returns for those stocks with high SUE.

In order to examine possible impacts from independent sorts, we also repeat those multivariate momentum strategies with dependent sorts. Table 11 presents the returns and the associated *t*-statistics to 2-way and 3-way sorted combined momentum strategies using independent sorts or dependent sorts. The results show that for 2-way sorted combined momentum strategies, the returns obtained from dependent sorts are insignificantly different from those obtained from independents sorts. However, for the combined momentum strategies based on 3-way sorts, those portfolios formed by dependent sorts significantly outperform those momentum portfolios using independent sorts by 23% to 40%. (All other results however do not change materially as a result of

dependent sorts.) For the ease of presentation, we only list the results of combined momentum strategies formed by independent sorts, as shown in Table 8, Table 9, and Table 10.

(Insert Table 11 Here)

5 Summary and Conclusion

In this study, we try to understand the market efficiency toward different aspects of firm performance, including prior returns, earnings surprises, and revenue surprises. It is well known that stock price represents the firm value evaluated by investors in aggregate based upon their available information; whilst the most important information for investors is firm earnings, a summary measure of firm performance; moreover, another important reference for investors regarding the persistence of firm earnings is offered by firm revenue information. In an efficient market, stock price is expected to reflect all information relevant to the firm, including firm performance. Therefore, the information linkages from revenue to earnings, from earnings to stock price offer a venue for the analysis of profitability from momentum strategies based on revenue surprises, earnings surprises and prior price performance.

In this study, we use relative strength strategy (buy winner and sell loser) build by Jegadeesh and Titmen (1993) to obtain a price momentum strategy and use positive minus negative (PMN) strategy introduced by Chordia and Shivakumar (2006) to construct an earnings momentum strategy and a revenue momentum strategy. We find that the profits of three types of momentum strategies all exist persistently during the period 1974 to 2007. After adjusted by market model or Fama-French three factor

model, the effects of momentum strategies still exists. Based upon under-reaction assumption of Barberis et al. (1998) and Hong and Stein (1999), our findings indicate that investors cannot fully reflect stock prices to the information of prior price returns, earnings surprises, and revenue surprises, especially for the stocks in the extreme deciles of prior price returns, earnings surprises, and revenue surprises.

We further investigate the market reaction toward the "joint information" among prior price return, earnings surprises, and revenue surprises. We find that the revenue momentum is no longer profitable among those loser stocks. That is, when it comes to security analysis, investors assess the information conveyed by each of these three performance measures jointly, instead of independently, with other performance measures. However, the fact that investors evaluate price by performance measures jointly is not conflict to the fact that each performance measure has its additional information content different from the information content provided by the other two performance measures. The results pariwise nested comparisons show that each performance measure still has its own information content, and the stock price fails to incorporate such information content in time.

Due to the finding of individual information contents held by performance measures, we investigate that the combined strategies by combining two different performance measures and all three performance measures. We find that returns to combined momentum strategies outperform returns to individual momentum strategies, and returns to 3-way sorting combined strategy outperform those to 2-way combined strategies. Such results further support the hypothesis that each performance measure has its unique information content which market cannot response efficiently. Furthermore, we believe that these findings would be useful for security analysis and portfolio management.

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Table 1. Summary Statistics of Sample Firm Characteristics

This table presents the descriptive statistics for those major characteristics of our sample stocks. Our sample includes those stocks listed on NYSE, AMEX, NASDAQ with data available to compute book to market ratios, revenue surprises and earnings surprises. All financial service operations and utility companies are excluded. Firms with prices below $5 as of the earnings announcement date are also excluded. Panel A lists the numbers of firm-quarter observations for small and large firms respectively during the period between January 1974 and December 2007. Panel B and Panel C respectively list the mean and median values for the measure of earnings surprises (SUE) and for the measure of revenue surprises (SURGE) across all firm-quarters in our sample. Those descriptive statistics of positive surprises, negative surprises, and zero surprises are presented separately. Sample firms are also classified into bottom 30%, middle 40%, and top 30% groups by their respective market capitalizations or book-to-market ratios.

Panel A: Sample Size and Firm Market Capitalization

	Number of Firm-Quarters	Market Cap (Thousand Dollars)			
		Mean	Median	Min	Max
ALL	217,361	2,000,918	208,375	714	524,351,578

Panel B. Descriptive Statistics of SUE

	Positive SUE				Negative SUE				Zero SUE
	N	Mean	Median	STD	N	Mean	Median	STD	*N*
ALL	109,974	2.41	1.90	1.90	107,370	-2.84	-2.08	2.40	17
Growth	33,511	2.37	1.91	1.83	31,682	-2.96	-2.27	2.41	1
Mid-BM	42,809	2.39	1.87	1.91	44,153	-2.85	-2.09	2.41	11
Value	33,654	2.47	1.93	1.95	31,535	-2.69	-1.90	2.37	5
Small	33,137	2.48	1.96	1.94	32,048	-2.71	-1.94	2.35	9
Mid-Size	42,956	2.39	1.87	1.90	44,009	-2.87	-2.13	2.41	8
Large	33,881	2.36	1.88	1.85	31,313	-2.91	-2.17	2.43	0

Panel C. Descriptive Statistics of SURGE

	Positive SURGE				Negative SURGE				Zero SURGE
	N	Mean	Median	STD	N	Mean	Median	STD	*N*
ALL	119,717	3.29	2.84	2.31	97,644	-2.89	-2.53	2.03	0
Growth	37,935	3.48	3.06	2.36	27,259	-2.86	-2.47	2.05	0
Mid-BM	46,992	3.28	2.83	2.32	39,981	-2.92	-2.57	2.04	0
Value	34,790	3.10	2.62	2.24	30,404	-2.86	-2.51	1.99	0
Small	35,759	3.16	2.68	2.27	29,435	-2.83	-2.48	1.99	0
Mid-Size	47,497	3.31	2.87	2.32	39,476	-2.92	-2.56	2.04	0
Large	36,461	3.39	2.95	2.34	28,733	-2.89	-2.52	2.04	0

