THREE ESSAYS ON MOMENTUM

by

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A DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Economics, Finance & Legal Studies
in the Graduate School of
The University of Alabama

TUSCALOOSA, ALABAMA

2010

ABSTRACT

Essay 1, *Growth/Value, Market-Cap, and Momentum,* examines the profitability of style momentum strategies on portfolios based on firm growth/value characteristics and market capitalization. We use monthly total returns of nine S&P style indices to avoid concerns about firm size, liquidity, credit risk, short-sale constraints, and transaction costs. We find that historically buying a past best performing style index and short-selling a past worst performing style index generates economically and statistically significant profit of 0.8% per month over the period June 1995 to March 2009. This profitability remains economically plausible after adjusting for systematic risk, short-sale costs, and transaction costs. Investors may actually implement style momentum strategies on exchange traded funds linked to the S&P style indices.

Essay 2, *Sector Momentum,* examines monthly returns of nine Select Sector SPDRs and finds historically buying past outperforming sectors and selling past underperforming sectors produces economically and statistically significant profits. Investors may be able to not only benefit from SPDRs' low fees, tax efficiency, and trading flexibility, but also exploit SPDRs as asset allocation tools to earn excess returns on sector momentum. For robustness checks, I test sector momentum investing strategies on CRSP-listed individual stocks between January 1963 and December 2008 using Global Industry Classifications Standard (GICS) and also find statistically significant payoffs.

Essay 3, *Momentum Strategies on Global ETFs*, examines the price momentum on 15 well-diversified iShares MSCI Country Index ETFs from April 1996 to December 2006. I find

statistically and economically significant profits for some momentum strategies: long past winners and short past losers. The results are robust to trading costs and excessive risks.

DEDICATION

This dissertation is dedicated to my parents who raised me with their tiny wages during my childhood and supported me through four year college education.

LIST OF ABBREVIATIONS AND SYMBOLS

ETF	Exchange traded fund
S.D.	Standard deviation
S&P	Standard & Poor's
t	Computed value of *t* test
<	Less than
=	Equal to

ACKNOWLEDGEMENTS

I am pleased to have this opportunity to thank the many colleagues, friends, and faculty members who have helped me with this dissertation. I am most indebted to Robert Brooks, the chairman of this dissertation, for his dedicated advising, excellent suggestions and generous helps. I would also like to thank all of my committee members, Thomas Downs, Robert McLeod, Junsoo Lee, and Brian Gray for their invaluable suggestions and inspiring questions.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Momentum-based investing strategies have led to extensive research. Jegadeesh and Titman (1993) first documented price momentum on individual stocks. Moskowitz and Grinblatt (1999) find significant profits on CRSP stocks of 20 industries between 1963 and 1995. However, several researchers suspect whether momentum strategies can actually be implemented. Avramov, Chordia, Jostova, and Philipov (2007) find that the winner and loser portfolios in other empirical papers are comprised mainly of high credit risk stocks. Momentum profitability is statistically significant and economically large among low-rated firms, but it is nonexistent among high-grade firms. The influence of momentum is limited to a small sample (4% of market capitalization) of companies with high credit risk. Hong, Lim and Stein (2000) focus on stock-level momentum and find that momentum strategies perform well among small stocks with low analyst coverage. In this dissertation, I expand momentum study to three different asset allocation areas: global, sector, and style, by using well-diversified and highly liquid ETFs or S&P Indices, so the results are more convincible than previous papers' findings on illiquid, high-beta or low-rated small stocks. More importantly, investors can actually implement momentum strategies which this dissertation investigates.

II. GROWTH/VALUE, MARKET-CAP, AND MOMENTUM

1. Introduction

Diversified portfolio performance is influenced by investing styles. Two common equity style measures are valuation and capitalization. Valuation style divides stocks into growth, blend, and value while capitalization style breaks stocks to large-cap, mid-cap, and small-cap. Certain styles may sometimes improve the portfolio performance. For example, during the tech boom of the late 1990s investors moved to large and mid cap growth while investors refocused on small cap value during the 2003 to 2006 period. The switch between growth and value can be the result of changes in earnings expectation or the overall economic outlook. At times, investors shift to lower book-to-market ratio stocks in pursuit of growth. Other times investors swing back to firm values in defense of market turmoil. Meanwhile, investors favor small-cap or mid-cap companies for their greater growth potential or large-cap companies for their relative stability from time to time.

1.1 Growth vs. Value

There is a general belief among academics and practitioners that value stocks are likely to outperform growth stocks. This belief would seem to provide strong support for favoring a value-oriented style. However, the S&P pure growth and value indices reveal that the case is not so clear-cut. Growth and value are highly cyclical, but on a cumulative monthly basis growth stocks outperformed value stocks over the period June 1995 to March 2009. The swing in performance between growth and value is not only hard to follow but can also adversely affect a portfolio's long-term buy-and-hold returns. Nevertheless, this substantial cyclicality can be

turned to an investment advantage. Since these two styles are successful at different times, buying a past winner and short-selling a past loser may create an attractive investment opportunity to increase portfolio returns and reduce performance volatility.

1.2 Market-Cap

In investing, company size also matters. Conventional wisdom holds that small-cap stocks outperform large-cap stocks over extended periods of time. However, the market favors different firm size at different times, resulting in a rotation of market-cap into or out of favor. Barberis and Shleifer (2003) point out that the outperformance of small-cap stocks during late 1970s and early 1980s drove investors and funds to small-cap stocks, pushing their returns higher. But after 1983 these good returns were eventually reversed. Jensen, Johnson, and Mercer (1998) find the small-cap premium is quite large during expansive policy periods and virtually non-existent during restrictive periods. Gompers and Metrick (2001) document that institutional holding of large-cap stocks has increased rapidly since 1990s. This large-cap favor may cause the underperformance of small stocks during some periods. In general, the differences in returns on small-caps and large-caps provide another investment opportunity: buying outperforming market-caps and short-selling underperforming market-caps.

1.3 Momentum Investing

Momentum-based investing strategies, first documented by Jegadeesh and Titman (1993), have led to extensive research. Using data from 1965 to 1989, Jegadeesh and Titman find that stocks with high returns over the past three to twelve months continue to outperform stocks with low past returns over the same period. Jegadeesh and Titman (2001) provide evidence that substantial momentum profits can still be made by buying past winners and short-selling past losers during 1990s even after the publication of their original study. Rouwenhorst (1999)

documents momentum profits across 12 European countries. Chordia and Shivakumar (2006) and Cooper, Gutierrez, Hameed (2004) find that momentum effect exists during expansionary periods but disappears after controlling for macroeconomic variables.

Moskowitz and Grinblatt (1999) document industry momentum and conjecture that industry momentum could be caused by cross-autocorrelation among stocks within the same industry. Hong, Torous and Valkanov (2007) show that a number of industries lead the stock market by up to two months, which is consistent with cross-industry momentum at the aggregate level.

Some papers examine whether institutional investors implement momentum strategies on equity portfolios. Grinblatt, Titman, and Wermers (1995) find that 77% of the funds examined are momentum investors. This percentage is higher for growth fund managers compared to balanced and income fund managers. Later, Burch and Swaminathan (2001) find that institutional investors such as insurance companies, banks, investment advisors and fund managers, adopt momentum trading strategies when allocating equity assets.

However, several researchers suspect whether momentum strategies can actually be implemented. Avramov, Chordia, Jostova, and Philipov (2007) find that the winner and loser portfolios in other empirical papers are comprised mainly of high credit risk stocks. Momentum profitability is statistically significant and economically large among low-rated firms, but it is nonexistent among high-grade firms. The influence of momentum is limited to a small sample (4% of market capitalization) of companies with high credit risk. Hong, Lim and Stein (2000) focus on stock-level momentum and find that momentum strategies perform well among small stocks with low analyst coverage.

To examine style momentum strategies, we use nine S&P style indices for this study to avoid previous researchers' concerns about firm size, credit rating, or stock liquidity, as well as

short-selling constraints and transaction costs. The remainder of this paper is organized as follows. Section 2 describes sample data and methodology employed for momentum portfolio construction and momentum trading strategies. Section 3 reports the profitability of various momentum strategies. Section 4 conducts some robustness checks. Section 5 concludes the study.

2. Data and Methodology

The data used in this study are the nine S&P style total return indices: S&P 500, S&P 500 Pure Growth, S&P 500 Pure Value, S&P MidCap 400, S&P MidCap 400 Pure Growth, S&P MidCap 400 Pure Value, S&P SmallCap 600, S&P SmallCap 600 Pure Growth, and S&P SmallCap 600 Pure Value. These nine indices divide the largest 1,500 domestic companies into nine portfolios from intersections of three market-cap categories (large-cap, mid-cap and small-cap) and three investment evaluations (growth, blend, and value). On the basis of market-cap, the S&P 500 index focuses on the large-cap stocks with at least US$ 3 billion each, covering approximately 75% of the U.S. equities. The S&P MidCap 400 index represents the mid-cap range of companies with market capitalization of US$ 750 million to US$ 3.3 billion, covering 7% of the U.S. equities. The S&P SmallCap 600 index represents the small-cap companies with market capitalization between US$ 200 million and US$ 1.0 billion, covering approximately 3% of the domestic equity market. Meanwhile, on the basis of firm evaluation, the S&P pure growth or value index consists of those stocks that exhibit only strong growth or value characteristics. To indicate firm characteristics more precisely, S&P adopts a 3 growth factor and 4 value factor methodology to calculate growth and value classfications in separate dimensions rather than only one factor such as the book-to-market ratio. The three growth factors include 5-year earnings per share growth rate, 5-year sales per share growth rate, and 5-year internal growth rate while the four value factors consist of price-to-book ratio, price-to-cash flow ratio, price-to-sales ratio, and

dividend yield. The stocks in pure growth or value baskets have a total 33% value weight in their market cap categories respectively.

	Growth	Blend	Value
Large-Cap	S&P 500 Pure Growth	S&P 500	S&P 500 Pure Value
Mid-Cap	S&P MidCap 400 Pure Growth	S&P MidCap 400	S&P MidCap 400 Pure Value
Small-Cap	S&P SmallCap 600 Pure Growth	S&P SmallCap 600	S&P SmallCap 600 Pure Value

We use the S&P indices as sample data for this study for four reasons. First, these nine S&P indices are widely used as benchmarks among academics and financial practitioners for trading or performance evaluation purposes. Second, the S&P indices are easier and less expensive to trade because of their market acceptability as basket trades and the fact that they require less rebalancing of individual stocks in comparison to customized portfolios. Third, by focusing on those 1,500 largest domestic stocks widely accepted by institutional investors, the results are less subject to potential severe illiquidity problems associated with micro companies. Last, nine style ETFs have been developed to closely track the nine S&P style indices and are actively traded since 2006[1]. Thus investors are able to use those nine style ETFs to facilitate their asset allocation decisions and actually implement the momentum trading strategies discussed in this paper.

Monthly values of the nine S&P total return indices are obtained from Bloomberg. Since the S&P pure growth and pure value index values are available only after June 1995, we use the complete history of monthly data from June 1995 to March 2009. This gives 1,368 observations and a 166-month sample period.

[1] We calculate correlation coefficients for the nine S&P indices and their corresponding ETFs and find all the values are greater than 0.99.

Table 1 summarizes firm market-cap, total market coverage, average monthly raw returns, average monthly excess returns in excess of 1-month U.S. Treasury bill rate, as well as average monthly abnormal returns adjusted by Fama-French three factors and t-statistics for each of the nine S&P style indices. On average mid-cap outperforms large-cap and also surprisingly outperforms small-cap although the difference between mid-cap and small-cap returns is less than the difference between mid-cap and large-cap returns. Fama and French (1993) documents that average monthly returns monotonically decrease from the largest mark-cap quintile to the smallest market-cap quintile over the period 1963 to 1991, but the average returns presented in Table 1 suggest that mid-cap stocks have the highest returns during our sample period.

Another surprise in Table 1 is the average monthly returns of pure growth index and pure value index. In each of the three market-cap categories, the pure growth index outperforms the pure value index by 0.18% to 0.41% per month. Due to the size effect, S&P MidCap 400 Pure Growth Index performs the best with a 1.01% monthly return while S&P 500 Pure Value Index averages the lowest monthly return of 0.50%.

2.1 Cyclicality of Market-cap and Growth/Value

Figure 1.1 presents cumulative monthly returns on the portfolio that short-sells S&P 500 and uses the proceeds to buy MidCap 400 but assumes 100% cash margin requirement for the short position. On a cumulative basis, large-cap cycle lasts 3 years until December 1998 when large-cap outperformed mid-cap by 40%. After 1998, however, mid-cap cycle started. By early 2001 mid-cap had quickly erased the relative gap created by the previous 3 year large-cap cycle and continued to outperform large-cap by 60% until 2006. In the current bear market, both large-cap and mid-cap have been disastrous and the difference in performance is relatively small. Figure 1.2 shows that small-cap has the same cycle as mid-cap and underperformed large-cap

during 1995-1998 but outperformed large-cap during 1999-2006. Compared to the sizeable difference in returns between mid-cap and large-cap, the advantage of mid-cap over small-cap is relatively small as exhibited by Figure 1.3.

Controlling for the market-cap effect, Figure 2 shows cumulative monthly returns on the portfolios that are long on pure growth index and short on pure value index in the large-cap, mid-cap and small-cap categories respectively. Clearly, growth and value stocks are cyclical. In 1998 and 1999, growth stocks soared and value stocks stalled. Then in the next two years, value rose while growth fell. But during 2002-2006, the differences in returns on value or growth stocks significantly shrank. In the recent economic recession, the growth stock cycle began again. During the full sample period June 1995 to March 2009, the returns on large-cap growth stocks and large-cap value stocks are virtually identical, but mid-cap and small-cap growth stocks cumulatively outperform mid-cap and small-cap value stocks by about 60% and 20% respectively.

2.2 Momentum Portfolio Construction and Trading Strategies

Using market-cap and growth/value cycles to time entry into and exit from a particular style can be successful if one is able to accurately identify the transition from one cycle to the other. However, on one hand, knowing which one style will perform well in the future is very difficult. On the other hand, momentum investing may be able to take advantage of style rotation. This section details how to construct momentum portfolios and how to rotate nine investment styles represented by the S&P large/mid/small-cap and growth/blend/value indices.

We construct momentum portfolios in the same way as Jegadeesh and Titman (1993).[2] Specifically, at the beginning of each month, we select a winner and a loser on the basis of

[2] Jegadeesh and Titman (1993) focus on the permutations of J=3, 6, 9, 12 and K =3, 6, 9, 12, but we consider more periods for portfolio formation and holding.

returns over the previous J month(s) (J = 1, 3, 6, 9 or 12). The winner (loser) is the index that has the highest (lowest) return over the previous month(s) among the nine S&P style indices. We then buy the winner, simultaneously short-sell the loser, and hold the positions for the next K month(s) (K = 1, 3, 6, 9 or 12). When the holding horizon K is longer than one month, an overlap occurs in the holding period. To avoid test statistics calculated on overlapping returns, we follow Jegadeesh and Titman (1993) to compute average monthly return of K strategies, each starting one month apart. In other words, this return is equivalent to the return of a composite portfolio in which 1/K of the holdings is updated each month and the remaining from the previous periods. For example, to construct Strategy 6-6 that is based on a 6-month ranking period and a 6-month holding horizon (J=6 and K=6), at the beginning of each month t, we buy a previous 6-month winning index and short-sell a previous 6-month losing index, then hold this long and short position for the next 6 months. Hence, at each month t, the 6-6 momentum portfolio consists of six parts equally weighted: a new long-short position at month t and the other five winner-loser positions carried over from month t-5 through t-1. The return on Strategy 6-6 in month t is the equal-weighted return on those six parts at month t.

3. Profitability of Momentum Strategies

3.1 Monthly Returns of Momentum Portfolios

Table 2 reports average monthly returns of winner, loser, and winner-loser momentum portfolios for 25 trading strategies based on 5 different ranking periods and 5 different holding horizons. 24 out of the 25 style momentum strategies produce positive returns, 10 of which are statistically significant at 1% or 5%. The most significant strategy, Strategy 6-6, yields an economically and statistically significant profit of 80 basis points per month (t = 2.41), to which the long position (buying the winner) contributes 81% of the total profit. The 1-K strategies

(Panel A) are the least profitable with a slightly significant return on Strategy 1-12 only. For the 3-K strategies (Panel B), average payoffs to Strategy 3-9 and Strategy 3-12 are 0.59% (t = 2.21) and 0.51% (t = 2.09) per month respectively while the return on Strategy 3-6 is 0.51% per month (t = 1.80). The 6-K strategies (Panel C) are the most statistically significant with monthly profits ranging from 0.69% (t = 2.29) to 0.80% (t = 2.41) per month over a 3- to 12- month holding horizon. Finally, all the 9-K strategies (Panel D) and 12-K strategies (Panel E) generate significant profits between 0.60% (t = 1.66) and 0.86% (t = 2.07) per month.

