Information Efficiency in Small and Underdeveloped Financial Market

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Abstract: *Testing the efficient market hypothesis can always bring interesting points regarding the functions of the financial markets. Every investor wants to beat the market, and therefore he is trying to find information that will gain him some privileges. On the other side, the stock exchanges and regulatory agencies are striving to eliminate those information privileges. This is where market efficiency, its theory, and its forms come into question. Until today one can find research on testing the efficiency of different developed markets. However, there are still a lot of gaps in research involving small and underdeveloped markets. This research may put the developing markets on the investment opportunities map of international investors. The purpose of this paper is to show how information efficiency relates to the Macedonian stock market by testing the weak form efficiency, using the augmented Dickey-Fuller (ADF) test to observe whether they contain a unit root or not. The results will be used to show the opportunities for adopting a profitable investment strategy using the technical analysis of the Macedonian stock exchange. Additionally, the results show that by using the mouthy price differences one cannot beat the market as the prices are moving with a random walk, which is not the case if investors are analyzing daily price differences.*

1. INTRODUCTION

Valuation and determinants of asset prices are important preconditions for the rational decision-making process. Knowing the intrinsic value of the asset investors own or are planning to buy is undoubtedly of great relevance for market developments. Although there is a consensus on the previous facts, there are doubts about the efficiency of the markets. In the modern market economy, the value of financial assets is expected to be explained with the Efficiency Markets Hypothesis (EMH). Finally, a key question is whether prices reflect the information for one financial instrument.

Even, EMH is popular, yet connected with numerous dilemmas, the empirical analysis fundamentally incorporates its hypothesis in financial markets research. In addition, modern science can not ask investors to share their wisdom. Contrary, financial analysis is based on empirical research of the past time series.

The main goal of the paper is to evaluate the Macedonian financial market's weak efficiency. Literature review reveals that there is numerous efficiency hypothesis researched in many countries, but that is not the case for the Macedonian capital market. Furthermore, North Macedonian financial market characteristics allow to only test for the weak form, and not the semi-strong, or even the strong form of efficiency.

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The paper empirically tests the hypothesis of the weak form of efficiency of the Macedonian financial market with several empirical tests on the stock prices constituting the MBI 10 index for the period of 05.01.2016 – 10.10.2019.

2. LITERATURE REVIEW

The Efficiency Markets Hypothesis (Fama, 1965), tested in many countries, shows low efficiency through numerous research. It is also well known that the Rational Expectations Theory and the development of EHM as a financial markets-specific theory are subject to the 2013 Nobel Prize for Fama and Shiller. According to Fama there are no fully efficient markets, as well as there is no fully competitive market. The overall conclusion of the weak-form empirical test is that market development is a significant determinant, as well as the specific research technique. Early research, suggests that the weak efficiency form comes from the low level of serial correlation and the level of transactional costs. Solnk (1974), analyzed 234 stocks in 8 major European capital markets and confirmed the market efficiency, which is still lower than the US market.

Hudson, Dempsey и Keasey (1996), analyzed the returns in the capital market in England for 58 years, concluding that rules of trading can explain the efficiency, but at the same time that it is not enough to make above-average returns. Another research on big and developed markets suggests that the random walk hypothesis is rejected, leading to predictability in the elements of the returns. The same research proves the mean reversion of the long-term returns. More specifically, autocorrections take negative prefixes for the first two years, reaching minimal values in the period of the third and fifth year, ending in zeros afterward. One possible explanation is connected with expected returns or overreaction of the investors, which leads to stock prices fluctuating around their fundamental value.

Various research on Hungarian, Russian, Greek, Portugees, Chezch, Polish and Turkish markets, (Abrosimova, Gishan, and Linowski 2002, Classens, Dasgupta, and Glen 1995, Gilmor and Memanus 2003), rejects the hypothesis on a random walk, referring to nonefficient markets. Worhington and Higgs (2003), analyze the EHM on 16 developed and 4 developing markets, confirming the weak efficiency in German, Irish, Portugees, Swedish, English, and Hungarian markets. Here, it should be emphasized that market liberalization and efficiency are in positive relation. Namely, based on calculations of the relation of variances and nonparametric tests, Kim and Singhal (2000) conclude that markets tend to be more efficient after liberalization.