Table 2. Correlation among Earnings surprises, Revenue surprises and Prior Price Performance *(revised)*

This table presents the correlations among SUE and SURGE and prior returns of our sample firms. At the end of each month, each sample firm should have its corresponding most current SUE, most current SURGE, and previous 6 month return. SUE and SURGE are winsorized at 5% and 95%, setting all SUE and SURGE values greater than the 95th percentile to the value of the 95th percentile and all SUE and SURGE values smaller than the 5th percentile to the value of the 5th percentile. Panel A lists the average Pearson's correlations among SUE, SURGE, prior returns between 1974 and 2007. Panel B lists the average Spearman's rank correlations, where all sample firms are grouped into 10 portfolios based on SUE, SURGE, and prior-6-month-returns independently at the end of each month. Decile 1 portfolio consists of those firms with the smallest value of the attribute (SUE, SURGE or prior 6 month returns) while Decile 10 consists of those with the largest value of the attribute. The correlations are calculated at the end of each month. The values reported in the table are monthly averages of those correlations. Sample firms are further classified into bottom 30%, middle 40%, and top 30% groups by their respective market capitalizations or book-to-market ratios at the end of the formation months. The numbers in parentheses are the average t-statistics under the null hypothesis that the correlation is zero. '***', '**' and '*' indicate statistical significance at 1%, 5% and 10%, respectively. Percentages in brackets represent the fraction of the months with non-zero correlations that are significant at 1% level.

Panel A. Correlations among *SUE*, *SURGE*, and *Prior-6-month-returns*

Correlated Variables	All Firms	Sub-sample by B/M			Sub-sample by Size		
		Value	Mid	Growth	Small	Mid	Large
(SUE, SURGE)	0.3149***	0.3355***	0.3472***	0.2673***	0.3729***	0.3349***	0.2608***
	(93.24)	(87.26)	(94.15)	(64.39)	(96.04)	(92.91)	(60.88)
	[99.5%]	[97.8%]	[99.5%]	[99.8%]	[98.8%]	[100%]	[98.8%]
(SUE, Prior returns)	0.1874***	0.2353***	0.2057***	0.1247***	0.2513***	0.2022***	0.1212***
	(65.45)	(64.11)	(59.98)	(34.42)	(69.19)	(57.72)	(32.17)
	[98.8%]	[85.8%]	[93.8%]	[59.8%]	[90.0%]	[93.5%]	[53.5%]
(SURGE, Prior returns)	0.1441***	0.1745***	0.1530***	0.1244***	0.1882***	0.1538***	0.1070***
	(43.65)	(49.09)	(43.04)	(26.72)	(48.38)	(43.34)	(22.24)
	[90.0%]	[61.0%]	[78.3%]	[58.0%]	[68.0%]	[79.8%]	[51.3%]

Panel B. Rank correlations among *SUE*, *SURGE*, and *Prior-6-month-returns*

Correlated Variables	All Firms	Sub-sample by B/M			Sub-sample by Size		
		Value	Mid	Growth	Small	Mid	Large
(SUE, SURGE)	0.3215***	0.3411***	0.3544***	0.2693***	0.3803***	0.3401***	0.2648***
	(101.92)	(99.65)	(104.94)	(66.26)	(113.59)	(97.08)	(63.11)
	[100%]	[99.0%]	[100%]	[100%]	[99.8%]	[100%]	[99.8%]
(SUE, Prior returns)	0.1846***	0.2490***	0.2038***	0.1195***	0.2620***	0.2005***	0.1179***
	(64.08)	(69.55)	(60.65)	(31.87)	(72.67)	(60.85)	(30.07)
	[98.5%]	[89.8%]	[94.8%]	[55.5%]	[92.0%]	[95.0%]	[49.3%]
(SURGE, Prior returns)	0.1435***	0.1733***	0.1515***	0.1205***	0.1890***	0.1545***	0.1043***
	(43.01)	(49.75)	(43.96)	(25.06)	(51.18)	(44.58)	(21.52)
	[87.5%]	[61.8%]	[77.0%]	[55.5%]	[70.0%]	[78.8%]	[50.0%]

Table 3. Returns to Earnings Momentum, Revenue Momentum and Price Momentum Strategies *(revised)*

This table presents monthly returns and the associated *t*-statistics from earnings, revenue, and price momentum strategies executed during the period from 1974 to 2007. Firms are sorted into 10 ascending deciles on the basis of previous 6 months returns. Portfolio of buying Decile 1 (winner) and selling Decile 10 (loser) are held for K (K=3, 6, 9, and 12) subsequent months and not rebalanced during the holding period. The average monthly returns of winner, loser, and price momentum strategies are presented in Panel A. For earnings momentum strategy, firms are grouped into 10 deciles based on the measure SUE during each formation month. Decile 1 represents the most negative earnings surprises and Decile 10 represents the most positive earnings surprises. The values of SUE for each formation month are computed using the most recent earnings announcements that were made within 3 months before the formation date. The zero investment portfolios, long the most positive earnings surprises portfolio and short the most negative earnings surprises portfolio (PMN), are held for K subsequent months and are not rebalanced during the holding period. Panel B lists the average monthly returns earned from the portfolio of those firms with the most negative SUE (Low), from the portfolio of those with the most positive SUE (High), and from the earnings momentum strategies (PMN). Revenue momentum strategies are developed with the same approach of earnings momentum strategies, by buying stocks with the most positive revenue surprises and selling stocks with the most negative revenue surprises. The zero investment portfolios are then held for K subsequent months. Panel C lists the average monthly returns earned from the portfolio of those firms with the most negative SURGE (Low), from the portfolio of those with the most positive SURGE (High), and from the revenue momentum strategies (PMN).

