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Tesi di laurea

Una visione d'insieme dell'ipotesi di Efficienza di Mercato INDAGINE SULL'EMH & SUL MERCATO ITALIANO An Overall View Of The Efficient Market Hypothesis INVESTIGATION ON THE EMH & ON THE ITALIAN MARKET

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Hrancico filom

"In God we trust, all others must bring data" Edwards Deming Alla mia famiglia che mi ha accompagnato lungo questo percorso

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Abstract

Il presente lavoro è stato sviluppato col proposito di esaminare l'ipotesi di efficienza di mercato definita da Eugene Fama. Dopo un'analisi preliminare volta a comprendere le tappe principali che hanno portato alla definizione dell'ipotesi, si è proceduto con un'osservazione

relativa alle critiche poste in essere a partire dagli anni '70 contro la tesi di efficienza informativa. Quindi dopo una panoramica più approfondita delle anomalie rilevate negli anni nel mercato, si è proceduto con un'analisi empirica del mercato volta a verificare la presenza di efficienza debole e semi-forte, oltre la presenza di possibili anomalie. Oggetto dell'analisi sono stati i sei indici principali della Borsa Italiana ed un campione di società estratto dal

FTSE MIB. Inoltre, dopo una definizione approfondita del loro ruolo nel mercato, si è proceduto ad esaminare l'efficienza nel mercato degli ETF italiani, per verificare se le loro caratteristiche li rendono più funzionali ad un mercato efficiente.

Introduction

The present work has been developed with the aim to explain the complexity over the concept of the Efficient Market Hypothesis (EMH). First, the analysis focuses on the literature relative to the hypothesis since its origin with the Eugene Fama's work. From here onward the attention is on the dualism between the criticism against the concept and the awareness that the hypothesis seems legit. Many detailed works follow one another over the time; that implies an evolution of the concept and its estimation methods. The Technical Analysis, the Fundamental analysis and the Behavioural Finance are the most representatives theoretical argumentations in net contrast with the EMH.

The step forward is to empirically analyse the efficiency for the Italian case, underlying some unsolved aspects such as the anomalies of the market. These second part of our investigation starts with the examination of empirical worldwide evidences during years until the latest ones. Concurrently with this examination, this work presents its own empirical evidence on the Italian case.

These investigations concern the different levels of the EMH, dividing the weak hypothesis from the semi-strong one.

A multitude of methods used over time in the search for efficiency comes up. The analysis ends up with some consideration about the truthfulness of the EMH, showing the results among the various Italian markets, best considering the Exchange-Traded Funds.

1. The Efficient Market Hypothesis.

1.1 The EMH since the beginning

Despite the existence of a certain documentation dated back to the eighteenth century, the first evidence about the concept of Efficient Market Hypothesis was given by Louis Bachelier. In 1900 Bachelier developed the groundwork for the hypothesis considered: first, modelling the mathematics of the Brownian motion, and then, introducing the formulation for a Random walk in security prices. He was the first to provide the law of probability for stock market fluctuations: starting from the total mathematical expectation of a player (sum of the possible gains weighted with their relative probabilities of realization), he found out that the expectation of the speculator was zero. Indeed he stated that past, present, and even future events were reflected by market price, but at the same time, they did not seem to influence price changes. Bachelier developed this analysis assuming that stock returns follow a fair game, that the probability that the future price p_{t+n} is a function of the current one (p_t) and

that transactions are uniformly spread across time (finite variance of the distribution of price changes and large transaction number during the given lapse of time). Bachelier's argumentation leads to the Markov-dependence as well as the utilization of the Central Limit theorem to call upon Normality. The consequence is the fact that the conditional and unconditional probability of the future price at the future time is governed by the Gaussian Law and proportional to the square root of time.¹

Unfortunately, his works passed unnoticed because of the backwardness of his time. Moving forward on the historical evolution of the efficient market concept, we find Wesley Mitchell. He was the first to discover that the distributions of price changes cannot be associated to samples from Gaussian populations. Even John Maynard Keynes, in 1923, stated that investors gained because of the risk bearing and not because they were able to predict better than the market what the future would show them. He confirmed his statement in 1936, comparing the stock market with a beauty contest and claiming that investors' decisions were the results of their animal spirits. It is a duty to mention Holbrook Working too. He equated stock returns to numbers from a lottery.

Early, Cowles concluded that there were no evidences of the possibility to predict the market. However, in 1937, he found evidences of serial correlation in averaged time series indices of stock prices, as long as he reported again that investment professionals do not beat the market in 1944. An important contribute to the Efficient Market Hypothesis was pointed out by Milton Friedman in 1953. Friedman stated that the efficient market held also when trading strategies of investors were correlated; these could happen because of the arbitrage. In the same year, Kendall, examined 22 UK stock and commodity price series discovering they were basically random. Moreover he found out the time dependence of the empirical variance (the non-stationarity). In 1959, after Kendal's contribute, Harry Roberts showed that a random walk and the current stock series resembled themselves.

Lingering on these last two authors, it is possible to summarise the literature point of view of this first studying period of the efficient market. Hence, the random walk formulation was seen as a system that generates the stock price process as follow:

$$p_t = p_{t-1} + r_t, t \in T \tag{1}$$

Random sample model (or chance mechanism)

¹ History of the Efficient Market Hypothesis, Martin Sewell, 2011, UCL Department of Computer Science

Where $r_t \sim IID(0, \sigma^2)$, that is r_t is an Independent and Identically Distributed process with zero mean and constant variance σ^2 . Here prices are assumed to be the partial sum of returns, $p_t = \sum_{k=1}^t r_k, t \in T$.

The issues of this former configuration is both on the absence of explicit distributional assumption and the fact that $\{p_t, t \in T\}$ implies that the first two moments exist (Markov-dependent process²). Nevertheless this literature implicitly hid that the distribution of returns was Normal and so the random walk as well. This means that $r_t \sim NIID(0, \sigma^2)$ is a Normal Independent and Identically Distributed process (with *N* stands for Normality).

For this model the process $\{p_t, t \in T\}$ is Markov-dependent with a probabilistic structure given by:

$$\binom{p_t}{p_{t-1}} \sim N \left[\binom{0}{0}, \binom{\sigma^2 t \quad \sigma^2 (t-1)}{\sigma^2 (t-1) \quad \sigma^2 (t-1)} \right], \quad t \in T$$

$$(2)$$

That is discrete-time equivalent to the Brownian motion process proposed by Bachelier.³

During the 1950s statisticians focused on the temporal independence of the return process. The independence had non-correlated mean. As a consequence, tests for the independence meant focusing on serial correlations with the aim not to find correlation. Until this period, the evidences of prices dependency were too weak. Another issue was the concept of Identical Distribution. Some observation performed by Kendall led to a new concept: The Heterogeneous Random Walk model: $p_t = p_{t-1} + r_t$, where $r_t \sim NI(0, \sigma^2)$ with $t \in T$. This means that Kendall confirmed the independency but contested the identical distribution (NI stands for non-Identically Distributed). Last concept to be reconsidered concerned the distribution of returns itself. According to Kendall, the bivariate frequency distribution of weekly price changes was nearly perfect symmetry and an appearance of approximate normality. However, the distance from the Normal Distribution, that literature found out until this period, was basically a misunderstanding.

This lead to summarise the main issues of this first development part of the EMH in the search for the truthfulness of the Normal Distribution assumption, the temporal independence, as well the identically distributed one.

At the begging of the 60s Berger and Mandelbrot found out that short-run movement of the price series obeyed the simple random walk hypothesis, but in the long-run they did not. He

² A stochastic process has the Markov property if the conditional probability distribution of future states of the process (conditional on both past and present states) depends only upon the present state, not on the sequence of events that preceded it. A process with this property is called a *Markov process*

³ On Modelling Speculative Prices: The Empirical Literature, Elena Andreou, Nikitas Pittis, Aris Spanos

distanced himself from Bachelier because of the usage of the natural logarithms of prices and the Paretian distribution (a stable non-linear distribution) instead of the Gaussian one. Eugene Fama verified that Mandelbrot's data adjusted to the stable distribution.

In 1964, both Alexander and Steiger separately tested for the non-randomness finding out that stocks did not follow a random walk. At the same time, Sharpe published his work on the Capital Asset Pricing Model.

Here we are: In 1965 Eugene Fama defined the efficient market for the first time (Random Walks in Stock Market Prices, 1965) and Samuelson the first formal economic argument for efficient markets as well (Proof that properly anticipated prices fluctuate randomly, 1965). Samuelson stated that observing many future prices sequences constructed with his model until their end-period, they will not show downward or upward movements, regardless the systematic seasonal pattern in X_t and the existence of an inflationary or deflationary period in X_t . He asserted that whether spot prices X_t were subject to the probability law and future prices sequence is subjected to the expected value assumption, hence the least sequence represented a fair game (or a martingale); this means that there exist changes in unbiased prices and finally that $E[\Delta^n Y(T, t)] \equiv 0$ (n = 1, 2, ..., T) and there exist no possibility to get an expected profit by exporting past changes from future prices. Y(T, t) already represented all the available accessible information for future prices in the optic of Samuelson. Easily speaking, Samuelson's hypothesis stated that price changes would be not forecastable whether the market is efficient, or rather, whether prices reflect all the information and expectations of the market. Ensuing that prices fluctuate randomly if news were announced randomly. Mandelbrot was one of the first to show that returns were unpredictable in competitive markets with rational risk-neutral investors.

In 1967, Roberts defined the efficient market hypothesis and distinguished between weak and strong form tests.

The 60s were characterized by the fact that Mandelbrot showed that Bachelier's Brownian motion model was not compatible with recent facts on the speculative prices. He discovered that the distributions of price changes were characterized by peaks distant from the normality. the D'Agostino and Stephen skewness-kurtosis Normality tests, managed by Mandelbrot, showed the impossibility for the Normality assumption to be confirmed. This was a consequence of the excess of kurtosis observed in the index series investigated. Moreover he found out that the non-parametric kernel early esteemed was more peaked with respect to the Normal distribution. Another negative acknowledgment was referred to the infinite variance syndrome of stock returns, the so-called Noah effect. Indeed, during his analysis, Mandelbrot found out that his samples were affected by an erratic fashion for second moments, reflected

by the impressive length of the tails of the samples considered. He joined this conclusion thanks to the sample recursive variance⁴. Mandelbrot innovation consisted in the usage of the Stable Paretian family of distribution (Levy, 1925) to best perform symmetry, leptokurticity and infinite variance. The Stable Paretian family appears as follow:

$$\log \phi(t) = i\delta t - \gamma |t|^{\alpha} \left[1 + i\beta \left(\frac{t}{|t|} \right) \tan \left(\frac{\pi \alpha}{2} \right) \right]$$
(3)

Where:

- α is called Pareto's exponent and it leads to the determination of the peaked degree ($0 < \alpha \leq$ 2).
- β helps finding the measure for the skewness ($-1 \le \beta \le 1$).

It is important to consider that $\beta=0$ makes symmetric the distribution, while a small α returns thicker tails. This capacity allow the Stable Paretian family to be quite flexible, giving the possibility to model the empirical regularities of leptokurticity, symmetry and infinite variance. A crucial point is the ability of this family to be stable. The stability (invariance property) implies that each stable distribution has an index of stability not influenced by the sampling interval. Firstly adopted over IID random variables, quickly adapted to non-ID ones. 5

Going to the point, Mandelbrot stated the assumption of temporal independence of returns, substituting the Gaussian distribution in favour of the Stable Paretian one. However, he certified that his model did not capture the observed alteration of small and big changes in fluctuations.

So well, during 60s, Madelbrot, Fama and Samuelson confirmed the fact that the efficiency of the market did not depend on IID process.

The concept of efficient market passed through the game of speculation. There existed two options: the game had to be fair, or returns should follow a martingale difference process. Fair games means that:

$$E(p_t|\sigma(r_{t-1},\ldots,r_1)) = 0, \qquad t \in T$$
(4)

That means that conditional returns expectation at time t, relatives to past information on returns, should be zero.

⁴ $\frac{1}{k}\sum_{i=1}^{k}(r_i - \bar{r})^2$, k=1,2,3,...,T⁵ On Modelling Speculative Prices: The Empirical Literature, Elena Andreou, Nikitas Pittis, Aris Spanos

The same way for the efficient market case: the best forecast for today's price, is yesterday's prices.

$$E(p_t|\sigma(p_{t-1},\dots,p_1)) = p_{t-1}, \qquad t \in T$$
(5)

Martingale formulation

The formulation above constitutes the exact opposite of the Random walk formulation: it considers $\{p_t, t \in T\}$ the main element, in a view from left to right of the previous composition.

$$p_t = E(p_t | \sigma(p_{t-1}, \dots, p_1)) + r_t, \quad t \in T$$
(6)

While $\{r_t, t \in T\}$ constitutes:

$$r = p_t - E(p_t | \sigma(p_{t-1}, ..., p_1)) + r_t, \quad t \in T$$
(7)

In 1970, Eugene Fama published the first complete paper of the EMH, *Efficient Capital Markets: A review of theory and empirical work.* Thanks to both Robert and Samuelson's work, he concluded that the efficient market is a market in which prices always *fully* reflect available information. Therefore, available information correspond to unpredictable information; as a consequence, stock prices (which change on the basis of new information) are unpredictable as well. Therefore. the best description that summarised and improved the research on random walk was defined by Fama. He created a model concerning the formation of prices: the Expected Return (or Fair Game) Model. The model appears as follow:

$$E(p_{i,t+1}|\varphi_t) = p_{i,t} [1 + E(r_{i,t+1}|\varphi_t)]$$
(8)

Where:

- $E(p_{i,t+1}|\varphi_t)$ is the expected value operator

- $p_{i,t}$ is the price of security *i* at time *t*
- $r_{i,t+1}$ is the rate of returns for security *i* at time t+1
- φ_t is the set of information reflected in the price at the initial time period.

The right hand of the equation above explains that the expected price of the security i is a function of today's price and the expected return of security i. Following the expected return theory, tomorrow's price minus today's price equals to zero:

$$x_{i,t+1} = p_{i,t} - E(p_{i,t+1}|\varphi_t)$$
(9)

Hence it is possible to affirm that

$$E(X_{i,t+1}|\varphi_t) = 0 \tag{10}$$

This means that the sequence $\{x_{j,t}\}$ is a fari game with respect to the information $\{\varphi_t\}$. This is equivalent to:

$$z_{i,t+1} = r_{i,t+1} - E(r_{i,t+1}|\varphi_t)$$
(11)

And then

$$E(z_{i,t+1}|\varphi_t) = 0 \tag{12}$$

This means that the sequence $\{z_{j,t}\}$ is a fair game as well, with respect to the information $\{\varphi_t\}$. Hence, $x_{i,t+1}$ represents the excess market value of the security *i* at time *t+1*, and as a consequence, $z_{i,t+1}$ is the return at time *t+1* in excess of equilibrium expected return projected at t.

In addition, considering the (8) it is possible to define the sub-martingale model:

$$E(p_{i,t+1}|\varphi_t) \ge p_{it} \quad \text{or} \quad E(r_{i,t+1}|\varphi_t) = 0 \tag{13}$$

This is equal to say that the expected price in t+1 is higher or equal to the current one (considering the current set of information). However if (8) is considered such as an equality, then:

$$E(p_{i,t+1}|\varphi_t) = E_t p_{i,t+1} = p_{i,t}$$
(14)

That corresponds to a martingale process which explains that the best expected value of $p_{i,t+i}$ (hence, of all the future value of p_i) is the current value $p_{i,t}$.

The concept of fully reflection of the current price leads to the consequence that two consecutives price variations are independent and identically distributed.

This above is the Random Walk model, written as:

$$f(r_{i,t+1}|\varphi_t) = f(r_{i,t+1}) \tag{15}$$

If the expected return is constant over time, hence:

$$E(r_{i,t+1}|\varphi_t) = E(r_{i,t+1}) \tag{16}$$

That means that it is just the mean of the distribution $r_{i,t+1}$ to be independent from the information at time *t*, not the whole distribution as stated by the random walk.

During his argumentation, Fama distinguished three different form of market efficiency: weak-form, semi-strong form and strong-form:

- 1. Weak-form efficiency: this form, following the efficient market hypothesis, assumes that stock prices already reflect all information. This means that none could obtain any excess return managing trading data such as history of past prices, training volume or short interest.
- 2. Semi-strong-form efficiency: this second efficient form asserts that all the *public available information* regarding the prospects of a firm, are included in the current stock prices. This suggest that none could understand if a stock is underestimated or not. As a consequence, none could earn an extra-return. This form assumes that there are no learning lags in the distribution of public information (balance sheet composition, earning forecasts, accounting practices, etc.).
- 3. Strong-form efficiency: this form asserts the inclusion in prices of the information inside companies (*private information*) as well as the previous form kind of information. So, the insider informative, following the strong form, is useless as well.

In the following years some authors published papers about the predictability of markets, while in 1973 Samuelson included pay dividends situations in the analysis of the market.

In 1978, Ball showed the generation of excess returns after public announcements of firms' earnings and in the same year, Jensen gave his own definition of the EMH. Two years later Sanford J. Grossman and Joseph E. Stiglitz showed the impossibility for the market to be

efficiently informed: information has a cost and, whether the information would be instantaneous available, investors that look for information would not receive compensation.

LeRoy and Porter showed excess volatility and rejected the EMH (*1981*). In 1986 Fischer Black firstly thought about noise traders, investors that trade just on the basis of information, underlying that their existences were a necessity for the liquidity of the market itself.

19 October 1987, called Black Monday, the worldwide stocks market crashed. It causes the largest percentage of loss ever seen on Dow Jones Index.

In 1988 Lo and MacKinlay rejected the random walk hypothesis for weekly stock market returns using the variance-ratio test. A year later Shiller would publish its *Market Volatility*, in which he considered the sources able to challenge the efficient market hypothesis.

In 1991 Matthew Jackson showed there exists an equilibrium with revealing prices and costly information acquisition, basing his evidences on the assumption that agent are not price-takers. In the same year, Fama published the second paper about the EMH, in which the weak-form test was switched with a general area of tests for return predictability.

In 1995 Robert Haugen demonstrated that an overreaction in the short-run can affect the longrun responses (*The New Finance: The Case Against Efficient Markets*). Chan et al. underlying the fact that the market probably responds only gradually to new information, but then, they evidenced the fact that the worldwide markets could be weak-form efficient.

In 1998 Fama ended his work with the third of his three reviews, ensuring that market efficiency survives the challenge from the literature on long-term return anomalies. Then, Zhang showed a theory of marginally efficient markets. Shleifer, in 2000, argued about the assumption of investor rationality and perfect arbitrage in his paper (*Inefficient Markets: An introduction to Behavioral Finance*). These are the assumption whose support the EMH: Investor Rationality, Arbitrage, Collective rationality and Costless information and trades.

In 2003 Malkiel supported the EMH after an investigation on the challenges against the efficiency. Another positive statement was given by William Schwert that showed that anomalies became weaken or disappeared.

In 2007 Wilson and Marashdeh showed the inconsistency of stock prices in the short-run, but, on the other hand, they demonstrated there exists consistency in the long-run. Years later Ball exploited the collapse of the Lehman Brothers to argue that the crisis arose because of the low attention to the EMH lesson. Otherwise in 2010 Lee et al. investigated the stationarity of real stock prices for developed and developing countries ending up with the conclusion that stock markets are not efficient.^{6 7}

⁶ The Econometrics of Financial Markets, John Y. Campbell, Andrew W. Lo, A. Craig MacKinlay, Princeton University Press, 1997

1.2 Critics and hints on Behavioural Finance

This paragraph emphasises the criticism about the efficient market hypothesis recalling the most important cases discussed.

It is easy to imagine who are the opponents of the EMH and why they do not believe in it. Each investor, each financial promoter, each trader involved in the search of extra-return could not affirm that they cannot beat the market. There are a series of discrepancies that many authors brought to light over years.

Burton Malkiel wrote that *monkey throwing darts at a newspaper's financial pages could select a portfolio that would do just as well as one carefully selected by experts.* This was congruous with the impossibility to predict prices.

However, this kind of view began to be seen with suspect. The possibility to get excess of return through the forecast of pricing began to be seen as possible. The market itself seemed to suggest it through events such as financial crisis, bubbles, herd phenomenon, etc.

Nevertheless, the fact that these gaps are supposed not to be easily forecasted despite their existence, could provide first aid to the mangled hypothesis.

If efficiency equals not to earn excess returns without excess of risks, then it is possible to affirm that markets are efficient although the existence of anomalies. Moreover evaluation errors would be adjusted in the long run.

Coming back to the inefficiency proofs, Burton G. Melkiel summarized some quotable evidences relative to the EMH:

Short-term Momentum including under-reaction to new information: autocorrelation in short run returns equals to suggest the possibility to forecast future prices. These investment tactics are inconstant over time and tend to vanish after their literature demonstration.

Long-run return reversals: negative autocorrelation showed over time by different authors have been interpreted as an excessive reaction to endogenous news (optimistic or pessimistic views). This leads to the possibility of exploiting the return to the mean of stocks in order to gain extra-returns. However there exist the possibility this will not happen.

Seasonal and Day-of-the-Week Patterns: In certain periods of the year, or months rather than weeks, it has been showed a tendency of stocks belonging to a same weighted stock index to perform high unusual returns. These held, for instance, for the January effect, as well as the Day-of-the-week effect. However there is no dependency from a period to another one. This fact, obviously, entails the non-predictability of the patterns or anomalies.

⁷ On Modelling Speculative Prices: The Empirical Literature, Elena Andreou, Nikitas Pittis, Aris Spanos

Predictable patterns based on valuation parameters: the category contains all the attempts to perform extra-returns by giving attention to the initial valuation parameters, through valuation ratios such as P/E (Price/Earning) or D (Dividend Yield).

Predicting future returns from initial dividend yields: this tactic is based on the exploiting of certain elements to perform better results. Generally the dividend-price ratio was interpreted as a good forecaster for future returns; the main strategy based on dividends was the Dogs of Dow, that consisted in the purchasing of the top ten Dow Jones Industrial Average stocks. *Predicting market returns from initial price-earnings multiples:* investors have tried to earn wider returns purchasing stocks to assemble their portfolio of investment, on the basis of the low price-earnings multiples.

Other predictable time series patterns: there is a huge literature relative to the usage of financial statistics to analyse the predictability of stock returns. An example could be the use of the short-term interest rates to forecast future stock returns. Since the financial elements documented consist in a larger sample with respect to the non-financial, they will be selected and empirical analysed ahead in this paper.

The Behavioural Finance, that is a theoretical current opposed to the efficient market hypothesis, includes some of the results of the cited tests as a proof to reject the EMH. In the early 90s, academic focus shifted to the human behaviours, meaning that speculators' decisions could be affected by them personal orientation rather than rational thinking.

The fathers of the BF could be identify in Kahneman and Tversky who developed a work concerning the analysis of decision under risk in 1979, but the literature is quite wide. In 2003, Shiller defined the BF as the finance with the widest social perspective, which include psychology and sociology.

The cognitive heuristics on the basis of the BF concerns *representativeness*, *anchoring*, *herding*, and *overconfidence*. From another point of view, the investors resulted affected by a sort of fallacies such as the tendency to be risk averse for losses rather than gains (*loss aversion*), the tendency of people to generate different mental accounts relative to past events (*mental accounting*) or the tendency to avoid to immediately sell fruitless stocks because of the pain the sale would generate to them.

The weight of the behavioural finance born by the fact that this cognitive alternative to the theoretical and empirical previous ones, was really able to challenge them at a new level, making authors questioning whether their path has to be modified.^{8 9 10}

⁸ The Efficient Market Hypothesis and Its Critics, Burton G. Malkiel, Princeton University, CEPS Working Paper No. 91, 2003

⁹ A Random Walk Down Wall Street, Burton G. Malkiel

2. Test on the EMH

2.1. An historical review

During the XX century a series of tests of the EMH have been implemented: *the Dogs of the Dow, the January effect, the Thank God it's Monday afternoon pattern, the hot news response*, and so on. The Dogs of the Dow was a theoretical certainty that suggested how to beat the market by means of the purchasing of the ten highest dividend yield stocks in Dow Jones 30-Stock Industrial Average. This strategy was performed by Michael O'Higgins, while tests on its truthfulness were effectuated by James O'Shaughnessy in 1920s. O'Shaughnessy found out that this strategy really had been able to beat the index by over two percentage points per year with no additional risk. This held as long as the strategy became too popular and the market in turn beat the strategy.

Another reason that push researchers to do test on the efficiency of the market was the unexplainable tendency of stock returns to be very high during the first two week of January. Object of empirical examination was the week-end effect as well. The *Thank God it's Monday afternoon* pattern suggested that the best moment to purchase stocks was Monday afternoon instead of Friday or Monday morning. This, because of the lower selling price with respect to other moments.

The more intuitive doubt concerning the efficient market hypothesis is intuitively the possibility that prices will immediately adjust for news when those come up. This doubt, for instance, subsequent to the announcement of dividends, rather than earnings surprises, has generated a literary trend called *Event Studies*.

At a later stage theories and tests which wanted to critically analyse the EMH branched out in time series strategies and cross-sectional ones.

Time series strategies consist in the *Dividend Jackpot Approach*, the *Trend is your friend* one, the *Initial P/E predictor*, and the *Back we go again strategy*. On the other hand, *Cross-sectional* strategies include the *Smaller is better effect*.

The *Trend is your friend* is also known as the already cited *Short-term momentum*, while the *Dividend Jackpot Approach* is based on the assumption that if stocks generate above-average dividend yields, hence investors will earn higher future returns. This last approach was tested first by Eugene Fama and Kennet French, and then, by John Campbell and Robert Shiller: they concluded that, through this artifice, investors can reach their scopes. Obviously this

¹⁰ From Efficient Market Hypothesis to Behavioural Finance: Can Behavioural Finance be the new dominant model for investing?, A. Konstantinidis, A. Katarachia, G. Borovas, M. E. Voutsa, Scientific Bulletin – Economic Sciences, Vol. 11/Issue 2

was in contrast with the assumption of the randomness of the market. Tests showed that when initial dividend yields were relatively high, investors would gain higher total rates of return. Nevertheless, this eventuality does not seem to hold with an individual investor that simply purchased a portfolio of individual stocks with the highest dividend yields and, in general, does not seem to persist over time. Object of tests was the *Back we go again* strategy as well. This strategy is better known as the *Long-run return reversals* and consisted in buying stocks that did not perform very well in the latest years, convincing oneself that those stocks would generate an above-average returns over the next few years. This depended on the fact that tests underlined the possibility that, even if there existed positive correlation among stock returns over short horizons, in term of years, they showed negative serial correlation. This would lead to gain extra-returns. In his revisionary work *A Random Walk Down Street*, Malkiel accepted the truthfulness of this latest strategy mentioned, asserting that fads and fashions can play a central role in stock pricing.

Moving on in the historical review of the tests over the EMH and its anomalies, the *Smaller is better* effect comes up. It starts from the fact that small company stocks generate larger returns than large company stocks do.¹¹

Fama and French divided stocks into deciles according to their size finding out that small firms outperformed larger ones. On the other hand, this could be not true, because it has to be considered that small firms provide higher risks to investors.

Finally there have to be hinted the *Stocks with low price-earnings multiples outperform those with high multiples* approach, also described as the GARP approach, that was tested by Sanjoy Basu during the 70, besides another pattern relatively recently tested, considering the relation between the ratio of stock's price to its book value and its later return, the P/BV (Price-to-book-value).

In general, the approach for the EMH consisted in statistical tests in security prices and returns or tests based on trading rules. Obviously, trading rules are not disclosed as much as tests because if someone found out a good strategy, he/she would not explain it to his/her trading competitors. Therefore the focus is put on econometrical tests.

For what concerns the weak-form of the efficient market hypothesis, some examples of tests are:

- Autocorrelation (serial correlation) tests
- Runs tests
- Sings tests
- Unit root tests

¹¹ A Random Walk Down Wall Street, Burton G. Malkiel

Semi-strong-form of the EMH have been tested in three different ways:

- Through the usage of time series analysis over public information (Dividend yield; Default Spread; Term structure spread; Quarterly earnings reports information)
- Through the examinations raised up by Event Studies (the object of these studies is the stock response time to economic events)
- Through cross-sectional analysis of returns over public information. This trend bases its efforts on the assumption that in an efficient market securities have risk-adjusted returns (P/E ratios; Price-Earnings/Growth ratios; The size effect; Book value-Market value)
 Among the Autocorrelation Tests, used in order to verify the presence of dependence in data series, so used to verify whether each value of the time series considered is influenced by the
- previous value and, in the same way, influences the following one, it is possible to find the following ones:
- Durbin-Watson Test: this is the first attempt to test for serial correlation in a linear time series model as:

$$y_t = x_t^T \beta + \varepsilon_t$$
 with $\varepsilon_t \sim WN(0, \sigma^2)$ (17)

It consists is a statistic (rather than a test) that helps to find out whether residual serial correlation exists or not.

The DW-Statistic is based on the following structure:

$$\begin{cases} H_0: P_1 = 0 \text{ no first order serial correlation} \\ H_0: P_2 \neq 0 \text{ first order serial correlation} \end{cases}$$

Here is the formula:

$$DW = \frac{\sum_{t=2}^{T} (\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2}{\sum_{t=1}^{T} \varepsilon_t^2}$$
(18)

With $\hat{\varepsilon}_t$ corresponding to the OLS residual.¹²

 Breusch-Godfrey Test: this is a test that allows statisticians to understand whether exists or not serial dependency in the variation of the dependent variable (in a dynamic linear model). It differs from the DW-statistic because of the possibility to test different serial correlation orders. The structure of the hypothesis is the following:

¹² Dispensa di Econometria delle Serie Storiche, Giulio Palomba, 2014 (P.10)

$$\begin{cases} H_0: \rho_1 = \rho_2 = \rho_3 = \dots = \rho_q = 0\\ there \ exists \ a \ \rho_i \neq 0, with \ i = 1, 2, 3, \dots, q \end{cases}$$

It is a test based on Lagrange multipliers that is approximated as follow:

$$LM_{BG} = TR^2 \sim x_q^2 \tag{19}$$

Where R^2 is the auxiliary regression and T the largeness of the sample case.¹³

• Ljung-Box Test: this is a test to establish if observations over a given time series are serial correlated. The null hypothesis foresee the absence of serial correlation:

$$\begin{cases} H_0: \rho_1 = \rho_2 = \rho_3 = \dots = \rho_q = 0\\ there \ exists \ a \ \rho_i \neq 0, with \ i = 1, 2, 3, \dots, q \end{cases}$$

So, the LB-statistic is:

$$LB = T(T+2)\sum_{i=1}^{q} \frac{\widehat{\rho_i}}{T-i} \sim X_q^2$$

$$\tag{20}$$

The **Runs Tests** could be a mean to understand if a data sample follows a random process. The runs test hypothesis follows the trend below:

$$\begin{cases} H_0: the sequence is random \\ H_1: the sequence is non - random \end{cases}$$

The statistic of the Runs test is the following:

$$Z = \frac{R - \overline{R}}{s_R} \tag{21}$$

Where *R* is the observed number or runs and \overline{R} is the expected number of runs. *s* is the standard deviation.

The **Sing Test** is a non-parametric test to verify the central tendency. In other words, a sign test tries to verify the central value for a probability distribution. The null hypothesis is represented hereinafter:

¹³ Dispensa di Econometria delle Serie Storiche, Giulio Palomba, 2014 (P.12)

$$\begin{cases} H_0: \mu = \mu_0 \\ H_1: \mu \neq \mu_0 \end{cases}$$

It uses the median. In order to perform bilateral tests, the sign test verifies the following hypothesis:

$$\begin{cases} H_0: me = me_0 \\ H_1: me \neq me_0 \end{cases}$$

In the case of unilateral test the hypothesis are:

$$\begin{cases} H_0: me \le me_0 \text{ vs } H_1: me > me_0 \\ or \\ H_0: me \ge me_0 \text{ vs } H_1: me > me_0 \end{cases}$$

The sign test is the non-parametric equivalent of the t test, but it differs because of the binomial distribution. In the practice, each value of the sample is compared with a defined value in order to transform lower values in negative signs and higher values in positive ones. The null hypothesis is not rejected when positive and negative signs appear approximately equal.^{14 15}

Economic and financial series are characterized by the property of non-stationarity, as a consequence statisticians tends to transform them by means of differentiation, logarithms, or logarithmic differences. It is necessary to verify if the time series under analysis are integrated, hence **Unit Root Tests** come to help testers.

Unit root tests try to verify the presence of a stochastic trend in a series. It consists of two different tests. Tests diverge for the null hypothesis. The first one follows the system below:

$$\begin{cases} H_0; \emptyset = 1 \\ H_1; |\emptyset| < 1 \end{cases}$$

The null hypothesis states that the generator process of x_t is I(1), integrated of order one, while the alternative is represented by an autoregressive stationary process. While the second test follows this other system:

¹⁴ Introduzione alla statistica non parametrica, Luigi Salmaso

¹⁵ Elementi di Statistica Descrittiva per distribuzioni univariate, Metodi non parametrici per un campione, Maria Pia D'Ambrosio, Franco Anzani, Six Sigma

$$\begin{cases} H_0 \colon | \varnothing | < 1 \\ H_1 \colon \emptyset = 1 \end{cases}$$

Therefore, in the second test, the null hypothesis is given by the absence of the non-stationary process, that is, on the other hand, present in the alternative hypothesis.^{16 17}

Here we have the main tests normally used:

• Augmented Dickey-Fuller Test (ADF): it is an univariate test. It uses an autoregressive parametric model. The ADF test is based on estimating the following regression:

$$y_t = \beta^T D_t + \varphi y_{t-1} + \sum_{j=1}^p \psi_j \Delta y_{t-j} + \varepsilon_t$$
(22)

Where:

- D_t is a vector of deterministic terms (constant, trend etc.).
- The p-lagged difference terms, Δy_{t-j} are used to approximate the ARMA structure of the errors.
- *p* is set so that the error ε t is serially uncorrelated. T ε_t homoskedastic.
- Phillips-Perron Test: it is used to test the null hypothesis over unit roots. It is based on the following regression:

$$y_t = \beta^T D_t + \varphi y_{t-1} + u_t \tag{23}$$

Where:

- u_t is an I(0) process that can be heteroskedastic. This is the main difference between the ADF and PP test.

