Sources of Price Momentum

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Abstract

Price momentum has not been clearly explained yet. Previous studies suggest the possibility that the price momentum effect is related with market's under-reaction to information. To find the sources of price momentum, we elaborate empirical analysis based on information of factors - size, value, profitability and investment. We find, first, that not only the factors but also their changes explain the cross-section of expected stock returns. Second, after controlling for information changes of both earnings and operating profit, the price momentum effect vanishes. Information on firm's operating profit is superior to that of earnings in absorbing price momentum. Our results suggest price momentum is due to the sluggish response to new information not only on earnings but also on operating profit.

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1. Introduction

There is extensive mount of finance literature that the cross-section of stock return is predictable based on many available information. One of available information is past returns or past price of stock. Jegadeesh and Titman (1993) documents that strategies which buy stocks that have performed well in the past and sell stocks that have performed poorly in the past generate significant positive returns over 3 to 12 month holding periods. This phenomenon is called price momentum. This results is still remaining anomaly to the efficient market hypothesis (EMH). For that reason, there is many studies to know source of price momentum. In this paper, we study whether price momentum and firm's information changes are related.

The information can be classified according to information characteristics. In the financial economics research, the EMH has been widely studied. The EMH states that asset prices fully reflect all available information. In order to test the EMH, Fama (1970) classified the empirical work concerned with the adjustment of security prices to three relevant information subsets. The first is weak form tests, in which the information set is just historical prices. The second is semi-strong form tests, in which the concern is whether prices efficiently adjust to other information that is obviously publicly available. The Last is strong form tests concerned with whether given investors of groups have monopolistic access to any information relevant for price formation. According to the analysis of the tests, in general terms, the theory of efficient markets is concerned with whether prices at any point in time fully reflect available information. The implication of the EMH is that it is impossible to beat the market consistently on a risk-adjusted basis since market prices should only react to new information or changes in discount rates. However, after then, the results of enormous studies have been inconsistent with the EMH.

Firstly for the weak form tests, there are many reports that historical prices information including past returns affects the future stock returns. An extensive body of finance literature documents that the cross-section of stock returns is predictable based on past returns. For example, DeBondt and Thaler (1985) report that long-term past losers outperform long-term past winners over the subsequent three

to five years. Jegadeesh (1990) find short-term return reversals. Jegadeesh and Titman (1993) add a new finding to this literature by documenting that over an intermediate horizon of three to twelve months, past winners on average continue to outperform past losers, so that there is momentum in stock prices.

Secondly for the semi-strong form tests, there are also many reports that publicly available information affects the future stock returns. The size effect is found by Banz (1981). He finds that market equity (ME) adds to the explanation of the cross-section of average returns. Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) find that average returns on U.S. stocks are positively related to the ration of a firms book value of common equity (BE) to its market value, ME. Fama and French (1992) find that size and book-to-market equity, capture the cross-sectional variation in average stock returns. Based on this study, Fama and French (1993) propose a three-factor (FF-3 factor) model which size and value factors added to capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965), and Black (1972). After this model is proposed, Haugen and Baker (1996) and Cohen, Gompers, and Vuolteenaho (2002) find that, controlling for book-to-market equity, average returns are positively related to profitability. Fairfield, Whisenant, and Yohn (2003), Richardson and Sloan (2003), and Titman, Wei, and Xie (2004) show a negative relation between average returns and investment. Fama and French (2006) study relationship between profitability, investment and average returns. Based on this study, Fama and French (2015) propose a five-factor (FF-5 factor) model which profitability and investment factors added to FF-3 factor model.

The question that why these kinds of information are related to the future stock returns remains. It is a very important topic so as to understand the capital market. Therefore many researchers investigated and analyzed the reason for the question. For example, the fact that presence of momentum in stock prices imply presence of the market under-reaction to information. For this reason, Hong and Stein (1999) propose a theory of under-reaction and price momentum. To explain under-reaction, Frazzini (2006) tests whether disposition effect induces under-reaction. You and Zhang (2009) study the immediate and delayed market reaction to U.S. Securities and Exchange Commission (SEC) EDGAR

10-K filings. Especially, Chan, Jegadeesh, and Lakonishok (1996) examine whether the predictability of future returns from past returns is due to the market under-reaction to information, in particular to past earnings news. Their results suggest a market that responds only gradually to new information. Price momentum and earnings momentum seems to be related each other, but not the same. In the stock market, stock price is changed by not only past earnings news, but also other kinds of news. In the EMH, stock price changes should fully reflect all available information. If so, which kinds of information are important to explain the cross-sectional variation in stock returns? We find way to determine the kinds of information as following.

Fama and French (1992) show that two easily measured variables, size and book-to-market equity, combine to capture the cross-sectional variation in average stock returns associated with market beta, size, leverage, book-to-market equity, and earnings-price ratios. After then, there is also evidence that profitability and investment add to the description of average returns provided by size and book-to-market ratio. Why these variables have primary roles to explain the cross-sectional future stock returns? Fama and French (2006) find the reason from valuation theory. Valuation theory says that expected stock returns are related to three variables: the book-to-market equity ratio, expected profitability, and expected investment. For that reason, three variables are important information to explain the cross-sectional future stock returns empirically and theoretically.

Based on this context, if the predictability of future returns from past returns is due to the market under-reaction to information, price momentum and information about the three variables: the book-to-market equity ratio, expected profitability, and expected investment might be related. In the previous researches, price momentum not seems to be related with size and above three variables. For example, after Fama and French (1993) present FF-3 factor model which have beta, size and value factors, Carhart (1997) presents 4 factor model which added momentum factor to FF-3 factor model because FF-3 factors cannot capture the cross sectional variation from price momentum. Even FF-5 factor model in Fama and French (2015) which have beta, size, value, profitability, and investment factors cannot capture the cross sectional variation from price momentum. Therefore, Fama and

French (2015) argue that if variables such as size and momentum help forecast returns, they must do so by implicitly improving forecasts of profitability and investment or by capturing horizon effects in the term structure of expected returns. However, in terms of the information under-reaction, price momentum might be related to the information about above factors. To find a link between price momentum and information of other factors, we consider not only the factors, but also recent information change of the factors. To compare with price momentum, we will call it factor momentum. There is already known the post-earnings announcement drift, or earnings momentum, first documented by Ball and Brown (1968). To determine proxies for factor momentum, we expand concept of earnings momentum to factors. Size, value, profitability, and investment factors and these factors momentum are considered with price momentum.

