EMPIRICAL RESEARCH ON THE INFORMATION EFFICIENCY OF THE MACEDONIAN STOCK EXCHANGE

MSc Ivona Tasevska
ivonatasevska@gmail.com

ABSTRACT
One of the basic hypotheses in modern finance that defines financial markets is the Efficient Market Hypothesis. The existence of information efficient markets, where all information is incorporated in the price of financial instruments is the basis of rational economic theory. There may be an upward or downward trend in the financial markets, but after the inclusion of new information in the financial instruments, they would stabilize until the next new information. In addition to the definition of efficient markets, the hypothesis of random walk has a significant application, which explains that the market cannot be beaten and that prices and returns move in a random upward or downward direction. The paper includes two methodologies to confirm the efficiency of the financial markets. The first research was conducted in order to confirm the hypothesis of a random walk implementing a coefficient of variance test. The test was conducted using a large series of data of the returns' movement of stock exchange indices on the Macedonian, Belgrade, Zagreb, Sofia and Ljubljana Stock Exchange, as well as the American S&P500 index. The second research which is including the model of market multipliers was conducted for the most liquid stocks on the Macedonian Stock Exchange and selected stocks from the US Stock Exchange Markets, in order to show the underestimation or overestimation in relation to the market value of stocks, thus to show the sentiment that investors have when trading a certain type of stock. The results of the research show that the regional financial markets, as well as the domestic ones, do not follow the random walk, giving an opportunity to the possibility of using alternative behavioral approaches to explain the reasons for the deviation. For the second survey, where significant differences in the fundamental and market value of the stocks appear, the reason for the deviation is the expectations of investors.

Keywords: *Efficient Market Hypothesis, Random Walk, Stock Exchange, Behavioral Finance*

JEL classification: *G4, G11, G14*

1. INTRODUCTION

Neoclassical economic theory argues that financial markets are efficient, and market efficiency increases with increasing information reflected in the prices of financial assets. The first approach in analyzing the movement on financial returns is Efficient Market Hypothesis, which assumes that the market utilizes all available information, and thus the prices of financial resources reflect the available information. As defined by Fama (1970), "In an efficient market, at any point in time, the actual price of a security will be a good estimate of its intrinsic value." Rational investors immediately include new relevant information in the prices or returns of financial assets, and finally depending on the type of information, prices and returns are adjusted downwards or upwards, resulting in a decrease or increase in prices and returns on financial assets. Following the logic of anticipating information events, above-average returns are not possible, as above-average returns would be zero, even if riskier instruments are involved in trading. By incorporating information from the past and the present in today's prices

of financial assets, only the inflow of new information or news will cause prices to change. However, that information or news is unpredictable and therefore impossible to predict prices and returns on financial assets.

Random walk hypothesis defines that stock prices move in a random walk in an unpredictable way, and therefore expected price analysis is unsuccessful in proving future trends. The Variance Ratio Test, also known in the literature as the Lo-MacKinaly variance ratio test, is the most commonly used test in empirical research on the random movement of securities prices. The test is used to test the hypothesis of efficient markets by determining whether securities prices are self-correlated. If stock prices show a correlation it would mean that past stock price information can help predict stock prices in the future, thus breaking the weak form of the efficient markets hypothesis. If the test shows a coefficient of variance equal to one (1), it is proved that the stock prices are moving in a random path. However, if it is proved that the coefficient of variance is higher than 1 (> 1) it is proved that the stock prices do not move in a random path and the explanation can and should be sought in the alternative approach assisted by behavioral finance. The explanation for the existence of inefficient markets and the rejection of the random walk hypothesis is in the numerous information that regional markets do not filter, and as consequence of such occurrences accurate and significant information is not incorporated in stock prices and returns. On the other hand, speculative information has a significant impact and causes movements that do not stabilize as quickly and efficiently as in information-efficient financial markets. Therefore, the paper analyzes the variance ratios in order to define the movement in the stock prices.

