

# The Impact of Covid-19 On the Performance of Exchange Traded Funds on Developed and Emerging Markets

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## Abstract

In this paper an endeavour was made to evaluate the impact of Covid-19 on the achievement of the investment objectives by selected ETFs in developed and emerging markets. For this purpose, the tracking errors calculated for 18 different ETFs operating on the basis of American, Asian and European stock indexes were analyzed.

The time range of the research was selected in such a way as to compare the period before the pandemic (pre-Covid) and the period after the pandemic (post-Covid). The research results show that the outbreak of the coronavirus pandemic has not had a negative impact on the degree of implementation of the investment objective, regardless of the degree of market development. For each of the analyzed markets, the calculated tracking errors were not higher in the post-Covid period as compared to the pre-Covid period. In the vast majority of cases, they were even lower. This means that the management of the ETF has run smoothly in the most turbulent period of the 21st century.

**Keywords:** ETF; Covid-19; Financial Market; Stock Indexes

## Introduction

The history of Exchange Traded Funds (ETFs) is relatively short, especially when compared with the history of other similar investment products available on the financial market, such as mutual funds or even index funds. The appearance of the latter in the 1970s gave rise to the operation of the passive funds segment (Bogle, 2016), which include the vast majority of ETFs (Perez, 2012; Marszk, 2018). The first ETFs were established successively in Canada, the USA and Japan in the first half of the 1990s (Foucher & Gray, 2014; Marszk & Lechman, 2019). The dynamic development of ETFs over the past years confirms the position of researchers who recognize this type of funds as the largest and most successful financial innovation in the field of investments (Deville, 2008; Antoniewicz & Heinrichs, 2014; Amenc et al., 2017). This is reflected in numerous and constantly growing scientific studies dealing with issues related to the functioning of the ETFs market.

In the world literature, studies can be found referring to three main thematic categories related to ETFs (Charupat & Miu, 2013). The first study examines the degree of implementation of the investment objective by the fund. In the case of passively managed ETFs, it is the most accurate representation of the rate of return obtained by the index on the basis of which the fund operates. The second group of studies refers to the effectiveness of the valuation of ETFs, which consists in determining the differences between the market valuation of ETFs and their net asset value (NAV). The consequence of this work is the determination of the factors influencing the emergence of these differences and the pace at which the arbitrage between different levels of the price of ETF shares and the value of the fund's assets is declining. (Bas & Sarioglu, 2015). Finally, in the third one, researchers are interested in the relationship between ETF's units and the financial instruments (shares, futures, etc.) that are part of the benchmark on the basis of which ETFs are operating. The available studies focus in particular on attempts to determine the impact of ETFs on the trading volume and the exchange rate margin of related financial instruments.

The research presented in this paper refers to the first of the three categories mentioned. The main objective is to investigate how the outbreak of the Covid-19 pandemic influenced the degree of achievement of the investment objectives by selected ETFs in developed and emerging markets. So far, few studies have been conducted to compare developed and emerging ETF's markets (Zawadzki, 2020), however, they have not focused on the period of the coronavirus pandemic. In 2020 ETFs faced unprecedented market volatility. The management of ETFs in such conditions seems difficult, which should be reflected in the problems with mapping the benchmark rate of return. In this study, it will also be verified whether the level of market development has had an impact on the investment results achieved by ETF managers.

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The structure of the paper is as follows: section two describes the current state of knowledge on Exchange-Traded Funds as a form of passive funds. The third section presents the tools for the measurement of ETF performance, called tracking errors. The fourth section deals with the results of the empirical analysis divided into two periods –prior the Covid 19 and at the time of Coronavirus. In the last section, the main conclusions are discussed and suggestions for future research are made.

## The main characteristics of ETFs

### *The definition and the size of ETFs' market*

Although the literature on the subject lacks a universal definition of Exchange Traded Funds (The International Organization of Securities Commissions, 2013; Hill et al., 2015; Madhavan, 2016; Investment Company Institute, 2017) as the most comprehensive and covering the most important attributes assigned to these funds should be considered the one proposed by Marszk et al. (2019), according to which ETFs are perceived as: innovative investment funds whose shares (participation units) are traded continuously on one or more markets, where the issue and redemption of shares (participation units) is a continuous process, determining a variable number of these instruments. The authors also point to an additional attribute, which is the link between the fund's share returns and the so-called benchmark, i.e. the portfolio or index on which the ETF is built.

