
Abnormal returns with momentum/contrarian strategies using exchange-traded funds

Received (in revised form): 25th February, 2008

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Abstract Investing in portfolios of exchange-traded funds (ETFs) provides abnormal returns that exceed transactions costs, when returns are adjusted for risk using Fama and French's three-factor model. Short formation and holding periods of one day to one week provide abnormal contrarian returns, as past losers become winners and past winners become losers. Medium formation and holding periods of 4–39 weeks provide abnormal momentum returns, as past winners keep winning and past losers keep losing. Abnormal returns for portfolios of ETFs result in an asset allocation setting including all four types of ETFs, namely domestic, international, sector, and bond ETFs, with contrarian returns maximised over a one-day formation and holding period, and with momentum returns maximised over a 20-week formation and holding period.

Journal of Asset Management (2008) **9**, 289–299. doi:10.1057/jam.2008.27

Keywords: *momentum abnormal returns, contrarian abnormal returns, exchange-traded funds, ETF, market efficiency, anomaly*

Introduction

This study extends the domain of momentum/contrarianism to a relatively new and popular investment vehicle, namely exchange-traded funds or ETFs. ETFs are powerful and flexible investment vehicles that combine the diversified portfolio features of mutual funds with the trading possibilities of individual securities. Currently, US ETFs function similarly to passively managed index mutual funds, as they are composed of a portfolio of stocks or bonds that track a particular index, thus

providing diversification within the portion of the market tracked by that index. The four general categories of ETFs are (1) broad-based domestic indices like the S&P 500, the NASDAQ 100, the Dow Jones US Total Market, the Russell 3000, the Wilshire 5000, some style-specific indices in both a 'value' and a 'growth' version, and size-based indices including large cap, mid cap, small cap, and micro cap; (2) sector indices including consumer, energy, financial, health, natural resources, real estate, utilities, and technology; (3) international indices

including global stock indices, regional indices, and country-specific indices; and (4) bond indices including three of the Lehman Treasury bond indices, two different corporate bond indices, and the Lehman TIPS index. What differentiates an ETF from a mutual fund is that an ETF trades on an exchange like a stock, enabling an ETF to be purchased or sold at intraday market prices, purchased on margin, sold short, and traded via stop orders and limit orders. Ordinary mutual funds can only be purchased and sold by market orders for end-of-day prices, and cannot be purchased on margin or sold short, which prevents the usual zero-investment momentum and contrarian portfolios of buying the winners and shorting the losers or of buying the losers and shorting the winners. Also, many mutual funds have redemption fees and other constraints to discourage or prevent the short-term trading necessary to implement a momentum or contrarian strategy.

Figure 1 shows the growth in ETFs from their introduction in 1993 with the SPDR Trust Series tracking the S&P 500 Index to 2005's assortment of 217 ETFs consisting of 80 broad-based domestic indices, 82 domestic sectors, 49 global/international equities, and six bond ETFs. Clearly, ETFs are on a growth path that should soon surpass the dollar amount invested in equity index

mutual funds. From the Investment Company Institute's (a mutual fund trade organisation) December 2005 statistics, ETFs (excluding Merrill Lynch's HOLDRS) represent a market value of \$300bn, which represents over 5 per cent of \$5.5tn invested in stock and hybrid mutual funds.

Considering that about 10 per cent of stock mutual fund investments are in indexed investments as opposed to actively managed funds, ETFs represent a significant portion (almost 35 per cent) of the US wealth invested in passively managed, index-type investment vehicles. With the growing popularity of ETFs among traders and investors, such an innovative financial product merits further study, especially when it can generate abnormal returns via a momentum or contrarian strategy.

Our research questions are (1) whether a momentum investing strategy of buying winners and shorting losers generates abnormal returns in the ETF market, (2) whether a contrarian investing strategy of buying losers and shorting winners generates abnormal returns in the ETF market, and (3) which formation and holding period is optimal for momentum investing and for contrarian investing. Our results contribute an affirmative answer to the first research question about momentum, as buying the winner decile of ETFs and shorting the loser