Additionally, to the variance ratio test the paper includes one more research which is conducted in order to analyze the long-term intrinsic value of the stock. The purpose of the research is to point out whether the intrinsic value differs from the stocks' market value. The result should contribute in the findings of market efficiency and information inflow that should be incorporated in the stocks' value.

In the paper, two researches have been introduced which differ by the statistical and methodological approaches. However, the main goal between the two researches is analyzing results about the informational efficiency of the stock markets by two different empirical aspects. The paper summarizes two different empirical approaches that should show whether rational approaches are sufficient to determine the movement of stock prices, or the asnweres should be serached in different areas in the finance, such as behavioral finance.

2. EMPIRICAL RESEARCH OF THE HYPOTHESIS OF A RANDOM WALK WITH SAMLE OF MACEDONIAN STOCKS

The Variance Ratio Test $z_N = \frac{VR\,(N)-1}{\sqrt{v_N/_n}}$ is implemented through the research in the returns of the stock exchange indices. The data sets that were applied in the research are based on the available data sets and are the following: data series of 1398 inputs for MBI10, data series of 1218 inputs for BELEX, data series of 1433 inputs for SOFIX, data series of 1096 inputs for CROBEX, data series of 870 inputs for SBITOP, and the largest data series of 2518 inputs for S&P500. The data sets satisfied the two conditions for successful testing: (1) the data series must be wide-ranging i.e. minimum over 30 to obtain an accurate z-stat value; and (2) the stocks' returns periods (n) should have minimum difference between the data sets i.e. the analyzed periods were 2, 4, 8 and 16 days. In order to confirm the hypothesis of a random walk, the coefficient of variance should be one (1).

From the data presented in accordance with the conducted research for each of the stock exchanges, it is inevitable to conclude that the hypothesis is rejected. Additionally, the test results are displayed:

Table no.1 – Variance ratio for analyzed indexes

	VR(2)	VR(4)	VR(8)	VR(16)
MBI10	1.20	1.35	1.54	1.56
BELEX15	0.96	1.06	1.27	1.23
SOFIX	1.00	1.10	1.33	1.46
CROBEX	0.94	1.12	1.43	1.65
SBITOP	0.96	1.04	1.24	1.40
S&P	0.84	0.86	0.80	0.74

Source: analyzes made by the author

In the analyzed samples, the market that has the lowest value of the coefficient of variance is defined as the most efficient, and that is expected to be the S&P 500 index which has the closest values up to one (1) for the analyzed period. Balkan stock exchanges in terms of information inefficiency are within almost the same limits, although the Belgrade Stock Exchange shows minimal slightly better coefficients of variance. According to the variance coefficient test, the Macedonian Stock Exchange is also an inefficient information market, where the relevant information is not properly incorporated in the prices and returns of the stocks. The answer to the reasons for information inefficiency should be confirmed by the alternative behavioral approach that offers the option of detecting heuristics and controlling them appropriately.

3. DEVIATION OF THE STOCKS' PRICES FROM THE MODEL OF VALUATION WITH MARKET MULTIPLIERS

To define the long-term intrinsic value of the stock, the fundamental factors are used that determine the performance of the company, where the market value of the stock is obtained. The most accurate theoretical model for stock valuation is the discounting of expected dividends or net profits. However, because the discount model is complex and requires a detailed and complex discount rate estimate to determine the present value of the expected dividend flow, simpler alternative approaches are used in practice. The market multipliers model is an approach that more applicable in research, but care should be taken when interpreting estimates of fundamental value obtained with these indicators that are considered approximate. The stock valuation model using both market price multipliers allows for a relatively simple way to estimate the market value of stocks. The two most popular multipliers are: (1) market price per stock / net profit per stock "P / E" and market price per stock / book value per stock "P / B" . Establishing a link between these two indicators creates a simple model for estimating the market value of a stock: $P/E = \frac{P/B}{E/B} = \frac{P/B}{ROE}$, where "ROE" is an indicator of profitability as a rate of return on equity. By implementing the data for the values for the multiplier " R / V " and "ROE" , the market value of the action "P $_m$" is performed with the following model: $P_m = \frac{[P/B]*E}{ROE}$. According to the model, stocks where the market price is lower than the market (fundamental) value are considered relatively undervalued stocks. Hence, they can be expected to have potential for future price growth which would close the gap in terms of their long-term value. In the opposite direction is the explanation for the stocks

