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Diversification Using International Exchange-Traded Funds

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Abstract

Exchange-Traded Funds (ETFs) are diversified portfolios of assets which trade like stocks and track a benchmark index. This manuscript looks at the diversification and return benefits a U.S. investor would receive by investing in Emerging market (EEM) and Total World (DGT) ETFs over the period of June 2003 to July 2019. We use S&P 500 ETF IVV as a proxy for U.S. market. EEM had the highest absolute return but also the highest risk. However, the U.S. ETF IVV had the greatest risk-adjusted return and the lowest tracking error. International ETFs were also highly correlated with the S&P 500. Overall, results indicate that U.S. investors receive limited diversification benefits through international ETFs.

Key Words: Honors College, undergraduate research, finance, investments, ETF, diversification

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List of Abbreviations

ETF	Exchange-Traded Fund
NAV	Net Asset Value
S&P	Standard & Poor
CWI	Cumulative Wealth Index

Introduction

There are several ways U.S. investors can diversify and invest internationally. They can directly buy ADRs which are stocks of foreign companies that trade on U.S. exchanges or they can invest indirectly through securities such as international mutual funds or ETFs. An ETF is a diversified portfolio of assets such as stocks which tracks a benchmark or index. The ETF provider owns the underlying assets, designs a fund to track their performance and then sells shares in that fund to investors. Share price is calculated as the Net Asset Value (NAV) divided by the number of shares issued and outstanding. Individuals can buy and sell shares of ETFs intra-day on an exchange, like stocks. This liquidity allows for the synthesis and redemption of creation units which are essential to the intraday calculation of NAV (Gastineau 2001). ETFs are also subject to tracking error. Tracking error is the difference between the return of the ETF and the benchmark it tracks. Ideally tracking errors should be as low as possible so that investors can obtain returns closest to the benchmark index. The largest source of tracking error for international ETFs is currency exchange rates (Shin and Soydemir, 2010).

In this thesis, I look at the performance and diversification benefits of Total World and Emerging markets ETFs for U.S. investors. The ETFs used in this study are IVV which tracks the S&P 500 and is a proxy for the U.S. stock market, SPDR Global Dow ETF (DGT) which is a proxy for the Developed markets, and iShares MSCI Emerging markets ETF (EEM) which is a proxy for the Emerging markets. I will also compute and compare the tracking errors of all the three different ETFs using methods utilized by Frino and Gallagher (2001) and Kanuri and McLeod (2015).

Literature Review

The case for international diversification through all investment vehicles is supported by the cornerstones of financial literature. Levy and Sarnat (1970) found that investing in emerging markets improved the risk-return relationship of an investor's portfolio. Investing in emerging markets was preferred over other developed economies which have high correlation to the U.S. market. Kanuri, et al. (2018) look at the performance and diversification benefits of Emerging market ETFs since their inception (January 2003 – June 2015) for U.S. investors by comparing their absolute and risk-adjusted performance to S&P 500 ETF IVV. Emerging market ETFs were much more expensive and had higher turnover compared to IVV. However, emerging market portfolio had low correlation with IVV. This indicates that Emerging Market ETFs do help U.S. investors diversify.

Despite these benefits, other studies cast doubt on international diversification. Stulz (1981) examined how segmentation among markets result in barriers to international investment. His model finds that international investments may be worth holding when there is enough risk to heighten returns. Below this level, returns would not be great enough to compensate for the extra expenses incurred when holding a foreign security. King and Wadhwani (1990) analyze the stock market crash of October 1987, where global indices fell together despite widely differing economic circumstances. This "contagion" between markets occurred due to attempts by rational agents to infer information from price changes in other markets. As volatility in major markets rose, other markets became increasingly volatile and losses were compounded. Hanna et al. (1999) look at the benefits of stock diversification in the G-7 countries. A portfolio