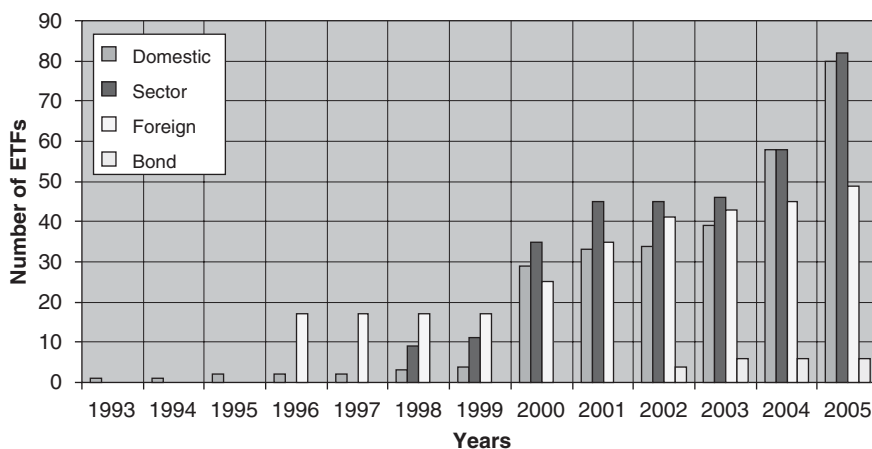


Figure 1 Growth in ETFs

decile of ETFs provide statistically significant abnormal returns for formation and holding periods of 4, 8, 12, 16, 20, 26, and 39 weeks with risk adjustment by Fama and French's (1993, 1996) three-factor model. The annualised momentum abnormal returns range from 8.4 to 13.5 per cent. Our results contribute an affirmative answer to the second research question about contrarianism, as buying the loser decile of ETFs and shorting the winner decile of ETFs provide statistically significant contrarian abnormal returns for formation and holding periods of one day and one week. The annualised contrarian abnormal returns range from 19.8 to 86.9 per cent with risk adjustment by Fama and French's three-factor model. Following the classic approach of Jegadeesh and Titman (1993), we find for question (3) that a 20-week formation and holding period provides the highest annualised abnormal returns of 13.5 per cent to an ETF momentum strategy, and a one-day formation and holding period provides the highest annualised abnormal returns of 86.9 per cent to an ETF contrarian strategy. These research questions are important, because momentum and contrarianism are both widespread anomalies identified by researchers as well as investment strategies used by investors to attempt to earn abnormal returns.

Data and methodology

Following the Jegadeesh and Titman (1993) methodology, we define the winner ETFs as the top performing decile over various formation periods and the loser ETFs as the poorest performing decile over various formation periods, and then form the momentum portfolio that buys the winner ETFs and shorts the loser ETFs over various holding periods. Also, adapting the Chan *et al.* (2000) methodology, we form the winner-minus-loser (WML) portfolio each week to increase the power of our tests; we equally weight the appropriate winner and

loser ETFs in the portfolios formed each week during the sample period and held for the indicated amount of time. Also, with ETFs tracking four different types of indices, broad-based domestic, sector or industry, foreign or country, and bond, we measure momentum with all the various ETF types pooled together to consider a strategy where market performance may favour one of the four types over the other three, which can determine whether a momentum-based asset allocation strategy exists, as well as to maximise our sample size. Our sample period runs from 20th March, 1996 to 31st December, 2005, a period of 483 weeks, with 19 ETFs available in 1996, so that the top and bottom deciles begin with two ETFs each as winners and losers, respectively. In 2005, 217 ETFs are available so that the deciles of winners and losers both include 21 ETFs. We consider formation periods of 1 day, 1, 2, 4, 8, 12, 16, 20, 26, 39, and 52 weeks, coupled with holding periods of the same length as the formation period for a total of 11 different momentum strategies. Clearly, the zero-investment contrarian portfolio of buying the loser ETFs and shorting the winner ETFs simply reverses the sign of the zero-investment momentum portfolio.

Since most ETFs are listed on the AMEX and others are listed on the NYSE and NASDAQ, the daily return data are available on the Center for Research in Securities Prices (CRSP) database. Most of the previous studies use CRSP data, which is of excellent quality when defining returns using close to close security prices. To evaluate the various ETFs in terms of risk levels, we use Fama and French's three-factor model: $R_{it} - R_{Ft} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + e_{it}$, where R_{it} is the return on portfolio i in period t , R_{Ft} is the Treasury bill rate in period t , $RMRF$ is the excess return on a value-weighted market proxy, and SMB and HML are the returns on zero investment, value-weighted, factor-mimicking portfolios for firm size and