Panel A. Price Momentum Returns

Holding Period	Loser	Winner	Loser-Mid	High-Mid	WML
3 months	0.0092***	0.0198***	-0.0037*	0.0069***	0.0106***
	(2.42)	(5.21)	(-1.91)	(2.95)	(3.66)
6 months	0.0095***	0.0204***	-0.0045**	0.0063***	0.0109***
	(2.53)	(5.44)	(-2.36)	(2.93)	(4.11)
9 months	0.0107***	0.0205***	-0.0044**	0.0053***	0.0098***
	(2.90)	(5.54)	(-2.46)	(2.69)	(4.31)
12 months	0.0118***	0.0191***	-0.0035**	0.0038**	0.0073***
	(3.27)	(5.22)	(-2.08)	(1.98)	(3.58)

Panel B. Earnings Momentum Returns

Holding Period	Low	High	Low-Mid	High-Mid	PMN
3 months	0.0089***	0.0196***	-0.0039***	0.0067***	0.0107***
	(3.16)	(6.85)	(-6.37)	(9.73)	(11.29)
6 months	0.0108***	0.0186***	-0.0033***	0.0044***	0.0077***
	(3.82)	(6.46)	(-6.04)	(6.83)	(8.84)
9 months	0.0127***	0.0180***	-0.0026***	0.0026***	0.0053***
	(4.42)	(6.28)	(-4.98)	(4.40)	(6.45)
12 months	0.0138***	0.0170***	-0.0016***	0.0015***	0.0032***
	(4.80)	(5.98)	(-3.40)	(2.78)	(4.22)

Panel C. Revenue Momentum Returns

Holding Period	Low	High	Low-Mid	High-Mid	PMN
3 months	0.0086***	0.0182***	-0.0052***	0.0044***	0.0095***
	(3.03)	(5.97)	(-7.10)	(4.63)	(7.58)
6 months	0.0109***	0.0175***	-0.0037***	0.0028***	0.0065***
	(3.83)	(5.69)	(-5.54)	(3.11)	(5.39)
9 months	0.0131***	0.0169***	-0.0025***	0.0013	0.0038***
	(4.56)	(5.53)	(-3.81)	(1.53)	(3.18)
12 months	0.0144***	0.0160***	-0.0012*	0.0003	0.0015
	(5.01)	(5.29)	(-1.88)	(0.42)	(1.33)

Table 4. Momentum Returns Sorted by Size and B/M

This table presents sub-sample monthly returns and the associated *t*-statistics from earnings, revenue, and price momentum strategies executed during the period from 1974 to 2007. Sample firms are classified into bottom 30%, middle 40%, and top 30% groups by their respective market capitalizations or book-to-market ratios in the ends of their formation months. In each sub-sample, firms are sorted into 10 ascending deciles on the basis of previous 6 months returns, SUE, or SURGE. Portfolio of buying Decile 1 (winner, most positive SUE, or most positive SURGE) and selling Decile 10 (loser, most negative SUE, or most negative SURGE) are held for K (K=3, 6, 9, and 12) subsequent months and not rebalanced during the holding period. Panel A lists the average monthly returns of price, earnings, and revenue momentum strategies for 3 different size sub-sample. Panel B presents the average monthly returns of price, earnings, and revenue momentum strategies for 3 different book-to-market ratio sub-sample.

The average monthly returns of price, earnings, and revenue momentum strategies are presented in Panel A. For earnings momentum strategy, firms are grouped into 10

Panel A. Momentum Returns by Firm Size

	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
Small Size (bottom 30%)	3 months	0.0194***	0.0222***	0.0205***
		(5.72)	(13.43)	(11.71)
	6 months	0.0175***	0.0162***	0.0145***
		(5.74)	(11.29)	(9.50)
	9 months	0.0144***	0.0118***	0.0102***
		(5.42)	(9.05)	(7.37)
	12 months	0.0111***	0.0079***	0.0060***
		(4.42)	(6.74)	(4.69)
	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
Mid Size (middle 40%)	3 months	0.0120***	0.0124***	0.0118***
		(4.10)	(10.04)	(8.77)
	6 months	0.0114***	0.0089***	0.0085***
		(4.20)	(8.11)	(6.83)
	9 months	0.0104***	0.0061***	0.0054***
		(4.37)	(5.97)	(4.51)
	12 months	0.0077***	0.0037***	0.0031***
		(3.54)	(3.97)	(2.69)
	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
Large Size (top 30%)	3 months	0.0029	0.0019*	0.0022
		(0.91)	(1.67)	(1.33)
	6 months	0.0054*	0.0014	0.0004
		(1.91)	(1.34)	(0.29)
	9 months	0.0058**	0.0005	-0.0011
		(2.34)	(0.56)	(-0.71)
	12 months	0.0045**	-0.0002	-0.0022
		(1.97)	(-0.22)	(-1.54)

