Do Style and Sector Indexes Carry Momentum?

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Abstract

Existing literature documents that cross-sectional stock returns exhibit price and earnings momentum patterns. The implementation of such strategies, however, is costly due to the large number of stocks involved and some studies show that momentum profits do not survive transaction costs. In this paper, we examine whether style and sector indexes commonly used in financial industry also have momentum patterns. Our results show that both style and sector indexes exhibit price momentum, and sector indexes also exhibit earnings momentum. Mostly importantly, these momentum strategies are profitable even after adjusting for potential transaction costs. Moreover, we show that price momentum in style indexes is driven by individual stock return momentum, whereas price momentum in sector indexes is driven by earnings momentum. Finally, using style indexes as illustration we show that performance of style investment can be substantially enhanced by incorporating the momentum effect.

1. Introduction

Existing literature has documented that cross-sectional stock returns exhibit momentum patterns. Namely, past winners continue to perform well and past losers continue to perform poorly. In particular, Jegadeesh and Titman (1993) shows that stocks with higher past returns subsequently earn 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. As shown by Fama and French (1996), the momentum effect is not subsumed by the size or value effects. On the other hand, Moskowitz and Grinblatt (1999) document a strong and prevalent momentum effect in industry components of stock returns which accounts for much of the individual stock momentum anomaly. They show that momentum investment strategies of buying past winning stocks and selling past losing stocks are significantly less profitable once industry momentum is controlled for. They further show that industry momentum investment strategies, which involve buying stocks from past winning industries and selling stocks from past losing industries, are highly profitable, even after controlling for common risk factors.

In addition to price momentum, the literature also documents an earnings momentum pattern. Earnings momentum is directly driven by the well-known post-earnings announcement drift phenomenon, i.e., firms reporting unexpectedly high earnings subsequently outperform firms reporting unexpectedly low earnings. The superior performance lasts 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. Foster, Olsen, and Shevlin (1984) documents an annualized payoff of 25% from earnings momentum strategies. Hew, Skerratt, Strong and Walker (1996) and Booth, Kallunki, and Martikainen (1996) extend the post-earnings announcement drift evidence to non-U.S. data. Furthermore, Chordia and Shivakumar (2006) examine whether earnings momentum and price momentum are related and they provide evidence that price momentum is captured by the systematic component of earnings momentum.

Nevertheless, trading strategies on both price momentum and earnings momentum can be costly if not infeasible at all. 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 effect survive transaction costs? Lesmond, Schill, and Zhou (2004) and Korajczyk and Sadka (2004) examine the effect of transaction costs on momentum effects. They provide evidence that the momentum profits often disappear after adjusting for transaction costs.

In this paper, we examine whether widely used style indexes and sector indexes in the financial industry also exhibit momentum patterns. The advantage of looking into these 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 generally small and the transaction costs of ETFs are mostly low. Thus, if these indexes also carry momentum effect then it would be much more feasible for such effect to be realized. More importantly, the performance of commonly used style indexes, such as size and value, can be further enhanced by taking into account of momentum effects.

The data used in our study consists of two sets of indexes constructed by Morningstar: Morningstar nine style indexes and Morningstar 12 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 from July 1997 to October 2007 for both style indexes and sector indexes.

We show that both style indexes and sector indexes exhibit price momentum patterns and the magnitude of price momentum profits far exceeds potential transaction costs. In particular, for style indexes price momentum effects are the strongest based on past 6-month returns, whereas for sector indexes price momentum effects are the strongest over 6-month holding periods. In comparison, momentum profits are generally higher for style indexes than for sector indexes. For the style indexes, the annualized momentum profits

based on past 6-month returns are as high as 16.99% and 13.42%, respectively, over the 3-month and 6-month holding periods. For the sector indexes, the annualized momentum profits based on the past 3-month and 6-month returns are, respectively, 4.86% and 6.71% over the 6-month holding period. Our results also show that these momentum profits are not driven by outliers. For the style index momentum portfolios based on past 6-month returns, the percentages of positive returns over the 3-month and 6-month holding periods are, respectively, 63% and 66%.

Based on index's historical earnings surprises, measured by standardized unexpected earnings (SUE) following existing literature, we find significant 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 the past 12-month SUEs are 6.97% and 6.56%, respectively, over the 3-month and 6-month holding periods. However, we find no evidence of earning momentum effect in style indexes.

