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EVALUATION THE PERFORMANCE OF EXCHANGE TRADED FUNDS (ETFs) LISTED ON THE INTERNATIONAL STOCK MARKETS

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Abstract
Exchange traded funds (ETFs) are one of the most popular and fastest growing classes of financial assets available in today's markets. Due to the significant increase in popularity, ETFs allow investors to diversify their portfolios through a basket of assets from different countries that are traded on international stock markets. The aim of this study is to analyze the performance of ETFs on different continents. The sample in this research is 40 ETFs listed on the stock exchanges in the USA, Europe, Asia-Pacific and Emerging markets. The monitoring period is 2015 to 2019. Standard indicators such as Tracking error, Jensen alpha, Treynor ratio, Appraisal ratio, Information ratio are used to evaluate ETFs performance. The results of this research showed that ETFs from the USA show the best performance, according to the selected measurement methods. The Treynor ratio has also been shown to be skewed, as ETFs with identical systemic risk but different overall risk are not quantified correctly.

Key words: *Appraisal ratio; beta coefficient; ETF; exchange traded fund; Information ratio; Jensen alpha; performance; stock market; Tracking error; Treynor ratio*

JEL Classification: *G11. G12, G15.*

I. INTRODUCTION

Investment funds are a vital part of the modern financial system, as they participate in operations created in other segments of the financial sector, such as capital markets or banking. Over the last ten years, the investment fund industry has undergone significant changes resulting, among other things, from the adoption of new technologies in the financial system according to Marszk and Lechman (2020). Passively managed funds have risen sharply over the last decade, rising from 8% in 2007 to 20% of global Assets Under Management (AUM) funds ten years later (Sushko and Turner, 2018). Liebi (2020) adds that ETFs are among the fastest growing investment products, reaching $3.7 trillion at the end of 2018. This growing popularity of passive investment has been supported by their strong expansion, as described by Aquilina et al. (2020). Exchange-traded funds and mutual funds allow individual investors to diversify their assets cheaply and easily, as well as to choose how to diversify. By investing in mutual funds and ETFs, investors can enter a broad market or limit the degree of diversification to a particular set type or preferred industry segment. Both ETFs and mutual funds allow investors to reduce the idiosyncratic risk associated with investing in only a few stocks. Because their shares are freely traded on stock exchanges and can be shortened, some consider ETFs to be a more attractive offer than mutual funds. Unlike index funds, ETFs can be traded intraday and have no investment lows, as reported by Glambosky et al. (2019). In addition, ETFs provide more flexibility for investors who prefer a particular type of underlying asset, providing more tailored indexing options. In some cases, ETFs may also provide investors with tax benefits according to Gastineau (2001), which help explain the wide popularity that ETFs enjoy among both retail and institutional investors (Charteris et al., 2014). One of the most attractive features of ETFs is low fees, which are lower than fees for the least expensive mutual funds. ETFs also have a number of other attractive features, including immediate exposures, transparency, dividend treatment, risk management, as reported by Kallinterakis et al. (2020). Like individual stocks, ETFs are traded in real time at a price determined by supply and demand (Madhavan, 2012). The first ETFs appeared in Canada in 1990, at the Toronto 35 Index Participation Fund (TIP), and since then the demand for ETFs has grown significantly and has become a subject of interest for researchers (for a more detailed review, see Deville, 2008). The aim of the first ETFs available to investors was to monitor the return on their key indicators, in this case defined as a selected market index, minimizing all possible tracking errors. ETFs were therefore a passive type of investment fund. Passive equity ETFs are still the largest category in all possible dimensions of market development (assets, turnover, number of funds, etc.). Over the years, however, the global ETF industry has become much more diversified and there are now many different types of ETFs available, with different investment objectives in relation to their benchmark (e.g., semi-passive), modified returns (e.g. leverage) and above all exposure to

various types of assets - not only stocks, but also bonds, commodities and others (Madhavan, 2016, Hill et al., 2015).