The rest of this paper is organized as follows. Section 2 describes details of data and method. Section 3 uses cross-section regressions to test proxies for factor momentum and to find relationship between price momentum and factor momentum. Section 4 shows sorted portfolio to know deeply relationship between price momentum and profitability momentum. Section 5 summarizes results and concludes.

2. Data and method

We use the Center for Research in Security Prices (CRSP) data for monthly returns, prices, shares outstanding and so on. We also use COMPUSTAT data for annual and quarterly income-statement and balance-sheet data. We merge COMPUSTAT annual and quarterly data. Where there is different between two data, we give priority to quarterly data. Finally, we merge CRSP and COMPUSTAT data and use it for regression and analysis.

Our data set is data of firms in the intersection of the NYSE, AMEX, and NASDAQ in CRSP data. We exclude financial firms which have standard industrial classification (SIC) codes between 6000 and 6999. We also exclude ADRs, REITs, Americus Trust Components, units, and closed-end funds from all our data set.

Data period is from January 1963 to December 2015 by CRSP monthly data. We match COMPUSTAT data to CRSP data with report date of quarterly earnings variables if it is available. After report date of quarterly earnings, that COMPUSTAT data can be matched with CRSP data. If a gap between fiscal quarter-end and report date of quarterly earnings overs 3 months or it is not available, we assume there is maximum 3 months gap between COMPUSTAT data and CRSP data because we use quarterly accounting data. Where report date of quarterly earnings available, over 95% of data have the gaps which are not over 3 months.

From CRSP data, returns are changed to percent returns and it include dividends. Delisting returns are also considered as ordinary returns. Market equity (M_t) is price multiply shares outstanding. Where M_t is used for a size proxy, most recent M_t is used.

From COMPUSTAT data, balance-sheet data is as in the following. Book equity (B_t) is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock (if available). For investment tax credit and the book value of preferred stock variables, if it is not available, it is assumed zero. We use positive B_t data. For a value proxy, book to market ratio (B_t/M_t) is defined. Because M_t is positive and we use positive B_t, B_t/M_t is also positive. At this time, M_t is comes from CRSP data which has same data date with B_t. Total Assets (A_t) is directly available from COMPUSTAT. It is used for investment proxy.

From COMPUSTAT data, income-statement data is as in the following. Annual operating profit (O_t) is annual revenues minus cost of goods sold, selling, general, and administrative expenses and interest expense (if available). Quarterly operating profit ($Q_{t,q}$) is the quarterly revenues minus cost of goods sold, selling, general, and administrative expenses and interest expense (if available). For interest expense, if it is not available, it is assumed zero. Annual earnings (I_t) is annual income before extraordinary items. Quarterly earnings ($I_{t,q}$) is quarterly income before extraordinary items. When we get annual income-statement data, we add up recent 4 quarterly income-statement data. Therefore we can use annual income-statement data on quarterly base and it can update quarterly to CRSP data.

For representing price momentum, four proxies are defined. MOM_03, MOM_06, MOM_09, and

MOM_12 are price momentum proxy from returns in recent 3, 6, 9, and 12 months respectively. For example, MOM_12 is monthly normalized return during recent 12 months except the most recent month. By skipping the most recent month, we avoid some of the bid-ask spread, price pressure, and lagged reaction effects like Jegadeesh and Titman (1993).

In order to test the effect of information changes on predicting the future stock returns, standardized unexpected variables (SU_var) are defined as factor momentum proxies. The standardized unexpected variable, SU_var = (var_t-var_{t-1})/σ_t, where σ_t is the standard deviation of (var_t-var_{t-1}) over the prior eight quarters. Foster, Olsen, and Shevlin (1984) examine different item series models for expected earnings and how the resulting measures of unanticipated earnings are associated with future returns. They find that a seasonal random walk model performs as well as more complex models, so many literature use it as their model of expected earnings. It is called standard unexpected earnings (SUE). We extend this concept to other variables to examine which variables are related with price momentum. Therefore we define and use various SU-var for our analysis. For example, we define standard unexpected operating profit (SUO). Earnings and operating profit are income-statement variable and to compute earnings, operating profit should be computed previously. Therefore they would have similar and different roles in our analysis. Various SU-var will be our information change proxy in this paper.

In order to analyze relationship between above variables and the future stock returns, we use the cross-sectional regression approach of Fama and MacBeth (1973). For each month, there are stock returns and available information variables which are expected to explain the future stock returns. For each month, Stock returns are regressed on that variables. This is called the cross-section regression. In our data, because we use CRSP data from January 1963 to December 2015, there are 636 monthly regression results. From these regression result, we can get average slopes and t-statistics for each variables. This method and used variables are similar with Fama and French (1992) and Fama and French (2006).