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 examine whether the price momentum effect in style indexes is driven by stock return momentum. We regress momentum profits based on different ranking and holding periods against various risk factors. The models in our analysis include the CAPM of Sharpe (1964) and Lintner (1965), the Fama-French (1993) 3-factor model, and the 4-factor model of Carhart (1997). The empirical results confirm that price momentum effect in style indexes is driven by stock return momentum. Finally, we examine whether price momentum effect in sector indexes is explained by earnings momentum effect. We employ a double sorting procedure in which momentum portfolios are constructed conditional on different ranges of SUEs. The empirical results confirm that price momentum effect in sector indexes is fully explained 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 indexes following the approach in Jegadeesh and Titman (1993). We also examine how the documented momentum effects are related to stock return momentums as well as related to each other. Section 4 concludes.

2. Data Description

The main data used in our study consists of Morningstar nine style indexes and Morningstar sector index family. Morningstar nine style indexes are corresponding to the well-known Morningstar nine 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. In this paper, we first compute standardized unexpected earnings (SUE) at the firm level and then calculate value-weighted average of SUE for each index based on its stock composition. The data used to compute SUE is from Compustat, and the holdings data for the indexes is from Morningstar Inc. As a measure of earning shock, SUE used in our study is constructed based on the assumption that earnings follow a seasonal random walk. [4] Specifically, it is defined as quarterly unexpected earnings (UE) divided by the standard deviation of UE, where UE is the reported quarterly earnings per share (EPS) in excess of EPS four quarters ago. The standard deviation is calculated from UE over the past 8 quarters or a minimum of 4 quarters.

Following are details of index construction as well as summary statistics of index returns and index characteristics.

[4] We note that some studies also construct SUE based on analyst consensus earnings forecast. However, analyst coverage only consists of a subset of stocks. For this reason, we use historical earnings to construct SUE in our study.

2.1 Morningstar Style Index

The nine style indexes are constructed in two steps according to Morningstar index construction methodology document (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 the largest stocks that comprise 70% of market capitalization of the investable universe. The Mid Cap Index represents the next largest stocks that comprise 20% of market capitalization of the investable universe. The Small Cap Index represents the next largest stocks that comprise 7% of the market capitalization of the investable universe. And 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. 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 following nine style indexes: Large Cap Value, Large Cap Core, Large Cap Growth, Mid Cap Value, Mid Cap Core, Mid Cap Growth, Small Cap Value, Small Cap Core, and Small Cap Growth indexes. The 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 standardized unexpected earnings of Morningstar Style Indexes. Panel A reports summary statistics of monthly returns from July 1997 to October 2007 and Panel B for standardized unexpected earnings (SUE) from July 1997 to May 2007 as the earnings data we have ends in May 2007. The standardized unexpected earnings are constructed by a bottom-up approach, i.e., they are the value-weighted average of standardized unexpected earnings of individual stocks in an index. 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 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 more likely have positive earnings surprises than value stocks do.

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 millions, $177 millions, and $92.46 millions, respectively. Note that there is a significant amount of asset invested in the growth index for both large and mid caps, and the small cap has the lowest investment in growth. It seems that investors prefer investing in growth stocks to value stocks for large and mid cap, but prefer value stocks for small cap. The average turnovers for the large cap, mid cap, and small cap ETFs are about 26%, 37%, and 53%, respectively, which indicate that stocks in the small cap group have a higher chance of moving in or out. Finally, the larger cap ETF has an expense ratio of 23 bps, and the expense ratios for the mid cap and small cap ETFs are about 5 bps higher.

2.2 Morningstar Sector Index

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 standardized unexpected earnings of Morningstar sector indexes. Again, panel A reports summary statistics of monthly returns from July 1997 to October 2007 and Panel B for standardized unexpected earnings (SUE) from July 1997 to May 2007. Energy sector has the highest average return, whereas the telecommunication sector has the lowest. The returns on most of sectors are negatively skewed. Only software and telecommunication sectors have positive skewness, which could be due to the last tech bubble in our sample. The consumer goods, financial services, and telecommunication sectors have higher levels of kurtosis than other sectors, which indicates that these three sectors tend to have extreme returns. The industrial materials and consumer services sectors have the highest SUE and the consumer goods sector has the lowest SUE and is also the only sector with negative SUE.

3. Momentum Effect

In this section, we construct momentum portfolios following the methodology in Jegadeesh and Titman (1993). The ranking variable used in our price momentum strategy is an index's return over the past three, six and twelve months prior to portfolio formation. The ranking variable in our earnings momentum strategy is an index's standardized unexpected earnings (SUE) over the past three, six and twelve months prior to portfolio formation. We examine the momentum effect by holding the portfolios for one, three, six, and twelve months following portfolio formation.