II. SELECTED THEORETICAL ISSUES AND LITERATURE REVIEW

Marszk and Lechman (2020) examined 13 European countries in the period 2004-2017 to determine whether the ETF's share of total investment fund assets has reached a "critical" level that allows them to grow further and may be associated with an impact on the financial system. Atanasova and Weisskopf (2020) examine the effect of the relative liquidity of international ETFs and their portfolios on the price difference between the fund's market prices and its net asset values. The authors found that higher liquidity is associated with a lower absolute value of the ETF premium/discount. They document the positive relationship between liquidity and price convergence of ETFs and their underlying shares. The effect of liquidity on convergence is stronger for ETFs with high holding costs. Ben-David et al. (2018) provide empirical evidence that higher ETF ownership leads to higher intraday and daily volatility of the funds 'underlying assets. They show that excess volatility may arise due to staleness in NAV and price discovery in the ETF. They exploit exogenous changes in index membership and find that ETF ownership increases the negative autocorrelation in stock prices and that stocks with higher ETF ownership display significantly higher volatility. Xu et al. (2019) examine some known indices of US stock markets and their exchange traded funds. They concluded that the effect of bilateral ETF trading is deeper when the ETF market shares more information, and further the flow of information to the index increases on the ETF trading side. Holden and Jayoung (2019) show that the introduction of trading in baskets such as ETFs can improve the liquidity of the underlying securities if these securities have limited investor participation. The informational impact of ETFs on their underlying assets is also theoretically examined by Cong and Xu (2016), who found that asset prices reflect more systematic information and less specific asset information after the introduction of compound securities, leading to improved overall asset cost-effectiveness, if any, because the asset-specific information asymmetry is not extremely small compared to systematic information asymmetry. Zhu and Bao (2019) comprehensively compare and explore the weak form of efficiency and interdependence on the US ETF market. Their results provided clear evidence that the US ETF market was multifractal in nature and the efficiency of the US ETF market declined after the global financial crisis. Neves et al. (2019) discuss the real effects of diversification, risk and performance of country-specific stock exchange investment funds using a sample of twenty-two iShares for the period 2004-2015, which covers the global financial crisis. They conclude that the benefits of diversification through this investment vehicle are limited, especially in times of crisis, suggesting the existence of contagion between funds that are indices. Itzhak et al. (2018) take advantage of exogenous changes in index membership and find that shares with higher ETF holdings show significantly higher volatility. ETF ownership increases the negative autocorrelation of stock prices. The increase in volatility appears to represent a disproportionate risk in prices, as shares with a high ownership of ETFs receive a significant risk premium. Saunders (2018) states that investors seeking a return on international investment should carefully examine their country's economic freedom index and fund-specific cost-benefit ratio to avoid any deviations from the return of the exchange traded fund and the return of the benchmark index. Thanakijsombat and Kongtoranin (2017) provide a comprehensive overview of the risk and return characteristics, performance and benefits of the ETF's international diversity. The results suggest that selective ETFs based in these economies perform poorly and provide relatively low returns, while exposing emerging market investors to significant overall and systematic risks. In addition, these ETFs have been found to be more sensitive to downside risk, making them relatively more vulnerable to market downturns. Although foreign capital ETFs are designed to provide investors with the full benefits of international diversification, we have found that they are significantly affected by local market conditions and sentiments, making them ineffective tools for international diversification. In their study, Xu and Yin (2017) examine the relationship between the volatility of stock market indices and the trading volumes of their exchange traded funds. Using common least squares approaches as well as generalized autoregressive conditional heteroskedasticities, they have shown that the current trading volume of the S&P 500 ETF is a key determinant of S&P 500 volatility at both monthly and daily frequencies. The vector autoregressive estimate, on the other hand, suggests a two-way Granger causality between S&P 500 volatility and S&P 500 ETF trading. A replication analysis of the other market indices and the corresponding ETFs monitoring these indices confirms that these findings are robust. Chen et al. (2017) use regressions to assess the impact of global, foreign and US investor sentiment on ETF returns traded in US markets. They also examine whether a country's economic freedom affects the relationship between investor sentiment and the ETF's return. We found that ETF returns are strongly determined by investor sentiment and the ETF's cost ratio.