In summary, each of the 25 momentum portfolios is less risky than its corresponding winner or loser portfolio and generally less volatile than the S&P indices in terms of standard deviation. Second, a previous 6- or 9- month winner (loser) is most likely to continue to outperform (underperform) in the next 3, 6, 9 or 12 months while a previous 1- month return on the S&P indices fails to indicate any future momentum performance. Third, the payoff to the momentum strategy is the highest over a 3, 6 or 9- month horizon and is still statistically significant over a 12-month horizon but may be indistinguishable from 0 over a 1-month horizon. Last, the momentum profit is primarily attributed to the long position that has a smaller standard deviation than the short position.

So far we calculate the rate of monthly return for the momentum portfolio based on a trading strategy that short-sells one losing index and uses the proceeds to buy the other winning index but assumes 100% cash margin requirement for the short position. If the cash margin requirements drop to 50%, the momentum profits detailed in Table 2 would double. As the margin requirements decrease further, the rate of return on the momentum portfolio increases even higher. For example, Ameritrade requires that the minimum amount of equity or cash

relative to the market value of the short position be 30%, so the zero-cost momentum profits in Table 2 would more than triple.

3.2 Frequency of S&P Indices in Momentum Portfolios

The momentum strategy involves intensive trading activities: buying a winner and short-selling a loser at the end of each ranking period and closing out the long and short position at the end of each holding period. To examine which index is likely to be a winner or a loser, we report in Table 3 the frequency of each S&P index that appears in the 25 momentum portfolios as either a winner or a loser. For a close comparison, the frequency of the loser is shown in parentheses. On average, small-cap value index as well as large-cap growth, blend or value indices appear the most frequently as either a winner or a loser in the 25 momentum portfolios while S&P SmallCap 600 Index and MidCap 400 are the least likely to win or lose. Given the outperformance of growth over value as documented in previous section, it is not surprising that MidCap 400 is much more likely to be a winner than to be a loser.

Table 4 and Figure 3 focus on the most significant momentum strategy, Strategy 6-6. S&P 500 Pure Growth wins as frequently as it loses with the frequency of 30 months out of the 154 months observed or 19% of the time. In contrast, the blend index MidCap 400 and SmallCap 600 appear the least frequently in the 6-6 momentum strategy portfolios. As one might expect, MidCap 400 Pure Growth is three times as likely to be a winner as to be a loser due to its relative outperformance among the nine S&P indices. Further examination of the monthly momentum portfolios over the full period reveals that the winner or loser position sometimes stays in the winner-loser momentum portfolio from one holding period to the next for several consecutive months. This observation suggests that transaction costs are not actually incurred since there is no need to close the initial position and re-open a new one.

3.3 Seasonality of Style Momentum

Jegadeesh and Titman (1993) and Chordia and Shivakumar (2002) document the strong negative January return for price momentum strategies. More recently Chordia and Shivakumar (2006) find the similar January effect on earnings momentum and speculate that this January loss is due to the tax loss selling hypothesis that investors sell losers in November and December and buy them back in January. This tax loss selling may not occur in our case since a momentum strategy buys a winner and simultaneously short-sells a loser each month, but a November or December loser is not necessarily a January winner, therefore momentum investors may not need to buy the loser back in January. To further investigate the January effect on style momentum strategies, we compute average payoffs to winner, loser, and momentum (winner-loser) portfolios of Strategy 6-6 in each calendar month and report the results in Table 5. As anticipated, the so-called January tax loss selling seems not to exist on style momentum strategies since January shows a similar positive return in magnitude as November and December. In addition, Strategy 6-6 realizes a relatively high return of 4.80% in February, 2.63% in June, and 1.25% in August. In contrast, only five months exhibit small losses ranging from -0.02% in July to -0.48% in October.

3.4 Correlation between Style Momentum and S&P 500

Chordia and Shivakumar (2002) find that momentum strategies on individual stocks produce positive returns during expansion periods but insignificantly negative returns during recession periods. To investigate whether style momentum strategies follow the same pattern, we examine the correlation between style momentum and S&P 500. Figure 4 compares rolling compounded 12-month returns of Strategy 6-6 and S&P 500. The style momentum strategy appears profitable most time, especially during an economic contraction period 2001 to 2003.

The graph shows that Strategy 6-6 performs extremely well when the market does extremely poorly. In contrast, when the market performs well, Strategy 6-6 does well too.

Table 6 reports the correlations among monthly returns on the 25 momentum strategies and the 9 S&P indices. Almost all the correlation coefficients are slightly negative, suggesting that momentum profits are not correlated with the overall market. For example, the most significant momentum strategy, Strategy 6-6, has a -0.2 correlation with S&P 500. In general, style momentum is more negatively correlated with value stocks than with growth stocks. Among three S&P pure value indices and three pure growth indices, S&P 500 Pure Value has the highest negative coefficients while S&P 500 Pure Growth has the lowest negative coefficients. Also, style momentum is more negatively correlated with mid-caps than with large-caps and small-caps since MidCap 400 has the highest negative coefficients among three blend market-caps. Finally, the 9-K strategies are most negatively correlated with all nine indices.

4. Robustness Checks

4.1 Adjusting the Market, Size and B/M Factor

Fama and French (1996) argue that the differences in returns between small and big firms (SMB) and between high and low book-to-market ratios (HML) can be additional risk factors in explaining cross-sectional U.S stock returns. To further examine whether excess returns of style momentum strategies are compensated by systematic risks, we use the Fama-French (1993) three-factor model:

$$R_t - R_{ft} = \alpha_t + b_1(Mkt - R_f)_t + b_2 SMB_t + b_3 HML_t + \varepsilon_t.$$

For month t, R_t is the monthly return of the momentum strategy, R_f is the 1-month Treasury bill rate, and Mkt-R_f, SMB and HML are the three factors. The estimate of the intercept α_t represents the average risk-adjusted abnormal return for month t. We regress the monthly excess returns of

Strategy 6-6 and Strategy 12-12 on the three factors over the sample period June 1995 through March 2009. The results are reported in Table 7.

Panel A shows the Fama-French three factors have significant effect on the winner or loser portfolio as expected, but only SMB has a slightly significant positive loading on the winner-loser momentum portfolio while the market factor has even negative effect on the performance of Strategy 6-6. After being adjusted by the three factors, the excess return on Strategy 6-6 is 0.55% per month, statistically significant at 10% level. In the regression on winner and loser, R^2 equals 86.5% and 79.2%. In contrast, R^2 value decreases to only 7.9% for the regression on winner-loser. Panel B reports the regression result on Strategy 12-12. Although the risk-adjusted excess return on Strategy 12-12 is not statistically significant, 44 basis points per month are still economically large. In a word, exposure to the Market, SMB or HML factor does not provide a simple explanation for the excess returns on style momentum strategies.

4.2 Short-Sale Costs

Short-selling stocks involves using borrowed shares. A momentum portfolio consists of a long and a short position, so an investor has to borrow the security to be shorted from a brokerage firm or an institutional investor using cash or Treasury securities as collateral equal to 102% of the market value (marked and settled daily) of the borrowed shares (see D'Avolio (2002)). Short-sellers also may face recall risks and short squeezes when increasingly optimistic investors compete with recalled borrowers to buy shares being sold by lenders. D'Avolio (2002) finds the value-weighted cost to borrow the shares is 25 basis points per annum and only 2% of stocks on loans experience recall. Since the S&P index linked ETFs are considered large, liquid and lendable stocks, it is reasonable to assume that the cost to borrow ETFs should be below 25 basis points a year.

4.3 Transaction Costs

Since Chan and Lakonishok (1997) report that an average round-trip cost is 0.90% for large-cap stocks and 3.31% for small-cap stocks on the NYSE, a number of researchers (Sadka (2003), Lesmond, Schill, and Zhou (2004), as well as Hanna and Ready (2005)) argue that transaction costs have traditionally been understated because most momentum portfolios mainly consist of small-cap, high-beta, and illiquid stocks that contribute most of momentum profits but cost much more to trade than large-cap stocks. Furthermore, momentum strategies could require high trading turnover and expensive short-sales. Therefore, academics and practitioners suspect whether momentum strategies can actually be profitable.

With current exchange-traded funds (ETFs) underlying the nine S&P indices that this paper studies, style momentum strategies could be profitable and become an attractive alternative to dynamic strategies based on individual stocks. For instance, to trade a highly liquid ETF that represents an S&P index is far cheaper than to trade hundreds of stocks in a momentum strategy portfolio. However, style momentum strategies are still more trading intensive than simple buy-and-hold strategies: investors must buy a past winner and short-sell a past loser at the end of each ranking period and close out their long-short positions by selling the winner and buying back the loser at the end of each holding period. This process requires up to four round-trip trades a year for the strategies with a 3-month holding period, up to two round-trip trades a year for the strategies with a 6-month holding period and up to one round-trip trade a year for the strategies with a 12-month holding period. As Table 4 shows, however, style momentum traders may not need to close out their entire positions at the end of each holding period as the winner or loser may continue to win or lose for several consecutive periods. If the momentum strategy retains the winner or loser in the following period, transaction costs are not actually incurred since there

is no need to close the initial position and to re-open a new one. To calculate the excess returns after potential transaction costs, we take Strategy 6-6 as an example.

Since Chan and Lakonishok (1997) estimate that an average round-trip cost is 0.9% for large-cap stocks, the maximum transaction costs for Strategy 6-6 would be 1.8% per year. Since transaction costs are not actually incurred if the long and short position remain in the following 6 months, the actual costs would be lower. In addition, transaction commissions charged by brokers have decreased substantially in the last decade due to intensive competition from online brokers. Therefore it is likely that Strategy 6-6 could cost less than 1.5% per year to execute. As Table 2 shows, the payoff to Strategy 6-6 is 6.6% per year. After potential short-sale and transaction costs, the risk-adjusted excess return on Strategy 6-6 would be about 4% per year, remaining economically large.

5. Conclusion

Stock portfolios are often classified as being valuation oriented (for example, growth, blend, or value funds), or market-cap oriented (for example, small-cap, mid-cap or large-cap funds), but their relative performance is dependent on growth/value and market-cap cycles. Growth may take the lead in the short term and value may retake the lead in the future. Moreover, at times the market favors large-cap while other times the cycle turns in favor of small-cap or mid-cap. This constant swing of the market pendulum could adversely affect portfolio returns, but may also significantly benefit style momentum investors who rotate their styles from time to time.

This paper examines performance of growth/blend/value portfolios, large/mid/small-cap portfolios, and style momentum portfolios using nine S&P style indices over the period June 1995 to March 2009. We find that growth outperforms value while mid-cap outpaces large-cap and small-cap on a buy-and-hold basis. When investors rotate their portfolios based on the past

return of each style, they may make profits. 24 out of the 25 style momentum strategies examined in this paper generate positive returns, 10 of which are statistically significant at 1% or 5%. The most significant strategy that buys a previous 6-month winner and short-sells a previous 6-month loser and then holds both positions for the next 6 months produces an economically and statistically significant profit of 80 basis points per month. Further analysis on frequency of winners and losers reveals that the past winner or loser sometimes stays in the momentum portfolio for several consecutive months, resulting in no transaction costs actually incurred. After adjusting for systematic risks as well as potential short-sale and transaction costs, the payoff to Strategy 6-6 still remains economically plausible with an annual 4% return. Unlike price or earning momentum documented by previous literature, style momentum seems not to exhibit a negative January return. In addition, style momentum strategy performs extremely well when the market performs poorly. This finding suggests that style momentum investors may profit not only in a bull market but also in a bear market. In the recent extremely turbulent market, momentum investors tend to hide in large-cap and value portfolios. However, as the overall market collapses, the style momentum strategies examined here performed well.

Previous researchers propose behavioral theories to explain momentum phenomenon and conjecture that momentum is attributed to investors' under-reaction or over-reaction, but the rotation of investment style could be partly due to the overall market conditions and outlook. Also, investors constantly switch between growth or small-cap stocks for their growth potential and value or large-cap stocks for their relative stability. As a result of these switches, style momentum strategies may profit from the undervalued style over a period of 3 to 12 months. At this point, the style momentum strategies appear profitable, but future research could further examine the trading strategies combining style momentum and sector momentum.

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Appendices

Figure 1: Cyclicality of Market-Cap (06/1995 – 03/2009)

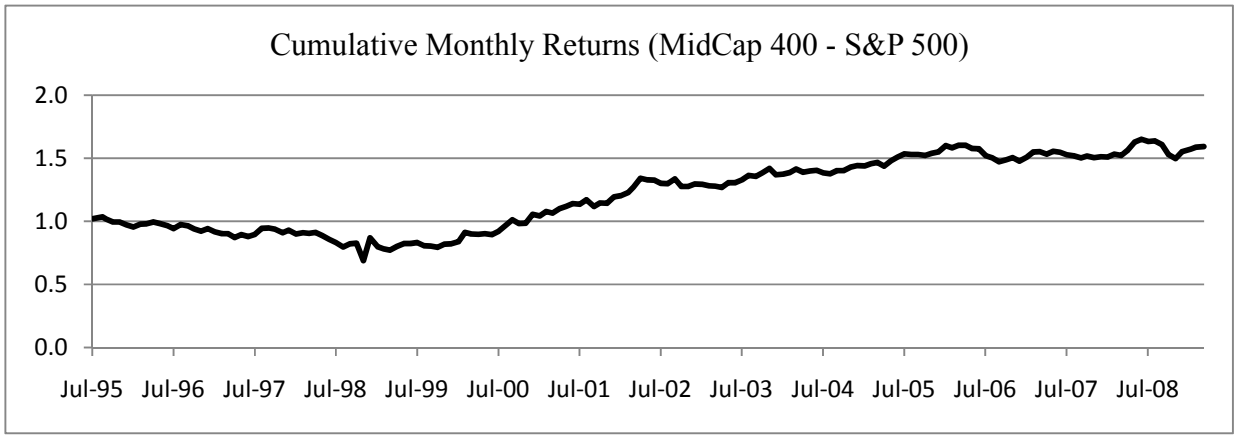


Figure 1.1 Cumulative monthly returns: long MidCap 400 and short S&P 500

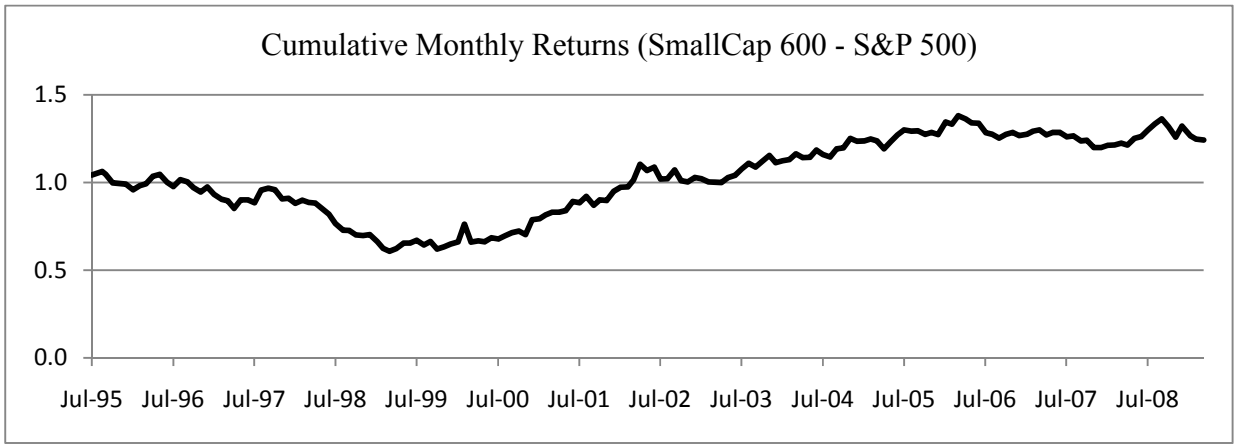


Figure 1.2 Cumulative monthly returns: long SmallCap 600 and short S&P 500

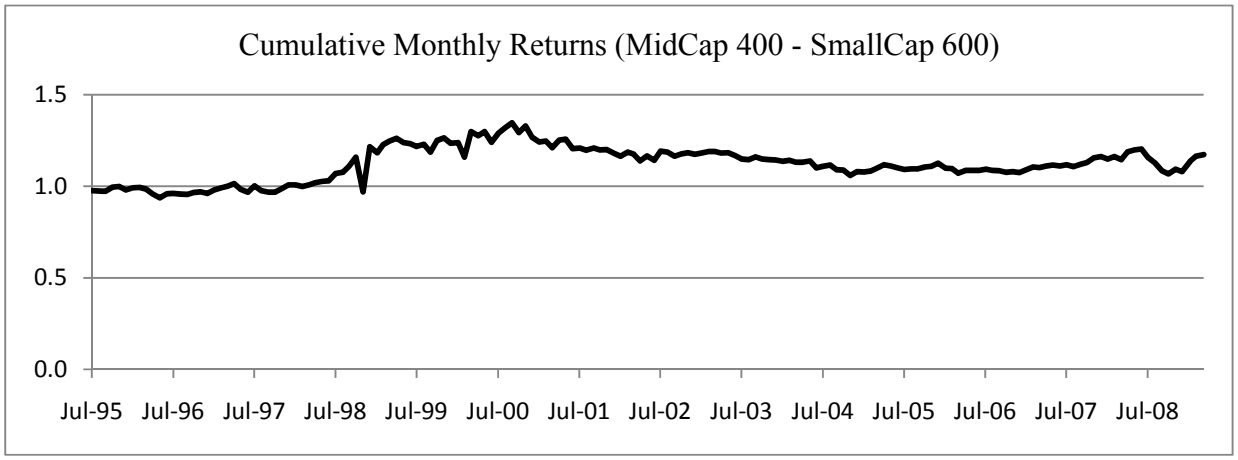


Figure 1.3 Cumulative monthly returns: long MidCap 400 and short SmallCap 600

Figure 2: Cyclicality of Growth / Value (06/1995 – 03/2009)

