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Analysis of S&P 500 Sector ETFs

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The University of Southern Mississippi

Analysis of S&P 500 Sector ETFs

By

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Abstract

Exchange Traded Funds (ETFs) are a diversified pool of assets that trade on an exchange and track an index. Tracking error is the difference between a portfolio's returns and the benchmark or index it was meant to mimic. Investors want the Exchange Traded Funds (ETFs) to track the benchmark very closely or have the tracking error as low as possible. This paper looks at the tracking errors of different S&P sector ETFs by using the average absolute differences in monthly returns between the ETF and its benchmark index. The results indicate that the Technology and Real Estate sectors have the highest tracking error while Consumer Discretionary and Consumer Staples have the lowest tracking errors. I also look at ETFs Beta which is a measure of systematic risk to determine if this measure of risk could be a source of tracking error. I find that ETFs tracking error does not depend on sector risk.

Tracking Error, Exchange-Traded Fund, Beta, Seasonality, Sector, Expense Ratio

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List of Abbreviations

S&P	Standard and Poor
ETF	Exchange-Traded Fund
NAV	Net Asset Value

Introduction

An Exchange Traded Fund is a diversified collection of assets that trades on an exchange and tracks a stock index, a commodity, bonds, or a basket of assets and track a benchmark or index. ETFs have many predecessors in terms of financial innovations. This structure is created with a basket of securities to begin with, and in this study's case the baskets of securities are the Sectors of the Standard and Poor 500 Index. The portfolio is sold off in shares, like stocks, that are calculated very closely to the Net Asset Value (NAV) of the securities divided by the number of shares outstanding. The shares are traded in the secondary market by individual investors. Large investors can redeem large block shares of the stocks that make up the portfolio, and create new shares of the ETF. This redemption and creation attribute of ETFs allows for arbitrage. Another attribute of how ETFs operate is that the shares and underlying portfolio are highly liquid. Exchange-traded funds are extremely popular with investors because of the ability to buy and sell shares at the current market price rather than the Net Asset Value at close of the previous day (Gastineau 2001).

Beta is a measure of volatility, or systematic risk, compared to the market. The market (S&P 500), as a whole, has a beta of 1. An ETF with higher than 1 has more volatility or correlation to the market. Likewise, an ETF with lower than 1 has less volatility or correlation to the market. Based on these facts, the hypothesis is that the higher beta ETFs will have higher tracking error because of the increased volatility and systematic risk than the market.

Tracking error is the difference of price between a portfolio and the index. These errors lead to unexpected profit or loss for investors expecting to receive the return of the index. The portfolios in the case of this study are S&P 500 Sector ETFs. The Standard and Poor 500 has ten sectors that divide the market. The sectors of the S&P 500 are Consumer Discretionary,

Consumer Staples, Energy, Financials, Health Care, Industrials, Materials, Real Estate, Technology, and Utilities. Each of these ten sector Exchange-Traded Funds has its own stock ticker symbol and that is how it will be identified in the charts that quantifiably display the results of the magnitude of the tracking errors, expense ratios, and betas.

Literature Review

ETFs like index funds track the movements of a benchmark index. The benchmarks that ETFs can track are stock indexes, bonds, commodities, and bundles of assets. Investors hold a belief that ETFs should track the trends of an index upwards and downwards. Studies in the past have examined ETFs according to premiums and discounts, the associations to linked markets, and performance in different market conditions. Other studies have examined tracking error in global markets. The aim of this study is to examine the ETFs that are tracking the sectors of the S&P 500. This study will answer questions in regards to the size and cause of tracking errors. Studies have examined ETFs according to premiums and discounts (Ackert and Tian, 2000; Delcoure and Zhong, 2007). In “Arbitrage and Valuation in the Market for Standard and Poor's Depository Receipts,” researchers find that financial assets tracking the S&P 500 are priced relatively efficiently (Ackert and Tian, 2000). This study also attributed much of the ownership of these assets to individual investors, known for waves of optimism and pessimism. Although this is true, the study found that sentiment did not significantly influence the pricing of these assets. In “On the premiums of iShares” researchers find that mispricing is temporary and converges to zero within a short amount of time. This study attributed the premiums that do arise for short periods of time to low institutional ownership (Delcoure and Zhong, 2007). In “iShares Australia: a clinical study in international behavioral finance” researchers evaluate pricing effectiveness. They found that increasing conditional risk was linked to falling prices, and