Panel B. Momentum Returns by B/M ratio

	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
Low B/M (bottom 30%)	3 months	0.0028	0.0029**	0.0038**
		(0.90)	(2.47)	(2.21)
	6 months	0.0057**	0.0021**	0.0019
		(2.01)	(2.00)	(1.18)
	9 months	0.0060**	0.0009	-0.0002
		(2.34)	(0.92)	(-0.11)
	12 months	0.0044*	0.0001	-0.0016
		(1.90)	(0.16)	(-1.10)
	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
Mid B/M (middle 40%)	3 months	0.0119***	0.0120***	0.0112***
		(3.86)	(9.55)	(8.56)
	6 months	0.0116***	0.0086***	0.0081***
		(4.17)	(7.78)	(6.85)
	9 months	0.0102***	0.0057***	0.0052***
		(4.33)	(5.71)	(4.67)
	12 months	0.0072***	0.0034***	0.0030***
		(3.43)	(3.68)	(2.82)
	Holding Period	***Mom(P) (WML)***	***Mom(E) (PMN)***	***Mom(R) (PMN)***
High B/M (top 30%)	3 months	0.0159***	0.0200***	0.0181***
		(4.91)	(13.07)	(10.71)
	6 months	0.0137***	0.0135***	0.0124***
		(4.95)	(10.21)	(8.50)
	9 months	0.0123***	0.0108***	0.0086***
		(5.26)	(8.89)	(6.60)
	12 months	0.0092***	0.0072***	0.0053***
		(4.22)	(6.49)	(4.44)

Table 5. Regression Results for the Momentum Portfolio Returns

This table presents the regression coefficients and *t*-statistics in parentheses from the CAPM and Fama-French three-factor model for the zero-investment portfolio returns earned from different momentum strategies ($MOM_{i,t}$) during the sample period from 1974 to 2007. The time-series regressions are as follows

$$Mom_{i,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + e_{i,t}$$

$$Mom_{i,t} = \alpha_i + \beta_{i,m}(R_{m,t} - R_{f,t}) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + e_{i,t}$$

Panel A reports the results for the monthly returns of price momentum portfolios, where firms are sorted into 10 ascending deciles on the basis of previous six months returns. The price momentum portfolios are formed by buying Decile 1 (winner) and selling Decile 10 (loser) and then held for six subsequent months. Panel B reports the regression results for the monthly returns of earnings momentum portfolios, where firms are grouped into 10 deciles based on the measure SUE during each formation month. The earnings momentum portfolios are formed by buying the stocks with the most positive SUE and selling the stocks with the most negative SUE; the portfolios are then held for six subsequent months. Panel C reports the regression results for the monthly returns of revenue momentum portfolios, where sample firms are grouped into 10 deciles based on the measure SURGE during each formation month. The revenue momentum portfolios are formed by buying the stocks with the most positive SURGE and selling the stocks with the most negative SURGE. The zero investment portfolios are then held for six subsequent months. The numbers in the parenthesis are *t*-statistics.

Panel A. Dependent Variable: Returns to Price Momentum Strategies - Mom(P)					
	α	***$R_m - R_f$***			***Adj-R2***
Rg. (1)	0.0111***	-0.0003			-0.0017
	(4.15)	(-0.57)			
	α	***$R_m - R_f$***	***SMB***	***HML***	***Adj-R2***
Rg. (2)	0.0105***	0.0002	-0.0022***	0.0008	0.0151
	(3.82)	(0.34)	(-2.57)	(0.81)	
Panel B. Dependent Variable: Returns to Earnings Momentum Strategies - Mom(E)					
	α	***$R_m - R_f$***			***Adj-R2***
Rg. (3)	0.0075***	0.0003			0.0021
	(8.58)	(1.35)			
	α	***$R_m - R_f$***	***SMB***	***HML***	***Adj-R2***
Rg. (4)	0.0081***	0.0001	-0.0005*	-0.0007**	0.0132
	(8.88)	(0.61)	(-1.86)	(-2.11)	
Panel C. Dependent Variable: Returns to Revenue Momentum Strategies - Mom(R)					
	α	***$R_m - R_f$***			***Adj-R2***
Rg. (5)	0.0057***	0.0013***			0.0594
	(4.80)	(5.09)			
	α	***$R_m - R_f$***	***SMB***	***HML***	***Adj-R2***
Rg. (6)	0.0082***	0.0006**	-0.0017***	-0.0033***	0.2219
	(7.29)	(2.13)	(-4.82)	(-8.32)	

Table 6. Cumulative Profits from Price Momentum, Earnings Momentum and Revenue Momentum Strategies

This table reports the cumulative returns of zero-cost momentum portfolio in each month following the formation period. *t* is the month after portfolio formation. Three different momentum strategies are tested. The sample period is 1974 to 2007. Panel A reports the results from the price momentum strategy. The price momentum portfolios are formed by buying Decile 1 (winner) and selling Decile 10 (loser) on the basis of previous six months returns. Listed are the cumulative portfolio returns for the loser portfolio, the winner portfolio and the price momentum portfolio. Panel B reports the results from the earnings momentum strategy, where firms are grouped into 10 deciles based on the measure SUE during each formation month. The earnings momentum portfolios are formed by buying the stocks with the most positive SUE and selling the stocks with the most negative SUE. Listed are the cumulative portfolio returns for the most-negative-SUE portfolio, the most-positive-SUE portfolio and the earnings momentum portfolio. Panel C reports the results from the revenue momentum strategy, where sample firms are grouped into 10 deciles based on the measure SURGE during each formation month. The revenue momentum portfolios are formed by buying the stocks with the most positive SURGE and selling the stocks with the most negative SURGE. Listed are the cumulative portfolio returns for the most-negative-SURGE portfolio, the most-positive-SURGE portfolio and the revenue momentum portfolio.