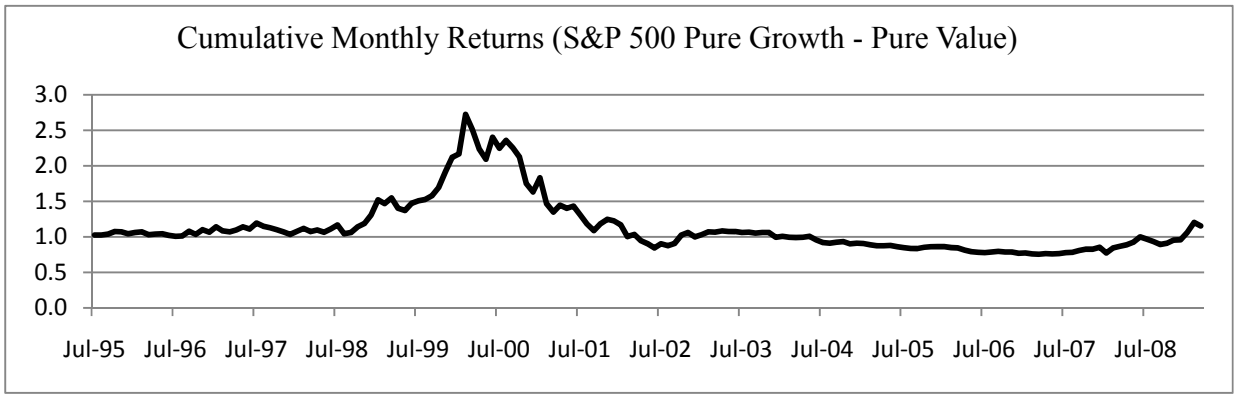


Figure 2.1 Cumulative monthly returns: long S&P 500 Growth and short S&P 500 Value

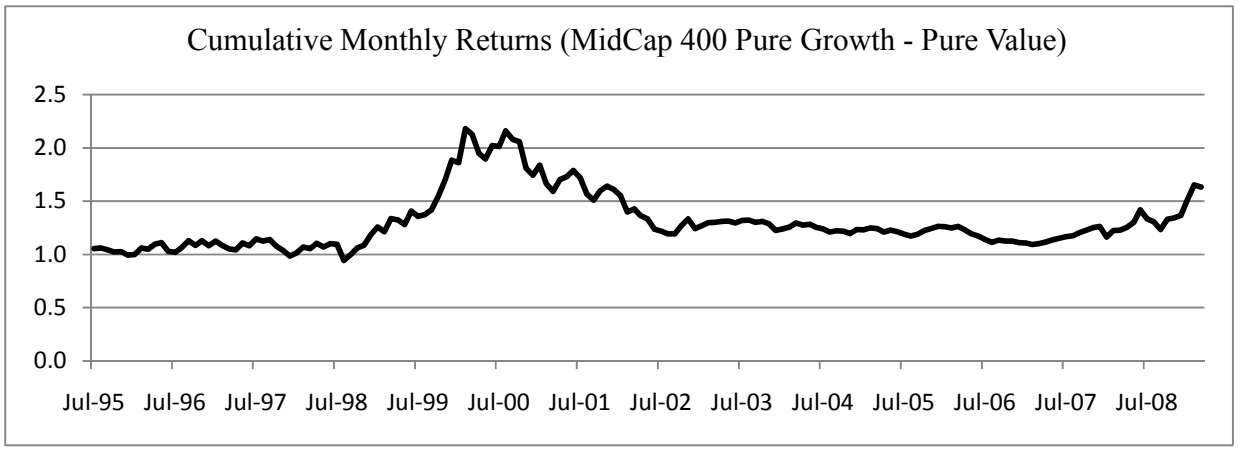


Figure 2.2 Cumulative monthly returns: long MidCap 400 Growth and short MidCap 400 Value

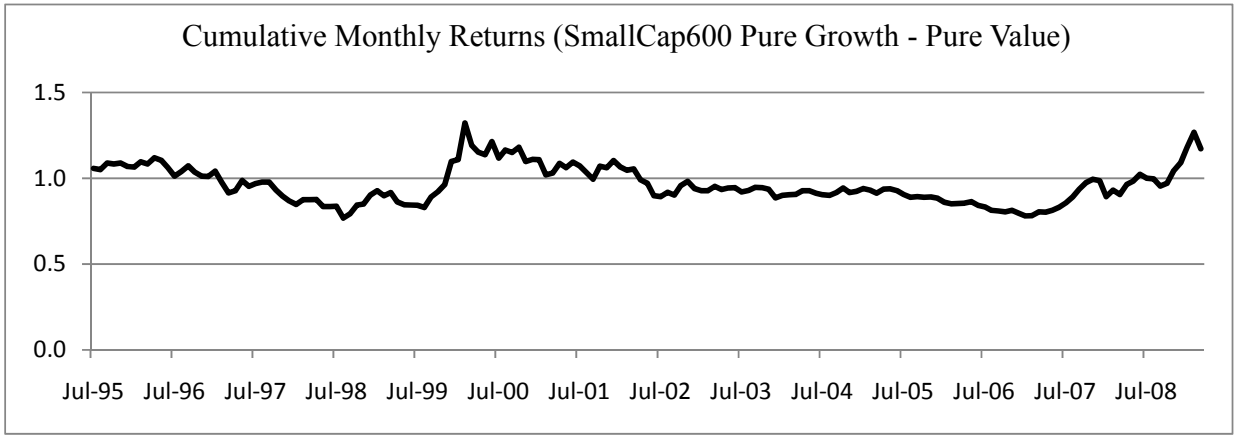
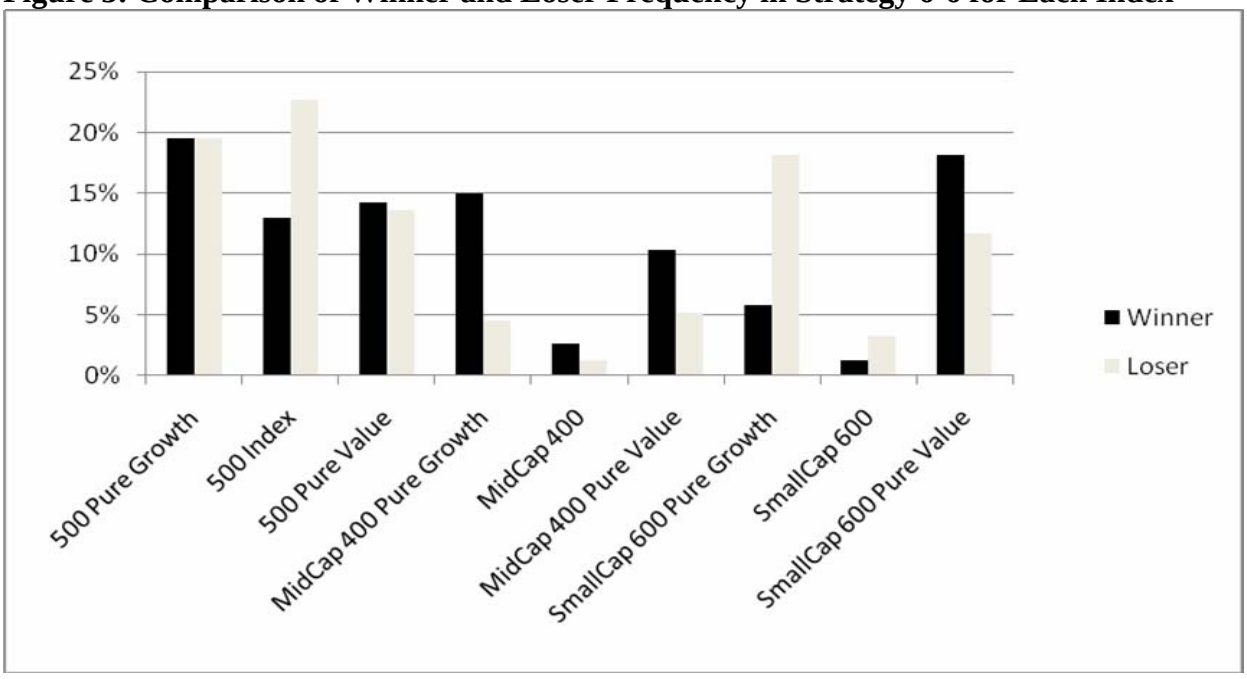


Figure 2.3 Cumulative monthly returns: long SmallCap 600 Growth and short SmallCap 600 Value

Figure 3: Comparison of Winner and Loser Frequency in Strategy 6-6 for Each Index



Reported are average payoffs to winner, loser, and momentum (winner-loser) portfolios of Strategy 6-6 in each calendar month over the period June 1995 to March 2009. Strategy 6-6 is designed as detailed in Table 2. It buys the past 6 month winner and short-sells the past 6 month loser and then holds the long and short position for the next 6 months

Figure 4: Rolling Compounded 12-month Returns of Strategy 6-6 and S&P 500

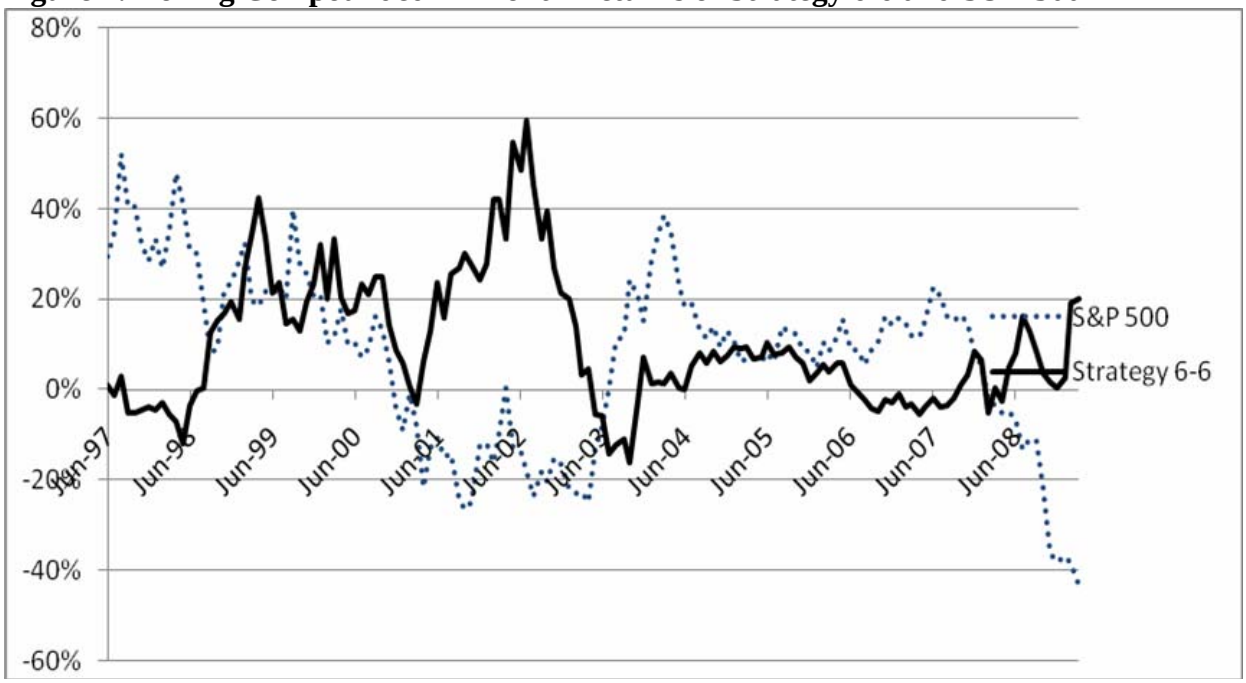


Table 1: Summary Statistics of S&P Indices

Market-Cap Categogy	Market Cap (billion US$)	Total Market Coverage	S&P Index	Raw Returns (%) Mean	Raw Returns (%) S.D.	Excess Returns (%) Mean	Excess Returns (%) S.D.	Abnormal Returns (%) Mean	Abnormal Returns (%) t-stat
Large-Cap	> 3	75%	S&P 500 Pure Growth	0.75	6.84	0.45	6.83	0.29	1.82
			S&P 500	0.49	4.59	0.19	4.57	0.01	0.16
			S&P 500 Pure Value	0.50	5.61	0.20	5.59	-0.34	-2.20
Mid-Cap	0.75 - 3.3	7%	S&P MidCap 400 Pure Growth	1.01	6.54	0.71	6.53	0.39	2.04
			S&P MidCap 400	0.82	5.76	0.52	5.75	0.20	0.87
			S&P MidCap 400 Pure Value	0.60	5.28	0.30	5.26	-0.24	-1.55
Small-Cap	0.2 - 1	3%	S&P SmallCap 600 Pure Growth	0.75	6.50	0.45	6.49	-0.02	-0.11
			S&P SmallCap 600	0.68	5.57	0.38	5.56	-0.08	-0.65
			S&P SmallCap 600 Pure Value	0.57	6.02	0.27	6.01	-0.39	-2.24

This table summarizes firm market-cap, total market coverage, average monthly raw returns, average monthly excess returns in excess of 1-month T-bill rate, as well as average monthly abnormal returns adjusted by Fama-French three factors and t-stat for each of nine S&P style indices. These nine indices divide the largest 1,500 domestic companies into nine portfolios from intersections of three market-cap categories (large-cap, mid-cap and small-cap) and three investment evaluations (growth, blend, and value). All means and standard deviations (S.D.) are computed over the period June 1995 to March 2009 and expressed in percentage.

Table 2: Monthly Returns of Momentum Strategies on S&P Indices

Panel A: Portfolios formed based on past 1 month returns and held over various horizons (1-K)

Portfolio Returns	1-1	1-3	1-6	1-9	1 - 12*
Winner	0.39	0.62	0.62	0.65	0.69
Std Dev.	5.73	5.50	5.55	5.49	5.50
Loser	0.55	0.46	0.49	0.38	0.43
Std Dev.	6.81	6.02	5.72	5.81	5.82
Winner - Loser	-0.16	0.16	0.13	0.27	0.25
Std Dev.	4.97	3.47	2.54	2.16	1.77
t-Stat	-0.42	0.59	0.65	1.57	1.77

Panel B: Portfolios formed based on past 3 month returns and held over various horizons (3-K)

Portfolio Returns	3-1	3-3	3-6*	3-9**	3-12**
Winner	0.56	0.62	0.78	0.82	0.82
Std Dev.	5.85	5.58	5.67	5.57	5.67
Loser	0.47	0.31	0.27	0.22	0.31
Std Dev.	7.14	6.52	6.05	6.08	5.94
Winner - Loser	0.09	0.32	0.51	0.59	0.51
Std Dev.	5.92	4.65	3.53	3.34	3.02
t-Stat	0.19	0.86	1.80	2.21	2.09

Panel C: Portfolios formed based on past 6 month returns and held over various horizons (6-K)

Portfolio Returns	6-1	6-3**	6-6***	6-9***	6-12**
Winner	0.95	1.06	1.00	0.99	0.90
Std Dev.	6.00	5.81	5.70	5.59	5.62
Loser	0.56	0.29	0.19	0.26	0.21
Std Dev.	7.12	6.53	6.46	6.32	6.23
Winner - Loser	0.39	0.77	0.80	0.74	0.69
Std Dev.	5.48	4.76	4.15	3.75	3.65
t-Stat	0.91	2.02	2.41	2.41	2.29

(Table 2 continued)

Panel D: Portfolios formed based on past 9 month returns and held over various horizons (9-K)

Portfolio Returns	9-1*	9-3**	9-6**	9-9**	9-12*
Winner	1.03	0.91	0.92	0.86	0.83
Std Dev.	5.79	5.66	5.60	5.63	5.72
Loser	0.23	0.05	0.15	0.07	0.13
Std Dev.	7.38	6.99	6.76	6.66	6.56
Winner - Loser	0.80	0.86	0.77	0.79	0.70
Std Dev.	5.69	5.17	4.66	4.58	4.39
t-Stat	1.76	2.07	2.02	2.09	1.91

Panel E: Portfolios formed based on past 12 month returns and held over various horizons (12-K)

Portfolio Returns	12-1*	12-3**	12-6*	12-9*	12-12*
Winner	0.86	0.95	0.87	0.87	0.77
Std Dev.	5.90	5.80	5.73	5.73	5.79
Loser	0.13	0.17	0.18	0.19	0.17
Std Dev.	6.91	6.76	6.64	6.60	6.50
Winner - Loser	0.73	0.78	0.69	0.68	0.60
Std Dev.	4.95	4.79	4.70	4.44	4.29
t-Stat	1.83	1.99	1.78	1.85	1.66

At the beginning of each month, we select a winner and a loser on the basis of returns over the previous J month (J = 1, 3, 6, 9 or 12). The winner (loser) is the index that has the highest (lowest) return over the previous month(s) among the nine style indices. We then buy the winner, simultaneously short sell the loser, and hold the position for the next K months (K = 1, 3, 6, 9 or 12). When the holding horizon K is longer than one period, an overlap occurs in the holding period. To avoid test statistics based on overlapping returns, we follow Jegadeesh and Titman (1993) to compute the period average return of K strategies, each starting one month apart. The monthly returns (%) of 25 winner-loser portfolios are calculated with standard deviation (%) and t-statistics.