book-to-market, respectively. Daily data on the factor-mimicking portfolios for the three zero-investment factor-mimicking portfolios, that is, $R_M - R_F$, SMB, and HML, are available on Kenneth R. French's website at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. Thus, we calculate the cross-sectional α 's for the excess return on the winner ETFs, the excess return on the loser ETFs, as well as the winner-minus-loser momentum portfolio to measure abnormal positive or negative returns. Although the three risk factors, RMRF, SMB, and HML are all calculated relative to US equities, no adjustments need to be made to use the above factor risk premiums for the foreign ETFs because all the ETFs are traded in dollars, traded during US market hours, and function as perfect substitutes for the other three categories of ETFs. Also, Zhong and Yang (2005) find that the prices of international ETFs are greatly influenced by US risk factors.

Main results

Table 1 shows that the annualised momentum abnormal returns for WML portfolios are statistically significant at the 1 per cent level of significance, ranging from 8.4 to 13.5 per cent, for strategies of formation and holding periods from 4 to 39 weeks with risk adjusted by Fama and French's three-factor model. The annualised momentum abnormal returns for the WML portfolio are maximised at 13.5 per cent for the 20-week formation and holding period strategy. From the results for the excess returns above the appropriate periodic Treasury bill rate for the momentum winner and loser ETF portfolios, we find that the losers drive the WML risk-adjusted results, with loser annualised momentum abnormal returns being very significant at the 1 per cent level for all formation and holding periods from 4 to 39 weeks with magnitudes ranging from -8.9 to -12.8 per cent.

Annualised contrarian abnormal returns are statistically significant at the 1 per cent

level of significance at 86.9 per cent for the short formation and holding periods of one day and at the 5 per cent level of significance at 19.8 per cent for the formation and holding periods of one week with risk adjusted by Fama and French's three-factor model. Thus, by reversing our momentum strategy to a contrarian strategy of buying the past losers and shorting the past winners, statistically significant returns are possible with abnormal annualised loser returns for the one-day formation and holding period of 45.4 per cent, and abnormal annualised winner returns for the one-day formation and holding period of -41.6 per cent. Thus, a formation and holding period of one day maximises our contrarian abnormal returns, while a formation and holding period of 20 weeks maximises our momentum abnormal return.¹

Abnormal returns net of transaction costs

Supporters of rational, efficient markets question whether the momentum and contrarian abnormal returns are real or illusory after considering transactions costs, since both momentum and contrarian strategies require a significant amount of trading to implement, potentially costing the investor or arbitrageur the bid-ask spread, brokerage commissions, and price impact for large orders. Lesmond *et al.* (2004) characterise the momentum profits with individual stocks identified by Jegadeesh and Titman (1993, 2001) and Hong *et al.* (2000) as illusory because the momentum profits net of their transactions cost estimates are insignificantly different from 0. ETFs, however, are much less costly to trade than individual equities with smaller bid-ask spreads and more liquidity to reduce the price impact of large trades.

Table 2 shows the momentum returns net of transactions costs for the formation and holding period of 26 weeks, which is the usual recommended momentum strategy in most previous studies. On average, the

Table 1 Annualised abnormal returns: Exchange-traded funds and momentum returns: 21st March, 1996–31st December, 2005

	1day 1day	1wk 1wk	2wk 2wk	4wk 4wk	8wk 8wk	12wk 12wk	16wk 16wk	20wk 20wk	26wk 26wk	39wk 39wk	52wk 52wk
<i>Fama and French's three-factor model: $R_{it} - R_{Ft} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + e_{it}$</i>											
<i>WML</i>											
Constant (%)	-86.9250	-19.7964	11.0838	11.6922	13.0897	10.2860	13.2135	13.5426	12.8348	8.4255	-0.0062
p-value	0.0000	0.0213	0.1056	0.0164	0.0006	0.0019	0.0000	0.0000	0.0000	0.0083	0.9985
<i>Winner</i>											
Constant (%)	-41.5500	-14.6744	2.4336	0.1768	0.3237	-0.3315	3.5321	4.6792	3.8318	-0.6001	-3.9998
p-value	0.0000	0.0264	0.5395	0.9543	0.8435	0.8364	0.0292	0.0015	0.0019	0.5465	0.0344
<i>Loser</i>											
Constant (%)	45.3750	7.5140	-8.6502	-11.5154	-12.7660	-10.6175	-9.6811	-8.8634	-9.0030	-9.0256	-3.9937
p-value	0.0000	0.2342	0.0981	0.0020	0.0001	0.0002	0.0001	0.0002	0.0002	0.0008	0.1332

Notes: (1) Annualised abnormal returns for the period indicated. Periodic abnormal returns, that is, alpha intercepts, are annualised by multiplying by either 250 trading days for one day one day strategy or by 52 divided by the number of weeks in the 10 weekly strategies.

