Do Style and Sector Indexes Carry Momentum?

By

Linda H. Chen, George J. Jiang and Kevin X. Zhu

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[1] Linda H. Chen, Department of Accounting & Finance, College of Management, University of Massachusetts Boston, Boston, MA02125. E-mail: linda.chen@umb.edu. George J. Jiang, Finance Department, Eller College of Management, University of Arizona, Tucson, Arizona 85721-0108. Phone: 520.621.3373. Fax: 520.621.1261. E-mail: gjiang@eller.arizona.edu. Kevin X. Zhu, School of Accounting and Finance, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong. E-mail: afkzhu@inet.polyu.edu.hk. We would like to thank Laura Cheney, Kuan-Hui Lee, Nancy Su, Wilson Tong, Flora Zhu and other seminar participants at the 4th International CAFM Conference in Seoul, 2010 Portfolio Management Conference, and Hong Kong Polytechnic University for helpful comments and suggestions.

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Abstract

Existing literature documents that cross-sectional stock returns exhibit both price momentum and earnings momentum. In this paper, we examine whether commonly used style and sector indexes also have momentum patterns. We show that style indexes exhibit strong price momentum, but little evidence of earnings momentum. On the other hand, sector indexes exhibit both significant price momentum and earnings momentum. Moreover, we provide evidence that price momentum in style indexes can be explained by individual stock return momentum, whereas price momentum in sector indexes is driven by earnings momentum. Finally, we show that a dynamic momentum strategy can further enhance the performance of style investment even after adjusting for transaction costs.

JEL classification: G10; G11; G14

Key Words: Style Indexes; Sector Indexes; Price Momentum; Earnings Momentum; Transaction Costs

1. Introduction

Existing literature has documented that cross-sectional stock returns exhibit price momentum patterns. Namely, past winners continue to perform well, and past losers continue to perform poorly. Stock price momentum is first documented by Jegadeesh and Titman (1993) who show that stocks with higher past returns subsequently have higher returns, at horizons ranging from 3 to 12 months. They refer to investment strategies of buying past winners and selling past losers as relative strength strategies, which are widely referred to as momentum strategies in subsequent studies. Fama and French (1996) show that the momentum effect is unexplained by a three factor model. In other words, the size and value effects do not subsume the predictive power of past stock returns for future stock returns.

In addition to price momentum, the literature also documents an earnings momentum pattern or the well-known post-earnings announcement drift (PEAD) phenomenon. That is, firms reporting unexpectedly high earnings subsequently outperform firms reporting unexpectedly low earnings. The superior performance persists for about nine months after the earnings announcement. Ball and Brown (1968) is the first to document an apparent delay in the stock price reaction to earnings surprises. Based on the data from 1974 to 1981, Foster, Olsen, and Shevlin (1984) show that there is potentially an annualized payoff of 25% from earnings momentum strategies. Bernard and Thomas (1990) provide evidence that the PEAD cannot be plausibly reconciled with arguments based on risk factors, but is consistent with the hypothesis of delayed price response.

In this paper, we examine whether widely used style indexes and sector indexes in the financial industry also exhibit momentum patterns and how price momentum is related to earnings momentum at the style and sector index level. The main motivation of our study is that despite the documented price momentum and earnings momentum in individual stocks, implementing such trading strategies can be costly if not infeasible. This is because these strategies involve trading on a large number of winner and

loser stocks. As a result, an important question is: can momentum effects survive transaction costs? Lesmond, Schill, and Zhou (2004) and Korajczyk and Sadka (2004) examine the effect of transaction costs on momentum profits. Lesmond, Schill, and Zhou (2004) find that standard momentum strategies require frequent trading in disproportionally high cost stocks. That is, stocks that generate large momentum returns are precisely those stocks with high trading costs. Korajczyk and Sadka (2004) show that returns of equal-weighted momentum portfolio are most sensitive to trading costs. Overall, they provide evidence that momentum profits often disappear after adjusting for transaction costs. The advantage of examining style and sector indexes is that most (if not all) of their returns are tracked directly by exchange-traded funds (ETFs). In addition, the number of these style and sector indexes is small and the transaction costs of ETFs are low. Thus, if these indexes also carry momentum effects then it would be much more feasible for such effects to be realized. We note that both style and sector investing strategies have been widely employed in the industry and extensively researched by academic studies (see, e.g., Brown and Goetzmann, 1997, 2001; Chan, Chen, and Lakonishok, 2002; Levis and Liodakis, 1999; and Lucas, van Dijk and Kloek, 2002). As an illustration, we show in this paper that a dynamic momentum strategy can further enhance the performance of style investment even after adjusting for transaction costs.

The data used in our study consists of two sets of indexes constructed by Morningstar: nine Morningstar Style Indexes and 12 Morningstar Sector Indexes. The style indexes cover about 97% of US equity markets with stocks ranging from small cap to large cap and from high growth (low value) to high value (low growth). The sector indexes cover stocks in three major super sectors: the Information Economy, the Service Economy, and the Manufacturing Economy and four specific groups within each of the super sectors. The sample period in our study is roughly a ten-year period from July 1997 to October 2007 for both style indexes and sector indexes.

We show that despite a small number of indexes, both style indexes and sector indexes exhibit significant price momentum patterns. We construct momentum portfolios based on 3-, 6-, and 12-month ranking periods, with 1-, 3-, 6-, and 12-month holding periods. Among all of the portfolios, style indexes exhibit the strongest price momentum effects when they are ranked on past 6-month returns, whereas sector indexes show the strongest price momentum effects at the 6-month holding period. In comparison, momentum returns are generally higher for style indexes than for sector indexes. For style indexes, the annualized returns of momentum portfolios formed on past 6-month returns are as high as 16.99% and 13.42% over the 3-month and 6-month holding periods, respectively. For sector indexes, the annualized returns of momentum portfolios formed on the past 3-month and 6-month returns, both with a 6-month holding period, are, respectively, 4.86% and 6.71%. Our results also show that these momentum profits are not driven by outliers. For the style index momentum portfolios formed on past 6-month returns with 3-month and 6-month holding periods, the percentages of positive returns are, respectively, 63% and 66%.

Based on historical earnings surprises, we find no evidence of earning momentum effects in style indexes. However, we find significant and pervasive earnings momentum patterns in sector indexes. The momentum effects are significant for 3-month to 12-month holding periods and robust to past SUEs. The annualized momentum profits based on past 12-month SUEs are 6.97% and 6.56%, respectively, over the 3-month and 6-month holding periods.

The fact that style indexes do not exhibit earnings momentum is evidence that price momentum in style indexes is not driven by earnings momentum. We explore alternative explanations of price momentum in style indexes by regressing momentum returns against various factors. The models included in our analysis are the CAPM, the 3-factor model of Fama-French (1993), and the 4-factor model of Carhart (1997). The empirical results show that the momentum returns have a highly

significant loading on the momentum factor of individual stocks (UMD). More importantly, the momentum returns of style indexes are fully explained by the momentum factor. Finally, we examine whether price momentum in sector indexes is driven by earnings momentum effect. We employ a double sorting procedure to examine the effect of past earnings surprises on the price momentum of sector indexes. Our results show that once we control for the effect of past earnings surprises, there is no longer significant price momentum in sector indexes. This is evidence that the price momentum effect in sector indexes is largely driven by earnings momentum.