*** Statistical significance at 1% level

** Statistical significance at 5% level

* Statistical significance at 10% level

Table 3: Frequency of Winning or Losing Index in Momentum Portfolios

Panel A: 1 Month Ranking Period

	1-1	1 - 3	1 - 6	1 - 9	1 - 12*
500 Pure Growth	28 (26)	27 (26)	27 (26)	27 (25)	27 (25)
500 Index	18 (24)	18 (24)	16 (24)	16 (23)	16 (23)
500 Pure Value	22 (24)	22 (23)	22 (23)	21 (23)	21 (21)
MidCap 400 Pure Growth	26 (15)	25 (15)	25 (15)	25 (14)	23 (14)
MidCap 400	4 (5)	4 (5)	4 (5)	4 (5)	3 (5)
MidCap 400 Pure Value	17 (16)	17 (16)	17 (15)	17 (15)	17 (15)
SmallCap 600 Pure Growth	16 (22)	16 (22)	16 (22)	16 (22)	16 (22)
SmallCap 600	7 (3)	7 (3)	6 (3)	6 (3)	6 (3)
SmallCap 600 Pure Value	26 (29)	26 (28)	26 (26)	24 (26)	24 (25)

Panel B: 3 Month Ranking Period

	3 - 1	3 - 3	3 - 6*	3 - 9**	3 - 12**
500 Pure Growth	26 (26)	25 (26)	25 (26)	25 (25)	25 (25)
500 Index	22 (29)	22 (29)	20 (29)	20 (29)	20 (29)
500 Pure Value	19 (23)	19 (23)	19 (23)	19 (21)	19 (18)
MidCap 400 Pure Growth	26 (14)	25 (14)	25 (14)	25 (14)	24 (14)
MidCap 400	5 (3)	5 (3)	5 (2)	5 (2)	3 (2)
MidCap 400 Pure Value	13 (14)	13 (14)	13 (13)	13 (13)	13 (13)
SmallCap 600 Pure Growth	17 (25)	17 (25)	17 (25)	16 (25)	16 (25)
SmallCap 600	3 (3)	3 (3)	3 (3)	2 (3)	2 (3)
SmallCap 600 Pure Value	31 (25)	31 (23)	30 (22)	29 (22)	29 (22)

Panel C: 6 Month Ranking Period

	6 - 1	6 - 3**	6 - 6***	6 - 9***	6 - 12**
500 Pure Growth	30 (31)	30 (31)	30 (30)	30 (30)	30 (30)
500 Index	22 (35)	20 (35)	20 (35)	20 (35)	20 (35)
500 Pure Value	22 (23)	22 (23)	22 (21)	22 (18)	22 (15)
MidCap 400 Pure Growth	23 (7)	23 (7)	23 (7)	22 (7)	21 (7)
MidCap 400	4 (2)	4 (2)	4 (2)	4 (2)	2 (2)
MidCap 400 Pure Value	16 (8)	16 (8)	16 (8)	16 (8)	16 (8)
SmallCap 600 Pure Growth	11 (28)	11 (28)	9 (28)	8 (28)	8 (28)
SmallCap 600	3 (5)	3 (5)	2 (5)	1 (5)	1 (5)
SmallCap 600 Pure Value	28 (20)	28 (18)	28 (18)	28 (18)	28 (18)

Panel D: 9 Month Ranking Period

	9 - 1*	9 - 3**	9 - 6**	9 - 9**	9 - 12*
500 Pure Growth	28 (33)	28 (33)	28 (33)	28 (33)	28 (33)
500 Index	15 (35)	15 (35)	15 (35)	15 (35)	15 (35)
500 Pure Value	22 (22)	22 (20)	22 (17)	22 (14)	22 (13)
MidCap 400 Pure Growth	27 (8)	25 (8)	25 (8)	24 (8)	21 (8)
MidCap 400	2 (2)	2 (2)	2 (2)	2 (2)	2 (2)
MidCap 400 Pure Value	10 (8)	10 (8)	10 (8)	10 (8)	10 (8)
SmallCap 600 Pure Growth	10 (25)	10 (25)	9 (25)	9 (25)	9 (25)
SmallCap 600	5 (2)	5 (2)	3 (2)	1 (2)	1 (2)
SmallCap 600 Pure Value	37 (21)	37 (21)	37 (21)	37 (21)	37 (19)

(Table 3 continued)

Panel E: 12 Month Ranking Period

	12 - 1*	12 - 3**	12 - 6*	12 - 9*	12 - 12*
500 Pure Growth	29 (31)	29 (31)	29 (31)	29 (31)	29 (31)
500 Index	14 (32)	14 (32)	14 (32)	14 (32)	14 (32)
500 Pure Value	22 (21)	22 (19)	22 (16)	22 (13)	22 (13)
MidCap 400 Pure Growth	29 (5)	27 (5)	27 (5)	25 (5)	22 (5)
MidCap 400	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
MidCap 400 Pure Value	8 (9)	8 (9)	8 (9)	8 (9)	8 (9)
SmallCap 600 Pure Growth	5 (32)	5 (32)	5 (32)	5 (32)	5 (32)
SmallCap 600	5 (1)	5 (1)	2 (1)	1 (1)	1 (1)
SmallCap 600 Pure Value	41 (22)	41 (22)	41 (22)	41 (22)	41 (19)

At the beginning of each month between June 1995 and March 2009, nine S&P indices are ranked and then assigned to momentum portfolios as detailed in Table 2. For example, Strategy 6-6 is constructed based on a 6-month ranking period and a 6-month holding horizon. Reported is the frequency that each index appears in the 25 style momentum portfolios as either a winner or a loser. For a close comparison, the frequency of the loser is shown in parentheses. ****, ** and * indicate momentum portfolio profits statistically significant at 1%, 5% and 10% respectively.

Table 4: Frequency of Winner and Loser in Strategy 6-6 Momentum Portfolio

	Percentage		Number of Months	
	Winner	Loser	Winner	Loser
500 Pure Growth	19%	19%	30	30
500 Index	13%	23%	20	35
500 Pure Value	14%	14%	22	21
MidCap 400 Pure Growth	15%	5%	23	7
MidCap 400	3%	1%	4	2
MidCap 400 Pure Value	10%	5%	16	8
SmallCap 600 Pure Growth	6%	18%	9	28
SmallCap 600	1%	3%	2	5
SmallCap 600 Pure Value	18%	12%	28	18
	100%	100%	154	154

This table focuses on the frequency that each of the nine S&P indices appears in Strategy 6-6 momentum portfolio as either a winner or a loser. Percentage describes how much of time each index becomes a winner or a loser during the 154-month sample period while number of months details how many months out of the total 154 months each index remains in the momentum portfolio as a winner or a loser respectively.

Table 5: Seasonality of Momentum Profits

	Winner		Loser		Winner - Loser	
	Mean (%)	S.D. (%)	Mean (%)	S.D. (%)	Mean (%)	S.D. (%)
January	0.28	5.24	-0.30	5.43	0.58	4.80
February	0.65	6.31	-4.15	7.14	4.80	5.29
March	1.74	3.99	1.73	5.81	0.01	3.13
April	2.08	4.78	2.22	5.43	-0.15	5.65
May	1.55	4.91	1.70	5.39	-0.15	3.21
June	1.49	4.29	-1.14	5.59	2.63	3.47
July	-1.44	6.06	-1.42	5.06	-0.02	3.49
August	0.43	6.45	-0.82	6.95	1.25	4.38
September	-0.97	6.01	-0.84	6.38	-0.13	2.15
October	0.22	7.67	0.70	8.45	-0.48	4.61
November	2.68	6.08	2.15	7.35	0.53	3.17
December	3.15	4.11	2.47	4.40	0.68	2.25

Reported are average payoffs to winner, loser, and momentum (winner-loser) portfolios of Strategy 6-6 in each calendar month over the period June 1995 to March 2009. Strategy 6-6 is designed as detailed in Table 2 It buys the past 6 month winner and short-sells the past 6 month loser and then holds the long and short position for the next 6 months.

Table 6: Correlation Matrix of Monthly Returns on 25 Strategies and 9 S&P Indices

	500 Growth	S&P 500	500 Value	400 Growth	MidCap 400	400 Value	600 Growth	SmallCap 600	600 Value
1-1	-0.09	-0.19	-0.21	-0.14	-0.24	-0.22	-0.09	-0.10	-0.22
1-3	-0.02	-0.17	-0.25	-0.01	-0.05	-0.22	-0.03	-0.04	-0.21
1-6	0.03	-0.11	-0.21	0.05	-0.01	-0.16	0.08	0.07	-0.13
1-9	-0.02	-0.15	-0.26	0.01	-0.04	-0.20	0.00	0.00	-0.20
1-12	-0.04	-0.15	-0.29	-0.02	-0.01	-0.25	-0.06	-0.05	-0.24
3-1	-0.13	-0.25	-0.27	-0.14	-0.25	-0.27	-0.11	-0.12	-0.21
3-3	-0.09	-0.22	-0.26	-0.10	-0.19	-0.24	-0.05	-0.07	-0.18
3-6	0.00	-0.13	-0.22	0.00	-0.08	-0.17	0.05	0.04	-0.11
3-9	-0.01	-0.14	-0.27	-0.01	-0.07	-0.22	0.01	0.01	-0.17
3-12	0.07	-0.08	-0.24	0.04	-0.02	-0.19	0.06	0.06	-0.13
6-1	-0.11	-0.20	-0.20	-0.12	-0.22	-0.20	-0.07	-0.07	-0.17
6-3	-0.09	-0.17	-0.20	-0.05	-0.12	-0.17	-0.04	-0.04	-0.16
6-6	-0.11	-0.20	-0.27	-0.10	-0.12	-0.23	-0.08	-0.07	-0.20
6-9	-0.10	-0.17	-0.28	-0.11	-0.13	-0.26	-0.14	-0.11	-0.24
6-12	-0.06	-0.16	-0.29	-0.07	-0.10	-0.27	-0.10	-0.09	-0.23
9-1	-0.16	-0.25	-0.26	-0.17	-0.28	-0.26	-0.13	-0.11	-0.24
9-3	-0.15	-0.25	-0.29	-0.14	-0.19	-0.26	-0.11	-0.10	-0.23
9-6	-0.13	-0.22	-0.32	-0.13	-0.17	-0.29	-0.13	-0.11	-0.25
9-9	-0.09	-0.21	-0.33	-0.11	-0.15	-0.30	-0.11	-0.09	-0.25
9-12	-0.04	-0.18	-0.33	-0.07	-0.10	-0.29	-0.07	-0.06	-0.23
12-1	-0.09	-0.17	-0.30	-0.12	-0.12	-0.28	-0.14	-0.13	-0.28
12-3	-0.06	-0.15	-0.29	-0.07	-0.10	-0.26	-0.10	-0.08	-0.25
12-6	-0.04	-0.15	-0.31	-0.06	-0.09	-0.28	-0.08	-0.06	-0.24
12-9	-0.05	-0.14	-0.31	-0.07	-0.09	-0.28	-0.12	-0.09	-0.25
12-12	-0.02	-0.13	-0.29	-0.05	-0.08	-0.27	-0.09	-0.07	-0.23

This table presents correlation coefficients of monthly returns on 25 momentum strategies and nine S&P indices. Column 1 represents the 25 momentum strategies constructed based on 5 different ranking periods and 5 different holding horizons. For example, Strategy 6-9 is to buy the past 6-month winner and short-sell the past 6-month loser and then hold the long and short position for the next 9 months. The sample period is from 06/1995 to 03/2009.

Table 7: Risk-adjusted Monthly Excess Returns of Mometum Strategies on S&P Indices

Panel A: Strategy 6-6

Portfolio Returns	α	Mkt - Rf	SMB	HML	R^2 (%)
Winner	0.43 (2.57)	1.04 (27.30)	0.43 (5.56)	0.29 (4.02)	86.5
Loser	-0.40 (-1.69)	1.21 (23.51)	0.20 (2.49)	0.38 (4.49)	79.2
Winner - Loser	0.55 (1.67)	-0.17 (-2.38)	0.23 (1.67)	-0.09 (-0.67)	7.9

Panel B: Strategy 12-12

Portfolio Returns	α	Mkt - Rf	SMB	HML	R^2 (%)
Winner	0.30 (1.78)	1.01 (24.16)	0.45 (5.89)	0.19 (3.08)	88.6
Loser	-0.42 (-1.68)	1.17 (19.68)	0.37 (4.38)	0.59 (6.19)	79.8
Winner - Loser	0.44 (1.26)	-0.16 (-1.83)	0.09 (0.70)	-0.41 (-2.96)	14.6

At the beginning of each month between June 1995 and March 2009, we calculate the returns on each of the nine S&P indices over the past 6 or 12 months and assign the index with the highest return to the winner portfolio and the index with the lowest return to the loser portfolio. Strategy 6-6 is to buy the past 6-month winner and short-sell the past 6-month loser and then hold the positions for the next 6 months. Similarly, Strategy 12-12 is to buy the past 12-month winner and short-sell the past 12-month loser and then hold the positions for the next 12 months. The three explanatory variables Mkt-Rf, SMB and HML are the Fama-French factors. The risk free rate is the 1 month T-bill rate. We regress the monthly excess returns of the winner portfolio, loser portfolio and winner-loser portfolio on the Fama-French three factors. The coefficients are expressed in percent per month and t-statistics are shown in parentheses.

III. SECTOR MOMENTUM

1. Introduction

Exchange Traded Funds (ETFs) are soaring in popularity as asset allocation tools. State Street Global Advisors of Boston estimates that total assets in the total 683 ETFs have grown rapidly to $612 billion by May 2008. Since the first U.S. ETF was launched in 1993, ETFs today cover a broad range of markets, including sectors, value, growth, small-cap, large-cap, gold, bonds, currency, overseas markets, and many more.

Unlike individual stocks, ETFs allow investors to easily target an asset class. Brinson, Hood and Beebower (1986) as well as Brinson, Singer and Beebower (1991) conclude that 93% of variation in returns is explained by asset allocation. Sector ETFs are useful tools to achieve varying levels of equity exposure within an asset allocation strategy. When investors believe a particular sector is going to perform better over a period of time than other sectors, they can buy its ETF without having to take firm-specific risks to choose the individual stocks that may be the winners.

In June 2004, Morgan Stanley's quantitative analytics team concluded that there was no basis for the traditional methodology of global asset allocation, namely regional first, then sector. Instead, Morgan Stanley believes investors ought to focus their asset allocation strategies more prominently on sectors (Jeremy Siegel (2005)). However, the fastest growing sectors may not yield the best returns.

Among the nine major sectors during 1957 through 2008, the financial sector has gained the largest share since the S&P 500 Index was founded in 1957. Financial's weight on the S&P 500 index has increased from less than 1% to over 13% in December 2008, while

Energy's weight has shrunk from over 21% to about 13% over the same period. If investors had been chasing the fastest-growing sector, they would have sunk the money into financial stocks and sold oil stocks. But they would have underperformed the market. Since 1957, the returns on Financial have actually fallen behind the S&P 500 Index, while Energy has outperformed the market during the same period.

Most investors may remember the year 2000 as a disappointing year for stock investment. In reality Financial rose 25.93% whereas Technology fell precipitously 42.04%. Thus, investors could have made profits if they had sold short Technology Sector SPDR (XLK) and gone long Financial Sector SPDR (XLF) - something they could not have done with mutual funds.