(2) Formation period includes daily returns from Thursday to Wednesday; holding period includes daily returns from Friday to Thursday.

(3) The winners represent the top decile of ETF returns available during the formation period; the losers represent the lowest decile of ETF returns available during the formation period. The above returns reflect portfolios with equal weightings of the appropriate winner and loser ETFs formed each week during the sample period and held for the indicated period of time.

(4) The WML is the zero net- investment portfolio created by buying the winner ETFs and by shorting the loser ETFs for the indicated holding period.

(5) p-Values are computed with robust standard errors corrected for heteroskedasticity and autocorrelation using the Newey–West adjustment (1987).



winner ETFs consisted of 10.64 per cent domestic and bond ETFs, 46.52 per cent sector ETFs, and 42.84 per cent international ETFs, while the loser ETFs consisted of 8.08 per cent domestic and bond ETFs, 54.97 per cent sector ETFs, and 36.95 per cent international ETFs. Quoted bid–ask spreads and brokerage commissions total 8.25 per cent per year, which reduced the net annualised abnormal returns to 4.58 per cent with risk adjustment by Fama and French’s three-factor model. Huang and Wei (2004) estimated the effective bid–ask spread to be about 30 per cent less than the quoted bid–ask spread, as transactions often take place between the quoted bid and ask prices; using effective bid–ask spreads reduces the transactions cost to 5.82 per cent per year. With effective spreads, the net annualised abnormal returns are 7.01 per cent with risk adjustment by Fama and French’s three-factor model. Clearly, the momentum abnormal returns earned using ETFs are not illusory, but represent economically viable and statistically significant returns even when reduced by transactions costs.

Results due to portfolio rebalancing

Another issue is portfolio rebalancing. The usual Jegadeesh and Titman methodology rebalances the winner and loser portfolios monthly, resulting in the six-month winners and losers, consisting of six equally weighted portfolios with one-sixth formed from today’s winners and losers and one-sixth formed from each of the previous one, two, three, four, and five month’s winners and losers. Our methodology uses equal weightings of the top and bottom decile ETF performers to form the winner and loser portfolios like Jegadeesh and Titman, but forms a new portfolio each week during the sample period and holds it for the indicated period of time without rebalancing.

Table 3 compares the annualised abnormal returns for portfolios with a formation and holding period of 26 weeks, using our methodology with no rebalancing as well as with one-week rebalancing, and portfolios with a formation and holding period of 24 weeks with four-week rebalancing similar to Jegadeesh and Titman.

Table 2 Annualised abnormal returns net of transactions costs for WML with 26-week formation and holding period: Exchange-traded funds and momentum returns: 21st March, 1996–31st December, 2005

Model	Annualised returns (%)	Transactions costs (%)	Net annualised returns (%)
Fama and French’s three-factor model	12.83	8.25	4.58

Notes: (1) Annualised abnormal returns for the period indicated. Periodic abnormal returns, that is, alpha intercepts, are annualised by multiplying by 2 to convert the 26-week abnormal return to an annualised abnormal return.

(2) Formation period includes daily returns from Thursday to Wednesday; holding period includes daily returns from Friday to Thursday.

(3) The winners represent the top decile of ETF returns available during the formation period; the losers represent the lowest decile of ETF returns available during the formation period. The above returns reflect portfolios with equal weightings of the appropriate winner and loser ETFs formed each week during the sample period and held for the indicated period of time.

(4) The WML is the zero net-investment portfolio created by buying the winner ETFs and by shorting the loser ETFs for the indicated holding period.

(5) Actual transactions were tabulated by domestic, sector, or international ETFs over the 9.29 years studied.

(6) Quoted bid ask spreads were estimated as the higher of those identified in Huang and Wei (2004) and Salomon Smith Barney (2002) resulting in estimates of 0.33 per cent for domestic ETFs, 0.62 per cent for sector ETFs, and 0.867 per cent for international ETFs.

