Time Series Momentum in Sector Based ETFs: Does a Momentum Effect Exist?

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The population utilized for this study was exchanged-traded-funds (ETFs) offered by The Vanguard Group® for years 2006 through 2018. The purpose of this quantitative study was to test for a momentum effect in eight of the S&P 500 sectors, and then to introduce risk and speculation as additional independent variables. The level of the presence of momentum was measured within each sector using a regression analysis at the 99% confidence level. This study showed no statistically significant presence of the momentum effect in all eight sectors, with the addition of risk positively affecting two of the eight sectors, and the addition of speculation affecting all eight sectors negatively. These findings do not support the viability of a momentum-based investment strategy. In addition, both risk and speculation should always be closely monitored in any portfolio.

Keywords: momentum, risk, speculation, investing, ETFs

INTRODUCTION

In the investing sub-field of finance, there are certain anomalies that are inherent to the stock market, but have gone unexplained in the past. Keim (1983) noted the "January effect" is a calendar anomaly where stock market returns in the month of January are higher than any other month during the year. DeBondt (1995) noted an overreaction anomaly where stock prices significantly increase or decrease over a period of time after unanticipated news regarding the company is publicly released. Jegadeesh and Titman (1993) introduced the momentum anomaly, which is an asset-pricing anomaly wherein future movement in stock prices are predicated on the price movements from previous periods. Over time, the momentum anomaly created the foundation for its own set of investing strategies collectively known as "momentum-based

investing". Investors utilizing these strategies seek to capitalize on the price momentum from previous periods in order to generate higher returns in the market.

Fundamental investing strategies use various indicators to signal investors when it is time to buy and sell stocks in the market. The core component of a momentum strategy, however, is to buy the "winners," which are stocks that have historically higher returns, and sell the "losers," which are stocks that have historically lower returns. When looking for possible indicators in momentum strategies, trade signals are often dependent on the type of security being traded in the markets. An exchange-traded fund (ETF) is one example of a security that is often at the center of momentum-based investment strategies. ETFs, which were popularized in the early 21st century, are a collection of securities comparable to mutual funds. Although there are momentum-based investment strategies using sector rotation strategies, there is very little academic literature on the testing of these momentum strategies while using ETFs. This may be because ETFs are still relatively new.

The share price of an ETF is primarily predicated on the Net Asset Value (NAV), which is the value of the underlying assets making up the composition of the ETF. These assets can vary from commodities such as silver to a basket of stocks based on individual sectors. As such, ETFs could be influenced by factors, such as non-systematic risk which may be associated with momentum investing, depending on their composition. In this respect, it is important to understand how risk factors into the valuation of different types of securities.

Risk can be broken down into two categories: (a) pure risk and (b) speculative risk. Pure risk only considers the possibility of a loss on the investment. Speculative risk, on the other hand, considers the possibility of a loss as well as the possibility of a gain. A risk premium could be one way to measure how risk affects the valuation of ETFs. This risk premium represents the return investors demand as compensation for investing in securities with a risk level higher than a "risk-free asset," such as the 90-day U.S. Treasury bill. Speculative proxies are another way to measure how risk affects the valuation of ETFs. These proxies commonly measure the speculative behavior of investors in the market.

Risk and speculation are different from sector to sector. Industry sectors are most commonly defined by the Global Industry Classification Standard (GICS), which as of 2019 classifies publicly traded companies into one of eleven sectors. Standard and Poor's (S&P 500) developed this classification system to define sectors within major market indices, such as the S&P 500.

There is a limited amount of research focusing on momentum and risk using ETFs. Since there is an increased interest in momentum-based investing strategies, it is important to understand if there is a momentum effect and how the momentum effect changes amongst different sectors. In addition, it is important to understand how risk and speculation interact with the momentum effect since risk and speculation impact security valuation. The purpose of this quantitative research was to examine the effect momentum, risk, and speculation have on ETF valuation in eight U.S. sectors. The independent variables are momentum, risk, and speculation. The dependent variable was the quarterly returns of the ETFs. The researchers utilize regression analysis to examine the effect the independent variables have on the dependent variable. The target population included sector ETFs provided by The Vanguard Group ®.