The rest of the paper is structured as follows. Section 2 discusses the data used in our study. Section 3 examines both price and earnings momentum effects in style and sector and what are the potential driving forces of price momentum. Section 4 uses style indexes to illustrate the dynamic momentum strategy. Section 5 concludes.

2. Data Description

The main data used in our study consists of nine Morningstar Style Indexes and Morningstar Sector Index family. Morningstar Style Indexes are corresponding to the well-known Morningstar style boxes. These style indexes cover 97% of US equity markets. Morningstar sector index family divides the stock universe into three major economic spheres or Super Sectors: the Information Economy, the Service Economy, and the Manufacturing Economy. Within each of these Super Sectors, four specific groups are defined for a total of 12 sectors. The indexes for these 12 sectors are used in the study. To implement earnings momentum strategies, we need measures of unexpected earnings for each index. Following Foster, Olsen, and Shevlin (1984), and Bernard and Thomas (1989), we first estimate standardized unexpected earnings (*SUE*) for each firm in each quarter. Specifically, forecasted earnings are estimated based on the following univariate time-series model with rolling 20-quarter observations:

$$E(Q_{i,t}) = E(Q_{i,t-4}) + \varphi_i (Q_{i,t-1} - Q_{i,t-5}) + \varsigma_i, \qquad (1)$$

where $Q_{i,t}$ is the quarterly earnings of the *i*th firm in quarter *t*. The difference between the actual and forecasted earnings is then scaled by the standard deviation of forecast error over the estimation period to obtain standardized unexpected earnings (*SUE*). [2] With the estimate of SUE for each firm, we then calculate the value-weighted average of SUE for each index based on its stock composition. Quarterly earnings data is from Compustat, and the holdings data for the indexes is from Morningstar Inc.

2.1 Characteristics of Morningstar Style Indexes

The nine style indexes are constructed in two steps according to Morningstar index construction methodology (Morningstar Construction Rules for Morningstar Indexes). In step 1, three market cap or size indexes are constructed: The Large Cap Index is constructed by selecting large stocks which comprise 70% of market capitalization of the investable universe. The Mid Cap Index represents the next largest stocks which comprise 20% of market capitalization of the investable universe. The Small Cap Index represents the next largest stocks which comprise 7% of the market capitalization of the investable universe. Then in step 2, within each of the cap indexes, index constituents are assigned to one of three style indexes according to value orientation vs. growth orientation. [3] The value-oriented index contains those stocks that, within the relevant cap index, have a stronger value orientation than growth orientation. The growth-oriented index contains those stocks that, within the relevant cap index, have a stronger growth orientation than value orientation. The two steps result in nine style indexes. The

[2] We note that some studies also construct SUE based on analyst earnings forecasts. However, the data is only available for a subset of stocks. For the purpose of our study, we use the SUE measure constructed from historical earnings.

[3] Morningstar assigns a value orientation score and growth orientation score to each stock. The value orientation is based on five value factors, namely earnings price ratio, dividend yields, sales, cash flow, and book-market ratio, and the growth orientation is based on four growth factors, namely the growth rates of earnings, sales, cash flow, and book value. The value orientation score and growth orientation score are weighted averages of their respective factors. For details, please refer to "Construction Rules for Morningstar Indexes", Morningstar, May 2004.

inception date of the style indexes is June 30, 1997. The indexes' base market values at inception are $1,000.

Table 1 reports summary statistics of monthly returns and SUE of Morningstar Style Indexes. The results show that monthly average returns are positive with negative skewness for all style indexes over the sample period. The average returns of mid and small caps are similar across value styles. The growth indexes have the highest standard deviations and largest ranges between maximum and minimum monthly returns. The core indexes have higher kurtosis than growth and value indexes. For the standardized unexpected earnings, the large core index has the highest SUE and the small value index has the lowest SUE. Interestingly, all growth indexes have positive SUEs, and in contrary, all value indexes show negative SUEs. This is consistent with the intuition that growth stocks are more likely to have positive earnings surprises than value stocks.

The Morningstar Style Indexes are investable and there are corresponding ETFs (Exchange-Traded Funds). These ETFs are issued by iShares and traded on New York Stock Exchange (NYSE). The inception date of these ETFs is June 28, 2004. Table 2 reports the time-series averages of the market value, net expense ratio, and turnover ratio of these ETFs from 2004 to 2008. The average market values for the large cap, mid cap, and small cap ETFs are about $277 million, $177 million, and $92.46 million, respectively. Note that for both large cap and mid cap ETFs there is a significant amount of asset invested in the growth indexes, whereas for the small cap ETFs there is less investment in growth indexes. It seems that investors prefer investing in growth stocks to value stocks in the large cap and mid cap groups, but prefer value stocks to growth stocks in the small cap group. The average turnovers for the large cap, mid cap, and small cap ETFs are about 26%, 37%, and 53%, respectively, which indicates that stocks in the small cap group have a higher chance of moving in or out. Nevertheless, these turnover ratios are low compared to the average turnover ratio of 70.2% for US equity funds during the period of

1990-1994 (see Wermers (2000)). Finally, the expense ratios are generally low, ranging from 0.20% for large core index to 0.30% for mid and small growth/value indexes. This is compared to the average expense ratio of 0.93% for US equity funds during the period of 1990-1994 (see Wermers (2000)).

2.2 Characteristics of Morningstar Sector Indexes

Morningstar Sector Indexes are constructed in the following steps. First, each stock in the stock universe is classified into one of 213 industries. The classification is primarily based on a company's annual report and Form 10-K. The company web sites, sell-side research, and trade publications are used as secondary sources. Second, based on companies' common operational characteristics, they are classified into 91 industry groups. Finally, 91 industry groups are folded into 12 sectors: Software, Hardware, Media, Telecommunications, Health Care, Consumer Services, Business Services, Financial Services, Consumer Goods, Industrial Materials, Energy, and Utilities. These 12 sectors are further classified into three major super sectors: the Information Economy, the Service Economy, and the Manufacturing Economy. The inception date of the twelve sector indexes is also June 30, 1997. The indexes' base market values at inception are $1,000. However, different from the Morningstar style indexes, there are no corresponding ETF's for these sector indexes.

Table 3 reports summary statistics of monthly returns and SUE of Morningstar Sector Indexes. The results show that the energy sector has the highest average return, whereas the telecommunication sector has the lowest return during our sample period. Return standard deviation is highest for the hardware sector and lowest for the consumer goods sector. The returns for most of the sectors are negatively skewed except the energy sector, the software sector, and the telecommunication sector. This could be due to the spike of oil price and tech bubble during our sample period. The consumer goods, financial services, and telecommunication sectors have higher levels of kurtosis than other sectors, which indicate

that these three sectors tend to have extreme returns. Panel B shows that SUE is positive for all sectors with the only exception of consumer goods sector. The industrial materials and consumer services are the sectors with the highest SUE.

