LIQUIDITY AND INFORMATIONAL INEFFICIENCY. THE CASE OF ROMANIA

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Abstract

The theory of financial markets developed by Eugene Fama was one of the conceptual bases of the studies trying to explain the financial assets' price changes. This theory was also important for the development of certain segments of the financial industry, such as mutual funds, in terms of supporting the development and diversification of these funds, understanding the raise in the value of the assets under administration and the importance of this segment within the financial market.

We shall test the efficient market hypothesis on the Romanian capital market, using the closing values of the BET index (the most important index for the Bucharest Stock Exchange) for the period January 3rd, 2007 – March 13, 2015. We perform the unit root tests, Jarque-Bera test, multiple variance ratio test and the GARCH model. The results of the study show that the Romanian capital market does not present the weak form of informational efficiency. A possible explanation comes from the low liquidity of the Romanian capital market, so that the price of the listed companies is not a relevant measure for the intrinsic value of those companies.

Keywords: efficient market, capital market, index, return

JEL Classification: G14, G15

1. Introduction

A milestone work of the Chicago School followers, whose validity was questioned by the recent global financial crisis (some saying that this theory is obsolete), the Efficient Market Hypothesis (EMH) was developed by Eugen Fama at the beginning of the 1960's, one of the first models being presented in his PhD dissertation at the University of Chicago Booth School of Business. According to the EMH, in an active market for financial instruments, where the participants have access to all the available and relevant information related to a company, the current price reflects all these information.

In one of the definitions of the informational efficient market, Eugene Fama takes into consideration the requirement that the

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market participants are rational, and their number is high, acting in a manner that makes possible for them to maximize their own return (in order to do that, they try to estimate the future prices of the financial instruments, considering all the available information). Moreover, in order for the price to reflect in a short time the new available information related to a company, a necessary requirement for the validity of the EMH is that the market should be liquid (such that exists some transmission mechanism of the information into the price).

After more than 50 successful years in both the academic and practitioners' fields, the EMH was seriously under question by the occurrence of some extreme events, hardly anticipated and explained by this theory. Such events were the 16% drop of the Dow Jones index in less than 3 weeks in July 2002 (from 9,250 points to 7,750 points), the 70% plunge of the index of high-tech companies listed on NASDAQ stock exchange in March, 2000-Ooctober, 2002, or the 50% drop of the US markets between March, 2008-March, 2009.

In this article, we briefly analyze the EMH validity of the Romanian capital market, using the closing values for the BET index in January, 3rd, 2007 – March, 13th, 2015. Moreover, we will discuss about the illiquidity of the Romanian capital market that seems to be one of the main causes of the informational inefficiency of the market.

2. Main Concepts Of Emh

Decisions made by rational investors (mainly institutional investors, as well as individuals) are the result of extensive and complex analysis of all the factors that characterize the market and the domain in which the company operates, both macroeconomics (trends of the economy/economies in which the company operates, changes in the specific legislation, social, political or economic movements/developments etc.), and microeconomics and company specific factors (information regarding the financial reports, corporate events etc.).

As a consequence, understanding the characteristics of the capital market in which the issuer is traded is essential for making the adequate decision to enter the market. One of the checks that can be done relates to testing the validity of the EMH. To this purpose, several statistical tests were proposed and used, to verify whether the market is informational efficient (meaning that the future prices of the financial instruments cannot be derived from the past values), namely unit root test, Jarque Bera test, multiple variance ratio test or GARCH model, applied on the most representative market indexes.

First tests of the informational efficiency of the capital markets were done at the beginning of the 1960's, by Eugene Fama (1965),

who countered the chartist theory, very popular since the beginning of the XX century, saying the past price evolution repeat itself, such that we can find some patterns. Afterwards, new testing methods have been proposed, some of them being very often used, as the one proposed by Lo and McKinlay (1988, 1990), that is known as the multiple variance ratio test (the most relevant test used for testing the informational efficiency). Using the data for the US market, Lo and MacKinlay (1999) found that the US capital market is not weak-form efficient, countering Eugene Fama's conclusions. Tests of the EMH validity were made using the data for almost every market in the world, some of them validating the hypothesis (for example, Worthington and Higgs, 2004, 2005, Gupta and Yang, 2011, or Khan, Ikram and Mehtab, 2012, Malkiel, 2012), some of them rejecting that hypothesis (as in the works of Sharma and Narayan, 2011, Harper and Jin, 2012).