LITERATURE REVIEW

Momentum

Jegadeesh and Titman (1993) validated momentum-based investing strategies by finding significant positive returns from 1965 to 1989 using momentum formation periods of 3, 6, 9, and 12-month horizons. These findings were not related to systematic risk or delayed stock price reactions, but instead were due to pure momentum carried over from previous periods. Some parts of the positive returns, however, dissipated within two years. Jegadeesh and Titman (2001) found similar returns when updating their initial study to include a longer timeframe.

These findings are consistent when applied to different countries (Griffin, Ji, & Martin, 2003), different industries (Moskowitz & Grinblatt, 1999), and different asset classes (Okunev & White, 2003). These implications show momentum-based strategies have significant positive returns in the short-term, resulting

in a shift in focus for momentum-based investing. This shift has moved from looking at the returns from momentum-based investing to examining the various components that may have an effect on momentum, and ultimately momentum-based investing strategies (Swinkels, 2004).

Moskowitz, Ooi, and Pedersen (2012) noted cross-sectional momentum looks at the relative performance of a cross-section of assets to analyze the average performance amongst the peers in the asset class. Recently, however, there has been a shift in how momentum and the various components affecting momentum are studied. The current literature uses a time-series approach to study momentum (Jong & Rhee, 2008; Ammann, Moellenbeck, & Schmid, 2010). With a time-series approach, momentum is measured through focusing on historical returns over time instead of comparing the returns amongst the asset classes. Moskowitz, Ooi, and Pedersen (2012) argued using a momentum strategy based on a time-series approach could be more profitable to an investor over time. However, Goyal and Jegadeesh (2017) argued against Moskowitz, Ooi, and Pedersen (2012) by indicating that excess returns under a time-series and a cross-sectional approach were generally equal.

The concept of momentum-based investing seems to go against two major mainstays in financial theory. The first major theory is the concept of "buy low and sell high." Under this concept investors should purchase securities when they are priced low, and sell when they are priced high. Under momentum-based investing however, investors are consistently purchasing securities that are increasing in price. The second theory, and arguably the source of greater controversy, is the efficient-market hypothesis. Fama (1970) argued asset prices reflect all available information, and thus argued investors could not outperform the market using any specific strategy. Although there are some arguments presented in the literature reconciling momentum and the efficient-market hypothesis (Barberis, Shleifer, & Vishny, 1998; Odean, 1999), there is still a lack of unanimous agreement for any one strategy.

Risk

Fama and French (1993) introduced the three-factor model, which has become one of the longstanding models used to explain equity market returns in the United States. The three factors included in this model are (a) market risk, (b) size, and (c) value (Fama & French, 1993). Although this model is widely accepted, subsequent research has noted it is country specific (Griffin, 2002), and should be modified depending on the country. Carhart (1997) extended the three-factor model by adding a momentum factor to create the "Carhart four-factor model." This extension has been widely used to explain the returns of momentum-based strategies as well as being one of the key models to factor the market risk premium into the explanation of momentum. After the introduction of these models, much of the research conducted adopted them to further specify the amount of elasticity various factors have when influencing momentum (Wang, Brooks, Lu, & Holzhauer, 2017).

Speculation

Overall, there is a lack of research regarding the interaction between speculation and momentum-based investing (Rouwenhorst & Tang, 2012). Most of the research in this area has focused on how speculation relates to different types of securities and industries (Haase & Zimmermann, 2019; Harris, 2011; Sanders, Irwin, & Merrin, 2010). A common proxy for speculation used in previous studies is the Volatility Index (VIX) presented by the Chicago Board Options Exchange (CBOE) (Simlai, 2010; Smales, 2017). Arthur, Williams, and Delfabbro (2016) noted an investor's behavior plays a significant role in speculation and this behavior could be correlated to gambling.