We should determine base variables to explain the future stock returns on the regression. According

to Fama and French (1992), firm's beta is not useful for cross-section regression. However it is useful for time-series regression in Fama and French (1993) and Fama and French (2015). Because we use cross-section regressions, the beta is excluded. Except the beta, we consider size, value, profitability, and investment proxy from FF-5 factor model. We also add price momentum proxy to these variables. It will be base variables. To show effects of information changes on the regression, factor momentum proxies will be added to the regression. For a size proxy, M_t is used and for a value proxy, B_t/M_t is used as Fama and French (2006). These two variables are always positive, we can use log of M_t and B_t/M_t. For a profitability proxy, we test both O_t/B_t and I_t/B_t. O_t/B_t is used by Fama and French (2015). I_t/B_t is used by Fama and French (2006). In our regression, both proxies are meaningful when it is included in the regression at the same time. Therefore both proxies are used all. The detail regression result will be presented later. For an investment proxy, the annual growth of total assets, dA_t/A_{t-1} is used where $dA_t=A_t-A_{t-1}$. It is used by Fama and French (2006, 2015). The profitability proxies and the investment proxies are not always positive. However they imply amount of increase and decrease for quarterly or annually, we can apply the concept of log returns to these variables. Therefore we use log of $(1+O_t/B_t)$, log of $(1+I_t/B_t)$, and log of $(1+dA_t/A_{t-1})$ for the regression. Because at the almost of case, O_t/B_t, I_t/B_t, and dA_t/A_{t-1} are not below -1, using of them is available. Very few exceptional cases are excluded. For a price momentum proxy, we test MOM_3, MOM_6, MOM_9, and MOM_12. In our regression, only MOM_12 is meaningful and absorb other three price momentum proxies. Therefore only MOM_12 is used. The detail regression result will be presented later. Based on the above variables, we test with the additional various factor momentum proxies. In the next section, these kinds of results are presented and analyzed.

3. Regression results and analysis

3.1 Base variables and price momentum

Firstly, we test to determine a profitability proxy. Table 1 shows the monthly cross-section return regressions to test two profitability proxies.

For the size proxy, $\ln(M_t)$, average slope is negative and the size proxy well explains the future stock returns. This results is consistent with the previous studies. Average slope is not much changed by combination of the profitability proxies.

For the value proxy, or book-to-market ratio, $\ln(B_t/M_t)$, average slope is positive and the value proxy also well explains the future stock returns. This results is also consistent with the previous studies. Average slope is not much changed by combination of the profitability proxies.

For the two profitability proxies, $\ln(1+O_t/B_t)$ and $\ln(1+I_t/B_t)$, average slope is positive and the two profitability proxies well explain the future stock returns when they are included separately and simultaneously. Because earnings are calculated as operating profit minus non-operating expenses, they should be somewhat related. In general, we can guess that when a firm get high operating profit, it might also get high earnings and vice versa. In spite of this close relationship, in the third regression result which include two profitability proxies, they explain the future stock returns independently. At the column of profitability 1, $\ln(1+O_t/B_t)$, average slope is 0.74 and t-statistics 8.18 where other profitability 2 is excluded from the regression. However, its average slope a little bit decrease to 0.62 and t-statistics also decrease 6.40 where other profitability 2 is included in the regression. At the column of profitability 2, $\ln(1+I_t/B_t)$, average slope is 1.10 and t-statistics 5.83 where profitability 1 is excluded from the regression. However, its average slope a little bit decrease to 0.81 and t-statistics also decrease 3.84 where other profitability 1 is included in the regression. This results show that although the two different profitability proxies a little bit absorb explanation power of other proxies, both are useful for explaining the future stock returns. Therefore in our analysis, we consider the two profitability proxies which one is based on operating profit and the other is based on earnings.

For the investment proxy, $\ln(1+dA_t/A_{t-1})$, average slope is negative and the investment proxy well explains the future stock returns. This results is consistent with the previous studies. Average slope is not much changed by combination of the profitability proxies.

For the price momentum proxy, MOM_12, average slope is positive and the price momentum proxy well explains the future stock returns. This results is consistent with the previous studies. Average

slope is not much changed by combination of the profitability proxies.

Secondly, we test to determine a price momentum proxy. Table 2 shows the monthly cross-section return regressions to test four price momentum proxies. For the size, value, profitability, and investment proxies, the regression results are similar with Table 1.

For the four price momentum proxies, MOM_03, MOM_06, MOM_09, and MOM_12, average slopes are positive and the price momentum proxies well explain the future stock returns where each proxy is included in the regression separately. However, where all price momentum proxies are included in the regression simultaneously, only MOM_12 well explains the future stock returns and explanation powers of other three price momentum proxies are absorbed. Naturally, MOM_12 contains information of MOM_03, MOM_06, and MOM_09. If the information of the past stock returns 3 or 6 months ago are much more dominant than the information of the past stock returns 9 or 12 months ago, MOM_12 cannot be surely more dominant than other three price momentum proxies. In other words, the information of the past stock returns 9 or 12 months ago is also important to explain the future stock returns. Even when we compare with the results of the regressions which include the four price momentum proxies separately, average slope and t-statistics are increase as the price momentum proxies contains long term information of the past stock returns. Therefore in our analysis, we consider only one price momentum proxies, MOM_12, which contains information of the past stock returns 12 months ago.

Overall, the regression results of all proxies of the factors well consist with previous studies to find and investigate variables which explain the future stock returns. The proxies in these regressions explain the future stock return independently. Particularly, price momentum is one of long-standing anomaly in the EMH. Fama and French (2006) point out that valuation theory says that expected stock returns are related to three variables: the book-to-market equity ratio (B_t/M_t), expected profitability, and expected investment. The valuation theory give us the reason why these variables well explain the future stock returns in the extensive financial empirical studies. However, the price momentum effect which presents in the stock market is still remaining question with the valuation theory. If we find a

link between the three variables and price momentum, we can have better understanding about price momentum because the three variables are already related with the valuation theory. To find the link between the three variables and price momentum, we add our factor momentum proxies to our analysis which includes the above proxies of base variables and price momentum.

3.2 Size and value momentum

Table 3 shows the monthly cross-section regressions with size and value momentum proxies. As we define, standard unexpected variables, SU_var, are included in the regression. In this section, SU_M_t, SU_B_t, SU_A_t, and SU_B_t/M_t are considered.

For the value proxy, B_t/M_t, information about this variable will change by both M_t and B_t as time goes by. SU_B_t/M_t represents information change of B_t/M_t directly. Additionally, SU_M_t and SU_B_t represent information change of B_t/M_t indirectly as component of B_t/M_t.