1.1 ETFs versus Mutual Funds

Investors may choose ETFs or mutual funds to achieve diversification and make profits on a particular sector, but the payoffs to these two investing tools could be different due to their structure.

a. Tax Efficiency

Mutual funds are subject to specialized tax rules. In particular, they must pass through realized capital gains to their shareholders. When mutual fund shareholders redeem shares, they are paid directly by the fund company. If the fund company must sell portfolio securities to raise cash to pay for shareholder redemptions, realized capital gains are passed on directly to the shareholders. In other words, the actions of other shareholders may result in one's tax liability. Dickson and Shoven (1995) as well as Dickson, Sialm, and Shoven (2000) emphasize that redemptions raise the tax burden on mutual fund investors. In contrast, ETFs are designed to shield investors in two ways from many of the tax burdens commonly found in actively managed mutual funds. First, portfolio turnover in ETFs is low resulting in a lower potential for capital gains. ETF portfolio transactions only occur when changes are

made to the underlying index, or when needed to maintain diversification requirements. Second, ETF shareholders are insulated from taxable events generated by other shareholders' redemption.

b. Low Fees

Carhart (1997) and Elton, Gruber, Das, and Hlavka(1993) document that expenses are a major factor of fund performance. Barber, Odean and Zheng (2005) find that the average operating expenses for diversified U.S. equity mutual funds is 0.90% although some index mutual funds could be lower. In contrast, the average expense ratio for index ETFs (e.g., Select Sector SPDRs) is 0.25%.

c. Trading Flexibility

Since ETFs are openly traded on an exchange as opposed to being valued at the end of the day as with mutual funds, they can be bought and sold with the same flexibility as individual stocks throughout the trading day. This flexibility allows investors to long one sector and short the other even in a falling market.

1.2 Momentum Investing

The existence of momentum may be explored using short term autocorrelation of returns. The objective is to determine if past performance is a predictor of future performance, and then if economically profitable trading strategies can be executed using historical information.

Jegadeesh and Titman (1993) and Chan, Jegadeesh, and Lakonishok (1996) find evidence to support return momentum during a 3-12 month formation and holding period and demonstrate that substantial returns can be made by buying past winners and selling past losers. Stocks that have performed extraordinarily well or poorly over the last 6 to 12 months continue to do so over the next 6 to 12 months. These findings appear to be very robust. Jegadeesh and Titman (2001) report that momentum strategies remained profitable even after

the publication of their original study. Rouwenhorst (1999) documents momentum in returns across 12 European countries.

More recently Chordia and Shivakumar (2006) and Cooper, Gutierrez, Hameed (2004) find that the existence of momentum profits is evident during expansionary periods. But momentum profits disappear after controlling for macroeconomic variables like Treasury bill yield, dividend yield, default spread and term structure of interest rates.

The implementation of momentum strategies within equity markets by institutional investors is examined in Grinblatt and Titman (1989) and Grinblatt, Titman, and Wermers (1995). The latter study finds that 77% of the funds examined are momentum investors. This percentage is higher for growth fund managers compared to balanced and income fund managers. Further, Burch and Swaminathan (2001) find institutional investors, classified as insurance companies, banks, investment advisors and fund managers, adopt momentum trading strategies when selecting equity investments.

Bange and Miller (2004) examine momentum investing in the context of the global asset allocation decision. Their study investigates the relationship between historical asset class returns and changes in asset allocation recommendations given by 16 investment houses, from 1982 to 1999. Their results show mixed support for momentum investing as a determinant in the asset allocation decision.

Perhaps most related to the present paper is work by Moskowitz and Grinblatt (1999) who document autocorrelation in industry returns and conjecture that industry momentum could be caused by cross-autocorrelation among stocks within the same industry. Hong, Torous and Valkanov (2007) show that a number of industries lead the stock market by up to two months, which is consistent with cross-industry momentum at the aggregate level. Hong, Lim and Stein (2000) focus on stock-level momentum and find that momentum strategies work better among small stocks with low analyst coverage.

Avramov, Chordia, Jostova, and Philipov (2007) find that the winner and loser portfolios in other empirical papers are comprised mainly of high credit risk stocks. Momentum profitability is statistically significant and economically large among low-rated firms, but it is nonexistent among high-grade firms. The influence of momentum is limited to a small sample (4% of market capitalization) of companies with high credit risk.

To handle previous researcher's concerns about firm size, credit rating or stock liquidity as well as short selling constraints and trading costs, I use large-cap, well-diversified and highly tradable sector ETFs for this study. I employ monthly data of nine sector SPDRs over the period January 1999 to December 2008 to examine sector momentum. The remainder of this paper is organized as follows. Section 2 describes sample data and methodology employed for portfolio formation and sector momentum trading strategies. Section 3 documents profitability of various momentum strategies. Section 4 conducts some robustness checks. Section 5 concludes the study.

2. Data and Methodology

2.1 Sample Data

The data used in this study are monthly returns of nine Select Sector SPDRs: Consumer Discretionary (Symbol: XLY), Consumer Staples (XLP), Energy (XLE), Financial (XLF), Health Care (XLV), Industrial (XLI), Material (XLB), Technology (XLK), and Utility (XLU). Sector SPDRs divide the S&P 500 into nine sector index funds. Each fund's portfolio is comprised principally of shares of constituent companies included in the S&P 500. Each stock in the S&P 500 is allocated to only one sector index. These nine sector ETFs were incepted on 12/22/1998 and have since been traded on NYSE Arca. They can be bought or sold short individually, as well as purchased on margin. Their monthly prices are available on CRSP and Yahoo Finance, but Yahoo Finance provides dividend-adjusted prices which are

more accurate for this study.[3] I use the complete history of monthly data from January 1, 1999 to December 31, 2008. This gives a sample of 1080 observations of monthly returns.

Table 8 reports summary statistics for the nine sector SPDRs. In Panel A, average monthly returns are computed over the period January 1999 to December 2008. On average, Energy is the best performing sector with a 1.52% monthly return while Technology is the worst with -0.32%. The weightings of each sector in the S&P 500 vary widely by years. Financial and Technology weigh substantially less in 2008 than in 2000 whereas Energy and Consumer Staples gain the shares in S&P 500 over the same period. Number of Holdings is the number of companies included in each sector. P/E and P/B ratio are the equally-weighted average ratio of price to earnings per share and ratio of stock price to its book value, respectively. P/E, P/B and Median Market Cap are calculated for constituent companies in each sector as of 12/31/2008. Panel B reports annual sector returns by year 1999-2008. Sector returns fluctuated wildly over the last 10 years. The average difference between the best performing and worst performing sector is more than 42% per year. For example, Technology was down 42.04% while Financial was up 25.93% in 2000, but Financial underperformed Consumer Staples by 40.32% in 2008.

2.2 Trading Strategies

The trading strategies examined in this paper are designed in a way similar to Jegadeesh and Titman (1993).[4] Specifically, at the beginning of each month, the cumulative returns of the past J months (J = 1, 3, 6, 9 or 12) for each of the 9 sector SPDRs are calculated and ranked in descending order. I assign the top sector (with the highest return) to the winner portfolio and the bottom sector (with the lowest return) to the loser portfolio. The portfolio is equally weighted at formation. I then buy the winner portfolio, simultaneously sell short the loser

[3] Using monthly data from CRSP yields no difference.

[4] Jegadeesh and Titman (1993) focus on the permutations of J=3, 6, 9, 12 and K =3, 6, 9, 12. However, Moskowitz and Grinblatt (1999) document a strong industry momentum on a 1 month horizon. Thus I consider more periods for portfolio formation and holding than Jegadeesh and Titman (1993).

portfolio, and hold the position for K months (K = 1, 3, 6, 9 or 12). When the holding horizon K is longer than one period, this creates an overlap in the holding period return. I follow Jegadeesh and Titman (1993) to compute the period average return of K strategies, each starting one period apart. In other words, this return is equivalent to the return of a composite portfolio in which 1/K of the holdings is updated each period and the remaining from the previous period. For example, for the strategy based on the previous 6-month returns and the next 6-month holding horizon (J=6 and K=6), at the beginning of each month t, the strategy buys the previous 6 month winning sector and short sells the previous 6 month losing sector, holding this position for the next 6 months. Hence, at each month t, the 6-6 sector momentum portfolio consists of six parts: a new investment at month t and the other five positions carried over from month t-5 through t-1.

3. Profitability of Momentum Strategies

3.1 Monthly Returns of Sector Momentum Portfolios

Table 9 reports average monthly returns of winner and loser portfolios, as well as winner-loser momentum portfolios, for the 25 trading strategies based on 5 different ranking periods and 5 different holding horizons. Consistent with Jegadeesh and Titman's (1993) findings on individual stock momentum, the results in Table 9 show that 23 of the 25 sector momentum strategies have positive average monthly profits whereas only two of the one-month horizon strategies (Strategy 1-1 and 3-1) break even. The most successful strategy is Strategy 6-6 that yields 0.89% per month statistically significant at 1% level. For Strategy 6-6, the long position (buying the winner) generates 0.68% per month or 76% of the total monthly returns while the short position (selling the loser) provides 0.21% per month or 24% of the total profits. For 1-K strategies (Panel A), no strategy has a significant return. For 3-K strategies (Panel B), Strategy 3-6 generates a statistically significant payoff of 0.66% per month. For 6-K strategies (Panel C), all the strategies produce statistically significant profits

ranging from 0.39% to 0.89% per month except for Strategy 6-1. For 9-K strategies (Panel D) and 12-K strategies (Panel E), only Strategy 12-6 yields a 0.59% significant return per month.

In summary, the return of sector momentum is the highest over a 6 month horizon and may still be statistically significant over a 3 or 9 month horizon but virtually indistinguishable from 0 over a 1 month horizon. Moreover, previous 1 month winners and losers may not generate significant payoffs to sector momentum portfolios in the following months. Last, momentum profits are primarily attributed to the buy-side.

3.2 Frequency of Sectors in Momentum Portfolios

Table 10 reports the frequency of each sector that appears in the 16 momentum portfolios as either a winner or a loser. For a close comparison, the frequency of losers is shown in parentheses. Since all of the 9 sector momentum strategies based on a 1 month ranking period or a 1 month holding horizon yields insignificant return, those results are not the focus. As Table 10 shows, Technology appears most frequently as a loser in the sector momentum portfolios for each ranking period while Energy is the most frequent winning sector over the 10 year sample period. For the most profitable strategy 6-6, Energy is classified as the winning sector for 40 times out of 108 or 37% of the time whereas Technology is classified as the losing sector for 30 times out of 108 or 28% of the time. Further examination on the monthly momentum portfolios reveals that Energy and Technology sometimes stay in the winner or loser portfolio from one holding period to the next for several consecutive months. This suggests that trading costs are not actually incurred since there is no need to close the initial position and to re-open a new one.

4. Robustness Checks

4.1 Sector Momentum on CRSP-listed Stocks

The best way to check the robustness of momentum strategies on sector SPDRs is to examine sector components of stock returns over a longer period. Moskowitz and Grinblatt

(1999) document industry momentum based on twenty industries from 1963 to 1995 using Standard Industrial Classification (SIC) code, but their results may raise a potential question: whether sector returns would exhibit a momentum phenomenon if sectors are classified by Global Industry Classifications Standard (GICS).

Bhojraj, Lee, and Oler (2003) point out that industry classification is a long-standing issue in financial research. Although Standardized Industry Classification (SIC) codes have been available since 1939, they are in the process of being replaced by North American Industry Classification System (NAICS) codes. At the same time, Standard & Poor's and MSCI jointly developed the Global Industry Classifications Standard (GICS) system to establish a global standard for categorizing companies into sectors and industries, thereby enabling securities owners, securities managers and investment research specialists to make seamless company, sector and industry comparisons across countries, regions, and globally. Standard & Poor's claims that the GICS methodology has been widely accepted as an industry analysis framework for investment research, portfolio management and asset allocation. The GICS classification system consists of 10 sectors, 24 industry groups, 64 industries and 139 sub-industries. The 10 sectors are: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Telecommunication Services and Utilities. Their GISC codes are 10, 15, 20, 25, 30, 35, 40, 45, 50, and 55, respectively.

This paper utilizes Global Industry Classification Standard (GICS) for two reasons: first, Bhojraj, Lee, and Oler (2003) has documented the superiority of using the GICS classification scheme for various financial and accounting research applications; second, sector SPDRs are designed according to GICS, therefore I could theoretically test the momentum strategies on sector SPDRs over a longer period as follows.

I include all NYSE, AMEX, and Nasdaq companies that have CRSP monthly returns and can be matched with a GICS sector code on Compustat. ADRs, Closed-end Funds, Shares of Beneficial Interest, Trusts, and Units are excluded. The sample period is from January 1963 to December 2008.

Since momentum strategies are long and short securities at the same time, I also exclude stocks priced less than $1 per share. This constraint is motivated by the fact that stocks priced under $1 per share are difficult to borrow and, thus, difficult to short sell (e.g., see D'Avolio, 2004). Also, Griffin, Ji, and Martin (2003) and Cooper, Gutierrez, and Hameed (2004) argue that the profitability of price momentum strategies is sensitive to controls for microstructure induced biases. To address concerns that momentum profits are solely driven by extremely small and illiquid stocks, I only include stocks priced no less than $1 per share for robustness checks.

Using the CRSP monthly returns and Compustat GICS two-digit sector codes, I form 10 value-weighted sector portfolios[5] and calculate their monthly returns each month from January 1963 to December 2008. Following Jegadeesh and Titman (1993) and Moskowitz and Grinblatt (1999), at the beginning of each month, 10 sector portfolios are ranked in descending order on the basis of their cumulative returns during the past J months (J=1, 3, 6, 9, and 12). I buy the top sector (winner) and short the bottom sector (loser) and hold this winner minus loser momentum portfolio over the next K months (K=1, 3, 6, 9, and 12). The profitability of these momentum trading strategies is presented on Table 11.

Table 11 reports average monthly returns of winner and loser portfolios as well as winner-loser momentum portfolios. The results are generally consistent with the findings of Jegadeesh and Titman (1993) for individual stocks and Moskowitz and Grinblatt (1999) for industries. All of the 25 trading strategies over various holding periods yield positive returns,

[5] Using equally-weighted sector portfolios and/or the strategy that skips a month does not make a substantive difference.

many of which are statistically significant. The most profitable strategies are based on the past 6 or 9 month returns and being held for the next 6 or 9 months. The 6-6, 6-9 and 9-6 trading strategy generate a statistically significant profit of 0.39%, 0.55% and 0.54% per month, respectively. In contrast to Jegadeesh and Timan's (1993) result on a short-term individual stock momentum, the 1-month sector momentum appears to be the strongest. Moskowitz and Grinblatt (1999) also find a strong 1-month industry momentum and explain that forming industry portfolios might eliminate the bid-ask spread effects which reverse the 1-month return for individual stocks. From a trading perspective, high turnover ratio would preclude profits from the 1-1 momentum trading. Later subperiod analysis shows that the 1-1 month momentum effect is insignificant during 2000 to 2008.

4.2 Subperiod Analysis

To further analyze sector momentum, I study sector momentum on CRSP-listed stocks over subperiods. Moskowitz and Grinblatt (1999) find industry momentum from 1963 to 1995, but Chordia and Shivakumar (2002 and 2006) discover that price momentum strategies do not earn profits during recession periods of 1972-1979 and the early 1990's. Jensen, Johnson, and Mercer (1998) argue that the size and value premium in U.S. stocks are predictably higher in an expansionary monetary policy environment. Finally, Lee and Swaminathan, (2000) argue that there may be a momentum cycle and late-cycle momentum trading fails to generate profits.

Using the same approach as above, I include all NYSE-Amex-NASDAQ stocks priced above $1 per share on CRSP database and obtain their GICS sector code from Compustat. I form ten value-weighted sector portfolios each month and go long the winner sector and short the loser sector. Subperiod profitability of sector momentum portfolios are reported in Table 12.

Subperiod analysis (Table 12) indicates that sector momentum strategies yield significant profits from 1980 through 2008. The 1-1 momentum trading strategy seems to the most profitable in each subperiod although its payoff is insignificant during 2000-2008. However, the transaction costs involved in this short-term trading strategy would substantially reduce the momentum profits. Similar to Chordia and Shivakumar's (2006) findings on price momentum of individual stocks, sector momentum is the strongest during 1980-1989 since all the trading strategies earn positive payoffs. The average returns of the intermediate-term momentum strategies (Strategy 6-6, 6-9, 9-6 or 9-9) are between 0.67% and 0.89% per month as Panel B reports. During the two periods of 1970-1979 and 1990-1999, which both cover an economic recession, sector momentum generates different results. Panel A shows momentum trading strategies fail in the 1970s primarily because the payoffs to the winner and to the loser are very similar in magnitude. In contrast, sector momentum strategies perform well during 1990-1999 as Panel B shows that 21 out of the 25 trading strategies are profitable. The significant payoff to the 6-9, 9-6 and 9-9 strategy are 0.96%, 0.88% and 0.82% per month, respectively. Finally, Panel D demonstrates that the sector momentum strategies on CRSP-listed stocks perform similarly well as the strategies on sector ETFs (Table 9) do during 2000-2008.