On the other hand, talking of semi-strong tests, it is opportune to introduce the concept of Event Study. This discipline has the aim to understand the impact of a specific event over a firm's value by means of financial data. Otherwise, event studies study whether a certain event would change or not the course of stocks. At a later stage the semi-strong test branch would be deeper examined.

¹⁶ Dispensa di Econometria delle Serie Storiche, Giulio Palomba, 2014

¹⁷ Introduzione all'econometria, N.Cappuccio, R.Orsi

2.2. Previous studies: the Italian cases

In Italy there were different authors focusing on the efficient market hypothesis question. Among them, Franco Caparrelli could be intended as the main exponent.

He performed several tests on the Italian market¹⁸ ¹⁹ ²⁰ ²¹, considering the whole market efficiency concept. He tested for weak, semi-strong and strong form. Let's see in the next step how he proceeded in his analysis.

2.2.1 The Weak-form

This first form elaborated under the EMH, states that the knowledge given by the past does not allow investors to have a better performance over stocks.

It is possible to sum up this hypothesis as follow:

$$Z_{t-1} = Z_{t-1}^* \quad E(R_t/Z_{t-1}) = E(R_t/Z_{t-1}^*)$$
(24)

Where Z_{t-1} corresponds to the prices, returns and exchanged volumes time series.

This form considers information as free and available for investors with homogeneous expectations in a transaction-costless market. This would lead to two consequences: there exist no mispriced stocks and there exist no possibility that an investor could follow an established path to earn extra-profit.

So, the first study Capparelli performed was about 30 securities during the period from December 1978 to December 1983²².

In his book, *Il Mercato Azionario, Caparelli synthetized results of the serial correlation test as follow:*

Daily		Weekly	Fortnightly	Monthly
$ar{eta}$	-0.1268	-0.1167	0.0139	0.0403
σ	0.1885	0.1394	0.1529	0.1172
$\sigma/\sigma(\beta)$	2.9921	2.2520	1.7434	0.9002
Terms number $> 2\sigma(\beta)$	15/30	11/30	4/30	1/30

¹⁸ La reazione in eccesso del prezzo dei titoli: la teoria e una verifica empirica sulle azioni italiane, Franco Caparrelli e Anna Maria D'Arcangelis, Bancaria, 51(10), 1995, pp. 8-17

¹⁹ Mercato efficiente ed effetto gennaio, Franco Caparrelli et al., Il Risparmio, (1), 1992, pp. 33

²⁰ Quando comprare e vendere in Borsa. Una verifica dell'effetto fine settimana, Franco Caparrelli e Alessandra Diotallevi, Bancaria, (5), 1991, pp. 27

²¹ La Borsa italiana e l'efficienza semiforte, Il Risparmio, (2), 1989, pp. 209

²²II Mercato Azionario, Franco Caparelli

Positive terms	8/30	7/30	13/30	19/30
number	0/50	7750	15/50	17/50

Table 2.1 – Summary of results for the correlation test 12/1978-12/1983, F. Caparrelli

Where $\bar{\beta}$ represents the mean value of the coefficient β , σ is the standard deviation, and $> 2\sigma(r)$ represents the number of terms higher than $2\sigma(r)$.

This table shows that the hypothesis holds better if monthly data are considered instead of the weekly ones. Indeed the mean value of β reduces. The number of the securities with a coefficient equals to zero decrease as well. Therefore the more the time interval grows the more the empirical result resembles the theory (meaning that the true value of the coefficient is equal to zero).

2.2.1 The Semi-strong-form

This form states that public information are quite instantaneous transferred into stock prices, as a consequence the knowledge of those information cannot produces the possibility to get an advantage over the market.

These information come from the study of companies through their balance sheets, the announcements of results, as well as programs and perspective of the companies themselves. Caparrelli examined 54 events of free share capital increase (intend aumenti di capitale a titolo gratuito – questa dovrebbe essere una traduzione migliore) from January 1975 to April 1987 relative to securities quoted on the stock exchange of Milan. This study focused the attention on the period before and after the announcement of dividends. The first phase was to define the market model for each stock over 148 months, and so defining alpha and beta coefficients. Then Caparrelli found out the expected returns with the aim to compare them to the effective ones. Finally he calculated the simple average residual and the cumulated one. This analysis underlined that there was an increment of stocks and profits since the moment of the announcement, but this increment had been balanced out in two months.

Another experiment was performed considering the period from October 1990 to August 1993. This test was based on the suggestion given by the column "Quanto valgono – Otto azioni ai raggi X degli esperti" of the magazine "Milano Finanza". The sample was composed of 231 purchasing suggestions against 67 selling suggestions. This study utilized the technique of the event study through the statistic suggest by Brown and Warner:

$$\sum e_t / \sum \sigma[e_t(m)] \tag{25}$$

The mentioned statistic consists in the ratio between the average residual of the day t and the estimation of the standard deviation of the average residuals during the period before the beginning of the test.

Days	Purchases	t-Stud	Sales	t-Stud		
-10	-0.151	-0.804	0.097	0.272		
-9	-0.107	-0.568	-0.174	-0.489		
-8	0.040	0.212	-0.248	-0.697		
-7	-0.222	-1.181	0.136	0.383		
-6	0.127	0.677	-0.066	-0.185		
-5	-0.113	-0.601	0.212	0.597		
-4	0.193	1.029	-0.574	-1.614		
-3	0.379	2.017	-0.405	-1.141		
-2	0.035	0.185	-0.436	-1.228		
-1	0.168	0.896	0.076	0.215		
1	0.542	2.883	-1.021	-2.873		
2	0.268	1.425	-0.299	-0.841		
3	0.024	0.127	-0.332	-0.933		
4	-0.156	-0.828	-0.621	-1.749		
5	-0.252	-1.339	0.327	0.921		
6	0.164	0.873	-0.257	-0.723		
7	0.175	0.931	-0.595	-1.674		
8	-0.114	-0.607	0.458	1.290		
9	-0.039	-0.209	0.318	0.895		
10	0.095	0.506	-0.364	-1.023		

Hereunder the results of the test with the daily average residuals:

Table 2.2 – Summary of results 10/1990-8/1993, F. Caparrelli

Results did not permit to refuse the null hypothesis that residuals are not correlated.

2.2.2 A continuing process

Tests to confirm or refuse the EMH have been carried on for years even now some authors try to perform new ones.

Indeed very recently, another form to test the semi-strong hypothesis has been developed. On February 26, of the current year, Arianna Ziliotto and Massimiliano Serati of the Carlo

Cattaneo LIUC University School of Economics and Management, published *The Semi-Strong Efficiency Debate: in Search of a New Testing Framework*. They built their idea on the basis that focusing just on return distribution and profit opportunities would twist the mean of the tests.

Their model is based on a Testing Tree that consists of three steps:

- Step 1: Market Surprise
- Step 2: Volatility
- Step 3: Spillovers



Figure 2.1 Testing Tree, The Semi-Strong Efficiency Debate: in Search of a New Testing Framework

In the first step it is possible to understand whether there exist market surprise, and so there is no anticipation of any information, or whether there exist no market surprise, and so there is the need to investigate. The second step lead to another investigation choice with respect to the degree of the volatility, evidencing the need to further investigation patterns in presence of low volatility of the market. Finally the model focuses on spillover effects, exploiting their impact on the market to discriminate on the existence of the efficiency.²³

²³ The Semi-Strong Efficiency Debate: in Search of a New Testing Framework, Arianna Ziliotto, Massimiliano Serati, Carlo Cattaneo LIUC University School of Economics and Management, February 2015

3. Anomalies on the EMH

As it has been showed hereby, the efficient market hypothesis consists of three forms. However, the most practical and interesting form is the semi-strong efficiency form. During the literature evolution researchers have found interesting way to test this form because of the evidence coming from the market. Dividends announcements, multiple ratios based on price and earnings, calendar events, etc.. are elements came to light by the investigation over the semi-strong form. This branch is known as Anomalies of the Efficient Market Hypothesis. In other words, the anomalies indicate inefficiency into markets, or rather a situation in which stocks deviate from the assumption of the EMH. Often this inefficiency has been proved not to be persistent once discovered, despite this interpretation is not always true. Indeed, after the documentation of an anomaly, there exist three possibility: the anomaly will disappear, reverse or attenuate. This leads to some question regarding the possibility to forecast these anomalies in order to get advantage over the market. On the other hand an anomaly could be the proof of the inadequacy of the model undertaken.

The anomalies branch has developed its literature since 80s as a consequence of the attention previously conferred to the efficient market investigation. Here, the purpose of researchers was to find out some systematic variations of the stock price. This working field is quite interesting because it allows to compare different markets, and so, it allows to understand whether markets follow the same rules. At the end of 80s Samuelson stated that finance was not anymore a perfect model, but it would be possible to accept the presence of anomalies into markets. This was the first step for opening the doctrine doors to events that the current doctrine could not explain.

According to *Latif et al.* (2011) it is possible to distribute anomalies into three basic area: Fundamental anomalies, technical anomalies and calendar (or seasonal) anomalies. Most common anomalies concerned rates of change on the basis of variations in specific temporal circumstance.²⁴

3.1 Calendar Anomalies

This category consists of those effects, based on the calendar, which are cyclical in returns. Most of the calendar effects have been diminished, disappeared or reversed as affirmed above. Calendar anomalies are observed in presence of each significant change in time: year, month,

 ²⁴ Market Efficiency, Market Anomalies, Causes, Evidences, and Some Behavioral Aspects of Market Anomalies,
 M. Latif, S. Arshad, M. Fatima, S. Farooq, Institute of Management Sciences Bahauddin Zakaria University,
 Multan, Pakistan, 2011

week or day. They became popular because of their huge typology and their affordable investigation. Calendar anomalies still face controversial opinion over their existence, especially by whom support the idea that transaction price would cancel them. In any case, it is possible to list the most common anomalies:

- Week-end/Monday effect
- January effect
- Holidays effect
- Intraday effect
- Halloween effect
- Turn of the month effect

3.2 The week-end effect

In 1973 F. Cross observed for the period 1953-1970 that the Stock Exchange Index has highly positive changes on Friday with respect to the other days, otherwise there were less increments on Monday. In 1980 Kenneth French disclosed an anomaly that consisted in the production of negative average return over weekends. French studied the Standard and Poor's (S&P) portfolio in the period 1953-1977. This analysis was integrated by Schwert including estimations of the weekend effect from February 1885 to May 2002, and other sample periods not included in French's study. The starting point was the following regression:

$$R_t = \alpha_0 + \alpha_w \ Weekend_t + \varepsilon_t \tag{26}$$

Where Weekend = 1 when the return spans Sunday, and zero otherwise. \propto_w represents the difference in average return over the weekend versus other days.²⁵

$lpha_0$	$t(\alpha_0=0)$	α_w	$t(\alpha_w = 0)$
0.0005	8052	-0.0017	-10.13
0.0004	4.46	-0.0013	-4.96
0.0007	3.64	-0.0030	-6.45
0.0007	6.80	-0.0023	-8.86
0.0005	4.00	-0.0005	-1.37
	α ₀ 0.0005 0.0004 0.0007 0.0007 0.0005	α_0 $t(\alpha_0 = 0)$ 0.000580520.00044.460.00073.640.00076.800.00054.00	α_0 $t(\alpha_0 = 0)$ α_w 0.00058052-0.00170.00044.46-0.00130.00073.64-0.00300.00076.80-0.00230.00054.00-0.0005

Hereinafter the results of the estimation:

 Table 3.1 Day-of-the-week effects in the U.S. stock returns, Anomalies and Market Efficiency. G. William

 Schwert

²⁵ Anomalies and Market Efficiency. G. William Schwert, University of Rochster, and NBER, 2003

The coefficient a_w appears negative when the returns over the weekend are lower than the ones in the other days. From data is evident that results from test have become less negative, underlying that the effect studied have started decreasing (or at least attenuating) since 80s (the discovered of the weekend effect). It leads to understand that the variance per time unit of the differences in price series is slower in the weekend. This means that Monday's price is the result of a random walk process that lasts three days. Following this ideology and starting again from daily data (1975-1989, historic MIB index by Milan Stock Exchange), Barone tried to verify whether the velocity of the stock prices generating process would change when markets are supposed to be closed. Therefore, in 1990, he published his study where standard deviations and averages of the index MIB rates were divided day by day. The rate averages resulted negative on Monday and Tuesday, and positive on Friday. Even the stock generating process velocity (standard deviation) resulted higher on Monday.²⁶

Moreover Barone tested the same sample also by means of a regression:

$$R_t = a_1 + b_2 D_2 + b_3 D_3 + b_4 D_4 + b_5 D_5 + u_t$$
(27)

Where D_2 is a dummy for Tuesday ($D_2 = 1$ if the observation falls on Tuesday, $D_2 = 0$ otherwise), D_3 is a dummy for Wednesday, and so on as follow:

 $D_2 = \frac{1 \text{ if the return belongs to Tuesday}}{0 \text{ if the return belongs to the other days}}$

 $D_3 = \frac{1 \text{ if the return belongs to Wednesday}}{0 \text{ if the return belongs to the other days}}$

 $D_4 = \frac{1 \text{ if the return belongs to Thursday}}{0 \text{ if the return belongs to the other days}}$

 $D_5 = \frac{1 \text{ if the return belongs to Friday}}{0 \text{ if the return belongs to the other days}}$

 a_1 is the average rate of change on Monday, while b_n represents the difference of the average rate of change on the other days.

²⁶ Aspects of Market Anomalies, M. Latif, S. Arshad, M. Fatima, S. Farooq, Institute of Management Sciences Bahauddin Zakaria University, Multan, Pakistan, 2011

Period Degree of freedom Ordinary Least Squares Generalized Least squares						
			F	Confidence	F	Confidence
				level		level
1975-1989	4	3384	6,69	0,000	6,95	0,000
1975-1979	4	1129	3,02	0,017	2,88	0,022
1980-1984	4	1169	2,37	0,050	2,50	0,041
1985-1989	4	1076	3,16	0,013	3,18	0,013

 Table 3.2 Il Mercato Azionario Italiano: efficienza e anomalie di calendario, E. Barone, 1990

The zero-hypothesis ($H_0: b_2 = b_3 = b_4 = b_5 = 0$) has been tested in the chart above. Results show that it is possible to reject the hypothesis at a confidence level of 95%. Rates of change on Monday appears reliably different from the others.

It is important to mention that the test used in this context was the F statistic of Snedecor:

$$F = \frac{\left[\frac{R^2}{(k-1)}\right]}{\left[\frac{(1-R^2)}{(n-k)}\right]} \tag{28}$$

With k and n-k degrees of freedom, where k represents the number of independent (forecasting) variables and n the number of observations:

It is possible to note that Barone did not report just the OLS data, but the GLS too. He found out that standard deviations results could suffer an heteroskedastic problem and so it would be better to standardize variables in the regression (27). As reported, he included in the analysis the generalized least squares contribution, underlying how results did not change.²⁷

So, this test underlined how the rates of change on Monday were reliably different from the ones on the other days of the week.

M. Gibbons and Hess got results quite similar to French using a linear regression model with different dummies. Indeed these dummies represented the expected returns of the various days instead of the difference with respect to Monday.

3.2.1 Other calendar anomalies

As aforementioned, there exist some other anomalies. An interesting anomaly is the holiday effect: Jacobs and Levy noted that the 35 percent of stocks growth in 1963-1982 occurred in the eight non-working days of the year. This leads to understand that this effect often occurs

²⁷ Il Mercato Azionario Italiano: efficienza e anomalie di calendario, E. Barone, 1990

on the national days, in the new year's day, etc. It is possible to distinguish between preholiday effect and post-holiday effect, both representing a change of direction in stock prices flow. Therefore, the holiday effect consists in a better performance on days preceding a holiday, and in a worst performance on next days. In 1990 Ariel verified a significant increment of stocks returns before Christmas and before the May Day with respect to other holidays.

Recently, Tamara Backovic Vulic tested this effect over the 13th July (Montenegrin Statehood day) for the period 2003-2009. Some results could be appreciated in the following graphic:



Figure 3.1 Testing the Efficient Market Hypothesis and its Critics - Application on the Montenegrin Stock Exchange, Tamara Backovic Vulic,

These results showed that this effect is not really effective in Montenegro, apart from two deducible cases.²⁸

The January effect has been the main famous calendar anomaly. It consists in a reliably higher rate of changes for every stocks in the month of January (with respect to the other months). For what concerns the Italian market, Giannasca and Macchiati (1986) discovered a strong seasonality in 1975-1989. Results based on the historic MIB showed rates of change equal on average to 0.33 per cent and significantly different from zero at a confidence level of 0.001 per cent. It is possible to observe these results in the following figure.

²⁸ Testing the Efficient Market Hypothesis and its Critics – Application on the Montenegrin Stock Exchange, Tamara Backovic Vulic, MSc University of Montenegro, Podgorica Faculty of Economics, professor assistant of Econometrics, Business Statistics, Operations Research, Applied Econometrics and Decision Making Models



Figure 3.2 Il Mercato Azionario Italiano: efficienza e anomalie di calendario, E. Barone, 1990

As stated by Caparelli, there are evidences of the prevalence of the January effect over the weekend effect. In fact the average return on Monday and Tuesday is resulted positive in January although it resulted negative during the other months:

Average	Monday	Tuesday	Wednesday	Thursday	Friday
Return					
January	-0.26%	0.23%	0.27%	0.25%	0.40%
Other months	-0.08%	-0.17%	0.14%	0.10%	0.15%
	TT 1	1 2 2 11 14	· · • • • • • • • • • • • • • • • • • •	1'	

Table 3.3 Il Mercato Azionario, F. Caparrelli

Rozeff and Kinney verified the presence of the January effect on a sample of stocks by the New York Stock Exchange in 1904-1974, observing higher returns concentrated in the first fifteen days of the month. The January effect has been justified by psychological belief that investors are affected by the conviction that the new year could start positively, or rather, as affirmed by Jacob and Levy, that investors usually wait the new year to sketch out a new strategy on the basis of the expected scenario proposed by analysts.

It is appropriate to hint the turn-of-the-month effect. The mere turn of the month seemed to be able to lead investors buying securities. This is confirmed by the fact that the rates of change at the beginning and at the last five days of the month appeared to be deeply positive pursuant to Ariel's work (1987). On the other hand, on the basis of Caparelli's work, the Italian market

appeared to show stock prices lower in the first part of the month (when the trading cycle ends up) and higher in the second part. However it is evident that these results could be affected by other anomalies such as the afore-mentioned January effect.

Boido et al. (2004) observed the summer-time (or daylight savings time) effect by means of the COMIT index. Results showed the presence of the effect on the basis of the fact that the time after the change of hour underlined a different prices average. In addition, days next to the daylight savings time moment appeared to get an average index value higher than the general mean.²⁹

3.3 Fundamental Anomalies

It is possible to gather together some anomalies under the name of fundamental anomalies by underlying the ones that appear to have some value for individual investors on the basis of financial reports. This section includes P/E effect, Book-to-Market ratios, Earnings announcements, Neglected-firm effect, High Dividend effect, and so on.

Going deeper in each meaning it is possible to briefly define these anomalies. The dividend yield anomaly states that high dividend yield stock outperforms the market with respect to the lower ones. Price to earnings ratio anomaly supported the idea that portfolio composed of low P/E stocks often outperform portfolios composed of high P/E stocks. In the same way stocks of companies with high book-to-market ratios outperform stocks with low book-to-market ratios. Moreover this effect seems not to be dependent on systematic risk, but on the fact that companies with low book-to-market ratios are perceived to be companies that grow rapidly. Earnings announcements can have variable effects on stock prices, their effects basically depend on analysts interpretation of the market in pursuit of predictability through earnings expectations published on website or personal relationships with experts. Again, the neglected-firm effect occurs on stocks that has lower trading volume in addition to the approximately absence of analysts support. It is possible to going on listing these anomalies, but a more advisable way is to examine one of them deeper.³⁰

3.4 The P/E effect

It has been stated that this effect asserts that the stock with low price to earnings ratio are likely to generate higher returns outperforming the market, while the stocks with high price to

²⁹ Anomalie di calendario: l'effetto ora legale, Boido, Claudio, Fasano, Antonio, Periodico: AF. Analisi finanziaria, 2004

³⁰ The neglected firm effect and an application in Istanbul Stock Exchange, Soner Akkoc, Mustafa Mesut Kayali, Metin Ulukoy, Banks and Bank Systems, Volume 4, Issue 3, 2009

earnings ratios tend to underperform with respect to the same market. The P/E ratio is calculated as the following ratio:

$$\frac{P}{E} = \frac{P_0}{EPS} \tag{29}$$

Where P_0 is the price of the security at time zero, and *EPS* is the earning per share calculated as the ratio between the last reported earnings and the number of stocks.

Among the various hypothesis over the meaning of the P/E effect, there exist some based on the CAPM and others based on risks attitude. Following this concept, low P/E stocks are assumed to be risker than high ones (this means that the β of the low P/E stocks is greater than the β of the high P/E ones), and therefore they would generate higher performance. Nevertheless further studies demonstrated that the leakage between low P/E and high β was not enough to explain the anomaly. Portfolio considered appeared to show greater performances even after the analysis started including risk. In 1977 Basu performed a study on this effect. His analysis followed this outline:

- Calculation of the P/E ratio for each security of the sample
- Composition of five portfolios on the basis of the P/E value
- Calculation of the monthly return for each portfolio
- Re-composition of portfolio (after 12 months)
- β coefficient estimation for each portfolio and indexes estimations

Results showed that the greater performance of low P/E samples was not related to an higher value of the systemic risk.

In 1994 Calcagnini and D'Arcangelis examined a sample of 42 securities for the period 1979-1992. They constructed some portfolios on the basis of the P/E ratio supposing to buy them at the beginning of the year and hold them for the whole year. Then it was constructed the market model to evaluate the performance on the basis of the systemic risk. Results showed unsatisfactory conclusions: in the long run the connection between low P/E and high performance seemed to hold, but there were no possibility to reject the equality hypothesis on the basis of the significance test of portfolio return differences.

Returns and statistics		Portfolios	
	1	2	3
Average P/E	8.27	17.18	57.71
Average return of the year	48.22	40.12	32.86
Systemic Risk (β)	1.03	0.99	0.92
-------------------	-------	-------	-------
Return/β	46.77	40.42	35.75

Table 3.4 Il Mercato Azionario, F. Caparrelli

3.4.1 Other fundamental anomalies

Akkok *et al.* (2009) studied the neglected-firm effect in 1999-2008 (Istanbul Stock Exchange) using monthly volume data. They found out that the portfolio they have constructed by popular stocks earned the highest abnormal return when compared to the abnormal returns earned by the other two portfolios constructed consisting of neglected and normal stocks. This leads to understand that ISE (Istanbul Stock Exchage) was not affected by the neglected-firm effect, even if previous tests have documented some evidences. Popular stocks showed higher average with respect to the portfolio consisting of neglected stocks in all years but 2008. Furthermore the monthly average abnormal return of neglected portfolio is negative. Moreover t-test showed values for popular portfolio which were statistically significant in each year, t-values for normal portfolio were significant in all years but 2008 at the 5% level.

They tried to establish whether their results were a consequence of the January effect as well. However they got same results and concluded their findings were not consistent with the January effect, contradicting the Neglected-firm effect.

Brian T. Brian T. Allman *et al.* gave a contribute to the Small-firm effect research analysing NYSE and AMEX stock prices in 1962-1975. They found out that portfolios of smallest firm on average experienced returns over 20% which were reliably higher than portfolios of largest firms. There were evidences that allow to think that investors could construct portfolios with systematically abnormal returns on the basis of firm size³¹.

3.5. Technical Anomalies

For technical anomalies it has been considered the techniques used to forecast future prices of stocks on the basis of past prices and past information which seemed to have some effect on markets. So, the purpose of the technical analysis is to study time series and exchanged volumes without considering the object, this raised some interesting anomalies. Among the anomalies identified in the technical field we found the Moving Averages and the Trading Range beak.

3.5.1 Hints on technical anomalies

³¹ The Size Effect, Brian T. Brian T. Allman et al, 2009

Hons and Tonks examined trading strategies in the US Stock Market founding signs of momentum strategies during the period 1977-1996. They discovered the possibility to gain advantages by past positives securities. Hence, the momentum anomaly states that securities that reliably went up in the past would probably continue to go up in the near future. This means that stocks which outperform on the short run period tend to perform well also in the future. The momentum strategy is based on the assumption that price of securities are more likely to keep moving in the same direction, than to change it. Momentum effect has been proved to be effective in the US Small and Large Cap universe³². Resistance and support level are the basis of the Trading Range Break strategy. Support level represents the level of price corresponding a break in the negative trend of a stock, while resistance level represents an abstract level in which prices stops to grow. Support level occurs when a big amount of purchasing affect those stocks which have performed negative trends, while resistance occurs when many stock sales take place at the same time. A trading range break tries to forecast and exploit these circumstances. A price penetrating the resistance level would generate a buy signal while a price penetrating the support level would generate a sell signal. The belief is that investors sell at the resistance level and buy at the support level. In 1992 Brock et al., analysed the above-mentioned effect on the Dow Jones Industrial Index from 1897 to 1985. They found out that this technical analysis would be effective against the market unless costs should be not carefully took into account since the beginning. Obviously there are contrasting examination on technical anomalies, but they are not be examined here.

3.6. Do famous anomalies persist nowadays?

This is a conflicting issue. The persistence of the anomalies appeared over the time do not persuade everyone. In 2002 Schwert observed that all the well-known anomalies in the finance literature do not hold up in different sample periods. Examples could be represented by the size and the value effects, which seem to have disappeared after the papers their existence have been brought to light.

In certain market happen that even the weekend and the dividend yield effect decreased their predictive power.

The small-firm turn-of-the-year effect became weaker in the years after it was first documented in the academic literature, although there is some evidence that it still exists.

³²Does Momentum Investing Work?, Alex Bryan, 2013

⁽http://ibd.morningstar.com/article/article.asp?id=591675&CN=brf295,http://ibd.morningstar.com/archive/ar chive.asp?inputs=days=14;frmtId=12,%20brf295)

The reason might be the popularity these anomalies achieve. In other words, investors that have been able to experience these anomalies, have tried to exploit them to beat the market as well. Moreover once anomalies have been discovered, prices could be corrected by operators on the basis of new information received.

Hence, Schwert suggested that anomalies could be more apparent than real. They could be the consequences of an hysteric research by many authors. It could be easy to share Schwert's opinion, but it is true that anomalies, in general, have been documented in different markets and different period corresponding similar, or even equal, results. Anomalies existed and will exist, especially considering that the first to give way were the calendar anomalies, the easier to be identified. Nevertheless this is an opinion that have to be replaced by facts, hence it will find an answer at the end of the path this paper is covering.

3.7. How many ways to test the EMH?

It is sure that the efficient market hypothesis has been over-tested over time. Researchers thought up many ways in order to satisfy or reject this theory. Beyond the latest effort produced by Zilotto and Serati, other authors invented strategies curiously different from the econometric and technical studies. Tests go from the data mining concept to the fractal estimation. The ways to test the EMH could be divided depending on calculation methods (as the latter two procedures cited) or on the kind of data collected. Concerning this second way, It is useful mention the field of the Event Studies. Event Studies consist in an empirical methodology based on a relevant specific event such as the stocks split, the announcement of financial reports, issues of new securities and so on. In other words, the ES are a mean to verify the impact of a specific event on a firm's value. Typically the process consists of many phases. First, a selection of one or more interest events have to be collected on the basis of revealed and expected returns. Then, the existence of these abnormal returns has to be proved, so the next step consists of statistic tests. Obviously the whole analysis depends on the availability of data. This means that the mere usage of statistical and mathematical tools has been surpassed. This continuing process probably will not end as long as authors will challenge themselves. However, nowadays, the wider solutions to test in different way the hypothesis Fama refined, consist of Fundamental and Technical analysis.

3.7.1 Hints on different ways to test the EMH and the anomalies affecting it: Fundamental and Technical analysis.

Basically the fundamental and technical studies are fields born to refuse the efficient market hypothesis. The Fundamental analysis studies the security in order to esteem the intrinsic

value to compare with the stock price. It is called "fundamental" because its methods focus on company fundamentals, or rather everything comes from financial documentation. Stocks current value is a function of the asset, economic and financial trend of a company. So, Fundamental analysis could consist in the study of financial data, management, business concept and competition in order to derive a forecast and profit from future price movements, but it could affect the industry level focusing on supply and demand forces for the products offered. Moreover, it bases its work on the comparison between the intrinsic value and the share of the security. On the contrary the technical analysis studies time series and volumes. Technical analysis raised at the beginning of the Twentieth Century thanks to Charles Dow's work. It started developing after the financial crisis in USA to arrive in 50s in Europe. The aim is to characterize instruments and techniques able to underline buying or selling signals in order to beat the market. Murphy defined technical analysis as the study of the market action by means of graphics for determining future price trends. The technical analysis tries to forecast a change on trends and maintain it as far as evidences will confirm it.

The explanations over the effectiveness of the technical analysis could be found on the repetitiveness of human behaviours or in their irregular rationality. However these elements are pointless/of no interest in the analysis I am doing here.

4. Is the Italian market efficient?

Everyone investing in the Exchange Market would know the answer to this question. The definition of the efficiency of a market is strictly related to the quantity and quality of the available information. Indeed markets are supposed to be efficient whether prices are correctly determined on the basis of the whole available information. In an efficient market securities issued present valuation relatives to the potential profit that their companies could reach. Financial markets have many functions: they finance investments through the transfer of sources from surplus to deficit sectors; they allow to negotiate investment; they control for the efficient market is a necessary condition to have a stable and well operating market. This is the reason of the huge literature explained before. As it has been show in the previous chapters, there exists some literature relative to the Italian case, but in order to observe recent conditions, from here onward, it is shown an independent analysis over the Italian Stock Exchange.

4.1 Testing the EMH on the Italian Market

Index Analysis

Purpose of the analysis on Index: stock market indexes represent the measure of the value of a section of the stock market. They are computed from the prices of selected stocks and represent a description of the market. An indexes combines several stocks or other investment vehicles together at aggregate level. The aim is to track the market's changes over time. Therefore indexes represent the perfect way to understand whether a market follow one of the three form of efficiency described in the financial literature.

4.1.1 Data

The first step in order to examine the Italian Market, in order to prove or reject the efficient market hypothesis, is defining data.

I collected indexes and companies data from Yahoo Finance Database³³. The former on indexes analysis, the latter on companies one (collected also from Datastream). For this study daily (Monday to Friday), weekly and monthly price index data has been used. The observation period fluctuates from January 1, 2009 to December 31, 2014.

The empirical analysis of this study uses data of adjusted close prices for six indexes of the Italian Stock Exchange: FTSE MIB; FTSE IT MICRO CAP; FTSE IT SMALL CAP; FTSE ITALIA ALL-SHS; FTSE ITALIA MID CAP; FTSE ITALIA STAR.

The period chosen for examinations start the year next the occidental financial crisis to the end of the last year in order to avoid to consider the effect of that crisis.

Index	Notations	Sample Period		Observations	
			Daily	Weekly	Monthly
FTSE MIB	FTSEMIB.MI	1/1/2009-	1548	311	72
		31/12/2014			
FTSE IT MICRO	ITMI.MI	1/1/2009-	1519	311	72
CAP		31/12/2014			
FTSE IT SMALL	ITSC.MI	1/1/2009-	1520	311	72
CAP		31/12/2014			
FTSE ITALIA ALL-	ITLMS.MI	1/1/2009-	1520	311	72
SHS		31/12/2014			
FTSE ITALIA MID	ITMC.MI	1/1/2009-	1520	311	72

³³ https://it.finance.yahoo.com/indices?e=milano

CAP		31/12/2014			
FTSE ITALIA	ITSTAR.MI	1/1/2009-	1548	313	72
STAR		31/12/2014			

Table 4.1 Description of Data Samples

Hereinafter I drawn indexes graphs divided on the basis of days, weeks and months during the six years above defined.



Table 4.2 Time Series Plots of Daily Prices of Italian Stock Exchange indices



Table 4.3 Time Series Plots of Weekly Prices of Italian Stock Exchange indices





Although there are some differences, it is possible to say that for what concerns daily prices, indexes seem to perform similar trends. On the contrary, in weekly and monthly comparison, FTSE ITALIA STAR index seems to be affected by increasing trends contrastingly with other indexes which appear to be affected by casual trends.

The study of the efficiency concerns return series. Returns have been calculated using the logdifference (continuously compounded formula) of each index price:

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) \tag{30}$$

Log return

Where p_t and p_{t-1} represent the adjusted closing prices of an index at time t and t-1, respectively. In depth, logarithmic returns are differences of log prices sampled at the same unit time interval. The use of log returns born from the necessity to have a constant process with log-normal percentages, because percentage returns are not made up such a normal distribution. Indeed price series do not typically fluctuate around a constant level. So the logarithmic transformation becomes necessary because of the significant asymmetry of the distribution of prices, in order to obtain a log-normal distribution.

Once established the data composition, it is possible to define the hypothesis of the study. The intention is to examine if the Italian Stock Market is weak and/or semi-strong efficient, as well as there exist anomalies over it.



Table 4.5 Time Series Plots of Daily Log Returns of Italian Stock Exchange indices



Table 4.6 Time Series Plots of Weekly Log Returns of Italian Stock Exchange indices

FTSE IT MICRO CAP (ITMI.MI)	FTSE IT SMALL CAP (ITSC.MI)
-----------------------------	-----------------------------



Table 4.7 Time Series Plots of Monthly Log Returns of Italian Stock Exchange indices

Time series plots of daily returns (Table 4.2) suggest that those series do not have a deterministic trend, that means they do not increase or decrease in the long run, also the variability does not blow up or significantly decrease in the long run. Positive values tend to be followed by positive values for brief observations, the same happens for negative values. Moreover, it is clear that all daily markets indexes fluctuate around zero. Differently, weekly and monthly data (Table 4.3 and 4.4) apparently show casual trends that seem to affect the successive one. In general these different indexes seem to follow similar trends for each timeline considered, a part for Micro and Small Cap indexes, but differences appear negligible. However all indexes seem not to show blowing mutations in the last two years.