Exchange Traded Funds are at the heart of the family of products known as Exchange Traded Products (ETPs). Apart from ETFs, these include (Marszk, 2016):

- ExchangeTraded Commodities (ETCs),
- ExchangeTraded Notes (ETNs),
- Exchange Traded Vehicles (ETVs).

The basic differences between ETFs and other ETPs lie in the instruments on the basis of which the relevant Exchange Traded products are created. While in the case of ETFs these are most often shares (Nawrot, 2007), ETCs are based on the commodity market (precious metals, energy commodities, etc.) using for this purpose derivative instruments in the form of futures or forward contracts (Ramaswamy, 2011). In turn, ETNs should be classified as debt instruments listed on stock exchanges. The return on these instruments depends on the performance of a specific benchmark, such as the bond market index (Dickson et al., 2013). The distinguishing feature of ETVs is that they are only traded on the American market and operate on a different legal basis than similar ETPs products (Abner, 2016; Marszk, 2016).

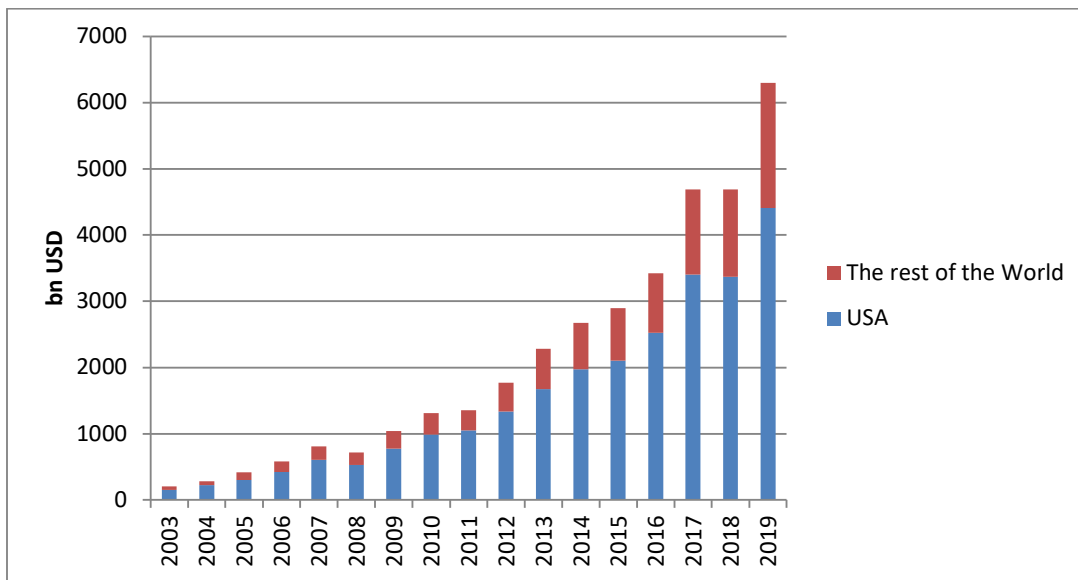
ETFs have the largest share of all ETPs in terms of both number of products and NAV. At the end of Q1 2021, this share was over 88% and over 97%, respectively (Table 1). Especially the latter value means that the importance of ETPs products other than ETFs should be considered marginal. Therefore, the focus of this study is on shares-based ETFs. These results also confirm that the outbreak of the Covid-19 pandemic did not reduce the interest in these investment products.