Although speculation has been a source of fascination and debate in the previous literature, there is a concern that speculation could destabilize markets since speculation is often connected to economic events such as "bubbles" (Blanchard & Watson, 1982; Jones, 2014). There is also some concern regarding the effect speculation may have in certain industries, such as oil, and how this speculation could harm the macro-economy (Angel & McCabe, 2009). As a result, some countries have tried to regulate the practice of speculation by passing legislation to prohibit it. In the United States, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 are good examples.

ETFs

ETFs are becoming more popular as investors are attracted to momentum-based investing strategies. Similar to mutual funds, ETFs can diversify their non-systematic risk, thus lowering their levels of volatility and overall risk. However, unlike mutual fund prices ETF prices are subject to market forces as prices fluctuate throughout the day. As such, ETFs have the advantage of being more flexible and more transparent since they are required to disclose their holdings on a daily basis (Chang, McAleer, & Wang, 2017). In addition, researchers are able to focus on specific sectors or asset classes with ETFs in order to better analyze those sectors (Wang et al., 2017; Chang, McAleer, & Wang, 2017; Du, 2017). Interestingly, Dimkpah and Ngassam (2013) found momentum does not exist when examining portfolios built using ETFs. However, there seemed to be a significant increase in return when using the "winner-loser" strategy.

METHODOLOGY

Due to the increased popularity of momentum-based strategies amongst investors, it is important to determine whether investors can use sector ETFs to exploit a momentum strategy across different U.S. sectors. In addition, it is important to analyze whether risk and speculation interact with momentum across different U.S. sectors. The importance of this analysis derives from knowing whether a momentum strategy is viable across the different sectors and the factors that may affect sector valuation.

Research Questions

There are three research questions in this study. First, is there a momentum effect across the eight U.S. sectors used in this study? Second, what is the interaction between momentum and risk across the eight U.S. sectors used in this study? Third, what is the interaction between momentum and speculation across the eight U.S. sectors used in this study?

Methodology and Design

The researchers used quantitative methodology to formulate answers to the research questions presented above. Quantitative methodology generally uses statistical methods to examine the relationships between two or more variables, so this type of methodology was ideal for this study (Jackson, 2012). The researchers also utilized a non-experimental research design to formulate answers to the research questions presented above. There were three independent variables used in the study – (a) momentum, (b) risk, and (c) speculation. The dependent variable was the quarterly returns earned by the ETFs. The chosen statistical method was regression analysis. This was an ideal statistical method because the study focused on examining the data for a momentum effect and the impact risk and speculation have on momentum across the eight sectors.

Population and Sample

The targeted population for this study included sector ETFs offered by The Vanguard Group® for calendar years 2006 through 2018. This population was chosen because these funds serve as adequate proxies for sector performance in the economy. The sectors represented in the study include – (a) consumer discretionary (VCR), (b) energy (VDE), (c) financial (VFH), (d) healthcare (VHT), (e) industrial (VIS), (f) technology (VGT), (g) real estate (VNQ), and (h) telecommunication services (VOX). These sector data were gathered on a quarterly basis from the beginning of calendar year 2006 through the end of calendar year 2018.

Operational Definition of Variables

There were three independent variables and one dependent variable used in the study. The three independent variables included (a) momentum, (b) risk, and (c) speculation. The one dependent variable included the quarterly return of each sector ETF used in the study. Below are the definitions of these variables:

Return. Measured using the end of quarter return for each of the sector ETFs used in the study. This variable measured historical returns in each sector from quarter to quarter.

Momentum. Measured using a one-quarter lag in the return at the end of each quarter for each sector used in the study; denoted as Y_{t-1}. This variable measured whether returns from last quarter influenced returns in the current quarter, i.e. a momentum effect.

Risk. Measured using the market risk premium ($R_m - R_{rf}$), whereas R_m is the return from the S&P 500 and R_{rf} is the return of a 10-year Treasury bond. This variable measured the excess return of the market, i.e. risk.

Speculation. Measured using the CBOE Volatility Index (VIX) at the end of each quarter of study. This variable measured the expected volatility in the market indicated by index options, i.e. speculation.