4.1.2 Weak Hypothesis

$\begin{cases} H_0: The \ Italian \ Stock \ Market \ is \ weak - form \ efficient \\ H_1: The \ Italian \ Stock \ Market \ does \ not \ follow \ a \ random \ walk \end{cases}$

4.1.3 Methodology and Results

In order to verify the hypothesis above, it has been used some statistical methods: descriptive analysis; the serial correlation test; the runs test; the sign test; the Augmented Dickey-Fuller and the Phillips-Perron unit root tests. In the following part it is possible to appreciate results of the analysis:

Daily analysis

Descriptive Analysis

FTSE IT MIC	CRO CAP	FTSE IT SM.	ALL CAP
(ITMI.MI)		(ITSC.MI)	
Mean	-2.53E-05	Mean	-0.000151
Median	0.000207	Median	0.000580
Maximum	0.064990	Maximum	0.140501
Minimum	-0.050985	Minimum	-0.102612
Std. Dev.	0.007917	Std. Dev.	0.011987
Skewness	-0.211812	Skewness	0.500588
Kurtosis	11.05956	Kurtosis	24.22985
Jarque-Bera	4122.567	Jarque-Bera	28608.22
Probability	0.000000	Probability	0.000000
FTSE ITALI	A ALL-SHS	FTSE ITALL	A MID CAP
(ITLMS.MI)		(ITMC.MI)	
Mean	9.64E-06	Mean	0.000149
Median	0.000544	Median	0.000881
Maximum	0.099795	Maximum	0.076267
Minimum	-0.063289	Minimum	-0.084373
Std. Dev.	0.016156	Std. Dev.	0.013058
Skewness	-0.141469	Skewness	-0.230025
Kurtosis	5.104263	Kurtosis	6.847751

Jarque-Bera	285.5051	Jarque-Bera	951.0660				
Probability	0.000000	Probability	0.000000				
FTSE ITALIA	A STAR	FTSE MIB					
(ITSTAR.MI))	(FTSEMIB.M	II)				
Mean	-1.50E-05	Mean	0.003577				
Median	0.000215	Median	0.000232				
Maximum	0.106839	Maximum	9.320000				
Minimum	-0.070442	Minimum	-6.430000				
Std. Dev.	0.017078	Std. Dev.	0.313571				
Skewness	-0.139126	Skewness	13.14048				
Kurtosis	5.255730	Kurtosis	646.4820				
Jarque-Bera	333.1904	Jarque-Bera	26752002				
Probability	0.000000	Probability	0.000000				

Table 4.8 Descriptive Analysis of Daily indexes returns

The descriptive analysis of the index, on the basis of the daily returns, underlines that half indexes have negative mean and half present a positive one. FTSE MIB index, that has the highest value, counteracts FTSE IT MICRO CAP index, that has the lowest value. Results from standard deviations underlines that FTSE MIB index presents the highest volatility compared with other Italian Stock Exchange indexes, that proves more dispersion of data with respect to other indexes. Again, FTSE IT MICRO CAP index presents the lowest standard deviation value, so the lowest volatility among Italian indexes. Moreover, all indexes present negative asymmetry (skewness indicates negative value) a part for FTSE IT SMALL CAP and FTSE MIB indexes which present positive asymmetry. Kurtosis values explain that the distributions of FTSE MIB, FTSE IT MICRO CAP and FTSE IT SMALL CAP are strongly centred with lights tails. Jarque-Bera test suggest that all indexes (more or less at the same level) have been extracted by a sample not distributed such as a normal random variable. P-values are equal to zero for all indexes. Results show none of the indexes can be represented by a normal distribution.

Runs test

A runs test is a non-parametric test that tries to analyse whether there exist a series of returns changes all moving in the same direction. In other words whether price changes are independent or not. Results could be positive in case of returns increments, zero in case of no changes and negative in case of returns decrements.

The null hypothesis states that the series is a random series. Stating the test, this could be demonstrated if the observed number of runs in the series appears to be closer possible to the expected number of runs.

Let's consider the FTSE IT MICRO CAP index:

```
(8 vars, 1519 obs)
```

```
. runtest logreturns
N(logreturns <= .0002067019959213) = 759
N(logreturns > .0002067019959213) = 760
obs = 1519
N(runs) = 780
z = 1
Prob>|z| = .32
```

The p-value attests that data are consistent with a random process at the 5% significance level, also the result of the test indicates that z=1 is less than the critical value, hence the returns series appears to follow a random process.

Now, take a look at the gathering outcomes:

ITM	II.MI	ITS	C.MI	ITLN	IS.MI	S.MI ITMC.MI		ITSTAR.MI		FTSEMIB.MI	
Z	P-value	Z	P-value	Z	P-value	Z	P-value	Z	P-value	Z	P-value
1	.32	-6	0	.77	.44	-3.23	0	-2.92	0	1.47	.14

Table 4.9 Runs Test for Daily returns on Italian Stock Exchange indexes

The FTSE IT SMALL CAP index definitely shows absence of randomness, as well as the FTSE IT MID CAP and the FTSE ITALIA STAR ones. This means that the RW hypothesis has been rejected for all these three indexes. On the other hand, the FTSE IT ALL-SHS, the FTSE MIB and the FTSE IT MICRO CAP indexes appear all random at significance level. This means that – on the basis of the Runs test – half of the six Italian indexes result efficient looking at day by day opportunities.

Unit Root test

The EMH demands for randomness (so, non-stationarity) in returns series. Established that, it is easy understand what could be the role performed by a unit root test. A unit root test is performed to understand if a series is stationary or less. The test statistic would results higher than the critical value in order not to reject the null hypothesis, and so, in order to verify the existence of the market efficiency.

In this case the null hypothesis states that the variable considered has to be integrated of order one, against the hypothesis of stationarity. The analysis is based on the examination of log prices.

LEVEL											
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI					
t-Statistic	-1.103242	-1.512297	-2.140894	-1.438197	-0.394105	-2.154447					
Prob.*	0.7166	0.5273	0.2287	0.5648	0.9078	0.2235					
		TEST (CRITICAL	VALUE							
1% level	-3.434451	-3.434454	-3.434448	-3.434448	-3.434376	-3.434371					
5% level	-2.863238	-2.863240	-2.863237	-2.863237	-2.863205	-2.863203					
10% level	-2.567722	-2.567723	-2.567722	-2.567722	-2.567705	-2.567703					

Augmented Dickey-Fuller Test

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

Table 4.1.0 ADF Test for Daily indexes log price (level)

Results of the ADF test show values from -0.394105 to -2.154447. This implies that all the companies appear to have a unit root at daily level. In particular, prices of the FTSE ITALIA STAR index appears strongly not correlated, while FTSE ALL-SHS and FTSEMIB indexes appear not correlated with less evidence. The null hypothesis cannot be reject because all the t-statistic appear smaller than relatives critical values, as well as the results given by p-values. ADF test over daily prices of the Italian Stock Exchange supports the weak form hypothesis.

Philip-Perron Test

The ADF test looks at the issue on the basis of the serial correlation of errors in a parametric way. On the contrary, Philip and Perron proposed a nonparametric method of controlling for serial correlation when testing for a unit root. The PP method estimates the non-augmented

DF test equation modifying the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. So, the main difference between ADF and PP test is that the former suffers the possibility of specification errors, while the latter eliminates the consequences of serial correlation directly esteeming long run effects.

			LEVEL									
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI						
t-Statistic	-1.373050	-1.442860	-2.127576	-1.508153	-0.410855	-2.135924						
Prob.*	0.5969	0.5624	0.2339	0.5294	0.9049	0.2306						
		TEST (CRITICAL	VALUE								
10/ laval	2 121151	2 121119	2 121119	2 121119	2 121271	2 424271						
1 % level	-3.434431	-3.434446	-3.434446	-3.434446	-3.434374	-3.434371						
5% level	-2.863238	-2.863237	-2.863237	-2.863237	-2.863204	-2.863203						
10% level	-2.567722	-2.567722	-2.567722	-2.567722	-2.567704	-2.567703						

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

Table 4.1.1 PP Test for Daily indexes log prices (level)

The PP test gives back same results of the ADF test, underlying another time the strongly evidence for the FTSE ITALIA STAR case.

Serial Correlation Test

The autocorrelation test is probably the most used test to examine a random walk. This test allows to examine whether stock prices are independent from each other. In this case, log returns have been used instead of simple prices. The hypothesis are the following:

 $\begin{cases} H_0: Data are independently distributed (the correlations are equal to zero, so any observed correlations resilt from randomness)$ $<math>H_1: The \ data \ are \ not \ independently \ distributed (serial \ correlation) \end{cases}$

The last two columns reported in the correlogram are the Ljung-Box Q-statistics and their p-values. The Q-Statistic is a test for the null hypothesis (no autocorrelation up to order k). If there is no serial correlation in the residuals, the autocorrelations and partial autocorrelations at all lags should be nearly zero, and all Q-statistics should be insignificant with large p-values.

FTSE IT MICRO CAP (ITMI.MI)	FTSE IT SMALL CAP (ITSC.MI)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
ψ	•	1 0.010	0.010	0.1441	0.704			1 0.188	0.188	53.734	0.000
1	1 2	2 0.047	0.047	3.5530	0.169	P	1	2 0.103	0.071	70.023	0.000
		4 0.038	0.038	20 439	0.122	10	1 3	3 0.060	0.030	75.519	0.000
i i	1 1	5 0.004	-0.000	20.469	0.001		l il	5 0.028	0.006	81.700	0.000
ų į	ի փ	6 0.020	0.010	21.092	0.002		1)	6 0.040	0.027	84.174	0.000
2	1 2	7 0.055	0.049	25.790	0.001	L D	4	7 -0.072	-0.094	92.206	0.000
1	u	9 0 0 57	0.025	26.081	0.001		1 10 1	8 0.002	0.023	92.212	0.000
ų		10 -0.019	-0.025	31.558	0.000			10 -0.060	-0.078	100.37	0.000
ų į	1 1	11 0.044	0.032	34.565	0.000		P	11 -0.011	0.011	100.56	0.000
		12 0.047	0.049	37.962	0.000		<u>и</u>	12 -0.002	0.006	100.57	0.000
	1 5	13 0.020	0.012	40 196	0.000		10 di	13 0.010	0.017	100.71	0.000
ան	ի դն	15 0.022	0.010	40.912	0.000		0	15 0.018	0.036	104.63	0.000
- p	u	16 0.079	0.064	50.612	0.000		l ú	16 0.041	0.057	107.18	0.000
2	2	17 0.028	0.025	51.808	0.000	1 1		17 0.026	-0.007	108.20	0.000
1	1 2	19 -0.027	-0.049	54 017	0.000			18 0.019	0.008	108.74	0.000
d.	ի դե	20 -0.034	-0.053	55.816	0.000	5		20 0.026	0.008	108.91	0.000
ę.	(¹	21 -0.031	-0.036	57.297	0.000		(u	21 -0.016	-0.045	110.38	0.000
2	2	22 0.022	0.032	58.052	0.000	1	l l	22 -0.006	-0.001	110.43	0.000
	1 2	23 0.021	-0.020	58.737	0.000		1 1	23 0.019	0.042	111.01	0.000
ֆ	6	25 0.034	0.033	62.387	0.000			25 0.023	0.022	111.01	0.000
ψ	ј ф	26 0.000	-0.004	62.388	0.000	l ii		26 -0.020	-0.024	112.44	0.000
<u>.</u>	1 2	27 0.028	0.027	63.627	0.000		u	27 -0.019	-0.008	113.02	0.000
		28 0.004	-0.012	03.051	0.000		1	28 -0.001	-0.003	113.02	0.000
ili ili	l ii	30 0.004	0.005	63.681	0.000			30 -0.026	-0.015	113.24	0.000
ψ	ј ф	31 -0.003	-0.007	63.700	0.000	l d	0	31 -0.030	-0.033	115.70	0.000
1	1 2	32 0.018	0.016	64.186	0.001	<u> </u>	1 11	32 -0.015	-0.000	116.06	0.000
		34 0.001	-0.003	64 192	0.001			33 -0.003	0.007	116.08	0.000
di di		35 -0.031	-0.018	65.665	0.001	ili ili	l ii	35 -0.002	0.003	116.10	0.000
	1	36 0.034	0.036	67.447	0.001		(l	36 -0.015	-0.021	116.44	0.000
			<u>a 10</u>	n							
FISCHALI	A ALL-SIIS		5.IVI)		FISEIIALI	A MID CAP	(ITMC			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
Autocorrelation	Partial Correlation	AC	PAC 0.010	Q-Stat 0.1545	Prob 0.694	Autocorrelation	Partial Correlation	AC	PAC 0.070	Q-Stat 7.5149	Prob 0.006
Autocorrelation	Partial Correlation	AC	PAC 0.010 -0.003	Q-Stat 0.1545 0.1704	Prob 0.694 0.918	Autocorrelation	Partial Correlation	AC	PAC 0.070 -0.016	Q-Stat 7.5149 7.7158	Prob 0.006 0.021
Autocorrelation	Partial Correlation	AC	PAC 0.010 -0.003 -0.020	Q-Stat 0.1545 0.1704 0.7757 1.0523	Prob 0.694 0.918 0.855 0.902	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005	PAC 0.070 -0.016 -0.003 0.006	Q-Stat 7.5149 7.7158 7.7555 7.9016	Prob 0.006 0.021 0.051
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044	PAC 0.010 -0.003 -0.020 -0.013 -0.044	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725	Prob 0.694 0.918 0.855 0.902 0.539	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039	PAC 0.070 -0.016 -0.003 0.006 -0.040	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160	Prob 0.006 0.021 0.051 0.099 0.071
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151	Prob 0.694 0.918 0.855 0.902 0.539 0.284	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.000	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216	Prob 0.006 0.021 0.051 0.099 0.071 0.116
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047 0.003 -0.027	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 2 0.017	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 0.010 0.010	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378	Prob 0.006 0.021 0.051 0.099 0.071 0.116 0.168
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047 0.003 -0.007 0.021	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.5005 8 1201	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.000 0.010 -0.019 0.009	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861	Prob 0.006 0.021 0.051 0.099 0.071 0.116 0.168 0.212 0.285
Autocorrelation	Partial Correlation	AC 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047 0.003 -0.007 0.021 -0.026	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.5005 8.1201 9.0461	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528	Autocorrelation	Partial Correlation	AC 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.000 0.010 -0.019 0.009 -0.014	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040	Prob 0.006 0.021 0.051 0.071 0.116 0.168 0.212 0.285 0.354
Autocorrelation	Partial Correlation	AC 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047 0.003 -0.007 0.021 -0.026 0.029	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.5005 8.1201 9.0461 9.9254	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.537	Autocorrelation	Partial Correlation	AC 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.000 0.010 -0.019 0.009 -0.014 0.024	Q-Stat 7.5149 7.7158 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823	Prob 0.006 0.021 0.051 0.099 0.071 0.116 0.168 0.212 0.285 0.354 0.377
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 12 0.020	PAC 0.010 -0.003 -0.013 -0.044 0.047 0.003 -0.007 0.021 -0.026 0.029 -0.013 0.029	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.5005 8.1201 9.0461 9.9254 10.112 11.500	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.537 0.606 0.566	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 12 0.026	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.024	Q-Stat 7.5149 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.905	Prob 0.006 0.021 0.051 0.099 0.071 0.116 0.212 0.285 0.212 0.285 0.354 0.377 0.451
Autocorrelation	Partial Correlation	AC 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029	PAC 0.010 -0.020 -0.020 -0.013 -0.044 0.047 0.021 -0.026 0.029 -0.013 -0.029 -0.013 -0.029 -0.028	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.5005 8.1201 9.0461 9.9254 10.112 11.509 12.835	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.537 0.606 0.568 0.540	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.024 -0.011 0.027	Q-Stat 7.5149 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348	Prob 0.006 0.021 0.051 0.099 0.071 0.116 0.212 0.285 0.354 0.377 0.451 0.448 0.499
Autocorrelation	Partial Correlation	AC 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.007 0.021 -0.026 0.029 -0.013 0.029 -0.028 -0.028 -0.009	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 9.0461 9.9254 10.112 11.509 12.835 12.897	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.522 0.528 0.523 0.506 0.540 0.540 0.540	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.027 0.012 -0.022	Q-Stat 7.5149 7.7158 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.212 0.285 0.285 0.285 0.354 0.377 0.451 0.448 0.499 0.532
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 16 0.036 16 0.036 16 0.036 17 0.005 18 0.025 19 0.025 10 0.025 11 0.025 12 0.025 13 0.026 14 0.025 12 0.025 14 0.025 14 0.025 14 0.025 14 0.025 14 0.025 14 0.025 14 0.025 15 0.026 16 0.025 17 0.025 17 0.025 17 0.025 17 0.025 11 0.024 12 0.011 13 0.030 14 -0.025 15 0.066 16 0.026 16 0.026 16 0.026 16 0.026 17 0.055 17 0.055 15 0.056 15 0.056 1	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.007 0.021 -0.026 0.029 -0.028 -0.028 -0.009 0.042	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 9.0461 9.9254 10.112 11.509 12.835 12.897 14.938 40.000	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.528 0.523 0.506 0.568 0.540 0.540 0.529 0.221	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 26 -0.019 17 0.026 14 0.026 15 -0.019 16 0.007 17 0.026 17 0.026 17 0.026 18 0.026 18 0.026 18 0.026 19 0.026 19 0.026 19 0.026 10 0.027 10 0.026 10 0.027 10 0.026 10 0.027 10 0.027 10 0.026 10 0.027 10 0.026 10 0.027 10 0.026 10 0.027 10 0.026 10 0.027 10 0.027 1	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.022 -0.022 0.012 0.012	Q-Stat 7.5149 7.7158 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.285 0.354 0.377 0.451 0.448 0.499 0.532 0.600
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027	PAC 0.010 -0.003 -0.020 -0.044 0.047 0.021 -0.026 0.029 -0.013 0.029 -0.028 -0.009 0.042 0.056	Q-Stat 0.1545 0.1704 0.7757 7.4523 4.0725 7.4531 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.835 12.897 14.938 19.490 20.585	Prob 0.694 0.918 0.855 0.539 0.284 0.383 0.484 0.522 0.537 0.606 0.568 0.540 0.610 0.610 0.529 0.301	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.027 0.012 -0.022 0.012 0.056 -0.020	Q-Stat 7.5149 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 13.918 13.918	Prob 0.006 0.021 0.099 0.071 0.168 0.212 0.285 0.354 0.377 0.451 0.448 0.499 0.532 0.532 0.532 0.600 0.387
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.026 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030	PAC 0.010 -0.003 -0.020 -0.044 0.047 0.021 -0.026 0.029 -0.013 0.029 -0.013 0.029 -0.028 -0.009 0.042 0.050 -0.026 -0.032	Q-Stat 0.1545 0.1704 0.7757 7.4523 4.0725 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.835 12.897 14.938 19.490 20.585 21.933	Prob 0.694 0.918 0.855 0.539 0.284 0.383 0.383 0.383 0.383 0.383 0.522 0.527 0.606 0.558 0.540 0.610 0.529 0.301 0.288	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.019 0.027 0.012 -0.022 0.012 0.012 0.012 0.056 -0.020 0.056	Q-Stat 7.5149 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.918 13.918 19.412 20.048	Prob 0.006 0.021 0.099 0.071 0.116 0.212 0.285 0.357 0.451 0.448 0.377 0.451 0.448 0.392
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.026 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007	PAC 0.010 -0.003 -0.020 -0.013 -0.044 0.047 0.021 -0.026 0.029 -0.013 0.029 -0.028 -0.028 -0.028 -0.028 -0.028 -0.029 -0.028 -0.0050 -0.029 -0.028 -0.020 -0.028 -0.020 -0.028 -0.020 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.028 -0.029 -0.028 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.029 -0.028 -0.029 -0.02	Q-Stat 0.1545 0.1704 1.07757 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 7.4531 9.9254 10.112 11.509 12.835 12.897 14.938 19.490 20.585 21.933 22.011	Prob 0.694 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.529 0.301 0.301 0.284 0.320 0.529 0.301 0.301 0.301 0.301 0.301 0.301 0.301 0.301 0.301 0.301 0.301 0.529 0.301 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.539 0.537 0.606 0.529 0.537 0.606 0.529 0.537 0.529 0.301 0.301 0.284 0.528 0.529 0.301 0.328 0.528 0.529 0.301 0.528 0.528 0.529 0.529 0.301 0.528 0.528 0.529 0.529 0.529 0.528 0.529 0.529 0.529 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.5	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.027 0.012 -0.022 0.012 0.056 -0.020 -0.014 -0.020 -0.020 -0.014 -0.020 -0.020 -0.012 -0.020 -0.020 -0.012 -0.020 -0.012 -0.020 -0.012 -0.020 -0.020 -0.020 -0.020 -0.019 -0.027 -0.020 -0.020 -0.027 -0.027 -0.020 -0.020 -0.020 -0.027 -0.020 -0.020 -0.020 -0.027 -0.020 -0.020 -0.020 -0.027 -0.020 -0.020 -0.020 -0.020 -0.027 -0.020 -0.014 -0.0014	Q-Stat 7.5149 7.7558 7.7555 7.8016 10.216 10.216 10.819 10.861 11.040 11.823 11.935 12.998 13.946 13.948 13.916 13.988 13.918 13.918 13.948 20.048 20.339	Prob 0.006 0.021 0.051 0.116 0.168 0.212 0.285 0.354 0.354 0.354 0.354 0.448 0.448 0.448 0.448 0.448 0.449 0.532 0.600 0.318 0.392 0.392 0.437
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 -0.022	PAC 0.010 -0.003 -0.020 0.013 -0.044 0.047 0.007 0.021 -0.026 0.029 -0.013 0.029 -0.028 -0.028 -0.004 -0.026 0.050 -0.026 0.050 -0.022 -0.026 0.022 -0.026 0.029 -0.028 -0.020 -0.028 -0.020 -0.028 -0.028 -0.020 -0.028 -0.020 -0.028 -0.028 -0.020 -0.028 -0.020 -0.028 -0.020 -0.028 -0.020 -0.028 -0.026 -0.029 -0.028 -0.026 -0.028 -0.028 -0.026 -0.028 -0.026 -0.028 -0.026 -0.028 -0.026 -0.028 -0.026 -0.026 -0.028 -0.026 -0.028 -0.026 -0.026 -0.028 -0.026 -0.028 -0.026 -0.026 -0.028 -0.026 -0.026 -0.027 -0.028 -0.026 -0.026 -0.026 -0.026 -0.028 -0.026 -0.026 -0.026 -0.027 -0.028 -0.026 -0.026 -0.026 -0.026 -0.027 -0.026 -0.028 -0.026 -0.026 -0.026 -0.026 -0.026 -0.028 -0.026 -0.004 -0.026 -0.026 -0.004 -0.0	Q-Stat 0.1545 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 9.9254 10.112 11.509 12.835 12.897 14.938 19.490 20.585 21.933 22.011 22.812 22.542	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.528 0.528 0.528 0.537 0.606 0.540 0.540 0.540 0.529 0.301 0.301 0.324 0.324	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.066 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 21 -0.034	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.009 -0.014 0.024 -0.011 0.027 0.012 -0.022 0.012 0.012 0.012 -0.022 0.056 -0.020 -0.014 -0.014 -0.014 -0.014 -0.014	Q-Stat 7.5149 7.7555 7.8016 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 19.181 19.412 20.048 20.339 22.109 24.010	Prob 0.006 0.021 0.051 0.071 0.116 0.168 0.212 0.285 0.354 0.354 0.354 0.354 0.448 0.499 0.532 0.600 0.318 0.600 0.318 0.367 0.393 0.437
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015	PAC 0.010 -0.020 -0.020 -0.013 -0.044 0.047 0.021 -0.026 0.029 -0.026 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.020 -0.0020 -0.	Q-Stat 0.1545 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 9.0461 9.9254 10.112 11.509 12.835 12.897 14.938 21.933 22.011 22.812 23.867	Prob 0.694 0.855 0.902 0.539 0.284 0.383 0.484 0.528 0.528 0.528 0.537 0.606 0.540 0.540 0.540 0.540 0.301 0.301 0.324 0.341 0.354	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 02 -0.014 21 -0.034 22 0.035 23 0.008	PAC 0.070 -0.016 0.003 0.006 -0.040 -0.040 -0.019 0.009 0.0014 0.024 -0.014 0.027 0.012 -0.022 0.012 -0.012 -0.012 0.056 -0.020 -0.014 -0.014 -0.014 -0.014 -0.014 -0.012 0.056 -0.020 -0.014 -0.012 -0.012 -0.012 -0.012 -0.015 -0.020 -0.014 -0.015 -0.020 -0.014 -0.015 -0.020 -0.014 -0.021 -0.015 -0.020 -0.014 -0.021 -0.021 -0.015 -0.022 -0.022 -0.012 -0.012 -0.019 -0.012 -0.022 -0.022 -0.012 -0.010 -0.019 -0.010 -0.019 -0.012 -0.022 -0.022 -0.012 -0.022 -0.022 -0.022 -0.012 -0.022 -0.022 -0.022 -0.022 -0.012 -0.022 -0.012 -0.022 -0.012 -0.022 -0.022 -0.012 -0.022 -0.012 -0.022 -0.012 -0.022 -	Q-Stat 7.5149 7.7555 7.8016 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 13.916 13.988 13.918 19.811 19.412 20.048 20.339 22.109 22.010 24.010	Prob 0.006 0.021 0.051 0.116 0.168 0.212 0.285 0.354 0.354 0.354 0.354 0.354 0.352 0.448 0.499 0.532 0.600 0.318 0.367 0.393 0.393 0.393 0.398
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001	PAC 0.010 -0.020 -0.020 -0.013 -0.047 0.021 -0.026 0.029 -0.028 0.029 -0.028 0.029 -0.028 0.029 -0.028 0.042 0.050 -0.026 -0.032 -0.004 -0.004 -0.0016 -0.001	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.835 21.933 22.011 22.812 23.867 23.867	Prob 0.694 0.918 0.955 0.902 0.539 0.539 0.284 0.383 0.484 0.522 0.528 0.528 0.540 0.568 0.540 0.540 0.529 0.301 0.288 0.301 0.288 0.301 0.324 0.372 0.459	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.019 -0.014 0.022 0.012 0.056 -0.020 -0.012 0.056 -0.020 -0.014 -0.012 0.054 -0.020 -0.014 -0.032 0.044 0.004	Q-Stat 7.5149 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 13.948 13.948 13.948 13.918 19.181 19.412 20.048 20.339 22.109 24.010 24.102 26.209	Prob 0.006 0.021 0.051 0.071 0.116 0.212 0.285 0.324 0.451 0.451 0.451 0.448 0.532 0.600 0.532 0.600 0.318 0.367 0.393 0.347 0.393 0.343
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016	PAC 0.010 0.003 0.020 0.013 0.044 0.047 0.021 0.021 0.021 0.021 0.021 0.029 0.023 0.029 0.023 0.029 0.0029 0.00200 0.00290000000000	Q-Stat 0.1545 0.1704 1.0523 4.07257 7.4151 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.835 21.933 22.011 22.812 23.540 23.867 23.867 23.867 23.867	Prob 0.694 0.918 0.855 0.902 0.539 0.539 0.522 0.528 0.522 0.528 0.540 0.568 0.568 0.568 0.568 0.568 0.568 0.560 0.529 0.301 0.284 0.301 0.288 0.301 0.324 0.372 0.311 0.288 0.340 0.354 0.354 0.372 0.469 0.565 0.559 0.554 0.559 0.559 0.554 0.556 0.5	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.027 0.012 0.012 0.052 0.052 0.044 0.004 -0.014 -0.020 -0.014 -0.020 -0.014 -0.020 -0.014 -0.020 -0.014 -0.020 -0.014 -0.052 0.052 -0.014 -0.052 -0.014 -0.052 -0.014 -0.052 -0.014 -0.052 -0.052 -0.014 -0.052 -0.014 -0.052 -0.052 -0.014 -0.052 -0.0552 -	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.216 10.378 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 19.181 19.412 20.048 20.339 22.109 24.010 24.010 24.010 24.020 26.209 29.139	Prob 0.006 0.021 0.051 0.091 0.116 0.168 0.212 0.285 0.354 0.451 0.448 0.493 0.451 0.448 0.493 0.532 0.600 0.318 0.367 0.392 0.347 0.393 0.347 0.393 0.343 0.255
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 26 -0.006	PAC 0.010 -0.020 -0.020 -0.020 -0.044 0.047 -0.026 0.021 -0.026 0.021 -0.026 0.029 -0.028 0.029 0.042 0.050 0.029 0.042 0.050 0.029 0.042 0.050 0.029 0.042 0.050 0.029 0.042 0.050 0.029 0.042 0.050 0.050 0.050 0.050 0.029 0.051 0.050 0.051 0.052 0.051 0.052 0.051 0.052 0.050 0.0520	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.835 12.835 12.835 21.933 22.011 22.812 23.540 23.867 23.867 23.867 23.867 24.233 24.263 24.2319	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.537 0.606 0.568 0.540 0.529 0.301 0.288 0.340 0.351 0.328 0.340 0.352 0.411 0.464 0.529 0.301 0.288 0.340 0.352 0.411 0.464 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.528 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.354 0.354 0.351 0.529 0.301 0.354 0.352 0.528 0.351 0.529 0.301 0.354 0.352 0.444 0.529 0.301 0.528 0.354 0.354 0.529 0.354 0.528 0.354 0.529 0.354 0.528 0.354 0.529 0.354 0.528 0.354 0.528 0.354 0.529 0.354 0.528 0.354 0.529 0.354 0.529 0.354 0.529 0.354 0.556 0.556 0.556 0.556 0.556 0.556 0.556 0.556 0.556 0.556 0.354 0.354 0.354 0.354 0.454 0.354 0.555 0.554 0.554 0.555 0.5	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 26 -0.014	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.019 -0.014 0.024 -0.011 0.027 0.012 -0.012 0.012 0.012 0.012 0.012 0.012 0.012 0.012 0.027 0.014 0.004 0.004 0.004 0.004 0.004 0.002 -0.014 0.022 0.026 -0.020 -0.012 0.027 0.022 -0.027 0.005 -0.027 0.005 -0.027 0.005 -0.027 0.005 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.024 -0.024 -0.024 -0.026 -0.026 -0.026 -0.027 -0.026 -0.024 -0.027 -0.026 -0.027	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 19.181 19.412 20.048 20.039 22.109 22.109 22.009 22.010 24.010 24.010 24.010 24.020 29.139 29.456	Prob 0.006 0.021 0.051 0.091 0.116 0.168 0.212 0.285 0.354 0.451 0.448 0.492 0.600 0.317 0.392 0.397 0.392 0.347 0.393 0.347 0.393 0.347 0.393 0.347 0.393 0.347 0.393 0.347 0.393 0.347 0.393 0.328 0.258 0.258 0.228 0.258 0.228 0.239 0.327 0.393 0.347 0.393 0.328 0.328 0.329 0.328 0.329 0.328 0.329 0.3
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.03 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.06 8 -0.06 8 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.06 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 27 -0.04 28 0.025	PAC 0.010 -0.020 -0.020 -0.013 -0.044 0.047 -0.026 0.029 -0.028 -0.003 0.029 -0.028 -0.009 -0.028 -0.009 -0.022 -0.004 -0.013 -0.029 -0.029 -0.022 -0.004 -0.012 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.021 -0.022 -0.021 -0.022 -0.021 -0.022 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.022 -0.021 -0.021 -0.022 -0.021 -0.022 -0.021 -0.022 -0	Q-Stat 0.1545 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 9.9254 10.112 11.509 12.835 12.835 12.835 12.835 21.933 22.011 22.812 23.540 23.867 23.869 24.263 24.319 24.339 25.332	Prob 0.694 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.528 0.537 0.606 0.568 0.568 0.540 0.610 0.288 0.301 0.301 0.322 0.411 0.4658 0.524 0.558 0.504 0.558 0.504 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.514 0.558 0.515 0.515 0.528 0.528 0.528 0.529 0.301 0.528 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.528 0.528 0.529 0.301 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.529 0.529 0.528 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.524 0.529 0.524 0.524 0.558 0.504 0.558 0.504 0.558 0.504 0.558 0.504 0.558 0.5104 0.558 0.610 0.558 0.610 0.558 0.610 0.558 0.610 0.610 0.558 0.610 0.610	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 27 -0.000 28 -0.000 20 -0.014 27 -0.000 28 -0.000 28 -0.000 28 -0.000 20 -0.000 28 -0.000 20 -0.014 20 -0.000 28 -0.000 28 -0.000 20 -0.000	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 0.019 -0.014 0.024 -0.011 0.027 0.012 -0.022 0.056 -0.020 0.014 -0.014 -0.024 -0.022 0.056 -0.022 0.025 -0.024 -0.024 -0.024 -0.022 -0.022 -0.022 -0.024 -0.024 -0.024 -0.022 -0.022 -0.022 -0.024 -0.024 -0.024 -0.025 -0.024 -0.024 -0.025 -0.024 -0.022 -0.022 -0.022 -0.022 -0.024 -0.024 -0.024 -0.025 -0.024 -0.025 -0.024 -0.024 -0.025 -0.024 -0.025 -0.024 -0.022 -0.022 -0.024 -0.024 -0.024 -0.025 -0.024 -0.026 -0.020 -0.026 -0.020 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.004 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.006 -0.000	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.948 20.048 20.0339 22.009 24.010 24.010 24.102 26.209 29.456 29.456 29.456	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.212 0.285 0.354 0.354 0.451 0.448 0.492 0.532 0.451 0.448 0.492 0.532 0.447 0.392 0.394 0.397 0.398 0.258 0.291 0.390
Autocorrelation	Partial Correlation	AC 2 -0.03 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.066 8 -0.066 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 27 -0.004 28 0.022 29 0.012	PAC 0.010 -0.020 -0.020 -0.013 -0.044 0.047 -0.026 0.029 -0.021 -0.026 0.029 -0.028 -0.009 -0.022 -0.004 -0.032 -0.044 -0.020 -0.021 -0.022 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.022 -0.021 -0.022 -0.021 -0.022 -0.021 -0.022 -0	Q-Stat 0.1545 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 9.9254 10.112 11.509 12.835 12.897 12.893 21.933 22.011 22.812 23.540 23.869 24.263 24.319 24.329 25.563	Prob 0.694 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.528 0.537 0.606 0.606 0.568 0.540 0.610 0.288 0.340 0.288 0.340 0.288 0.340 0.529 0.301 0.288 0.340 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.558 0.340 0.558 0.610 0.558 0.610 0.504 0.558 0.519 0.558 0.519 0.529 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.528 0.529 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.529 0.301 0.528 0.528 0.528 0.529 0.301 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.528 0.529 0.528 0.529 0.528 0.529 0.528 0.529 0.529 0.528 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.529 0.558 0.504 0.558 0.504 0.558 0.504 0.558 0.504 0.558 0.564 0.558 0.564 0.564 0.558 0.610 0.564 0.564 0.558 0.610 0.564 0.565 0.5	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.004 26 -0.014 27 -0.000 28 -0.001 29 0.032 29 0.032 29 0.032 29 0.032 20 0.011 1 -0.034 29 0.032 20 0.032 20 0.032 20 0.032 20 0.032 20 0.032 20 0.032 20 0.032 20 0.032 20 0.012 20 0.032 20 0.032 20 0.032 20 0.014 20 0.032 20 0.032 20 0.032 20 0.032 20 0.014 20 0.032 20 0.032	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 0.019 -0.014 0.024 -0.011 0.027 0.012 -0.022 0.056 -0.020 0.014 -0.014 -0.014 -0.022 0.044 0.002 -0.022 -0.022 -0.022 -0.027 0.006 -0.000 -0.000 -0.012 -0.022 -0.022 -0.022 -0.027 -0.000 -0.000 -0.000 -0.019 -0.019 -0.019 -0.019 -0.019 -0.019 -0.019 -0.019 -0.019 -0.019 -0.012 -0.027 -0.022 -0.027 -0.022 -0.027 -0.022 -0.027 -0.022 -0.027 -0.027 -0.022 -0.027 -0.007 -0.00	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.918 13.918 13.918 13.918 13.918 20.048 20.339 22.109 24.010 24.102 26.209 29.456 29.456 29.456 29.456 29.456 29.456	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.285 0.354 0.354 0.451 0.448 0.492 0.532 0.451 0.448 0.492 0.532 0.437 0.392 0.316 0.392 0.347 0.398 0.347 0.398 0.221 0.399 0.251 0.390 0.365
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.03 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.012 23 -0.015 24 0.001 25 0.016 26 -0.006 27 -0.004 28 0.025 29 0.012 30 -0.016 20 -0.012 30 -0.016 20 -0.012 30 -0.016 31 -0.025 31 -0	PAC 0.010 -0.020 -0.020 -0.013 -0.044 0.047 -0.026 0.029 -0.013 0.029 -0.013 0.029 -0.013 0.029 -0.013 0.029 -0.021 -0.026 0.042 0.050 -0.022 -0.004 -0.012 -0.002 0.021 -0.002 0.021 -0.002 -0.012 -0.021 -0.021 -0.022 -0.004 -0.022 -0.004 -0.021 -0.025 -0	Q-Stat 0.1545 0.1704 1.07257 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 9.9254 10.112 2.835 12.897 14.938 19.490 20.585 21.937 14.938 19.490 20.585 21.933 22.011 22.812 23.540 23.569 24.263 25.563 25.976 25.5776	Prob 0.694 0.855 0.902 0.539 0.284 0.383 0.484 0.322 0.528 0.528 0.528 0.528 0.528 0.528 0.529 0.301 0.301 0.329 0.324 0.321 0.411 0.469 0.558 0.514 0.558 0.611 0.649 0.676	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.06 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 27 -0.000 28 -0.001 28 -0.002 29 0.032 30 -0.038 30 -0.08	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.010 0.010 -0.019 0.019 -0.014 0.024 -0.012 0.027 -0.022 0.014 -0.014 -0.014 -0.020 -0.020 -0.014 -0.014 -0.020 -0.0000 -0.000	Q-Stat 7.5149 7.7558 7.7555 7.8016 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.918 20.048 20.339 22.109 24.010 24.010 24.020 29.139 29.456 29.456 29.456 29.456 33.228	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.285 0.354 0.354 0.451 0.448 0.499 0.532 0.600 0.318 0.392 0.437 0.392 0.394 0.392 0.343 0.258 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.343 0.251 0.398 0.354 0.397 0.398 0.343 0.251 0.398 0.321 0.398 0.354 0.398 0.321 0.398 0.321 0.398 0.321 0.339 0.365 0.313 0.365 0.313 0.365 0.313 0.365 0.313 0.365 0.313 0.365 0.313 0.365 0.315 0.355 0.355 0.354 0.398 0.325 0.354 0.398 0.398 0.398 0.399 0.398 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.397 0.398 0.398 0.398 0.397 0.398 0.398 0.398 0.397 0.3988 0.3988 0.3988 0.3988 0.3988 0.3988 0.3988 0.3
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 27 -0.004 28 0.025 29 0.012 30 -0.016 31 0.005	PAC 0.010 -0.020 -0.020 -0.013 -0.047 0.003 -0.047 0.021 -0.026 0.029 -0.013 0.029 -0.026 0.029 -0.026 0.029 -0.032 -0.004 -0.032 -0.004 -0.021 -0.022 -0.021 -0.022 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.021 -0.022 -0.021 -0.022 -0.021 -0.022 -0.021 -0.025 -0.021 -0.025 -0.021 -0.025 -0.055 -0.05	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.0725 7.4151 7.4531 7.4531 7.4531 1.2505 8.1201 1.509 12.835 12.897 14.938 19.490 20.585 21.933 22.011 22.812 23.869 24.263 24.339 24.339 24.332 25.563 25.976 26.041 26.042 26.043 26.041 26.042 26.043 26.041 26.044 26.041 26.044 26.041 26.044 26.044 26.044 26.044 27.575	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.528 0.529 0.301 0.301 0.301 0.324 0.324 0.321 0.528 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.301 0.529 0.554 0.554 0.554 0.554 0.554 0.554 0.6611 0.6649 0.6476 0.771 0.676 0.676 0.676 0.676 0.676 0.676 0.771 0.676 0.577 0.577 0.577 0.578 0.578 0.577 0.578 0.57 0.57 0.57 0.57 0.57 0.57 0.57 0.57	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 0 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 27 -0.000 28 -0.002 29 0.032 30 -0.038 31 0.002	PAC 0.070 -0.016 -0.003 0.006 -0.040 -0.040 -0.019 0.019 -0.014 0.024 -0.012 -0.022 0.012 -0.022 0.012 -0.022 0.012 -0.022 0.012 -0.022 0.014 -0.014 -0.014 -0.014 -0.014 -0.027 -0.020 -0.020 -0.040 -0.020 -0.020 -0.020 -0.020 -0.020 -0.040 -0.027 -0.022 0.056 -0.020 -0.020 -0.014 -0.012 -0.022 0.056 -0.020 -0.020 -0.014 -0.014 -0.012 -0.022 0.056 -0.020 -0.020 -0.014 -0.014 -0.012 -0.020 -0.020 -0.020 -0.014 -0.012 -0.020 -0.020 -0.014 -0.014 -0.014 -0.012 -0.020 -0.020 -0.020 -0.040 -0.040 -0.014 -0.012 -0.020 -0.020 -0.014 -0.027 -0.040 -0.007 -0.041 -0.007 -0.041 -0.007 -0.00	Q-Stat 7.5149 7.7555 7.8016 10.216 10.216 10.378 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 13.916 13.988 13.916 13.988 13.916 13.988 13.916 22.009 24.010 24.102 26.209 29.456 29.456 33.228 33.237 35.501	Prob 0.006 0.021 0.099 0.071 0.116 0.168 0.285 0.354 0.354 0.448 0.499 0.532 0.448 0.499 0.532 0.451 0.348 0.499 0.532 0.354 0.393 0.393 0.393 0.398 0.343 0.291 0.398 0.343 0.291 0.398 0.393 0.395 0.313 0.303
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 16 0.036 17 0.054 18 -0.027 19 -0.030 12 -0.017 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 27 -0.004 28 0.025 29 0.012 30 -0.016 31 0.005 32 -0.005 33 -0.020	PAC 0.010 -0.020 -0.013 -0.047 0.003 -0.013 -0.047 0.021 -0.026 0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.020 -0.020 -0.020 -0.021 -0.004 -0.001 -0.001 -0.001 -0.001 -0.001 -0.001 -0.001 -0.001 -0.001 -0.001 -0.002 -0.003 -0.002 -0.003 -0.004 -0.002 -0.003 -0.002 -0.003 -0.001 -0	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.07255 7.4151 7.4531 7.5005 8.1201 9.0461 9.9254 10.112 11.509 12.835 21.933 22.011 12.897 14.938 19.490 23.869 24.329 24.329 25.563 25.976 26.011 26.689	Prob 0.694 0.918 0.855 0.902 0.539 0.539 0.539 0.522 0.528 0.522 0.528 0.528 0.540 0.540 0.529 0.301 0.288 0.301 0.301 0.364 0.372 0.469 0.558 0.540 0.558 0.540 0.558 0.554 0.554 0.558 0.554 0.554 0.554 0.554 0.554 0.554 0.554 0.554 0.554 0.555 0.902 0.537 0.372 0.484 0.364 0.558 0.469 0.469 0.6610 0.6610 0.558 0.372 0.469 0.554 0.557 0.464 0.372 0.464 0.354 0.372 0.464 0.372 0.464 0.354 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.464 0.372 0.477 0.477 0	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 27 -0.000 28 -0.000 29 0.032 30 -0.038 31 0.002 32 -0.039 33 -0.007	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.027 0.012 0.012 0.052 -0.020 -0.014 -0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.022 0.052 -0.020 -0.014 0.027 -0.012 0.052 -0.020 -0.014 0.027 -0.020 -0.014 0.027 -0.020 -0.014 0.027 -0.020 -0.014 0.027 -0.020 -0.014 -0.020 -0.020 -0.014 -0.020 -0.020 -0.014 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.027 -0.022 -0.052 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.032 -0.027 -0.027 -0.038 -0.0000 -0.0000 -0.000 -0.000 -0.000 -0.	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.216 10.378 10.819 11.040 11.823 11.935 12.998 13.348 13.916 13.916 13.916 13.916 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.918 13.918 19.412 20.048 20.339 22.109 24.010 24.010 24.020 29.456 29.456 29.456 33.228 33.237 35.551 35.651	Prob 0.006 0.021 0.051 0.091 0.116 0.162 0.285 0.324 0.451 0.448 0.499 0.532 0.600 0.313 0.343 0.228 0.343 0.343 0.228 0.343 0.343 0.343 0.359 0.334
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 26 -0.006 26 -0.006 26 0.002 27 -0.004 28 0.025 29 0.012 30 -0.012 30 -0.012 31 0.005 32 -0.05 33 -0.020 34 -0.039	PAC 0.010 0.003 -0.020 -0.033 -0.044 0.047 0.020 0.021 -0.020 0.021 -0.020 0.021 -0.029 0.029 0.029 0.029 0.029 0.029 0.020 0.009 0.029 0.020 0.003 0.029 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.020 0.003 0.029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.0042 0.0009 0.0042 0.003 0.0020 0.003 0.0029 0.003 0.0029 0.003 0.0029 0.0042 0.003 0.0029 0.0029 0.0042 0.0007 0.0029 0.0042 0.0009 0.0042 0.0009 0.0020 0.0029 0.0020 0.0029 0.0020 0.0020 0.0020 0.0020 0.0029 0.0020 0.0020 0.0020 0.0020 0.0020 0.0020 0.0020 0.00020 0.002000 0.00200000000	Q-Stat 0.1545 0.1704 1.0523 4.07257 7.4151 7.4531 7.5005 8.1201 9.9254 10.112 11.509 12.837 14.938 19.490 20.585 21.933 22.011 22.812 23.540 23.867 23.869 24.339 24.339 25.3563 25.3563 25.576 26.011 26.048 26.689 29.087	Prob 0.694 0.918 0.855 0.902 0.284 0.383 0.484 0.522 0.528 0.536 0.568 0.568 0.568 0.568 0.560 0.510 0.529 0.301 0.288 0.301 0.324 0.372 0.311 0.288 0.340 0.354 0.372 0.464 0.355 0.464 0.558 0.610 0.610 0.649 0.6761 0.771 0.773 0.707	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 44 -0.037 25 0.044 26 -0.014 26 -0.014 27 -0.000 28 -0.000 29 0.032 31 0.002 32 -0.038 31 0.002 32 -0.038 31 0.007 34 0.006	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.027 0.012 0.012 0.012 0.012 0.012 0.012 0.027 -0.014 -0.014 -0.014 -0.014 -0.022 0.055 -0.020 -0.014 -0.014 -0.020 -0.014 -0.020 -0.020 -0.014 -0.020 -0.020 -0.020 -0.014 -0.020 -0.000 -0.00	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.216 10.378 10.819 11.040 11.823 11.935 12.998 13.916 13.916 13.988 13.916 13.988 19.181 19.412 20.048 20.048 20.048 20.048 20.048 20.048 20.109 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 24.010 25.591 33.228 35.591	Prob 0.006 0.021 0.051 0.091 0.116 0.162 0.285 0.354 0.451 0.448 0.492 0.600 0.337 0.392 0.347 0.393 0.347 0.393 0.343 0.258 0.343 0.258 0.343 0.343 0.343 0.343 0.359 0.303 0.348
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 27 -0.004 28 0.025 29 0.012 30 -0.016 26 -0.006 27 -0.004 28 0.025 29 0.012 30 -0.016 26 -0.006 31 0.005 32 -0.005 33 -0.020 34 -0.039 35 0.029 35 0.009 35	PAC 0.010 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.042 -0.020 -0.021 -0.020 -0.021 -0.029 -0.028 -0.029 -0.028 -0.029 -0.020	Q-Stat 0.1545 0.1704 1.0523 4.07257 1.0523 4.07255 8.1201 9.0461 9.9254 10.112 11.509 12.835 12.835 12.835 12.835 21.933 22.011 22.832 23.540 23.867 23.869 24.263 24.339 24.263 25.376 25.576 25.577 26.041 26.048 26.689 29.087 29.214 20.645	Prob 0.694 0.918 0.855 0.902 0.539 0.284 0.383 0.484 0.522 0.528 0.537 0.606 0.568 0.540 0.568 0.540 0.301 0.301 0.354 0.372 0.411 0.469 0.610 0.610 0.649 0.6761 0.721 0.773 0.707 0.773 0.775 0.755 0.	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 27 -0.000 28 -0.000 29 0.032 30 -0.038 31 0.002 32 -0.038 31 0.002 32 -0.039 33 -0.007 34 0.066 35 -0.011	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.024 -0.011 0.027 0.012 -0.012 0.012 0.012 0.027 -0.022 0.014 -0.014 -0.014 -0.014 -0.014 -0.027 -0.027 0.005 -0.027 0.006 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.044 0.002 -0.038 -0.000 0.027 -0.044 0.002 -0.040 0.025 -0.000 0.027 -0.044 0.002 -0.020 0.005 -0.000 0.002 -0.000 0.000 -0.0001 -0.000 -0.	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.988 19.181 19.412 20.048 20.039 22.109 24.010 24.010 24.010 24.010 24.010 24.010 24.02 29.456 33.228 33.228 33.227 35.591 35.652	Prob 0.006 0.021 0.051 0.091 0.116 0.168 0.212 0.354 0.354 0.451 0.448 0.492 0.600 0.317 0.392 0.347 0.393 0.347 0.393 0.347 0.393 0.347 0.393 0.343 0.258 0.258 0.343 0.390 0.365 0.310 0.390 0.365 0.3159 0.303 0.354 0.359 0.303 0.354 0.359 0.303 0.354 0.355 0.
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.017 19 -0.030 20 -0.017 21 -0.023 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.026 27 -0.004 28 0.025 29 0.012 30 -0.016 26 -0.006 27 -0.004 28 0.025 29 0.012 30 -0.016 26 -0.06 11 0.05 32 -0.015 33 -0.020 34 -0.039 35 0.009 36 -0.028	PAC 0.010 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.042 -0.020 -0.021 -0.020 -0.021 -0.029 -0.028 -0.029 -0.021 -0.029 -0.029 -0.029 -0.021 -0.021 -0.021 -0.020 -0.021	Q-Stat 0.1545 0.1704 1.0523 4.07257 1.0523 4.07255 8.1201 9.0461 9.9254 10.112 11.509 12.835 12.835 12.835 21.933 22.011 22.832 20.585 21.933 22.011 22.832 23.540 23.867 23.869 24.263 24.339 24.263 25.376 25.576 25.577 29.214 30.435	Prob 0.694 0.918 0.855 0.902 0.284 0.383 0.484 0.522 0.528 0.536 0.568 0.568 0.568 0.540 0.610 0.301 0.354 0.372 0.411 0.469 0.610 0.610 0.649 0.6761 0.721 0.773 0.707 0.743 0.707	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.015 15 -0.019 16 0.007 17 0.058 18 -0.012 19 -0.020 20 -0.014 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 27 -0.000 28 -0.000 29 0.032 30 -0.038 31 0.002 32 -0.039 33 -0.007 34 0.066 35 -0.001 36 -0.016	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.024 -0.011 0.027 0.012 -0.012 0.012 0.012 0.026 -0.020 -0.014 -0.014 -0.014 -0.032 -0.027 0.005 -0.044 0.000 -0.044 0.0027 -0.038 -0.000 0.027 -0.044 0.000 0.052 -0.044 0.000 0.052 -0.044 0.000 0.052 -0.044 0.000 0.052 -0.044 0.000 0.052 -0.027 0.005 -0.000 0.052 -0.000 0.005 -0.000 0.052 -0.000 0.005 -0.000 0.000 0.012 -0.014 0.027 -0.026 -0.026 -0.027 0.038 -0.000 0.000 0.027 -0.044 0.000 -0.044 0.0027 -0.032 -0.027 0.002 -0.032 -0.027 0.002 -0.038 -0.000 0.000 0.000 -0.014 -0.014 -0.014 -0.014 -0.014 -0.025 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.038 -0.000 -0.021 -0.020 -0.027 -0.027 -0.022 -0.027 -0.022 -0.027 -0.027 -0.027 -0.022 -0.027 -0.027 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.027 -0.000	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.160 10.216 10.378 10.819 11.040 11.823 11.935 12.998 13.348 13.916 13.916 13.988 19.181 19.412 20.048 20.039 22.109 24.010 24.010 24.010 24.010 24.010 24.010 24.02 20.456 33.228 33.228 33.228 33.228 33.2591 35.652	Prob 0.006 0.021 0.051 0.091 0.116 0.168 0.212 0.354 0.377 0.451 0.448 0.492 0.600 0.317 0.392 0.307 0.392 0.347 0.393 0.347 0.393 0.347 0.393 0.343 0.258 0.258 0.343 0.390 0.365 0.3159 0.303 0.354 0.359 0.303 0.354 0.359 0.303 0.354 0.355 0.
Autocorrelation	Partial Correlation	AC 1 0.010 2 -0.003 3 -0.020 4 -0.013 5 -0.044 6 0.047 7 0.005 8 -0.006 9 0.020 10 -0.025 11 0.024 12 -0.011 13 0.030 14 -0.029 15 -0.006 16 0.036 17 0.054 18 -0.027 19 -0.030 20 -0.007 21 -0.037 22 0.022 23 -0.015 24 0.001 25 0.016 26 -0.006 26 -0.006 26 -0.006 31 0.025 29 0.012 30 -0.012 30 -0.012 31 0.005 32 -0.005 33 -0.028 34 -0.039 35 0.009 36 -0.028	PAC 0.010 0.003 -0.020 -0.013 -0.044 0.047 0.021 -0.026 0.029 -0.028 0.029 0.021 -0.029 0.020 0.009 0.020 0.009 0.0020 0.0019 0.0021 0.001 0.0021 0.001 0.0021 0.001 0.0021 0.001 0.0021 0.0021 0.0021 0.001 0.0021 0.	Q-Stat 0.1545 0.1704 0.7757 1.0523 4.07255 8.1201 9.0461 9.9254 10.112 11.509 12.835 21.933 22.011 22.812 23.540 23.867 23.869 24.329 24.329 25.332 25.563 25.576 26.011 26.689 29.087 29.214 30.435	Prob 0.694 0.918 0.855 0.902 0.284 0.383 0.484 0.522 0.528 0.537 0.568 0.568 0.568 0.560 0.568 0.560 0.568 0.301 0.288 0.301 0.320 0.301 0.324 0.372 0.311 0.469 0.504 0.558 0.610 0.610 0.649 0.611 0.676 0.721 0.773 0.773 0.773 0.773	Autocorrelation	Partial Correlation	AC 1 0.070 2 -0.011 3 -0.005 4 0.005 5 -0.039 6 -0.006 7 0.010 8 -0.017 9 0.005 10 -0.011 11 0.023 12 -0.009 13 0.026 14 0.017 17 0.058 18 -0.012 19 -0.020 20 -0.014 21 -0.034 22 0.035 23 0.008 24 -0.037 25 0.044 26 -0.014 26 -0.014 27 -0.000 28 -0.000 29 0.032 30 -0.038 31 0.002 32 -0.039 31 0.002 32 -0.038 31 0.007 34 0.006 35 -0.001 36 -0.016	PAC 0.070 -0.016 -0.003 0.006 -0.040 0.010 -0.019 -0.014 0.027 0.012 0.014 -0.022 0.012 0.056 -0.020 -0.014 -0.014 -0.022 0.055 -0.000 0.027 -0.022 -0.044 0.000 0.052 -0.027 0.006 -0.000 0.052 -0.021 -0.022 -0.025 -0.020 -0.027 -0.022 -0.027 -0.027 -0.027 -0.027 -0.022 -0.027 -0.021	Q-Stat 7.5149 7.7158 7.7555 7.8016 10.216 10.378 10.861 11.040 11.823 11.935 12.998 13.348 13.916 13.916 13.988 13.916 13.916 13.988 13.916 13.988 13.916 13.988 13.916 13.946 29.4566 29.4566 29.4566 29.4566 29.4566 29.4566 29.4566 29.45666 29.45666666666666666666666666666666666666	Prob 0.006 0.021 0.051 0.091 0.116 0.162 0.285 0.354 0.451 0.448 0.493 0.532 0.600 0.318 0.367 0.393 0.367 0.393 0.343 0.258 0.343 0.258 0.343 0.343 0.359 0.313 0.359 0.344 0.388 0.462 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.388 0.445 0.344 0.388 0.445 0.445 0.388 0.445 0.445 0.388 0.445 0.445 0.388 0.445 0.4