Panel A. Price Momentum				**Panel B. Earnings Momentum**				**Panel C. Revenue Momentum**			
t (month)	Loser (%)	Winner (%)	WMN (%)	*t* (month)	Negative SUE (%)	Positive SUE (%)	PMN (%)	*t* (month)	Negative SURGE (%)	Positive SURGE (%)	PMN (%)
1	1.24	1.84	0.60*	1	0.71	2.20	1.49***	1	0.69	1.99	1.30***
2	2.00	3.97	1.94***	2	1.61	4.15	2.52***	2	1.54	3.81	2.24***
3	2.71	5.90	3.16***	3	2.62	5.83	3.18***	3	2.54	5.43	2.86***
4	3.53	7.88	4.31***	4	3.76	7.48	3.69***	4	3.70	7.07	3.33***
5	4.46	9.96	5.46***	5	4.98	9.23	4.22***	5	4.93	8.74	3.77***
6	5.37	12.01	6.57***	6	6.21	10.91	4.64***	6	6.23	10.31	4.02***
7	6.28	14.06	7.71***	7	7.57	12.50	4.87***	7	7.66	11.75	4.02***
8	7.41	15.88	8.47***	8	9.12	14.01	4.90***	8	9.26	13.12	3.86***
9	8.71	17.66	8.95***	9	10.62	15.54	4.92***	9	10.92	14.54	3.62***
10	10.07	19.24	9.17***	10	12.16	16.89	4.73***	10	12.64	15.79	3.16***
11	11.57	20.76	9.19***	11	13.79	18.27	4.48***	11	14.40	17.15	2.75***
12	13.18	22.11	8.94***	12	15.47	19.71	4.23***	12	16.17	18.48	2.31***
13	14.70	23.18	8.48***	13	16.81	21.11	4.30***	13	17.63	19.73	2.09***
14	16.43	24.33	7.90***	14	18.21	22.59	4.39***	14	19.19	21.06	1.87***
15	18.08	25.46	7.38***	15	19.47	24.05	4.58***	15	20.57	22.31	1.74***
16	19.69	26.67	6.98***	16	20.86	25.59	4.73***	16	22.11	23.58	1.47***
17	21.29	27.89	6.60***	17	22.18	27.09	4.92***	17	23.58	24.84	1.26**
18	22.90	29.21	6.32***	18	23.52	28.69	5.18***	18	25.02	26.13	1.10*
19	24.44	30.79	6.35***	19	24.99	30.30	5.31***	19	26.59	27.48	0.88
20	26.07	32.36	6.29***	20	26.47	31.89	5.42***	20	28.21	28.88	0.67
21	27.73	34.02	6.29***	21	28.00	33.47	5.47***	21	29.85	30.21	0.35
22	29.34	35.57	6.24***	22	29.52	35.02	5.50***	22	31.46	31.59	0.12
23	31.02	37.19	6.18***	23	31.14	36.65	5.51***	23	33.03	33.03	-0.01
24	32.77	38.76	5.99***	24	32.83	38.26	5.43***	24	34.65	34.51	-0.14
25	34.46	39.89	5.43***	25	34.35	39.71	5.36***	25	36.10	35.87	-0.23
26	36.16	41.15	4.99***	26	35.92	41.13	5.21***	26	37.63	37.30	-0.33
27	37.82	42.34	4.52***	27	37.44	42.54	5.10***	27	39.03	38.69	-0.35
28	39.58	43.65	4.07***	28	39.01	44.07	5.06***	28	40.59	40.13	-0.45
29	41.45	44.98	3.54***	29	40.59	45.64	5.04***	29	42.17	41.68	-0.50
30	43.22	46.46	3.25***	30	42.18	47.12	4.94***	30	43.70	43.22	-0.48
31	44.86	48.04	3.18**	31	43.67	48.63	4.97***	31	45.17	44.70	-0.47
32	46.49	49.60	3.10**	32	45.16	50.16	5.00***	32	46.68	46.21	-0.47
33	48.08	51.17	3.09**	33	46.66	51.61	4.96***	33	48.20	47.64	-0.55
34	49.72	52.72	3.01**	34	48.22	53.08	4.86***	34	49.82	49.20	-0.62
35	51.27	54.23	2.96**	35	49.79	54.66	4.87***	35	51.44	50.71	-0.73
36	52.87	55.72	2.85**	36	51.36	56.22	4.86***	36	53.03	52.21	-0.82

Table 7. Momentum Strategies – Two-Way Dependent Sorts by Prior Returns, Earnings Surprise and Revenue Surprise

This table presents the results of pairwise nested comparison between momentum strategies. In Panel A shows the comparison between earnings momentum and revenue momentum during the period 1974 to 2007. In each month, stocks are first sorted into five groups by earnings surprises (revenue surprises), then further sorted by revenue surprises (earnings surprises) in each group. All portfolios are held for 6 months. The monthly returns to 10 extreme portfolios and 5 conditional earnings (revenue) momentum strategies are presented. Pair test and F test are provided under the hypothesis that conditional earnings (revenue) momentum profits are the same. Panel B shows the comparison between price and earnings momentum strategies, and Panel C shows the comparison between price and revenue momentum strategies.