3. Momentum Effects

3.1 Style Indexes

In this section, we investigate whether there are price and earnings momentum effects in Morningstar Style Indexes. At the beginning of every month during our sample period, the indexes are ranked by their cumulative returns or their average SUEs over the past three, six, and twelve months and assigned to one of three portfolios. Portfolio 1 (P1) consists of the three style indexes with the highest past cumulative returns (or the highest average SUEs). Portfolio 3 (P3) consists of the three style indexes with the worst past cumulative returns (or the lowest average SUEs). The remaining indexes are in portfolio 2 (P2). Each portfolio is then held over the next one, three, six, or twelve months. The combination of three different ranking periods and four different holding periods results in 12 momentum strategies. All indexes are equally-weighted in the portfolios. The momentum portfolio (P1-P3) is a portfolio that takes a long position in portfolio 1 (buy winners) and a short position in portfolio 3 (sell losers). Thus, the return of a momentum portfolio, often referred to as the momentum profit, is essentially the spread between the returns of portfolio 1 and portfolio 3.

Table 4 reports the average holding period return (mean), its t-statistics (t-Stat), and the percentage of positive return (+%) for each portfolio over our sample period. Panel A reports the results of the price momentum effect and Panel B reports the results of the earnings momentum effect in Morningstar Style Indexes.

3.1.1. Price Momentum of Style Indexes

The results in Panel A of Table 4 show that the average returns of portfolio P1, P2, and P3 are all positive. For the momentum portfolios (P1-P3), except for the one with a 12-month ranking period and a 12-month holding period, the average returns are all positive. In particular, with the 6-month ranking period the average returns of the momentum portfolios are all statistically significant at the 5% confidence level for all holding periods. This indicates that past 6-month index returns are the strongest momentum indicator. The annualized momentum profit for the 3-month and 6-month holding periods are as high as 16.99% and 13.42%, respectively. In addition, the percentages of positive returns are, respectively, 63% and 66% for these two holding horizons. This suggests that the momentum profit is not driven by outliers. With a 3-month ranking period, the average returns of the momentum portfolios with a 6-month or 12-month holding period are also statistically significant at the 5% confidence level. However, the momentum profits are clearly lower than those based on the 6-month ranking period. With a 12-month ranking period, only the momentum profit with a 3-month holding period is weakly significant at the 5% confidence level.

In comparison, as reported in Jegadeesh and Titman (1993) for individual stocks over the sample period of 1965-1989, the annualized momentum profits for the 3-month and 6-month holding periods with the 6-month ranking period are, respectively, 14.57% and 14.03%. Based on a more recent sample period of 1984-2000, Verardo (2009) reports an annualized momentum profit of 11.75% for individual stocks where both the ranking period and holding period are 6 months. This is evidence that the momentum effects of the style indexes are as strong as those in individual stocks. From Panel A of Table 4, we also note that in contrast to the reversal pattern at the one month horizon as documented in the literature for individual stock returns (see., e.g, Jegadeesh and Titman (1993)), we do not find such

patterns in style indexes. In fact, the average returns of the momentum portfolios with a 1-month holding period are all positive, although only significant with a 6-month ranking period.

3.1.2. Earnings Momentum of Style Indexes

The results in Panel B of Table 4 show that the average returns of portfolios P1, P2 and P3 are all positive. However, the average returns of the momentum portfolios are statistically insignificant at the 5% confidence level. The only exception is the portfolio with a 12-month ranking period and a 12-month holding period where the average return is statistically significant at the 5% confidence level but is negative. In fact, for the 12-month holding period, the average returns of the momentum portfolio (P1-P3) are negative for all ranking periods. The results show that in contrast to the price momentum, there is little evidence of earnings momentum effects in style indexes.

3.1.3. What Contributes to the Price Momentum of Style Indexes?

The absence of earnings momentum effects in style indexes is evidence that price momentum in style indexes is not driven by earnings momentum. In this section, we explore an alternative explanation, namely, whether price momentum in style indexes is related to price momentum of individual stocks. It is possible that winners and losers are clustered by style or firm characteristics such that the stock return momentum carries to the style indexes. To address the issue, we employ three different asset pricing models, namely, the 1-factor CAPM of Sharpe (1964) and Lintner (1965), the 3-factor model of Fama and French (1993), and the 4-factor model of Carhart (1997). Under each model, we regress monthly returns of momentum portfolios against various risk factors. Our focus is whether alpha estimates of the momentum portfolios are significant in the 1-factor CAPM, 3-factor, and 4-factor models. The specifications of these models are as follows:

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + e_t \quad (2)$$

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + e_t \quad (3)$$

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + e_t \quad (4)$$

where $r_{P1-P3,t}$ is the return of the momentum portfolio in excess of one-month T-bill yield; RMRF is the CRSP value-weighted return in excess of the one-month T-bill yield; and SMB, HML, and UMD are monthly size, B/M, and momentum factors. The factor data is from Kenneth R. French's Data Library.

Table 5 reports the regression results of all three models. Under the CAPM and the 3-factor Fama-French model, almost all alphas are positive. In particular, the alpha estimates of style index momentum portfolios with the 6-month ranking period are all statistically significant. The results show that the 1-factor CAPM and the 3-factor Fama-French model cannot explain the momentum profits in style indexes. However, when the momentum factor (UMD) is added into the model as an additional explanatory variable, i.e., under the 4-factor Carhart model, these alphas become statistically insignificant. In addition, the loadings on UMD are all positive and highly statistically significant except for the momentum portfolio with the 12-month ranking period and 12-month holding period. It can also be seen that with the addition of the momentum factor, the adjusted R-squares of the 4-factor Carhart model are substantially improved over the Fama-French 3-factor model. Overall, the results show that the price momentum effects in style indexes can be fully explained by the momentum factor of individual stocks.

To summarize, our results show that the style indexes exhibit significant price momentum patterns and the momentum effects are as strong as those in individual stocks. That is, aggregating individual stocks according to firm characteristics such as size and B/M, these diversified portfolios continue to exhibit strong price momentum patterns. However, the same cannot be said about the earnings momentum. Our results show that the style indexes exhibit little evidence of earnings momentum. That

is, in contrast to the findings based on individual stocks, once stocks are aggregated according to firm characteristics, namely size and B/M ratio, there is no longer an earnings momentum effect. One of the implications of these findings is that if PEAD for individual stock returns is due to delayed price response as suggested in Bernard and Thomas (1990), such delayed response to earnings surprises disappears at the style index level. Finally, the absence of earnings momentum in the style indexes suggests that earnings momentum is not the source of price momentum in style indexes. Instead, we find that price momentum in style indexes can be explained by the momentum factor of individual stocks.

3.2. Sector Indexes

In this section, we investigate whether there are price and earnings momentum effects in Morningstar Sector Indexes. The portfolios P1, P2, and P3 and the momentum portfolio (P1-P3) are constructed the same way as they are constructed for the style indexes. The only difference is that portfolios P1, P2, and P3 now consist of four sector indexes.

Table 6 reports the average holding period return, its t-statistics, and the percentage of positive returns for all portfolios constructed with 3-month, 6-month, and 12-month ranking periods and over 1-month, 3-month, 6-month, and 12-month holding periods. Again, Panel A reports the results on price momentum effects and Panel B reports the results on earnings momentum effects in sector indexes.