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob		Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
ų.	μ	1 0.004	0.004	0.0280	0.867		ψ	ų.	1	0.004	0.004	0.0280	0.867
ψ	U U	2 -0.010	-0.010	0.1974	0.906				2	-0.010	-0.010	0.1974	0.906
	U U	3 -0.019	-0.019	0.7609	0.859				3	-0.019	-0.019	0.7609	0.859
	1 10	4 -0.013	-0.013	1.0150	0.908		ų į	ų i	4	-0.013	-0.013	1.0150	0.908
Q.	() ()	5 -0.044	-0.045	4.0874	0.537		() (() ()	5	-0.044	-0.045	4.0874	0.537
l i l	l i	6 0.048	0.047	7.6121	0.268		i p	i i p	6	0.048	0.047	7.6121	0.268
- P	II	7 0.006	0.004	7.6606	0.363		ll ll	L III	7	0.006	0.004	7.6606	0.363
- P	1 II	8 -0.001	-0.002	7.6625	0.467		ll ll		8	-0.001	-0.002	7.6625	0.467
	1 1	9 0.021	0.022	8.3489	0.499			l l l	9	0.021	0.022	8.3489	0.499
	1 III	10 -0.023	-0.024	9.1449	0.518		ų į	ų – į	10	-0.023	-0.024	9.1449	0.518
i)	1 1	11 0.025	0.030	10.115	0.520			i i i i i i i i i i i i i i i i i i i	11	0.025	0.030	10.115	0.520
	1 II	12 -0.012	-0.014	10.341	0.586		ų į	ų – į	12	-0.012	-0.014	10.341	0.586
l ip	1 1	13 0.028	0.028	11.565	0.564			i i i i	13	0.028	0.028	11.565	0.564
()	()	14 -0.029	-0.028	12.914	0.533		() (() ()	14	-0.029	-0.028	12.914	0.533
	1 II	15 -0.013	-0.016	13.188	0.588		ų į	ų – į	15	-0.013	-0.016	13.188	0.588
l in	l i	16 0.042	0.047	15.938	0.457		i p	i i p	16	0.042	0.047	15.938	0.457
l i	i n	17 0.058	0.054	21.232	0.216		ip	ų –	17	0.058	0.054	21.232	0.216
•	II	18 -0.026	-0.024	22.259	0.221		() ()		18	-0.026	-0.024	22.259	0.221
•	(()	19 -0.031	-0.033	23.809	0.204		() ()	¢ (19	-0.031	-0.033	23.809	0.204
ψ	ψ	20 -0.003	-0.001	23.825	0.250		ψ	ψ	20	-0.003	-0.001	23.825	0.250
	II	21 -0.019	-0.012	24.415	0.273				21	-0.019	-0.012	24.415	0.273
	1 1	22 0.021	0.018	25.123	0.291			l de la composición de	22	0.021	0.018	25.123	0.291
	II	23 -0.016	-0.022	25.502	0.325				23	-0.016	-0.022	25.502	0.325
ψ	ψ	24 0.000	-0.003	25.502	0.379		ψ	ψ	24	0.000	-0.003	25.502	0.379
	1 1	25 0.009	0.012	25.622	0.428			l de la composición de	25	0.009	0.012	25.622	0.428
ψ	ψ	26 -0.004	-0.006	25.646	0.483		ψ	ψ	26	-0.004	-0.006	25.646	0.483
	1 1	27 -0.004	0.002	25.673	0.537	1	ψ	l l	27	-0.004	0.002	25.673	0.537
I)	1 1	28 0.025	0.020	26.673	0.536	1	- (P	փ	28	0.025	0.020	26.673	0.536
1 1	1 1	29 0.011	0.010	26.863	0.579			փ	29	0.011	0.010	26.863	0.579
	I (I	30 -0.020	-0.018	27.491	0.597		4		30	-0.020	-0.018	27.491	0.597
1 III	1 1	31 0.009	0.013	27.625	0.640			փ	31	0.009	0.013	27.625	0.640
ф –	ψ	32 -0.001	0.003	27.626	0.688	1	ψ	l l	32	-0.001	0.003	27.626	0.688
	()	33 -0.023	-0.031	28.478	0.692	1		l (33	-0.023	-0.031	28.478	0.692
•	0	34 -0.045	-0.048	31.752	0.578	1	() (l (34	-0.045	-0.048	31.752	0.578
1 0	1 1	35 0.011	0.013	31.960	0.616	1		փ	35	0.011	0.013	31.960	0.616
•	()	36 -0.031	-0.027	33.518	0.587	1	() (l (36	-0.031	-0.027	33.518	0.587
						-							

Table 4.1.2 Serial Correlation of Daily Indexes Returns

Correlograms above give some fundamental results. FTSE IT MICRO CAP and FTSE IT SMALL CAP indexes show p-values equal to zero, and so, despite AC and PAC values fluctuating around zero, both these indexes show evidences of serial correlation. This means there exist dependency on returns, hence they cannot be considered efficient under the weak form. FTSE IT MID CAP and FTSE ALL-SHS show lags which tend to zero, with p-values increasing as the number of lags increase. Even FTSE MIB and FTSE ITALIA STAR present AC and PAC values close to zero during all the lags, and big p-values to sustain them.

This results show values different from zero, this implies the possibility of weak efficiency for all the index considered a part the first aforementioned two.

Weekly analysis

Descriptive Analysis

FTSE IT M	ICRO CAP	FTSE IT SMALL CAP				
(ITMI.MI)		(ITSC.MI)				
Mean	-0.000166	Mean	-0.000820			
Median	0.000693	Median	0.003088			

Maximum	0.073477	Maximum	0.188200
Minimum	-0.084839	Minimum	-0.145638
Std. Dev.	0.019353	Std. Dev.	0.030450
Skewness	-0.567725	Skewness	-0.048941
Kurtosis	6.094205	Kurtosis	9.653034
Jarque-Bera	140.7709	Jarque-Bera	2874.019
Probability	0.000000	Probability	0.000000
FTSE ITALIA	A ALL-SHS	FTSE ITALL	A MID CAP
(ITLMS.MI)		(ITMC.MI)	
Mean	-9.66E-05	Mean	0.000587
Median	0.004178	Median	0.004464
Maximum	0.098895	Maximum	0.099089
Minimum	-0.166138	Minimum	-0.118513
Std. Dev.	0.035876	Std. Dev.	0.030663
Skewness	-0.778706	Skewness	-0.542197
Kurtosis	4.902333	Kurtosis	4.677453
Jarque-Bera	78.32538	Jarque-Bera	51.70061
Probability	0.000000	Probability	0.000000
FTSE ITALIA	A STAR	FTSE MIB	
(ITSTAR.MI))	(FTSEMIB.M	(II)
Mean	0.002418	Mean	-0.000154
Median	0.005728	Median	0.003403
Maximum	0.065871	Maximum	0.104721
Minimum	-0.127629	Minimum	-0.169836
Std. Dev.	0.023588	Std. Dev.	0.037858
Skewness	-1.120660	Skewness	-0.726880
Kurtosis	6.484522	Kurtosis	4.790298
Jarque-Bera	223.8655	Jarque-Bera	69.36318
Probability	0.000000	Probability	0.000000

Table 4.1.3 Descriptive Analysis of Weekly indexes returns

The descriptive analysis of the index, on the basis of the weekly returns, highlights that all indexes have negative mean a part for FTSE IT MID CAP and FTSE ITALIA STAR indexes. The FTSE ITALIA STAR index has the highest value, whereas FTSE IT SMALL CAP index presents the lowest value. As happened for the daily data FTSE MIB index presents the highest volatility compared with other Italian Stock Exchange indexes, but now the difference from the standard deviation of the FTSE IT ALL-SHS index results hair's-breadth. Yet again FTSE IT MICRO CAP index shows the lowest volatility among Italian indexes. Weekly data attest that all the indexes present negative asymmetry. Even with less evidence, kurtosis values explain that the distributions of all the indexes are strongly centred with lights tails here as well. Jarque-Bera test suggest that all indexes (more or less at the same level) have been extracted by a sample not distributed such as a normal random variable. P-values are equal to zero for all indexes. Results show none of the indexes can be represented by a normal distribution.

Runs Test

ITM	I.MI	ITS	C.MI	ITLMS.MI		ITMC.MI		ITSTAR.MI		FTSEMIB.MI	
Z	P-value	Z	P-value	Z	P-value	Z	P-value	Z	P- value	Z	P-value
-3.86	0	-4.08	0	.68	.5	-1.25	.21	-1.19	.23	.06	.95

Table 4.1.4 Runs Test for Weekly returns on Italian Stock Exchange indexes

The p-value attests that FTSE IT MICRO CAP and FTSE IT SMALL CAP indexes are inconsistent at conventional level. The other indexes result consistent with a random process at the 5% significance level. Z-values are less than the critical value, hence the returns series appears to follow a random process, but for the FTSE IT MID CAP and FTSE ITALIA STAR indexes which present z-values higher than the critical one.

It is possible to affirm that only the FTSE IT ALL-SHS and the FTSE MIB indexes are supposed to be efficient on the basis of the runs test.

Unit Root test

			LEVEL			
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI
t-Statistic	-1.212644	-1.347591	-2.176997	-1.523991	-0.346203	-2.176645
Prob.*	0.6699	0.6080	0.2153	0.5203	0.9148	0.2154

Augmented Dickey-Fuller Test

TEST CRITICAL VALUE											
1% level	-3.451214	-3.451214	-3.451214	-3.451214	-3.451146	-3.451146					
5% level	-2.870621	-2.870621	-2.870621	-2.870621	-2.870591	-2.870591					
10% level	-2.571679	-2.571679	-2.571679	-2.571679	-2.571663	-2.571663					

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

Table 4.1.5 ADF Test for Weekly indexes log prices (level)

For what concerns weekly data, ADF statistic fluctuates from -0.346203 (FTSE IT MICRO CAP) to -2.176997 (FTSE ALL-SHS) and the associated one-sided *p*-value (for each index observations) is reliable high, hence p-values indicate that observations are consistent with the null hypothesis. This leads not to rejected the null unit root hypothesis at conventional level. In other words, market indexes suggest the presence of efficiency in the Italian market.