**Table 1: The number and assets of ETFs in comparison to ETP products**

Specification	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	IQ2021
Number of ETPs	2093	2546	3398	4085	4456	4750	5162	5711	6141	6627	7598	8066	8614	8893
Number of ETFs	1620	1970	2489	3032	3346	3611	3988	4457	4834	5285	6472	7081	7604	7845
No. of ETFs in No. of ETPs [%]	77,4	77,4	73,2	74,2	75,1	76,0	77,3	78,0	78,7	79,7	85,2	87,8	88,3	88,2
NAV ETPs [bn USD]	774	1158	1478	1526	1952	2403	2788	2998	3553	4840	4817	6363	7992	8563
NAV ETFs [bn USD]	716	1041	1313	1355	1772	2284	2675	2899	3424	4691	4685	6194	7737	8331
NAV of ETFs in NAV of ETPs [%]	92,5	89,9	88,8	88,8	90,8	95,0	95,9	96,7	96,4	96,9	97,3	97,3	96,8	97,3

Source: Author's own on the basis of ETFGI.





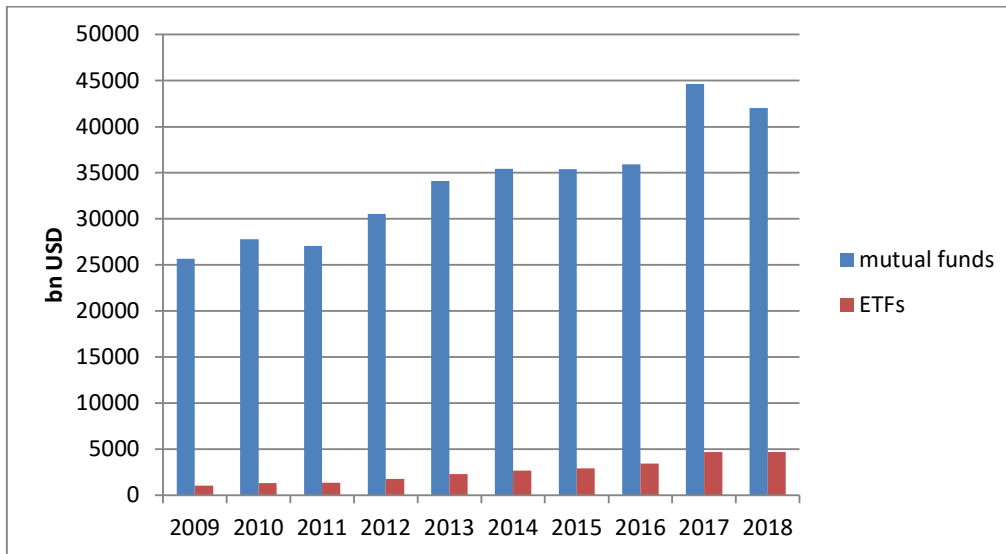
**Figure 1: Net Asset Value of ETFs in the World and in the United States**

Source: Author’s own on the basis of Investment Company Institute.

While the United States was not a pioneer in this regard, it is in this market that the number and value of ETFs traded is greatest (Figure 1). Each year between 2003 and 2018, the United States accounted for over 70% of global net asset value (NAV). Currently, the global ETFs market is worth over \$ 6 trillion. The United States alone has over 2,000 ETFs with assets in excess of \$ 4 trillion.

***ETF as an example of a passively managed fund***

Even though when considering all types of investment funds, the greatest importance should be assigned to collective investment funds, commonly known as mutual funds, the increase in the popularity of ETFs, visible especially in recent years, is noteworthy. While in 2009 NAV of ETFs accounted for approx. 4% of NAV of collective investment funds, in 2018 it was already over 11% (Figure 2). This is due to the growing interest in passive forms of investment, which, as previously was mentioned, include the vast majority of ETFs.



**Figure 2: The comparison of NAVs of ETFs and mutual funds**

Source: Author’s own on the basis of Investment Company Institute.

The development of passive portfolio management is rooted in the Efficient Market Hypothesis (EMH) hypothesis, assuming that the prices of financial instruments include information available at a given moment (Fama, 1970; Basu 1977; Malkiel 2003; Evans & Honkapohja, 2005; Sewell 2012; Konak, Seker 2014; Zawadzki, 2018). The translation of EMH on the market of investment funds should be understood in the way that, on the basis of all available market information, it is not possible to achieve higher rates of return for investments made through actively managed funds, compared to financial instruments reflecting the stock exchange index (Dębski, 2010; Chlebisz, 2018). Such instruments include passively managed ETFs, for which the strategy of modeling an investment portfolio on a selected index may be applied (Nawrot, 2007).