consisting solely of the S&P 500 dominates any portfolio that can be constructed from the S&P 500 and the major market index of the G-7 countries. Jacobs, Müller, and Weber (2014) found that for global equity allocation, prominent optimization models do not outperform heuristic stock weighting schemes. Diversification gains are mainly driven by a well-balanced allocation over different asset classes, and international optimization methods do not add substantial value. Humphrey, Benson, Low, and Lee (2015) analyze diversified portfolios using optimization techniques and found that investors would be better off not diversifying their holdings. Their conclusion is based on the idea that investors do not face the perfect, theoretical markets that are often used as the underlying assumption in financial literature. The friction in realistic markets, due to short-selling restrictions and fees, were the focus of their analysis. Kanuri and McLeod (2015) find that international ETFs are highly correlated with major U.S. indices during the period of their analysis (January 2008 – June 2013), and therefore, offered limited diversification benefits for U.S. investors. This study will examine absolute and risk-adjusted returns and whether U.S. investors receive diversification benefits from International ETFs. We use a longer time period compared to the previous analyses.

Data

To ensure equal comparison, ETFs chosen were created on or before June 2003 and have continuous price and trading data from June 2003 through July 2019. This time period was selected due to U.S. ETFs being created before Total World and Emerging markets ETFs. Table 1 provides information about each ETF used, its creation date, the index it tracks, and its category. The data for this analysis was obtained through the

Bloomberg Terminal and will be used to determine U.S. ETF returns compared to its index and Total World and Developing markets ETF performances.

Performance and Risk

Following Shin and Soydemir (2010), the ETFs are ranked based on their performance for the period of June 2003 through July 2019.

Table 1: Shows the ETF, the benchmark it follows, the inception date and category to which it belongs

ETF	Name	Benchmark	Inception	Category
IVV	iShares Core S&P 500 ETF	S&P 500 TR USD	5/15/2000	U.S.
DGT	SPDR Global Dow ETF	DJ Global TR USD	9/25/2000	Total World
EEM	iShares MSCI Emerging Markets	MSCI EM NR USD	4/7/2003	Emerging

Table 2 provides the return rankings of all three ETFs in descending order. Standard deviation is used as a measure of risk for each ETF and index. The results in Table 2 show that the Emerging market ETF and its index have the highest average monthly return and risk (standard deviation) over the period. U.S.-based ETF IVV and its benchmark had the second highest returns with significantly lower standard deviation than the Total World and Emerging market ETFs over the entire period.

Table 2: Shows average monthly returns and standard deviation (in %) of ETFs and their index

Rank	ETF	No. of obs	Avg. monthly ETF return	ETF SD	Avg. Monthly Index Return	Index SD	Category
1	EEM	194	0.95702%	6.04914%	1.03428%	6.08816%	Emerging
2	IVV	194	0.82701%	3.88406%	0.83193%	3.88933%	U.S.
3	DGT	194	0.52087%	4.03012%	0.54708%	4.02903%	Total World

Risk-adjusted Performance

Sharpe Ratios

A security may have higher returns, but this could be because it has higher risk. To adjust for the risk of each investment, the average Sharpe ratio for each ETF was calculated over the period. This has been used in previous literature [Kanuri and McLeod (2015) & Kanuri, et al. (2017)] to compare performance among ETFs. Table 3 shows the Sharpe ratio of each ETF ranked in descending order.

The Sharpe ratio is calculated as

$$\boldsymbol{SR} = (\boldsymbol{R}_{ETF} - \boldsymbol{R}_{F})/\boldsymbol{\sigma}_{ETF}$$

where

$\boldsymbol{R}_{ETF}$ is the monthly return of the ETF,

$\boldsymbol{R}_{F}$ is the one month T-bill rate, and

$\boldsymbol{\sigma}_{ETF}$ is the standard deviation of monthly ETF returns.

The Sharpe ratio calculates the compensation an investor receives for each unit of risk assumed over the risk-free rate of the T-bill. For the purpose of this analysis, the one

month US T-Bill was used as a gauge for the risk-free rate. The higher the Sharpe ratio, the better the ETF's performance.