Philip-Perron Test

	LEVEL											
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI						
t-Statistic	-1.473871	-1.542083	-2.218229	-1.523991	-0.484485	-2.221724						
Prob.*	0.5457	0.5110	0.2003	0.5203	0.8909	0.1990						
		TEST (CRITICAL	VALUE								
1% level	-3.451214	-3.451214	-3.451214	-3.451214	-3.451146	-3.451146						
5% level	-2.870621	-2.870621	-2.870621	-2.870621	-2.870591	-2.870591						
10% level	-2.571679	-2.571679	-2.571679	-2.571679	-2.571663	-2.571663						

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

Table 4.1.6 PP Test for Weekly indexes returns (level)

Serial Correlation Test

Remembering that the absence of serial correlation in the residuals is certified by autocorrelations and partial autocorrelations at all lags equal to zero, and an insignificant Q-statistics with large p-values, it is possible to take a look at the current results:

FTSE IT MICRO CAP (ITMI.MI)	FTSE IT SMALL CAP (ITSC.MI)

	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
	- Þ	ים	1 0.083	0.083	2.1686	0.141			1 0.149	0.149	7.0007	0.008
	12		2 0.151	0.145	9.3107	0.010	11		2 0.009	-0.014	7.0257	0.030
			4 -0.110	-0.155	19.784	0.001			4 0 054	0.012	7.0646	0.070
	ւի	լ թ	5 0.063	0.044	21.045	0.001		մի	5 -0.019	-0.036	8.1043	0.151
	i Di Tutu		6 0.045	0.062	21.687	0.001	u !	1 11	6 -0.054	-0.047	9.0376	0.171
	· 🗖		8 0.184	0.152	33.012	0.002			8 -0.011	-0.012	9.0399	0.250
	E '	=	9 -0.119	-0.148	37.540	0.000	i di i	լ պես	9 -0.076	-0.071	10.946	0.279
			10 -0.006	-0.017	37.553	0.000	<u>q</u> :		10 -0.052	-0.026	11.815	0.298
	i di i	i ji	12 -0.042	0.038	38.342	0.000	i ji	i i i i i i i i i i i i i i i i i i i	12 0.009	0.010	11.800	0.374
	ug u	<u></u>	13 -0.033	-0.086	38.708	0.000	i pi	լոր	13 0.050	0.057	12.694	0.472
		լ պո	14 -0.064	-0.077	40.060	0.000			14 -0.048	-0.066	13.457	0.491
	i pi	i ji	16 0.075	0.078	41.941	0.000	 	լ լը։	16 0.048	0.049	14.297	0.577
	1	1 11	17 -0.007	0.021	41.958	0.001		1 1	17 0.021	-0.001	14.437	0.636
			18 0.054	-0.005	42.910	0.001			18 0.018	0.019	14.546	0.693
	ιμ	ի դն	20 0.017	0.012	48.564	0.000	. ju	լիս	20 0.034	0.017	14.996	0.777
	1	1 .41	21 0.013	-0.025	48.619	0.001	<u>'</u>	<u> </u>	21 0.028	0.023	15.258	0.810
	, n.		22 0.030	0.005	48.922	0.001	1 1 1		22 0.039	0.045	15.767	0.827
	. In	ի հեր	24 0.034	-0.010	52.060	0.001	ı (i	լոլո	24 -0.026	-0.041	16.379	0.874
	101	<u>¶</u> '	25 -0.051	-0.099	52.960	0.001	111		25 -0.008	0.006	16.403	0.902
	. bi	1 1	27 0.043	0.004	53.704	0.001			27 0.048	0.028	17.420	0.920
	ul i	ili	28 -0.011	0.020	53.747	0.002	I I	l ili	28 -0.002	-0.008	17.421	0.940
	1 D 1 1 L		29 0.055	0.031	54.806	0.003			29 -0.014	-0.016	17.488	0.954
	i li		31 0.004	-0.026	54.892	0.004	i i i		31 -0.083	-0.082	19.915	0.938
	i 🛛		32 -0.025	-0.007	55.112	0.007	<u> </u>	•	32 -0.131	-0.102	25.894	0.768
			33 -0.068	-0.012	56,724	0.006	101	լ պես Լերեն	33 -0.081	-0.051	28.215	0.704
	ւր	iji	35 0.041	0.020	57.501	0.010	i pi	լ ն	35 0.055	0.060	29.358	0.737
	uļu —		36 -0.014	0.007	57.567	0.013	i	1]1	36 0.011	0.015	29.401	0.774
]	FTSE ITAL	IA ALL-SH	IS (ITL	MS	.MI)		FTSE ITAL	IA MID CA	AP (ITN	AC.N	(IM	
-												
	Autocorrelation	Bartial Correlation	40	DAC	O Stat	Brok	Autocorrelation	Bartial Correlation	40	BAC	O Ptot	Brob
	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat 0.0082	Prob 0.928		Partial Correlation	AC	PAC	Q-Stat 0.4005	Prob 0.527
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038	PAC -0.005 0.017 0.038	Q-Stat 0.0082 0.1034 0.5494	Prob 0.928 0.950 0.908	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037	PAC -0.036 0.019 0.039	Q-Stat 0.4005 0.5284 0.9640	Prob 0.527 0.768 0.810
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 0.020	PAC -0.005 0.017 0.038 -0.032	Q-Stat 0.0082 0.1034 0.5494 0.8818	Prob 0.928 0.950 0.908 0.927	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 0.025	PAC -0.036 0.019 0.039 -0.022	Q-Stat 0.4005 0.5284 0.9640 1.1548	Prob 0.527 0.768 0.810 0.885 0.820
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.026	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052	Prob 0.928 0.950 0.908 0.927 0.962 0.977	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.4403 1.6228	Prob 0.527 0.768 0.810 0.885 0.920 0.951
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 7 -0.025	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.026 -0.023	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.4403 1.6228 1.6317	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.026 -0.023 -0.002 -0.149	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.4403 1.6228 1.6317 4.4071 9.3644	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.026 -0.023 -0.002 -0.149 -0.080	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118 -0.128	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.4403 1.6228 1.6317 4.4071 9.3644 13.304	Prob 0.527 0.768 0.810 0.825 0.920 0.951 0.977 0.819 0.404 0.207
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.026 -0.023 -0.002 -0.149 -0.080 0.031 -0.015	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.526	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118 -0.128 0.006 0.060	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.6228 1.6317 4.4071 9.3644 13.304 13.817	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.951 0.977 0.819 0.404 0.207 0.268 0.313
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029	PAC -0.005 0.017 0.038 -0.021 -0.026 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.520 11.038 11.318	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.526 0.584	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118 -0.128 0.006 0.060 0.069	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6228 1.6317 4.4071 9.3644 13.304 13.817 13.400	Prob 0.527 0.768 0.810 0.985 0.920 0.951 0.977 0.819 0.404 0.207 0.208 0.313 0.323
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 0.001	PAC -0.005 0.017 0.038 -0.022 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022 0.056 0.005	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 1.038 11.318 12.807 12.907	Prob 0.928 0.950 0.908 0.962 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.526 0.584 0.584 0.517	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.025	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.018 -0.128 0.006 0.060 0.069 0.034 0.014	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.4031 1.6287 4.4071 9.3644 13.400 13.817 14.749 15.335 15.735	Prob 0.527 0.768 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.208 0.313 0.323 0.356 0.400
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015	PAC -0.005 0.017 0.038 -0.022 -0.023 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022 0.056 -0.008 0.002	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.807 12.885	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.526 0.584 0.526 0.584 0.584 0.681	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.094 0.060 0.069 0.034 0.015 0.044	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.6284 1.6317 4.4071 9.3644 13.304 13.817 14.749 15.335 15.738 16.902	Prob 0.527 0.768 0.885 0.920 0.951 0.971 0.404 0.207 0.268 0.313 0.323 0.356 0.400 0.392
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 17 0.028	PAC -0.005 0.017 0.038 -0.032 -0.021 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022 0.056 -0.008 0.002 0.008 0.002	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.805 13.143	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.526 0.584 0.526 0.584 0.526 0.617 0.681 0.727	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 17 -0.027 18 -0.024 18 -0.024 19 -0.124 19 -0.124 19 -0.124 19 -0.124 19 -0.124 19 -0.124 19 -0.025 10 -0.024 10 -0.127 10 -0.025 10 -0.024 10 -0.025 10 -0.024 10 -0.027 10	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118 0.006 0.060 0.060 0.069 0.034 0.015 0.044 0.004	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.6228 1.627 4.4071 9.3644 13.304 13.817 14.749 15.335 15.738 16.902 17.142	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.405 0.392 0.445
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.002 19 0.000	PAC -0.005 0.017 0.038 -0.021 -0.021 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022 0.056 -0.008 0.002 0.023 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.026 -0.026 -0.021 -0.026 -0.021 -0.026 -0.021 -0.025 -0.021 -0.025 -0.055	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.805 13.143 13.160 13.160	Prob 0.928 0.950 0.908 0.927 0.985 0.997 0.985 0.994 0.460 0.596 0.584 0.584 0.584 0.542 0.611 0.727 0.681 0.727 0.830	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 19 0.039 19 0.039 10 0.053 10	PAC -0.036 0.019 0.039 -0.022 -0.033 -0.027 -0.004 0.096 -0.118 -0.128 0.066 0.060 0.069 0.034 0.015 0.044 0.004 0.002 0.014	Q-Stat 0.4005 0.5284 0.9640 1.1548 1.6228 1.627 4.4071 9.3644 13.304 13.817 14.749 15.335 15.738 16.902 17.142 17.159 17.660	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.405 0.323 0.356 0.405 0.392 0.445 0.527
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.023 -0.002 -0.149 -0.080 0.031 -0.015 0.022 0.056 -0.008 0.002 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.024 -0.023 -0.024 -0.024 -0.025 -0.024 -0.025 -0.055	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.524 10.800 11.038 11.318 12.807 12.885 13.143 13.160 13.513	Prob 0.928 0.950 0.908 0.927 0.985 0.997 0.985 0.994 0.460 0.526 0.584 0.542 0.544 0.542 0.681 0.727 0.681 0.727 0.830 0.854	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 20 0.048	PAC -0.036 0.019 0.022 -0.033 -0.027 -0.004 0.096 -0.118 -0.128 0.060 0.060 0.069 0.034 0.015 0.044 0.002 0.014 0.002 0.014 0.002	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4228 1.6317 4.4071 9.3644 13.304 13.304 13.817 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.405 0.323 0.356 0.405 0.392 0.445 0.559
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.023 -0.002 -0.149 -0.049 -0.049 0.031 -0.015 0.022 0.056 -0.002 0.023 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.049 -0.056 -0.056 -0.056 -0.056 -0.025 -0.056 -0.025 -0.005 -0.025 -0.055	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.800 11.038 11.318 12.807 12.805 13.143 13.160 13.513 14.297 15.194	Prob 0.928 0.950 0.908 0.927 0.985 0.994 0.467 0.396 0.460 0.584 0.584 0.584 0.542 0.681 0.727 0.681 0.727 0.681 0.854 0.854 0.854 0.854	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 20 0.048 21 -0.034 22 0.054	PAC -0.036 0.019 0.039 -0.027 -0.004 0.096 -0.118 -0.128 0.060 0.060 0.060 0.069 0.034 0.015 0.044 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.002 0.014 0.015 0.018 0.019 0.027 0.027 0.018 0.027 0.018 0.027 0.018 0.026 0.018 0.026 0.018 0.026 0.018 0.026 0.027 0.026 0.027 0.026 0.027 0.026 0.027 0.026 0.027 0.026 0.027 0.026 0.027 0.026 0.027 0.027 0.025	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.304 13.817 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 29.208	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.405 0.392 0.445 0.512 0.559 0.597 0.557
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 33 0.011	PAC -0.005 0.017 -0.028 -0.032 -0.021 -0.023 -0.022 -0.149 -0.080 0.031 -0.015 0.022 -0.080 -0.008 -0.002 -0.008 -0.002 -0.025 -0.023 -0.025 -	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.800 11.038 11.318 12.807 12.885 13.143 13.160 13.513 14.297 15.186 15.228	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.584 0.584 0.584 0.542 0.681 0.727 0.681 0.727 0.854 0.854 0.854 0.857 0.854	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.037 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.037	PAC -0.036 0.019 0.022 -0.033 -0.027 -0.004 0.096 -0.1128 0.006 0.060 0.060 0.034 0.015 0.044 0.002 0.011 0.039 -0.025 0.080 -0.013	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6228 1.6317 4.4071 9.3644 13.304 13.304 13.817 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.206	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.402 0.445 0.512 0.559 0.559 0.597 0.501
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.048 25 -0.048 26 -0.048 27 -0.048 28 -0.048 29 -0.058 20 -	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.026 -0.023 -0.022 0.040 0.022 0.056 -0.023 0.022 0.022 0.022 0.022 0.023 0.022 0.022 0.023 0.022 0.023 0.022 0.022 0.023 0.022 0.023 0.022 0.023 0.022 0.023 0.022 0.022 0.023 0.022 0.023 0.022 0.022 0.023 0.022 0.022 0.023 0.022 0.023 0.022 0.023 0.022 0.022 0.023 0.024 0.022 0.023 0.024 0.023 0.024 0.023 0.024 0.023 0.024 0.023 0.024 0.02	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.800 11.038 11.318 12.807 12.885 13.143 13.160 13.513 14.297 15.186 15.228 15.944 15.944	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.460 0.584 0.584 0.542 0.681 0.727 0.782 0.854 0.854 0.857 0.854 0.857 0.854 0.857	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 20 0.048 21 -0.034 22 0.064 23 -0.037 24 -0.016 5 -0.039 24 -0.016 5 -0.039 25 -0.037 26 -0.034 27 -0.027 26 -0.034 27 -0.027 27 -0.027 28 -0.034 29 -0.034 20 -0.034 29 -0.034 20 -0.0	PAC -0.036 0.019 -0.022 -0.033 -0.022 -0.027 -0.004 0.069 0.034 0.069 0.034 0.069 0.034 0.004 0.004 0.022 0.011 0.039 -0.025 0.034 0.039 -0.025 0.044 0.039 -0.025 0.044 0.039 -0.025 0.044 0.059 -0.025 0.044 0.059 -0.025 0.059 0.057	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.206 20.756	Prob 0.527 0.768 0.810 0.885 0.920 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.400 0.325 0.445 0.512 0.559 0.597 0.507 0.501 0.653 0.653
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.026 -0.023 -0.022 0.040 0.022 0.056 -0.023 0.022 0.022 0.022 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.024 -0.023 -0.025 -0.023 -0.025 -0.023 -0.025 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.026 -0.023 -0.026 -0	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.524 10.800 11.038 11.318 12.807 12.807 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 17.637 18.657 19.577 19.5777 19.577 19.5777 19.5777 19.5777 19.5777 19.5777 19.5777 19.5777	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.460 0.584 0.584 0.542 0.617 0.727 0.782 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.927 0.926 0.927 0.927 0.927 0.928 0.927 0.927 0.927 0.928 0.927 0.928 0.927 0.928 0.927 0.927 0.927 0.928 0.927 0.824 0.854 0.854 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.856 0.85700000000000000000000000000000000000	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.027 18 -0.027 18 -0.034 22 0.064 21 -0.034 22 0.064 23 -0.016 25 -0.023 26 -0.042	PAC -0.036 0.019 -0.022 -0.033 -0.022 -0.027 -0.027 -0.027 -0.026 0.069 0.069 0.069 0.069 0.069 0.069 0.034 0.005 0.044 0.022 0.011 -0.027 -0.025 -0.027 -0.025 -0.024 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.027 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.128 -0.026 -0.026 -0.026 -0.128 -0.026 -0.027 -0.026 -0.128 -0.026 -0.027 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.027 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.027 -0.025 -0.017 -0.017 -0.017 -0.017 -0.027 -0.017 -0.027 -0.017 -0.027 -0.017 -0.017 -0.015 -0.018 -0.018 -0.018 -0.018 -0.018 -0.018 -0.017 -0.017 -0.017 -0.015 -0.018 -0.01	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.817 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.206 20.756 20.936 21.542	Prob 0.527 0.768 0.810 0.885 0.920 0.977 0.819 0.404 0.207 0.268 0.313 0.326 0.400 0.323 0.356 0.400 0.392 0.445 0.512 0.545 0.557 0.557 0.507 0.507 0.653 0.663 0.653 0.6713
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052 27 -0.005	PAC -0.005 0.017 0.038 -0.032 -0.026 -0.023 -0.026 -0.023 0.040 0.022 0.056 -0.023 0.022 0.022 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.024 -0.025 -0.023 -0.025 -0.024 -0.025 -0.025 -0.025 -0.025 -0.026 -	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.524 10.524 10.524 10.524 10.524 11.318 12.807 12.885 13.143 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.644	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.9947 0.396 0.460 0.584 0.584 0.584 0.542 0.6811 0.727 0.782 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.886 0.889 0.889 0.914	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.034 22 0.064 23 -0.034 23 -0.042 27 0.066	PAC -0.036 0.019 -0.022 -0.033 -0.022 -0.027 -0.004 0.069 0.034 0.069 0.034 0.069 0.044 0.025 0.044 0.029 0.034 -0.128 0.039 -0.027 -0.028 -0.028 -0.028 -0.028 -0.028 -0.029 -0.028 -0.029 -0.028 -0.029 -0.029 -0.028 -0.029 -0.027 -0.024 -0.029 -0.027 -0.024 -0.029 -0.027 -0.027 -0.027 -0.024 -0.029 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.027 -0.015 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.039 -0.038 -0.038 -0.039 -0.038 -0.03	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.206 20.756 20.936 20.756 20.936 21.542 23.050	Prob 0.527 0.768 0.810 0.885 0.920 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.400 0.325 0.445 0.512 0.545 0.559 0.597 0.507 0.653 0.663 0.713 0.682
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.07 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052 27 -0.005 28 -0.024 29 -0.024 29 -0.024 29 -0.024 29 -0.024 20 -0.024 20 -0.024 20 -0.024 20 -0.024 20 -0.024 20 -0.025 20 -0.024 20 -0.025 20 -0.024 20 -0.025 20 -0.024 20 -0.025 20 -0	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.026 -0.023 -0.022 0.040 0.022 0.056 -0.023 0.022 0.022 0.022 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.024 -0.023 -0.025 -0.023 -0.025 -0.023 -0.025 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.026 -0.023 -0.026 -0.026 -0.023 -0.026 -0.026 -0.023 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.026 -0.020 -0.026 -0.046 -0	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.524 10.524 10.800 11.038 11.318 12.807 12.805 13.143 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.644 17.637 18.255 19.455	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.460 0.584 0.584 0.542 0.6817 0.727 0.782 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.886 0.890 0.889 0.914 0.929	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.07 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.016 25 -0.023 26 -0.042 27 0.066 28 -0.004 29 0.024	PAC -0.036 0.019 -0.022 -0.033 -0.022 -0.027 -0.027 -0.044 0.056 0.044 0.029 0.034 0.039 -0.025 -0.015 -0.015 -0.015 -0.015 -0.038 0.055 -0.025 -0.038 -0.038 -0.038 -0.039 -0.038 -0.039 -0.038 -0.039 -0.038 -0.039 -0.038 -0.039 -0.044 -0.039 -0.047 -0.045	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.756 20.936 21.542 23.050 23.076	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.404 0.207 0.268 0.323 0.326 0.445 0.512 0.545 0.557 0.557 0.507 0.653 0.663 0.613 0.682 0.713 0.682 0.754
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.07 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052 27 -0.005 28 -0.026 29 -0.034 30 0.015	PAC -0.005 0.017 0.038 -0.022 -0.022 -0.022 0.040 0.031 -0.056 -0.080 0.022 0.056 -0.023 -0.020 0.022 0.022 0.022 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.025 -0.023 -0.025 -0.023 -0.025 -0.024 -0.046 -0.044 -0.055 -0.024 -0.044 -0.055 -0.055 -0.044 -0.055 -0.	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.524 10.524 10.800 11.038 11.318 12.807 12.805 13.143 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.644 17.885 18.357 18.357	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.9947 0.396 0.460 0.584 0.584 0.542 0.6817 0.727 0.782 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.886 0.890 0.889 0.914 0.929 0.932	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 20 0.048 21 -0.034 22 0.064 23 -0.016 25 -0.023 26 -0.042 27 0.066 28 -0.024 30 0.019	PAC -0.036 0.019 -0.022 -0.033 -0.022 -0.027 -0.044 0.069 0.039 0.044 0.005 0.044 0.022 0.039 -0.128 0.044 0.029 -0.125 -0.027 -0.025 -0.027 -0.015 -0.012 -0.038 0.055 -0.012 -0.038 -0.055 -0.012 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.014 -0.004 -0.0	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.206 20.756 20.936 21.542 23.050 23.279 23.400	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.401 0.207 0.268 0.323 0.326 0.400 0.323 0.356 0.400 0.392 0.445 0.512 0.557 0.557 0.557 0.557 0.557 0.653 0.663 0.653 0.662 0.713 0.682 0.729 0.768
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052 27 -0.005 28 -0.026 29 -0.034 30 0.015 31 -0.025 31 -0	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.020 -0.020 0.040 0.022 0.056 -0.023 0.022 0.056 -0.023 0.022 0.022 0.022 0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.023 -0.024 -0.023 -0.025 -0.023 -0.025 -0.023 -0.025 -0.023 -0.025 -0.024 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.055 -0.054 -0.054 -0.054 -0.055 -0.054 -0.054 -0.055 -0.054 -0.055 -0.054 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.0	Q-Stat 0.0082 0.1034 0.5494 0.5494 0.8818 1.0047 1.2052 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 17.637 17.637 17.637 17.637 18.8578 18.3577 18.5578 18.5578 18.5578 19.778 18.5578 19.778 18.5578 19.777 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.778 19.777 19.778 19.7777 19.7777 19.7777 19.7777 19.7777 19.7777 19.7777 19.7777 19.777	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.526 0.526 0.544 0.526 0.542 0.617 0.727 0.782 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.891 0.891 0.892 0.962 0.962	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.039 20 0.048 21 -0.034 22 0.064 23 -0.037 24 -0.016 25 -0.023 26 -0.042 27 0.066 28 -0.0024 30 0.019 31 -0.024 30 -0.24 30 -0.24 30 -0.24 30 -0.24 31 -0.024 31 -0.024 31 -0.024 32 -0.024 32 -0.024 33 -0.024 31 -0.024 31 -0.024 31 -0.024 32 -0.024 30 -0.024 30 -0.024 30 -0.024 31 -0.024 31 -0.024 32 -0.024 30 -0.024	PAC -0.036 0.019 -0.022 -0.033 -0.027 -0.027 -0.042 0.069 0.040 0.069 0.034 0.015 0.044 0.020 0.014 0.020 0.014 0.020 0.039 -0.025 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.756 20.936 21.542 23.076 23.279 23.400 24.014 24.01	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.405 0.977 0.207 0.268 0.313 0.326 0.400 0.323 0.356 0.400 0.356 0.445 0.512 0.597 0.570 0.597 0.507 0.597 0.507 0.603 0.663 0.663 0.663 0.682 0.729 0.729 0.798 0.810 0.201 0.595 0.595 0.597 0.601 0.653 0.682 0.729 0.729 0.728 0.798 0.810 0.595 0.798 0.798 0.595 0.597 0.798 0.601 0.798 0.798 0.597 0.7988 0.7988 0.799 0.798 0.7998 0.7998 0.799 0.799 0.799
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 10 -0.076 11 0.029 12 -0.027 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.07 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 24 -0.046 25 -0.048 26 -0.052 27 -0.055 28 -0.026 29 -0.034 30 0.015 31 -0.025 32 -0.049 33 -0.065	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.026 -0.023 -0.022 -0.020 -0.020 -0.020 -0.020 -0.020 -0.020 -0.023 -0.025 -0.023 -0.025 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.026 -0.023 -0.025 -0.026 -0.023 -0.026 -0.023 -0.026 -0.028 -0.028 -0.028 -0.028 -0.028 -0.028 -0.049 -0.046 -0.048 -0.046 -0.048 -0.046 -0.048 -0.046 -0.048 -0.046 -0.048 -0.046 -0.048 -0.046 -0.048 -0.049 -0.046 -0.049 -0.046 -0.046 -0.046 -0.046 -0.047 -0.046 -0.047 -0.	Q-Stat 0.0082 0.1034 0.5494 0.5494 0.5494 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 17.637 17.637 18.578 18.3577 18.578 19.408 20.871 18.578 19.408 20.871 18.578 19.408 20.871 18.578 19.408 20.871 18.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.871 19.578 19.408 20.578 19.408 20.577 20.578 20.578 20.577 20.578 20.578 20.577 20.578 20.578 20.577 20.578 20.577 20.578 20.578 20.577 20.578 20.57	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.526 0.526 0.526 0.542 0.617 0.681 0.727 0.782 0.830 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.891 0.891 0.829 0.912 0.922 0.962 0.962 0.962 0.950	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.07 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.042 27 0.066 28 -0.042 27 0.066 28 -0.042 31 -0.024 33 0.003 31 -0.042 32 -0.004 33 0.003 31 -0.042 33 0.003 31 -0.042 32 -0.004 33 0.003 31 -0.042 33 0.003 31 -0.042 33 0.003 31 -0.042 33 0.003 31 -0.042 33 0.003 31 -0.042 32 -0.004 33 0.003 31 -0.042 32 -0.004 33 0.003 31 -0.042 32 -0.004 32 -0.004 33 0.003 32 -0.004 32 -0.004 33 0.003 32 -0.004 32 -0.004 33 0.003 32 -0.004 32 -0.004 33 0.003 31 -0.042 32 -0.004 31 -0.042 32 -0.004 31 -0.042 32 -0.004 31 -0.042 32 -0.004 31 -0.042 32 -0.004 32 -0.004	PAC -0.036 0.019 -0.022 -0.033 -0.027 -0.027 -0.044 0.096 0.069 0.034 0.015 0.044 0.026 0.044 0.026 0.044 0.026 0.041 0.039 -0.025 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 -0.025 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.012 -0.025 -0.015 -0.015 -0.015 -0.012 -0.038 -0.025 -0.015 -0.015 -0.015 -0.015 -0.015 -0.012 -0.038 -0.055 -0.012 -0.038 -0.004 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.015 -0.012 -0.004 -0.0	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.756 20.936 21.542 23.076 23.279 23.400 24.014 24.012	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.404 0.207 0.268 0.313 0.326 0.400 0.323 0.356 0.400 0.323 0.356 0.445 0.512 0.597 0.570 0.597 0.507 0.507 0.603 0.696 0.713 0.682 0.729 0.729 0.768 0.810 0.810 0.810 0.810 0.810 0.810 0.825 0.729 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.825 0.729 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.951 0.597 0.597 0.597 0.597 0.597 0.597 0.597 0.597 0.601 0.653 0.696 0.729 0.729 0.729 0.810 0.810 0.820 0.729 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.729 0.729 0.810 0.810 0.810 0.810 0.729 0.729 0.729 0.810 0.810 0.810 0.810 0.729 0.729 0.729 0.729 0.729 0.810 0.810 0.810 0.820 0.729 0.729 0.729 0.810 0.810 0.810 0.810 0.820 0.729 0.729 0.729 0.810 0.810 0.810 0.810 0.820 0.729 0.729 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.820 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.820 0.729 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.820 0.729 0.810 0.810 0.810 0.830 0.810 0.8
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 14 0.067 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.07 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.015 31 -0.025 34 0.055 34 0.055	PAC -0.005 0.017 0.038 -0.022 -0.021 -0.026 -0.023 -0.022 -0.020 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.040 -0.000 -0.	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4164 1.00524 1.4164 10.8000 11.038 11.318 12.807 12.885 13.160 13.513 14.297 15.186 15.248 15.944 16.727 17.637 17.637 17.637 17.637 18.578 19.408 20.871 21.944	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.396 0.526 0.526 0.542 0.617 0.681 0.727 0.782 0.830 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.854 0.890 0.891 0.829 0.922 0.962 0.962 0.962 0.962 0.951	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.032 26 -0.042 27 0.066 28 -0.099 29 -0.24 40 -0.016 25 -0.023 26 -0.042 27 0.066 28 -0.009 29 -0.24 40 -0.019 31 -0.042 32 -0.004 33 -0.005 -0.042 34 -0.006 -0.042 34 -0.006 -0.042 -0.042 -0.042 -0.044 -0.042 -0.044 -0.016 -0.042 -0.044 -0.006 -0.042 -0.044 -0.006 -0.042 -0.044 -0.006 -0.042 -0.044 -0.006 -0.044 -0.066 -0.044 -0.066	PAC -0.036 0.019 -0.022 -0.033 -0.027 -0.027 -0.044 0.096 0.069 0.034 0.059 -0.018 -0.015 -0.012 -0.015 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.038 -0.055 -0.012 -0.012 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.004	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.756 20.936 21.542 23.070 23.076 23.279 23.400 24.014 24.018	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.977 0.819 0.977 0.207 0.268 0.323 0.326 0.445 0.512 0.597 0.597 0.5701 0.653 0.696 0.713 0.682 0.729 0.729 0.729 0.810 0.8000 0.8000 0.8000 0.8000 0.8000 0.8000 0.8000 0.8000 0
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 14 0.067 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.015 28 -0.026 29 -0.034 20 -0.055 31 -0.025 32 -0.045 31 -0.025 32 -0.045 33 -0.065 34 0.055 35 0.046 36 0.026 36 0.026 37 0.026 36 0.026 37 0.026 36 0.026 36 0.026 36 0.026 37 0.027 37 0.025 37	PAC -0.005 -0.021 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 0.056 0.022 -0.023 0.040 0.031 -0.025 -0.023 0.046 0.056 0.031 -0.046 0.055 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.025 -0.026 -0.023 -0.025 -0.022 -0.026 -0.023 -0.025 -0.049 -0.055 -0.049 -0.055 -0.034 -0.055 -0.005 -	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.160 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 18.578 19.408 20.871 18.3578 19.408 20.871 21.944 22.677 23.140	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.396 0.526 0.584 0.584 0.584 0.584 0.681 0.782 0.830 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.891 0.829 0.912 0.929 0.932 0.952 0.962 0.961 0.952	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.007 19 0.039 20 0.044 22 0.064 23 -0.032 26 -0.042 27 0.066 28 -0.099 29 -0.224 30 0.019 31 -0.042 32 -0.004 33 0.003 34 -0.066 35 0.052 36 0.024 36 0.024 37 0.025 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 36 0.024 37 0.025 36 0.024 36 0.024 37 0.025 36 0.024 37 0.025 36 0.024 37 0.025 36 0.024 36 0.024 37 0.025 36 0.024 37 0.025 36 0.024 37 0.025 37 0.	PAC -0.036 0.019 -0.022 -0.037 -0.027 -0.027 -0.027 -0.027 -0.026 0.044 0.044 0.045 0.042 0.015 -0.025 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.015 -0.025 -0.015	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.936 20.936 21.542 23.050 23.076 23.279 23.400 24.014 24.018 24.012 24.036 24.972 25.132 24.036 24.972 25.13	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.401 0.207 0.268 0.313 0.326 0.400 0.323 0.356 0.400 0.325 0.597 0.570 0.597 0.570 0.653 0.696 0.729 0.768 0.810 0.682 0.729 0.768 0.810 0.843 0.898 0.898 0.898 0.893 0.913
	Autocorrelation	Partial Correlation	AC 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 14 0.067 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.007 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 23 0.015 28 -0.026 29 -0.034 20 -0.052 28 -0.026 29 -0.034 30 -0.055 31 -0.025 32 -0.048 30 -0.055 32 -0.048 30 -0.055 35 0.046 36 0.036 36 0.036	PAC -0.005 -0.021 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.022 0.056 0.022 -0.023 0.040 0.056 0.031 -0.046 0.055 -0.034 -0.046 0.055 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.034 -0.025 -0.035 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055 -0.055	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.143 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 17.637 18.578 18.3578 18.3578 18.3578 19.408 20.871 21.944 22.677 23.140	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.526 0.584 0.584 0.584 0.584 0.584 0.617 0.782 0.857 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.891 0.829 0.929 0.932 0.952 0.962 0.946 0.952	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.007 19 0.039 20 0.044 22 0.064 23 -0.032 26 -0.042 27 0.066 28 -0.099 29 -0.224 40 0.019 31 -0.042 32 -0.04 33 0.003 34 -0.066 35 0.052 36 0.021 36 0.021 36 0.021 36 0.021 37 -0.027 37 -0.027 38 -0.04 30 -0.04 30 -0.04 30 -0.04 30 -0.04 30 -0.04 30 -0.04 31 -0.04 30 -0.04	PAC -0.036 0.019 -0.022 -0.037 -0.027 -0.027 -0.024 0.015 0.044 0.044 0.045 0.042 0.015 0.044 0.042 0.015 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.025 -0.012 -0.012 -0.015 -0.012 -0.025 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.307 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 20.756 20.936 21.542 23.070 23.076 23.279 23.400 24.014 24.018 24.01	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.977 0.207 0.268 0.323 0.326 0.400 0.323 0.356 0.400 0.323 0.356 0.445 0.512 0.597 0.597 0.5701 0.653 0.696 0.713 0.682 0.729 0.768 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.810 0.820 0.729 0.729 0.729 0.810 0.810 0.820 0.729 0.729 0.810 0.810 0.820 0.729 0.729 0.729 0.810 0.810 0.820 0.729 0.729 0.810 0.898 0.895 0.913 0.898 0.895 0.913 0.895 0.913 0.898 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.895 0.913 0.895 0.895 0.895 0.913 0.895 0.895 0.895 0.895 0.895 0.895 0.895 0.895 0.895 0.895 0.913 0.895 0.913 0.895 0.913 0.913 0.913 0.895 0.913 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.915 0.
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 14 0.067 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.07 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 23 0.015 28 -0.026 29 -0.034 20 -0.055 31 -0.025 32 -0.045 31 -0.025 32 -0.046 30 -0.055 34 0.055 35 0.046 36 0.036	PAC -0.005 0.017 0.038 -0.022 -0.026 -0.023 -0.022 -0.026 0.022 -0.028 -0.029 -0.028 0.020 -0.029 -0.029 -0.029 -0.029 -0.020 0.022 0.021 -0.020 -0.020 -0.023 0.046 0.056 0.031 -0.025 -0.023 0.040 0.056 -0.039 -0.045 -0.031 -0.046 0.055 -0.045 -0.055 -0.045 -0.055 -0.045 -0.055 -0.045 -0.055 -0.045 -0.055 -0.045 -0.05	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4128 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.143 13.160 13.513 14.297 15.186 15.944 16.727 17.637 17.637 17.637 17.637 18.578 19.408 20.877 18.578 19.408 20.877 12.1944 22.677 23.140	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.396 0.526 0.584 0.526 0.584 0.526 0.617 0.727 0.782 0.830 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.851 0.890 0.891 0.929 0.932 0.962 0.962 0.962 0.952	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.007 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.037 24 -0.016 25 -0.023 26 -0.042 27 0.066 28 -0.099 29 -0.024 30 0.019 31 -0.042 32 -0.004 33 0.003 34 -0.006 35 0.052 36 0.021	PAC -0.036 0.019 -0.022 -0.033 -0.027 -0.044 0.096 -0.118 0.069 0.034 0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.038 0.055 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.012 -0.015 -0.012 -0.004 -0	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.304 13.317 14.749 15.335 15.738 16.902 17.142 17.159 17.660 18.438 18.819 20.266 20.936 21.542 23.050 23.050 23.076 23.279 23.400 24.014 24.018 25.133 25.133 26.138 26.138 26.138 26.138 27.14	Prob 0.527 0.768 0.810 0.810 0.977 0.819 0.404 0.207 0.268 0.313 0.326 0.400 0.323 0.356 0.400 0.325 0.559 0.597 0.570 0.653 0.663 0.653 0.662 0.713 0.682 0.729 0.768 0.810 0.829 0.768 0.810 0.840 0.829 0.768 0.810 0.840 0.829 0.768 0.810 0.840 0.778 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.829 0.768 0.810 0.840 0.713 0.888 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.895 0.913 0.895 0.895 0.913 0.895 0.895 0.913 0.895 0.913 0.895 0.895 0.913 0.895 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.895 0.913 0.913 0.815 0.8
	Autocorrelation	Partial Correlation	AC 1 -0.005 2 0.017 3 0.038 4 -0.032 5 -0.020 6 -0.025 7 -0.025 8 -0.003 9 -0.150 10 -0.076 11 0.029 14 0.067 13 0.029 14 0.067 15 -0.001 16 0.015 17 0.028 18 -0.071 19 0.000 20 0.033 21 -0.048 22 0.051 23 0.011 23 0.015 31 -0.025 28 -0.026 29 -0.034 20 -0.055 31 -0.025 32 -0.048 26 -0.052 33 -0.055 34 0.055 35 0.046 36 0.036 (TSTA)	PAC -0.005 0.017 0.022 -0.026 -0.023 -0.022 -0.026 -0.023 -0.022 0.056 0.022 0.056 -0.023 0.040 0.022 0.025 -0.023 0.040 0.022 0.025 -0.023 0.040 0.031 -0.025 -0.023 0.040 0.032 0.022 0.056 -0.039 -0.046 0.032 0.040 0.022 0.025 -0.023 0.040 0.022 0.025 -0.023 0.040 0.022 0.025 -0.023 0.020 0.022 0.025 -0.023 0.020 0.025 0.022 0.025 -0.023 0.040 0.022 0.025 -0.023 0.040 0.031 -0.025 -0.023 0.040 0.032 0.040 0.032 0.040 0.035 -0.045 -0.045 -0.045 0.032 -0.045 0.031 -0.045 -0.045 0.022 0.056 -0.045 -0.045 -0.045 0.022 0.056 -0.045 -0.0	Q-Stat 0.0082 0.1034 0.5494 0.8818 1.0047 1.2052 1.4164 8.6804 10.524 10.800 11.038 11.318 12.807 12.885 13.160 13.513 14.297 15.186 15.228 15.944 16.727 17.637 17.637 17.637 17.637 18.578 19.408 20.877 18.578 19.408 20.877 12.1944 22.677 23.140 I)	Prob 0.928 0.950 0.908 0.927 0.962 0.977 0.985 0.994 0.467 0.396 0.467 0.526 0.526 0.542 0.617 0.681 0.727 0.782 0.830 0.854 0.857 0.854 0.857 0.854 0.857 0.854 0.890 0.891 0.829 0.912 0.922 0.962 0.962 0.952	Autocorrelation	Partial Correlation	AC 1 -0.036 2 0.020 3 0.037 4 -0.025 5 -0.030 6 -0.024 7 -0.005 8 0.093 9 -0.124 10 -0.110 11 0.017 12 0.036 13 0.053 14 0.042 15 0.035 16 0.059 17 -0.027 18 -0.007 19 0.039 20 0.048 21 -0.034 22 0.064 23 -0.032 26 -0.042 27 0.066 28 -0.099 29 -0.224 40 0.019 31 -0.042 32 -0.004 33 -0.033 34 -0.006 35 0.052 36 0.021 . MI)	PAC -0.036 0.019 -0.022 -0.033 -0.027 -0.027 -0.044 0.066 0.060 0.069 0.034 0.015 -0.012 0.039 -0.025 0.044 0.025 -0.015 -0.017 -0.015 -0.012 0.039 0.055 -0.012 0.039 0.035 -0.017 -0.015 -0.017 -0.015 -0.017 -0.015 -0.017 -0.015 -0.017 -0.015 -0.017 -0.015 -0.017 -0.017 -0.017 -0.017 -0.015 -0.017 -0.017 -0.015 -0.017 -0.015 -0.017	Q-Stat 0.4005 0.5284 0.96400 1.1548 1.4403 1.6317 4.4071 9.3644 13.304 13.304 13.317 14.749 15.335 15.738 16.902 17.142 17.159 17.660 20.756 20.936 20.756 20.936 21.542 23.050 23.070 23.400 24.014 24.018 24.022 24.036 24.976 25.133	Prob 0.527 0.768 0.810 0.885 0.920 0.951 0.977 0.819 0.404 0.207 0.268 0.313 0.326 0.400 0.325 0.545 0.559 0.559 0.557 0.559 0.557 0.559 0.557 0.559 0.557 0.651 0.653 0.663 0.663 0.663 0.663 0.682 0.713 0.682 0.778 0.778 0.810 0.841 0.798 0.810 0.841 0.898 0.895 0.913 0.9