EMH is still respected in the literature dealing with capital markets since high efficiency is primarily connected with cost efficiency (Blume, Durlauf, 2015). Additionally, the research should consider investors' emotions and different transaction costs as a reason for discrepancies in fundamental changes in value and current stock prices (Goedhart, Koller, Wessels, 2010).

Accepting the weak efficiency form is related to current and correct price adjustments after relevant information, such as mergers, acquisitions, stock splits, etc. The seasonal character of the stock prices is inconsistent with EMH. The existence of EMH anomalies recognized as the January effect, overreaction, mean reversal, small firm effects, etc, suggest a more comprehensive approach to stock price movement analysis. Today is widely accepted that market efficiency contradictions relate to investors' irrationality, leading to accepting behavioral finances, as a combination with the core EMH.

Although there are numerous constraints in measuring price efficiency, the need for price information level; the level of investor informativity, as a fundamental for investing in capital markets, still must be a priority in academic research efforts.

3.   DATA AND METHODOLOGY

The paper shows the results of the weak form Market Efficiency test based on a random walk model, defined as a process with a current value dependent on past values:

$$X_t = X_{t-1} + \varepsilon_t, \text{ or, } X_t - X_{t-1} = \rho + \varepsilon_t \tag{1}$$

Only when $\rho = 1$, we can conclude for unstationary process, thus random walk.

$$\Delta(X_t - X_{t-1}) = \rho - 1 + \varepsilon_t \tag{2}$$

The coefficient $(\rho - 1)$ is measured with the least squares method. Measuring the coefficient helps to accept the hypothesis for a random walk when $\rho = 1$, and refusing when $\rho < 1$.

Random walk is described as:

$$P_t = P_{t-1} = \varepsilon_t, \text{ where } \varepsilon_t \in IID, N(0, \sigma^2) \tag{3}$$

Where, P_{t-1} is the stock prices in $t-1$, ε_t error term with $(0, \delta^2)$, and is a stochastic process.

Additionally, the paper consists of a unit root test, augmented Dickey-Fuller test, autocorrelation, and run test. The data used to test the hypothesis is defined with daily, weekly and monthly values of the MBI 10 index for the period of 05.01.2016 – 10.10.2019. Data series usually are nonstationary as a trend and seasonal oscillations. Thus, it was crucial to run the necessary data consistency tests. Descriptive statistics show, that for the analyzed period the value of the MBI 10 index has a rising trend, with several episodes of decline. The overall rise is more than 100%, and the analyzed period is connected with political shifts, mainly toward improving the political prospects of the Macedonian economy.

Figure 1. MBI 10 movement
Source: Macedonian stock exchange

Testing the efficiency in transitional capital markets, such as Macedonian, should involve the liquidity, institutional and regulatory context, size, and information characteristics. In other words, refusing the efficiency hypothesis does not necessarily mean that investors are gaining over-average returns, meaning that inefficiency may come because of low liquidity and the ability to realize the transaction with current market prices.

Proving the random walk hypothesis means that Macedonian investors can not beat the market, or that the Macedonian stock market is efficient. Opposite, if the test determines serial correlation in daily, weekly, or monthly stock returns, proving that the series is stationary, with no unit root, the analysis can reject the null hypothesis – prices are moving with a random walk.

Hypothesis testing is based on random walk models, specifically: movement test, run тest, auto-correlation test, and unit root test (ADF, KPSS). For every test, the hypothesis is given in Table 1.

Table 1. Methods used to test the hypothesis

Run тest	Autocorrelatoion test	Unit root testADF	Unit root test KPSS
X_0: *Returns are independent* X_a: *Returns are dependent*	X_0: *returns are not in correlation* X_a: *returns are in correlation*	X_0: *Series has a unit root* X_a: *Series does not have a unit root*	X_0: *Series is stationary* X_a: *Series is not stationary*

Source: Author's research

Accepting the hypothesis that the returns are independent, not in correlation, do not have unit root and the series is stationary leads to accepting the null Hipotesis - prices are moving with a random walk.

4. RESULTS

A weak form of efficiency is tested with the logarithm of the daily, weekly, and monthly index of the returns:

$$R_t = \log\left(\frac{P_{It}}{P_{It-1}}\right) \qquad (4)$$

Estimating with computer software, the results of the different tests are given in Table 2.