Table 3: Sharpe ratios calculated using the one month T-Bill rate

Rank	ETF	Sharpe ratio	Category
1	IVV	0.18641	U.S.
2	EEM	0.14118	Emerging
3	DGT	0.10369	Total World

The results shown in Table 3 indicate that the U.S.-based IVV has the highest risk-adjusted return of the group despite the fact that Emerging market ETF having the highest absolute monthly return. This is due to higher risk or standard deviation that EEM experiences compared to the other two ETFs. The difference in standard deviation among these securities is expected since emerging market securities are inherently more risky. EEM had the second highest Sharpe Ratio while developed world ETF DGT had the lowest Sharpe Ratio.

Cumulative Wealth Index

The cumulative returns for the ETFs were computed using their monthly returns. Following Woolridge (2004), Kanuri and McLeod (2015), Kanuri (2016) and Johnson and Kanuri (2018), cumulative returns are used to create a cumulative wealth index (CWI). The CWI shows the value of $1,000 invested in each ETF during June 2003 in July 2019. This model also assumes the reinvestment of dividends. The results in Table 4 support the data summarized in Table 2; the Emerging Market security achieved the highest cumulative returns (185.66%) and CWI over the entire period of the study. IVV

was next with 160.44% cumulative return and DGT was last with cumulative returns of 101.05%.

Table 4: Shows cumulative returns and CWI of returns over the entire period

Rank	ETF	Cumulative Returns (June 2003 through July 2019)	Cumulative Wealth in $ July 2019 ($1000 invested in June 2003)	Category
1	EEM	185.66%	2,856.63	Emerging
2	IVV	160.44%	2,604.40	U.S.
3	DGT	101.05%	2,010.48	Total World

Tracking Error

Tracking error is an important metric to consider when investing in an ETF. Tracking error is defined as the difference in returns between the ETF and the benchmark it tracks. If a U.S. investor uses an ETF for the purpose of international diversification and there exists a high tracking error, the benefits of diversification will be significantly less than what the benchmark index provides. The tracking error of an ETF should ideally be zero so that the investor's gains and diversification benefits are maximized. However, this is not possible in a realistic market due to expenses charged by ETFs, dividends passed through to shareholders, and the cost of periodically rebalancing the underlying portfolio of securities so that the holdings match the benchmark index (Frino and Gallagher, 2001). Following Frino and Gallagher (2001) and Kanuri and McLeod (2015), tracking error for each ETF is measured in three ways.

The first method for computing tracking error is the absolute average differences between the return of the ETF and its benchmark index. It is calculated as

$$\boldsymbol{TE1} = \sum_{t=1}^{N} Abs\ (Return\ on\ ETF - Return\ on\ Benchmark\ Index)/n$$

The second method for computing tracking error uses the standard error obtained from a regression analysis that takes the benchmark index return as the x-input range and the ETF return as the y-input range. The model for the output is represented as

$$\boldsymbol{TE\ 2} = \boldsymbol{ETF}_{i.t} = \boldsymbol{\alpha}_i + \boldsymbol{\beta}_i \times \boldsymbol{BR}_{i.t} + \boldsymbol{\varepsilon}_{i.t}$$

where

$\boldsymbol{ETF}_{i.t}$ is monthly ETF return,

$\boldsymbol{BR}_{i.t}$ is monthly benchmark index return,

$\boldsymbol{\alpha}_i$ is the return that can be achieved above the benchmark index,

$\boldsymbol{\beta}_i$ is the measure of systematic risk of the ETF, and

$\boldsymbol{\varepsilon}_{i.t}$ is standard error

$\boldsymbol{\alpha}_i$, $\boldsymbol{\beta}_i$, and $\boldsymbol{\varepsilon}_{i.t}$ are outputs of the regression analysis. The standard error obtained from the regression mirrors tracking error. If the ETF follows its index exactly, the standard error would be zero.

The third method used for tracking errors computes the standard deviation of return differences between the ETF and its benchmark index. This method is calculated as

$$\boldsymbol{TE3} = \frac{\sqrt{1}}{n-1}\sum_{t=1}^{N}(\boldsymbol{R}_{i.t} - \boldsymbol{R}_{j.t})^2$$

where

$\boldsymbol{R}_{i.t}$ is ETF monthly returns, and

$\boldsymbol{R}_{j.t}$ is benchmark index monthly returns.