Testing the EMH on the Romanian capital market was made by Codârlaşu (2000), that rejected this hypothesis, similar conclusions being obtained by Dragotă and Mitrică (2004), Stănculescu and Mitrică (2012), Dragotă and Oprea (2014).

3. Testing The Emh On The Romanian Capital Market

Even though the first institutions of the capital market were set-up at the beginning of the 1990s (by the creation of an Agency of Securities as a subsidiary of the National Bank of Romania), we cannot say that in Romania a real capital market is functioning, as the stock exchange is not yet a solid environment where the available capitals from the economy are allocated to the companies searching financial support for their investment plans. This fact can be easily seen from the marginal place of the capital market as an environment that provides financial resources for the Romanian economy, compared to the banking system (for example, the balance of the loans for nonfinancial companies being, at the end of January, 2015, at the level of 104.3207 billion lei).

Moreover, even though the Bucharest Stock Exchange opened its trading sessions for almost 20 years, the stock exchange still plays a marginal role in the Romanian financial system, fact that is indicated by the level of the market capitalization in the Gross Domestic Product (that was, at the end of February, 2015, at 20%, a level comparable with that of Bulgaria, but far away from the Poland, that has over 40%).

The evolution of the Romanian capital market can be assessed from the indexes of the Bucharest Stock Exchange, the most well-known being the BET index, launched in September, 19th, 1997, as a free float market capitalization weighted index of the 10

most liquid companies listed on the Bucharest Stock Exchange. The specific behavior of the Romanian stock market during 2007-2009 was analyzed by Panait and Lupu (2009), the main conclusion being that the more pronounced influence of the crisis is an aftermath of maturity lack of Romanian stock exchange.

We shall analyze the BET evolution in January, 3rd, 2007-March, 13, 2015 and use the closing values to perform the unit root test, Jarque Bera test, multiple variance ratio test and GARCH model.

Starting from this time series, we test whether the logarithmic series is stationary, using the unit root test (or Dickey Fuller test). Performing this test, we see that calculated t-statistic is -1.550021, a value that is in absolute value less than the critical levels at 1%, 5% and 10%. As a consequence, the Dickey Fuller test shows the presence of the unit root in the logarithmic series.

Table 1

The Dickey Fuller test for BET index (03.01.2007-13.03.2015)

Null Hypothesis: LOG_BET has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=25)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.550021	0.5081
Test critical values:	1% level	-3.433214	
	5% level	-2.862691	
	10% level	-2.567429	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOG_BET)
Method: Least Squares
Date: 03/17/15 Time: 23:19
Sample (adjusted): 1/05/2007 3/13/2015
Included observations: 2136 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG_BET(-1)	-0.001756	0.001133	-1.550021	0.1213
D(LOG_BET(-1))	0.094475	0.021550	4.384018	0.0000
C	0.015067	0.009775	1.541305	0.1234
R-squared	0.009908	Mean dependent var		-8.26E-05

Adjusted R-squared	0.008979	S.D. dependent var	0.016677
S.E. of regression	0.016602	Akaike info criterion	-5.357222
Sum squared resid	0.587889	Schwarz criterion	-5.349263
Log likelihood	5724.513	Hannan-Quinn criter.	-5.354309
F-statistic	10.67211	Durbin-Watson stat	1.991651
Prob(F-statistic)	0.000024		

Source: www.bvb.ro, own calculation

We continue by finding the integration degree of the logarithmic series that can be seen by applying the unit root test on the first difference. The result is presented in the following table. We can see that the null hypothesis can be rejected, as the absolute value of the t-statistic is greater than the critical values for the 1%, 5% and 10% levels. So, the daily return of the BET index is stationary and, as a consequence, this series is not a random walk.