Among the studies on the scope of the fund's implementation of the investment objective, one should mention in particular those referring to the American market. They highlight the lower rates of return generated by holding an ETF compared to the benchmark. The reason for such an undervaluation is primarily the transaction costs associated with the purchase / sale of ETFs (Kotsovetzky, 2003; Bernstein, 2004; Agapova, 2011) and the adoption by fund managers of passive management strategies while attempting to reduce tracking error (Gastineau, 2004).

Apart from the American market, reference should be made to studies referring to ETFs operating in Europe. Also in this case, worse results of passive investment products compared to the benchmark are indicated. The main reasons for the undervaluation of ETFs are management costs and the fiscal aspect related to the differentiated method of income tax settlement by European investors (Milonas & Rompotis, 2006; Blitz, Huij & Swinkels, 2012). In addition to the aforementioned, it is more and more common to undertake research on the implementation of the investment objective in emerging countries that are characterized by high dynamics of economic growth. This case applies to both ETFs that are traded on the stock exchanges of individual countries, and funds operating on the basis of the stock indexes of these countries, but listed on the markets in the United States or Western Europe. Studies in this area emphasize the occurrence of higher levels of tracking errors in emerging economies compared to developed ones. The source of this state of affairs indicates, among other things, foreign exchange risk, or generally less liquidity for emerging markets (Shin & Soydemir, 2010; Blitz & Huij, 2012).

### The tools for the measurement of ETF performance

The basic tools for measuring the effectiveness of the degree of achievement of the investment objective include those related to estimating the tracking difference (TD) and tracking error (TE). Even though ETFs are assumed to follow the movement of the indexes accurately, in practice the returns on investments in ETFs differ from the rates of return of the replicated index (benchmark). The difference between the investment results achieved by an ETF fund and at the same time the results of the replicated index is referred to as the tracking difference. For example, if the return rate of a fund's investment is calculated at 10 % p.a., whereas the return rate of the benchmark equals 11 % p.a., it means that the tracking difference was -1% p.a. The formula for calculating the tracking difference at time t is as follows (Madhavan, 2016):

$$TD_t = (p_t - p_{t-1}) - (I_t - I_{t-1})$$

where:

$p_t$  - ln NAV values of the ETF fund at the end of period t,

$p_{t-1}$  - ln NAV values of the ETF fund at the end of period t-1,

$I_t$  - ln value of the income index (adjusted for dividend payment) at the end of the period t,

$I_{t-1}$  - ln value of the income index (adjusted for dividend payment) at the end of the period t-1.

Even if the return rate on the index differs from the return rate generated by the NAV of the ETF, this ought not to be a significant discrepancy. The tracking difference is utilised to identify potential revenues and costs that determine the occurrence of deviations from the index value.

The tracking difference is frequently confused with the term tracking error. In reality, however, these terms are not the same, as the TE allows the determination of the volatility of differences in the return rates generated by the ETF compared to the index on which the fund operates. That is the reason why it is rather a qualitative measure. Additionally, the TE may be subject to both ex post and ex ante measurements. The TD applies only to ex-post calculations. In the analysis of historical data, the tracking error is calculated either as the standard deviation of differences in the rates of return achieved by the ETF and a given benchmark, or as the variation of the tracking difference. Usually, calculations are made based on the formula above using daily rates of return (Madhavan, 2016). For TE forecasts, the covariance matrix of a particular risk model is utilised. This is defined as the volatility or standard deviation of the ex ante risk of the difference between the ETF and the benchmark.

It results from the above that the calculation of the TE is a bit more complex. There do not appear a single, universal method of measuring effectiveness in this area. In practice, several different tools of measurement are utilised (Roll, 1992; Pope & Yadav, 1994; Cresson, Cudd & Lipscomb, 2002). In terms of the TEs, these include measures described by the following three formulas:



1. The difference in return rates between the ETF and the benchmark:

$$TE_1 = \frac{\sum_{t=1}^n e_i}{n}$$

where:

$e_i$  – i-th ETF tracking error,

$n$  – number of observations,

$e_i = NR_{i,t} - ER_{i,t}$ ,

where:

$NR_{i,t}$  – ln of return rates of i-th ETF at time  $t$ ,

$ER_{i,t}$  – ln of return rates of the benchmark (index), on the basis of which i-th ETF at time  $t$  operates.