(7) Commissions were estimated at 0.13 per cent by combining Scottrade’s \$7.00 per trade with an estimated account balance of \$125,000 invested long in the winner ETFs and \$125,000 invested short in the loser ETFs. Scottrade’s flat commission applies to both market and limit orders regardless of trade frequency, account balance, or number of shares in the transaction.

Table 3 Annualised abnormal returns using Fama and French's three-factor model exchange-traded funds and momentum returns: 21st March, 1996–31st December, 2005

	26wk 26wk No rebalancing	26wk 26wk 1wk rebalancing	24wk 24wk 4wk rebalancing
<i>Fama and French's three-factor model: $R_{it} - R_{Ft} = \alpha_i + b_i R_{MRF_t} + s_i SMB_t + h_i HML_t + e_{it}$</i>			
<i>WML</i>			
Constant (%)	12.8348	16.0264	16.1109
<i>p</i> -value	0.0000	0.0728	0.0935
<i>Winner</i>			
Constant (%)	3.8318	2.7248	1.7641
<i>p</i> -value	0.0019	0.5230	0.7150
<i>Loser</i>			
Constant (%)	-9.0030	-13.3016	-14.3468
<i>p</i> -value	0.0002	0.1033	0.0689

Notes: (1) Annualised abnormal returns for the period indicated. Periodic abnormal returns, that is, alpha intercepts, are annualised by multiplying by 2 for the no rebalancing or by 52 divided by the number of weeks in the rebalancing period.

(2) Formation period includes daily returns from Thursday to Wednesday; holding period includes daily returns from Friday to Thursday.

(3) The winners represent the top decile of ETF returns available during the formation period; the losers represent the lowest decile of ETF returns available during the formation period. The above returns reflect portfolios with equal weightings of the appropriate winner and loser ETFs formed each week during the sample period and held for the indicated period of time for the no rebalancing.

(4) The WML is the zero net-investment portfolio created by buying the winner ETFs and by shorting the loser ETFs for the indicated holding period.

(5) The 26 weeks with one-week rebalancing portfolios represent 26 equally weighted portfolios formed from the winner and loser ETFs from today, one week ago, two weeks ago, three weeks ago, and each other week ago up to and including 25 weeks ago. Thus, the winner and loser returns represent one-week returns.

(6) The 24 weeks with four-week rebalancing portfolios represent six equally weighted portfolios formed from the winner and loser ETFs from today, four weeks ago, eight weeks ago, 12 weeks ago, 16 weeks ago, and 20 weeks ago. Thus, the winner and loser returns represent four-week returns.

(7) *p*-values are computed with robust standard errors corrected for heteroskedasticity and autocorrelation using the Newey–West adjustment (1987).

Rebalancing six portfolios over four-week periods necessitates using a 24-week formation and holding period rather than a 26-week formation and holding period. The results are qualitatively the same for all three methodologies of rebalancing, with similar annualised abnormal return magnitudes of 12.8 per cent with no rebalancing vs 16.0 per cent with one-week rebalancing vs 16.1 per cent with four-week rebalancing, while no rebalancing has greater statistical significance than both one- and four-week rebalancing.

Results due to the type of ETF

Our results so far have not identified the source of the abnormal momentum or

contrarian returns because we formed all winner and loser portfolios of ETFs from the asset pool that included all four types of ETFs, namely domestic, sector, international, and bond. Our study purposefully chooses all four types of ETFs simultaneously to extend momentum/contrarian studies to the asset allocation domain as well as to maximise the length of the sample period studied, since ETFs are a relatively new investment vehicle. On average, about 51 per cent of the ETFs in the winner and loser portfolios are sector ETFs and about 40 per cent are international ETFs, with the remaining 9 per cent from the domestic and bond ETFs. To control for the effects of including sector and international ETFs, we augmented Fama and French's

three-factor model with dummy variables, identifying whether or not the winner, loser, and WML portfolios included sector or international portfolios.

Table 4, in the ‘Including dummies’ columns, clearly shows large and very significant abnormal momentum returns for WML portfolios formed from domestic and bond ETFs only with annualised abnormal momentum returns ranging from 44.7 per cent with no rebalancing to 70.9 per cent with four-week rebalancing. These large abnormal momentum returns are driven by the loser portfolios of domestic and bond ETFs, which continue to lose a very significant annualised abnormal momentum return of -47.6 per cent with no rebalancing to -56.6 per cent with four-week rebalancing. Clearly, the economic times when the top and bottom 26-week

performance deciles are dominated by domestic and bond ETFs rather than the more volatile and focused sector and international ETFs are excellent times to implement a momentum strategy for the next 26 weeks. At more typical economic times when the top and bottom 26-week performance deciles include either sector or international ETFs or both, the abnormal momentum returns over the next 26 weeks are reduced, with the result being driven by the sector and international ETF losers losing significantly less than their domestic and bond ETF counterparts.