SU_M_t also represent information change of the size proxy, M_t. For SU_M_t, there is possibility that SU_M_t is related with MOM_12 because they are related with information change of the past stock price. However, only SU_M_t includes information change of shares outstanding and only MOM_12 includes information of dividends. Besides, SU_M_t is normalized by standard deviation of $dM_t=M_t-M_{t-1}$. Because of these reasons, MOM_12 still well explain the future stock returns with SU_M_t.

For SU_B_t, it also represent information change of the profitability proxies indirectly as component of O_t/B_t and I_t/B_t. However, in these cases, O_t and I_t are more important information than B_t because B_t is for normalizing to compare with different capital size of firms. There is possibility that SU_B_t is related with the investment proxy because they are related with information change of the capital size of firms. However, only the investment proxy includes information change of liability. Besides, they normalized by different variables. There is also possibility that SU_B_t is related with earnings information because B_t contains retained earnings and B_t is changed by amount of earnings. On the other hands, B_t is changed by amount of issuing new equities. This amount is related with investment of firms. B_t itself can represent the size of firms replacing M_t. Overall, SU_B_t has chances to be

related with other various information. Because of it, we also consider SU_A_t. A_t contains not only information of B_t but also information of liability. SU_A_t also has chances to be related with other various information in same manner with the case of SU_B_t.

For SU_M_t, there is no big difference in the regression and SU_M_t itself has no significant explanation power to predicting future stock returns. Because M_t is directly related with the stock prices, actually information of M_t is updated daily. In our analysis, in order to compare with various information changes fairly, terms of information changes are fitted to one year. In our additional analysis (it is not in this paper), where we changes term of information change about M_t from one year to one month, SU_M_t has negative average slopes and seems to be related with short-term reversion rather than intermediate-term momentum. Further analysis on the SU_M_t might be over the main topic of this paper which is related with price momentum.

However, SU_B_t well explains the future stock returns. Where SU_B_t is included in the regression, average slope of profitability 2, $\ln(1+I_t/B_t)$, decrease and losing explanation power to predict the future stock returns. It seems to be absorbed by SU_B_t because as earlier mentioned, SU_B_t is related with earnings information. On the other hand, in the case of Profitability 1, $\ln(1+O_t/B_t)$ is not significantly affected. Totally in the regressions in table 3, O_t is more stable than I_t to explain the future stock returns. SU_A_t also well explains the future stock returns and the investment proxy, $\ln(1+dA_t/A_{t-1})$, is not significantly affected.

SU_B_t/M_t doesn't well explains the future stock returns as SU_B_t or SU_A_t separately, but in the last regression in the table 3, SU_B_t, SU_A_t, and SU_B_t/M_t are well explains the future stock returns with base variables and price momentum. However, it doesn't seem to be related with the price momentum effect because the price momentum proxy, MOM_12 is not significantly affected by them. Therefore they have some explanation power to predict the future stock returns but it doesn't imply that their explanation powers come from under-reaction of the stock market to the information about size or value of firms.

3.3 Profitability momentum

Table 4, 5, and 6 shows the monthly cross-section regressions with profitability momentum proxies. As we define, standard unexpected variables, SU_var, are included in the regression. In this section, SU_O_t, SU_O_t/B_t, SU_I_t, and SU_I_t/B_t are considered.

Firstly in the table 4, where all profitability momentum proxies are included in the regression, average slope of the price momentum proxy decrease to almost half. On the other hand, the price momentum proxy still have a role to explain the future stock returns. All profitability momentum proxies in the table 4 explain the future stock returns separately and simultaneously. Profitability 2, $\ln(1+I_t/B_t)$, is fully absorbed by them. Similar with previous section 3.2, O_t is more stable than I_t to explain the future stock returns.

Because O_t and I_t have seasonality, we also consider profitability momentum proxies based on quarterly operating profit, $O_{t,q}$ and quarterly earnings, $I_{t,q}$. Secondly in the table 5, where all profitability momentum proxies are included in the regression, average slope of the price momentum proxy decrease to almost zero. Additionally, t-statistics of the price momentum proxy decrease from 6.32 to 0.44 so it losing its explanation power to predict the future stock returns. All profitability momentum proxies in the table 5 also explain the future stock returns separately and simultaneously. Comparing the result of the table 4 and the table 5, we can see that in general, average slopes and t-statistics of the quarterly profitability proxies are higher than it of the annually profitability proxies.

Especially, $SU\_I_{t,q}$ is same with standard unexpected earnings, SUE, which is well known and used in the studies related with post earnings announcement drift (PEAD) or earnings momentum. When SUE is included alone in the regression, average slope of the price momentum proxy decrease from 0.11 to 0.07 and t-statistics of it decrease from 6.32 to 4.04. This result is consistent with the study of Chan, Jegadeesh, and Lakonishok (1996) that price momentum and earnings momentum are related but not the same. However, where we additionally consider standard unexpected operating profit, SUO, they can almost replace price momentum. This result give us to fine understanding about source of price momentum. Price momentum is strongly related with the recent changes of profitability

information. It is not captured by only SUE but by SUE and SUO. Naturally, SUO has similar characteristics with SUE but surely explains the future stock returns even after controlling size, value, profitability, investment, price momentum, and earnings momentum.

To compare with the quarterly profitability proxies in the table 5 each other, the table 6 is presented. The table 6 shows the regression results where combinations of the two quarterly profitability momentum proxies are included in the regression. In the second regression, we can see that the combination of SUO and SUE are enough to significantly absorb explanation power of price momentum to predict the future stock returns. In the third regression, we can see that the combination of the normalized profitability momentum proxies are also enough to do it. Comparing the forth regression and the fifth regression, we can see that the profitability momentum proxies based on operating profit is better than based on earnings to do it. Where the profitability momentum proxies based on operating profit are included in the regression, t-statistics of the price momentum proxy is 0.72. However, the profitability momentum proxies based on earnings are included in the regression, t-statistics of the price momentum proxy is 3.31.