Panel A. Revenue Momentum vs. Earnings Momentum

Revenue momentum in various SUE groups			*Earnings momentum in various SURGE groups*		
Portfolios classified by SUE	Portfolios classified by SURGE	Ave. Monthly Return	Portfolios classified by SURGE	Portfolios classified by SUE	Ave. Monthly Return
E1 (Low)	R1 (Low)	0.0075	R1 (Low)	E1 (Low)	0.0072
	R5 (High)	0.0109		E5 (High)	0.0116
	R5-R1	0.0034 (3.0648)		E5-E1	0.0044 (5.2727)
E2	R1 (Low)	0.0100	R2	E1 (Low)	0.0088
	R5 (High)	0.0125		E5 (High)	0.0125
	R5-R1	0.0025 (2.4741)		E5-E1	0.0037 (5.4477)
E3	R1 (Low)	0.0102	R3	E1 (Low)	0.0097
	R5 (High)	0.0131		E5 (High)	0.0145
	R5-R1	0.0030 (3.1684)		E5-E1	0.0048 (7.1735)
E4	R1 (Low)	0.0108	R4	E1 (Low)	0.0104
	R5 (High)	0.0134		E5 (High)	0.0152
	R5-R1	0.0026 (2.7819)		E5-E1	0.0048 (6.3694)
E5 (High)	R1 (Low)	0.0128	R5 (High)	E1 (Low)	0.0123
	R5 (High)	0.0166		E5 (High)	0.0168
	R5-R1	0.0038 (3.6365)		E5-E1	0.0046 (5.4740)
Tests for Difference in Momentum Profits:					
RevMom(E5)-RevMom(E1)		0.0004 (0.3481)	*EarnMom(R5)-EarnMom(R1)*		0.0001 (0.1355)
Equality of RevMom (F-stat)		0.2807 (p =0.8907)	*Equality of EarnMom (F-stat)*		0.3729 (p =0.8282)

Table 7. Momentum Strategies – Two-Way Dependent Sorts by Prior Returns, Earnings Surprise and Revenue Surprise (cont.)

Panel B. Price Momentum vs. Earnings Momentum

Price momentum in various SUE groups			*Earnings momentum in various PriorRet groups*		
Portfolios classified by SUE	Portfolios classified by Prior Ret	Ave. Monthly Return	Portfolios classified by Prior Ret	Portfolios classified by SUE	Ave. Monthly Return
E1 (Low)	P1 (Loser)	0.0070	P1 (Loser)	E1 (Low)	0.0066
	P5 (Winner)	0.0112		E5 (High)	0.0106
	P5-P1	0.0042 (2.2447)		E5-E1	0.0039 (4.4696)
E2	P1 (Loser)	0.0093	P2	E1 (Low)	0.0090
	P5 (Winner)	0.0132		E5 (High)	0.0120
	P5-P1	0.0040 (2.0901)		E5-E1	0.0030 (4.5788)
E3	P1 (Loser)	0.0091	P3	E1 (Low)	0.0100
	P5 (Winner)	0.0150		E5 (High)	0.0137
	P5-P1	0.0059 (3.2936)		E5-E1	0.0038 (6.2533)
E4	P1 (Loser)	0.0105	P4	E1 (Low)	0.0103
	P5 (Winner)	0.0161		E5 (High)	0.0150
	P5-P1	0.0056 (3.1741)		E5-E1	0.0047 (7.7749)
E5 (High)	P1 (Loser)	0.0111	P5 (Winner)	E1 (Low)	0.0120
	P5 (Winner)	0.0198		E5 (High)	0.0198
	P5-P1	0.0087 (4.5956)		E5-E1	0.0079 (9.2667)
Tests for Difference in Momentum Profits:					
PrcMom(E5)-PrcMom(E1)		0.0045 (3.3981)	*EarnMom(P5)-EarnMom(P1)*		0.0039 (3.8026)
Equality of PrcMom (F-stat)		1.0459 (p =0.3820)	*Equality of EarnMom (F-stat)*		6.8360 (p <0.0001)

Panel C. Price Momentum vs. Revenue Momentum

Price momentum in various SURGE groups			*Revenue momentum in various PriorRet groups*		
Portfolios classified by SURGE	Portfolios classified by Prior Ret	Ave. Monthly Return	Portfolios classified by Prior Ret	Portfolios classified by SURGE	Ave. Monthly Return
R1 (Low)	P1 (Loser)	0.0081	P1 (Loser)	R1 (Low)	0.0078
	P5 (Winner)	0.0110		R5 (High)	0.0085
	P5-P1	0.0029 (1.6990)		R5-R1	0.0007 (0.6382)
R2	P1 (Loser)	0.0090	P2	R1 (Low)	0.0092
	P5 (Winner)	0.0126		R5 (High)	0.0109
	P5-P1	0.0037 (2.1364)		R5-R1	0.0016 (1.9031)
R3	P1 (Loser)	0.0101	P3	R1 (Low)	0.0101
	P5 (Winner)	0.0151		R5 (High)	0.0134
	P5-P1	0.0050 (2.8163)		R5-R1	0.0033 (4.4409)
R4	P1 (Loser)	0.0099	P4	R1 (Low)	0.0102
	P5 (Winner)	0.0166		R5 (High)	0.0145
	P5-P1	0.0067 (3.9034)		R5-R1	0.0043 (5.5513)
R5 (High)	P1 (Loser)	0.0089	P5 (Winner)	R1 (Low)	0.0121
	P5 (Winner)	0.0195		R5 (High)	0.0194
	P5-P1	0.0106 (5.4321)		R5-R1	0.0072 (7.0025)
Tests for Difference in Momentum Profits:					
PrcMom(R5)-PrcMom(R1)		0.0077 (5.2705)	*RevMom(P5)-RevMom(P1)*		0.0065 (5.6120)
Equality of PrcMom (F-stat)		2.9609 (p=0.0188)	*Equality of RevMom (F-stat)*		7.6236 (p<0.0001)

Table 8. Momentum Strategies – Two-Way Sorts by Prior Returns, Earnings Surprise and Revenue Surprise

For each month, we form equal-weighted portfolios according to the breakpoints of two of the following three firm characteristics: a firm's prior six-month stock performance, its earnings surprise (SUE) and its revenue surprise (SURGE). Panel A presents the future returns of the 25 portfolios independently sorted on prior price performance and on SUE. The returns of "*price-earnings combined momentum strategy*" are obtained by buying the portfolio of the most winning stocks and the stocks with the highest SUE (prior performance = 5 and SUE = 5) and selling the portfolio of the most losing stocks and the stocks with the lowest SUE (prior performance = 1 and SUE = 1). Panel B presents the future returns of the 25 portfolios independently sorted on prior price performance and on SURGE. The returns of "*price-revenue combined momentum strategy*" is obtained by buying stocks in the portfolio of highest price performance and highest SURGE and selling stocks in the portfolio of lowest price performance and lowest SURGE. Panel C presents the future returns of the 25 portfolios independently sorted on SUE and on SURGE. The returns of "*earnings-revenue combined momentum strategy*" is obtained by buying stocks in the portfolio of highest SUE and highest SURGE and selling stocks in the portfolio of lowest SUE and lowest SURGE. We also present the returns of single sorted portfolios based on the quintiles of price performance, SUE or SURGE at the bottom of each panel for the purpose of comparisons.