III. DATA AND METHODOLOGY

A data set of 40 ETFs from four continents over the last 5 years, i.e. from 2015-2019, is selected to evaluate the performance of exchange-traded funds, using monthly data. Specifically, the 10 most powerful ETFs are selected from each continent of Europe, USA, Asia-Pacific and Emerging Markets. The paper focuses exclusively on equity and passively managed ETFs, i.e. funds that attempt to replicate the underlying equity index as faithfully as possible. An overview of selected ETFs is given in Tab. 1. The performance of the ETF is monitored according to the most frequently used indicators to measure the fund's performance. In addition to the return denoted by *r* and the riskiness measured by the standard deviation σ, the following ratios are also used:

Appraisal ratio expresses the additional return, adjusted for systematic risk per unit of individual risk taken. It therefore tells about the quality of the selection of investment instruments for the fund's portfolio by the manager and compares it with their risk, i.e. it focuses on the non-diversified part of the portfolio.

$$Appraisal\ ratio = \frac{\alpha}{\sigma} \tag{1}$$

The Treynor ratio is a reward for volatility, which assumes that the fund eliminates unique risk by appropriate portfolio diversification and only assumes systematic risk. This indicator therefore compares the additional return of the fund with the factor β, not with the standard deviation. Treynor (1965) expressed this indicator mathematically as follows, where r_f denotes the risk-free rate on the market:

$$Treynor\ ratio = \frac{r - r_f}{\beta} \tag{2}$$

Tracking error measures deviations in the fund's portfolio and benchmark performance. According to Bacon (2008), this indicator shows the volatility of differences in performance using a standard deviation. In other words, it quantifies the volatility of the excess return, i.e. the difference between the return of the fund's portfolio and the benchmark, around the average value, i.e. the average excess return. Tracking error can be calculated as follows, where *n* is the number of observations:

$$Tracking\ error = \sqrt{\frac{\sum_{i=1}^{i=n}(r_i - \bar{r})^2}{n}} \tag{3}$$

Information ratio compares the fund's performance with the market's performance, taking into account the risk. The information ratio gives the ratio of excessive return and standard deviation of excess return, i.e. tracking error. The calculation of the information ratio is as follows, where r_m is the market return:

$$Information\ ratio = \frac{r - r_M}{Tracking\ error} \tag{4}$$

Beta coefficient expresses the degree of systematic or market risk or also the volatility of the fund's portfolio with respect to the selected benchmark. In essence, it indicates the sensitivity of the fund's portfolio returns to the development of the entire market. The instability of external factors will make ETF shares riskier, and this will have an impact on the decline in capital market performance, as described by Pasaribu et al. (2019). Mathematical notation of beta coefficient:

$$\beta = \frac{\sum_{i=1}^{i=n}\left[\left(r_i - r_{f,i} - \bar{r} - \overline{r_f}\right)x\left(r_{M,i} - r_{f,i} - \overline{r_M} - \overline{r_f}\right)\right]}{\sum_{i=1}^{i=n}(r_{M,i} - r_{f,i} - \overline{r_M} - \overline{r_f})^2} \tag{5}$$

Jensen alpha, together with beta, is the second regression parameter of the CAPM model. It measures the ability of the fund manager to generate the fund's return above the return given by the benchmark and also the ability to deal with systematic market risk. With his indicator, Jensen basically evaluates the work of fund managers and their ability to actively outperform the market:

$$\alpha_J = r - \left[r_f + \beta(r_M - r_f)\right] \tag{6}$$

Fig. 1 to 4 show a PMFG graph from a pair correlation matrix based on monthly data of all examined ETFs by individual continents. This graph is the first extension of the Minimum Spanning Tree (MST) and the full name is Planar Maximally Filtered Graph. PMFG is a comprehensive network that was first introduced in Tumminello et al. (2005) and Aste et al. (2005). In this case, the degree of similarity of the ETF is given by the Person's correlation coefficient. Individual ETFs are marked according to ticker. A lighter color indicates a stronger correlation between the funds. Conversely, a darker color indicates independence or even a negative correlation between individual ETFs. In terms of European ETFs, ETFs with a ticker of VGK, EZU, iEUR show a very strong positive relationship with all other ETFs from the same continent. Which can be seen from Fig. 1, where these bonds are shown lighter - yellow to orange. The average value of the correlation coefficient of these ETFs is around 0.95. On the contrary, EWU, EWL and EWP in particular show a lower positive correlation, while this correlation is on average 0.78. Fig. 2 graphically illustrates the interrelationships between ETFs from the Emerging markets continent. There is also a negative dependence, specifically between the EGPT and UAE funds with all other funds examined. The average dependence of these ETFs is on the value of the Person's correlation coefficient of 0.7. Fig. 3 shows the correlation relationship between ETFs from the USA. Where it is