FINDINGS

An autoregressive model was used to examine momentum by analyzing the relationship between current ETF returns and ETF returns from the previous quarter. This model was also used to examine the interaction between momentum and risk and momentum and speculation. The results of these analyses with their respective discussions are presented below.

Research Question 1

Is there a price momentum effect across the eight U.S. sectors used in this study?

$H1_0$. *There is not a momentum effect.*

$H1_a$. *There is a momentum effect.*

TABLE 1
HYPOTHESIS 1 RESULTS: MOMENTUM

Sector	Coefficient	Significance (p-value)
Consumer Discretionary	.151	.3042
Energy	.100	.4996
Financial	.161	.2601
Healthcare	-.010	.9452
Industrial	.134	.3621
Technology	.076	.6127
Real Estate	.118	.4069
Telecommunication Services	.199	.1695

There does not seem to be a momentum effect in any of the eight sectors. Since all of the p-values from the regression are greater than .05 (Table 1), this suggests ETF returns from the previous quarter do not influence ETF returns in the current quarter. This insignificance indicates momentum is not present in any of the sectors analyzed in the study since previous returns cannot be used to predict future returns, at least on a quarterly basis. Instead, there could be other missing factors that influence ETF returns. There is empirical evidence to support the null hypothesis, which states there is not a momentum effect.

These results provide evidence contrary to Jegadeesh and Titman (1993; 2001) who found a significant momentum effect when using various formation periods. In addition, these results provide evidence contrary to Moskowitz, Ooi, and Pederson (2012) who found a momentum strategy based on a time-series approach could be profitable to an investor over time. The results from our study indicate previous returns do not influence future returns. This would indicate an investor could not employ a pure momentum strategy using the sector ETFs analyzed in the study since returns do not necessarily carry over to future quarters.

On the other hand, these results provide support for Dimkpah and Ngassam (2013) who also found momentum did not exist when analyzing returns from ETFs. More importantly, however, these results provide support for Fama (1970) who found asset prices reflect all available information so investors cannot outperform the market using any specific strategy, especially a pure momentum strategy. This would also provide support for the "random walk" hypothesis.

Research Question 2

Is there an interaction effect between momentum and risk?

$H2_0$. *There is no significant interaction between momentum and risk.*

$H2_a$. *There is significant interaction between momentum and risk.*

TABLE 2
HYPOTHESIS 2 RESULTS: MOMENTUM AND RISK INTERACTION

Sector	Coefficient	Significance (p-value)
Consumer Discretionary	2.283	.0066*
Energy	.959	.3455
Financial	.865	.2787
Healthcare	.678	.4351
Industrial	1.311	.1122
Technology	2.069	.0045*
Real Estate	.842	.5067
Telecommunication Services	.563	.6370

*significant at the 1% level

There does not seem to be an interaction effect between momentum and risk in the energy, financial, healthcare, industrial, real estate, and telecommunication services sectors. Since the p-values from the regression are greater than .05 (Table 2) in these sectors, this suggests ETF returns from the previous quarter do not influence ETF returns in the current quarter when incorporating risk. This indicates momentum does not have differing effects on future returns based on changes in risk. Instead, future returns could be influenced by changes in risk regardless of what previous returns were. There is empirical evidence to support the null hypothesis for these sectors, which states there is no significant interaction between momentum and risk.

On the other hand, there does seem to be an interaction effect between momentum and risk in the consumer discretionary and technology sectors. Since the p-values from the regression are less than .05 (Table 2) in these sectors, this suggests ETF returns from the previous quarter do influence ETF returns in the current quarter when incorporating risk. This indicates momentum does have differing effects on future returns based on changes in risk in these sectors. Since each of these coefficients is positive, this would indicate the momentum effect in these sectors would increase in periods where the risk premium increases. There is empirical evidence to support the alternative hypothesis for these sectors, which states there is significant interaction between momentum and risk.

Research Question 3.

Is there an interaction effect between momentum and speculation?