Estimated results suggest that the hypothesis X_0 for all three models is rejected. As we can see all three series have a p-value below 0,05. That leads to the conclusion that daily, weekly, and monthly returns are not random and that in the analyzed period the results find an inefficiency market for MBI 10 index. As well as the Run test, with the correlation test, the results detect a statistically significant (+) coefficient of correlation in lag 1. Thus, again we are refusing X_0 and accepting X_a for all three series, concluding that the Macedonian stock market is not moving with a random walk. Another characteristic of weekly data is that they have the highest positive coefficient of correlation, meaning that when investors use technical analyses can beat the market.

Unit root test where the p-value is below the critical value for all three series whilst again refusing the null hypothesis. Accepting the alternative hypothesis means that the prices at the Macedonian stock market, more specifically the stocks consisting of the MBI 10 do not move with the random walk. Only with the KPSS test for daily and weekly returns, we can find a random walk, but in this stage, we must treat such a case as an exclusion, rather than a rule (Table 3).

Table 2. Results of the different tests

Run test	R_{td}	R_{tw}	R_{tm}
Number above cutoff	1533	1499	83
Number below cutoff	1462	1479	65
Number of runs	1099	491	59
E (R)	1448,355	1447,815	71,071
Stdev (R)	26,895	26,885	5,880
Z-value	-12,989	-35,589	-2,053
p-value (2-tailed)	0,000	0,000	0,040

Lag	R_{td}	R_{tw}	R_{tm}
1,00	0,3987	0,8811	0,1440
2,00	0,0480	0,6793	0,0676
3,00	-0,0077	0,4695	-0,0749
4,00	0,0111	0,2704	0,1109
5,00	0,0092	0,1203	0,0147
6,00	0,0600	0,0900	0,0597
7,00	0,0332	0,0987	-0,1054
8,00	0,0270	0,1162	0,0064
9,00	0,0464	0,1360	0,0247
10,00	0,0385	0,1497	-0,0748
…	…	…	…
139,00	0,0353	-0,0327	0,0002

Source: Author's research

Table 3. Results of the different tests

KPSS тest	R_{td}	R_{tw}	R_{tm}
Eta (Observed value)	0,177	0,116	0,169
Eta (Critical value)	0,475	0,438	0,475
p-value (one-tailed)	0,331	0,563	0,351
Alpha	0,05	0,05	0,05

ADF тest	R_{td}	R_{tw}	R_{tm}
k	14	14	5
Tau (Observed value)	-10,954	-9,516	-4,154
Tau (Critical value)	-3,384	-3,384	-3,421
p-value (one-tailed)	< 0,0001	< 0,0001	0,007
alpha	0,05	0,05	0,05

Source: Author's research

5. CONCLUSION

Determining the price value is crucial for every investor. They invest a lot to find undervalued stocks. Even though country regulators, stock exchange, and company corporate culture make a great effort to publish every important and relevant information, academic research seeks certain results in market efficiency. The most relevant question is whether the level of efficiency is weak, semi-strong, or strong. The Efficient Market Hypothesis is widely tested, and still, dubious results can be found in different countries and periods. Even though the analysis of EMH is from decades ago, the analysis of the Macedonian stock market is at its very beginning.

The empirical research on hypothesis testing, with several techniques, suggests that all three series (daily, weekly, and monthly) return of the MBI 10 index refuse the null hypothesis for the random walk. Thus, the paper concludes that the Macedonian stock market is inefficient in its weak form.

This conclusion can be supported by the latest developments in the Macedonian stock market. The extremely high global political risks, global economic threats, and changes in the key stock price determinants, such as interest rates, has a low effect on current stock prices. Additionally, even though some professional investors' analysis suggests that some stocks are at a "sell" position, their prices still have days of increase or moderate levels of decrease.

Literature suggests that the inefficiency and the level of stock market development are a direct link. Together with the development of the stock market, political and economic stability and economic development are key determinants for price efficiency. Additionally, in discussing future measures, institutional reforms are the key aspects. The specter of measures relates to every policy maker in the country (government, central bank, securities market regulatory agencies, stock exchange, academia) in coordinating activities towards better regulation, higher financial literacy, liberalization, etc. In that context, every measure should ultimately rise the information efficiency for both, investors' and companies' benefits.

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