3.1 Style Indexes

In this section, we investigate whether there is momentum effect in Morningstar style indexes. We report the price momentum effect based on the portfolios of style indexes formed on lagged returns and the earnings momentum effect formed on lagged SUEs. At the beginning of every month, the indexes are ranked by their compound returns from July 1997 to October 2007 (or their average SUEs from July 1997 to May 2007) over the past three, six, and twelve months and assigned to one of three portfolios. Portfolio 1 (P1) consists of three style indexes with the highest past compound returns (or average SUEs). Portfolio 3 (P3) consists of three style indexes with the worst past compound returns (or average SUEs). The remaining indexes are in portfolio 2 (P2). Each portfolio is then held over the next one, three, six, to 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 (buys winners) and a short position in portfolio 3 (sells 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 on the price momentum effect and Panel B reports the results on the earnings momentum effect in Morningstar style indexes.

3.1.1. Price Momentum

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 12-month ranking and 12-month holding periods, 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 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 is evidence that the momentum profit is not driven by outliers. With the 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 5% confidence level. However, the momentum profits are clearly lower than those based on the 6-month ranking period. With the 12-month ranking period, only the momentum profit with 3-month holding period is weakly significant at 5% confidence level. We also note that in contrast to the reverse effect at one month horizon for individual stock returns as documented in the literature, we do not find such patterns in style indexes. In fact, the average returns of the moment portfolios with a 1-month holding period are all positive, although only significant with a 6-month ranking period.

In practice, transaction costs are of course incurred in such momentum strategies due to portfolio rebalancing. Since the style indexes can be traded just like stocks through their corresponding index funds, with an average cost of 20 bps for a round trade[5], profits from implementing momentum strategies on style indexes are still substantial. This is particularly true for the momentum portfolios (P1-P3) with 3 to 6-month ranking periods and 3 to 12-month holding periods. Note that based on the construction only a part of a portfolio is traded monthly. As a result, if a round trade costs 20 bps, i.e., trading cost accounting for 0.2% of total transaction, the monthly trading cost would be 20 bps for a momentum portfolio with 1-month holding period, 6.67 bps for 3-month holding period, 3.33 bps for 6-month holding period, and 1.67 bps for 12-month holding period. The results show that the momentum portfolios of style indexes are profitable even after adjusting for transaction costs when they are implemented with the 3 to 6-month ranking periods and 6 to 12-month holding periods.

3.1.2. Earnings momentum

[5] Bhardwaj and Brooks (1992) report that when the dollar volume (V) is between $50,001 and $500,000, the typical commission is $134 + 0.001V. In other words, the variable cost is 0.1 percent. For on-line investors, the cost is even lower.

The results in Panel B of Table 4 show that the average returns of portfolio P1, P2 and P3 are all positive. For the 12-month holding period, the average returns of momentum portfolio (P1-P3) are negative for all ranking periods. Also for the 6-month holding period, the momentum portfolio (P1-P3) with a 12-month ranking period has a negative average return. However, none of the momentum portfolios has statistically significant average returns at 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 5% confidence level. The results show that in contrast to the price momentum, there is little earnings momentum effect in style indexes. This is evidence that there is no clustering or persistence for earnings among stocks with the same style.

In short, our results indicate that the style indexes exhibit strong price momentum effect. Our results also show little evidence that there is earnings momentum effect in the style indexes. In addition, the price momentum effect appears to be the strongest with the 6-month ranking period. The profits of the momentum portfolios are substantial even after adjusting for transaction costs when they are implemented with the 3 to 6-month ranking periods and 6 to 12-month holding periods.

3.1.3. What Contributes to the Price Momentum Profit?

In previous sections, we show that there is strong evidence for price momentum effect but little evidence for earnings momentum effect in style indexes. This is evidence that price momentum in style indexes is not driven by earnings momentum. In this section, we employ the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the 3-factor model of Fama and French (1993), and the 4-factor model of Carhart (1997) to examine whether the momentum factor in stock returns can explain price momentum profit in style indexes. We focus on alpha estimates of the momentum portfolio (portfolio 1 minus portfolio 3) in the CAPM, 3-factor, and 4-factor models. The specifications of these models are,

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + e_t \qquad (1)$$

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + e_t \quad (2)$$

$$r_{P1-P3,t} = \alpha + \beta_1 RMRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + e_t \quad (3)$$

Where $r_{P1-P3,t}$ is the return on the momentum portfolio between portfolio 1 and portfolio 3 in excess of the one-month T-bill return; RMRF is the value-weight return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month T-bill rate; and SMB, HML, and UMD are returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year momentum in stock returns. These factor data are from Kenneth R. French's Data Library.