To sum up, price momentum is strongly related with the recent changes of profitability information. In the previous studies, earnings momentum which is represented by SUE is compared with price momentum but under the concept of profitability momentum, operating profit momentum which is represented by SUO is also compared with price momentum in the our studies. After controlling for information changes of both earnings and operating profit, the price momentum effect vanishes. Information on firm's operating profit is superior to that of earnings in absorbing price momentum. Differently with the results of section 3.2, their explanation power to predict the future stock returns seems to come from under-reaction of the stock market to the information about profitability of firms because they are more dominant than price momentum and replaceable it.

3.4 Investment momentum

Table 7 shows the monthly cross-section regressions with investment momentum proxies. As we define, standard unexpected variables, SU_var, are included in the regression. In this section, SU_dA_t, SU_dA_t/A_{t-1}, SU_dB_t, and SU_dB_t/B_{t-1} are considered.

In our analysis, investment factor is dA_t/A_{t-1}. Actually according to Fama and French (2006), the valuation equation from the valuation theory calls for equity investment, dB_t/B_{t-1}, but they measure investment as asset growth, dA_t/A_{t-1}, which they judge gives a better picture of investment. Therefore in this section, we consider not only SU_dA_t and SU_dA_t/A_{t-1}, but also SU_dB_t, and SU_dB_t/B_{t-1} as the investment momentum proxies.

For the four invest momentum proxies, SU_dA_t, SU_dA_t/A_{t-1}, SU_dB_t, and $SU\_dB_t/B_{t-}1$, average slopes are positive and the investment momentum proxies well explain the future stock returns where each proxy is included in the regression separately. However, where all investment momentum proxies are included in the regression simultaneously, only SU_dB_t well explains the future stock returns and explanation powers of other three price momentum proxies are weakened. Profitability 2, $\ln(1+I_t/B_t)$, is significantly absorbed by them. Similar with previous section 3.2 and 3.3, O_t is more stable than I_t to explain the future stock returns. Similar with previous section 3.2, they doesn't seem to be related with the price momentum effect because the price momentum proxy, MOM_12 is not significantly affected by them. Therefore they have some explanation power to predict the future stock returns but it doesn't imply that their explanation powers come from under-reaction of the stock market to the information about investment of firms.

4. Portfolio results and analysis

In the previous sections, we can find source of price momentum from information changes of profitability of firms. In our analysis, SUE and SUO have important roles to capture price momentum. To compare SUE and SUO in detail, we present the result of portfolio analysis. Data set is same with the data set of previous regression analysis. For fair comparison, we use CRSP returns data where if

there is MOM_12, SUE, and SUO is simultaneously available. In this section, we note MOM_12 as just MOM.

Table 8 shows average monthly returns for portfolio formed on MOM and SUE. At the end of each month, stocks are allocated to ten MOM groups using NYSE break point. Stocks are also allocated independently to ten SUE groups using NYSE break point. Therefore one hundred portfolios are generated. At the end row and column, the table shows spreads of average monthly returns between highest decile portfolio and lowest decile portfolio. As we know, generally average returns of high price momentum portfolio are higher than average returns of low price momentum portfolio. Where we see only average monthly returns for ten portfolios formed on MOM, there is a tendency that it increases as MOM increases from 0.68% to 1.78% so spread is 1.11%. However, where we consider not only MOM but also SUE, there are no tendency that it increases as MOM increases. Only in the lowest SUE portfolios, spread is positive as 0.77. Even the rest of SUE portfolios, spreads are all negative. On the other hand, as we know, generally average returns of high SUE portfolio are higher than average returns of low SUE portfolio. Where we see only average monthly returns for ten portfolios formed on SUE, there is a tendency that it increases as SUE increases from -0.97% to 3.05% so spread is 4.02%. Besides, where we consider not only SUE but also MOM, there remains stable tendency. This result means that positive spread of price momentum portfolios actually comes from correlation between MOM and SUE so if we control the effect of SUE, it remains no longer.

Table 9 shows average monthly returns for portfolio formed on MOM and SUO. Except that SUE is replaced to SUO, other conditions are same with the table 8. The result of the table 9 also similar with the result of the table 8. This result means that positive spread of price momentum portfolios actually comes from correlation between MOM and SUO so if we control the effect of SUO, it remains no longer.

Table 10 shows average monthly returns for portfolio formed on SUE and SUO. Except that MOM is replaced to SUE, other conditions are same with table 9. Where we see only average monthly returns for ten portfolios formed on SUO, there is a tendency that it increases as SUO increases from -0.97%

to 2.94% so spread is 3.91%. It is almost same level with the spread of SUE portfolios. More important thing is that where we consider SUE and SUO together, there remains stable tendency on both sides. All spreads of SUE and SUO portfolios are positive over monthly 1% and slightly lower than where SUE and SUO are independently considered. This result means that SUE and SUO are somewhat correlated but they give us independent dimensional information to predict the future stock returns.

5. Summaries and conclusions

We study to find source of price momentum. Many previous studies suppose that price momentum is caused by market under-reaction to information. In order to know which kinds of information are important to explain the price momentum effect, we consider information about existing well known factors such as size, value, profitability, and investment factors. It is confirmed that they explain the future stock returns by the various financial empirical studies. Value, profitability, and investment factors are also have theoretical background by the valuation theory to answer the question why they explain the future stock returns. To represent information changes about those factors, we define proxies of it and call factor momentum. This concept is expanded from existing earnings momentum which commonly represented by standard unexpected earnings, SUE. Therefore various size, value, profitability, and investment momentum proxies are tested by the cross-section regression of Fama and MacBeth. In general, factor momentum proxies are helpful to explain the future stock returns even after controlling size, value, profitability, investment, and price momentum. However, only profitability momentum proxies can capture the price momentum effect successfully. It is available because we use two kinds of profitability factors based on both operating profit, O_t and earnings, I_t. Information change about two kinds of profitability factors are represented by SUO and SUE respectively. We show that information change of operating profit is important in order to capture price momentum compared with earnings. To investigate relationships between price momentum, SUE and SUO in detail, we also analyze with the average returns of portfolios. SUE and SUO are

clearly more dominant to explain the future stock returns than price momentum. SUE and SUO can give us independent dimensional information about the future stock returns beyond price momentum. These results suggest price momentum is due to the sluggish response to new information not only on earnings but also on operating profit.