3.2.1. Price Momentum of Sector Indexes

Panel A of Table 6 shows that the average returns of portfolios P1, P2, P3, and the momentum portfolios (P1-P3) based on Morningstar Sector Indexes are all positive. For momentum portfolios with the 6-month holding period, the average returns are statistically significant at the 5% confidence level for all ranking periods. The annualized momentum profits over a 6-month holding period with the 3-

month and 6-month ranking periods are 4.86% and 6.71%, respectively. For the 12-month holding period, the average returns of the momentum portfolios are statistically significant with the 3-month or the 6-monthly ranking period. The magnitudes of annualized momentum portfolio profits are smaller, however, compared to those with the 6-month holding period. For the 1-month or the 3-month holding period, none of the momentum portfolios has significant positive returns. The results show that different from the style indexes, momentum effects for sector indexes are more sensitive to holding periods.

These results are consistent with the industry momentum findings in Moskowitz and Grinblatt (1999). Moskowitz and Grinblatt (1999) form 20 value-weighted industry portfolios every month from July 1963 to July 1995. Two digit Standard Industrial Classification (SIC) codes are used to form industry portfolios. With a 6-month ranking period and a 6-month holding period, they report an annualized return of 5.28% for momentum portfolio with a long position in three industries with highest past returns and a short position in three industries with lowest past returns.

3.2.2. Earnings Momentum of Sector Indexes

Panel B of Table 6 shows similar results on earnings momentum effects in sector indexes as those on price momentum effect in Panel A. The average returns of portfolios P1, P2, P3, and (P1-P3) are all positive. In particular, the profit patterns of earnings momentum portfolios are similar to those of price momentum portfolios. For example, the average returns of the earnings momentum portfolios with a 6-month holding period are statistically significant at the 5% confidence level for all ranking periods. In addition, the average returns of the earnings momentum portfolio with a 12-month ranking period and 3-month holding period are statistically significant at the 5% confidence level. The average returns are weakly significant (t-stat 1.972) for the momentum portfolios with a 3-month holding period and a 3-month or 6-month ranking period. With the 12-month ranking period, the annualized momentum profits

with 3-month and 6-month holding periods are 6.97% and 6.56%, respectively. Furthermore, except for the momentum portfolios with a 1-month holding period the percentages of positive returns are all above 61%. Overall, the results show that the earnings momentum portfolios of sector indexes are profitable when they are implemented with 3 to 12-month holding periods.

The results show that in contrast to the results for style indexes, there are strong earnings momentum effects in sector indexes. However, the magnitude of earnings momentum profit of sector indexes appears to be smaller than that based on individual stocks. Bernard and Thomas (1989) construct the earnings momentum portfolio with a long position in the top SUE decile and a short position in the bottom SUE decile over the sample period of 1974-86. They report a 4.2% abnormal return over the 60 days subsequent to earnings announcements, or about 18% on an annualized basis.

3.2.3. Does Earnings Momentum Explain Price Momentum in Sector Indexes?

The previous subsections show that sector indexes exhibit both price momentum effects and earnings momentum effects. The question is: to what extent the price momentum of the sector indexes is driven by earnings momentum? Chordia and Shivakumar (2006) examine the relation between price momentum and earnings momentum for individual stock returns. They provide evidence that price momentum is captured by the systematic component of earnings momentum. One casual observation seems to suggest that the price momentum of the sector indexes is driven by earnings momentum. That is, the price momentum effect is significant only in the case where the earnings momentum effect is significant. To address this question formally, we resort to a double sorting approach. At the end of each month we first sort sector indexes into three groups based on their past average SUE rankings. Group 1 consists of 4 indexes with the highest SUE rankings and group 3 consists of 4 indexes with the lowest SUE rankings. The remaining 4 indexes are in group 2. Within each SUE group, indexes are further

sorted into 4 sub-portfolios based on their past cumulative returns. The index with the highest return is portfolio 1 and the index with the lowest return is portfolio 4. The momentum portfolio (P1-P4) is a portfolio that is long in portfolio 1 and short in portfolio 4. This double sorting procedure allows us to examine whether price momentum in sector indexes can be explained by earnings momentum when we control for the effect of SUEs.

Table 7 reports the time series means of the monthly returns of each sub-portfolio as well as the momentum portfolios (P1-P4). The holding period for these portfolios is all set equal to 6 months since the sector indexes have the strongest momentum effect at the 6-month holding period. The ranking periods are set to be the same for past SUE and returns, ranging from 3-month to 12-month. The results in Panel A, B, and C are based on 3-month, 6-month, and 12-month ranking periods, respectively. The last row of each panel reports the average returns of the sub-portfolios across SUE groups with the same past return rank. Averaging across different SUE groups essentially controls the effect of past SUEs. Overall, stocks in the high SUE group have higher returns. This is consistent with the earnings momentum effect. However, it can be seen that conditional on SUE, only the group with the highest SUE exhibits a significant price momentum effect. That is, the price momentum effect in sector indexes is mainly driven by stocks with high SUEs. In the other two SUE groups, there is no significant price momentum effect. More importantly, after controlling for SUE, none of the momentum portfolios have statistically significant returns at the 5% confidence level. For example, in Panel A, after controlling for SUE, the average return of the momentum portfolio is 3% with a t-statistic of 1.890. The results suggest that the price momentum effect in sector indexes is largely driven by the earning momentum effect.

To summarize, our results show that similar to the style indexes, the sector indexes also exhibit significant price momentum. Aggregating individual stocks within each sector, these diversified portfolios continue to exhibit strong price momentum. However, the profits of price momentum for

sector indexes are generally lower than for style indexes, although in both cases they are substantial and are of economic significance. In addition, our results show different patterns of price momentum between style indexes and sector indexes. The price momentum effect seems to be the strongest with the 6-month ranking period for the style indexes, whereas it is the strongest over the 6-month holding period for the sector indexes. In contrast to style indexes which exhibit little evidence of earnings momentum, we find that sector indexes exhibit significant earnings momentum. Our results show that earnings momentum effects are prevalent for sector indexes over 3-month to 12-month holding periods and are robust to the ranking periods of past SUE. That is, earnings surprises aggregated at the sector level continue to have predictive power of future sector returns, albeit the predictive power is much lower than at the individual stock level. This finding suggests that if PEAD at the individual stock level is due to delayed stock price response, then such delayed price response remains significant at the sector level. Finally, we provide evidence that price momentum in sector indexes is largely driven by earnings momentum. Once controlling for unexpected earnings surprises, there is no longer a significant price momentum effect in sector indexes.

4. Dynamic Style Portfolios Enhanced by the Momentum Effect

The evidence documented in previous sections suggests that investment portfolios consisting of style and sector indexes could potentially be enhanced by exploiting the momentum effect. However, such dynamic momentum strategies incur transaction costs as a result of portfolio rebalancing. In this section, we use style indexes to illustrate the dynamic momentum strategy and examine the effect of transaction costs on its performance. Dynamic portfolios are constructed following the approach in Jegadeesh and Titman (1993). Specifically, the dynamic portfolio over-weighs style indexes in portfolio 1 (P1) by a fixed percentage (Delta) and under-weighs style indexes in portfolio 3 (P3) by the same

percentage whenever the portfolio is rebalanced. We compare the performance of this portfolio with that of a buy-and-hold passive benchmark portfolio which equally weighs all indexes. The value of delta for dynamic portfolios is set to 10 percent in our illustration.