Table 5 reports results of the models for the price momentum portfolios of style indexes. Almost all alphas of momentum portfolios of style indexes with the 6-month ranking period are statistically significant under the CAPM and the Fama-French 3-factor model and these alphas are positive. However, when the momentum factor (UMD) is added into the model as an additional explanation variable, i.e., under the Carhart 4-factor model, these alphas become statistically insignificant, which indicates that the positive alphas of the momentum portfolios are contributed by the momentum factor as the loadings on UMD are positive and statistically significant except for the momentum portfolio with the 12-month ranking period and holding period. It can also be seen that after adding the momentum factor, the adjusted R-square of the Fama-French 3-factor model are significantly improved, which indicates that the momentum factor does explain additional variability in the returns of momentum portfolios. Furthermore, there are no alphas that are significant under the Carhart 4-factor model. Overall, the results show that the price momentum effects in style indexes are directly related to stock return momentum.

3.2. Sector Indexes

In this section, we investigate whether there is momentum effect in Morningstar sector indexes. The portfolios P1, P2, and P3 and the momentum portfolio (P1-P3) are constructed in the same way as they are constructed in the style index case in the previous section except 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 effect and Panel B reports the results on earnings momentum effect in sector indexes.

3.2.1. Price Momentum

Panel A of Table 6 show that the average returns of portfolios P1, P2, P3, and the momentum portfolios (P1-P3) based on Morningstar sector indexes are all positive. These results confirm the industry momentum findings in Moskowitz and Grinblatt (1999). Compared to the price momentum profits of the style indexes, the momentum profits are generally lower. For the 6-month holding period, the average returns of the momentum portfolios are all statistically significant at 5% confidence level. The annualized momentum profits 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, holding period is more important for momentum effect for sector indexes.

3.2.2. Earnings momentum

Panel B of Table 6 shows similar results as those in Panel A on earnings momentum effect in sector indexes. The average returns of portfolio P1, P2, P3, and (P1-P3) are all positive. The profit patterns of earnings momentum portfolios are similar to those of price momentum portfolios. In addition, the average returns of the earnings momentum portfolio with 12-month ranking period and 3-month holding period are statistically

significant at 5% confidence level. The average returns are weakly significant (t-stat 1.972) for the momentum portfolios with 3-month holding period and 3-month or 6-month ranking period. In particular, the annualized momentum profits with 3-month and 6-month holding periods are 6.97% and 6.56%, respectively, with 12-month ranking period. Furthermore, except for the momentum portfolios with 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.

In summary, our results indicate that sector indexes exhibit both price momentum effect and earnings momentum effect. However, our results also show that momentum profits for sector indexes are generally lower than for style indexes, although in both cases they are substantial and are of economic significance. In addition, the price momentum effect appears 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 Furthermore, we find that the earnings momentum effects are prevalent for sector indexes over 3-month to 12-month holding periods and are robust to the ranking periods of standardized unexpected earnings.

3.2.3. Does Earnings Momentum Explain Price Momentum?

The previous subsections show that the sector indexes exhibit both price momentum effect and earnings momentum effect. Since Chordia and Shivakumar (2006) provide evidence that price momentum is captured by the systematic component of earnings momentum, an interesting question for us is whether or to what extent SUEs captures the earnings momentum-price momentum relation in the sector indexes. Causal observations of the results in Table 6 suggest such possibility. First of all, in general earnings momentum profits in Panel B are stronger than price momentum in Panel A. Secondly, price momentum effect is significant only in the case where earnings momentum effect is significant.

To address this question formally, at the end of each month we first sort sector indexes into three groups based on their past average SUE ranks. Group 1 consists of 4 indexes with the highest SUE ranks and group 3 consists of 4 indexes with the lowest SUE ranks. The remaining 4 indexes are in group 2. Within each SUE group, indexes are further assigned to one of 4 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. A momentum portfolio (P1-P4) is a portfolio that takes a long position in portfolio 1 and a short position in portfolio 4. This double sorting procedure allows us to examine whether the price momentum can be explained by the earnings momentum in sector indexes when controlling for SUEs.