decreasing conditional risk was linked to rising prices. This study hypothesized that behavioral finance was the cause of correlations between foreign markets. This hypothesis was not wholly correct, as the markets followed weak-form efficiency because investors overreact to available information (Durand and Scott, 2003). In "Active vs. passive ETFs" researchers describe passive ETFs as arbitragable securities and found that passive ETFs have smaller absolute deviations than active ETFs. Passive ETFs have statistically important, but not economically significant, premiums. This study also determined that bid-ask spreads are larger in passive ETFs than active ETFs, despite the active ETFs having access to superior information (Thirumalai, 2011). In "Exchange-traded funds in bullish and bearish markets" researchers find that ETFs have positive tracking errors in both bullish and bearish markets. They attribute the positive tracking errors in both bull and bear markets to investors willing to pay a premium for ETF investments. According to the study, investors are willing to do this because ETFs always provide positive returns that cover transaction costs and returns in bullish and bearish markets (Wong and Shun, 2010). Studies have also focused on tracking error (Kanuri and McLeod, 2015; Ramaswamy, 2011; Shin and Soydemir, 2010). In "Does it pay to diversify? US vs. international ETFs." researchers used three methods of calculating tracking error that will be used in the process of this study. This study determined that U.S. ETFs outperformed International ETFs on all basis, eliminating nearly all of the global diversification benefits. This is especially true in times of extreme financial distress. This further indicates the importance of this study focused on the S&P 500 sector ETFs (Kanuri and McLeod, 2015). In "Market Structures and Systemic Risks of Exchange-Traded Funds" researchers performed a study that found that risk is complicated to determine in long financial intermediation chains. The lack of transparency is a cause of increased risk of financial products. ETFs use derivatives that replicate returns, thus increasing

systemic risk in the financial system (Ramaswamy, 2011). In "Exchange-traded funds, persistence in tracking errors and information dissemination" researchers found that changes in exchange rates are a significant source of tracking error in ETFs. This was determined after testing many factors such as dividends, expense ratios, and spreads of trading prices effects on the tracking error. U.S. market-benchmarked ETFs are not directly exposed to exchange rate risk as Foreign market ETFs. This study also found U.S. ETFs are less reliant upon past performance in determining pricing than Asian markets (Shin and Soydemir, 2010).

The focus of this study will conclude with information that displays the rankings of consistency of the sector ETFs and how investors can hedge against the active risks. The previous literature has focused on comparing U.S. ETFs to International ETFs, leaving great room for the study of domestic funds.

Research Questions

Question: Which Sector ETF has the highest and lowest tracking error?

This research will shed light on the question of which sector ETF has the highest tracking error. Knowing this information will allow investors to make informed decisions and set expectations based on the results.

Hypothesis: The Sector ETF with the highest Beta will have the highest tracking error.

Beta is a measure of systematic or non-diversifiable risk that is inherent in a fund's composition. This hypothesis is based on the idea that the higher risk or volatility would lead to differences in returns of the sectors and the indices.

Rationale

This research's rationale is that the ideal tracking error is zero, meaning the fund tracks the benchmark perfectly. This ideal tracking error is based on the reasoning that investors choose to invest in portfolios that track benchmarks so that they can get the return of a benchmark index over a given period of time. Since investors want the tracking error as low as possible, they will want to know which sector has the highest tracking error, not to avoid investing in that sector completely, but to know the history of the ETF compared to the benchmark (Kanuri and McLeod, 2015).

Goals

The goals of this academic research project are to measure the tracking error of the sector Exchange-Traded Funds when compared to the sectors of the S&P 500. Once this goal has been achieved the goal will then be to explain the causes of the magnitude of the tracking error. The goals of the thesis as a whole are to make contributions to the field of Finance in a meaningful manner that encompasses the sectors of the Standard and Poor Index.