Table 5 frames the analysis of asset allocation vs type of ETF differently, by comparing the 26-week formation and holding period WML, winner, and loser ETF performance over a shorter sample period, from 1st January, 1999 to 31st

Table 4 Abnormal returns using Fama and French’s three-factor model exchange-traded funds and momentum returns: 21st March, 1996–31st December, 2005

	26wk 26wk No rebalancing		24wk 24wk 4wk rebalancing	
	No dummies	Including dummies	No dummies	Including dummies
<i>WML</i>				
Constant	0.0642	0.2234	0.0124	0.0545
<i>p</i> -value	0.0000	0.0000	0.0935	0.0037
Mkt – R_F	-0.2173	-0.5151	-0.3915	-0.4279
<i>p</i> -value	0.1044	0.0000	0.0273	0.0168
HML	0.6994	0.9840	0.6155	0.6431
<i>p</i> -value	0.0000	0.0000	0.0082	0.0097
SMB	0.5045	1.1623	0.5375	0.6535
<i>p</i> -value	0.0058	0.0000	0.0450	0.0193
DumSect		-0.2585		-0.0321
<i>p</i> -value		0.0000		0.1039
DumInt		-0.0022		-0.0217
<i>p</i> -value		0.9587		0.2752
Adjusted R^2	0.1431	0.2930	0.1343	0.1544
<i>Winner</i>				
Constant	0.0192	-0.0112	0.0014	-0.0145
<i>p</i> -value	0.0019	0.4922	0.7150	0.2714
Mkt – R_F	0.9686	0.9595	1.1392	1.1450
<i>p</i> -value	0.0000	0.0000	0.0000	0.0000
HML	0.1675	0.1938	0.2606	0.3157
<i>p</i> -value	0.0003	0.0000	0.0368	0.0317
SMB	0.4006	0.4317	0.3357	0.3739
<i>p</i> -value	0.0000	0.0000	0.0027	0.0049
DumSect		-0.0042		-0.0026
<i>p</i> -value		0.8057		0.7996
DumInt		0.0341		0.0184
<i>p</i> -value		0.0415		0.1556
Adjusted R^2	0.5696	0.5705	0.6301	0.6294

Table 4 Continued

	26wk 26wk No rebalancing		24wk 24wk 4wk rebalancing	
	No dummies	Including dummies	No dummies	Including dummies
<i>Loser</i>				
Constant	-0.0450	-0.2380	-0.0110	-0.0435
<i>p</i> -value	0.0002	0.0000	0.0689	0.0037
Mkt - R_F	1.1859	1.3995	1.5307	1.5561
<i>p</i> -value	0.0000	0.0000	0.0000	0.0000
HML	-0.5319	-0.8358	-0.3549	-0.4209
<i>p</i> -value	0.0000	0.0000	0.0407	0.0118
SMB	-0.1039	-0.7177	-0.2018	-0.3241
<i>p</i> -value	0.4983	0.0000	0.3483	0.1181
DumSect		0.2444		0.0329
<i>p</i> -value		0.0000		0.0262
DumInt		0.0569		0.0135
<i>p</i> -value		0.0033		0.1019
Adjusted R^2	0.4279	0.5391	0.5954	0.6115

Notes: (1) Augmented Fama and French's three-factor model with dummy variables for sector and international ETFs:

$$R_{it} - R_{Ft} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + c_i Dum_{S_t} + d_i Dum_{I_t} + e_{it}$$

where $Dum_{S_t}=1$ if the portfolio at time t includes at least one sector ETF, and 0 otherwise; and $Dum_{I_t}=1$ if the portfolio at time t includes at least one international ETF, and 0 otherwise.

(2) Dependent variable is periodic return for the WML which is the winner-minus-loser portfolio, a zero net-investment portfolio formed by buying the winners and shorting the losers over the listed formation and holding periods, or excess periodic return for the winner or loser portfolio above the risk free rate as proxied by the appropriate periodic Treasury bill rate over the listed formation and holding period.