The average tracking error for each ETF was also calculated as the average of TE1, TE2, and TE3. The results shown in Table 5 indicate that the U.S. ETF had the lowest tracking error with each calculation method. In fact, the tracking error of the U.S. ETF was much lower than the Emerging market ETF which consistently had the highest tracking error. These results are not surprising given that international ETFs face complications such as time delays, exposure to unsafe market conditions, and have higher expense ratios (Kanuri and McLeod, 2015). Based on the level of tracking errors among the three securities, it can be concluded that the U.S. ETF would maximize an investor's return relative to the benchmark index and yield the most desirable diversification benefit.

Table 5: Shows TE1, TE2, TE3, and average TE and ranked in ascending order (smaller TE is better)

Rank	ETF	TE1	TE2	TE3	TE Average	Category
1	IVV	0.0049165%	0.0004400%	0.0079745%	0.00444%	U.S.
2	DGT	0.0262165%	0.0223217%	0.3074490%	0.11866%	Total World
3	EEM	0.0772511%	0.0453211%	0.6247155%	0.24910%	Emerging

Alpha and Beta

Using the model described by Jensen (1968), I compute alpha and beta for each ETF to determine any other benefits the investor receives by owning the security. It is computed as follows

$$\left(\boldsymbol{R}_{ETF,\ t} - \boldsymbol{R}_{\mathrm{f},\ \mathrm{t}}\right) = \boldsymbol{\alpha}_i + \boldsymbol{\beta}_i \times \left(\boldsymbol{R}_{Benchmark,\ t} - \boldsymbol{R}_{f,\ t}\right) + \boldsymbol{\varepsilon}_{i,t}$$

Where

$\boldsymbol{R}_{ETF,\ t}$ is the monthly of the ETF,

$\boldsymbol{R}_{Benchmark,\ t}$ is the monthly return of the benchmark index, and

$\boldsymbol{R}_{f,\ t}$ is the one month T-bill rate

Alpha (α) is the measure of return a security can achieve above its benchmark index. An ETF is not expected to have any return above its benchmark because they are intended to passively track the benchmark. In fact, it is more common to have a negative alpha since ETFs usually underperform their benchmark due to management fees.

Beta (β) is the measure of the systematic risk of a security. Systematic risk refers to the risk of the market or sector that cannot be lessened through further diversification. Examples of systematic risk include natural disasters, disease, war, economic depression, and any other events which indiscriminately affect an entire market. If $\beta = 1$, the return of the ETF perfectly matches the return of its benchmark index and indicates a passive management strategy. If $\beta < 1$, the fund's risk is less than the benchmark, and if $\beta > 1$, the fund's risk is greater than the benchmark. Both indicate a more active management strategy. For the purpose of this analysis, the ideal value of beta is 1 because investors typically use ETFs to closely track a specific index. The results are summarized below in Table 6.

Table 6: Shows α and β for each ETF ranked by alpha (smaller absolute value is better)

ETF	α	t	β	t	R^2	Category
IVV	-0.00003787	-8.6069733	0.99864274	9003.98914	0.99999763	US
DGT	-0.00024773	1.10980476	0.99736095	181.213220	0.99418714	Total World
EEM	-0.00065199	-1.4385918	0.988346898	134.3329609	0.989472151	Emerging

As expected, all ETFs had slightly negative alphas compared to their benchmark which indicates all of the three ETFs underperformed their respective benchmark. ETFs are at least expected to underperform their benchmark by the expense they charge. Both DGT (0.50%) and EEM (0.68%) have higher expense ratio than IVV (0.04%), which explains the difference in performance. A similar pattern is found in the beta values of the three ETFs; all securities had a beta value slightly below 1, and the U.S. ETF was closest to 1 while the Emerging market ETF was farthest from 1. This also indicates that all ETFs slightly underperformed their benchmark over the period of the analysis.