Subperiod analysis suggests that the payoff to buying previous strong sectors and selling previous weak sectors is significant especially over a 6 or 9 month horizon. Sector momentum strategies perform well during an economic expansion period but could do poorly during a recession period although their profitability does not exhibit strong correlation to overall market movements.

4.3 Adjusting the Market, Size and B/M Factor

Fama and French (1996) argue that the differences in returns between small and big firms (SMB) and between high and low book-to-market value ratios (HML) can be additional risk

factors in explaining cross-sectional U.S stock returns. To further examine whether excess returns of sector momentum strategies are compensation for systematic risks, I regress the monthly excess returns of the 6-6 momentum strategy on sector SPDRs on the market, SMB and HML factor from January 1999 through December 2008. The results reported in Table 13.

Panel A shows the Fama-French three factors have significant effect on the winner or loser portfolio, but essentially no effect on the winner-loser momentum portfolio. After adjusted by the three factors, the return on the momentum strategy is 0.59% per month, statistically significant at 1% level. The above results demonstrate that exposure to the market, SMB or HML factor does not provide a simple explanation for the excess returns on sector momentum strategies.

4.4 Transaction Costs

Chan and Lakonishok (1997) document that an average round-trip cost is 0.9% for large capitalization stocks and 3.31% for small capitalisation stocks on the NYSE. However, a number of researchers (Lesmond, Schill, and Zhou (2004), Hanna and Ready (2001), and Sadka (2003)) argue that transaction costs have traditionally been understated because most momentum strategies are dominated by smaller, high-beta stocks that generate large momentum returns but cost much more to trade than big-cap stocks. Further, momentum strategies could require higher trading frequencies as well as shorting stocks which is an expensive process.

Since the momentum strategies investigated in this paper are implemented on large-cap and highly liquid sector SPDRs, transaction costs would be far lower than they would be in the momentum strategy on individual stocks or industries. However, the momentum strategy on sector SPDRs may be more trading intensive than simple buy-and-hold strategy: investors must buy the winning sector and short sell the losing sector at the end of each ranking period and close out their long-short positions by selling the winner and buying back the loser at the

end of each holding period. This requires up to four round-trip trades a year for strategies with a 3-month holding period, up to two roundtrip trades a year for strategies with a 6-month holding period and up to one round-trip trade a year for strategies with a 12-month holding period. However, sector momentum traders may not need to close out their entire positions at the end of each holding period as some sectors may continue to be the winner or loser from one holding period to the next. If the momentum strategy retains the winning or losing sector in the following period, trading costs are not actually incurred since there is no need to close the initial position and to re-open a new one. To estimate the potential transaction costs, I focus on the 6-6 momentum strategy as an example.

As Chan and Lakonishok (1997) estimate that an average round-trip cost is 0.9% for large capitalisation stocks, the possible maximum costs for the 6-6 trading strategy would be 1.8% per year. Since trading costs are not actually incurred if the long and short positions remain in the following 6 months, the actual costs would be lower. In addition, trading commissions have decreased substantially in the last decade due to intensive competition from online brokers, therefore it is likely that the 6-6 momentum strategy could cost less than 1.5% per year. As Table 9 shows the payoff to the 6-6 strategy, the annual profit after transaction costs would be about 9%, an economically and statistically significant figure.

5. Conclusion

Momentum investing can generate substantial profits, but it is important to implement momentum strategies with appropriate securities. Korajczyk and Sadka (2004) point out that momentum trading increases turnover and thus cannot be profitably implemented in illiquid stocks. Avramov, Chordia, Jostova, and Philipov (2007) argue that the momentum portfolios in other empirical papers are comprised mainly of high credit risk stocks. As large-cap, well-diversified and highly liquid ETFs, Select Sector SPDRs appear to be excellent tools to

exploit sector momentum. At the same time, investors may maintain a truly diversified stock portfolio within a particular sector in a cost-effective manner.

This paper examines the profitability of momentum strategies on Select Sector SPDRs over the period January 1999 to December 2008. Using the monthly dividend-adjusted returns, I find that momentum strategies on sector SPDRs could yield economically and statistically significant payoffs. Based on a 6-month ranking period and a 6-month holding horizon, the 6-6 sector momentum strategy appears to be the most profitable trading strategy, producing an average profit of 0.89% a month. This statistically significant profit is robust to transaction costs and the Fama-French three factors.

I also investigate the payoffs to sector momentum strategies on CRSP-listed individual stocks between January 1963 and December 2008 by using Global Industry Classifications Standard (GICS) and find that the 1-1 strategy is surprisingly the most successful. However, considering portfolio turnover ratio and microstructure effect, the 6-6 strategy still seems to perform the best.

Further subperiods analysis demonstrates that sector momentum strategies may not perform as well over an economic recession period as they do over an economic expansion period. This suggests that investors need to take caution when implementing momentum strategies on sector SPRDs. Further research on an explanation for sector momentum is needed.

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Table 8: Summary Statistics of Sector SPDRs

Panel A: Description of SPDRs

Sector	ETF Symbol	Monthly Returns (%)		Weightings in S&P 500			Number of Holdings	Average P/E Ratio	Average P/B Ratio	Market Cap
		Mean (%)	S.D. (%)	2000	2005	2008				
Consumer Discretionary	XLY	0.31	5.01	10.3	10.7	8.4	80	19.90	1.90	3.78
Consumer Staples	XLP	0.23	3.47	8.1	9.6	12.9	41	14.20	2.99	12.33
Energy	XLE	1.52	5.95	6.6	9.3	13.3	40	6.70	1.57	13.02
Financial	XLF	0.30	5.03	17.3	21.3	13.3	81	11.48	0.86	5.85
Health Care	XLV	0.28	3.92	14.4	13.3	14.8	54	12.20	2.61	11.32
Industrial	XLI	0.61	4.76	10.6	11.4	11.1	59	9.80	2.06	8.65
Material	XLB	0.98	5.91	2.3	3.3	3.3	29	9.60	1.38	5.47
Technology	XLK	-0.32	8.17	26.7	18.1	19	83	12.50	2.37	5.49
Utility	XLU	0.65	4.54	3.8	3.3	4.2	33	11.90	1.53	7.09

Panel B: Annual Sector Returns (%)

Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Consumer Discretionary	18.63	-16.10	13.74	-18.76	37.39	13.27	-6.37	18.63	-13.21	-33.49
Consumer Staples	-14.49	26.04	-9.63	-19.78	11.26	8.11	3.12	14.78	12.75	-14.95
Energy	19.04	24.92	-18.04	-14.56	26.76	33.88	40.43	18.61	36.72	-38.70
Financial	3.57	25.93	-8.90	-14.65	31.01	10.88	6.49	19.21	-18.61	-55.27
Health Care	20.90	-11.63	0.04	-1.44	15.14	1.73	6.73	7.34	7.18	-23.06
Industrial	23.39	7.43	-10.06	-24.51	33.00	17.78	3.01	13.89	13.47	-38.89
Material	22.78	-17.09	0.57	-5.58	38.13	13.57	4.55	18.60	22.06	-44.12
Technology	66.69	-42.04	-22.76	-38.28	39.49	5.53	-0.02	12.34	15.38	-41.41
Utility	-3.76	22.31	-12.86	-27.91	26.18	24.21	16.80	20.95	19.36	-29.08

Summary statistics are reported for nine sector SPDRs. Average monthly returns (Mean) and standard deviations (S.D.) are computed over the period 1/1/1999 to 12/31/2008. Sector SPDRs divide the S&P 500 into nine sectors. Each company in the S&P 500 is allocated to only one sector. The weightings of each sector in the S&P 500 index vary by years. Number of holdings is the number of companies included in the sector. P/E and P/B ratio are the average ratio of price to earnings per share and ratio of stock price to itsbook value, respectively. P/E, P/B and Median Market Cap are calculated for constituent companies in each sector as of 12/31/2008. Panel B reports annual sector returns by year 1999-2008.

Table 9: Monthly Returns of Momentum Strategies on SPDR Sector ETFs

Panel A: Portfolios formed based on past 1 month returns and held over various horizons (1-K)

Portfolios	1-1	1-3	1-6	1-9	1-12
Winner	0.00	-0.14	0.20	0.27	0.35
Std Dev.	0.06	3.43	2.58	2.15	1.95
Loser	0.00	-0.14	-0.04	0.15	0.21
Std Dev.	0.07	4.03	2.58	2.35	2.17
Winner - Loser	0.00	0.01	0.24	0.13	0.13
Std Dev.	0.08	3.85	2.82	2.55	2.32
t-Stat	-0.21	0.02	0.90	0.53	0.59

Panel B: Portfolios formed based on past 3 month returns and held over various horizons (3-K)

Portfolios	3-1	3-3	3-6***	3-9	3-12
Winner	0.00	0.18	0.50	0.45	0.44
Std Dev.	0.06	3.55	2.57	2.10	1.96
Loser	0.00	-0.03	-0.16	0.11	0.28
Std Dev.	0.08	4.01	2.84	2.44	2.15
Winner - Loser	0.00	0.22	0.66	0.34	0.16
Std Dev.	0.08	4.00	2.73	2.48	2.25
t-Stat	-0.21	0.58	2.57	1.44	0.73

Panel C: Portfolios formed based on past 6 month returns and held over various horizons (6-K)

Portfolios	6-1	6-3**	6-6***	6-9***	6-12*
Winner	0.01	0.53	0.68	0.66	0.56
Std Dev.	0.06	3.24	2.35	2.04	2.00
Loser	0.00	-0.27	-0.21	0.02	0.17
Std Dev.	0.08	4.23	2.86	2.48	2.19
Winner - Loser	0.01	0.80	0.89	0.63	0.39
Std Dev.	0.09	4.10	2.62	2.52	2.30
t-Stat	1.00	2.06	3.52	2.58	1.72

(Table 9 continued)

Panel D: Portfolios formed based on past 9 month returns and held over various horizons (9-K)

Portfolios	9-1	9-3	9-6	9-9	9-12
Winner	0.00	0.42	0.37	0.34	0.29
Std Dev.	0.07	3.63	2.72	2.40	2.15
Loser	0.00	-0.26	-0.08	0.06	0.27
Std Dev.	0.08	4.46	2.76	2.41	2.14
Winner - Loser	0.01	0.68	0.46	0.28	0.02
Std Dev.	0.09	4.37	2.89	2.81	2.46
t-Stat	0.93	1.62	1.62	1.01	0.07

Panel E: Portfolios formed based on past 12 month returns and held over various horizons (12-K)

Portfolios	12-1	12-3	12-6*	12-9	12-12
Winner	0.00	0.27	0.25	0.21	0.25
Std Dev.	0.06	3.81	2.75	2.39	2.14
Loser	-0.01	-0.43	-0.31	-0.07	0.06
Std Dev.	0.08	4.47	2.90	2.55	2.13
Winner - Loser	0.01	0.70	0.56	0.28	0.19
Std Dev.	0.08	4.39	2.98	2.85	2.36
t-Stat	1.60	1.63	1.89	0.96	0.79

At the beginning of each month between January 1999 and December 2008, I calculate the returns of the past J months (J = 1, 3, 6, 9 or 12) for each of the 9 Sector SPDRs and rank them in descending order. I assign the top sector (with the highest return) to the winner portfolio and the bottom sector (with the lowest return) to the loser portfolio. I then buy the winner portfolio, simultaneously sell short the loser portfolio, and hold the position for K months (K = 1, 3, 6, 9 or 12). Reported are the monthly returns (expressed in percent) of 25 winner-loser portfolios and their standard deviations and t-statistics.

**** Statistical significance at 1% level
** Statistical significance at 5% level
* Statistical significance at 10% level

Table 10: Frequency of Sector SPDRs in Momentum Portfolios

Panel A: 3 Month Ranking Period

	3 - 3		3 - 6***		3 - 9		3 - 12	
Consumer Discretionary	9	(9)	9	(9)	9	(9)	9	(9)
Consumer Staples	10	(12)	8	(12)	8	(12)	7	(12)
Energy	29	(13)	29	(11)	28	(11)	26	(11)
Financials	2	(15)	2	(15)	2	(12)	2	(10)
Health Care	10	(8)	9	(8)	8	(8)	8	(8)
Industrials	4	(2)	4	(2)	4	(2)	4	(2)
Materials	13	(12)	14	(11)	14	(11)	14	(11)
Technology	22	(33)	22	(33)	21	(33)	21	(32)
Utilities	15	(11)	15	(11)	15	(11)	15	(11)

Panel B: 6 Month Ranking Period

	6 - 3**		6 - 6***		6 - 9***		6 - 12*	
Consumer Discretionary	8	(10)	8	(10)	8	(8)	8	(8)
Consumer Staples	5	(11)	6	(11)	5	(11)	5	(11)
Energy	36	(8)	40	(8)	31	(8)	28	(8)
Financials	3	(8)	3	(13)	3	(4)	3	(1)
Health Care	7	(15)	7	(15)	7	(15)	7	(15)
Industrials	1	(2)	1	(2)	1	(2)	1	(2)
Materials	13	(11)	14	(11)	14	(11)	14	(11)
Technology	13	(30)	13	(30)	13	(30)	13	(30)
Utilities	17	(9)	17	(9)	16	(9)	16	(9)

Panel C: 9 Month Ranking Period

	9 - 3		9 - 6		9 - 9		9 - 12	
Consumer Discretionary	7	(5)	7	(5)	7	(5)	7	(5)
Consumer Staples	4	(12)	2	(12)	1	(12)	1	(12)
Energy	40	(8)	39	(8)	37	(8)	34	(8)
Financials	3	(18)	3	(15)	3	(12)	3	(9)
Health Care	9	(17)	9	(17)	9	(17)	9	(17)
Industrials	0	(2)	0	(2)	0	(2)	0	(2)
Materials	15	(12)	15	(12)	15	(12)	15	(12)
Technology	16	(30)	16	(30)	16	(30)	16	(30)
Utilities	15	(5)	15	(5)	15	(5)	15	(5)

Panel D: 12 Month Ranking Period

	12 - 3		12 - 6*		12 - 9		12 - 12	
Consumer Discretionary	4	(8)	4	(8)	4	(8)	4	(8)
Consumer Staples	2	(12)	0	(12)	0	(12)	0	(12)
Energy	42	(2)	41	(2)	38	(2)	35	(2)
Financials	5	(19)	5	(16)	5	(13)	5	(10)
Health Care	10	(19)	10	(19)	10	(19)	10	(19)
Industrials	0	(2)	0	(2)	0	(2)	0	(2)
Materials	16	(9)	16	(9)	16	(9)	16	(9)
Technology	16	(33)	16	(33)	16	(33)	16	(33)
Utilities	11	(2)	11	(2)	11	(2)	11	(2)

At the beginning of each month between January 1999 and December 2008, 9 sector SPDRs are ranked and then assigned to momentum portfolios as detailed in Table 9. Specifically, the 6-6 strategy is based on 6 month ranking period and 6 month holding horizon. Reported is the frequency that each sector appears in the 16 sector momentum portfolios as either a winner or a loser. For a close comparison, the frequency of losers is shown in parentheses. ****, ** and * indicate momentum portfolio profits statistically significant at a 1%, 5% and 10% level, respectively.