not possible to find a perfect correlation between SPY and VTI funds with a correlation value of 1. However, other ETFs also show a high positive dependence with an average correlation value of 0.98. The last continent examined is the ETFs from Asia-Pacific shown in Fig. 4. The lowest dependence is shown by ETF with ticker EWY and EWT. The other Asia-Pacific again show a high positive correlation with each other with an average value of the Person correlation coefficient of 0.93.

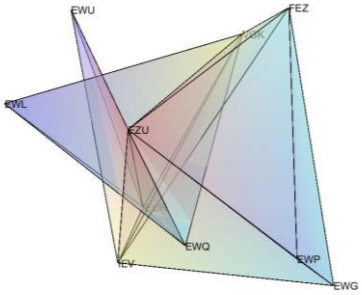

Figure 1 – PMFG graph from a matrix of Pearson's correlation of Europe ETFs

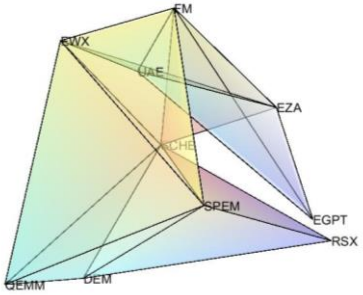

Figure 2 – PMFG graph from a matrix of Pearson's correlation of Emerging markets ETFs

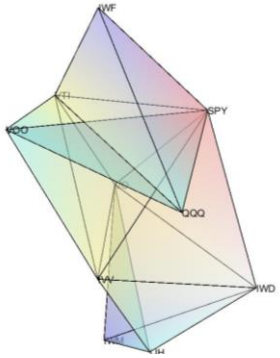

Figure 3 – PMFG graph from a matrix of Pearson's correlation of USA ETFs

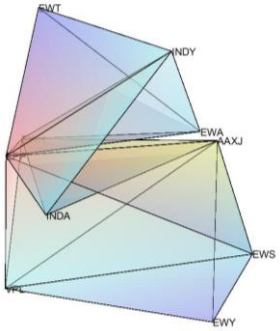

Figure 4 – PMFG graph from a matrix of Pearson's correlation of Asian-Pacific ETFs

IV. RESULTS - EVALUATION PERFORMANCE OF ETFS

In Tab. 1 shows the resulting values of the above indicators used to measure the performance of the ETF. The first indicator monitored is the return on funds. ETFs from the USA show the highest returns for the entire monitored five-year period, specifically the ETF with the QQQ ticker with a total yield of 111.79 % followed by the IWF with a yield of 90.80 %. From this point of view, ETFs from the USA can be described as the most profitable. ETFs from Europe and Asia-Pacific have a comparable return of around 20 %. The worst performers were ETFs from the Emerging market, where almost a third of the monitored funds made losses for the period 2015-2019. An exception is RSX, which can be compared in profit with US funds.

Table 1. Evaluation performance of ETFs

No.	ETF ticker	Average return	Standard deviation	Tracking error	Treynor ratio	Appraisal ratio	Information ratio
		Europe					
1	Vanguard FTSE Europe ETF (VGK)	19.75 %	13.58 %	3.18 %	13.88 %	0.21	0.87
2	iShares MSCI EMU ETF (EZU)	18.40 %	14.72 %	7.55 %	16.01 %	0.11	0.23
3	iShares Core MSCI Europe ETF (iEUR)	20.61 %	13.60 %	3.90 %	13.95 %	0.26	0.87
4	iShares MSCI Germany ETF (EWG)	7.65 %	15.88 %	7.26 %	17.27 %	0.08	0.22
5	iShares MSCI United Kingdom ETF (EWU)	4.85 %	14.08 %	10.14 %	15.62 %	0.06	0.11
6	SPDR EURO STOXX 50 ETF (FEZ)	15.13 %	15.38 %	7.45 %	16.58 %	0.15	0.33
7	iShares MSCI Switzerland ETF (EWL)	37.34 %	12.29 %	7.41 %	13.87 %	0.13	0.25
8	iShares Europe ETF (IEV)	15.93 %	13.41 %	7.41 %	14.62 %	0.15	0.30