where the price is above the value, they are defined as relatively overvalued, and without significant potential for significant growth of the market price in the future.
Table 2 presents the estimates for the deviation of the average prices of the ten stocks from the MBI10 index for 2020 in relation to their market values calculated according to the model of market multipliers, as well as the most liquid stocks in 2021. However, the past two years are atypical periods for sample analysis under the influence of the pandemic, so it may result in unusual conclusions, especially due to the increase in banks' profits, which are a large part of the sample. The data used for the analysis of the fundamental value of the stocks are the available data for 2020, except for 4 companies for which the available data for 2021 were used.

Table no.2 – Analysis of fundamental value of stocks

Company	Average stock price	Market value by the model	Diccount / premium results
Komercijalna Banka (KMB)*	12,723.19	10,585.53	20.19%
Alkaloid (ALK)	18,608.59	13,882.17	34.05%
Tutunska Banka (TNB)*	29,000.00	25,514.37	13.66%
Makpetrol (MPT)	76,000.00	37,296.47	103.77%
Granit (GRNT)	1,320.00	430.28	206.77%
Stopanska Banka (STB)*	1,540.96	1,273.12	21.04%
Replek (REPL)	92,001.00	110,123.40	-16.46%
Makstil (STIL)	100.00	193.92	-48.43%
Stopanska Banka Bitola (SBT)	3,206.01	5,478.28	-41.48%
Makedonski Telekom (TEL)	364.51	334.94	8.83%
TTK (TTK)*	1,350.00	776.09	73.95%
Makedonija Turist (MTUR)	4,700.00	(2,873.20)	-263.58%

Source: analyzes made by the author

Furthermore, eight of the stocks are overvalued (KMB 20.19%, ALK 34.05%, TNB 13.06%, MPT 103.77%, GRNT 206.77%, STB 21.04%, TEL 8.83%, TTK 73.95%), and the other four stocks of the sample are undervalued (REPL -16.46%, STIL -48.43%, SBT -41.48%, MTUR -263.58%). From the group of undervalued stocks, the most underrated stock of Macedonia Tourist stands out (discount of 263.58%) due to the negative net profit per stock "E". For other stocks, the reason for the discounts is the result of the additional return (a kind of liquidity premium) that investors demand due to the shallowness of the market for individual stocks, which in turn reduces the market price below market value. Specifically, the illiquid small selection of stock types causes reluctance to trade with one type of stock, and favoring and focusing on another type of stock (overvalued stocks). Recognizing that the research data are data influenced by the pandemic, underestimation as well as overestimation of stocks on a large scale also comes from herd behavior, focusing and creating favored stocks. Consequently, the overvalued stocks, as it was emphasized, are mostly from the banking sector, which announced excellent financial results for the past two years, which further encourages investors to focus on them. The probability of the premium that appears with these stocks is the sentiment of the investors and the security they have from the stocks in their portfolio, for several reasons: (1) regular dividend payment, (2) good financial results and (3) expectations for further growth of price and higher yields.
To confirm the relevance of the model, a sample analysis of ten (10) stocks of US companies traded on world stock exchanges in 2021 was performed. In sample of 10 randomly selected

stocks 7 are overvalued, i.e. with a premium (FB 62.51%, TSLA 25.20%, AMZN 31.61%, WMT 0.07%, PYPL 122.65% MSFT 11.73%, JNJ 10.42), and the other 3 stocks are undervalued (AAPL -1.67%, KO -9.86%, WFC -0.69%). Overvalued stocks are in most of the technology sector, which is especially favored by investors after the outbreak of the pandemic. From the case of the selected stocks, the biggest impression is left by the WFC stock which has the smallest deviation between the average market price and the long-term fundamental value.