Table 2

The Dickey Fuller test for the daily returns of the BET index (03.01.2007-13.03.2015)

Null Hypothesis: DL_BET has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=25)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-42.04833	0.0000
Test critical values:	1% level	-3.433214	
	5% level	-2.862691	
	10% level	-2.567429	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DL_BET)
Method: Least Squares
Date: 03/17/15 Time: 23:56
Sample (adjusted): 1/05/2007 3/13/2015
Included observations: 2136 after adjustments

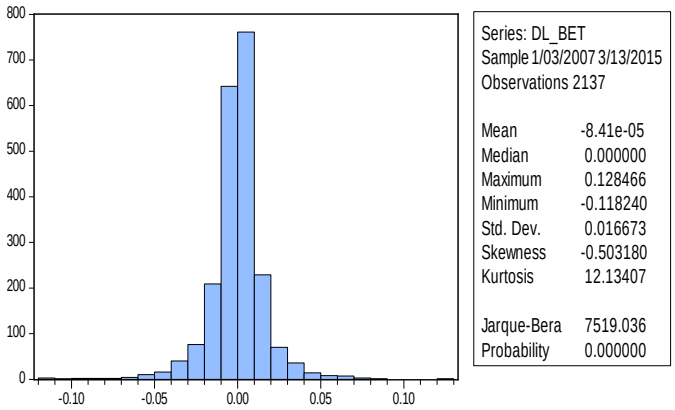
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DL_BET(-1)	-0.906232	0.021552	-42.04833	0.0000
C	-7.50E-05	0.000359	-0.208616	0.8348
R-squared	0.453110	Mean dependent var		-8.20E-07

Adjusted R-squared	0.452853	S.D. dependent var	0.022451
S.E. of regression	0.016607	Akaike info criterion	-5.357032
Sum squared resid	0.588551	Schwarz criterion	-5.351726
Log likelihood	5723.310	Hannan-Quinn criter.	-5.355091
F-statistic	1768.062	Durbin-Watson stat	1.991561
Prob(F-statistic)	0.000000		

Source: www.bvb.ro, own calculation

Another test used to assess the informational efficiency of the market tries to find whether the daily return series follows a normal distribution. In order to find that, we use the Jarque Bera test, whose results show that the daily return series is not normal.

Figure 1: The Jarque-Bera test for the daily returns of BET index (03.01.2007-13.03.2015)



Source: www.bvb.ro, own calculation

Comparing the details of the statistics of the daily return series for BET index with the details of a normal distribution, we can see that the first series is not normal. This conclusion can be drawn from the fact that the Jarque Bera test shows a slightly negative mean (-0.0000841) for the daily return of the BET index, and the standard deviation is 0.016673. Also, the distribution is steeper than the normal distribution (*that means that many values are concentrated around the mean*), and the Kurtosis is 12.13, much larger than 3 (*the value corresponding to a normal distribution*). Furthermore, the skewness is negative (-0.503180), so the distribution is left-side asymmetric, that means that the returns are greater than those estimated by the normal distribution. Since the Jarque-Bera test leads to the conclusion that the daily return is not a normal distribution, the weak-form efficiency is rejected for the Romanian capital market.

One of the most powerful test used for assessing the informational efficiency of the capital market is the multiple variance ratio test, that takes into consideration 2-, 4-, 8- and 16-days intervals. Under the assumption that the errors are heteroskedastical, we obtain the following result:

Table 3

Multiple variance ratio test for daily returns of BET index (*errors are heteroskedastical*)

Null Hypothesis: DL_BET is a martingale
Date: 03/18/15 Time: 00:21
Sample: 1/03/2007 3/13/2015
Included observations: 2136 (after adjustments)
Heteroskedasticity robust standard error estimates
User-specified lags: 2 4 8 16

Joint Tests	Value	df	Probability
Max |z| (at period 2)*	9.123886	2136	0.0000

Individual Tests

Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.567886	0.047361	-9.123886	0.0000
4	0.272590	0.087185	-8.343268	0.0000
8	0.130488	0.128976	-6.741659	0.0000
16	0.064703	0.176686	-5.293553	0.0000

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom

Test Details (Mean = -8.20358946643e-07)

Period	Variance	Var. Ratio	Obs.
1	0.00050	--	2136
2	0.00029	0.56789	2135
4	0.00014	0.27259	2133
8	6.6E-05	0.13049	2129
16	3.3E-05	0.06470	2121

Source: www.bvb.ro, own calculation

Applying the multiple variance ratio test, we see that the biggest value is obtained (in absolute value) for the 2-days interval (equal to 9.123886). In order to test whether the null hypothesis is rejected, we compare these results with the critical value for the Studentized Maximum Modulus distribution (*with m parameters and ∞ degrees of freedom*) and, as a consequence, the null hypothesis is rejected (*since all the calculated values have an absolute value that is*

bigger than 2.49). This means that the series of daily returns of the BET index is not a martingale and, therefore, the Romanian capital market is not weak-form informational efficient.