As noted earlier, due to the fact that holding period may be longer than the monthly rebalancing frequency, at the beginning of each month only a sub-portfolio is rebalanced based on past index returns. For example, a portfolio with 6-month holding period consists of 6 sub-portfolios with overlapping holding periods. At the beginning of each month one of the 6 sub-portfolios is rebalanced such that the weight on the indexes in P1 is 10 percent higher and the weight on the indexes in P3 is 10% lower relative to the equally-weighted benchmark portfolio. For each dynamic portfolio, we consider two cases: (i) there are no transaction costs, and (ii) there are transaction costs. According to Bhardwaj and Brooks (1992), we assume a 20 bps transaction cost for a round trade. [4] For simplicity, when a sub-portfolio in a dynamic portfolio is rebalanced, we assume that the indexes in this sub-portfolio are entirely replaced. Note that in this way we somehow inflate the transaction costs since it may not be necessary to rebalance 100% of a sub-portfolio. Thus, the results presented here are more conservative than in practical situations.

Figure 1 plots the performance of dynamic price momentum portfolios of style indexes over the sample period. All portfolios are assumed to be one dollar in the beginning. The portfolios in Panel 1A are assumed without transaction costs and those in Panel 1B with transaction costs. For comparison, the equally-weighted benchmark portfolio is also plotted in each figure. For simplicity of presentation, we use RP and HP to denote Ranking Period and Holding Period, respectively, and X and Y to indicate the number of months for the ranking period and the number of months for the holding period, respectively.

[4] Bhardwaj and Brooks (1992) report that when the dollar volume (V) is between \$50,001 and \$500,000, the typical commission can be estimated by \$134 + \$0.001V. In other words, the variable cost is 0.1 percent. For on-line investors, the cost is even lower. Note that the style indexes can be traded just like stocks through their corresponding index funds.

Thus, the notation RP*X*HP*Y* represents a momentum strategy based on *X*-month ranking period and *Y*-month holding period.

Overall, the plots show that dynamic portfolios generate excess returns over the equally-weighted benchmark portfolio, even after adjusting for transaction costs. As expected, transaction cost has a stronger negative impact on the performance of dynamic portfolios with shorter holding periods. Panel 1A shows that before transaction costs, the dynamic portfolio with a 1-month holding period has the best performance. However, as shown in Panel B, after accounting for transaction costs, the terminal value of this portfolio drops from about 3.75 to below 3. Instead, dynamic portfolios with 3-month and 6-month holding periods have better performance than those with 1-month or 12-month holding period.

5. Conclusion

In this paper, we examine whether Morningstar Style Indexes and Morningstar Sector Indexes exhibit price and earning momentum effects. We find that both the style indexes and sector indexes carry price momentum. We also find that the sector indexes carry significant earnings momentum effects. However, we find no evidence of earnings momentum effects in style indexes. We further examine what drives price momentum in style and sector indexes. We provide evidence that the price momentum effect in style indexes can be explained by the factor of individual stock return momentum, and the price momentum effect in sector indexes is largely driven by the earnings momentum.

Our findings have practical implications. Since the returns on most (if not all) indexes are tracked directly by exchange-traded funds (ETFs), such momentum strategies are implementable with reasonable transaction costs. We show that the momentum strategy can further enhance the performance of style investing even after adjusting for transaction costs.

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Table 1: Summary Statistics of Returns and SUE of Morningstar Style Indexes

The table reports summary statistics of monthly returns and SUE for each of the Morningstar Style Indexes. SUE is the value-weighted average of SUE of individual stocks in an index. ‘‘Stdev,’’ ‘‘Skew,’’ and ‘‘Kurto’’ denote the standard deviation, skewness, and excess kurtosis, respectively.

Name	Mean	Stdev	Skew	Kurto	Max	Min
Panel A: Monthly returns						
Large Core Index	0.7%	4.0%	-0.514	2.136	13.0%	-16.0%
Large Growth Index	0.4%	6.7%	-0.569	0.905	15.0%	-23.0%
Large Value Index	0.8%	4.1%	-0.386	1.398	12.0%	-13.0%
Mid Core Index	1.0%	4.5%	-0.723	2.318	12.0%	-19.0%
Mid Growth Index	0.9%	7.2%	-0.431	1.322	19.0%	-23.0%
Mid Value Index	1.0%	4.1%	-0.507	0.857	11.0%	-11.0%
Small Core Index	1.1%	5.1%	-0.984	2.528	10.0%	-22.0%
Small Growth Index	0.8%	8.3%	-0.136	1.338	31.0%	-26.0%
Small Value Index	1.0%	4.4%	-0.32	1.185	13.0%	-14.0%
Panel B: Standardized unexpected earnings						
Large Core Index	0.123	0.301	-0.153	1.230	0.891	-0.780
Large Growth Index	0.072	0.315	-0.604	0.794	0.712	-0.975
Large Value Index	-0.014	0.230	-0.410	0.529	0.466	-0.655
Mid Core Index	0.035	0.139	0.124	-0.504	0.325	-0.250
Mid Growth Index	0.085	0.178	-1.112	1.726	0.460	-0.454
Mid Value Index	-0.008	0.119	-0.446	-0.066	0.237	-0.324
Small Core Index	-0.011	0.151	-0.519	-0.176	0.317	-0.365
Small Growth Index	0.019	0.159	-0.715	0.767	0.361	-0.422
Small Value Index	-0.033	0.125	0.099	-0.538	0.251	-0.291

Table 2: Statistics of iShares Morningstar Style Index Funds

The table reports time-series averages of market value, net expense ratio, and turnover ratio for iShares Morningstar style index funds from 2004 to 2008.

Name	Average Market Value (millions)	Average Net Expense Ratio (%)	Average Turnover Ratio (%)
iShares Morningstar Large Core Index	$171.11	0.20	29.67
iShares Morningstar Large Growth Index	$365.58	0.25	27.67
iShares Morningstar Large Value Index	$294.43	0.25	20.67
iShares Morningstar Mid Core Index	$117.70	0.25	41.67
iShares Morningstar Mid Growth Index	$290.59	0.30	35.00
iShares Morningstar Mid Value Index	$122.76	0.30	32.67
iShares Morningstar Small Core Index	$113.15	0.25	60.00
iShares Morningstar Small Growth Index	$68.29	0.30	52.00
iShares Morningstar Small Value Index	$95.93	0.30	46.33

Table 3: Summary Statistics of Returns and SUE of Morningstar Sector Indexes

The table reports summary statistics of monthly returns and SUE for each of the Morningstar Sector Indexes. Again, SUE is the value-weighted average of SUE of individual stocks in an index. ‘‘Stdev,’’ ‘‘Skew,’’ and ‘‘Kurto’’ denote the standard deviation, skewness, and excess kurtosis, respectively.