9	iShares MSCI France ETF (EWQ)	33.77 %	14.54 %	7.34 %	15.64 %	0.14	0.27
10	iShares MSCI Spain ETF (EWP)	-4.28 %	17.81 %	8.19 %	18.15 %	0.12	0.20
	USA						
11	SPDR S&P 500 ETF (SPY)	68.53 %	12.10 %	2.32 %	12.34 %	0.17	0.84
12	iShares Core S&P 500 ETF (IVV)	69.00 %	12.07 %	2.23 %	12.32 %	0.17	0.90
13	Vanguard S&P 500 ETF (VOO)	69.25 %	12.00 %	2.12 %	12.31 %	0.17	0.95
14	Vanguard Total Stock Market ETF (VTI)	68.53 %	12.10 %	2.05 %	12.53 %	0.19	1.13
15	Invesco QQQ (QQQ)	111.79 %	15.12 %	0.75 %	15.23 %	0.06	1.25
16	iShares Russell 1000 Growth ETF (IWF)	90.80 %	12.73 %	1.12 %	13.04 %	0.10	1.11
17	iShares Core S&P Mid-Cap ETF (IJH)	43.87 %	13.82 %	0.93 %	14.31 %	0.11	1.69
18	iShares Russell 2000 ETF (IWM)	40.24 %	15.88 %	6.60 %	16.08 %	0.12	0.21
19	iShares Russell 1000 Value ETF (IWD)	43.44 %	11.70 %	6.18 %	14.76 %	-0.45	-0.76
20	Vanguard Mid-Cap Index ETF (VO)	50.42 %	13.29 %	3.36 %	13.33 %	0.12	0.42
	Asia-Pacific						
21	iShares MSCI South Korea ETF (EWY)	12.54 %	19.60 %	9.69 %	15.57 %	0.11	-0.15
22	iShares MSCI Taiwan ETF (EWT)	43.12 %	52.16 %	51.29 %	38.20 %	1.07	0.04
23	iShares MSCI All Country Asia ex-Japan ETF (AAXJ)	23.01 %	16.38 %	4.76 %	15.83 %	0.17	0.39
24	Vanguard FTSE Pacific ETF (VPL)	36.76 %	13.03 %	4.65 %	13.91 %	0.20	0.57
25	iShares MSCI India ETF (INDA)	13.12 %	16.34 %	6.71 %	13.94 %	-0.01	-0.32
26	iShares MSCI Pacific ex Japan ETF (EPP)	25.74 %	14.85 %	5.11 %	15.27 %	0.24	0.67
27	iShares MSCI Hong Kong ETF (EWH)	23.26 %	17.26 %	4.35 %	17.32 %	0.15	0.54
28	iShares MSCI-Australia ETF (EWA)	28.48 %	14.74 %	10.73 %	16.26 %	0.06	0.08
29	iShares India 50 ETF (INDY)	19.24 %	16.72 %	6.29 %	14.00 %	-0.05	-0.41
30	iShares MSCI Singapore ETF (EWS)	9.34 %	17.81 %	7.44 %	15.56 %	0.33	0.36
	Emerging markets						
31	Schwab Emerging Markets Equity ETF (SCHE)	18.02 %	16.49 %	5.16 %	16.62 %	0.17	0.46
32	SPDR Portfolio Emerging Markets ETF (SPEM)	19.18 %	15.72 %	3.62 %	16.22 %	0.16	0.72
33	WisdomTree EM Equity Income Fund (DEM)	18.08 %	17.61 %	9.21 %	17.64 %	0.41	0.61
34	VanEck Vectors Russia ETF (RSX)	68.56 %	22.76 %	7.14 %	22.45 %	0.19	0.51
35	iShares MSCI Frontier 100 ETF (FM)	14.84 %	14.57 %	6.27 %	12.44 %	0.15	-0.04
36	SPDR S&P Emerging Small Cap ETF (EWX)	10.35 %	14.86 %	6.44 %	17.27 %	-0.03	0.13
37	iShares MSCI South Africa ETF (EZA)	-16.79 %	23.22 %	17.93 %	21.09 %	0.00	-0.18
38	SPDR MSCI EM StrategicFactors ETF (QEMM)	11.29 %	14.33 %	5.12 %	17.05 %	-0.07	0.13
39	VanEck Vectors Egypt Index ETF (EGPT)	-47.32 %	25.48 %	7.98 %	23.85 %	-0.14	-0.65
40	iShares MSCI UAE ETF (UAE)	-17.39 %	18.53 %	7.73 %	19.10 %	0.11	0.24