Contribution to Field of Finance

The contribution this research makes to the field of finance is to quantifiably display the sectors with the largest and smallest tracking errors. This information will ideally then be used by investors to make better-informed decisions on which sector to invest. They will also have the information on the tracking error to allow them to adjust their expectations to reflect these errors or choose to invest in a different company's version of the sector ETF the investor desires. The information that will come from this research will also be a stepping stone for other researchers investigating the phenomenon of tracking error. This research will also investigate the causes of

the largest tracking errors. This information could contribute to the fund's better allocation of funds and diminishing of expenses to be used by fund managers.

Sources of Tracking Error

Frino and Gallagher (2010) attributed tracking error to a variety of sources. The primary source of tracking error is that the index is seen as a “paper” portfolio. This is explained as a portfolio where transactions may occur at any time without cost. The ETFs also have market frictions to contend with. The index can change in composition to new weights almost automatically with no transaction costs. This is not true for the ETFs because physical trading is required to reallocate the fund to match the index (Frino, 2010). The causes of tracking error are transaction costs, fund cash flows, treatment of dividends by the index, volatility of the benchmark, corporate activity, and index composition changes (Chiang, 1998). Tracking error can also be attributed to the liquidity of the underlying index because of its implications for transaction costs (Kiem, 1999). The volatility of the index can also be a source of tracking error in the case that the ETF does not perfectly mirror the index. Dividend timing is a cause of tracking error because the index can include the dividends on the ex-dividend date, but the ETF does not actually receive the dividend until after the ex-dividend date. There are also seasonality factors that could be a cause of tracking error. The “January Effect” can also be seen to be a true cause of tracking error. This effect is a seasonal increase in stock prices during the month of January. Ex-dividend dates are one type of seasonality that leads to tracking error (Frino, 2001). Transaction costs are the costs incurred in the process of portfolio implementation, rebalancing, and client capital flows. Fund cash flows increase tracking error in the case that the size and timing of new cash being invested by clients into index securities as quickly as possible. Corporate activity such as restructuring can be a source of tracking error. When companies

merge or are acquired by a company outside of the index, there may be a timing delay between the cash settlement the ETF receives and the removal of that security from the index (Frino, 2001).

Data

The monthly returns for all S&P 500 sector ETFs and their benchmark indices were collected from Bloomberg Terminal over the period 12/31/1998-12/31/2018. Real Estate sector did not have the same time frame of data as the rest of the securities. This difference in data was because the Real Estate Select Sector SPDR Fund, XLRE, had an inception date of October 17, 2015. The other sector ETFs had inception dates earlier than the December 31, 1998, which is the starting point of this study.

Table 1. Tracking Error of Sector ETFs

Sector	ETF Ticker	Index Ticker	Tracking Error
Technology	XLK	IXT	0.65525%
Real Estate	XLRE	IXRE	0.49850%
Utilities	XLU	IXU	0.47090%
Energy	XLE	IXE	0.35395%
Financials	XLF	IXM	0.33554%
Industrial	XLI	IXI	0.33140%
Materials	XLB	IXB	0.30639%
Healthcare	XLV	IXV	0.27929%
Consumer Staples	XLP	IXR	0.27811%
Consumer Discretionary	XLY	IXY	0.26908%

Methodology

This study will use one method of calculating tracking error in the analysis of the Sector ETFs of the S&P 500. Following Frino and Gallagher (2001), Wong and Shum (2010) & Kanuri and McLeod (2015), I use the average absolute differences in monthly returns between the ETF and its benchmark index.

$$\sum_{t=1}^N ABS(\text{Return on ETF} - \text{Return on the Benchmark Index})/n$$

This research involved collecting data on the 10 sectors of the S&P 500 and the 10 sector Exchange-Traded funds. The time period being evaluated in this study is from 12/31/1998-12/31/2018 with monthly data over the twenty-year period. The data for the sectors and their betas comes from the Bloomberg Terminal software. The function used in the calculation of tracking error is HP, which is the Historical Price, this was set to the time period 12/31/1998-12/31/2018 with monthly results. This data was then exported to excel to use the formula for tracking error. BETA which is a measure of systematic risk for different sectors was also downloaded from Bloomberg Terminal.