Name	Mean	Stdev	Skew	Kurto	Max	Min
Panel A: Monthly returns						
Business Services Sector	0.7%	5.1%	-0.646	0.757	12.2%	-16.5%
Consumer Goods Sector	0.6%	3.8%	-0.511	3.114	14.8%	-14.6%
Consumer Services Sector	0.9%	5.0%	-0.167	0.425	14.1%	-13.5%
Energy Sector	1.3%	5.7%	0.403	0.204	17.9%	-12.2%
Financial Services Sector	0.9%	5.2%	-0.317	3.218	17.5%	-22.5%
Hardware Sector	1.0%	10.0%	-0.337	0.499	21.4%	-31.3%
Healthcare Sector	0.7%	4.1%	-0.377	0.612	12.2%	-12.2%
Industrial Materials Sector	0.8%	4.9%	-0.123	0.834	14.3%	-13.9%
Media Sector	0.6%	6.6%	-0.005	1.027	22.9%	-17.4%
Software Sector	1.0%	9.7%	0.127	0.834	33.1%	-24.4%
Telecommunication Sector	0.5%	6.8%	0.48	2.893	31.6%	-15.6%
Utilities Sector	1.0%	4.7%	-0.229	0.128	13.6%	-12.2%
Panel B: Standardized unexpected earnings						
Business Services Sector	0.045	0.225	-0.452	-0.760	0.431	-0.416
Consumer Goods Sector	-0.028	0.285	0.749	1.010	0.979	-0.535
Consumer Services Sector	0.113	0.350	-0.465	-0.170	0.818	-0.846
Energy Sector	0.054	0.443	-0.034	-0.007	1.220	-1.090
Financial Services Sector	0.068	0.248	-0.216	-0.710	0.499	-0.485
Hardware Sector	0.004	0.444	-0.560	0.092	1.027	-1.177
Healthcare Sector	0.045	0.299	-0.023	0.713	0.826	-0.780
Industrial Materials Sector	0.156	0.377	-0.348	0.457	0.890	-0.942
Media Sector	0.060	0.269	-0.062	-0.692	0.655	-0.520
Software Sector	0.033	0.584	-0.067	-0.075	1.335	-1.501
Telecommunication Sector	0.023	0.283	1.007	0.843	0.840	-0.421
Utilities Sector	0.011	0.150	-0.324	-0.052	0.360	-0.375

Table 4: Returns of Morningstar Style Index Portfolios Formed on Lagged Return or Lagged SUE

At the beginning of each month, the indexes are ranked by their cumulative returns or average SUEs over the past three, six, and twelve months. Portfolio P1 (P3) consists of three style indexes with the highest (lowest) past returns or SUEs. The remaining indexes are in portfolio P2. All portfolios are equally-weighted. The momentum portfolio (P1-P3) is a portfolio that is long in P1 and short in P3. The table reports the average holding period return, its t-statistic, and the percentage of positive return (+%) for each portfolio over our sample period.

Holding Period (Month)	Portfolio	Portfolio Formation Period: Past 3-Month Return/SUE			Past 6-Month Return/SUE			Past 12-Month Return/SUE		
		Mean	T-Stat	+ %	Mean	T-Stat	+ %	Mean	T-Stat	+ %
Panel A: Price momentum										
1	P1	0.01	2.224	0.636	0.015	3.297	0.661	0.012	2.454	0.643
	P2	0.009	2.161	0.628	0.008	1.95	0.619	0.008	1.996	0.607
	P3	0.004	0.769	0.579	0.001	0.206	0.568	0.002	0.407	0.589
	P1 – P3	*0.006*	*1.158*	*0.546*	*0.014*	***2.709***	*0.602*	*0.01*	*1.813*	*0.554*
3	P1	0.033	3.683	0.656	0.045	5.207	0.707	0.036	3.756	0.636
	P2	0.024	3.46	0.656	0.022	3.094	0.655	0.025	3.806	0.673
	P3	0.014	1.499	0.597	0.005	0.45	0.578	0.014	1.387	0.582
	P1 – P3	*0.019*	*1.913*	*0.555*	*0.04*	***4.199***	*0.629*	*0.022*	***2.071***	*0.573*
6	P1	0.069	5.539	0.776	0.078	6.367	0.761	0.065	4.577	0.738
	P2	0.052	5.358	0.741	0.046	5.014	0.735	0.052	5.772	0.757
	P3	0.022	1.817	0.664	0.013	0.973	0.637	0.039	3.086	0.71
	P1 – P3	*0.047*	***3.336***	*0.603*	*0.065*	***4.77***	*0.664*	*0.027*	*1.639*	*0.57*
12	P1	0.118	6.075	0.773	0.136	7.346	0.813	0.098	4.745	0.772
	P2	0.114	8.236	0.8	0.102	7.472	0.757	0.108	7.805	0.792
	P3	0.063	3.34	0.691	0.065	3.034	0.701	0.105	5.149	0.792
	P1 – P3	*0.055*	***2.398***	*0.591*	*0.071*	***3.081***	*0.626*	*-0.007*	*-0.282*	*0.525*
Panel B: Earnings Momentum										
1	P1	0.012	2.464	0.629	0.010	2.307	0.628	0.009	1.920	0.617
	P2	0.006	1.105	0.586	0.007	1.356	0.602	0.006	1.117	0.607
	P3	0.007	1.691	0.621	0.007	1.712	0.602	0.008	1.966	0.607
	P1 – P3	*0.005*	*1.328*	*0.534*	*0.003*	*0.992*	*0.522*	*0.001*	*0.223*	*0.495*
3	P1	0.030	3.721	0.667	0.030	3.729	0.649	0.028	3.276	0.648
	P2	0.021	2.256	0.579	0.018	1.865	0.568	0.022	2.437	0.629
	P3	0.022	2.877	0.667	0.025	3.174	0.631	0.028	3.588	0.657
	P1 – P3	*0.009*	*1.294*	*0.526*	*0.005*	*0.772*	*0.514*	*0.000*	*-0.066*	*0.419*
6	P1	0.056	4.972	0.757	0.055	4.970	0.722	0.045	3.887	0.716
	P2	0.039	3.067	0.667	0.031	2.401	0.639	0.050	4.052	0.745
	P3	0.048	4.841	0.739	0.052	4.831	0.731	0.061	5.694	0.765
	P1 – P3	*0.007*	*0.710*	*0.514*	*0.003*	*0.291*	*0.491*	*-0.016*	*-1.399*	*0.422*
12	P1	0.099	5.976	0.714	0.088	5.131	0.706	0.064	3.394	0.688
	P2	0.084	4.315	0.724	0.094	4.733	0.725	0.113	5.795	0.771
	P3	0.104	6.463	0.829	0.113	6.786	0.833	0.125	7.461	0.854
	P1 – P3	*-0.005*	*-0.299*	*0.524*	*-0.025*	*-1.366*	*0.480*	*-0.061*	***-3.259***	*0.448*

Table 5: Regressions of Momentum Portfolio Returns of Morningstar Style Indexes on Risk Factors

The table reports the regression results of the momentum portfolio returns of Morningstar Style Indexes against various risk factors. RMRF, SMB, HML and UMD are, respectively, the excess monthly market return over risk-free rate, the size, the book-to-market equity, and the momentum factors. Alpha is the intercept of the regressions. The t-statistics are in parentheses.