We will apply the same test, considering that the errors are homoskedastical, finding the next results:

Table 4

Multiple variance ratio test for daily returns of BET index (errors are homoscedastic)

Null Hypothesis: DL_BET is a random walk
Date: 03/18/15 Time: 00:30
Sample: 1/03/2007 3/13/2015
Included observations: 2136 (after adjustments)
Standard error estimates assume no heteroskedasticity
User-specified lags: 2 4 8 16

Joint Tests	Value	df	Probability
Max |z| (at period 2)*	19.97098	2136	0.0000
Wald (Chi-Square)	410.0410	4	0.0000

Individual Tests

Period	Var. Ratio	Std. Error	z-Statistic	Probability
2	0.567886	0.021637	-19.97098	0.0000
4	0.272590	0.040479	-17.96991	0.0000
8	0.130488	0.064003	-13.58539	0.0000
16	0.064703	0.095240	-9.820399	0.0000

*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom

Test Details (Mean = -8.20358946643e-07)

Period	Variance	Var. Ratio	Obs.
1	0.00050	--	2136
2	0.00029	0.56789	2135
4	0.00014	0.27259	2133
8	6.6E-05	0.13049	2129
16	3.3E-05	0.06470	2121

Source: www.bvb.ro, own calculation

Analyzing these results, we can observe that the absolute values calculated for 2-, 4-, 8- and 16 days intervals are bigger than the critical value of the Studentized Maximum Modulus distribution (with m parameters and ∞ degrees of freedom) and, therefore, the null hypothesis is rejected. We can say that the null hypothesis, or that the series of the daily returns is martingale, is rejected, that

means that the Romanian capital market is not weak-form informational efficient.

Another test used for assessing the informational efficiency of the capital market is the GARCH (1,1) model, that presumes that the return follows an autoregressive process ARMA (1,1). The results of this test are summarized in the following table:

Table 5

GARCH model for daily returns of BET index (05.01.2007-13.03.2015)

Dependent Variable: DL_BET
Method: ML - ARCH (Marquardt) - Normal distribution
Date: 03/18/15 Time: 00:39
Sample (adjusted): 1/05/2007 3/13/2015
Included observations: 2136 after adjustments
Convergence achieved after 17 iterations
MA Backcast: 1/04/2007
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	-0.183775	0.215884	-0.851270	0.3946
MA(1)	0.276730	0.210549	1.314325	0.1887
Variance Equation				
C	4.45E-06	5.92E-07	7.518187	0.0000
RESID(-1)^2	0.191359	0.009955	19.22252	0.0000
GARCH(-1)	0.806937	0.009057	89.09871	0.0000

R-squared	0.009928	Mean dependent var	-8.26E-05
Adjusted R-squared	0.009464	S.D. dependent var	0.016677
S.E. of regression	0.016598	Akaike info criterion	-5.921238
Sum squared resid	0.587876	Schwarz criterion	-5.907973
Log likelihood	6328.882	Hannan-Quinn criter.	-5.916383
Durbin-Watson stat	1.990915		

Inverted AR Roots	-.18
Inverted MA Roots	-.28

Source: www.bvb.ro, own calculation

From this table we see that the AR(1) and MA(1) coefficients are not statistically significant, as their related probabilities are 0.3946 and 0.1887, respectively. This means that an attempt to estimate the daily returns of the BET index using an autoregressive process

ARMA is not adequate, since the resulted equation is not stable (*as the coefficients are not statistically significant*).