2. The arithmetic average of the absolute values of the daily tracking error levels:

$$TE_2 = \frac{\sum_{t=1}^n |e_i|}{n}$$

3. The standard deviation of the differences between the rates of return of the i-th ETF and the rates of return of the benchmark:

$$TE_3 = \sqrt{\frac{1}{n-1} \sum_{t=1}^n e_i^2}$$

From the investor's point of view, the values characterizing both the tracking difference and tracking error should be as low as possible.

## Research methodology and results

In this study, the tracking errors were calculated taking into account each of the above three approaches. Table 2 reports the profiles – including: name of the fund, ticker, benchmark (stock market index), inception year, total net assets, gross expense ratio and market type – of the 18 iShares Country Funds, six for each region (Asia-Pacific, Europe and the Americas) regarding the division into developed and emerging markets. This means that for each market type there are 9 ETFs, 3 for each region. The selection criteria was the size of net assets for each location and market development. Only the markets with the largest net assets were selected. It should be mentioned that the expense ratios of both US ETFs are the lowest considering the entire sample. This seems to be reasonable, since they target their own market, hence they are not the subject to the risks of cross border trading.

**Table 2: The main characteristic of ETF funds employed in the study**

Fund name	Ticker	Benchmark	Inception year	Net assets <sup>a</sup> [mln USD]	Gross expense ratio [%]	Market
<b>Asia Pacific</b>						
iShares MSCI India ETF	INDA	MSCI India Index	2012	5,622	0.69	emerging
iShares MSCI China ETF	MCHI	MSCI China Index	2011	4,891	0.59	emerging
iShares MSCI S.Korea ETF	EWY	MSCI Korea 25/50	2000	4,728	0.74	emerging
iShares MSCI Japan ETF	EWJ	MSCI Japan Index	1996	13,191	0.49	developed
iShares MSCI H. Kong ETF	EWH	MSCI Hong Kong Index	1996	2,025	0.49	developed
iShares MSCI Australia ETF	EWA	MSCI Australia Index	1996	1,552	0.5	developed
<b>Europe</b>						
iShares MSCI Russia ETF	ERUS	MSCI Russia 25/50	2010	632	0.59	emerging
iShares MSCI Turkey ETF	TUR	MSCI Turkey Invest.	2008	367	0.59	emerging
iShares MSCI Poland ETF	EPOL	MSCI Poland IMI	2010	295	0.61	emerging
iShares MSCI UK ETF	EWU	MSCI UK Index	1996	2,663	0.5	developed
iShares MSCI Germany ETF	EWG	MSCI Germany Index	1996	2,282	0.49	developed
iShares MSCI Switzerland ETF	EWL	MSCI Switz. 25/50	1996	1,181	0.5	developed
<b>Americas</b>						



iShares MSCI Brazil ETF	EWZ	MSCI Brazil 25/50	2000	10,248	0.59	emerging
iShares MSCI Mexico ETF	EWX	MSCI Mexico IMI	1996	726	0.49	emerging
iShares MSCI Chile ETF	ECH	MSCI Chile IMI	2007	512	0.59	emerging
iShares Core S&P 500 ETF	IVV	S&P 500 Index	2000	219,58	0.04	developed
iShares Russell 1000 Growth	IWF	Russell 1000 Growth	2000	52,535	0.19	developed
iShares MSCI Canada ETF	EWC	MSCI Canada Custom	1996	2,775	0.49	developed

<sup>a</sup> the data as of 31<sup>th</sup> of March 2020

Source: Author's own.

All data were collected with daily frequency using logarithmic returns of the ETFs in the case of funds, and logarithmic returns of the index value. They range from January 2019 to December 2020. Simultaneously the 2019 was treated as the pre-covid period whereas 2020 as a post-covid period. This division is proposed according to the fact that a novel coronavirus was identified by Chinese authorities at the very beginning of 2020. If the ETF fund replicates the benchmark (index) well, then the average tracking error is expected to be close to zero.