Table 2. Expense Ratio and Beta Comparison

Sector	TICKER	Expense Ratio	Adjusted Beta
Real Estate	XLRE	0.13%	0.988
Financials	XLF	0.13%	0.997
Technology	XLK	0.13%	1.001
Utilities	XLU	0.13%	0.992
Energy	XLE	0.13%	0.999
Industrials	XLI	0.13%	1.005
Materials	XLB	0.13%	1.004
Health Care	XLV	0.13%	1.011
Consumer Staples	XLP	0.13%	1.006
Consumer Discretionary	XLY	0.13%	1.005

Results and Discussion

The Sector ETFs listed in descending order of tracking errors are Technology, Real Estate, Utilities, Energy, Financials, Industrials, Materials, Healthcare, Consumer Staples, Consumer Discretionary. The Technology Sector had the largest tracking error and a beta of 1.001. This beta places the Technology Sector at a level of risk that is near the middle of the constituent ETFs. The Real Estate Sector had the second largest tracking error, but the lowest beta of 0.988. This means that it had the lowest market risk, and the next to highest difference in price between the ETF and the Index. The lowest tracking error was in the Consumer Discretionary ETF and it carried a beta of 1.005. The second lowest tracking error was in the Consumer Staples Sector ETF. Consumer staples had a beta of 1.006, suggesting that it carries one of the highest measures of market risk.

Following Frino (2010), Chiang (1998), and Kiem (1999); the tracking error comes from causes such as expense ratio, seasonality, transaction costs, and dividend treatment. The hypothesis that was established at the beginning of this study was that the sector with the highest beta would also have the largest tracking error. This hypothesis was formed from the idea that higher risk or volatility found in high beta investments could lead to price differences from the sectors and their respective indices. As the results indicate, this hypothesis was incorrect because beta is a measure of risk for a specific investment. The problem inherent in this hypothesis was the failure to consider that each sector ETF and index consist of the same stocks. This means that while beta may be higher for a sector, the ETF and index have equal amounts of market risk. Another way of stating the shortcoming of this hypothesis is that the tracking error comparison is made between the ETF and index of each sector, but the beta is compared between the different sectors. Another reason that the expectation was different from the result can be attributed to the

time period difference. The results for Real Estate are limited in their accuracy due to the shorter time frame over which the ETF was in existence, from 10/07/2015-12/31/2018. This time period is significantly shorter than the range of the study from 12/31/1998-12/31/2018. This problem only arises with the Real Estate sector; all other sectors were operating before the start date of the data collection for this study. These are the reasons that the expectation differed from the end result.

Conclusions

This study evaluates the magnitude of tracking errors of the S&P 500 Sector ETFs and discusses the known causes of tracking error found in the literature. Tracking error, as defined in this study, is the difference in price of the index and portfolio. Technology and Real Estate sectors had the highest tracking error while Consumer Staples and Consumer Discretionary had the lowest tracking error. I also looked at the systematic risk or Beta of different sectors. The expectation was that more volatile or risky sectors would have higher tracking error. This was not the case as all of the sector ETFs had almost similar risk, from .988 to 1.011. These betas are extremely close to 1.0, meaning that there are minimal differences from correlated to the market. The tracking error of the Sector ETFs can partially be attributed to the expense ratio. The expense ratio for each of the funds was 0.13%, and this ratio is taken away from the return of the fund for investors. These results could be used by investors to make a decision as to which sectors track the benchmark or the index closely. The use investors could get out of this research is that in knowing the tracking error for each sector they can understand the behavior their investment in that sector will likely have. The fact that the beta and tracking error do not match could be a focus of future research. Although the expectation was incorrect because beta was not correlated to tracking error, the field of finance could benefit from research into the exact reasons

that beta and tracking error are not directly associated. Another focus of future research could be directly attributing the tracking error of the Sector ETFs to causes that are discussed in previous literature or new causes that have yet to be discovered. This would contribute to the field by finding a method that explains causation of sources of tracking error to the extent of the difference in prices.

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