(3) Formation period includes daily returns from Thursday to Wednesday; holding period includes daily returns from Friday to Thursday.

(4) The winners represent the top decile of ETF returns available during the formation period; the losers represent the lowest decile of ETF returns available during the formation period. The above returns reflect portfolios with equal weightings of the appropriate winner and loser ETFs formed each week during the sample period and held for the indicated period of time for the no rebalancing.

(5) The 24 weeks with four-week rebalancing portfolios represent six equally weighted portfolios formed from the winner and loser ETFs from today, four weeks ago, eight weeks ago, 12 weeks ago, 16 weeks ago, and 20 weeks ago. Thus, the winner and loser returns represent four-week returns.

(6) RMRF is the excess return on the market portfolio, which is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP minus the periodic Treasury bill rate (from Ibbotson Associates) over the listed formation and holding periods.

(7) HML (high book-to-market minus low book-to-market) is the average return on the two value portfolios minus the average return on the two growth portfolios, that is, $HML=1/2$ (small value+big value)- $1/2$ (small growth+big growth).

(8) SMB (small size minus big size) is the average return on the three small portfolios minus the average return on the three big portfolios, $SMB=1/3$ (small value+small neutral+small growth)- $1/3$ (big value+big neutral+big growth).

(9) DumSect is a dummy variable that equals 1 if the WML, winner, or loser portfolio includes at least one sector ETF, and it equals 0, otherwise.

(10) DumInt is a dummy variable that equals 1 if the WML, winner, or loser portfolio includes at least one international ETF, and it equals 0, otherwise.

(11) *p*-values are computed with robust standard errors corrected for heteroskedasticity and autocorrelation using the Newey-West adjustment (1987).

December, 2005, to allow a sufficient number of ETFs in each category to meaningfully define winners and losers. With risk adjustment by Fama and French's three-factor model, the asset allocation pool including all four types of ETFs generates a

somewhat significant abnormal contrarian return, but the bond ETFs generate a significant abnormal momentum return and the domestic, international, and sector ETFs generate abnormal contrarian returns that are insignificantly different from 0. Among the

Table 5 Abnormal returns using Fama and French's three-factor model with 26-week formation and holding periods exchange-traded funds and momentum returns: 1st January, 1999–31st December, 2005

	Types of ETFs included				
	All types	Bond	Domestic	International	Sector
<i>WML</i>					
Constant	-0.0169	0.0177	-0.0077	-0.0065	-0.0230
<i>p</i> -value	0.0880	0.0176	0.3985	0.4869	0.1296
Mkt - R_F	-0.5199	-0.0160	-0.4614	0.0980	-0.6963
<i>p</i> -value	0.0000	0.8779	0.0000	0.1951	0.0000
HML	0.5668	-0.0597	0.4910	0.0781	0.9995
<i>p</i> -value	0.0000	0.6054	0.0000	0.2383	0.0000
SMB	1.2073	-0.2130	1.3176	0.2713	1.6787
<i>p</i> -value	0.0000	0.1134	0.0000	0.0296	0.0000
Adjusted R^2	0.4194	0.0872	0.3951	0.0351	0.4223
<i>Winner</i>					
Constant	0.0071	-0.0098	0.0034	0.0195	0.0016
<i>p</i> -value	0.1979	0.1467	0.6395	0.0188	0.8314
Mkt - R_F	1.1181	0.3147	0.9048	1.2354	1.2738
<i>p</i> -value	0.0000	0.0012	0.0000	0.0000	0.0000
HML	0.2284	0.4040	0.2149	0.2336	0.3492
<i>p</i> -value	0.0000	0.0000	0.0069	0.0001	0.0000
SMB	0.4002	-0.4391	0.6932	0.4502	0.1982
<i>p</i> -value	0.0001	0.0012	0.0001	0.0013	0.1333
Adjusted R^2	0.7923	0.2491	0.6548	0.6629	0.6570
<i>Loser</i>					
Constant	0.0240	-0.0276	0.0110	0.0260	0.0247
<i>p</i> -value	0.0018	0.0000	0.0060	0.0001	0.0433
Mkt - R_F	1.6380	0.3307	1.3662	1.1374	1.9700
<i>p</i> -value	0.0000	0.0000	0.0000	0.0000	0.0000
HML	-0.3384	0.4636	-0.2761	0.1556	-0.6503
<i>p</i> -value	0.0000	0.0000	0.0001	0.0104	0.0000
SMB	-0.8070	-0.2261	-0.6244	0.1789	-1.4805
<i>p</i> -value	0.0000	0.0002	0.0000	0.1060	0.0000
Adjusted R^2	0.8229	0.2818	0.8384	0.6648	0.7460

Notes: (1) Fama and French's three-factor model: $R_{it} - R_{Ft} = \alpha_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + e_{it}$.