**Table 3: The results of Pre-Covid and Post-Covid tracking errors**

Ticker	Pre - Covid			Post - Covid		
	TE <sub>1</sub> [%]	TE <sub>2</sub> [%]	TE <sub>3</sub> [%]	TE <sub>1</sub> [%]	TE <sub>2</sub> [%]	TE <sub>3</sub> [%]
Asia Pacific						
INDA	- 0.052	0.150	0.151	-0.050	0.130	0.148
MCHI	- 0.055	0.265	0.275	-0.052	0.251	0.244
EWY	- 0.041	0.221	0.265	-0.033	0.217	0.232
Emerging total	- 0.045	0.216	0.208	-0.043	0.194	0.203
EWJ	- 0.027	0.087	0.087	-0.022	0.082	0.086
EWX	- 0.022	0.102	0.109	-0.019	0.090	0.080
EWA	- 0.030	0.133	0.164	-0.026	0.123	0.015
Developed total	- 0.026	0.108	0.112	-0.022	0.101	0.062
Europe						
ERUS	- 0.077	0.201	0.298	-0.070	0.196	0.264
TUR	- 0.044	0.302	0.287	-0.043	0.287	0.267
EPOL	- 0.049	0.222	0.202	-0.044	0.204	0.200
Emerging total	- 0.056	0.266	0.258	-0.055	0.243	0.248
EWU	- 0.041	0.195	0.187	-0.034	0.192	0.167
EWG	- 0.019	0.198	0.166	-0.016	0.187	0.154
EWL	- 0.011	0.142	0.130	-0.010	0.135	0.125
Developed total	- 0.034	0.168	0.149	-0.027	0.161	0.146
Americas						
EWZ	- 0.032	0.286	0.289	-0.030	0.252	0.288
EWX	- 0.033	0.312	0.332	-0.032	0.302	0.303
ECH	- 0.052	0.211	0.228	-0.050	0.196	0.225
Emerging total	- 0.042	0.268	0.265	-0.040	0.249	0.238
IVV	- 0.024	0.054	0.060	-0.022	0.051	0.055
IWF	- 0.016	0.065	0.070	-0.015	0.063	0.066
EWC	- 0.030	0.098	0.096	-0.030	0.097	0.092
Developed total	- 0.025	0.084	0.086	-0.023	0.082	0.072

Source: Author's own.

Generally, it can be seen that ETFs in the US exhibit the lowest level of tracking errors, since they target their own market, thus not being subject neither to the different trading times nor to the liquidity issues. At the same time, the tracking errors for emerging markets are higher compared to developed markets for each of the three regions. In general, the largest problems with index mimicking occur on European markets. The reason behind the mispricing between developed and emerging markets has been both: higher foreign exchange risk and generally less liquidity for emerging markets.

The results obtained in Table 3 do not confirm that the outbreak of the coronavirus pandemic would have a negative impact on the degree of implementation of the investment objective, regardless of the degree of market development. It may come



as a surprise, however, for each of the analyzed markets, the obtained tracking errors results were not higher in the post-Covid period as compared to the pre-Covid period. In the vast majority of cases, they were even lower.

ETF performance throughout the market volatility in the first part of 2020 demonstrated how ETFs can add stability to capital markets. In the face of record volatility, ETFs performed as designed. At the same time, investors did not give up investing in passive funds, which is reflected in the increase in the number and value of ETFs in the world.

## Conclusion

Throughout the pandemic and resulting market volatility, investors increasingly turned to ETFs to allocate capital and manage risk in their portfolios. While there are some areas that can be improved to further benefit investors, ETFs generally functioned well and delivered on investor expectations during the COVID-19 crisis despite facing the most turbulent market conditions in over a decade. The conducted research shows that the outbreak of the pandemic has not had a negative impact on the achievement of the investment objective by ETFs.

In most of the analyzed cases, tracking errors were lower in the post-covid period compared to the pre-covid period. In no case happened that the tracking error was higher. At the same time, higher tracking errors appeared in emerging markets. The results show that emerging markets prompt ETF mispricing. From the point of view of geographical coverage, the lowest values were recorded in the case of ETFs on US indexes, and the highest in the case of ETFs on European indexes.