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
ւի	ի ւի։	1 0.052	0.052	0.8398	0.359	i	I I	1 -0.003	-0.003	0.0034	0.954
i pi	ի հեր	2 0.078	0.076	2.7844	0.249	i ĝi	ի դին	2 0.025	0.025	0.1989	0.905
	1 1	3 0.008	0.001	2.8061	0.422	i ĝi	լ դի	3 0.039	0.039	0.6742	0.879
	1 11	4 0.011	0.004	2.8425	0.585	u (i	101	4 -0.026	-0.027	0.8965	0.925
11		5 0.003	0.001	2.8450	0.724	u (Li	101	5 -0.033	-0.035	1.2471	0.940
10	ի սիս	6 -0.038	-0.040	3.3132	0.769	- UL		6 -0.021	-0.021	1.3880	0.967
1 1	1 1	7 -0.008	-0.005	3.3334	0.853	u (Li	101	7 -0.033	-0.030	1.7428	0.973
i pi	լոր	8 0.073	0.080	5.0371	0.754	u (Li		8 -0.026	-0.023	1.9623	0.982
i di i	(1)	9 -0.067	-0.074	6.4898	0.690		E I	9 -0.148	-0.148	9.1082	0.427
C I	[]	10 -0.096	-0.103	9.5188	0.484	ng i	(d)	10 -0.071	-0.074	10.735	0.379
ւիւ	ի հեր	11 0.029	0.051	9.7858	0.550	ւի	ի դիս	11 0.034	0.038	11.105	0.435
10	10 1	12 -0.035	-0.026	10.198	0.599	ut i	1 10	12 -0.037	-0.027	11.557	0.482
i Di	լ ի	13 0.059	0.058	11.348	0.582	- I)I	1)1	13 0.021	0.013	11.709	0.552
i pi	լոր	14 0.066	0.077	12.798	0.542	ı þi	լին	14 0.081	0.067	13.897	0.457
ւիս		15 0.032	0.010	13.136	0.592	1	10	15 -0.007	-0.014	13.912	0.532
i þi	ի դի	16 0.048	0.019	13.892	0.607	- Din	1 1	16 0.021	0.005	14.053	0.595
11	լ դի	17 0.007	0.013	13.908	0.674	ւի	լոր	17 0.043	0.029	14.679	0.619
l l l l l l l l l l l l l l l l l l l	n[18 -0.074	-0.077	15.717	0.612	1 1	10	18 -0.006	-0.025	14.690	0.683
1 1	1 1	19 -0.002	-0.013	15.718	0.676	1 1		19 0.006	-0.014	14.700	0.741
ւիւ	լյի	20 0.028	0.051	15.979	0.718	ւլի	լոր	20 0.030	0.037	14.999	0.776
	1 1	21 0.011	0.003	16.017	0.769	u (101	21 -0.044	-0.041	15.649	0.789
i p	ip	22 0.093	0.084	18.964	0.648	ւի	լին	22 0.050	0.054	16.501	0.790
10	ili	23 -0.027	-0.014	19.207	0.689	- iji	լին	23 0.013	0.044	16.562	0.830
10	ի պիս	24 -0.030	-0.050	19.518	0.724	ug i	101	24 -0.054	-0.048	17.573	0.823
10	1 10	25 -0.034	-0.023	19.909	0.752	ığı	101	25 -0.052	-0.061	18.494	0.821
10		26 -0.031	-0.002	20.246	0.780	ng i	101	26 -0.050	-0.034	19.341	0.822
i pi	լ ւթ	27 0.054	0.045	21.234	0.775	- U	1 1	27 -0.011	-0.007	19.379	0.856
11	ili	28 0.004	-0.013	21.241	0.815	u di u	1 10	28 -0.025	-0.031	19.597	0.879
i di i	լ պես	29 -0.051	-0.060	22.156	0.814	սի	ի պի	29 -0.035	-0.025	20.031	0.892
1 1	1 1	30 -0.000	-0.017	22.156	0.848	- ili	1 1	30 0.021	0.006	20.179	0.912
10	1 1	31 -0.027	-0.002	22.418	0.869	u la companya da companya d	վելու	31 -0.026	-0.027	20.424	0.926
e i	լ պես	32 -0.092	-0.065	25.370	0.791	ul i	1 10	32 -0.036	-0.021	20.889	0.934
i i i i i i i i i i i i i i i i i i i	ן ום ו	33 -0.069	-0.067	27.026	0.759	ng i		33 -0.067	-0.100	22,468	0.917
11	ի դին	34 0.006	0.029	27.038	0.796	ւի	լոր	34 0.058	0.029	23.642	0.908
ւի	i]i	35 0.031	0.014	27.389	0.817	i 🖬	լո	35 0.040	0.039	24.215	0.915
10	լ պես	36 -0.008	-0.026	27.413	0.847	1 ju	ի դի	36 0.040	0.022	24.795	0.921

Table 4.1.7 Serial Correlation of Weekly Indexes Returns

The serial correlation test performed casts light on weekly data nature. None of the indexes show AC values equal to zero, but most of them are close to zero, especially in the first three lags. There is absence of serial correlation, so there is no possibility to reject the null hypothesis, a part for FTSE IT MICRO CAP that shows no reliable significance.

Monthly analysis

Descriptive Analysis

Hereunder there is the descriptive analysis of monthly data (Table 4.2.2). Indexes show both negative and positive mean as before. Here, the highest mean is represented by the FTSE ITALIA STAR index, while the lowest one by the FTSE IT SMALL CAP index. FTSE MIB, FTSE IT ALL-SHS and FTSE IT SMALL CAP indexes, in order of size, show the highest volatility compared with the others, proving a dispersion of data higher with respect to other indexes. The FTSE IT MICRO CAP index proves itself again to be the less volatile index. Skweness indicates that more than the half of the indexes present negative asymmetry, the remaining ones positive asymmetry. Kurtosis highlights, with less power than daily and weekly tests, that indexes are all centred with lights tails. Jarque-Bera test suggest that all indexes could be part of a sample distributed such as a normal random variable. P-values are

significant at conventional level. So, results show the possibility that these indexes can be represented by a normal distribution.

FTSE IT MIC	CRO CAP	FTSE IT SMALL CAP				
(ITMI.MI)		(ITSC.MI)				
Mean	-0.000533	Mean	-0.003192			
Median	-0.004399	Median	0.001138			
Maximum	0.101259	Maximum	0.153825			
Minimum	-0.106699	Minimum	-0.167443			
Std. Dev.	0.042944	Std. Dev.	0.062911			
Skewness	0.002743	Skewness	-0.066219			
Kurtosis	2.557975	Kurtosis	3.194997			
Jarque-Bera	0.586248	Jarque-Bera	0.166691			
Probability	0.745929	Probability	0.920033			
FTSE ITALIA	A ALL-SHS	FTSE ITALIA	A MID CAP			
(ITLMS.MI)		(ITMC.MI)				
Mean	0.000204	Mean	0.003156			
Median	0.001335	Median	0.007948			
Maximum	0.175204	Maximum	0.140468			
Minimum	-0.150522	Minimum	-0.130417			
Std. Dev.	0.064445	Std. Dev.	0.052619			
Skewness	-0.142062	Skewness	0.067841			
Kurtosis	2.776273	Kurtosis	2.613736			
Jarque-Bera	0.392341	Jarque-Bera	0.502829			
Probability	0.821872	Probability	0.777700			
FTSE ITALIA	A STAR	FTSE MIB				
(ITSTAR.MI))	(FTSEMIB.M	II)			
Mean	0.010833	Mean	-0.000323			
Median	0.013298	Median	0.001949			
Maximum	0.143101	Maximum	0.188966			
Minimum	-0.109644	Minimum	-0.169271			
Std. Dev.	0.044428	Std. Dev.	0.068631			
Skewness	-0.022868	Skewness	-0.169041			
Kurtosis	3.599380	Kurtosis	2.960027			

Jarque-Bera	1.084045	Jarque-Bera	0.347693
Probability	0.581571	Probability	0.840426

Table 4.1.8 Descriptive Analysis of Monthly indexes returns

Runs test

ITM	II.MI	ITS	C.MI	ITLMS.MI		ITMC.MI		ITSTAR.MI		FTSEMIB.MI	
Z	P-value	Z	P-value	Z	P-value	Z	P-value	Z	P- value	Z	P-value
95	.34	.47	.63	0	1	95	34	47	.63	0	1

Table 4.1.9 Runs Test for Monthly returns on Italian Stock Exchange indexes

All the indexes based on monthly data appear to follow a random process at the 5% significance level. This means that - on the basis of the Runs test - all Italian indexes result efficient looking at month by month opportunities.

Unit Root test

Augmented Dickey-Fuller Test

LEVEL									
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI			
t-Statistic	-1.636714	-1.233176	-1.910166	-1.290406	-1.196992	-1.900363			
Prob.*	0.4587	0.6558	0.3259	0.6298	0.6715	0.3304			
	TEST CRITICAL VALUE								
1% level	-3.527045	-3.525618	-3.525618	-3.525618	-3.527045	-3.525618			
5% level	-2.903566	-2.902953	-2.902953	-2.902953	-2.903566	-2.902953			
10% level	-2.589227	-2.588902	-2.588902	-2.588902	-2.589227	-2.588902			

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

Table 4.2.0 ADF Test for Monthly indexes returns (level)

Results are smaller with respect to the critical values and the associated one-sided *p*-value indicates that observations are consistent with the null hypothesis. This leads not to rejected the null unit root hypothesis at conventional level. In other words, market indexes suggest the presence of weak efficiency in the Italian market, even for FTSEMIB and ITLMS which show higher value than the values of the other indexes. This is confirmed by the PP test below too.

Philip-Perron Test

LEVEL									
	ITMI.MI	ITSC.MI	ITLMS.MI	ITMC.MI	ITSTAR.MI	FTSEMIB.MI			
t-Statistic	-1.478253	-1.327966	-1.887157	-1.467209	-0.736188	-1.853117			
Prob.*	0.5389	0.6123	0.3365	0.5444	0.8303	0.3524			
	TEST CRITICAL VALUE								
1% level	-3.525618	-3.525618	-3.525618	-3.525618	-3.525618	-3.525618			
5% level	-2.902953	-2.902953	-2.902953	-2.902953	-2.902953	-2.902953			
10% level	-2.588902	-2.588902	-2.588902	-2.588902	-2.588902	-2.588902			

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

Table 4.2.1 PP Test for Monthly indexes log prices (level)

Serial Correlation Test

FTSE IT MICRO CAP (ITMI.MI)			FTS	E IT SM	IALL CAP	(ITSC	.MI)					
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Auto	correlation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 0.257 2 0.097 3 -0.058 4 0.139 5 0.074 6 0.116 7 0.021 8 -0.083 9 -0.133 10 -0.105 11 0.020 12 -0.065 13 -0.038 14 -0.074 15 -0.027 16 -0.075 17 -0.032 18 -0.049 19 0.011 20 -0.026 21 -0.161 22 -0.176 23 -0.147 24 -0.039 25 -0.062 26 -0.062 27 -0.092 28 -0.180 29 -0.092 30 0.011 31 0.067 32 -0.043	0.257 0.033 -0.097 0.005 0.069 0.000 -0.130 -0.083 -0.070 0.055 -0.083 0.014 0.002 -0.038 -0.029 -0.043 -0.029 -0.043 -0.045 -0.043 -0.029 -0.045 -0.	4,9629 5,6852 5,9445 7,4582 7,8578 8,9676 9,0033 9,5714 11,067 12,042 12,048 12,049 13,049 13,049 13,118 13,653 13,752 14,005 14,075 16,795 20,114 22,458 22,629 23,519 24,690 24,690 28,618 29,666 29,681 30,279	0.026 0.058 0.114 0.163 0.175 0.296 0.271 0.286 0.361 0.413 0.483 0.593 0.625 0.685 0.730 0.730 0.783 0.576 0.576 0.576 0.577 0.576 0.574 0.574 0.574 0.574 0.572 0.431 0.482 0.542				$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 0.139 1 -0.071 2 0.002 3 0.001 4 -0.013 3 0.091 1 -0.128 2 -0.128 3 -0.037 3 -0.010 3 -0.022 5 -0.057 7 0.061 7 -0.083 3 -0.032 9 0.0227 2 -0.010 3 -0.031 9 0.0272 2 -0.0128 3 -0.031 3 -0.032 3 -0.031 3 -0.022 3 -0.023 1 -0.048 7 -0.269 3 -0.036 2 -0.054 1 -0.073	1.4415 1.6361 1.6550 2.2658 2.2858 2.7828 3.6048 5.2858 5.6155 5.6248 6.2312 6.5977 6.6103 7.1215 7.2471 7.2522 7.5233 8.1616 8.6384 8.7407 8.9331 9.2933 9.5239 10.118 17.784 2.6515 2.6.515 2.7.247 2.7.247 2.7.247 2.7.247 2.6.515 2.6.515 2.6.515 2.6.515 2.7.2477 2.7.2477 2.7.24	0.230 0.441 0.647 0.686 0.836 0.836 0.824 0.727 0.778 0.846 0.858 0.921 0.950 0.950 0.950 0.976 0.976 0.976 0.976 0.976 0.976 0.979 0.990 0.992 0.994 0.994 0.994 0.994 0.552 0.552 0.558 0.690 0.690
FTSE ITALIA ALL-SHS (ITLMS.MI)			FTS	e ital	IA MID CA	P (ITI	ИС.N	4I)				

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		$ \begin{array}{c} 1 & 0.066 \\ 2 & -0.237 \\ 3 & 0.101 \\ 4 & 0.082 \\ 5 & -0.109 \\ 6 & -0.052 \\ 7 & -0.076 \\ 8 & -0.081 \\ 9 & 0.062 \\ 10 & 0.060 \\ 11 & -0.005 \\ 12 & -0.076 \\ 13 & -0.026 \\ 14 & -0.007 \\ 15 & 0.074 \\ 16 & 0.002 \\ 17 & -0.118 \\ 18 & 0.137 \\ 19 & 0.011 \\ 20 & -0.072 \\ 21 & 0.072 \\ 21 & 0.072 \\ 22 & -0.066 \\ 23 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 25 & -0.077 \\ 24 & -0.064 \\ 30 & -0.050 \\ 30 & 0.155 \\ 31 & 0.044 \\ 32 & -0.165 \\ \end{array} $	0.066 -0.242 0.146 -0.029 -0.064 -0.029 0.050 0.033 0.033 0.033 -0.048 -0.056 0.080 0.056 0.080 0.056 0.080 0.056 0.080 0.056 0.080 0.056 0.080 0.056 0.022 0.054 0.050 0.050 0.022 0.054 0.0500 0.0500 0.0500000000	0.3267 4.5868 5.3771 5.9023 6.8491 7.0705 7.5410 8.0869 8.7283 9.2394 9.3016 9.8125 9.3056 9.8125 9.3056 9.8125 9.3056 9.8125 9.3056 9.8128 11.167 13.028 13.558 14.093 14.093 15.126 15.574 16.424 20.606 20.790 23.864 24.179 27.226 27.473 31.120	0.568 0.101 0.207 0.232 0.314 0.425 0.493 0.558 0.647 0.682 0.750 0.811 0.876 0.848 0.750 0.848 0.750 0.848 0.750 0.848 0.831 0.852 0.866 0.893 0.803 0.703 0.803 0.803 0.703 0.511			$ \begin{array}{c} 1 & 0.156 \\ 2 & -0.076 \\ 3 & 0.142 \\ 4 & 0.169 \\ 5 & -0.049 \\ 6 & 0.046 \\ 7 & 0.000 \\ 8 & -0.101 \\ 9 & 0.040 \\ 10 & 0.061 \\ 11 & 0.003 \\ 12 & -0.039 \\ 13 & -0.031 \\ 14 & -0.076 \\ 15 & 0.021 \\ 14 & -0.076 \\ 15 & 0.021 \\ 13 & -0.031 \\ 14 & -0.076 \\ 15 & 0.021 \\ 12 & -0.145 \\ 13 & -0.028 \\ 23 & -0.042 \\ 24 & -0.010 \\ 20 & -0.188 \\ 27 & -0.069 \\ 24 & -0.010 \\ 25 & -0.077 \\ 26 & -0.188 \\ 27 & -0.069 \\ 24 & -0.010 \\ 25 & -0.077 \\ 26 & -0.188 \\ 27 & -0.069 \\ 28 & -0.143 \\ 29 & -0.023 \\ 30 & 0.054 \\ 31 & -0.028 \\ 32 & -0.206 \\ \end{array} $	0.156 -0.102 0.177 0.0111 -0.072 -0.081 -0.081 -0.081 -0.086 0.056 0.051 -0.061 -0.061 -0.071 -0.089 -0.089 -0.089 -0.089 -0.089 -0.089 -0.089 -0.080 0.055 0.040 -0.145 -0.048 -0.040 -0.146 -0.040 -0.146 -0.040 -0.146 -0.048 -0.040 -	1.8313 2.2653 3.8171 6.0497 6.2371 6.4061 7.2590 7.7085 7.7093 7.8459 7.7093 8.4636 8.5061 8.9547 11.003 11.004 12.212 12.959 13.139 13.139 14.898 15.320 15.335 19.431 19.987 22.526 22.898 23.001	0.176 0.322 0.282 0.282 0.284 0.393 0.509 0.509 0.739 0.739 0.739 0.739 0.739 0.848 0.864 0.915 0.856 0.894 0.879 0.883 0.879 0.883 0.867 0.883 0.810 0.831 0.738 0.818 0.831 0.778 0.849 0.798 0.849 0.637
FTSE ITAL	IA STAR (I	TSTAI	R.M	()		FTSE MIB	(FTSEMIB	.MI)			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		$ \begin{array}{c ccccc} 1 & 0.292 \\ 2 & -0.041 \\ 3 & 0.095 \\ 4 & 0.055 \\ 5 & -0.072 \\ 6 & 0.021 \\ 7 & -0.118 \\ 8 & -0.173 \\ 9 & 0.087 \\ 10 & 0.008 \\ 11 & -0.080 \\ 11 & -0.080 \\ 11 & -0.080 \\ 12 & 0.073 \\ 13 & 0.013 \\ 14 & -0.054 \\ 15 & 0.083 \\ 16 & -0.001 \\ 17 & -0.119 \\ 18 & 0.039 \\ 10 & 0.074 \\ 21 & -0.022 \\ 20 & -0.074 \\ 21 & -0.022 \\ 22 & -0.018 \\ 23 & -0.114 \\ 24 & 0.027 \\ 27 & -0.243 \\ 29 & -0.050 \\ 30 & 0.007 \\ 31 & 0.015 \\ 32 & -0.079 \\ \end{array} $	0.292 -0.138 0.166 -0.040 -0.062 -0.082 -0.198 -0.047 -0.198 -0.047 -0.039 -0.039 -0.039 -0.075 -0.013 -0.075 -0.013 -0.024 -0.064 -0.040 -0.040 -0.187 -0.172 -0.187 -0.198 -0.024 -0.024 -0.025 -0.187 -0.187 -0.198 -0.024 -0.025 -0.0	6.3887 6.5148 7.2111 7.4506 7.8630 7.9003 9.0384 11.528 12.167 12.172 12.732 13.211 13.226 13.489 14.131 14.131 15.512 15.660 15.742 16.300 16.379 16.413 32.029 36.540 36.852 36.858 36.858 36.858	0.011 0.038 0.065 0.114 0.250 0.250 0.274 0.204 0.274 0.311 0.354 0.431 0.438 0.516 0.559 0.616 0.674 0.698 0.795 0.677 0.808 0.795 0.767 0.808 0.748 0.777 0.808 0.517 0.231 0.150 0.150 0.120			1 0.056 2 -0.259 3 0.107 4 0.096 5 -0.103 6 -0.061 7 -0.077 8 -0.065 9 0.066 10 0.043 11 0.014 12 -0.082 13 -0.038 14 0.007 15 0.065 16 -0.002 17 -0.113 18 0.145 19 0.011 20 -0.079 21 0.078 22 0.002 23 -0.100 24 -0.070 25 -0.092 23 -0.100 24 -0.070 25 -0.092 20 -0.184 27 0.060 30 0.168 31 0.044 32 -0.169	0.056 -0.263 0.151 -0.037 -0.051 -0.057 0.049 -0.055 0.025 0.025 0.025 0.025 0.022 0.044 -0.058 0.021 -0.044 -0.128 0.020 0.010 -0.128 0.020 0.050 0.010 -0.219 0.051 0.021 0.055 0.051 -0.225 0.051 -0.225 0.051 -0.225 0.051 -0.225 0.051 -0.054 -0.054 -0.054 -0.054 -0.054 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.134 -0.057 -0.144 -0.057 -0.144 -0.057 -0.054 -0.054 -0.054 -0.054 -0.055 -0.144 -0.057 -0.054 -0.054 -0.055 -0.144 -0.057 -0.054 -0.054 -0.055 -0.144 -0.057 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.054 -0.055 -0.055 -0.012 -0.055 -0.0	0.2358 5.3609 6.2432 6.97057 7.8179 8.1228 8.6061 8.9558 9.3247 9.4834 9.5013 10.099 10.236 10.625 10.625 11.859 13.920 13.932 14.565 15.197 15.198 16.220 16.833 17.796 21.7706 21.7706 21.7706 21.7706 21.7716 25.361 25.	0.627 0.069 0.100 0.137 0.229 0.282 0.346 0.408 0.487 0.576 0.675 0.745 0.779 0.873 0.809 0.734 0.843 0.854 0.843 0.854 0.843 0.855 0.731 0.608 0.635 0.731 0.608 0.635 0.497 0.536 0.397

Table 4.2.2 Serial Correlation of Monthly Indexes Returns

All data indexes show large p-values with significant Q-statistic results and autocorrelation values close to zero. There is absence of serial correlation, and so the null hypothesis results to be respected. Be careful, serial correlation test has been performed with log return data.

Companies Analysis

Purpose of the analysis on Companies: although the analysis over indexes looks at the whole market, it is interesting to look at specific companies as well. If it could be proved that even

companies which form the market indexes are subjected to the efficient market hypothesis, hence it is possible to affirm the EMH holds for the Italian market as whole.

4.1.4 Data

As done before for the indexes, now the first step in order to examine specific companies of the Italian Market is defining data. Data collected for the study of the companies consist of observations for the period January 1, 2009-December 31, 2014.

This empirical analysis of this study uses data of adjusted close prices for eight companies quoted on the FTSE MIB index of the Italian Stock Exchange: BMPS (BANCA MONTE PASCHI SIENA); ENEL.MI; ENI.MI; FNC.MI (FINMECCANICA); ISP.MI (INTESA SAN PAOLO); MS.MI (MEDIASET); TIT.MI (TELECOM ITALIA); UCG.MI (UNICREDIT). This companies have been chosen on the basis of their actual financial situation (especially to observe the trends generated by BMPS), as well as the opportunity to look at big companies operating in different industries. The choice comes from my personal belief that the behaviour of these companies do not get too away from other companies of the FTSE MIB, indeed these companies have a long existence, as well as being well renowned in the Country. Moreover these companies did not enjoy merger and acquisition over time (i.e., FCA is not part of the sample because trends would be distorted)

Index	Notations	Sample Period	Observations		
			Daily	Weekly	Monthly
BANCA MONTE	BMPS	1/1/2009-	1566	314	73
PASCHI SIENA		31/12/2014			
ENEL	ENEL.MI	1/1/2009-	1566	314	73
		31/12/2014			
ENI	ENI.MI	1/1/2009-	1566	314	73
		31/12/2014			
FINMECCANICA	FNC.MI	1/1/2009-	1566	314	73
		31/12/2014			
INTESA SAN	ISP.MI	1/1/2009-	1566	314	73
PAOLO		31/12/2014			
MEDIASET	MS.MI	1/1/2009-	1566	314	73
		31/12/2014			
TELECOM	TIT.MI	1/1/2009-	1566	314	73
PAOLO MEDIASET TELECOM	MS.MI TIT.MI	31/12/2014 1/1/2009- 31/12/2014 1/1/2009-	1566 1566	314 314 314	73 73

ITALIA		31/12/2014			
UNICREDIT	UCG.MI	1/1/2009-	1566	314	73
		31/12/2014			

Table 4.2.3 Description of Data Samples (Companies)

Hereinafter I drew companies graphs divided on the basis of days, weeks and months during the six years above defined. Log prices are used in the analysis.





Table 4.2.4 Time Series Plots of Daily Prices of FTSE MIB Selected Companies

The daily graphic analysis leads to make some considerations. BMPS shows weak appearance a negative trend that approximately starts in 2010 and causes a reliable slowdown in 2011. Indeed it is well known what is the situation of the Bank nowadays. Other indexes, on the other hand, suggest that the changes of trends are casual, and they appear to have permanent effect on following values. This could mean there exist presence of unit roots in the time series relatives to selected companies' prices.





Table 4.2.5 Time Series Plots of Weekly Prices of FTSE MIB Selected Companies





Table 4.2.6 Time Series Plots of Monthly Prices of FTSE MIB Selected Companies

Although there are some differences, it is quite evident that daily, weekly and monthly data of the same company show the same trend over time. It is remarkable to underline that Intesa San Paolo does not show any trends in any timeline.

It is possible to examine companies' trends looking at log returns.





Table 4.2.7 Time Series Plots of Daily Log Returns of FTSE MIB Selected Companies





Table 4.2.8 Time Series Plots of Weekly Log Returns of FTSE MIB Selected Companies



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Table 4.2.9 Time Series Plots of Monthly Log Returns of FTSE MIB Selected Companies

It appears evident the presence of an high level of volatility affecting all the companies selected, more or less at the same level.

4.1.5 Weak Hypothesis

 $\begin{cases} H_0: The \ Italian \ Stock \ Market \ is \ weak - form \ efficient \\ H_1: The \ Italian \ Stock \ Market \ does \ not \ follow \ a \ random \ walk \end{cases}$

4.1.6 Methodology and Results

In order to verify the hypothesis above, it has been used some statistical methods: descriptive analysis; the serial correlation test; the runs test; the sign test; the Augmented Dickey-Fuller and the Phillips-Perron unit root tests. In the following part it is possible to appreciate results of the analysis:

Daily analysis

Descriptive Analysis

BM	PS	ENEL.MI			
Mean	13.22980	Mean	3.521919		
Median	8.170000	Median	3.669000		
Maximum	33.73470	Maximum	4.832000		
Minimum	1.888100	Minimum	2.034000		
Std. Dev.	9.011182	Std. Dev.	0.623629		
Skewness	0.524339	Skewness	-0.247208		
Kurtosis	1.744747	Kurtosis	2.018937		
Jarque-Bera	174.5688	Jarque-Bera	78.75230		
Probability	0.000000	Probability	0.000000		
ENI	MI	FNC.	MI		
Mean	16.91433	Mean	6.966502		
Median	17.10000	Median	7.052500		
Maximum	20.41000	Maximum	12.72000		
Minimum	12.17000	Minimum	2.620000		
Std. Dev.	1.319303	Std. Dev.	2.773127		
Skewness	-0.609348	Skewness	0.115006		
Kurtosis	3.998725	Kurtosis	1.736534		
Jarque-Bera	161.9942	Jarque-Bera	107.6137		
Probability	0.000000	Probability	0.000000		
ISP.	MI	MS.	MI		
Mean	1.899712	Mean	3.447743		
Median	1.993200	Median	3.446000		
Maximum	3.003600	Maximum	6.485000		
Minimum	0.868000	Minimum	1.166000		
Std. Dev.	0.545722	Std. Dev.	1.309733		
Skewness	-0.016783	Skewness	0.051758		
Kurtosis	1.817425	Kurtosis	2.091111		
Jarque-Bera	91.32456	Jarque-Bera	54.60088		
-------------	----------	-------------	-----------		
Probability	0.000000	Probability	0.000000		
UCG	.MI	TIT.	MI		
Mean	7.543875	Mean	0.877705		
Median	5.898750	Median	0.882500		
Maximum	16.78220	Maximum	1.253000		
Minimum	2.204400	Minimum	0.471000		
Std. Dev.	3.942104	Std. Dev.	0.168754		
Skewness	0.535372	Skewness	-0.287508		
Kurtosis	1.906951	Kurtosis	2.387494		
Jarque-Bera	152.7663	Jarque-Bera	46.05394		
Probability	0.000000	Probability	0.000000		

Table 4.3.0 Descriptive Analysis of Daily Companies Returns

The descriptive analysis of the selected companies, on the basis of the daily returns, underlines that half companies show negative mean and half present a positive one. MS.MI represents the highest mean among these companies, while UCG.MI has the lowest one. Results from standard deviations confirm the hypothesis of high volatility made before. ENI and Finmeccanica seem to be the companies with most dispersion of returns with respect to their mean, whereas Telecom Italia presents the lowest standard deviation value, so the lowest volatility among the selected sample. Finmeccanica, Intesa San Paolo and Telecom Italia presents negative value for skewness. Moreover Mediaset, Banca Monte Paschi di Siena and Intesa San Paolo are centred stronger than the other observed companies. Jarque-Bera test suggest that the most part of the companies have been extracted by a sample not distributed such as a normal random variable, a part from a weak result concerning Finmeccanica. FNC.MI is also the only company to show significance on the basis of a p-value of 0.848705. Results suggest the only company that could be represented by a normal distribution would be Finmeccanica, but it does not appear to reach all the owed properties.