Diversification

To determine any diversification benefits that the U.S. investor receives by investing in Total World and Emerging market securities, we must find the correlation in returns between those ETFs and the U.S. ETF IVV from June 2003 to July 2019. Additionally, the international ETFs are regressed against the S&P 500 index to find alpha, beta, and R^2. The results of the correlation analysis are found in Table 7, and the results of the regression analysis are found in Table 8.

Table 7: Shows correlation among all ETFs

June 2003 - July 2019	*IVV*	*DGT*	*EEM*
IVV	1		
DGT	0.939514043	1	
EEM	0.771710234	0.822149665	1

The data obtained through the correlation analysis shows both DGT and EEM are highly correlated with the U.S. ETF IVV. Correlation ranges from 0.77 to 0.94 with the Total World having the highest correlation to IVV. This result aligns with expectations because the Total World ETF tracks securities in other Developed markets such as the U.K., Germany, and Japan which are relatively more correlated to the returns of the S&P 500 than Emerging market securities.

Table 8: Regression of Monthly International ETF Returns on Monthly S&P 500 Returns

ETF	α	t	S&P 500	t	R^2	Category
DGT	-0.002889	-2.8428352173	0.9734779505	37.9929878	0.8826023	Total World
EEM	-0.000416	-0.1469446608	1.2003902420	16.8185000	0.5956719	Emerging

Using the same method discussed in the Alpha and Beta section, Table 8 shows the results of monthly international ETFs regressed against monthly S&P 500 index returns for the period of June 2003 to July 2019. Both ETFs have a beta value close to or higher than 1 – DGT had a beta close to 1 (0.97) while EEM had a beta of 1.20. EEM's beta of 1.2 indicates that it is more risky than the S&P 500. The R^2 values range from 0.60 to 0.88, indicating that both the international ETFs were highly dependent on the S&P 500 ETF IVV. These results were similar to Pennathur, Delcoure, and Anderson

(2002) and Kanuri and McLeod (2015). The results of this study indicate that there very minimal diversification benefits from investing in international ETFs for U.S. investors due to the close relationships held between international indices and the S&P 500.

Conclusions

This manuscript looks at the performance and diversification benefits of Total World and Emerging Market ETFs for U.S. investors. Results show that the Emerging market ETF had the highest total and average returns in addition to the highest risk or standard deviation. However, U.S. ETF has the highest Sharpe ratio or risk-adjusted returns of all the three securities over the period of June 2003 to July 2019. Three methods for computing tracking error were used; the Emerging market ETF EEM had the highest tracking error whereas U.S. ETF IVV had the lowest tracking error in all three calculations. These results were expected because international ETFs often have higher expense ratios than U.S. ETFs.

The regression analysis of each ETF against its benchmark index shows that all alphas were negative, and all betas were slightly below one. Again, these results were expected because it indicates that the ETFs all slightly underperformed their benchmark indices. Since all Betas are very close to 1 (>= 0.988), all ETFs had a passive management strategy over the period of analysis. Like tracking error, the U.S. ETF was the closest to matching the returns of its benchmark while the Emerging market ETF had the largest difference in returns compared to its benchmark.

Diversification analysis among the ETFs showed that the returns of international ETFs were highly correlated to the returns of the S&P 500 ETF IVV. Correlation ranged from 0.77 for the Emerging market ETF to 0.94 for the Total World ETF; these results

were expected as the Total World ETF encompasses other Developed market indices which are more correlated to the S&P 500 than Emerging market indices.

In conclusion, the results of this analysis indicate that U.S. investors receive limited diversification benefits through Total World and Emerging market ETFs over the period of June 2003 to July 2019. The Emerging market ETF had the highest absolute return over the period of analysis, but the U.S. ETF had the highest risk-adjusted returns or Sharpe Ratio of all three ETFs. IVV also tracked its benchmark index more closely than the other securities. The returns of the International ETFs were also highly correlated to the returns of the U.S. market. Therefore, U.S. investors should be cautious when investing in International ETFs for diversification purposes since they offer less risk-adjusted returns and are also highly correlated to the S&P 500.

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