$H3_0$. *There is no significant interaction between momentum and speculation.*

$H3_a$. *There is significant interaction between momentum and speculation.*

TABLE 3
HYPOTHESIS 3 RESULTS: MOMENTUM AND SPECULATION INTERACTION

Sector	Coefficient	Significance (p-value)
Consumer Discretionary	-.019	.2480
Energy	-.012	.3778
Financial	-.002	.8979
Healthcare	-.010	.5042
Industrial	.000	.9976
Technology	-.004	.8061
Real Estate	.012	.3810
Telecommunication Services	-.015	.3800

There does not seem to be an interaction effect between momentum and speculation in any of the eight sectors. Since all of the p-values from the regression are greater than .05 (Table 3), this suggests ETF returns from the previous quarter do not influence ETF returns in the current quarter when incorporating speculation. This indicates momentum does not have differing effects on future returns based on changes in speculation. Instead, future returns could be influenced by changes in speculation regardless of what previous returns were. There is empirical evidence to support the null hypothesis, which states there is no significant interaction between momentum and speculation.

Risk

When looking at risk by itself, there is evidence to indicate risk does in fact influence future returns. Since all of the p-values from the regression are less than .05 (Table 4), this suggests the market risk premium influences ETF returns. Each of the regression coefficients are positive, which would indicate increases in the market risk premium will lead to increases in ETF returns. This would provide support for the traditional financial theory of the risk-return relationship, which argues increases in risk will lead to increases in expected returns.

The magnitude of these increases differs from sector to sector. ETF returns in the energy, financial, industrial, and technology sectors seem to be impacted more by changes in the risk premium since the regression coefficients are greater than one. This indicates a 1 percent change in the risk premium should lead to a >1 percent change in ETF returns. On the other hand, ETF returns in the consumer discretionary, healthcare, real estate, and telecommunication services sectors do not seem to be impacted as much since the regression coefficients are less than one. This indicates a 1 percent change in the risk premium should lead to a <1 percent change in ETF returns.

TABLE 4
REGRESSION RESULTS: STAND ALONE RISK

Sector	Coefficient	Significance (p-value)
Consumer Discretionary	.946	<.01*
Energy	1.012	<.01*
Financial	1.184	<.01*
Healthcare	.743	<.01*
Industrial	1.084	<.01*
Technology	1.013	<.01*
Real Estate	.922	<.01*
Telecommunication Services	.640	<.01*

*significant at the 1% level

Speculation

When looking at speculation by itself, there is evidence to indicate speculation does in fact influence future returns. Since all of the p-values from the regression are less than .05 (Table 5), this suggests speculation influences ETF returns. Each of the regression coefficients are negative, which would indicate increases in speculation will lead to decreases in ETF returns. The magnitude of this impact stays somewhat consistent across the eight sectors. This suggests increases in speculation impacts all sectors analyzed in this study somewhat equally.

These results provide support for Blanchard and Watson (1982) and Jones (2014) who found speculation is often connected to economic events such as "bubbles" which could destabilize markets. This echoes Angel and McCabe (2009) who noted speculation could harm the macro-economy. We can tie our findings of a negative relationship into the aforementioned studies since we found an increase in speculation leads to a reduction in ETF returns. These findings make sense since our dataset included periods where there was instability in the markets such as years 2007-2008 and in the end of year 2018.

TABLE 5
REGRESSION RESULTS: STAND ALONE SPECULATION

Sector	Coefficient	Significance (p-value)
Consumer Discretionary	-.005	<.01*
Energy	-.008	<.01*
Financial	-.008	<.01*
Healthcare	-.005	<.01*
Industrial	-.008	<.01*
Technology	-.006	<.01*
Real Estate	-.005	<.01*
Telecommunication Services	-.005	<.01*

*significant at the 1% level

IMPLICATIONS

A core component of a momentum-based strategy is to buy the "winning" stocks and sell the "losing" stocks. Given the increased popularity of momentum-based strategies amongst investors, the results from this study provide some inferences regarding the prospective use of sector ETFs. More specifically, the applicability of the results from this study could focus on the viability of utilizing sector ETFs to employ sector rotation strategies.