Table 7 reports the time series means of the monthly returns of portfolios, the average returns of momentum portfolios (P1-P4) with their t-statistics, as well as their averages across SUE groups. The holding period for these portfolios is all set to 6 months since in the sector indexes the momentum portfolios with 6-month holding period show the strongest momentum effect. 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. 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 significant price momentum effect. That is, the price momentum effect in sector indexes is mainly driven by stocks with high SUEs. More importantly, after controlling for SUE, none of the returns of momentum portfolios is statistically significant at 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 is driven by the earning momentum effect in sector indexes.

3.3 Dynamic Style Portfolios Enhanced by the Momentum Effect

In this section, we construct a dynamic style portfolio that takes advantage of the momentum effect. 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.

Dynamic portfolios are constructed following Jegadeesh and Titman (1993) approach. At the beginning, a dynamic portfolio is divided into several sub-portfolios. For example, a portfolio with 6-month holding period is divided into 6 sub-portfolios. These sub-portfolios are rebalanced sequentially in every 6 months. To be specific, in every month one of sub-portfolios in the portfolio is rebalanced to have 10 percent more weight on indexes in P1 and 10 percent less weight on indexes in P3 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. Again, we assume a 20 bps transaction cost for a round trade. For simplicity, when a sub-portfolio in a dynamic portfolio is rebalanced, we assume that the indexes in this sub-portfolio are completely sold first and then bought to meet the index composition required by the dynamic portfolio, i.e., overweighing indexes in P1 by 10 percent and underweighting indexes in P3 by 10 percent. Note that in this way we somehow inflate the transaction cost since it might not be necessary to rebalance 100% of a sub-portfolio. Thus, the results presented here are more conservative than in practical situations.

Figure 1 and Figure 2 plot the values of price momentum dynamic portfolios of style indexes over the sample period. All portfolios are assumed to be one dollar in the beginning. The portfolios in Figure 1 have 3-month ranking period and in Figure 2 have 6-month ranking period. The portfolios in Figure 1A and Figure 2A are assumed to have no transaction costs and those in Figure 1B and Figure 2B to have 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. *X* and *Y* are used to indicate the number of months in a ranking period and the number of months in a holding period respectively. Thus, the notation RP*X*HP*Y* represents a momentum strategy based on *X*-month ranking period over *Y*-month holding period.

The dynamic portfolios in Figure 1 start from October 1997 because the first three months are used as a ranking period. Since they have different holding periods, these portfolios do not end at the same time. For instance, the dynamic portfolio with a 6-month holding period ends in May 2007 since the last observation in our sample is for October 2007. Figure 1A shows that before transaction cost, the dynamic portfolios outperform the equally-weighted benchmark portfolio by an average of 49.15% in cumulative returns. The dynamic portfolio with a 6-month holding period has the best performance, outperforming the benchmark portfolio by 64.79% in cumulative return. However, Figure 1B shows that after counting for transaction cost, the dynamic portfolio with a 1-month holding period underperforms the equally-weighted benchmark portfolio. Note that the annual transaction cost for the dynamic portfolio with a 1-month holding period is 240 bps. As expected transaction costs have a larger negative impact on the profitability of dynamic portfolios when the momentum portfolio is rebalanced more frequently or holding periods are shorter.

The dynamic portfolios in Figure 2 start from January 1998 because the first six months are used as a ranking period. Again, the dynamic portfolios do not end at the same time. Figure 2A and 2B show that all dynamic portfolios outperform the equally-weighted benchmark portfolio. Figure 2A shows that before the transaction cost, the dynamic portfolio with a 1-month holding period has the best performance. After counting for transaction cost, the value of this portfolio drops from a value close to 3.75 to below 3, which again shows that the transaction cost has notable impact on the profitability of dynamic portfolios.

Overall, the figures show that dynamic portfolios generate considerably extra values over the equally-weighted benchmark portfolio. The transaction cost has significant negative

impact on the values of dynamic portfolios that have short holding periods. Comparing Figure 1 to Figure 2, it reveals that the values of dynamic portfolios based on a 6-month ranking period are significantly larger than those based on a 3-month ranking period. The results also show that the dynamic portfolios with a 3-month or a 6-month holding period are more profitable than those with a 1-month or a 12-month holding period.