Panel A. Future Returns Sorted on Prior Price Performance and Earnings Surprise (SUE)

		Prior Price Performance					*Price momentum*	
		P1(Loser)	P2	P3	P4	P5(Winner)	(P5 – P1) | SUE	
	E1(Low)	0.0089	0.0113	0.0120	0.0121	0.0123	0.0056	(2.50)
	E2	0.0109	0.0124	0.0133	0.0138	0.0160	0.0051	(2.23)
SUE	E3	0.0109	0.0128	0.0140	0.0148	0.0182	0.0073	(3.25)
	E4	0.0116	0.0134	0.0148	0.0156	0.0190	0.0074	(3.38)
	E5(High)	0.0116	0.0142	0.0162	0.0176	0.0223	0.0104	(4.49)
Earnings momentum	(E5-E1) |P	0.0034 (3.14)	0.0029 (3.79)	0.0042 (5.68)	0.0055 (7.67)	0.0082 (8.27)		
Price-Earnings combined momentum strategy: P5|E5 – P1|E1							**0.0133*****	**(6.39)**

Panel B. Future Returns Sorted on Prior Price Performance and Revenue Surprise (SURGE)

		Prior Price Performance					*Price momentum*	
		P1(Loser)	P2	P3	P4	P5(Winner)	(P5 – P1) | SURGE	
	R1(Low)	0.0099	0.0115	0.0122	0.0125	0.0139	0.0041	(1.81)
	R2	0.0107	0.0123	0.0134	0.0134	0.0156	0.0049	(2.14)
SURGE	R3	0.0118	0.0137	0.0146	0.0152	0.0182	0.0064	(2.82)
	R4	0.0108	0.0136	0.0148	0.0158	0.0196	0.0088	(4.30)
	R5(High)	0.0101	0.0125	0.0155	0.0172	0.0220	0.0119	(5.18)
Revenue momentum	(R5-R1) |P	0.0002 (0.14)	0.0010 (0.97)	0.0033 (3.63)	0.0048 (5.13)	0.0083 (6.59)		
Price-Revenue combined momentum strategy: P5|R5 – P1|R1							**0.0121*****	**(5.16)**

Panel C. Future Returns Sorted on Earnings Surprise (SUE) and Revenue Surprise (SURGE)

		SURGE					*Revenue momentum*	
		R1(Low)	R2	R3	R4	R5(High)	(R5 – R1) | SUE	
	E1(Low)	0.0100	0.0108	0.0118	0.0119	0.0132	0.0042	(2.77)
	E2	0.0122	0.0125	0.0130	0.0137	0.0156	0.0035	(2.59)
SUE	E3	0.0123	0.0129	0.0150	0.0146	0.0155	0.0032	(2.70)
	E4	0.0126	0.0146	0.0157	0.0157	0.0160	0.0034	(2.88)
	E5(High)	0.0142	0.0153	0.0172	0.0180	0.0189	0.0041	(2.93)
Earnings momentum	(E5-E1)|SURGE	0.0048 (4.41)	0.0045 (5.12)	0.0054 (6.36)	0.0060 (6.31)	0.0049 (4.35)		
Price-Revenue combined momentum strategy: R5|E5 – R1|E1							**0.0089*****	**(6.81)**

Table 9. Comparisons of Assorted Single and Combined Momentum Strategies

This table presents the return contribution by considering additional sorting criterion, being prior returns, earnings surprise or revenue surprise. In the table, '***P***', '***E***' and '***R***' respectively refers to price momentum, earnings momentum and revenue momentum strategy. Momentum strategies based on combined criteria are indicated with plus signs. For example, '***P+E***' denotes "*price-earnings combined momentum strategy*", i.e., P5|E5 – P1|E1. Panel A summarizes the returns obtained from momentum strategies based on one-way sorts, two-way sorts and three-way sorts. Panel B lists the return contributions of each additional sorting criterion based on the return differences. The associated t-statistics are in the parentheses. Panel C lists the incremental returns obtained by applying additional two sorting criteria. All returns are expressed as monthly returns.

Panel A. Summary of Momentum Returns from Various Single/Multiple Sorting Criteria					
One-Way Sorts		Two-Way Sorts		Three-Way Sorts	
Momentum Strategy	Return	Momentum Strategy	Return	Momentum Strategy	Return
Mom(P)	0.0083***	***Mom(P+E)***	0.0133***	***Mom(P+E+R)***	0.0157***
	(3.95)		(6.39)		(6.71)
Mom(E)	0.0063***	***Mom(P+R)***	0.0121***		
	(9.32)		(5.16)		
Mom(R)	0.0049***	***Mom(E+R)***	0.0089***		
	(4.61)		(6.81)		