Momentum

When looking at pure momentum, there does not seem to be a momentum effect in any of the eight sectors analyzed in this study. This means ETF returns from the previous quarter do not influence ETF returns in the current quarter. These results align with Dimkpah and Ngassam (2013) who also found pure momentum did not exist in their sample. Collectively, these insignificant findings also provide support for Fama (1970) who found asset prices reflect all available information so investors cannot outperform the market using any specific strategy. This would suggest that future returns are predicated on something other than previous returns.

Application

Employing a pure momentum-based investment strategy would require investors to consistently purchase securities that are increasing in price (i.e. positive returns). Based on our findings however, investors would be unable to successfully employ a momentum-based strategy using the sector ETFs analyzed in the study. Since our results indicate that previous returns cannot be used to predict future returns, investors would be unable to determine which of the ETFs would continue to provide positive

returns into the future. This would also make it increasingly difficult to employ a momentum strategy focused on sector rotation since investors would be unable to determine which direction ETF returns would move in the future based on the ETF returns from the previous quarter.

Interaction With Risk

There does not seem to be an interaction effect between momentum and risk in six of the eight sectors; energy, financial, healthcare, industrial, real estate, and telecommunication services. This means that ETF returns from the previous quarter do not influence ETF returns in the current quarter when incorporating risk in these sectors. The implication here is that momentum does not have a differing effect on future returns based on changes in the risk premium. Instead, future returns in these sectors could be influenced by changes in the risk premium regardless of previous returns.

There does seem to be an interaction effect between momentum and risk in two of the eight sectors; consumer discretionary and technology. This means that ETF returns from the previous quarter do influence ETF returns in the current quarter when incorporating risk in these sectors. The implication here is that momentum does have a differing effect on future returns based on changes in the risk premium. Since each of these coefficients is positive, this would indicate the momentum effect in these sectors would increase in periods where the risk premium increases. This finding provides partial support for Carhart (1997) in the consumer discretionary and technology sectors. The four-factor model presented in Carhart (1997) used the market risk premium to explain momentum.

Application

Although investors would be unable to employ a pure momentum strategy as a part of their portfolio, there is some indication investors could use a strategy that encompasses momentum and the risk premium in some sectors as there is an interaction between momentum and the risk premium present in the consumer discretionary and technology sectors. Thus, investors could employ a sector rotation strategy that alternates investments between these two sectors based on the returns from the previous quarter and expected changes in the market risk premium.

Changes in the market risk premium can stem from one of two things – (a) changes in interest rates and/or (b) changes in the expected market return. All else being equal, a decline in interest rates, such as what we have seen lately, should result in an increase in the market risk premium. This increase in the market risk premium would signal a future momentum effect in the consumer discretionary and technology sectors. Thus, investors wanting to employ a strategy that encompasses momentum and the risk premium should keep a close eye on future expected movements in interest rates. This will allow them to determine whether the consumer discretionary or technology sector would be more profitable in the near future.

Interaction With Speculation

There does not seem to be an interaction effect between momentum and speculation in any of the eight sectors. This means that ETF returns from the previous quarter do not influence ETF returns in the current quarter when incorporating speculation in these sectors. The implication here is that momentum does not have a differing effect on future returns based on changes in speculation. Instead, future returns in these sectors could be influenced by changes in speculation regardless of previous returns.

Application

Although investors would be unable to employ a pure momentum strategy as part of their portfolio, there is also no indication investors could use a strategy that encompasses momentum and speculation as an interaction between momentum and speculation is not present in any of the eight sectors. This lack of interaction would suggest investors would be unable to employ any type of momentum strategy whenever there is increased speculation in the market. Speculation in this study was measured by the VIX index. Increases in the VIX index indicate there is increased speculation in the market, which would undoubtedly come with more volatility. This would make it even more difficult for investors to follow a true momentum

strategy since the extra volatility in the market could essentially mask any momentum from the previous quarter.