4. Conclusion

In this paper, we examine whether Morningstar style indexes and sector indexes exhibit price and earning momentum effects. We find that the both style indexes and sector indexes carry price momentum. The magnitude of price momentum profits far exceeds potential transaction costs. For style indexes price momentum effects are the strongest based on past 6-month returns, whereas for sector indexes price momentum effects are the strongest over 6-month holding periods. In comparison, momentum profits are generally higher for style indexes than for sector indexes. We also find that the sector indexes carry significant earnings momentum effects. The momentum effects are significant for 3 to12-month holding periods based on past standardized unexpected earnings ranging from 3-month to 12-month. However, we find no evidence of earnings momentum effects in style indexes.

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. For instance, the Morningstar style indexes have their corresponding ETFs which are traded in Nor York Stock Exchange. The momentum effects carried by the Morningstar style indexes found in this paper can be easily realized by using these ETFs.

We further examine whether price momentum effect in style indexes is driven by stock return momentum. Our empirical results conclude that the price momentum effect in style indexes is driven by stock return momentum. Finally, we confirm that the price momentum effect is explained by the earnings momentum in sector indexes.

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Table 1: Statistics of Returns and Standardized Unexpected Earnings (SUE) of Morningstar Style Indexes

The table reports summary statistics of monthly returns from July 1997 to October 2007 and SUE from July 1997 to May 2007of Morningstar style indexes. The SUE is constructed by a bottom-up approach, i.e., it is the value-weighted average of SUE of individual stocks in an index. ‘‘Stdev,’’ ‘‘Skew,’’ and ‘‘Kurto’’ denote the time series 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: Statistics of Returns and Standardized Unexpected Earnings (SUE) of Morningstar Sector Indexes

The table reports summary statistics of monthly returns from July 1997 to October 2007 and SUE from July 1997 to May 2007 of Morningstar sector indexes. Again, the SUE is constructed by a bottom-up approach, i.e., it is the value-weighted average of SUE of individual stocks in an index. ‘‘Stdev,’’ ‘‘Skew,’’ and ‘‘Kurto’’ denote the time series 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: Table 4: Return Statistics of Portfolios of Morningstar Style Indexes Formed on Lagged Return or Lagged Standardized Unexpected Earnings (SUE)
At the beginning of each month, the indexes are ranked by their compound returns or average SUEs over the past three, six, and twelve. Portfolio 1 (P1) consists of three style indexes with the highest past returns or (SUEs). Portfolio 3 (P3) consists of three style indexes with the worst past returns (or SUEs). The remaining indexes are in portfolio 2 (P2). All indexes are equally-weighted in the portfolios. The momentum portfolio (P1-P3) is a portfolio that takes a long position in P1 and a short position in P3. The table 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.

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: Momentum Portfolios of Morningstar Style Indexes Formed on Lagged Returns

The table reports the performance (alpha) of the momentum portfolios (portfolio 1 minus portfolio 3) in all scenarios identified by the combinations of portfolio-ranking periods and portfolio-holding periods. RMRF, SMB, and HML are Fama and French's (1993) market proxy and factor-mimicking portfolios for size and book-to-market equity. UMD is a factor mimicking portfolio for one-year return momentum. Alpha is the intercept of the models. 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)	(5.1)	.
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)	(4.9)	.
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)	(0.7)	.

Table 6: Return Statistics of Portfolios of Morningstar Sector Indexes Formed on Lagged Return or Standardized Unexpected Earnings (SUE)

At the beginning of every, the indexes are ranked by their compound returns or average SUEs over the past three, six, and twelve months. Portfolio 1 (P1) consists of four sector indexes with the highest past returns (or SUEs). Portfolio 3 (P3) consists of four sector indexes with the worst past returns (or SUEs). The remaining indexes are in portfolio 2 (P2). All indexes are equally-weighted in the portfolios. The momentum portfolio (P1-P3) is a portfolio that takes a long position in P1 and a short position in P3. The table 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.

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: Portfolio Return of Morningstar Sector Indexes based on Lagged Returns and Standardized Unexpected Earnings (SUE)

At the end of each month, indexes are sorted on past SUEs to classify the indexes 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 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 table reports the time series means of the monthly returns of portfolios, their averages across SUE groups, as well as the average returns of the momentum portfolios, i.e. portfolio 1 minus portfolio 4, and their t-statistics. The holding period for these portfolios is all set 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: Values of Dynamic Portfolios of Morningstar Style Indexes Formed on Lagged Return, Delta Equal to 10 Percent with 3-Month Ranking Period
The figure shows the values of dynamic portfolios and the equally-weighted benchmark portfolio of the style indexes. The ranking periods for the dynamic portfolios are three months and holding periods are one, three, six, and twelve months. Dynamic portfolios start from October 1997 because the first 3 months are used as a ranking period. The portfolios do not end at the same time because they have different holding periods. All portfolios are assumed to start at one dollar. The amount for overweighting indexes in P1 and underweighting indexes in P3 is 10 percent. In notation RPXHPY, RP and HP denote Ranking Period and Holding Period, respectively, and X and Y indicate the number of months in a ranking period and the number of months in a holding period. The notation RPXHPY represents a momentum strategy based on X-month ranking period over Y-month holding period. EWP represents the equally-weighted benchmark portfolio. Figure 1A plots the values of dynamic portfolios with no transaction costs and Figure 1B with transaction costs.