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Table 1

Monthly cross-section return regressions to test two profitability proxies

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. dA_t is A_t-A_{t-1}. MOM_12 is a price momentum proxy from returns in recent 12 months. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum		
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	Int	R^2
Average	-0.19	0.37	0.74		-0.65	0.11	2.15	0.04
t-statistics	-5.02	6.75	8.18		-5.06	6.40	6.69	
Average	-0.19	0.35		1.10	-0.63	0.10	2.18	0.04
t-statistics	-5.14	5.97		5.83	-5.14	5.97	6.94	
Average	-0.20	0.39	0.62	0.81	-0.71	0.11	2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32	6.89	

Table 2

Monthly cross-section return regressions to test four price momentum proxies

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, and A_t are market equity, book equity, annual operating profit, and total assets. dA_t is A_t-A_{t-1}. MOM_03, MOM_06, MOM_09, and MOM_12 are price momentum proxies from returns in recent 3, 6, 9, and 12 months respectively. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability	Investment	Momentum 1	Momentum 2	Momentum 3	Momentum 4		
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_03	MOM_06	MOM_09	MOM_12	Int	R^2
Average	-0.18	0.27	0.78	-0.51	0.02				2.12	0.03
t-statistics	-4.64	4.41	8.13	-3.88	3.64				6.37	
Average	-0.18	0.29	0.74	-0.51		0.05			2.07	0.04
t-statistics	-4.81	5.03	8.00	-4.01		5.02			6.43	
Average	-0.18	0.34	0.76	-0.54			0.08		2.06	0.04
t-statistics	-4.82	6.10	8.52	-4.25			5.43		6.51	
Average	-0.19	0.37	0.74	-0.65				0.11	2.15	0.04
t-statistics	-5.02	6.75	8.18	-5.06				6.40	6.69	
Average	-0.19	0.36	0.72	-0.66	0.00	0.01	-0.02	0.13	2.09	0.04
t-statistics	-5.42	6.92	8.62	-5.37	-1.01	0.58	-0.94	6.89	6.98	

Table 3

Monthly cross-section return regressions with size and value momentum proxies

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. dA_t is A_t-A_{t-1}. MOM_12 is a price momentum proxy from returns in recent 12 months. SU_var means standardized unexpected variable. The standardized unexpected variable SU_var = (var_t-var_{t-1})/σ_t, where σ_t is the standard deviation of (var_t-var_{t-1}) over the prior eight quarters. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum						
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	SU_M_t	SU_B_t	SU_A_t	SU_B_t/M_t	Int	R^2
Average	-0.20	0.39	0.62	0.81	-0.71	0.11					2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32					6.89	
Average	-0.20	0.39	0.66	0.76	-0.65	0.10	0.01				2.18	0.04
t-statistics	-5.48	6.71	6.76	3.46	-4.99	5.68	1.40				6.89	
Average	-0.20	0.40	0.65	0.46	-0.71	0.10		0.02			2.18	0.04
t-statistics	-5.59	5.89	5.96	1.24	-2.66	5.89		6.65			6.78	
Average	-0.20	0.39	0.74	0.78	-1.04	0.10			0.02		2.13	0.04
t-statistics	-5.41	6.09	5.36	2.52	-5.84	5.96			4.18		6.65	
Average	-0.20	0.36	0.82	0.75	-0.78	0.10				0.02	2.15	0.04
t-statistics	-5.46	5.78	6.43	2.79	-5.95	5.48				1.85	6.79	
Average	-0.21	0.36	0.73	0.63	-1.06	0.11	0.01	0.02	0.02	0.04	2.16	0.04
t-statistics	-5.84	5.54	6.35	1.95	-6.77	6.06	0.38	5.60	4.09	2.60	6.75	

Table 4

Monthly cross-section return regressions with profitability momentum proxies 1

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. dA_t is A_t-A_{t-1}. MOM_12 is a price momentum proxy from returns in recent 12 months. SU_var means standardized unexpected variable. The standardized unexpected variable SU_var = $(var_t\text{-}var_{t-1})/\sigma_t$, where σ_t is the standard deviation of $(var_t\text{-}var_{t-1})$ over the prior eight quarters. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum						
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	SU_O_t	SU_O_t/B_t	SU_I_t	SU_I_t/B_t	Int	R^2
Average	-0.20	0.39	0.62	0.81	-0.71	0.11					2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32					6.89	
Average	-0.20	0.42	0.55	0.75	-0.93	0.10	0.09				2.17	0.04
t-statistics	-5.51	6.66	5.34	2.53	-6.48	5.73	12.45				6.80	
Average	-0.19	0.44	0.57	0.53	-0.56	0.10		0.07			2.19	0.04
t-statistics	-5.30	5.59	4.63	1.61	-1.71	5.58		9.84			6.81	
Average	-0.21	0.46	0.63	0.52	-0.84	0.08			0.16		2.19	0.04
t-statistics	-5.82	8.05	6.53	2.43	-6.64	4.95			18.95		6.94	
Average	-0.19	0.40	0.73	0.69	-0.73	0.09				0.11	2.15	0.04
t-statistics	-5.34	6.70	6.41	2.40	-5.53	5.06				12.99	6.86	
Average	-0.20	0.52	0.51	-0.41	-0.42	0.06	0.05	0.03	0.13	0.06	2.28	0.04
t-statistics	-5.71	6.23	3.41	-0.54	-0.67	3.27	6.48	4.42	10.58	6.33	6.88	