Risk

Our findings indicate future returns cannot be predicted based on past returns, thus making an investment strategy based on pure momentum not advisable. One possible explanation for this is due to changes in the risk premium. Our findings indicate risk does in fact influence future returns in a positive manner; meaning increases in risk should lead to higher expected returns in the future. This aligns with traditional financial theory of the risk-return relationship. The magnitude of this relationship varies from sector to sector with the energy, financial, industrial, and technology sectors appearing to benefit the most in an environment with an increasing market risk premium.

Application

Although investors would be unable to employ a pure momentum strategy as part of their portfolio, there is an indication investors could use a strategy that focuses more on the market risk premium than returns from the previous quarter. In this sense, the focus would be on the energy, financial, industrial, and technology sectors since their regression coefficients were greater than 1, which would indicate an increasing market risk premium would impact momentum in those sectors more favorably and by a larger margin.

Overall, the positive relationship between the market risk premium and ETF returns found in this study suggests all investors should keep an eye on the market risk premium regardless of the investment strategy they employ. As with an investor utilizing a strategy that encompasses momentum and risk in consumer discretionary and technology sectors, these investors should also keep an eye on future interest rate changes as they will likely impact the market risk premium going forward.

Speculation

Our findings indicate future returns cannot be predicted based on past returns, thus making an investment strategy based on pure momentum not advisable. One possible explanation discussed above is changes in the risk premium. Another possible explanation is due to changes in speculation. Our findings indicate speculation does in fact influence future returns in a negative manner; meaning increases in speculation should lead to lower expected returns in the future. The magnitude of this relationship stays fairly consistent across all sectors. This seems to suggest speculation negatively impacts the overall economy, which is consistent with previous literature (Angel & McCabe, 2009; Blanchard & Watson, 1982; Jones, 2014).

Application

Although investors would be unable to employ a pure momentum strategy as part of their portfolio, there is an indication that any investment strategy would not be profitable in periods of increased speculation. Periods with increased speculation are often connected to economic events which could harm the macro-economy and destabilize the markets (Angel & McCabe, 2009; Jones, 2014). Given the events during the Great Recession, it did not matter what type of investment strategy was employed, most investors lost money over this period of time. More recently, investors lost a great deal of money toward the end of 2018 when there was increased levels of speculation.

Although investors are unable to employ an investment strategy based on momentum with the ETFs analyzed in the study, it is still important to factor speculation into any investment strategy. Increased levels of speculation tend to lead to investment losses, as evidenced in 2007-2008 and again in at the end of 2018. One possible way investors can monitor speculation is by following the VIX index provided by the CBOE. Once increased levels of speculation are discovered investors can subsequently short the ETFs in hopes of repurchasing them at lower prices in the future; thus, gaining their investment return a different way. These same investors could then go back to their initial investment strategy once the levels of speculation decline.

LIMITATIONS AND FUTURE RESEARCH

There are several limitations present in this study. One limitation of this study was the use of only sector ETFs offered by The Vanguard Group®. A potential study could use sector ETFs offered by other investment firms or even aggregate several sector ETFs together to see if the same results occur. A second limitation of this study was there were no economic variables used in the study. It is possible certain economic data may have affected the results of the study. Future research could include economic variables in order to see how economic activity ties into a momentum effect. A final limitation is the measurement of momentum. This study used a one-quarter lag to measure momentum, whereas future studies could use a two-quarter or three-quarter lag to measure momentum.

CONCLUSION

Unexplained anomalies have always existed in the financial sub-field of investing because they are inherent to the market. The purpose of this quantitative study was to examine one of those known anomalies, that of the momentum effect. This study was able to show a momentum effect is not present in any of the eight sectors from the S&P 500. There was also empirical evidence showing an interaction effect between momentum and risk in the consumer discretionary and technology sectors. In addition, there is also empirical evidence showing there is not an interaction effect between momentum and speculation. The findings of this study seem most significant for the consumer discretionary and technology sectors and less significant in the other sectors. The findings of this study do not support efforts by investors to systematically employ a momentum-based investing strategy using the sector ETFs analyzed in this study. In addition, there is empirical evidence showing all investors should monitor speculation and risk regardless of the investment strategy they use.

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