(2) Dependent variable is periodic return for the WML which is the winner-minus-loser portfolio, a zero net-investment portfolio formed by buying the winners and shorting the losers over the listed formation and holding periods, or excess periodic return for the winner or loser portfolio above the risk free rate as proxied by the appropriate periodic Treasury bill rate over the listed formation and holding period.

(3) Formation period includes daily returns from Thursday to Wednesday; holding period includes daily returns from Friday to Thursday.

(4) The winners represent the top decile of ETF returns available during the formation period; the losers represent the lowest decile of ETF returns available during the formation period. The above returns reflect portfolios with equal weightings of the appropriate winner and loser ETFs formed each week during the sample period and held for the indicated period of time.

(5) All sample periods include 1st January, 1999–31st December, 2005 except for the bond ETFs which include the sample period from 27th July, 2002 to 31st December, 2005.

(6) RMRF is the excess return on the market portfolio, which is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP minus the periodic Treasury bill rate (from Ibbotson Associates) over the listed formation and holding periods.

(7) HML (high book-to-market minus low book-to-market) is the average return on the two value portfolios minus the average return on the two growth portfolios, that is, $HML = 1/2$ (small value+big value) - $1/2$ (small growth+big growth).

(8) SMB (small size minus big size) is the average return on the three small portfolios minus the average return on the three big portfolios, $SMB = 1/3$ (small value+small neutral+small growth) - $1/3$ (big value+big neutral+big growth).

(9) *p*-values are computed with robust standard errors corrected for heteroskedasticity and autocorrelation using the Newey–West adjustment (1987).

winners, only the international ETFs generate a positive significant abnormal return. The bond loser ETFs generate a negative, very significant abnormal return, but the loser ETFs for the asset allocation pool and the domestic, international, and sector generate positive, very significant abnormal returns. Since losing 1996–1998 from the sample reduces the magnitude and significance of the abnormal momentum/contrarian returns across all five ETF pools, some of the advantage of the asset allocation pool of all four types of ETFs reported earlier is due to the longer available sample period.² This analysis, however, indicates some differences between the holding period performances of the four different types of ETFs, which may lead to improvements over a naïve momentum/contrarian strategy.

Conclusion

This study extends Jegadeesh and Titman's momentum/contrarian anomaly to a new domain: portfolios of ETFs that either buy the winners and short the losers or buy the losers and short the winners, respectively. Currently, all US ETFs are passively managed to track an index, not actively managed to time the market or 'beat the market' by loading up on high momentum stocks. Yet, in spite of this disadvantage to actively managed mutual funds, ETFs provided economically and statistically significant abnormal returns to contrarian strategies of buying the loser ETFs and shorting the winner ETFs with formation and holding periods of one day and one week, and to momentum strategies of buying the winner ETFs and shorting the loser ETFs with formation and holding periods from 4 to 39 weeks. This study is also the first to demonstrate momentum in a changing asset allocation setting that includes US stocks, US bonds, foreign stocks, as well as sector or industry funds. In contrast to Lesmond *et al.* (2004), we find that momentum/contrarian abnormal returns are not illusory, but are

achievable by investors and arbitrageurs using ETFs, which are ideal instruments with which to implement such a contrarian or momentum strategy.

Notes

1. Results with no risk adjustment are qualitatively the same as those with risk adjustment by Fama and French's three-factor model. Results with extra time between the formation and holding period are also qualitatively the same, with a slight reduction in the magnitude of the abnormal returns for most strategies.
2. With no risk adjustment, the asset allocation pool including all four types of ETFs generates very significant abnormal momentum returns for the WML portfolio, as do both the domestic only and sector only WML portfolios. The sector ETFs and domestic ETFs generate larger abnormal momentum returns for the WML portfolio than the asset allocation pool, but the bond ETFs and international ETFs both generate smaller, less statistically significant abnormal returns for the WML portfolio than the asset allocation pool, primarily because both the bond loser abnormal returns and the international loser abnormal returns are positive rather than negative.

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