Table 5

Monthly cross-section return regressions with profitability momentum proxies 2

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. $O_{t,q}$ and $I_{t,q}$ are quarterly operating profit and quarterly earnings. dA_t is A_t-A_{t-1}. MOM_12 is a price momentum proxy from returns in recent 12 months. SU_var means standardized unexpected variable. The standardized unexpected variable SU_var = (var_t-var_{t-1})/σ_t, where σ_t is the standard deviation of (var_t-var_{t-1}) over the prior eight quarters. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum	SUO		SUE			
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	$SU\_O_{t,q}$	$SU\_O_{t,q}/B_t$	$SU\_I_{t,q}$	$SU\_I_{t,q}/B_t$	Int	R^2
Average	-0.20	0.39	0.62	0.81	-0.71	0.11					2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32					6.89	
Average	-0.27	0.49	0.58	1.45	-1.16	0.07	0.32				2.33	0.04
t-statistics	-4.86	5.28	1.28	2.33	-6.34	2.72	20.78				5.58	
Average	-0.23	0.47	0.92	1.28	-0.84	0.08		0.23			2.18	0.04
t-statistics	-3.92	5.21	1.87	1.85	-4.49	2.68		15.80			5.04	
Average	-0.21	0.46	0.68	0.64	-0.82	0.07			0.28		2.15	0.04
t-statistics	-5.75	8.00	6.97	2.94	-6.58	4.04			26.68		6.83	
Average	-0.19	0.37	0.81	0.58	-0.76	0.08				0.21	2.16	0.04
t-statistics	-5.41	6.27	6.99	2.25	-5.67	4.44				19.50	6.90	
Average	-0.21	0.71	1.25	0.73	-0.97	0.01	0.22	0.09	0.25	0.04	2.13	0.04
t-statistics	-3.50	6.88	2.89	1.49	-5.54	0.44	9.54	2.93	10.49	1.07	5.41	

Table 6

Monthly cross-section return regressions with profitability momentum proxies 3

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. $O_{t,q}$ and $I_{t,q}$ are quarterly operating profit and quarterly earnings. dA_t is A_t-A_{t-1}. MOM_12 is a price momentum proxy from returns in recent 12 months. SU_var means standardized unexpected variable. The standardized unexpected variable SU_var = (var_t-var_{t-1})/σ_t, where σ_t is the standard deviation of (var_t-var_{t-1}) over the prior eight quarters. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum	SUO		SUE			
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	$SU\_O_{t,q}$	$SU\_O_{t,q}/B_t$	$SU\_I_{t,q}$	$SU\_I_{t,q}/B_t$	Int	R^2
Average	-0.20	0.39	0.62	0.81	-0.71	0.11					2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32					6.89	
Average	-0.27	0.52	0.62	1.11	-1.20	0.04	0.25		0.24		2.34	0.04
t-statistics	-4.57	5.50	1.27	1.65	-6.53	1.46	15.42		11.70		5.29	
Average	-0.19	0.47	1.21	0.63	-0.68	0.04		0.19		0.18	2.04	0.05
t-statistics	-3.33	5.32	2.53	0.92	-3.76	1.32		8.69		5.25	4.55	
Average	-0.20	0.59	1.19	0.86	-0.90	0.03	0.29	0.12			2.00	0.05
t-statistics	-3.11	6.55	2.40	1.28	-5.14	0.72	13.95	4.93			4.27	
Average	-0.21	0.44	0.83	0.48	-0.88	0.06			0.26	0.07	2.17	0.04
t-statistics	-5.88	7.35	7.20	1.86	-6.64	3.31			20.90	6.43	6.95	
Average	-0.21	0.71	1.25	0.73	-0.97	0.01	0.22	0.09	0.25	0.04	2.13	0.04
t-statistics	-3.50	6.88	2.89	1.49	-5.54	0.44	9.54	2.93	10.49	1.07	5.41	

Table 7

Monthly cross-section return regressions with investment momentum proxies

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average slopes and their Fama-MacBeth t-statistics from monthly cross-section regressions to predict stock returns. M_t, B_t, O_t, I_t, and A_t are market equity, book equity, annual operating profit, annual earnings, and total assets. dA_t and dB_t are A_t-A_{t-1} and B_t-B_{t-1} respectively. MOM_12 is a price momentum proxy from returns in recent 12 months. SU_var means standardized unexpected variable. The standardized unexpected variable SU_var = (var_t-var_{t-1})/σ_t, where σ_t is the standard deviation of (var_t-var_{t-1}) over the prior eight quarters. Int is the regression intercept and the regression R^2 is adjusted for degrees of freedom.

	Size	Value	Profitability 1	Profitability 2	Investment	Momentum						
	$\ln(M_t)$	$\ln(B_t/M_t)$	$\ln(1+O_t/B_t)$	$\ln(1+I_t/B_t)$	$\ln(1+dA_t/A_{t-1})$	MOM_12	SU_dA_t	SU_dA_t/A_{t-1}	SU_dB_t	SU_dB_t/B_{t-1}	Int	R^2
Average	-0.20	0.39	0.62	0.81	-0.71	0.11					2.18	0.04
t-statistics	-5.44	6.61	6.40	3.84	-5.74	6.32					6.89	
Average	-0.18	0.38	0.69	0.38	-0.89	0.10	0.03				2.12	0.04
t-statistics	-4.91	5.95	6.69	1.26	-6.79	5.66	4.93				6.55	
Average	-0.18	0.38	0.70	0.37	-0.88	0.10		0.03			2.13	0.04
t-statistics	-4.90	5.97	6.78	1.23	-6.70	5.62		5.07			6.56	
Average	-0.19	0.37	0.69	0.29	-0.83	0.10			0.02		2.16	0.04
t-statistics	-5.04	5.90	6.67	0.93	-6.61	5.67			4.93		6.63	
Average	-0.18	0.37	0.70	0.25	-0.79	0.10				0.02	2.15	0.04
t-statistics	-4.97	5.80	6.74	0.74	-6.37	5.69				4.15	6.60	
Average	-0.19	0.37	0.71	0.27	-0.98	0.10	0.03	0.00	0.03	0.00	2.17	0.04
t-statistics	-5.09	5.82	6.74	0.81	-7.47	5.38	1.71	0.09	3.07	0.10	6.69	

Table 8

Average monthly returns for portfolios by price momentum and SUE

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average monthly returns for portfolio formed on price momentum (MOM) and standardized unexpected earnings (SUE). At the end of each month, stocks are allocated to ten price momentum groups using NYSE break point. Stocks are allocated independently to ten standardized unexpected earnings groups using NYSE break point.