Panel B. Contribution of Momentum Returns from Single Prior Performance Information					
Incremental Return Contribution of Price Momentum		Incremental Return Contribution of Earnings Momentum		Incremental Return Contribution of Revenue Momentum	
Diff. in momentum strategies	Return Difference	Diff. in momentum strategies	Return Difference	Diff. in momentum strategies	Return Difference
Mom(P+E) - Mom(E)	0.0070***	***Mom(E+P) - Mom(P)***	0.0050***	***Mom(R+P) - Mom(P)***	0.0038***
	(4.01)		(6.87)		(3.75)
Mom(P+R) - Mom(R)	0.0071***	***Mom(E+R) - Mom(R)***	0.0040***	***Mom(R+E) – Mom(E)***	0.0025***
	(4.18)		(6.56)		(2.98)
Mom(P+E+R)-Mom(E+R)	0.0068***	***Mom(P+E+R)-Mom(P+R)***	0.0036***	***Mom(P+E+R)-Mom(P+E)***	0.0024**
	(4.55)		(4.75)		(2.55)

Panel C. Contribution of Momentum Returns from Multiple Prior Performance Information					
Incremental Return Contribution of (Price + Earnings) Momentum		Incremental Return Contribution of (Price + Revenue) Momentum		Incremental Return Contribution of (Earnings + Revenue) Momentum	
Diff. in momentum strategies	Return Difference	Diff. in momentum strategies	Return Difference	Diff. in momentum strategies	Return Difference
Mom(P+E+R) - Mom(R)	0.0108***	***Mom(P+E+R) - Mom(E)***	0.0094***	***Mom(P+E+R) - Mom(P)***	0.0074***
	(6.36)		(4.81)		(5.40)

Table 10. Returns of Momentum Strategies in January and in Non-January Months

This table presents average monthly returns and the associated *t*-statistics for the returns obtained from single momentum strategies, 2-way sorted combined momentum strategies, and 3-way sorted combined momentum strategies for all calendar months, for January, and for non-January months. The *F*-statistics and *p*-values are computed under the hypothesis that the returns to momentum strategies are equal in January and non-January months.

Momentum Strategies	*All months*	*Jan.*	*Feb. - Dec.*	*F-Statistics*	*p-Value*
Mom(P)	0.0083***	-0.0117	0.0101***	27.14657	<0.01
	(3.95)	(-0.82)	(4.93)		
Mom(E)	0.0063***	0.0030	0.0067***	7.1672	<0.01
	(9.32)	(0.82)	(10.02)		
Mom(R)	0.0049***	-0.0062*	0.0060***	32.9566	<0.01
	(4.61)	(-1.71)	(5.38)		
Mom(P+E)	0.0133***	-0.0116	0.0151***	26.6698	<0.01
	(6.39)	(-1.07)	(7.60)		
Mom(P+R)	0.0121***	-0.0152	0.0146***	41.7058	<0.01
	(5.16)	(-1.28)	(6.40)		
Mom(E+R)	0.0089***	-0.0052	0.0102***	35.7046	<0.01
	(6.81)	(-0.93)	(7.76)		
Mom(P+E+R)	0.0157***	-0.0113	0.0182***	40.8212	<0.01
	(6.71)	(-0.93)	(8.02)		

Table 11. Returns of Combined Momentum Strategies – A Comparison between Dependent Sorts and Independent Sorts

This table presents returns and the associated *t*-statistics from 2-way/3-way sorted combined momentum strategies, which are formed using independent sorts or dependent sorts. A momentum strategy formed on the basis of multiple criteria, which we call 'combined momentum strategy', is said to apply independent sorts if portfolios are independently sorted into quintiles according to their prior price performance, SUE and SURGE, with the partition points being independent across these criteria. A combined momentum strategy is said to apply dependent sorts if portfolios are sorted into quintiles according to their prior price performance, SUE and SURGE, with a particular sorting order. For example, a 2-way sorted momentum strategy based on SUE and SURGE using dependent sorts could be formed by first sorting on SUE then on SURGE (*SURGE|SUE*) or first sorting on SURGE then on SUE (*SUE|SURGE*). We present here the returns of momentum strategies following all possible sequences of 2-way dependent sorts and 3-way dependent sorts.

Momentum Strategies	***Independent sorts***	***Dependent sorts***					
		P6 | SUE	***SUE | P6***				
Mom(P+E)	0.0133***	0.0128***	0.0132***				
	(6.39)	(6.28)	(7.36)				
Dep_sorts – Indep_sorts **(t-statistic only)**		(-1.39)	(0.23)				
		P6 | SURGE	***SURGE | P6***				
Mom(P+R)	0.0121***	0.0114***	0.0116***				
	(5.16)	(5.25)	(5.81)				
Dep_sorts – Indep_sorts **(t-statistic only)**		(-1.84)	(0.94)				
		SURGE | SUE	***SUE | SURGE***				
Mom(E+R)	0.0089***	0.0091***	0.0097***				
	(6.81)	(7.50)	(7.62)				
Dep_sorts – Indep_sorts **(t-statistic only)**		(0.36)	(1.71)				
		P6|SURGE|SUE	***SURGE|P6|SUE***	***P6|SUE|SURGE***	***SUE|P6|SURGE***	***SURGE|SUE|P6***	***SUE|SURGE|P6***
Mom(P+E+R)	0.0157***	0.0193***	0.0195***	0.0220***	0.0206***	0.0210***	0.0201***
	(6.71)	(4.09)	(4.38)	(4.61)	(4.50)	(4.92)	(4.79)
Dep_sorts – Indep_sorts **(t-statistic only)**		(2.17)	(2.35)	(3.36)	(2.85)	(2.85)	(2.40)

Figure 1.

This figure shows the average cumulative profits of relative strength portfolio with respect to earnings surprises, revenue surprises, and prior price performance. The relative strength portfolio is buying stocks in highest decile and selling stocks in lowest decile on every formation date, and holding for 36 months. The cumulative profits are calculated by adding monthly returns from formation month *t* to month *t+i*.