Table no.3 – Analysis of fundamental value of stocks

Company	Average stock price	Market value by the model	Diccount / premium results
Meta Platforms (FB)	330.27	203.23	62.51%
Tesla (TSLA)	832.71	665.09	25.20%
Amazon (AMZN)	3,351.50	2,546.51	31.61%
Wal-Mart (WMT)	142.37	142.28	0.07%
Apple (AAPL)	151.83	154.41	-1.67%
Coca Cola (KO)	56.56	62.75	-9.86%
Wells Fargo & Company (WFC)	48.88	49.22	-0.69%
PayPal Holdings (PYPL)	233.74	104.98	122.65%
Microsoft Corporation (MSFT)	297.94	266.67	11.73%
Johnson&Johnson (JNJ)	167.31	151.53	10.42%

Source: analyzes made by the author

4. CONCLUSION

In the paper, two researches were conducted, the first one in order to confirm the hypothesis of a random walk on the Macedonian Stock Exchange, including the regional stock exchanges, and the second research in order to confirm the deviations between the long-term fundamental value of the stock and its market value. For the first study, the hypothesis is rejected using a coefficient of variance test where all the results for all stock exchanges showed significant deviations from the hypothesis, except the stock index S&P500, which showed that it is the most efficient and closest to the random walk hypothesis. The reasons for the information inefficiency of the regional stock exchanges are the numerous information, the significant ones of which are not incorporated in the price, and the speculative information causes irrational movements in the financial markets. The hypothesis of the second research was confirmed by using the model of market multipliers, which recorded significant discounts / premiums of stocks in relation to the market value. The reason for the significant underestimation and overestimation of stocks is the sentiment of investors, the behavior of the herd and the favoring of a certain type of investment industry. The conclusion of the researches is that although the use of models from the neoclassical economy gives us an empirically accurate overview of financial markets, the explanation for rejecting rational hypotheses and behavior should be derived from alternative approaches such as behaviorist finance that interprets investment behavior.

REFERENCES

1. Burton, E., Shah, S., (2013), *Behavioral Finance* , John Wiley & Sons, Inc., Hoboken, New Jersey
2. Cuthbertson, K., Nitzsche, D., (2005), *Quantitative Financial Economics*, Second Edition, John Wiley & Sons, Inc., Hoboken,

3. Cuthbertson K, Nitzsche D, (2001), *Investment spots and derivative markets*, John Wiley & Sons, USA
4. Fama, E., (1970), "Efficient Capital Markets: A Review of Theory and Empirical Work", *The Journal of Finance* , Vol.25 (2), pp.383-417
5. Fama, E., French, K., (1992), "The Cross-Section of Expected Stock Returns", *The Journal of Finance* , Vol.47 (2), pp.427-465
6. Fama, EF, French, KR, (1996), "Multifactor Explanations of Asset Pricing Anomalies", *Journal of Finance* , Vol. 47 (1), pp. 426-465
7. Filipovski, V., (2017), Vrednuvanjeto na makedonskite *akcii, Ekonomija i Biznis* , June 2017
8. Filipovski, V., Tevdovski, D., (2018), Stock market efficiency in South Eastern Europe: testing return predictability and presence of calendar effects
9. Gitman JL, Joehnk DM, (2004), *Fundamentals of investing* , Eight Edition, Pearson Education Inc. Boston
10. Shiller, R., J., (2003), "From Efficient Markets Theory to Behavioral Finance" *Journal of Economic Perspectives* , Vol. 17 (1), pp. 83-104
11. Taylor JS, (2005), *Asset Price Dynamics, Volatility, and Prediction,* Princeton University Press, Princeton and Oxford
12. Macedonian Stock Exchange AD Skopje (mse.mk) , accessed in February 2022
13. Yahoo Finance - Stock Market Live, Quotes, Business & Finance News , accessed in February 2022
14. SEE Link - Home (see-link.net) , accessed in February 2022
15. S&P 500 (SP500) | FRED | St. Louis Fed (stlouisfed.org) , accessed in February 2022