Figure 1A: Values of Dynamic Portfolios with No Transaction Costs

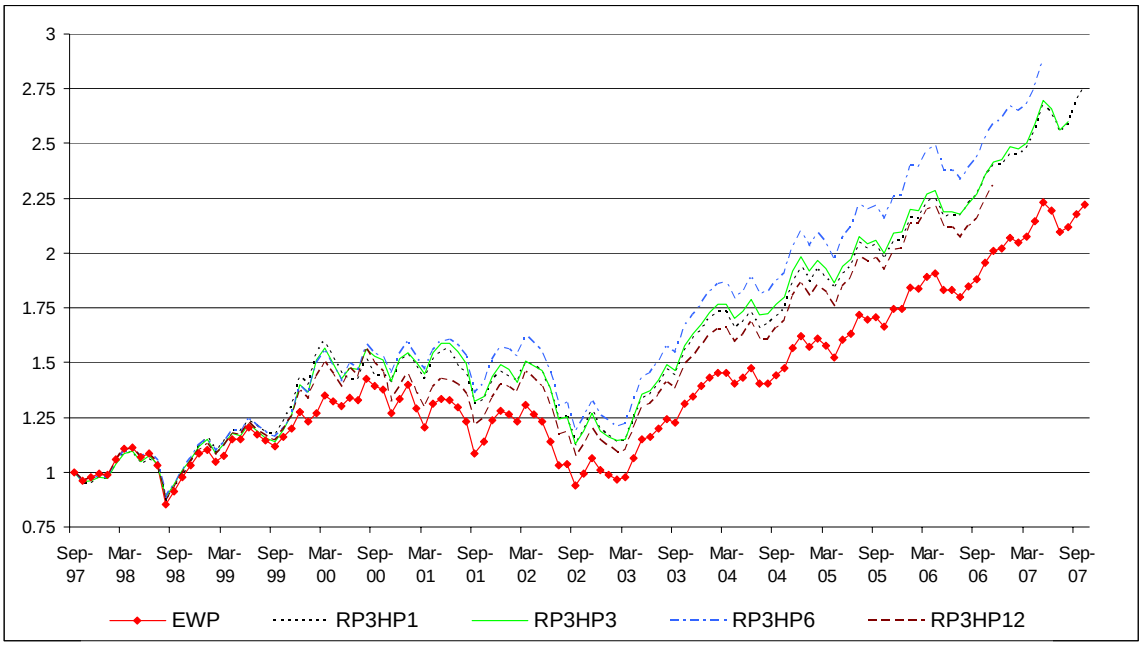

Figure 1B: Values of Dynamic Portfolios with Transaction Costs

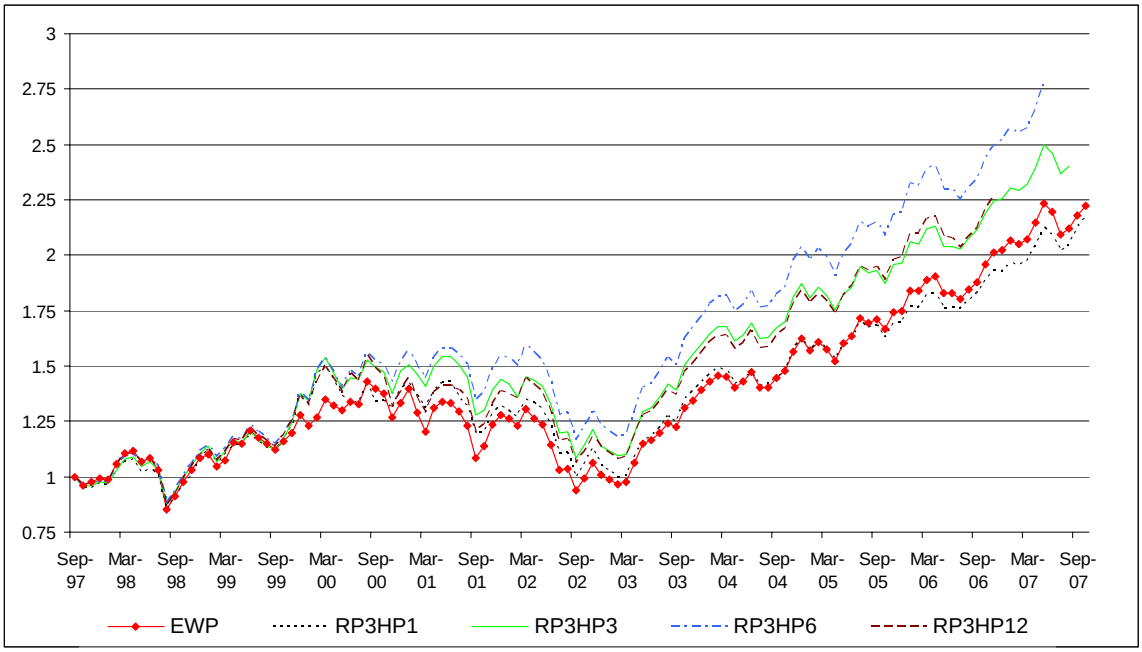

Figure 2: Values of Dynamic Portfolios of Morningstar Style Indexes Formed on Lagged Return, Delta Equal to 10 Percent with 6-Month Ranking Period

The momentum portfolios in Figure 2 are constructed similarly to those in Figure 1. The only difference between Figure 1 and Figure 2 is the ranking period. The ranking period in Figure 2 is