Table 11: Monthly Returns of Sector Momentum Strategies on CRSP Stocks

Panel A: Portfolios formed based on past 1 month returns and held over various horizons (1-K)

Portfolios	1-1***	1-3*	1-6	1-9	1-12**
Winner	1.66	1.26	1.15	1.21	1.28
Std Dev.	5.90	3.76	2.66	2.30	2.13
Loser	0.15	0.93	1.03	1.06	1.04
Std Dev.	6.68	3.86	2.83	2.28	2.04
Winner - Loser	1.52	0.33	0.13	0.17	0.24
Std Dev.	6.81	4.25	3.05	2.61	2.47
t-Stat	4.95	1.72	0.93	1.46	2.13

Panel B: Portfolios formed based on past 3 month returns and held over various horizons (3-K)

Portfolios	3-1	3-3	3-6	3-9***	3-12***
Winner	1.48	1.27	1.25	1.31	1.38
Std Dev.	5.78	3.69	2.73	2.34	2.15
Loser	1.07	1.12	1.04	1.00	0.98
Std Dev.	6.84	4.02	2.86	2.26	1.94
Winner - Loser	0.42	0.15	0.21	0.30	0.39
Std Dev.	7.23	4.34	3.28	2.67	2.48
t-Stat	1.28	0.75	1.40	2.48	3.46

Panel C: Portfolios formed based on past 6 month returns and held over various horizons (6-K)

Portfolios	6-1*	6-3*	6-6***	6-9***	6-12***
Winner	1.39	1.35	1.46	1.55	1.52
Std Dev.	6.04	3.78	2.71	2.29	2.19
Loser	0.78	0.97	1.07	1.00	1.06
Std Dev.	7.14	4.13	2.85	2.24	2.02
Winner - Loser	0.61	0.38	0.39	0.55	0.46
Std Dev.	7.11	4.32	2.93	2.61	2.48
t-Stat	1.88	1.92	2.94	4.66	4.06

(Table 11 continued)

Panel D: Portfolios formed based on previous 9 month returns and held over various horizons (9-K)

Portfolios	9-1**	9-3*	9-6***	9-9***	9-12***
Winner	1.54	1.48	1.52	1.51	1.42
Std Dev.	6.30	3.81	2.89	2.54	2.25
Loser	0.83	1.09	0.98	1.05	1.11
Std Dev.	7.13	4.07	2.83	2.28	2.04
Winner - Loser	0.71	0.39	0.54	0.46	0.31
Std Dev.	7.76	4.44	3.40	2.92	2.60
t-Stat	2.01	1.92	3.45	3.43	2.63

Panel E: Portfolios formed based on past 12 month returns and held over various horizons (12-K)

Portfolios	12-1	12-3**	12-6**	12-9*	12-12
Winner	1.54	1.51	1.40	1.39	1.32
Std Dev.	6.28	3.86	2.99	2.50	2.26
Loser	0.97	1.07	1.06	1.14	1.23
Std Dev.	7.15	4.03	2.86	2.34	2.05
Winner - Loser	0.57	0.43	0.34	0.25	0.09
Std Dev.	7.87	4.72	3.48	2.89	2.58
t-Stat	1.60	2.00	2.15	1.86	0.76

Using all CRSP stocks priced above $1/share and the Global Industry Classification Standard (GICS) two-digit sector code from Compustat, I form 10 value-weighted sector portfolios and calculate their monthly returns each month from January 1963 to December 2008. At the beginning of each month, the 10 sector portfolios are ranked in descending order on the basis of their cumulative returns during the past J months (J=1, 3, 6, 9, and 12). I buy the top sector (winner) and short the bottom sector (loser) and hold this winner minus loser momentum portfolio over the next K months (K=1, 3, 6, 9, and 12). Reported are the monthly returns (expressed in percent) of 25 winner-loser portfolios and their standard deviations and t-statistics.

**** Statistical significance at 1% level
** Statistical significance at 5% level
* Statistical significance at 10% level

Table 12: Monthly Returns of Sector Momentum Strategies over Four Subperiods

Panel A (Jan 1970 - Dec 1979)

Ranking Period	1	3	6	9	12
1	1.20	0.10	0.03	0.05	0.00
	*(2.98)***	*(0.36)*	*(0.17)*	*(0.34)*	*(0.02)*
3	-0.40	-0.12	-0.10	-0.06	0.01
	(-0.74)	*(-0.43)*	*(-0.45)*	*(-0.34)*	*(0.04)*
6	0.32	0.18	0.21	0.20	0.05
	(0.68)	*(0.59)*	*(0.97)*	*(1.23)*	*(0.34)*
9	0.15	0.12	0.25	0.21	0.04
	(0.28)	*(0.38)*	*(1.07)*	*(1.13)*	*(0.24)*
12	0.18	-0.13	-0.13	-0.16	-0.17
	(0.35)	*(-0.42)*	*(-0.58)*	*(-0.96)*	*(-1.24)*

Panel B (Jan 1980 - Dec 1989)

Ranking Period	1	3	6	9	12
1	2.44	0.71	0.34	0.46	0.58
	*(3.60)****	*(1.73)**	*(1.11)*	*(1.64)*	*(2.18)***
3	0.98	0.49	0.80	0.99	0.91
	(1.56)	*(1.24)*	*(2.67)****	*(3.74)****	*(3.78)****
6	0.96	0.57	0.67	0.89	0.83
	(1.49)	*(1.43)*	*(2.21)***	*(3.27)****	*(3.05)****
9	1.19	0.63	0.84	0.89	0.68
	*(1.74)**	*(1.52)*	*(2.60)****	*(3.00)****	*(2.30)***
12	1.00	0.85	0.79	0.73	0.60
	(1.43)	*(1.94)***	*(2.41)****	*(2.29)***	*(1.95)**

Panel c (Jan 1990 - Dec 1999)

Ranking Period	1	3	6	9	12
1	1.84	0.40	0.07	0.15	0.49
	*(3.24)****	*(1.07)*	*(0.25)*	*(0.70)*	*(2.45)****
3	0.91	-0.31	-0.79	-0.03	0.46
	(1.46)	*(-0.75)*	*(-2.71)*	*(-0.15)*	*(2.04)***
6	0.51	-0.15	0.31	0.88	0.75
	(0.80)	*(-0.36)*	*(1.23)*	*(3.89)****	*(4.06)****
9	1.17	0.66	0.96	0.82	0.69
	*(1.78)**	*(1.56)*	*(2.91)****	*(3.56)*	*(3.79)****
12	1.10	0.96	0.81	0.71	0.44
	(1.64)	*(2.03)***	*(2.53)****	*(3.13)****	*(2.39)****

(Table 12 continued)

Panel D (Jan 2000 - Dec 2008)

Ranking Period	1	3	6	9	12
1	0.80	0.01	0.01	-0.21	-0.12
	(0.82)	*(0.01)*	*(0.03)*	*(-0.62)*	*(-0.35)*
3	0.61	0.47	0.77	0.23	0.35
	(0.57)	*(0.76)*	*(1.65)**	*(0.66)*	*(1.01)*
6	0.36	0.66	0.87	0.56	0.39
	(0.33)	*(2.03)***	*(3.05)****	*(2.55)****	*(1.15)*
9	0.05	0.15	0.49	0.06	0.12
	(0.04)	*(0.25)*	*(1.82)**	*(0.16)*	*(0.33)*
12	0.02	0.06	0.03	-0.17	-0.24
	(0.02)	*(0.09)*	*(0.05)*	*(-0.46)*	*(-0.74)*

Using all CRSP stocks priced above $1/share and the Global Industry Classification Standard (GICS) two-digit sector code from Compustat, I form 10 value-weighted sector portfolios and calculate their monthly returns each month during each subperiod. At the beginning of each month, the 10 sector portfolios are ranked in descending order on the basis of their cumulative returns during the past J months (J=1, 3, 6, 9, and 12). I buy the top sector (winner) and short the bottom sector (loser) and hold this winner minus loser momentum portfolio over the next K months (K=1, 3, 6, 9, and 12). Reported are the monthly returns (expressed in percent) of the 25 winner-loser momentum portfolios over the four subperiods. T-statistics are shown in parentheses.

**** Statistically significant at 1% level
** Statistically significant at 5% level
* Statistically significant at 10% level

Table 13: Risk-adjusted Excess Monthly Returns of Mometum Strategies on Sector SPDRs

Panel A: 6-6 Momentum Strategy

Portfolio Returns	α	Mkt - Rf	SMB	HML
Winner	0.36 (1.74)	0.22 (4.81)	0.08 (1.42)	0.18 (2.88)
Loser	-0.48 (-1.75)	0.28 (5.08)	0.10 (1.39)	0.14 (1.75)
Winner - Loser	0.59 (2.37)	-0.06 (-1.19)	-0.01 (-0.21)	0.02 (0.28)

Panel B: 12-12 Momentum Strategy

Portfolio Returns	α	Mkt - Rf	SMB	HML
Winner	0.15 (0.70)	0.17 (3.60)	-0.14 (-1.73)	0.01 (0.13)
Loser	-0.13 (-0.66)	0.19 (4.20)	-0.09 (-1.16)	0.18 (2.85)
Winner - Loser	0.06 (0.25)	-0.02 (-0.41)	-0.05 (-0.41)	-0.17 (-1.56)

At the beginning of each month between January 1999 and December 2008, I calculate the returns of the 9 Sector SPDRs over the past 6 or 12 months and rank them in descending order. I assign the top ETF (with the highest returns) to the ‘‘winner portfolio’’ and the bottom ETF (with the lowest returns) to the ‘‘loser portfolio." The 6-6 momentum strategy is to buy the past 6 month winner and hold the portfolio for the next 6 months. Similarly, the 12-12 momentum strategy is to buy the past 12 month winner and hold the portfolio for the next 12 months. The three explanatory variables Mkt-Rf, SMB and HML are the Fama-French factors. The risk free rate is 1 Month T-bill rate. I regress the monthly returns of winner portfolio, loser porfolio and Winner - Loser portfolio on Fama-French three factors. The coefficients are expressed in percent per month and t-statistics are shown in parentheses.

IV. MOMENTUM STRATEGIES ON GLOBAL ETFS

1. Introduction

Index Exchange Traded Funds (ETFs) are rapidly becoming a staple investment tool for a wide spectrum of investors, both individual and institutional. There are several reasons: Firstly, Index ETFs tend to have lower expense ratios than most actively managed funds. They do not incur the usual expensive operational and research costs found in actively managed funds. According to ETFZone, annual fees for ETFs are as low as .09% of assets, which is breathtakingly low compared to the average mutual fund fees of 1.4%. Secondly, Index ETFs tend to have lower portfolio turnover and therefore are less likely to realize capital gains than heavily traded active funds. Poterba and Shoven (2002) find that the tax liabilities are less for index ETFs than average mutual funds since they are not impacted by other shareholders' activities. In contrast, if a mutual fund realizes capital gains, it is obligated to distribute those gains to every shareholder. Essentially, shareholders remaining in the fund may receive capital gains for activities they may not have initiated. Thirdly, Index ETFs allow the investors to more extensively access the market across asset classes, sectors, styles, regions, or even nations.

In 1996, American Stock Exchange began to list iShares MSCI Index Funds[6] for many different foreign countries. These ETFs represent the MSCI (Morgan Stanley Capital International) country equity indices. As of 2007, there are 25 iShares MSCI series for 20 countries and five regions, including iShares for EAFE and the European Monetary Union. Investors can buy and short sell these ETFs. To avoid sample selection bias, in this paper, all of

[6] iShares MSCI funds track the performance of several international equity indexes. Each country index series invests in an optimized portfolio of common stocks based on that country's Morgan Stanley Capital International benchmark country index. BGI is the investment advisor.

the 15 iShares MSCI Index ETFs for the developed markets are used to test for momentum in the portfolio returns.

Momentum refers to the tendency of stock prices to continue moving in the same direction for several months after an initial impulse, which is simply a change in the price itself. The most basic form of momentum is price momentum, while earnings momentum is momentum following a revision in analysts' earnings forecasts (Chan, Jegadeesh, and Lakonishok 1996). An extensive body of finance literature documents that past stock returns can predict the future stock returns. Price momentum was noted in aggregate US stock prices in the late 1980's (Poterba and Summers (1988)), in individual US stock prices in the early 1990's (Jegadeesh and Titman (1993)), and in international markets later in the 1990's (Rouwenhorst (1998), (1999)).

The momentum anomaly documented by Jegadeesh and Titman (1993) remains one of the most intriguing puzzles in empirical asset pricing. It constitutes perhaps the toughest challenge for rational theories of the cross-section of stock returns. Stocks that have performed extraordinarily well over the last 6 to 12 months continue to perform well over the following 6 to 12 months. Stocks that have declined continue to do so. These findings appear to be very robust. Jegadeesh and Titman (2001) report that momentum strategies remained profitable even after the publication of their original study. Abnormal profits of momentum strategies are also documented in non-US equity markets. For example, Ahmet and Nusret (1999) find abnormal profits of long-term contrarian strategies in the stock markets of seven non-US industrialized countries. Chang, McLeavey, and Rhee (1995) document abnormal profits of short-term momentum strategies in the Japan stock market. Hameed and Ting (2000) notice the same in the Malaysia stock market. Rouwenhorst (1998, 1999) finds momentum profits in 12 European equity markets and in six (out of 20) emerging equity markets. Hameed and Yuanto (2000)

report that momentum strategies generate small but statistically significant profits in six Asian stock markets. Schiereck, DeBondt, and Weber (1999) discover abnormal profits for intermediate-term momentum strategies in the Germany equity market.

Momentum is hardly explained by a traditional asset pricing model. Such a model requires that high average returns are simply compensation for some form of risk; but stocks that have risen recently typically seem to have lower risk, not higher risk as would be required for risk to explain momentum (Grundy and Martin (2001); Griffin, Ji, and Martin (2003)).

Fama (1991) notes that the predictability of stock returns over time is among the most controversial issues on stock market efficiency. Strict market efficiency requires that security prices fully reflect all available information. Evidence of momentum in stock returns certainly seems inconsistent with strict market efficiency since current prices do not reflect past prices. The controversy has led to various explanations on the possibility and the sources of abnormal profits of momentum strategies.

Based on behavioral irrationality of investors, researchers argue that momentum profits are due to market inefficiency and result from stock prices' irrational reactions to information and investors' herding behavior. For example, Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam, (1998) and Hong and Stein (1999) develop models that are based on behavioral bias. In these models, the human cognitive bias leads investors either to underreact to information or to adopt positive feedback strategies that result in delayed overreaction to information. The tendency to herd among investors (for example, among fund managers) is a well-documented fact, which helps explain the profits of intermediate-term momentum strategies (see, e.g., Grinblatt, Titman, and Wermers (1995); Lakonishok, Shleifer, and Vishny (1994)).

The market-efficiency supporters, on the other hand, argue that time-varying common factors or data mining lead to the existence of intermediate-term momentum profits. According to this explanation, the abnormal returns of momentum strategies are attributable to common factors that are not accounted for in, for example, CAPM or a three-factor model. As Jegadeesh and Titman (1993) point out, to the extent that high past returns are partly due to high expected returns, winner portfolios will contain high-risk stocks that would also generate higher expected returns in the future. Conrad and Kaul (1998) examine this possibility and conclude that momentum profits can be explained by the cross-sectional difference in individual stocks' expected returns. Chordia and Shivakumar (2000) also show that momentum profits can be driven by time-varying expected returns.

In this paper, I employ iShares ETF monthly data for 15 developed markets for the period April 1996 to December 2006 to test for the price momentum. The remainder of this paper is organized as follows. Section 2 describes the data and the methodology employed for portfolio formation and investment strategies. Section 3 documents the profitability of various momentum strategies. Section 4 conducts some robustness checks. Section 5 provides some possible behavioral explanations to the momentum profits. Section 6 concludes the study.

2. Data and Methodology

The data used in this study are the monthly prices of iShares ETF Morgan Stanley Capital International (MSCI) Index ETFs for 15 developed countries. These country index ETFs have been traded in AMEX since April 1996. The data are available from Bloomberg and Yahoo Finance, but Yahoo Finance provides dividend-adjusted prices which are used for this study. The iShares International Index ETFs have wide market coverage and are diversified. MSCI indices

are computed consistently across markets[7], thereby allowing for a direct comparison across countries. The indices are calculated on the end-of-period value-weighted indices of a large sample of companies in each country. The countries examined in this paper include Australia (Symbol: EWA), Austria (EWO), Belgium (EWK), France (EWQ), Germany (EWG), Hong Kong (EWH), Italy (EWI), Japan (EWJ), Netherlands (EWN), Singapore (EWS), Spain (EWP), Sweden (EWD), Switzerland (EWL), the United Kingdom (EWU), and the United States (SPY). Because the focus of this paper is on intermediate-term returns, the complete history of monthly data from April 1, 1996 to December 31, 2006 is used. This gives a sample of 1,935 observations.

The trading strategies examined in this paper are designed in a way similar to Jegadeesh and Titman (1993). Specifically, at the end of each month, the return of the past J months (J = 1, 3, 6, 9 or 12) for each of the 15 ETFs are calculated and ranked in descending order.[8] I assign the top three ETFs (with the highest returns) to the ‘‘winner portfolio’’ and the bottom three ETFs (with the lowest returns) to the ‘‘loser portfolio’’. These portfolios are equally weighted at formation. I then buy the winner portfolio, simultaneously sell short the loser portfolio, and hold the position for K months (K = 1, 3, 6, 9 or 12). When the holding horizon K is longer than one period, this creates an overlap in the holding period return. I follow Jegadeesh and Titman (1993) to compute the period average return of K strategies, each starting one period apart. In other words, this return is equivalent to the return of a composite portfolio in which 1/K of the holdings is updated each period and the remaining from the previous period is carried over. For example, at the end of month t, the J = 6, K = 3 portfolio of winners consists of three parts: a position carried over from the investment at the end of month t-3 and two similar positions resulting from the

[7] MSCI country index captures 85% of the total country market capitalization while it accurately reflects the economic diversity of the market.
[8] For more robustness, I consider more periods for portfolio formation and holding than Jegadeesh and Titman (1993).

portfolios at the end of months t-2 and t-1. At the end of month t, the first of these holdings will be liquidated and replaced with the ETFs with highest six-month performance as of time t.