Runs test

Now it is possible to look at runs test result for companies daily returns as well:

BMP	S.MI	ENE	L.MI	EN	I.MI	FNC.MI		ISP.MI		MS.MI		UCG.MI		TIT.MI	
Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value

-2.28	.02	1.93	.05	1.14	.25	.28	.78	1.36	.17	-2.01	.04	.12	.9	.08	.94
	Table 4.2.1 Pune Test for Daily returns on ETSE MIP Selected Companies														

Table 4.3.1 Runs Test for Daily returns on FTSE MIB Selected Companies

BMPS, MS.MI and TIT.MI are the only companies that seem not to follow some randomness processes, but first two cited companies show dat not really significance. By the way, this leads to think that the other companies are supposed to be efficient under the weak form.

Unit Root test

In order to join more reliable results, ADF and PP tests, with their relatives first differences, have been performed. These tests are based on log prices.

	LEVEL												
	BMPS.MI	ENEL.MI	ENI.MI	FNC.MI	ISP.MI	MS.MI	UCG.MI	TIT.MI					
t-Statistic	-0.392914	-2.041856	-3.711379	-1.444246	-1.884979	-1.247856	-1.389292	-2.366591					
Prob.*	0.9080	0.2689	0.0041	0.5617	0.3396	0.6555	0.5890	0.1515					
	TEST CRITICAL VALUE												
1% level	-3.434325	-3.434323	-3.434323	-3.434323	-3.434323	-3.434323	-3.434325	-3.434323					
5% level	-2.863183	-2.863182	-2.863182	-2.863182	-2.863182	-2.863182	-2.863183	-2.863182					
10% level	-2.567693	-2.567692	-2.567692	-2.567692	-2.567692	-2.567692	-2.567693	-2.567692					

Augmented Dickey-Fuller Test

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

Table 4.3.2 ADF Test for Daily FTSE MIB Selected Companies (level)

Here, there is something that immediately appears evident, ENI is on the left of the critical values. This leads to think that ENI does not appear weak efficient considering daily prices. The result could be an open door for investors in order to beat the market. By the way, p-value over ENI's results does not lead to any significant levels. Remains the fact that result for ENI suggest the absence of a unit root, so the rejection of the null hypothesis. Moreover, also Telecom appears to be weakly smaller than its critical values.

Philip-Perron Test

				LEVEL				
	BMPS.MI	ENEL.MI	ENI.MI	FNC.MI	ISP.MI	MS.MI	UCG.MI	TIT.MI
t-Statistic	-0.249340	-1.993124	-3.813543	-1.463946	-1.688596	-1.264650	-1.320413	-2.236335

Prob.*	0.9296	0.2900	0.0028	0.5519	0.4369	0.6479	0.6220	0.1935
			TEST C	RITICAL	VALUE			
1% level	-3.434323	-3.434323	-3.434323	-3.434323	-3.434323	-3.434323	-3.434323	-3.434323
5% level	-2.863182	-2.863182	-2.863182	-2.863182	-2.863182	-2.863182	-2.863182	-2.863182
10% level	-2.567692	-2.567692	-2.567692	-2.567692	-2.567692	-2.567692	-2.567692	-2.567692

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

Table 4.3.3 PP Test for Daily FTSE MIB Selected Companies (level)

The PP leads exactly to the same results of the ADF test.

Serial Correlation Test

 $\begin{cases} H_0: Data \ are \ independently \ distributed \ (the \ correlations \ are \ equal \ to \ zero, so \ any \\ observed \ correlations \ resilt \ from \ randomness) \\ H_1: The \ data \ are \ not \ independently \ distributed \ (serial \ correlation) \end{cases}$

It is helpful to repeat that no serial correlation in residuals means that the autocorrelations and partial autocorrelations at all lags should be nearly zero, and all Q-statistics should be insignificant with large p-values. The Ljung-Box test has been carried out on the basis of log return data.

	BM	PS					ENEL	N	11			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
ι μ		1 0.100	0.100	15.631	0.000	dı.	l du	1	-0.041	-0.041	2 6781	0 102
<u> </u>		2 -0.021	-0.031	16.318	0.000	li li		2	0.005	0.003	2 7 1 9 8	0.257
ų.	1 P	3 -0.064	-0.059	22.740	0.000	1	1 1	3	0.004	0.004	2,7399	0.433
1		4 0.011	0.023	22.929	0.000		4	4	-0.013	-0.012	2.9865	0.560
1	' <u> </u> '	5 0.005	-0.002	22.963	0.000	di di	d	5	-0.038	-0.040	5.3177	0.378
1	<u>"</u>	6 -0.005	-0.009	23.002	0.001))	6	0.041	0.038	7.9197	0.244
		7 -0.029	-0.026	24.373	0.001		1 10	7	-0.017	-0.013	8.3497	0.303
111		8 -0.006	-0.000	24.421	0.002	11	1 1	8	0.003	0.002	8.3670	0.398
		9 0.056	0.055	29.308	0.001		1 10	9	-0.010	-0.011	8.5098	0.484
1	1 2	10 0.030	0.016	30.754	0.001		1 (U	10	-0.014	-0.015	8.8114	0.550
1	1 !!	11 -0.018	-0.020	31.260	0.001	l ip	l ip	11	0.052	0.054	13.035	0.291
1		12 -0.013	-0.001	31.525	0.002	() ()	(P	12	-0.044	-0.043	16.161	0.184
1	1 1	13 -0.019	-0.018	32.100	0.002	l i	1 1	13	0.042	0.040	18.981	0.124
		14 -0.020	-0.021	32.743	0.003	11		14	-0.007	-0.006	19.062	0.163
	1 2	15 0.036	0.040	34.793	0.003	11	1 1	15	0.008	0.009	19.164	0.206
	1 2	16 0.048	0.042	38.511	0.001	i p	1 9	16	0.034	0.038	20.982	0.179
1	1 1	17 0.029	0.022	39.857	0.001		l "	17	-0.008	-0.012	21.074	0.223
"		18 -0.021	-0.024	40.569	0.002	9	l q	18	-0.035	-0.028	22.992	0.191
2	1 1	19 0.029	0.036	41.913	0.002			19	0.008	-0.000	23.084	0.234
		20 -0.014	-0.019	42.206	0.003			20	0.000	0.005	23.084	0.285
		21 -0.005	-0.004	42.252	0.004	u u	1 <u>4</u>	21	-0.033	-0.031	24.776	0.257
<u> </u>		22 -0.050	-0.042	46.153	0.002	1 2	1 2	22	0.029	0.020	26.116	0.247
<u>"</u>		23 -0.017	-0.005	46.623	0.003	5	1 1	23	-0.025	-0.018	27.105	0.252
<u>"</u>		24 -0.010	-0.012	46.791	0.004	1 1	1 3	24	0.031	0.020	28.593	0.230
1		25 0.019	0.007	47.343	0.004	1 3	1 3	20	0.017	0.023	29.005	0.201
1	1 1	26 -0.001	-0.007	47.346	0.006			20	-0.020	0.025	30.319	0.255
1		27 0.011	0.015	47.548	0.009			20	-0.000	-0.002	30.319	0.300
2		28 0.026	0.025	48.609	0.009		1 1	20	-0.001	-0.003	30.520	0.340
2		29 0.027	0.022	49.752	0.010	1 1	1 1	30	-0.021	-0.025	31 344	0.300
1	1 1	30 0.010	0.011	49.923	0.013	1 1		31	-0.011	-0.010	31 548	0.439
ų.	I "	31 -0.016	-0.014	50.343	0.015		1 1	32	0.023	0.023	32 407	0 447
<u>"</u>	1 1	32 -0.015	-0.010	50.703	0.019	l ii	l ii	33	-0.018	-0.020	32 943	0.470
Q.	¶'	33 -0.030	-0.028	52.104	0.018		1 1	34	-0.023	-0.016	33 777	0 479
ų.	1 1	34 -0.006	-0.006	52.158	0.024		1 1	35	0.018	0.009	34 289	0.502
'P	1 9	35 0.033	0.032	53.909	0.021	l ú	1 6	36	-0.030	-0.025	35.721	0.482
d,	Q:	36 -0.043	-0.056	56.819	0.015		1 4 '	100	0.000	0.020	00.721	0.702

	ENI.	.MI					FNC.	MI			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
<u>*</u>	1 1	1 -0.017	-0.017	0.4357	0.509			1 0.017	0.017	0.4463	0.504
		3 0.008	0.004	0.4542	0.797	1		2 0.012	-0.001	0.6555	0.721 0.884
<u> </u>	1 1	4 -0.019	-0.018	1.0902	0.896	փ		4 0.015	0.015	0.9964	0.910
		5 -0.019 6 0.030	-0.019	3.1116	0.895	() ()	()	5 -0.037	-0.038	3.1993	0.669
փ		7 0.028	0.029	4.3671	0.737	փ	ի դե	7 0.035	0.036	5.1728	0.639
		8 -0.016	-0.014	4.7458	0.784		լ փ	8 -0.024	-0.026	6.1020 7.8554	0.636
փ	ի ան	10 -0.038	-0.039	7.4286	0.684	ան	ļ fi	10 0.009	0.007	7.9861	0.630
() ()		11 -0.002	-0.001	7.4383	0.763	1	10 10	11 -0.004	-0.006	8.0072	0.713
		13 -0.016	-0.020	10.552	0.648	ան	ի դն	13 0.013	0.009	10.393	0.662
		14 -0.068	-0.071	17.845	0.214			14 -0.015	-0.016	10.753	0.705 0.616
ф	φ	16 0.005	0.006	17.899	0.330	1	1	16 -0.002	-0.008	12.830	0.685
2	2	17 0.031	0.033	19.470	0.302	10		17 0.054	-0.057	17.440	0.425
l di	i ii	19 -0.015	-0.016	20.191	0.383	փ	ի դե	19 0.016	0.010	18.145	0.513
0	0	20 -0.031	-0.030	21.669	0.359			20 0.045	0.050	21.334 21.406	0.378 0.434
i ii	i ii	22 0.006	0.0012	21.850	0.469	փ	1 1	22 0.011	0.011	21.614	0.483
l l	1 Q	23 -0.051	-0.059	25.991	0.301	di di	19 11	23 0.021	0.025	22.319	0.501
j ji	j	25 0.020	0.043	31.343	0.162	l l	iji	25 -0.020	-0.011	25.710	0.423
1	1 1	26 -0.024	-0.023	32.229	0.186	100 U	¶'	26 -0.028	-0.031	26.989	0.410
		28 0.031	0.038	35.542	0.167	ų.	<u>1</u>	28 0.044	0.052	30.076	0.360
<u> </u>	1 !!	29 -0.021	-0.014	36.277	0.166			29 -0.015	-0.029	30.414 30.484	0.394
		30 -0.001	0.002	36.380	0.199	<u>e</u>	<u> </u>	31 -0.045	-0.041	33.678	0.339
<u> 1</u>	1 1	32 0.024	0.020	37.311	0.238	() ()		32 -0.045	-0.060	36.958	0.251 0.052
		33 -0.017	-0.018	37.789 38.912	0.260	e e	•	34 -0.026	-0.029	48.308	0.053
•	1 1	35 0.035	0.032	40.837	0.229			35 -0.005	-0.010	48.353	0.066
.h.	I W	36 0.009	0.015	40.974	0.261			•			
	ISP.	MI					MS.N	MI			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Ratial Carrelation	10	DAG	O Stat	Drah
	μ	1 -0.006	-0.006	0.0488	0.825	Autocorrelation	Partial Correlation	AC	PAC	น-รเลเ	PIOD
	1 Qi	2 -0.044	-0.044	3.0357	0.219	0		1 0.03	1 0.031 1 -0.022	1.5058	0.220
•	(4 -0.036	-0.039	9.9760	0.041	<u>•</u>	<u> </u>	3 -0.04	5 -0.044	5.4276	0.143
ці ір	[] ¹	5 -0.054	-0.060	14.535	0.013		U	4 -0.04	0.039	8.1139 8.6915	0.087
j ji	ի դի	7 0.016	0.007	17.533	0.014	2	1 1	6 0.02	6 0.021	9.7609	0.135
		8 -0.006	-0.010	17.588	0.025	ц. ф		8 0.04	5 0.059 5 0.044	19.307	0.025
e e	•	10 -0.028	-0.028	19.850	0.031			9 -0.00	0.004	19.307	0.023
		11 0.032	0.039	21.484 23.163	0.029	ֆ		11 0.01	0.020	21.582	0.028
ų į	ի տի	13 0.018	0.019	23.668	0.034	1 U		12 -0.01	1 -0.012 3 0.043	21.760 25.423	0.040
		14 -0.022	-0.013	24.449 25.676	0.040	<u> (</u>	<u>(</u>	14 -0.01	-0.030	26.019	0.026
ի	ի փ	16 0.018	0.026	26.216	0.051	1		15 0.02	1 0.021 1 0.043	26.705 29.731	0.031
10 10		17 0.041	0.041	28.868	0.036	1 2	2	17 0.02	4 0.028	30.670	0.022
վ	ի փ	19 -0.030	-0.029	30.560	0.045	l di		19 -0.002	2 -0.023	31.461	0.026
		20 -0.005	-0.006	30.600	0.061	1		20 -0.00	6 -0.007	31.512	0.049
i)	j	22 0.031	0.030	32.644	0.067		1	22 0.01	5 0.006	35.365	0.025
	1 1	23 -0.008	-0.018	32.741	0.086	1 0 1		23 0.01	3 0.016 -0.057	35.879	0.042
iii ii	i ii	25 -0.009	-0.008	32.962	0.132		1 1	25 0.01	3 0.031	40.269	0.027
<u></u>	<u></u>	26 -0.030	-0.030	34.350	0.126			26 0.00	0.005 0.006	40.348 40.398	0.036 0.047
j - 1	iji	28 0.034	0.008	36.419	0.149		<u>u</u>	28 0.00	4 -0.009	40.422	0.061
	1 2	29 0.030	0.020	37.856	0.126		l di	30 -0.03	+ 0.043 1 -0.038	43.462 44.997	0.041 0.039
	u	31 0.043	0.049	41.390	0.141	<u>•</u>	!	31 -0.04	3 -0.031	47.995	0.026
<u>.</u>	1 1	32 -0.016	-0.004	41.778	0.116			32 -0.05	i -0.054 6 -0.005	52.132 52.191	0.014
		33 -0.013	-0.009	42.065 47.351	0.134			34 0.01		52.402	0.023
<u>)</u>)	35 0.020	0.019	47.996	0.071	н 1	1 1	36 -0.00	1 -0.032	53.975	0.021
	ו ייי	30 -0.038	-0.036	50.340	0.057						
	UCG.MI						TIT.I	MI			

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
i	1 10	1 0.093	0.093	13.656	0.000	u		1 -0 013	-0.013	0 2738	0.601
i)))	2 0.042	0.033	16.409	0.000	l di	1 10	2 -0 010	-0.010	0 4267	0.808
	1 10	3 -0.014	-0.022	16.738	0.001	di di	ի դե	3 -0.052	-0.053	4,7523	0.191
0	(t	4 -0.036	-0.034	18.730	0.001	l di	1 0	4 -0.030	-0.032	6,1970	0.185
D 1	լ պե	5 -0.076	-0.069	27.809	0.000	լի	լ փ	5 -0.005	-0.007	6.2351	0.284
11))	6 0.007	0.023	27.890	0.000		1 1	6 -0.004	-0.007	6.2570	0.395
ji ji) (h	7 0.021	0.024	28.606	0.000		1 1	7 0.007	0.003	6.3307	0.502
11	ψ	8 0.004	-0.004	28.633	0.000	ф	1 10	8 -0.008	-0.009	6.4238	0.600
i)) ()	9 0.037	0.031	30.773	0.000	(i	1 10	9 -0.017	-0.018	6.8744	0.650
	1 ()	10 0.022	0.013	31.546	0.000	() ()	0	10 -0.036	-0.037	8.8952	0.542
	1 (P	11 0.018	0.016	32.060	0.001	(i	(l	11 -0.014	-0.017	9.2241	0.601
() ()	(()	12 -0.035	-0.036	33.946	0.001	(i	(l	12 -0.013	-0.017	9.5007	0.660
11	μ ψ	13 -0.006	0.000	34.010	0.001	ı p))	13 0.046	0.041	12.899	0.456
() ()	(((14 -0.039	-0.030	36.425	0.001	(i	(l	14 -0.016	-0.019	13.289	0.504
() ()	II	15 -0.029	-0.021	37.715	0.001	μ	l ψ	15 0.005	0.002	13.329	0.577
i p	l ip	16 0.044	0.051	40.780	0.001	(i	1 10	16 -0.016	-0.013	13.733	0.619
i P	1 (P	17 0.080	0.068	50.806	0.000	<u>ф</u>	1 1	17 0.014	0.014	14.032	0.665
11	1 W	18 0.005	-0.015	50.849	0.000		1 10	18 -0.023	-0.024	14.883	0.670
0	(P	19 -0.028	-0.039	52.107	0.000	() ()	0	19 -0.031	-0.034	16.448	0.627
11	μ ψ	20 0.000	0.007	52.107	0.000		II	20 -0.010	-0.014	16.608	0.678
Q.	1 W	21 -0.038	-0.022	54.417	0.000		1 II	21 -0.010	-0.014	16.764	0.725
Q.	1 W	22 -0.031	-0.017	55.981	0.000	1	II	22 -0.016	-0.022	17.161	0.754
	1 W	23 -0.016	-0.013	56.383	0.000		μ - ψ	23 -0.005	-0.007	17.198	0.799
	¶	24 -0.018	-0.020	56.901	0.000	1	II	24 -0.019	-0.023	17.762	0.814
l ll	¶	25 -0.024	-0.021	57.853	0.000	l i P	1 1	25 0.041	0.038	20.447	0.723
1	1 1	26 0.012	0.006	58.088	0.000	- P	1 1	26 0.015	0.011	20.820	0.751
12	1 1	27 0.025	0.017	59.055	0.000	զ	U	27 -0.030	-0.032	22.299	0.722
'II	1 7	28 0.041	0.038	61.753	0.000	l 'P	'P	28 0.070	0.069	30.144	0.356
	<u>"</u>	29 -0.003	-0.011	61.767	0.000	1 III	¶'	29 -0.015	-0.012	30.494	0.390
		30 -0.019	-0.019	62.351	0.000	Y	"	30 0.008	0.002	30.589	0.436
1 1	1 1	31 0.020	0.037	62.969	0.001	l l	¶'	31 -0.037	-0.032	32.820	0.378
	"	32 -0.009	-0.002	63.096	0.001	12	1 12	32 0.036	0.037	34.865	0.333
	<u>"</u>	33 -0.006	-0.013	63.145	0.001	1 1	1 1	33 0.028	0.028	36.100	0.326
	1 1	34 -0.004	-0.011	63.169	0.002	1 1	1 1	34 -0.004	-0.005	36.123	0.370
1 1	1 1	35 0.016	0.018	63.573	0.002	<u> </u>		35 -0.003	0.001	36.140	0.415
ų,	i di	36 -0.022	-0.021	64.362	0.003	ц ^и	I 4'	36 -0.073	-0.068	44.708	0.151

Table 4.3.4 Serial Correlation of Daily FTSE MIB Selected Companies

A part for BMPS and UCG companies show some low p-values, leading to reject the absence of serial correlation, and so the null hypothesis, if considered with the AC and PAC value which differ from zero (even if really close to it). On the other hand, almost all the companies do not reject the null hypothesis and so are consistent with the efficient market hypothesis.

Weekly analysis

Descriptive Analysis

BM	PS	ENEI	L.MI
Mean	13.23605	Mean	3.526465
Median	8.143300	Median	3.686500
Maximum	32.96120	Maximum	4.832000
Minimum	1.912500	Minimum	2.180000
Std. Dev.	9.053442	Std. Dev.	0.625748
Skewness	0.519649	Skewness	-0.255377
Kurtosis	1.736595	Kurtosis	2.040991
Jarque-Bera	35.01534	Jarque-Bera	15.44576

Probability	0.000000	Probability	0.000443
ENI.	MI	FNC	.MI
Mean	16.92000	Mean	6.972296
Median	17.11000	Median	7.075000
Maximum	20.41000	Maximum	12.67000
Minimum	12.20000	Minimum	2.678000
Std. Dev.	1.304258	Std. Dev.	2.778483
Skewness	-0.553892	Skewness	0.113001
Kurtosis	4.087784	Kurtosis	1.740975
Jarque-Bera	31.53682	Jarque-Bera	21.40722
Probability	0.000000	Probability	0.000022
ISP.	MI	MS.	MI
Mean	1.902262	Mean	3.450897
Median	2.001200	Median	3.463000
Maximum	3.003600	Maximum	6.415000
Minimum	0.938000	Minimum	1.197000
Std. Dev.	0.543226	Std. Dev.	1.311780
Skewness	-0.030356	Skewness	0.048622
Kurtosis	1.817917	Kurtosis	2.091260
Jarque-Bera	18.32985	Jarque-Bera	10.92806
Probability	0.000105	Probability	0.004236
UCG	.MI	TIT.	MI
Mean	7.545173	Mean	0.878432
Median	5.883450	Median	0.880000
Maximum	16.78220	Maximum	1.251000
Minimum	2.335600	Minimum	0.476700
Std. Dev.	3.934684	Std. Dev.	0.168408
Skewness	0.533833	Skewness	-0.300358
Kurtosis	1.906341	Kurtosis	2.377461
Jarque-Bera	30.56267	Jarque-Bera	9.791765
Probability	0.000000	Probability	0.007477

Table 4.3.5 Descriptive Analysis of Weekly FTSE MIB Selected Companies

The descriptive analysis of the selected companies, on the basis of the weekly returns, highlights the clear contrast from BMPS.MI to UCG.MI in terms of mean. The daily returns high volatility is confirmed by weekly evidences too. ENI and Finmeccanica again with most dispersion than others. Moreover Mediaset, Banca Monte Paschi di Siena, Unicredit and Intesa San Paolo are centred stronger than the other observed companies. Jarque-Bera test

suggest that the most part of the companies have been extracted by a sample not distributed such as a normal random variable. FNC.MI confirms to be an exception.

Runs Test

BN	/IPS	ENE	L.MI	EN	I.MI	FNG	C.MI	ISP	.MI	MS	S.MI	UCO	G.MI	TIT	.MI
Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value
.11	.91	23	.82	11	.91	.9	.37	0	1	-1.58	.11	.34	.73	1.13	.26

Table 4.3.6 Runs Test for Weekly returns on FTSE MIB Selected Companies

All companies appear to follow a random order process. Hence, for what concerns weekly analysis, the whole selected sample of campanies appear to be weak form efficient.

Unit Root test

Augmented Dickey-Fuller Test

	BMPS.MI	ENEL.MI	ENI.MI	FNC.MI	ISP.MI	MS.MI	UCG.MI	TIT.MI			
t-Statistic	-0.205830	-1.964814	-3.766310	-1.454239	-1.747778	-1.237516	-1.250745	-2.289314			
Prob.*	0.9347	0.3025	0.0036	0.5556	0.4062	0.6589	0.6530	0.1761			
			TEST C	RITICAL	VALUE						
1% level	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078			
5% level	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561			
10% level	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647			

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

Table 4.3.7 ADF Test for Weekly FTSE MIB Selected Companies (level)

Philip-Perron Test

LEVEL										
	BMPS.MI	ENEL.MI	ENI.MI	FNC.MI	ISP.MI	MS.MI	UCG.MI	TIT.MI		
t-Statistic	-0.245977	-2.012348	-3.726090	-1.561244	-1.678354	-1.363130	-1.279372	-2.113676		
Prob.*	0.9294	0.2815	0.0042	0.5012	0.4413	0.6005	0.6400	0.2395		
	TEST CRITICAL VALUE									
1% level	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078	-3.451078		
5% level	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561	-2.870561		
10% level	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647	-2.571647		

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

Table 4.3.8 PP Test for Weekly FTSE MIB Selected Companies (level)

Again, weekly data show positive results to confirm the null hypothesis for all the company selected but ENI.

Serial Correlation Test

	BMPS						ENEL	MI			
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
ığı -	սի	1 -0.060	-0.060	1.1583	0.282	ı¢ı	u[i	1 -0.063	-0.063	1.2685	0.260
i i pi	1 1	2 0.071	0.068	2.7778	0.249	i pi	լ ւթ	2 0.064	0.060	2.5618	0.278
ւիս	ի դի	3 0.026	0.035	3.0010	0.391	10	1 10	3 -0.021	-0.014	2.7074	0.439
i)i	1 10	4 0.010	0.008	3.0313	0.553	1	1 10	4 -0.012	2 -0.018	2.7567	0.599
i	1 10	5 0.023	0.020	3.1955	0.670	□	'P	5 0.104	0.105	6.2369	0.284
1 1	1 1	6 0.007	0.008	3.2134	0.782	l l l	ן ייםי	6 -0.081	-0.069	8.3716	0.212
10	1 10	7 -0.050	-0.053	4.0275	0.777	101	יוףי	7 -0.039	-0.062	8.8618	0.263
1 10	1 10	8 -0.014	-0.023	4.0929	0.849	101	1 101	8 -0.043	-0.035	9.4506	0.306
□ !	□ '	9 -0.130	-0.127	9.5666	0.387	1		9 0.015	0.016	9.5206	0.391
1 1 1	ייםי	10 -0.056	-0.069	10.607	0.389	101	1 10	10 -0.026	-0.035	9.7425	0.463
יים		11 0.092	0.106	13.350	0.271	'	9'	11 -0.112	2 -0.108	13.853	0.241
101	1 10	12 -0.056	-0.025	14.392	0.276		1 11	12 -0.015	-0.020	13.931	0.305
ייםי	ייין ו	13 0.070	0.063	16.027	0.248			13 0.096	0.112	16.949	0.202
11		14 0.001	0.016	16.027	0.312		1 1	14 0.045	0.044	17.610	0.225
'	<u></u> '	15 -0.100	-0.111	19.317	0.200		1 12	15 0.097	0.093	20.717	0.146
1 1	1 101	16 -0.010	-0.045	19.349	0.251	101		16 -0.040	0-0.013	21.253	0.169
<u>-</u>	1 '['	17 -0.004	-0.007	19.354	0.309	1	1 22	17 0.044	0.020	21.888	0.189
i pi	יייייין	18 0.076	0.076	21.315	0.264	101	" ! '	18 -0.039	-0.068	22.406	0.214
1	1 1	19 -0.010	-0.009	21.352	0.318			19 0.020	0.006	22.543	0.258
1 1	'['	20 -0.020	0.002	21.484	0.369			20 -0.003	0.004	22.546	0.312
i pi	l i Pi	21 0.048	0.054	22.255	0.385		1 11	21 -0.003	0.018	22.550	0.368
		22 -0.004	-0.006	22.260	0.444		1	22 -0.015	0.031	22.626	0.423
		23 0.004	0.003	22.265	0.504		1 2	23 0.033	0.055	22.987	0.402
L !!!	1 11	24 0.009	-0.039	22.294	0.562			24 -0.095	0.078	20.048	0.301
!	1 11	25 -0.004	-0.019	22.301	0.618		1 20	25 0.010	0.023	20.133	0.401
101	1	26 -0.046	-0.035	23.035	0.631	1 <u>1</u>		20 -0.084	0.015	20.091	0.330
	1	27 0.026	0.041	23.268	0.671			27 -0.002	0.015	20.093	0.301
	1 11	28 -0.072	-0.039	25.049	0.025		1 11	20 -0.042	0.074	20.202	0.462
	1	29 -0.020	-0.042	25.191	0.008			29 -0.003	-0.005	20.231	0.405
·		30 0.045	0.000	25.911	0.080	ili ili		31 -0.010	0.023	20.260	0.555
		31 -0.053	-0.055	20.000	0.076			32 0.009	0.022	20.203	0.604
		32 0.037	0.010	27.371	0.700	in i		33 -0.026	-0.014	20.538	0.640
		33 0.020	0.049	27.000	0.737			34 0.023	-0.002	29,734	0.677
1 11		34 -0.044	-0.057	20.102	0.746			35 -0.011	-0.014	29 775	0 718
l ihi							1 in	36 0 114	0.092	34 408	0.544
. н .	'µ' 'µ' 36 0.072 0.086 30.060 0.746					· P	ч Ч	100 0.114	0.002	54.400	0.044
	ENI.MI						FNC.	MI			

Autocorrelation Partial Correlation	AC PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC PAC	Q-Stat Prob
	1 0.015 0.01 2 -0.104 -0.01 3 -0.088 -0.06 4 -0.076 -0.06 5 -0.035 -0.05 6 0.043 0.07 7 0.079 0.06 8 -0.087 -0.06 9 0.068 0.06	5 0.0699 14 3.4929 15 5.9393 16 7.7794 13 8.1696 9 8.7787 10.778 17 10.778 13.260 14.784	0.791 0.174 0.115 0.100 0.147 0.186 0.149 0.103 0.097			1 0.011 0.011 2 0.138 0.138 3 -0.001 -0.003 4 0.074 0.056 5 -0.043 -0.044 6 -0.098 -0.117 7 -0.089 -0.079 8 -0.027 -0.003 9 -0.016 0.013	0.0370 0.847 6.0727 0.048 6.0728 0.108 7.8191 0.098 8.4048 0.135 11.470 0.075 14.048 0.050 14.286 0.075 14.369 0.110
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5 18.241 7 18.242 1 18.242 1 19.545 1 19.680 9 19.750 2 2465 8 25.110 4 25.492 7 28.852 6 28.879 0 29.126 4 29.651 3 30.519 8 32.922	0.051 0.076 0.106 0.120 0.145 0.232 0.287 0.212 0.287 0.212 0.157 0.183 0.195 0.149 0.184 0.215 0.235 0.247 0.200			10 -0.097 -0.081 11 -0.079 -0.078 12 0.008 0.016 13 -0.030 -0.028 14 0.033 0.034 15 0.125 0.143 16 0.039 0.006 17 0.129 0.074 18 -0.118 -0.154 19 0.138 0.100 20 -0.036 -0.002 21 0.120 0.111 22 0.077 0.144 23 0.072 0.044 24 -0.042 -0.084 25 0.025 0.019 26 -0.009 0.031 27 -0.095 -0.058	17.415 0.006 19.434 0.054 19.455 0.078 19.742 0.102 20.094 0.127 25.281 0.046 25.777 0.057 31.316 0.018 35.999 0.007 42.836 0.002 47.689 0.001 51.472 0.001 52.286 0.001 52.315 0.002 52.315 0.002
	28 -0.068 -0.05 29 0.099 0.05 30 -0.010 -0.02 31 -0.049 -0.05 32 -0.132 -0.13 33 -0.025 -0.02 34 0.022 -0.02 35 0.047 -0.00 36 0.073 0.02	i7 34.550 i0 37.940 i6 37.972 i8 38.816 i5 44.920 i2 45.143 i2 45.312 i7 46.100 i4 48.019	0.183 0.124 0.150 0.158 0.064 0.077 0.093 0.099 0.087		MS 1	28 -0.008 0.047 29 -0.028 0.005 30 -0.095 -0.118 31 0.043 0.034 32 -0.086 -0.049 33 -0.041 -0.018 34 -0.001 -0.001 35 -0.051 -0.043 36 0.133 0.078	55.446 0.002 55.715 0.002 58.862 0.001 59.512 0.002 62.105 0.001 62.685 0.002 63.604 0.002 69.963 0.001
Autocorrelation Partial Correlation	AC PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC PAC	Q-Stat Prob
	1 -0.108 -0.101 2 0.081 0.073 3 -0.058 -0.044 4 0.057 0.04 5 -0.079 -0.06 6 0.033 0.017 7 -0.026 -0.002 8 -0.065 -0.08 9 -0.096 -0.01 10 -0.024 -0.02 11 -0.006 -0.02 12 -0.023 -0.02 13 0.075 0.01 14 0.062 0.07 15 0.017 0.01 18 -0.028 -0.03 19 -0.027 -0.04 20 -0.033 0.05 23 -0.023 0.01 24 -0.05 -0.01 25 -0.010 -0.00 26 -0.037 -0.03 27 -0.017 -0.04 29 -0.021 -0.02	8 3.6835 1 5.7008 3 9.9006 1 10.485 2 7.9063 3 9.9006 1 10.468 2 11.859 2 14.834 3 15.027 6 15.213 9 17.073 5 18.423 9 19.326 9 19.326 9 19.826 0 19.824 1 19.826 0 19.824 1 19.826 0 19.824 1 19.826 0 19.824 1 19.825 8 20.066 7 20.615 6 24.379 9 24.978 1 24.998 1 24.998 2 25.157 2 25.567	0.055 0.055 0.077 0.095 0.164 0.158 0.164 0.158 0.096 0.131 0.230 0.196 0.196 0.196 0.196 0.241 0.269 0.310 0.269 0.310 0.405 0.405 0.405 0.405 0.405 0.405 0.405 0.405 0.405 0.556 0.605 0.576 0.576 0.576 0.576 0.576 0.576 0.576			1 0.003 0.003 2 0.064 0.064 3 0.086 0.086 4 0.008 0.004 5 0.040 1.0090 6 -0.081 -0.003 9 -0.024 -0.031 9 -0.021 -0.003 10 -0.707 -0.066 11 -0.034 -0.027 12 -0.036 -0.032 13 0.040 0.053 14 0.080 0.095 15 0.044 0.051 16 0.030 -0.021 17 0.068 0.040 18 -0.031 0.002 20 0.113 0.002 21 -0.013 0.002 22 0.111 0.108 23 0.039 0.059 24 0.008 0.008 25 0.105 0.093 26 -0.042 -0.041	0.0020 0.964 1.3240 0.516 3.7029 0.295 3.7214 0.445 4.2470 0.516 3.7214 0.445 4.2470 0.514 6.3753 0.382 6.5669 0.475 6.5674 0.584 8.3071 0.599 8.6905 0.650 9.1202 0.693 9.6469 0.723 11.773 0.625 12.411 0.648 12.432 0.714 14.533 0.763 14.534 0.802 14.534 0.803 19.308 0.683 19.308 0.683 19.329 0.734 13.78 0.570 23.725 0.592 23.725 0.592 23.729 0.645 25.214 0.667 25.231 0.679
	30 0.008 -0.00 31 0.009 0.01 32 0.018 0.01 33 -0.020 -0.03 34 0.087 0.07 35 -0.029 -0.02 36 0.116 0.08	2 25.182 6 25.210 0 25.329 8 25.473 7 28.153 1 28.446 6 33.275	0.758 0.792 0.822 0.749 0.776 0.599	1)1 101 101 101 101 101		31 0.012 0.016 32 -0.053 -0.040 33 -0.030 -0.013 34 0.068 0.101 35 -0.048 -0.014 36 0.040 0.006	25.984 0.722 26.990 0.718 27.303 0.746 28.937 0.714 29.760 0.719 30.324 0.735