In terms of risk, as measured by the standard deviation, despite the highest return, ETFs from the USA were placed. ETFs from Europe also show low risk, where the average standard deviation is around 14.5 %. On the contrary, the riskiest are ETFs from Asia-Pacific with an average value of 19.9 %. Here you can find even the riskiest ETF with an EWT ticker of 52.16 %. This high value can be caused by a high deviation from the benchmark, and thus by an inappropriately chosen underlying index or a compiled basket of assets that does not correspond to the underlying index. ETFs from Emerging markets, although not nearly as good as other funds, show higher risk with an average standard deviation of 18.3 %.

In Tab. 1, the ratios are given below. The first is in terms of passively managed ETF Tracking error. Hougan (2015) argues that the tracking difference is one of the most important statistics in evaluating ETF performance. The Tracking error is the difference between the fund's return and its benchmark return. Investors should expect that index fund returns underestimate the underlying index only to the extent of management fees (Frino and Gallagher, 2001). The lowest difference between ETF performance and the underlying index is for ETFs from the USA. Where, for example, the ETQ QQQ shows a deviation from the underlying index of only 0.75 %. In other words, this and other ETFs from the US perfectly replicate the underlying stock index. ETFs from other continents show a comparable deviation from the benchmark, where the indicator is around 7 %.

Another examined indicator is the Treynor ratio. The Treynor ratio expresses the reward for volatility, so a higher number is desirable, which means higher performance of the fund. However, this indicator does not include the total risk, measured by the standard deviation, but only the systematic risk, represented by the beta coefficient. The disadvantage of the Treynor ratio is the fact that it completely ignores the unique risk, as it presupposes a perfect diversification of the portfolio. This finding was also reflected in Tab. 1, where funds with identical systematic risk but with different overall risk are not quantified correctly, as a fund with higher overall risk does not have a completely diversified portfolio and achieves a higher unique risk. Examples are mutual funds and ETFs from Emerging markets, which according to this indicator show the highest performance per unit of risk, but this is not a completely true statement, as a substantial part of the risk, a unique risk, is omitted. On the other hand, funds with low or almost zero unique risk, specifically the American ETF, are worse off. For this reason, this indicator is often not used in practice.

The penultimate indicator in Tab. 1 is the Appraisal ratio. This indicator evaluates the quality selection of equities for the fund's portfolio by the manager and focuses on the non-diversified part of the portfolio. In summary, most ETFs show a positive value, which means that the fund manager manages to effectively select stocks in the portfolio, and thus the fund can outperform the market. Some funds from Emerging markets report negative values of this indicator. As a result, these funds fail to use specific risk effectively. It can therefore be concluded that the fund manager is not able to decipher suitable stocks with interesting return potential and include them in the portfolio.

The last analyzed indicator is the Information ratio. The higher the value of this indicator, the more successful the fund's management against the underlying index and the higher the portfolio's consistency. The traditional winners, as the table indicates, are the American ETFs, which indicates a higher performance in terms of the risk involved in investing in these funds. Other ETFs also achieve lower positive values. Negative values recur for ETFs from Emerging markets, from which it can be concluded that these funds are not more efficient than the benchmark.