	All	Low-MOM	2	3	4	5	6	7	8	9	High_MOM	High-Low
All		0.68	1.05	1.06	1.17	1.32	1.29	1.37	1.49	1.65	1.78	1.11
Low-SUE	-0.97	-1.43	-0.82	-0.60	-0.59	-0.85	-0.91	-0.47	-0.58	-0.74	-0.66	0.77
2	-0.33	-0.50	-0.08	-0.08	-0.12	-0.13	-0.21	-0.23	-0.35	-0.63	-1.14	-0.64
3	0.25	0.41	0.39	0.19	0.35	0.28	0.33	0.23	0.25	0.04	-0.57	-0.98
4	0.87	1.07	1.09	0.60	0.95	1.10	0.78	0.95	0.60	0.76	0.40	-0.67
5	1.52	2.30	1.64	1.48	1.45	1.55	1.32	1.19	1.41	1.17	1.12	-1.19
6	1.79	2.53	1.87	1.71	1.50	1.88	1.58	1.45	1.69	1.73	1.67	-0.86
7	2.11	2.42	2.56	2.31	1.93	2.26	1.95	1.85	1.92	1.96	2.02	-0.40
8	2.43	2.87	2.83	2.53	2.26	2.22	2.31	2.28	2.18	2.21	2.53	-0.34
9	2.64	2.88	2.79	2.68	2.76	2.55	2.34	2.14	2.41	2.77	2.82	-0.06
High_SUE	3.05	3.89	3.25	2.78	2.72	2.66	2.62	2.77	2.78	3.05	3.40	-0.49
High-Low	4.02	5.31	4.06	3.38	3.31	3.51	3.53	3.24	3.36	3.80	4.06	

Table 9

Average monthly returns for portfolios by price momentum and SUO

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average monthly returns for portfolio formed on price momentum (MOM) and standardized unexpected operating profit (SUO). At the end of each month, stocks are allocated to ten price momentum groups using NYSE break point. Stocks are allocated independently to ten standardized unexpected operating profit groups using NYSE break point.

	All	Low-MOM	2	3	4	5	6	7	8	9	High-MOM	High-Low
All		0.68	1.05	1.06	1.17	1.32	1.29	1.37	1.49	1.65	1.78	1.11
Low-SUO	-0.97	-1.23	-0.84	-0.95	-0.55	-0.68	-0.84	-0.41	-0.74	-1.00	-1.26	-0.03
2	-0.17	-0.33	-0.02	0.09	-0.02	0.14	-0.10	-0.17	-0.37	-0.29	-0.67	-0.34
3	0.25	0.21	0.52	0.40	0.31	0.27	0.08	0.38	0.52	0.17	-0.48	-0.69
4	0.91	1.45	0.90	0.78	0.96	0.84	0.82	0.60	0.58	0.94	0.43	-1.02
5	1.40	1.71	1.56	1.26	1.42	1.64	1.41	1.12	1.33	1.31	1.09	-0.61
6	1.80	2.19	2.27	1.98	1.67	2.01	1.46	1.51	1.69	1.62	1.51	-0.68
7	2.06	2.30	2.48	2.15	1.96	2.05	1.91	1.98	1.89	1.85	2.05	-0.25
8	2.39	2.75	2.73	2.46	2.24	2.20	2.24	2.21	2.19	2.41	2.42	-0.32
9	2.77	3.35	3.04	2.82	2.77	2.47	2.68	2.44	2.38	2.67	2.98	-0.38
High_SUO	2.94	3.42	2.81	2.59	2.45	2.70	2.60	2.55	2.86	2.86	3.41	-0.01
High-Low	3.91	4.65	3.65	3.54	3.00	3.38	3.44	2.97	3.59	3.86	4.67	

Table 10

Average monthly returns for portfolios by SUE and SUO

Data range is NYSE, AMEX, and NASDAQ stocks in January 1963-December 2015, 636 months. The table shows average monthly returns for portfolio formed on standardized unexpected earnings (SUE) and standardized unexpected operating profit (SUO). At the end of each month, stocks are allocated to ten standardized unexpected earnings groups using NYSE break point. Stocks are allocated independently to ten standardized unexpected operating profit groups using NYSE break point.

	All	Low-SUE	2	3	4	5	6	7	8	9	High-SUE	High-Low
All		-0.97	-0.33	0.25	0.87	1.52	1.79	2.11	2.43	2.64	3.05	4.02
Low-SUO	-0.97	-1.49	-0.69	-0.43	-0.27	0.99	0.98	1.14	0.67	1.81	1.43	2.93
2	-0.17	-0.82	-0.53	0.24	0.39	1.05	0.95	0.59	0.57	0.68	1.67	2.49
3	0.25	-0.46	-0.33	0.02	0.60	0.75	1.41	1.01	1.34	1.66	1.96	2.42
4	0.91	-0.18	-0.04	0.54	0.90	1.15	1.54	1.41	1.78	1.34	1.55	1.73
5	1.40	0.20	0.62	0.40	1.00	1.74	1.54	1.98	1.64	1.37	2.57	2.38
6	1.80	0.44	0.28	0.70	1.08	1.75	2.00	2.13	2.26	2.00	2.49	2.05
7	2.06	0.62	0.41	0.83	1.37	1.94	1.89	2.28	2.52	2.06	2.75	2.13
8	2.39	0.85	1.40	0.69	1.53	1.78	2.24	2.35	2.65	2.76	2.84	2.00
9	2.77	1.31	0.86	1.35	2.02	1.86	2.06	2.50	2.80	3.19	3.18	1.87
High-SUO	2.94	1.33	0.99	1.32	2.07	2.16	2.19	2.52	2.85	2.91	3.34	2.00
High-Low	3.91	2.83	1.68	1.75	2.34	1.17	1.21	1.38	2.18	1.10	1.90	