Ranking Period (Months)	Holding Period (Months)	CAPM			Fama and French 3-Factor Model					Carhart 4-Factor Model					
		Alpha	RMRF	Adj R-sq	Alpha	RMRF	SMB	HML	Adj R-sq	Alpha	RMRF	SMB	HML	UMD	Adj R-sq
3	1	0.40%	-0.27	0.039	0.37%	-0.37	0.35	-0.03	0.095	-0.01%	-0.19	0.23	0.05	0.37	0.215
3	1	(0.81)	(-2.43)	.	(0.75)	(-2.88)	(2.67)	(-0.17)	.	(-0.02)	(-1.54)	(1.85)	(0.32)	(4.34)	.
3	3	1.09%	-0.10	-0.003	1.68%	-0.45	0.54	-0.40	0.189	0.47%	-0.27	0.47	-0.20	0.32	0.246
3	3	(1.11)	(-0.79)	.	(1.81)	(-3.46)	(3.93)	(-2.81)	.	(0.48)	(-1.92)	(3.52)	(-1.3)	(3.11)	.
3	6	3.04%	-0.05	-0.007	3.45%	-0.30	0.57	-0.26	0.125	0.65%	-0.09	0.49	-0.02	0.38	0.203
3	6	(***2.13***)	(-0.41)	.	(***2.34***)	(-2.09)	(3.78)	(-1.97)	.	(0.4)	(-0.57)	(3.39)	(-0.13)	(3.46)	.
3	12	1.68%	0.08	-0.006	4.41%	-0.30	0.50	-0.47	0.149	-1.10%	-0.06	0.47	-0.23	0.34	0.179
3	12	(0.7)	(0.54)	.	(1.63)	(-1.85)	(3)	(-3.41)	.	(-0.3)	(-0.28)	(2.88)	(-1.32)	(2.21)	.
6	1	1.24%	-0.34	0.067	1.06%	-0.44	0.60	0.10	0.235	0.50%	-0.17	0.42	0.22	0.56	0.522
6	1	(***2.5***)	(-3.06)	.	(***2.29***)	(-3.73)	(4.96)	(0.65)	.	(1.34)	(-1.68)	(4.26)	(1.85)	(8.35)	.
6	3	3.49%	-0.33	0.058	3.03%	-0.55	0.71	0.04	0.252	1.37%	-0.27	0.60	0.33	0.45	0.389
6	3	(***3.78***)	(-2.85)	.	(***3.49***)	(-4.48)	(5.55)	(0.28)	.	(1.61)	(-2.23)	(5.11)	(2.49)	(5.10)	.
6	6	5.19%	-0.23	0.022	4.47%	-0.40	0.62	-0.06	0.149	2.52%	-0.23	0.55	0.12	0.27	0.189
6	6	(***3.82***)	(-1.87)	.	(***3.21***)	(-2.83)	(4.27)	(-0.47)	.	(1.62)	(-1.49)	(3.82)	(0.86)	(2.53)	.
6	12	4.18%	-0.11	-0.004	8.19%	-0.64	0.57	-0.66	0.267	2.36%	-0.36	0.52	-0.40	0.37	0.307
6	12	(1.73)	(-0.77)	.	(***3.15***)	(-4.18)	(3.4)	(-5.19)	.	(0.7)	(-2.0)	(3.15)	(-2.51)	(2.62)	.
12	1	0.77%	-0.17	0.009	0.69%	-0.40	0.58	-0.18	0.214	0.08%	-0.04	0.33	-0.03	0.70	0.636
12	1	(1.4)	(-1.42)	.	(1.37)	(-3.13)	(4.41)	(-1.09)	.	(0.23)	(-0.46)	(3.56)	(-0.23)	(11.23)	.
12	3	1.32%	0.03	-0.009	1.78%	-0.51	0.71	-0.62	0.341	-0.04%	-0.15	0.53	-0.25	0.58	0.525
12	3	(1.22)	(0.22)	.	(1.91)	(-3.81)	(5.15)	(-4.45)	.	(-0.05)	(-1.16)	(4.37)	(-1.91)	(6.47)	.
12	6	0.32%	0.28	0.023	1.30%	-0.35	0.96	-0.75	0.459	-1.70%	-0.05	0.78	-0.44	0.47	0.558
12	6	(0.19)	(1.86)	.	(0.92)	(-2.56)	(6.27)	(-6.26)	.	(-1.2)	(-0.34)	(5.45)	(-3.52)	(4.90)	.
12	12	-4.92%	0.23	0.016	0.81%	-0.28	0.27	-0.68	0.228	-0.74%	-0.20	0.24	-0.61	0.11	0.224
12	12	(***-1.98***)	(1.62)	.	(0.26)	(-1.77)	(1.24)	(-4.87)	.	(-0.19)	(-1.01)	(1.09)	(-3.45)	(0.70)	.

Table 6: Returns of Morningstar Sector Index Portfolios Formed on Lagged Return or Lagged SUE

At the beginning of each month, the indexes are ranked by their cumulative returns or average SUEs over the past three, six, and twelve months. Portfolio P1 (P3) consists of four sector indexes with the highest (lowest) past returns or SUEs. The remaining indexes are in portfolio P2. All portfolios are equally-weighted. The momentum portfolio (P1-P3) is a portfolio that is long in P1 and short in P3. The table reports the average holding period return, its t-statistic, and the percentage of positive return (+%) for each portfolio over our sample period.

Holding Period (Month)	Portfolio	Portfolio Formation Period: Past 3-Month Return/SUE			Past 6-Month Return/SUE			Past 12-Month Return/SUE		
		Mean	T-Stat	+ %	Mean	T-Stat	+ %	Mean	T-Stat	+ (%)
Panel A: Price momentum										
	P1	0.009	2.211	0.603	0.01	2.087	0.576	0.009	1.871	0.607
	P2	0.007	1.715	0.628	0.006	1.699	0.593	0.007	1.706	0.607
	P3	0.007	1.297	0.554	0.007	1.231	0.585	0.004	0.767	0.545
1	*P1 – P3*	*0.002*	*0.482*	*0.488*	*0.003*	*0.571*	*0.568*	*0.005*	*0.848*	*0.545*
	P1	0.028	3.642	0.706	0.029	3.715	0.733	0.027	3.243	0.655
	P2	0.02	2.805	0.655	0.021	2.884	0.612	0.022	2.954	0.618
	P3	0.021	2.399	0.622	0.015	1.627	0.595	0.014	1.571	0.627
3	*P1 – P3*	*0.007*	*1.042*	*0.529*	*0.014*	*1.747*	*0.595*	*0.013*	*1.635*	*0.555*
	P1	0.058	5.296	0.75	0.058	5.406	0.761	0.053	4.073	0.701
	P2	0.042	4.081	0.655	0.04	3.78	0.655	0.043	4.375	0.71
	P3	0.034	2.982	0.698	0.025	2.175	0.655	0.029	2.439	0.682
6	*P1 – P3*	*0.024*	***2.355***	*0.526*	*0.033*	***3.286***	*0.584*	*0.024*	***2.012***	*0.514*
	P1	0.111	5.868	0.736	0.112	5.661	0.71	0.088	4.065	0.693
	P2	0.082	5.307	0.727	0.086	5.556	0.72	0.079	5.538	0.733
	P3	0.072	3.958	0.736	0.06	3.075	0.729	0.064	3.096	0.713
12	*P1 – P3*	*0.039*	***2.255***	*0.545*	*0.052*	***2.727***	*0.617*	*0.024*	*1.166*	*0.525*
Panel B: Earnings momentum										
	P1	0.009	2.451	0.638	0.008	2.052	0.602	0.010	2.444	0.598
	P2	0.008	1.859	0.629	0.008	1.962	0.584	0.007	1.629	0.589
	P3	0.006	1.178	0.552	0.007	1.294	0.593	0.003	0.594	0.551
1	*P1 – P3*	*0.003*	*0.774*	*0.552*	*0.001*	*0.299*	*0.540*	*0.007*	*1.687*	*0.607*
	P1	0.030	3.994	0.675	0.028	3.564	0.676	0.029	3.838	0.686
	P2	0.020	2.859	0.667	0.020	2.840	0.658	0.022	2.908	0.657
	P3	0.019	2.176	0.640	0.017	1.930	0.604	0.012	1.287	0.543
3	*P1 – P3*	*0.011*	*1.927*	*0.623*	*0.011*	*1.927*	*0.613*	*0.017*	***2.559***	*0.619*
	P1	0.060	5.089	0.721	0.053	4.571	0.713	0.054	4.979	0.745
	P2	0.038	3.998	0.676	0.043	4.586	0.704	0.045	4.255	0.686
	P3	0.033	3.016	0.667	0.023	2.025	0.630	0.022	1.758	0.637
6	*P1 – P3*	*0.026*	***3.675***	*0.649*	*0.030*	***3.533***	*0.639*	*0.032*	***3.604***	*0.647*
	P1	0.107	6.380	0.762	0.096	5.933	0.794	0.081	5.191	0.708
	P2	0.085	5.190	0.705	0.093	5.417	0.725	0.072	4.480	0.729
	P3	0.059	3.156	0.695	0.053	2.669	0.667	0.059	2.666	0.677
12	*P1 – P3*	*0.048*	***3.896***	*0.638*	*0.043*	***3.326***	*0.667*	*0.022*	*1.618*	*0.615*