Despite its signs of originality, the work is not free from drawbacks. In this regard, it should be emphasized that the paper indicates the discrepancies between the ETFs and the value of stock indexes, but it does not allow the reasons for these deviations to be determined. To obtain this aim, this study should be expanded by testing an econometric model in which the impact on the tracking error of adopted dependent variables, such as the exchange rate or the liquidity of a given market, would be analyzed.

## References

- Abner, D.J. (2016). *The ETF Handbook. How to Value and Trade Exchange-Traded Funds*, Wiley, New Jersey.
- Agapova, A. (2011). Conventional Mutual Index Funds versus Exchange Traded Funds. *Journal of Financial Markets*, 14 (2), 323-343.
- Amenc, N., Goltz, F. i Le Sourd, V. (2017). *The EDHEC European ETF and smart beta survey*. EDHEC-Risk Institute.
- Anadu, K., Kruttli, M., McCabe, P., Osambela, E., Shin, C.H. (2018). *The Shift from Active to Passive Investing: Potential Risks to Financial Stability?* Federal Reserve Bank of Boston, Working Paper, RPA 18-04.
- Antoniewicz, R. i Heinrichs, J. (2014). Understanding exchange-traded funds: How ETFs work. *ICI Research Perspective*. 20(5), 1-20.
- Basu, S. (1977). Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis, *The Journal of Finance*, 32 (3), 663-682.
- Bernstein, R. S. (2004). A Comparison of Tax Efficiencies of ETFs, Vipers, and Open and Closed End Funds. *Corporate Taxation*, 31(2), 34-38.
- Bas, N.K., Sarioglu, S.E. (2015). Tracking Ability and Pricing Efficiency of Exchange Traded Funds: Evidence from Borsa Istanbul, *Business and Economics Research Journal*, 6 (1), 19-33.
- Blitz, D. i Huij, J. (2012). Evaluating The Performance of Global Emerging Markets Equity Exchange-Traded Funds. *Emerging Markets Review* 13 (2), 149-158.
- Blitz, D., Huij, J. i Swinkels, L. (2012). The Performance of European Index Funds and Exchange Traded Funds. *European Financial Management*, 18 (4), 649-662.
- Bogle, J.C. (2016). The index mutual fund: 40 years of growth, change, and challenge, *Financial Analysts Journal*, 72 (1), 9-13.
- Charupat, N. i Miu, P. (2013). Recent developments in exchange-traded funds literature. Pricing efficiency, tracking ability and effects on underlying assets. *Managerial Finance*, 39(5), 427-443.
- Chlebisz A., (2018) Efektywność ETF w porównaniu do aktywnie zarządzanych akcyjnych funduszy inwestycyjnych na podstawie rynku kapitałowego w Polsce, „Rynek-Społeczeństwo-Kultura” nr 1(27), s. 46-50.
- Cresson, J., Cudd, R. and Lipscomb, T. (2002). The Early Attraction of S&P Index Funds: Is Perfect Tracking Performance an Illusion? *Managerial Finance*, 28 (7), 1-8.
- Deville, L. (2008). *Exchange traded funds: History, trading and research*, [w:] M. Doumpos, P. Pardalos, i C. Zopounidis (red.), *Handbook of financial engineering*, Springer, s. 67-98.
- Dębski W. (2010). *Rynek finansowy i jego mechanizmy. Podstawy teorii i praktyki*, Warszawa: Wydawnictwo Naukowe PWN, s. 509.
- Dickson J., Mance L., Rowley Jr. J. (2013), *Understanding synthetic ETFs*. Vanguard Research.