3. Profitability of Momentum Strategies

Table 16 reports equal-weighted average returns of the winner and loser portfolios, as well as the difference between winner and loser portfolios, over various holding periods for the 25 strategies. Returns are annualized. There are 5 parts in Table 16, which differ by formation periods, and each part has 5 strategies with different holding periods. The first row in each part refers to the specific strategy. For example, Strategy 6-6 (that is, Strategy with J = 6 and K= 6) represents the strategy that ETFs are ranked according to their previous 6 month returns and then held for the next 6 months. To examine whether momentum profits exist, I calculate the average returns of winner and loser portfolios, which are annualized, and the difference between their annualized returns. If the difference between the winner's return and loser's return is statistically significantly larger than zero, then there exists a momentum profit. Otherwise, no profit exists. Table 16 shows that all of 25 momentum strategies have positive profit and some momentum profits are statistically significant. Statistically significant profits are available for 9 strategies whose formation periods are mostly among 3 and 6 months whereas the statistically weakest momentum profits are available for K = 12 strategies. For 1-K strategies (Panel A), only 1-9 strategy have a significant profit at 10% level. For 3-K strategies (Panel B), the profits for 6 and 9- month holding periods are statistically significant at 5% level. For 6-K strategies (Panel C), the profits for 3-, 6-, 9- and 12-month holding periods are statistically significant, especially the 6-6 strategy is significant at 1% level. For 9-K strategies (Panel D), most strategies except the one with 6 month holding periods generate statistically significant profit. For 12-K strategies (Panel E), all the strategies are insignificant though they are positive. The result shows the 6-6

momentum strategy is the most profitable and the strategies based on the previous 6 month returns are more profitable than any other momentum strategies, which is consistent with Jegadeesh and Titman's (1993) finding.

4. Robustness Checks

While the profits on each momentum strategy shown above are quite strong, they should be interpreted with caution because they could be driven by potential biases associated with market risks, size and value factors, and transactions costs. In this subsection, some robustness checks are conducted.

4.1 Robustness to Market Risk and Other Factors

Since all of the 15 iShares International Index ETFs in this paper are selected from the developed market, have wide market coverage, and are well diversified, a simple risk measure would be the standard deviation of returns. Table 16 shows that the winner portfolios have a lower standard deviation than the loser portfolios at all the significantly profitable trading strategies. There is, therefore, no evidence that winner countries are riskier than loser countries.

Fama and French (1996) argue that the differences in returns between small and big firms (SMB) and between high and low book-to-market value ratios can be additional risk factors in explaining cross-sectional U.S stock returns. To further examine whether the excess returns from momentum strategies are compensation for systematic risks, I estimate a three-factor Fama-French model with the SMB and HML factor as additional sources of risk. SMB and HML factor are obtained from Kenneth French's web site. For the market return, the MSCI world index monthly data is used. The results are reported in Table 17 for the 6-6 momentum strategy. The table shows that SMB and HML factor have positive but insignificant loadings on winner and loser portfolios while the market return has significantly positive loading on both portfolios. For

the winner-loser momentum portfolio, none of the three factors has positive loading. The above results demonstrate that exposure to the market risk, SMB or HML factor does not provide a simple explanation for the excess returns on momentum strategies.

4.2 Transaction Costs

So far I do not consider any transaction cost involved in the momentum strategy. Total costs include not only the bid-ask spread but also applicable commissions. In this study, 15 well-diversified country index ETFs for the developed markets are used, so the investors can buy and sell these ETFs easily. Also, since these ETFs are well diversified, the spread between bid and ask is small relative to illiquid small stocks. Furthermore, the monthly momentum strategies provided in this paper have much lower costs than the daily momentum strategies. However, the momentum strategies in this study do require somewhat intensive trading, so the transaction costs can lower the actual returns.

To examine the effect of transactions costs, I consider the case with J = 6 and K = 6: each of the winner and loser portfolios consists of 3 ETFs, so the investor needs a maximum of 24 trades per year for the winner-loser momentum strategy. As of 2007, some discount online brokers charge $10 or less per trade, so the total trading cost is $240 per year. Assuming the total investment is $20,000 or more, the total trading cost should be below 2%. This produces an after-cost excess return of 8.36% - 2%= 6.36% per year, which remains an economically significant figure.

In sum, the robustness checks presented in this subsection suggest that the global momentum strategies are robust to the market risk and size and value factors. Even after considering intensive transactions involved in the strategies, ETFs investors can still profit from global momentum.

5. Behavioral Explanations

Hong and Stein (1999) argue that momentum profits result from stock prices' irrational reactions to information and investors' herding behavior. Underreaction theory stresses a process of gradual adjustment to news. Stock prices initially underreact to the news, and then adjust over time so that the long-term response is the appropriate rational one.

Underreaction is most likely to occur when fundamental news arrives that has important implications for the future cash flows of a stock. It is caused by the limited ability of most investors to access and process information, and by overconfidence that leads investors to cling to their original views even in the face of relevant new information (Daniel, Hirshleifer, and Subrahmanyam (1998)). Rational investors do respond to fundamental news, but they do not trade aggressively enough to drive prices all the way to the level that would be justified by fundamentals. Instead, on good news they drive the price up to a level at which it is still profitable to hold the stock, while on bad news they drive the price down to a level at which it is still profitable to short the stock. Over time, as all investors absorb fundamental news, the price adjusts fully to the news and this allows arbitrageurs to unwind their positions profitably. This story is consistent with the strong evidence for momentum in response to fundamental impulses such as earnings announcements or analysts' forecast revisions.

Overreaction is more likely to be associated with "soft" or qualitative information (Daniel and Titman (2004)). For example, investors may place undue credence in stories about a website company as a new economic model. Irrationality of this sort generates mispricing that can be exploited by value investors. It may also generate momentum in the short run if irrational investors respond gradually to soft information, if they copy each others' trades, or if they tend to buy stocks that have performed well recently. These behavior patterns are sometimes described

as herding. Evidence on flows into mutual funds does suggest that individual investors are attracted to funds, fund categories, and fund families that have performed well recently, consistent with the herding hypothesis (Sirri and Tufano (1998)).

There is little evidence that herding generates short-run momentum that eventually reverses. One suggestive piece of evidence is provided by Brunnermeier and Nagel (2004), who show that hedge funds rode the technology bubble through the late 1990's even after technology stocks became wildly overpriced on any conventional measure. These funds appeared to believe that positive short-term momentum would overcome poor long-term value, and their strategies were quite successful. Overall, however, the evidence for momentum generated by overreaction is weaker than the evidence for momentum generated by underreaction to fundamentals.

The studies by Brennan and Cao (1997), Choe, Kho, and Stulz (1999), and Clark and Berko (1996) suggest that one may think of investors as having an informational advantage in their home markets, explaining why investors might have a home bias. In this view, suppose that favorable news is released involving the home market. Foreign investors now raise their valuation by more than domestic investors. Thus, these foreign investors purchase domestic equity at higher prices. As a result, domestic investors, left holding less domestic equity, become better diversified and, for a given perceived distribution of future dividends, may accept lower expected returns. Domestic equity prices thus initially rise further, but then revert over the longer horizon as the broadening of the investors' base lowers expected returns.

6. Conclusion

This paper examines the profitability of the momentum strategies on 15 iShares MSCI Index ETFs for the developed national markets from April 1996 to December 2006. Since these 15 ETFs have low management fees, tax efficiency and well diversified components, the investor

may profit from the global momentum. Using monthly data, I find consistently positive returns from buying past winners and short selling past losers. Some of the portfolio profits are not only statistically but also economically significant after transaction costs.

I also investigate the effects of the market risk and the Fama-French size and value factors on the momentum portfolios. I find that the momentum profits are robust to these factors. Even after imposing reasonable transaction costs, the significant momentum profits still hold.

The finance literature provides a behavioral explanation of momentum profit: stock prices initially underreact to the released news, and then adjust over time. However, fur- ther research on the source of the price momentum is needed.

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Table 14

Summary Statistics for Average Monthly Returns on 15 iShares MSCI Index ETFs

Country	ETF Symbol	Mean (% per month)	Standard Deviation (% per month)	β (beta) with World Index
Austria	EWA	1.28	5.56	0.69
Australia	EWO	1.02	5.63	0.99
Belgium	EWK	1.03	5.51	0.90
France	EWQ	1.11	5.72	1.15
Germany	EWG	0.98	6.76	1.37
Hong Kong	EWH	0.70	8.27	1.36
Italy	EWI	1.21	6.10	1.00
Japan	EWJ	0.15	6.08	0.97
Netherlands	EWN	0.77	5.52	1.12
Singapore	EWS	0.44	8.56	1.39
Spain	EWP	1.43	6.06	1.15
Sweden	EWD	1.33	7.61	1.52
Switzerland	EWL	0.83	4.99	0.92
UK	EWU	0.82	4.06	0.84
US	SPY	0.82	4.36	1.00
World		0.59	4.10	1.00

This table reports the average monthly returns on iShares ETF Morgan Stanley Capital International (MSCI) Index ETFs for 15 developed countries from April 1, 1996 to December 31, 2006. These 15 ETFs have been traded on AMEX since April of 1996. World is MSCI world index. I use 1 month T-bill rate for risk-free rate to compute the the β with world index.

Table 15

Average Holding Period Returns for iShares MSCI Index ETFs

Country	ETF Symbol	Holding Period Returns (%)									
		1 MO		3 MO		6 MO		9 MO		12 MO	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Austria	EWA	1.28	5.56	3.86	10.68	7.84	15.58	12.27	20.06	17.40	26.45
Australia	EWO	1.02	5.63	3.06	9.05	6.06	12.22	9.14	15.36	12.39	18.36
Belgium	EWK	1.03	5.51	3.08	10.21	6.08	14.37	9.32	19.27	12.64	24.08
France	EWQ	1.11	5.72	3.32	9.76	6.63	13.38	10.14	17.64	13.55	21.22
Germany	EWG	0.98	6.76	2.88	11.93	5.51	16.75	8.50	22.25	11.14	25.85
Hong Kong	EWH	0.70	8.27	2.15	15.58	3.85	19.78	5.75	27.19	7.73	31.61
Italy	EWI	1.21	6.10	3.62	10.28	7.36	14.00	11.39	18.19	15.45	22.29
Japan	EWJ	0.15	6.08	0.54	11.27	1.47	17.64	2.78	23.02	4.64	27.96
Netherlands	EWN	0.77	5.52	2.18	9.50	4.24	13.19	6.22	16.94	8.00	20.15
Singapore	EWS	0.44	8.56	1.54	17.01	2.69	22.46	4.42	30.98	5.83	35.62
Spain	EWP	1.43	6.06	4.36	11.20	8.57	15.19	12.56	18.50	16.74	22.89
Sweden	EWD	1.33	7.61	3.87	13.29	7.67	19.87	11.71	26.26	15.84	32.39
Switzerland	EWL	0.83	4.99	2.52	9.04	4.90	12.11	7.41	15.03	9.90	18.07
UK	EWU	0.82	4.06	2.51	7.37	4.97	10.84	7.26	14.14	9.57	17.75
US	SPY	0.82	4.36	2.42	7.54	4.85	10.84	7.22	14.42	9.69	18.25
Average		0.93	6.05	2.79	10.91	5.51	15.22	8.41	19.95	11.37	24.20

Using monthly prices, I calculate average holding period returns (J = 1, 3, 6, 9, and 12 months) and standard deviations (S.D.) for each of iShares MSCI (Morgan Stanley Capital International) Index ETFs for 15 developed countries from the period April 1996 to December 2006. These ETFs are traded on AMEX. The sample includes 1,935 monthly observations.

Table 16

Profitability of Momentum Strategies Based on Equal-weighted Returns

Panel A

Portfolios formed based on previous 1 month returns and held over 5 different horizons (1-K)					
Portfolio	1-1	1-3	1-6	1-9*	1-12
Winner	1.67	0.51	0.26	0.18	9.14
	(19.75)	(19.10)	(15.69)	(26.11)	(16.93)
Loser	1.32	0.38	0.20	0.13	8.82
	(17.97)	(20.43)	(16.10)	(24.70)	(20.76)
Winner - Loser	0.31	0.12	0.06	0.04	0.33
	(14.32)	(15.68)	(12.99)	(22.64)	(18.16)
t-Stat	0.58	1.06	1.43	1.71	0.19

Panel B

Portfolios formed based on previous 3 month returns and held over 5 different horizons (3-K)					
Portfolio	3-1*	3-3	3-6***	3-9**	3-12
Winner	17.01	13.53	14.83	13.79	12.88
	(19.05)	(19.36)	(19.91)	(20.33)	(21.89)
Loser	7.95	11.16	7.66	8.63	9.48
	(20.58)	(23.56)	(23.04)	(24.47)	(24.69)
Winner - Loser	8.49	2.19	6.92	5.06	3.40
	(15.73)	(21.16)	(22.62)	(23.24)	(22.35)
t-Stat	1.68	0.57	2.33	2.03	1.62

Panel C

Portfolios formed based on previous 6 month returns and held over 5 different horizons (6-K)					
Portfolio	6-1	6-3**	6-6***	6-9**	6-12*
Winner	15.50	17.47	16.28	14.62	13.88
	(18.71)	(19.46)	(19.04)	(20.33)	(21.88)
Loser	7.23	8.59	7.61	8.63	9.55
	(22.44)	(24.84)	(23.58)	(26.19)	(26.76)
Winner - Loser	7.77	8.35	8.36	5.87	4.33
	(18.47)	(22.41)	(21.56)	(24.22)	(24.62)
t-Stat	1.30	1.97	2.91	2.22	1.85

(Table 16 continued)

Panel D:

Portfolios formed based on previous 9 month returns and held over 5 different horizons (9-K)					
Portfolio	9-1	9-3	9-6*	9-9	9-12
Winner	17.96	15.71	13.52	13.24	13.31
	(19.15)	(19.83)	(19.49)	(20.51)	(22.45)
Loser	10.59	8.97	7.67	8.75	9.90
	(23.71)	(25.86)	(24.52)	(27.68)	(27.91)
Winner - Loser	0.54	1.54	2.78	3.28	3.41
	(18.65)	(22.54)	(23.28)	(26.75)	(26.59)
t-Stat	1.10	1.48	1.80	1.48	1.33

Panel E

Portfolios formed based on previous 12 month returns and held over 5 different horizons (12-K)					
Portfolio	12-1	12-3	12-6	12-9	12-12
Winner	15.49	13.78	13.02	12.47	12.52
	(19.33)	(20.29)	(20.20)	(21.24)	(23.06)
Loser	9.66	9.11	9.04	10.85	11.14
	(24.28)	(26.15)	(25.19)	(27.88)	(27.71)
Winner - Loser	5.36	4.38	3.82	1.58	1.38
	(19.53)	(23.69)	(24.78)	(27.33)	(27.22)
t-Stat	0.83	0.97	1.14	0.52	0.52

At the end of each period, I calculate the return of the past J months (J = 1, 3, 6, 9 or 12) for each of the 15 ETFs and rank them in descending order. I assign the top three ETFs (with the highest returns) to the ‘‘winner portfolio’’ and the bottom three ETFs (with the lowest returns) to the ‘‘loser portfolio.’’ These portfolios are equally weighted at formation. I then buy the winner portfolio, simultaneously sell short the loser portfolio, and hold the position for K months (K = 1, 3, 6, 9 or 12). The annualized returns for the 25 winner-loser portfolios are calculated with (standard deviation) and t-values.

*** Statistical significance at 1% level

** Statistical significance at 5% level

* Statistical significance at 10% level

Table 17

Risk-adjusted Excess Returns for the 6-6 Momentum Strategy

Portfolio	α	t-stat	β (world)	t-stat	β (SMB)	t-stat	β (HML)	t-stat
Winner	0.902	4.37	0.2	3.76	0.023	0.44	0.081	1.23
Loser	0.156	0.61	0.254	3.83	0.082	1.23	0.134	1.64
Winner - Loser	0.451	1.86	-0.051	-0.82	-0.054	-0.86	-0.051	-0.66

SMB and HML factor data are from Kenneth French's website and the market return from the MSCI world index monthly data. Risk free rate is 1 Month T-bill rate. The 6-6 momentum strategy is to buy the past 6 month winner and hold the portfolio for the next 6 months.

V. OVERALL CONCLUSION

Stock portfolios are often constructed based on valuation / market-cap, sectors, or countries, but their relative performance is dependent on market favorites. Growth may take the lead in the short term and value may retake the lead in the future. Moreover, at times the market favors large-cap while other times the cycle turns in favor of small-cap or mid-cap. Meanwhile, sectors and countries play important roles in portfolio returns. The constant swing of the market pendulum could adversely affect portfolio returns, but may also significantly benefit momentum investors who rotate their portfolio from time to time.

This dissertation examines performance of three momentum strategies using S&P style indices as well as sector and global ETFs. I find that style, sector and global momentum strategies produce economically and statistically significant monthly profit of 0.80%, 0.89% and 0.70% respectively. The results remain economically plausible after adjusting for systematic risk, short-sale costs, and transaction costs.

Previous researchers propose behavioral theories to explain momentum phenomenon and conjecture that momentum is attributed to investors' under-reaction or over-reaction, but the rotation of investment style, sector or country could be partly due to the overall market conditions and outlook. At this point, the three momentum strategies appear profitable, but future research could further examine the trading strategies combining style, sector, and global momentum.

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