set to 6 months. As a result, all dynamic portfolios start from January 1998 because the first six month is used as a ranking period. Again, Figure 2 shows the values of dynamic portfolios of the style indexes with 1-month, 3-month, 6-month, and 12-month holding periods. Figure 2A plots the values of momentum portfolios with no transaction costs and Figure 2B with transaction costs.

Figure 2A: Values of Dynamic Portfolios with No Transaction Costs

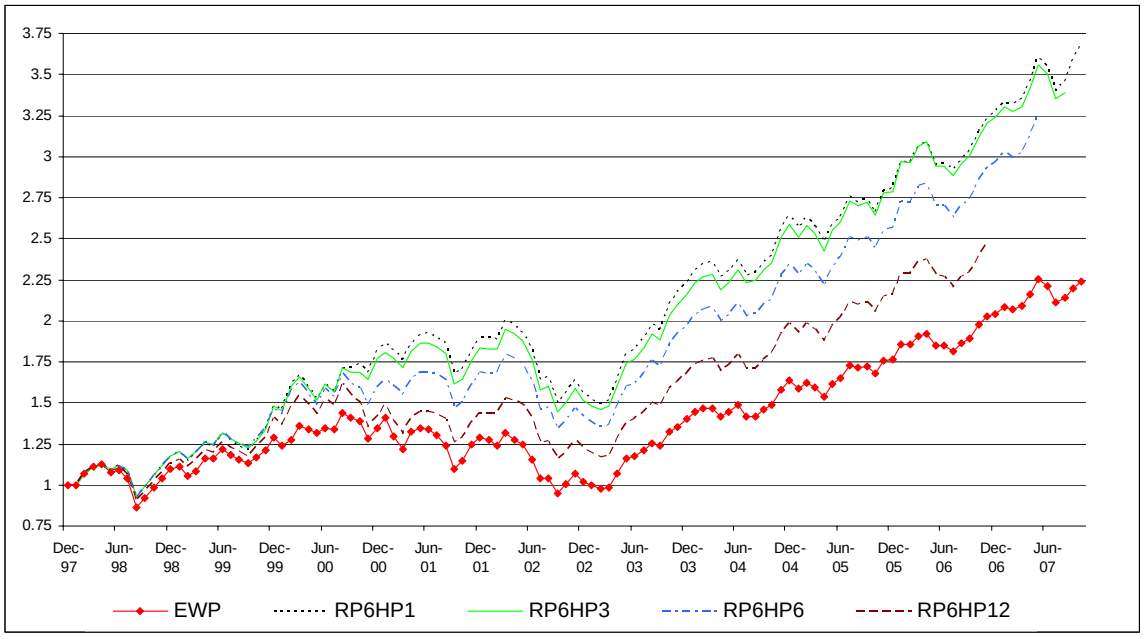

Figure 2B: Values of Dynamic Portfolios with Transaction Costs