- Evans G.W., Honkapohja S. (2005). An interview with Thomas J. Sargent, *Macroeconomic Dynamics*, 9, s.561-583.
- Fama, E. F. (1970). Efficient capital markets: a review of theory and empirical work, „*The Journal of Finance*”, 25 (2), s. 383-417.
- Foucher, I., & Gray, K. (2014). Exchange-traded funds: Evolution of benefits, vulnerabilities and risks. In: Bank of Canada Financial System review, December, 37-46.
- Gastineau, G.L. (2004). The Benchmark Index ETF Performance Problem. *Journal of Portfolio Management*, 30 (2), 96-103.
- Gierałtowska, U. (2015). Fundusze indeksowe a fundusze ETF notowane na Giełdzie Papierów Wartościowych w Warszawie, *Zeszyty Naukowe Uniwersytetu Szczecińskiego nr 892, Finanse, Rynki Finansowe, Ubezpieczenia nr 78*, 55-74.
- Hill, J.M., Nadig, D., i Hougan, M. (2015). A comprehensive guide to exchange-traded funds (ETFs). Charlottesville, VA: CFA Institute Research Foundation.
- <http://www.etfgi.com>
- <http://www.ici.org>
- Investment Company Institute. (2019). Investment Company Fact Book 2017.
- Investment Company Institute. (2019). Investment Company fact book. A review of trends and activities in the investment company industry.
- Konak, F., Seker, Y. (2014). The Efficiency of Developed Markets: Empirical Evidence from FTSE 100, *Journal of Advanced Management Science*, 2 (1), 29-32.
- Kostovetsky, L. (2003). Index Mutual Funds and Exchange Traded Funds. *The Journal of Portfolio Management*, 29 (4), s. 80-92.
- Madhavan, A. N. (2016). *Exchange-Traded Funds and the new dynamics of investing*. Oxford University Press. New York.
- Malkiel B.G. (2003). *The Efficient Market Hypothesis and Its Critics*, CEPS Working Paper No. 91.
- Marszk, A. (2016). Impact of Innovative Financial Products on Financial Systems: Exchange Traded Products and the Polish Financial System. *Ekonomia Międzynarodowa*, nr 14, 114-131.
- Marszk, A. (2018). Polskie aktywa w zagranicznych funduszach inwestycyjnych typu Exchange-Traded Funds: rozmiary, struktura oraz znaczenie dla polskiego systemu finansowego. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 531*, 325-336.
- Marszk, A., Lechman, E., Yasuyuki, K. (2019). *The Emergence of ETFs in Asia-Pacific*, Springer.
- Marszk, A., & Lechman, E. (2019). *Exchange-Traded Funds in Europe*, Elsevier,
- Milonas, N. T. & Rompotis, G. G. (2006). Investigating European ETFs: The case of the Swiss exchange traded funds. *Arbeitspapier für die jährliche Konferenz der HFAA in Thessaloniki*, <http://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2007-Vienna/Papers/0232.pdf>
- Miziołek, T., Feder-Sempach, E. (2018). Czy fundusze ETF notowane na GPW w Warszawie dobrze odwzorowują wyniki indeksów?, *Studia i Materiały*, 1 (26), s. 37– 47.
- Nawrot, W. (2007). *Exchange-Traded Funds (ETF). Nowe produkty na rynku funduszy inwestycyjnych*. CeDeWu. Warszawa.
- Perez, K. (2012). *Fundusze inwestycyjne. Rodzaje, zasady funkcjonowania, efektywność*. Wolters Kluwer, Warszawa 2012.
- Pope, P.F. i Yadav, P.K. (1994). Discovering errors in tracking error. *The Journal of Portfolio Management*, 20(2), 27–32.
- Ramaswamy S. (2011), Market structures and systematic risks of exchange- traded funds, *BIS Working Papers No. 343*, Basel.
- Roll, R. (1992). A mean/variance analysis of tracking error. *The Journal of Portfolio Management*, 18(4), 13–22.
- Sewell, M. (2012). The Efficient Market Hypothesis: Empirical Evidence, *International Journal of Statistics and Probability*, 1(2), s. 164-178.
- Shin, S. i Soydemir, G. (2010). Exchange-Traded Funds, Persistence in Tracking Errors and Information Dissemination. *Journal of Multinational Financial Management*, 20 (4-5), 214-234.
- The International Organization of Securities Commissions. (2013). *Principles for the Regulation of Exchange Traded Funds*.
- Zawadzki, K. (2018). Wpływ czynników behawioralnych na decyzje inwestycyjne na rynkach rozwiniętych i rozwijających się, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 531*, 462-471.
- Zawadzki, K. (2020). The performance of ETFs on developed and emerging markets with consideration of regional diversity, *Quantitative Finance and Economics 2020, Volume 4, Issue 3: 515-525*.