Table 7: Returns of Morningstar Sector Index Portfolios Double Sorted on Past SUE and Lagged Returns

At the end of each month, indexes are sorted on past SUEs into 3 groups. Group 1 consists of 4 indexes with the highest past SUEs and group 3 consists of 4 indexes with the lowest past SUEs. The remaining 4 indexes are in group 2. Within each SUE group, 4 indexes are further assigned to one of 4 sub-portfolios based on their past cumulative returns. The index with the highest return is sub-portfolio 1 and the index with the lowest return is sub-portfolio 4. The table reports the time series means of the monthly returns for each of the sub-portfolios as well as their averages across SUE groups (in the last row of each panel). The average returns of the momentum portfolios, i.e. portfolio 1 minus portfolio 4, and their t-statistics are also calculated and reported. The holding period for all portfolios is set equal to 6 months. The ranking periods are set to be same for SUE and past returns. The results in Panel A, B, and C are based on 3-month, 6-month, and 12-month ranking periods, respectively.

Panel A: Average returns of portfolios sorted on past 3-month SUE and 3-month return

		Ranks of past returns					
		1 (H)	2	3	4(L)	1(H)-4(L)	t-Stat.
Ranks of SUE	1(H)	0.095	0.066	0.048	0.029	0.066	3.457
	2	0.037	0.049	0.036	0.037	-0.001	-0.052
	3(L)	0.051	0.023	0.037	0.027	0.024	1.375
Controlling for SUE		0.061	0.046	0.040	0.031	0.030	1.890

Panel B: Average returns of portfolios sorted on past 6-month SUE and 6-month return

		Ranks of past returns					
		1 (H)	2	3	4(L)	1(H)-4(L)	t-Stat.
Ranks of SUE	1(H)	0.087	0.069	0.023	0.033	0.054	2.806
	2	0.054	0.050	0.042	0.038	0.016	1.077
	3(L)	0.045	0.018	0.013	0.021	0.024	1.512
Controlling for SUE		0.062	0.045	0.026	0.031	0.031	1.770

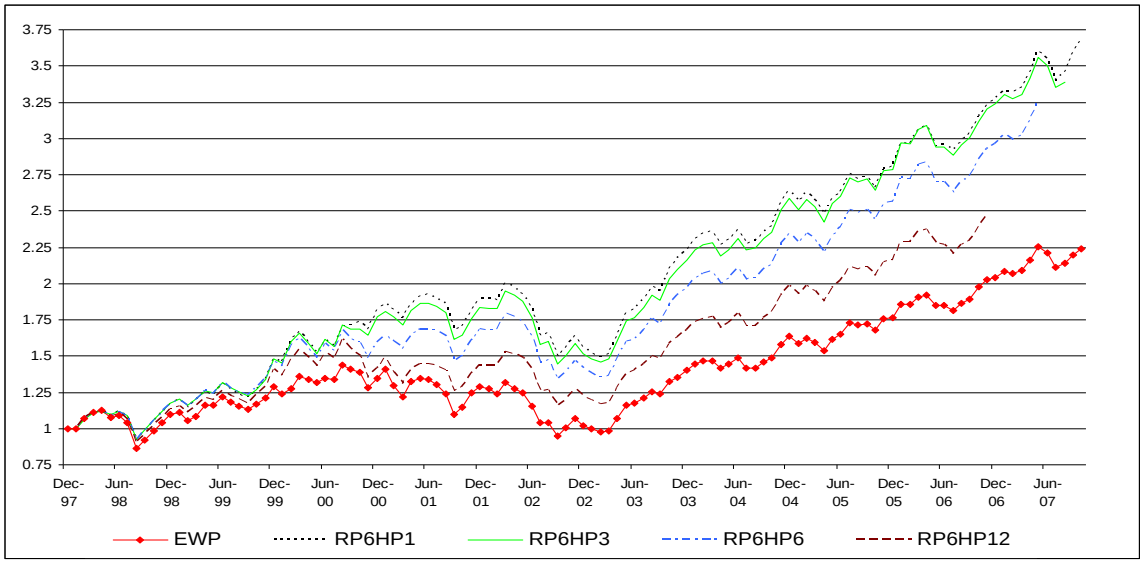
Panel C: Average returns of portfolios sorted on past 12-month SUE and 12-month return

		Ranks of past returns					
		1 (H)	2	3	4(L)	1(H)-4(L)	t-Stat.
Ranks of SUE	1(H)	0.069	0.074	0.051	0.023	0.046	2.354
	2	0.052	0.050	0.043	0.045	0.007	0.328
	3(L)	0.034	-0.002	0.032	0.028	0.006	0.346
Controlling for SUE		0.052	0.041	0.042	0.032	0.019	0.630

Figure 1: Performance of Dynamic Momentum Portfolios Based on Morningstar Style Indexes – with 6-Month Ranking Period

The figure plots the performance of various dynamic momentum portfolios, together with that of the passive equally-weighted benchmark portfolio (denoted by EWP) of the style indexes. The ranking period for the dynamic portfolios is 6 months and holding periods are one, three, six, and twelve months. All portfolios are assumed to start at one dollar. Relative to the passive equally-weighted benchmark portfolio, the dynamic portfolio over-weights (under-weights) indexes in P1 (P3) by 10 percent. The notation RPXHPY denotes a portfolio with X-month ranking period (RP) and Y-month holding period (HP). Panel 1A plots the performance of dynamic portfolios with no transaction costs and Panel 1B with transaction costs.

Panel 1A: Performances of Dynamic Portfolios with No Transaction Costs



Panel 1B: Performances of Dynamic Portfolios with Transaction Costs