Table 2. The segmentation of ETFs

Segment	$\beta < 1$ (defensive)	$\beta = 1$ (neutral)	$\beta > 1$ (aggressive)
$\alpha < 0$ (underperform)	IWD, EWX, QEMM	-	INDA, INDY, EGPT
$\alpha = 0$ (neutral)	-	-	-
$\alpha > 0$ (outperform)	EZU, EWG, EWU, FEZ, EWL, IEV, EWQ, VTI, IWF, VPL, EPP, EWA, SPEM, UAE	iEUR, EWP, VOO, IJH, DEM	VGK, SPY, IVV, QQQ, IWM, VO, EWY, EWT, AAXJ, EWH, EWS, SCHE, RSX, FM, EZA

In Tab. 2, segmentation of selected ETFs is performed in terms of beta coefficient and Jensen alpha indicators. These regression indicators are based on regression analysis, which is based on the classical CAPM model. The vast majority of ETFs have a value close to one, which is intuitive, as ETFs are based on the most faithful replication of the reference index, for which the vast majority of analyzed ETFs use full physical replication. Exactly one is achieved by European iEUR and EWP, American VOO, IJH and Emerging markets DEM. For other ETFs, the beta coefficient is just above or just below one. Beta analysis, the ETF have the type of stocks that are aggressive and defensive, as described by Hutabarat and Naomi (2016). Jensen's alpha represents the second regression parameter from the CAPM equation. It expresses the added value of the fund manager to achieve a higher return than the market return, taking into account the sensitivity of the fund to the movement of the entire market represented by the beta coefficient. If alpha shows positive values, it indicates the ability of the fund manager to beat the market and better deal with systematic risk, with a negative alpha, active portfolio management fails. These are mainly ETFs from Asia-Pacific and Emerging markets. In terms of segmentation, therefore, there are a total of 3 ETFs that are underperform-defensive; the same number in the underperform-aggressive segment; there are a total of 14 ETFs in the outperform-defensive segment; 5 ETFs in the outperform-neutral segment; and 15 ETFs in the outperform-aggressive segment; other segments remained unoccupied. Overall, 6 stocks are categorized as underperforming and 34 stocks are categorized as outperform.

V. DISCUSSION

In evaluating the performance of the ETFs, the Treynor ratio proved to be an inappropriate indicator, as it does not include the total risk, measured by the standard deviation, only the systematic risk, represented by the beta coefficient. This distorted the performance results when comparing between continents. ETFs with identical systematic risk but with different overall risk are not quantified correctly. It would be more appropriate to choose the Sharpe ratio instead of this indicator, or Sortino ratio. Sharpe ratio calculates with the total risk and is therefore particularly suitable for comparing funds across categories. The Sortino ratio takes into account the so-called asymmetric risk. This eliminates growth volatility from the calculation, which is positive for the investor, and calculates only the decline volatility that causes the investor a loss. He also proved to be a problem with Jensen's alpha, which neglects unique risk, according to the CAPM model, which assumes a perfectly diversified portfolio. For this reason, it is necessary to select not only appropriate evaluation indicators when evaluating the performance of the ETFs, as an inappropriately chosen indicator can significantly skew results and the investor can make the wrong decision and significantly lose the invested financial amount. Similarly, Hodges et al. (2013) that it is necessary to work carefully with these indicators.

VI. CONCLUSION

The paper focused on evaluating the performance of exchange-traded funds, referred to by the acronym ETF. A data set of 40 ETFs from four different continents was selected for research: Europe, USA, Asia-Pacific and Emerging market. A correlation analysis was performed using the PMFG chart, showing a strong positive dependence between funds from different continents. Subsequently, performance analyzes were performed using traditional indicators such as Treynor ratio, Jensen alpha, beta coefficient, Appraisal ratio, Information ratio and, last but not least, Tracking error. In terms of return and risk, US ETFs clearly dominate, being able to diversify their portfolios almost perfectly and replicate the underlying index. ETFs from Europe are in a similar situation, however, in terms of total return, they cannot be compared to ETFs from the USA. Conversely, ETFs from Emerging markets are not more powerful than the underlying stock index and do not have perfectly diversified portfolios. The ETFs from Asia-Pacific performed similarly. For investors who prefer to ETF with low volatility, they can choose a stock, which segmented in the outperform-defensive category. On the other hand, investors who prefer to stock with high volatility, they can choose a stock, which segmented in the outperform-aggressive category.

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VII. REFERENCES

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