On the other hand, the volatility can be expressed by the equation:

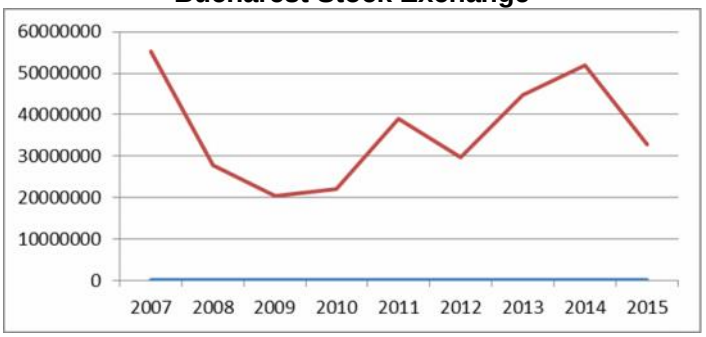
σ_t=0.00000445 + $0.191359\sigma_{t-1}$+ $0.8069376\varepsilon_{t-1}^2$, where all the coefficients are statistically significant at 1% level.

Since we identified an equation that can be used for estimating the daily volatility of the BET index returns, we can conclude that the capital market is not weak-form informational efficient.

These results lead to the conclusion that the Romanian capital market is not informational efficient (*in the weak-form status*), that means that the prices do not reflect all available past information related to the listed companies. Is this an indication that it is possible to obtain better returns compared to the risk taken on the Romanian capital market? The answer can be derived from the value of daily trading activity on the Bucharest Stock Exchange, as well as their structure, considering whose companies' shares are most traded in current day-to-day operations.

We consider the daily average trading activity on the Bucharest Stock Exchange, for every year in the 2007-2015 timeframe. We observe that, during the time of turbulences on the financial markets (between 2008 and 2010), the average daily trading activity was less than 30 million lei (*with a minimum in 2009, of 20.37 million lei, and a closed value in 2010, of 21.93 million lei*). This evolution is revealed by the following graph:

Figure 2: Daily average trading activity in 2007-2015 on Bucharest Stock Exchange



Source: www.bvb.ro, own calculation

Between 2007 and 2010, the sharp reduction in the average daily trading activity occurred during a time when the traded volume was approximately constant (*in a range of 12.83 billion shares and*

14.43 billion shares) and the number of trades was also constant (*in the range of 1.3-1.5 million*). The apparent improvement for the average daily trading activity in 2012, 2013 and 2014, was mainly due to the initial public offerings started by the Romanian authorities, to the repurchase programs initiated by some listed companies or to the private placements realized by some of issuers (*like those made by Fondul Proprietatea, issuer that was listed in 2011*), anyone of these operations not being recurrent.

Analyzing the structure of the main contributors to the daily trading activity, the period can be divided into two sub-periods, each of them being characterized by some issuers that dominated the trades on Bucharest Stock Exchange. Since the listing of the Fondul Proprietatea in January, 26th, 2011, at least 50% of the daily turnover were the trades with the shares of the 5 Financial Investment Companies (*Banat-Crisana, Moldova, Transilvania, Muntenia and Oltenia*), closed-end funds created as a result of Mass Privatization Program, a fact that indicates a significant concentration of the trading activity of a small number of issuers. After the Fondul Proprietatea initial public offering (*that lead, also, to the increase in the trading activity in 2011*), this company became the most traded issuer and, together with the shares of the 5 Financial Investment Companies, they dominate almost all daily trading activity on Bucharest Stock Exchange (*in most of the days, over 70% of the traded value*).

Taking into consideration these characteristics of the Romanian capital market, we can draw the conclusion that one of the causes for invalidating the EMH is the low liquidity on the Bucharest Stock Exchange, that makes the process of incorporating the new available information in the case of many issuers (*especially, those that are illiquid or are not followed by investors*) to be a lengthy one. Moreover, in the case of the issuers than are not regularly followed by investors, the process of incorporating the new information can lead to large swings in price, to levels that are not fundamentally reasonable and do not reflect the intrinsic value of the companies.

4. Conclusion

Using the data for the BET index (a representative index for the Romanian capital market) in January, 3rd, 2007-March, 13th, 2015, we apply four methods to test the EMH on the Romanian capital market, finding that this hypothesis is rejected. One of the causes for this situation, among others, is the low liquidity on the Bucharest Stock Exchange, that makes the process of incorporating the new available information related to an issuer to have no immediate direct effects (in the case of the companies whose shares

are not followed by investors, have a small free-float or are illiquid) or to have an excessive effect, by amplifying the volatility of the price (to levels that are not relevant and have no basis on the intrinsic value of these companies, but only as a result of the low liquidity).

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