Image: Second	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
ID 2 0.107 0.106 3.7679 0.152 1 1 1 2 0.007 0.5359 0.137 I I 3 0.008 0.023 0.229 0.11 1 4 0.033 0.008 4.115 0.028 0.229 0.229 1 1 4 0.031 0.047 6.629 0.323 1 1 5 0.054 0.033 0.030 1 1 5 0.008 0.021 4.6521 0.460 1 1 7 0.017 0.032 7.2873 0.400 1 1 6 0.033 0.228 0.666 1 1 0.017 0.032 7.2873 0.400 1 1 1 0.020 5.8282 0.666 1 1 1 0.017 0.033 0.372 1 1 1 0.010 0.032 6.1242 0.727 1 1 <th1< th=""> <th1< th=""> <th1< th=""> <th< td=""><td></td><td>1 10</td><td>1 -0.021</td><td>-0.021</td><td>0.1386</td><td>0.710</td><td>ıdı.</td><td>l du</td><td>1 -0.081</td><td>-0.081</td><td>2.0697</td><td>0.150</td></th<></th1<></th1<></th1<>		1 10	1 -0.021	-0.021	0.1386	0.710	ıdı.	l du	1 -0.081	-0.081	2.0697	0.150
Image: Constraint of the state of	1	1 1	2 0.107	0.106	3.7679	0.152	11	1 10	2 -0.024	-0.031	2.2574	0.323
Image: Constraint of the second sec	ig i	1 10	3 -0.074	-0.071	5.5359	0.137	i di i	d i	3 -0.080	-0.086	4.3195	0.229
Image: Construction of the second s	ւլի	1 10	4 0.036	0.023	5.9599	0.202	10	ի պիս	4 -0.031	-0.047	4.6289	0.328
1 1 6 0.031 0.019 7.1930 0.303 1 1 6 0.039 0.028 5.1531 0.524 1 1 1 7 0.017 0.302 7.2873 0.400 1 1 7 0.045 0.028 5.564 1 1 9 0.058 0.059 10.119 0.341 1 1 9 0.020 0.228 6.564 1 1 1 0 0.015 0.011 0.341 1 1 1 9 0.020 0.023 6.5628 0.792 1 1 1 0.025 0.031 1.188 0.424 1 1 1 0.021 0.034 0.282 1 1 1 1 0.021 0.038 0.825 1 1 1 1 0.025 0.038 1.2558 0.482 1 1 1 1 1 0.045 0.808 0.801	101	1 101	5 -0.054	-0.038	6.8801	0.230	10	1 10	5 -0.008	-0.021	4.6521	0.460
I I T 0.007 0.032 7.2873 0.400 I I T 7 0.045 0.047 5.7955 0.566 II II 8 0.017 0.038 0.340 III III 8 0.010 0.032 6.1242 0.727 III III 10 0.015 0.031 10.188 0.424 III III 10 0.032 6.1242 0.727 III III 0.015 0.037 10.188 0.424 III III 10 0.027 0.047 12.354 0.418 III III 10 0.021 0.038 0.826 0.727 III III 13 0.025 0.038 12.558 0.482 III III 13 0.021 0.084 0.4856 0.476 IIII III 10 11 13 0.021 0.828 0.901 0.933 0.901 0.933 0.901 0.934 0.911	ւի	1 10	6 0.031	0.019	7.1930	0.303	ւիս	ի դիս	6 0.039	0.028	5.1531	0.524
Q I <thi< th=""> <thi< th=""> <thi< th=""> <thi< th=""></thi<></thi<></thi<></thi<>	1)1	լյի	7 0.017	0.032	7.2873	0.400	10	վե	7 -0.045	-0.047	5.7955	0.564
Image: Constraint of the state of	101	(d)	8 -0.073	-0.087	9.0310	0.340	10	1 10	8 -0.010	-0.020	5.8282	0.666
1 1 10 0.015 0.031 10.188 0.424 1 1 10 10 10.102 10.103 6.2682 0.792 0 1 1 1.0072 0.037 1.1893 0.372 1 11 11 10.034 6.2682 0.792 1 1 1 1.0072 0.037 1.2554 0.448 1 1 1 1.0034 0.627 0.867 1 1 1.4 0.027 0.038 12.558 0.482 1 1 14 0.005 0.018 7.6207 0.867 1 1 1.4 0.027 0.076 0.801 1.4656 0.476 1 1 1 1.6035 0.068 1.0019 0.819 1 1 1.6 0.025 0.18 1.4656 0.476 1 1 1 1.6035 0.688 1.011 1.6 0.031 1.035 0.888 1 1 1 1.0017 1.683 0.907 1 1 1 1.0035 0.011 </td <td>u di u</td> <td>1 10</td> <td>9 -0.058</td> <td>-0.059</td> <td>10.119</td> <td>0.341</td> <td>101</td> <td>լոլո</td> <td>9 -0.030</td> <td>-0.032</td> <td>6.1242</td> <td>0.727</td>	u di u	1 10	9 -0.058	-0.059	10.119	0.341	101	լոլո	9 -0.030	-0.032	6.1242	0.727
I I 10 11 -0.072 1.183 0.372 I I I 11 -0.034 0.6538 0.826 I I I 12 -0.037 -0.047 12.354 0.418 I I I 12 -0.050 -0.070 7.4692 0.825 I I 13 0.025 0.383 12.558 0.482 I I I 13 -0.021 -0.042 7.6207 0.867 I I I 14 0.025 0.018 14.656 0.476 I I I 14 0.002 10.021 0.866 I I I 16 0.003 0.002 10.21 0.866 0.934 I I I 16 0.003 0.001 0.868 0.934 I I 18 0.008 0.027 18.036 0.453 I I I 19 0.004 0.007 10.888 0.934 I I 19 0.004 0.012 18.517 0.553 </td <td>1)1</td> <td>լի</td> <td>10 0.015</td> <td>0.031</td> <td>10.188</td> <td>0.424</td> <td>10</td> <td> ս(ս</td> <td>10 -0.021</td> <td>-0.034</td> <td>6.2682</td> <td>0.792</td>	1)1	լի	10 0.015	0.031	10.188	0.424	10	ս(ս	10 -0.021	-0.034	6.2682	0.792
1 1 12 -0.037 -0.047 12.354 0.418 1 1 12 -0.050 -0.070 7.4692 0.825 1 1 1 1 0.024 0.024 12.757 0.566 1 1 14 0.005 0.008 16.66 1 1 14 0.005 0.008 10.019 0.819 1 1 1 1 0.024 0.021 1.876 0.866 1 1 16 0.003 0.002 10.021 0.866 1 1 1 16 0.025 0.18 1.871 0.388 1 1 1 16 0.003 10.021 0.866 1 1 1 10 18 0.008 0.027 18.036 0.453 1 1 18 0.017 10.838 0.907 1 1 1 0.014 0.012 18.573 0.4553 1 1 19 0.007 0.0176 0.838 0.907 1 1 1 20 0.014	i di i	(d)	11 -0.072	-0.072	11.893	0.372	10	ս(ի	11 -0.034	-0.048	6.6538	0.826
1 13 0.025 0.038 12.558 0.482 1 1 13 -0.021 -0.042 7.6207 0.867 1 1 4 0.024 0.021 12.757 0.546 1 1 14 0.005 -0.018 7.6284 0.908 1 1 16 0.025 0.018 14.871 0.534 1 1 16 -0.003 -0.002 10.019 0.819 1 1 16 0.025 0.018 14.871 0.534 1 1 16 -0.003 -0.002 10.021 0.866 1 1 18 0.035 0.011 18.452 0.492 1 1 19 -0.007 10.688 0.907 1 1 19 0.035 0.011 18.452 0.492 1 1 19 -0.007 10.688 0.907 1 1 20 0.014 0.012 18.517 0.554 1 1 1 20 0.007 10.888 0.927 1 1<	i di i	1 10	12 -0.037	-0.047	12.354	0.418	iĝ i	וםי	12 -0.050	-0.070	7.4692	0.825
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Table 4.3.9 Serial Correlation of Weekly FTSE MIB Selected Companies

Weekly data tested for serial correlation confirm the companies selected cannot be identify in a random process, but the results lead to suppose an approximation to the random walk exists, and so there exist the possibility of presence of weak form efficiency too.

Monthly analysis

Descriptive Analysis

BM	PS	ENEI	L.MI
Mean	13.24745	Mean	3.529714
Median	8.131900	Median	3.680000
Maximum	32.78930	Maximum	4.816000
Minimum	1.912500	Minimum	2.298000
Std. Dev.	9.154201	Std. Dev.	0.625372
Skewness	0.521662	Skewness	-0.198198
Kurtosis	1.764007	Kurtosis	2.106198
Jarque-Bera	7.957619	Jarque-Bera	2.907869
Probability	0.018708	Probability	0.233649
ENI.	MI	FNC	.MI

Mean	16.89986	Mean	6.997973
Median	17.00000	Median	7.025000
Maximum	20.10000	Maximum	12.13000
Minimum	13.02000	Minimum	2.728000
Std. Dev.	1.269989	Std. Dev.	2.793289
Skewness	-0.478323	Skewness	0.096703
Kurtosis	3.489197	Kurtosis	1.664729
Jarque-Bera	3.511554	Jarque-Bera	5.536911
Probability	0.172773	Probability	0.062759
ISP.	MI	MS.	MI
Mean	1.908696	Mean	3.456899
Median	1.952000	Median	3.440000
Maximum	2.954300	Maximum	6.415000
Minimum	0.997500	Minimum	1.214000
Std. Dev.	0.539197	Std. Dev.	1.319629
Skewness	-0.070197	Skewness	0.073947
Kurtosis	1.720163	Kurtosis	2.152369
Jarque-Bera	5.042147	Jarque-Bera	2.251899
Probability	0.080373	Probability	0.324344
UCG	.MI	TIT.	MI
Mean	7.511841	Mean	0.882500
Median	6.021000	Median	0.891000
Maximum	15.75130	Maximum	1.150000
Minimum	2.408900	Minimum	0.512500
Std. Dev.	3.878725	Std. Dev.	0.169978
Skewness	0.520571	Skewness	-0.378028
Kurtosis	1.853851	Kurtosis	2.277711
Jarque-Bera	7.292801	Jarque-Bera	3.325522
Probability	0.026085	Probability	0.189615

Table 4.4.0 Descriptive Analysis of Monthly Companies Returns

It is evident that monthly observation suggest more for normality. P-values suggest more significance in results but standard deviations confirm a tendency of almost all companies to suffer a certain volatility. Distributions also appear to be less centred than observed in the previous examinations.

Runs test

BM	1PS	ENE	L.MI	EN	I.MI	FNC	C.MI	ISP	.MI	MS	S.MI	UCO	G.MI	TIT	.MI
Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value	Z	P- value
.12	.9	-1.06	.29	12	.91	59	.56	.59	.55	82	.41	59	.56	.12	.9

Table 4.4.1 Runs Test for Monthly returns on FTSE MIB Selected Companies

Monthly analysis gives back same results as weekly gave before. This means all companies are supposed to be weak form efficient.

Unit Root test

Augmented Dickey-Fuller Test

				LEVEL						
	BMPS.MI	ENEL.MI	ENI.MI	FNC.MI	ISP.MI	MS.MI	UCG.MI	TIT.MI		
t-Statistic	-0.104127	-1.778844	-3.054587	-1.432481	-1.608144	-1.253222	-1.174932	-1.992398		
Prob.*	0.9444	0.3880	0.0347	0.5618	0.4733	0.6469	0.6811	0.2896		
TEST CRITICAL VALUE										
1% level	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233		
5% level	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358		
100/ laval	0 500507	2 500507	2 500507	2 588587	2 588587	-2 588587	-2 588587	2 588587		

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

Table 4.4.2 ADF Test for Monthly FTSE MIB Selected Companies (level)

Philip-Perron Test

LEVEL											
	BMPS.MI ENEL.MI ENI.MI FNC.MI ISP.MI MS.MI UCG.MI TIT.MI										
t-Statistic	-0.179464	-1.929321	-3.250374	-1.432481	-1.569088	-1.302700	-1.258365	-1.904737			
Prob.*	0.9355	0.3173	0.0211	0.5618	0.4931	0.6242	0.6446	0.3284			
			TEST C	RITICAL	VALUE						
1% level	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233	-3.524233			
5% level	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358	-2.902358			
10% level	-2.588587	-2.588587	-2.588587	-2.588587	-2.588587	-2.588587	-2.588587	-2.588587			

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

Table 4.4.3 PP Test for Monthly FTSE MIB Selected Companies (level)

Monthly data seem to suggest more tendency not to refuse the null hypothesis with respect both to daily and weekly ones. Indeed, ENI shows weak efficiency at 1% significant level on the basis of the MacKinnon one-sided p-values.

Serial Correlation Test

Even monthly data give back results similar to the previous ones, excluding a strongly existence of weak form efficiency into selected companies.

Finally the analysis to test the weak-form efficiency focuses on two anomalies established during years: the day of the week effect and the January effect.

The Day Of The Week Effect

The most violations of the efficient market hypothesis have been identified in calendar anomalies. Hereinafter will be examined the day of the week effect for each Italian Stock Exchange index. Be a matter of days, it follows that the object of the examination are the daily returns for the whole period of mine investigation (2009-2014). The purpose is to find out whether there is any statistical significant difference among index returns on different days of the week.

The starting point would be the following regression:

$$R_t = \mu + b_2 D_2 + b_3 D_3 + b_4 D_4 + b_5 D_5 + \varepsilon_t \tag{31}$$

where D_1 is the dummy variable for Tuesday (that means $D_1 = 1$ if the observation is on Monday, $D_1 = 0$ otherwise), D_2 is the dummy variable for Wednesday, D_3 is the dummy variable for Thursday, and finally D_4 is the dummy variable for Friday. The intercept μ represents the rate of change of Monday, while b_n is the difference between the average rate of daily change and μ . The null hypothesis is the following:

$$H_0: b_1 = b_2 = b_3 = b_4 = 0$$

So the index will be proved subjected to the weak-form efficiency whether coefficient will result equal to zero, otherwise the null hypothesis would not be proved consistent with the data.

FTSE IT MICRO CAP

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/05/2009 12/30/2014 Included observations: 1519

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@WEEKDAY=2	9.39E-05	0.000642	0.146288	0.8837
@WEEKDAY=3	-0.000307	0.000643	-0.477448	0.6331
@WEEKDAY=4	-0.000463	0.000643	-0.720526	0.4713
@WEEKDAY=5	0.000814	0.000646	1.260045	0.2078
С	-5.00E-05	0.000456	-0.109635	0.9127
R-squared	0.003098	Mean depende	nt var	-2.53E-05
Adjusted R-squared	0.000464	S.D. dependen	t var	0.007917
S.E. of regression	0.007915	Akaike info crite	erion	-6.836798
Sum squared resid	0.094851	Schwarz criteri	on	-6.819267
Log likelihood	5197.548	Hannan-Quinn	criter.	-6.830271
F-statistic	1.176099	Durbin-Watson	stat	1.973705
Prob(F-statistic)	0.319464			

Table 4.4.4 Day of the Week FTSE IT MICRO CAP

FTSE IT SMALL CAP

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/02/2009 12/30/2014 Included observations: 1520

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@WEEKDAY=2	-0.000567	0.000973	-0.582465	0.5603
@WEEKDAY=3	0.000392	0.000974	0.402608	0.6873
@WEEKDAY=4	-0.000935	0.000974	-0.960794	0.3368
@WEEKDAY=5	-0.000700	0.000978	-0.716457	0.4738
С	0.000212	0.000691	0.306028	0.7596
R-squared	0.001654	Mean depende	ent var	-0.000151
Adjusted R-squared	-0.000982	S.D. dependen	it var	0.011987
S.E. of regression	0.011993	Akaike info crit	erion	-6.005779

Sum squared resid	0.217889	Schwarz criterion	-5.988258
Log likelihood	4569.392	Hannan-Quinn criter.	-5.999256
F-statistic	0.627327	Durbin-Watson stat	1.611672
Prob(F-statistic)	0.643045		

Table 4.4.5 Day of the Week FTSE IT SMALL CAP

FTSE IT ALL-SHS

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/02/2009 12/30/2014 Included observations: 1520

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@WEEKDAY=2	0.002333	0.001310	1.781403	0.0750
@WEEKDAY=3	0.002804	0.001312	2.137177	0.0327
@WEEKDAY=4	0.001898	0.001311	1.447882	0.1479
@WEEKDAY=5	0.001692	0.001316	1.285152	0.1989
С	-0.001741	0.000931	-1.870898	0.0616
R-squared	0.003463	Mean depend	lent var	9.64E-06
Adjusted R-squared	0.000832	S.D. depende	ent var	0.016156
S.E. of regression	0.016149	Akaike info cr	iterion	-5.410658
Sum squared resid	0.395087	Schwarz crite	rion	-5.393137
Log likelihood	4117.100	Hannan-Quin	Hannan-Quinn criter.	
F-statistic	1.316142	Durbin-Watson stat		1.976480
Prob(F-statistic)	0.261748			

Table 4.4.6 Day of the Week FTSE IT ALL-SHS CAP

FTSE IT MID CAP

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/02/2009 12/30/2014 Included observations: 1520

Variable	Coefficient	Std. Error	t-Statistic	Prob.
 @WEEKDAY=2	0.001059	0.001059	0.999494	0.3177
@WEEKDAY=3	0.001793	0.001061	1.690432	0.0912
@WEEKDAY=4	0.001704	0.001060	1.607391	0.1082
@WEEKDAY=5	0.001671	0.001064	1.569929	0.1166

С	-0.001098	0.000753	-1.458998	0.1448
R-squared	0.002656	Mean dependent var		0.000149
Adjusted R-squared	0.000023	S.D. dependen	0.013058	
S.E. of regression	0.013058	Akaike info criterion		-5.835595
Sum squared resid	0.258312	Schwarz criteri	-5.818074	
Log likelihood	4440.052	Hannan-Quinn criter.		-5.829072
F-statistic	1.008753	Durbin-Watson stat		1.856060
Prob(F-statistic)	0.401651			

Table 4.4.7 Day of the Week FTSE IT MID CAP

FTSE ITALIA STAR

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/02/2009 12/30/2014 Included observations: 1548

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@WEEKDAY=2	0.002310	0.001368	1.688386	0.0915
@WEEKDAY=3	0.002814	0.001372	2.050137	0.0405
@WEEKDAY=4	0.001876	0.001372	1.367162	0.1718
@WEEKDAY=5	0.001593	0.001371	1.161814	0.2455
С	-0.001732	0.000968	-1.788810	0.0738
R-squared	0.003124	Mean depende	nt var	-1.50E-05
Adjusted R-squared	0.000540	S.D. dependen	t var	0.017078
S.E. of regression	0.017073	Akaike info crite	erion	-5.299419
Sum squared resid	0.449762	Schwarz criteri	on	-5.282156
Log likelihood	4106.750	Hannan-Quinn criter.		-5.292998
F-statistic	1.208892	Durbin-Watson stat		1.989917
Prob(F-statistic)	0.305067			

Table 4.4.8 Day of the Week FTSE ITALIA STAR

FTSE MIB

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 1/02/2009 12/30/2014 Included observations: 1548

Variable	Coefficient	Std. Error	t-Statistic	Prob.
@WEEKDAY=2	0.008162	0.025134	0.324731	0.7454

@WEEKDAY=3	0.008666	0.025215	0.343670	0.7311
@WEEKDAY=4	0.037988	0.025215	1.506538	0.1321
@WEEKDAY=5	0.001167	0.025195	0.046320	0.9631
С	-0.007584	0.017787	-0.426376	0.6699
R-squared	0.001946	Mean dependent var		0.003577
Adjusted R-squared	-0.000641	S.D. dependen	0.313571	
S.E. of regression	0.313671	Akaike info crit	0.522282	
Sum squared resid	151.8152	Schwarz criteri	on	0.539545
Log likelihood	-399.2461	Hannan-Quinn criter.		0.528703
F-statistic	0.752084	Durbin-Watson	2.003083	
Prob(F-statistic)	0.556596			

Table 4.4.9 Day of the Week FTSE MIB

It is possible to look at the summarised results below:

Index	μ	Prob.	<i>D</i> ₂	Prob.	<i>D</i> ₃	Prob.	D_4	Prob.	D_5	Prob.
ITMI.MI	-0.00005	0.9127	0.0000939	0.8837	-0.000307	0.6331	-0.000463	0.4713	0.000814	0.2078
ITSC.MI	0.000212	0.7596	-0.000567	0.5603	0.000392	0.6873	-0.000935	0.3368	-0.000700	0.4738
ITLMS.MI	-0.001741	0.0616	0.002333	0.0750	0.002804	0.0327	0.001898	0.1479	0.001692	0.1989
ITMC.MI	-0.001098	0.1448	0.001059	0.3177	0.001793	0.0912	0.001704	0.1082	0.001671	0.1166
ITSTAR.MI	-0.001732	0.0738	0.002310	0.0915	0.002814	0.0405	0.001876	0.1718	0.001593	0.2455
FTSEMIB.MI	-0.007584	0.6699	0.008162	0.7454	0.008666	0.7311	0.037988	0.1321	0.001167	0.9631

Table 4.5.0 Italian Stock Exchange Day of the week effect

It appears clear that none of the indexes present coefficients equal to zero, but they are all close to it. Monday rates appears different from each other, furthermore they result negative, a part for the FTSE IT SMALL CAP index. The fact that results show values close to zero, with p-value that suggest as a good probability for those coefficients to be zero, allows not to reject the null hypothesis. Hence all the indexes could be considered efficient under the weak efficient form.

Index	F-statistic	Prob (F-statistic)
ITMI.MI	1.176099	0.319464
ITSC.MI	0.627327	0.643045
ITLMS.MI	1.316142	0.261748
ITMC.MI	1.008753	0.401651
ITSTAR.MI	1.208892	0.305067
FTSEMIB.MI	0.752084	0.556596

Table 4.5.1 Italian Stock Exchange Day of the week effect

In order to assess, easier and for sure, the proof of the weak efficiency under the day of the week effect, the above table summarise results for the F-statistic and their relatives p-values. Thanks to p-values it is easy to notice that F-statistics suggest all the indexes are efficient under the weak-form. Indeed probabilities show value higher than the α . This means that all indexes appear to follow a RW at 5% significance level.

The January Effect

Another important effect, as it has possible to see in the present work, is the January effect. In order to test the presence of this effect into the Italian market, it has been performed a regression as follow:

$$R_t = \mu + \beta' D_t + \varepsilon_t \tag{32}$$

Where D_t is a dummy for the month of January³⁴. Now, let's proceed:

FTSE IT MICRO CAP

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 2009M01 2014M12 Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.005325	0.018431	0.288899	0.7735
С	-0.000977	0.005321	-0.183545	0.8549
R-squared	0.001191	Mean depende	nt var	-0.000533
Adjusted R-squared	-0.013078	S.D. dependen	0.042944	
S.E. of regression	0.043224	Akaike info crite	-3.417448	
Sum squared resid	0.130783	Schwarz criteri	on	-3.354208
Log likelihood	125.0281	Hannan-Quinn criter.		-3.392272
F-statistic	0.083463	Durbin-Watson stat		1.474034
Prob(F-statistic)	0.773512			

³⁴ Data consist of monthly returns

FTSE IT SMALL CAP

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 2009M01 2014M12 Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.039244	0.026606	1.475016	0.1447
С	-0.006462	0.007680	-0.841367	0.4030
R-squared	0.030144	Mean dependent var		-0.003192
Adjusted R-squared	0.016289	S.D. dependen	0.062911	
S.E. of regression	0.062397	Akaike info crite	-2.683229	
Sum squared resid	0.272533	Schwarz criterion		-2.619988
Log likelihood	98.59624	Hannan-Quinn criter.		-2.658052
F-statistic	2.175671	Durbin-Watson stat		1.742760
Prob(F-statistic)	0.144692			

Table 4.5.3 January effect FTSE IT SMALL CAP

FTSE IT ALL-SHS

Dependent Variable: LOG_RETURNS Method: Least Squares

Sample: 2009M01 2014M12

Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.016954	0.027601	0.614262	0.5410
С	-0.001209	0.007968	-0.151773	0.8798
R-squared	0.005361	Mean dependent var		0.000204
Adjusted R-squared	-0.008848	S.D. dependen	0.064445	
S.E. of regression	0.064730	Akaike info crite	-2.609811	
Sum squared resid	0.293295	Schwarz criterion		-2.546570
Log likelihood	95.95318	Hannan-Quinn criter.		-2.584634
F-statistic	0.377318	Durbin-Watson stat		1.826567
Prob(F-statistic)	0.541034			

Table 4.5.4 January effect FTSE IT ALL-SHS

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 2009M01 2014M12 Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.029832	0.022313	1.336952	0.1856
С	0.000670	0.006441	0.104031	0.9174
R-squared	0.024899	Mean depender	nt var	0.003156
Adjusted R-squared	0.010969	S.D. dependent var		0.052619
S.E. of regression	0.052329	Akaike info criterion		-3.035136
Sum squared resid	0.191685	Schwarz criterio	on	-2.971895
Log likelihood	111.2649	Hannan-Quinn criter.		-3.009959
F-statistic	1.787440	Durbin-Watson	stat	1.682741
Prob(F-statistic)	0.185567			

Table 4.5.5 January effect FTSE IT MID CAP

FTSE ITALIA STAR

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 2009M01 2014M12 Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.015438	0.018990	0.812983	0.4190
С	0.009547	0.005482	1.741517	0.0860
R-squared	0.009354	Mean depende	nt var	0.010833
Adjusted R-squared	-0.004798	S.D. dependent var		0.044428
S.E. of regression	0.044534	Akaike info criterion		-3.357725
Sum squared resid	0.138832	Schwarz criterio	on	-3.294484
Log likelihood	122.8781	Hannan-Quinn criter.		-3.332548
F-statistic	0.660941	Durbin-Watson	stat	1.421767
Prob(F-statistic)	0.418985			

Table 4.5.6 January effect FTSE ITALIA STAR

FTSE MIB

Dependent Variable: LOG_RETURNS Method: Least Squares

Sample: 2009M01 2014M12

Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
JANUARY	0.016320	0.029408	0.554946	0.5807
С	-0.001683	0.008489	-0.198303	0.8434
R-squared	0.004380	Mean dependent var		-0.000323
Adjusted R-squared	-0.009843	S.D. dependent var		0.068631
S.E. of regression	0.068968	Akaike info criterion		-2.482955
Sum squared resid	0.332964	Schwarz criterion		-2.419714
Log likelihood	91.38639	Hannan-Quinn criter.		-2.457779
F-statistic	0.307965	Durbin-Watson	stat	1.846195
Prob(F-statistic)	0.580700			

Table 4.5.7 January effect FTSE MIB

Hereinafter it possible to appreciate the whole analysis under all the indexes levels:

Index	January	Prob.	Other Months	Prob.
ITMI.MI	0.005325	0.7735	-0.000977	0.8549
ITSC.MI	0.039244	0.1447	-0.006462	0.4030
ITLMS.MI	0.016954	0.5410	-0.001209	0.8798
ITMC.MI	0.029832	0.1856	0.000670	0.9174
ITSTAR.MI	0.015438	0.4190	0.009547	0.0860
FTSEMIB.MI	0.016320	0.5807	-0.001683	0.8434

 Table 4.5.8 The January Effect (Italian Stock Exchange)

The coefficient relatives to January (dummy variable for January) measures the difference between the intercept value on January and the intercept value of months different from January. The second coefficient measures the value of the intercept for the other months. The coefficient of January does not seem to reliably differ from zero, this leads to understand that the intercept on January does not suffer changes with respect to values assumed during the other months. Therefore the effect seems not to be present in the Italian market.

4.1.7 Semi-Strong Hypothesis

The semi-strong form of market efficiency occurs when prices immediately reflect all public available information, and so, there exists no possibility to beat the market by predicting future price movements.

Before assessing the semi-strong efficiency of Italian companies, an example of semi-strong efficiency is reported in the following rows as an additional explanation of the theory:

Mario Rossi held 100 shares of FCA. He had purchased them on 1 January 2015 for 9,60 \notin per share. FCA is a company that appears among the main worldwide car manufacturers. Mario is not an active investor so he does not checks the stock performance daily. On 12 January 2015 he discovered that FCA has incurred in some trade union troubles by an article published on 11 January 2012 by Il Sole 24 Ore. According to the article, FCA is wasting labour time because of an all-out strike. Total outstanding shares of FCA are 1,2 billion. Mario sold off his holding for $8,5 \notin$ per share in the opening hours of 13 January 2015, the company's stock price had climbed to 10,7 \notin per share. The market seems to be semi-strong form efficient because had adjusted itself to the public information on 12 January 2015 as soon as the market came to know about it and changed on 15 January 2015 when FCA solved its problems as was shown by a tweet of the FCA CEO Sergio Marchionne.

4.1.1 Methodology

The idea on the basis of this analysis is that if some anomalies affect the Italian market, the market would result not semi-strong efficient.

The analysis tries to the presence of the Dividend Yield influence over market prices, in order to study the possibility of the presence of this anomaly and to verify the existence of semistrong efficiency into the market.

Dividend Yield

As introduced, another good expedient to keep tracks of stocks behaviours is testing for dividends. The dividend yield consists in the ratio of the total amount of dividends paid out by a company in the last year, over the last month. It is possible to analyse the effect of the dividend yield on some companies on the basis of the following regression:

$$R_t = \mu + \delta' F_{t-1} + \varepsilon_t \tag{33}$$

Dividends Yield has been calculated as the ratio between the last dividend paid out and daily prices. So I constructed a dummy for the month of January and I verified results of the coefficient.

Dependent Variable: LOG_RETURNS Method: Least Squares Sample: 2/02/2009 1/29/2010 Included observations: 257

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUMDATA4	-0.002624	0.222452	-0.011795	0.9906
С	0.000375	0.062056	0.006049	0.9952
R-squared	0.000001	Mean depende	nt var	0.000171
Adjusted R-squared	-0.003921	S.D. dependent var		0.953477
S.E. of regression	0.955344	Akaike info criterion		2.754261
Sum squared resid	232.7340	Schwarz criterion		2.781880
Log likelihood	-351.9226	Hannan-Quinn criter.		2.765368
F-statistic	0.000139	Durbin-Watson	stat	2.979286
Prob(F-statistic)	0.990598			

Table 4.5.9 Dividend Yield effect BMPS

Results from the regression above suggest that dividend yields do not help investors to forecast future prices because the coefficient is not really different from zero, as suggested by a reliable p-value. This means in turn that dividend yields do not appear to influence returns. R-squared is really low, as confirmed by the F-statistic at 10% significance level. This means that dividends do not help to explain returns, suggesting that returns are difficult to forecast and leading not to reject the null hypothesis. Hence the Italian market could be considered semi-strong form efficient.

The year 2010 was characterized by no dividends for BMPS.

ENI

Dividends Yield has been calculated as the ratio between the total dividend paid out of the previous year (0,5 + 0,65 for the period 2009) and daily prices.

Dependent Variable: LOG_RETURN Method: Least Squares Sample (adjusted): 2/02/2010 1/31/2011 Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELD	-0.344979	0.133404	-2.585972	0.0103
С	0.134424	0.051959	2.587088	0.0102
R-squared	0.025265	Mean dependent var		7.63E-05
Adjusted R-squared	0.021487	S.D. dependent var		0.013986
S.E. of regression	0.013835	Akaike info criterion		-5.715604
Sum squared resid	0.049381	Schwarz criterion		-5.688214
Log likelihood	745.0285	Hannan-Quinn criter.		-5.704593
F-statistic	6.687249	Durbin-Watson stat		2.019524
Prob(F-statistic)	0.010259			

Table 4.6.0 Dividend Yield effect ENI

Results from the regression above suggest that there exists the possibility that dividend yields help investors to forecast future prices because the coefficient is different from zero. On the other hand, the p-value does not suggest considerable reliability results at 5% significance level. Moreover, neither the F-statistic is considerable significant at 5% statistical level, and the R-squared and the Adjusted R-squared indicate that the relation between returns and dividend yields is not considerable. This leads not to reject the null hypothesis, hence the Italian market could be considered semi-strong form efficient.

Dependent Variable: LOG_RETURN Method: Least Squares Sample (adjusted): 2/02/2010 1/31/2011 Included observations: 260 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELD	-0.344979	0.133404	-2.585972	0.0103
С	0.134424	0.051959	2.587088	0.0102
R-squared	0.025265	Mean depende	ent var	7.63E-05
Adjusted R-squared	0.021487	S.D. dependent var		0.013986
S.E. of regression	0.013835	Akaike info criterion		-5.715604
Sum squared resid	0.049381	Schwarz criteri	on	-5.688214
Log likelihood	745.0285	Hannan-Quinn criter.		-5.704593
F-statistic	6.687249	Durbin-Watson	stat	2.019524
Prob(F-statistic)	0.010259			

Table 4.6.1 Dividend Yield effect ENI

It is possible to notice the same results for the period from February, 2 2010 to January, 29 2011. The results obtained lead to strongly reject the possibility that dividend yields could 95

help investors to forecast future returns. Hence, ENI seems to be part of a semi-strong efficient market.

MEDIASET

Dependent Variable: LOG_RETURN Method: Least Squares Sample (adjusted): 2/03/2009 1/29/2010 Included observations: 259 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELDS	-0.051800	0.040719	-1.272147	0.2045
С	0.015168	0.010690	1.418819	0.1572
R-squared	0.006258	Mean depende	nt var	0.001654
Adjusted R-squared	0.002391	S.D. dependent var		0.019309
S.E. of regression	0.019285	Akaike info criterion		-5.051238
Sum squared resid	0.095586	Schwarz criteri	on	-5.023772
Log likelihood	656.1353	Hannan-Quinn criter.		-5.040195
F-statistic	1.618358	Durbin-Watson	stat	2.299076
Prob(F-statistic)	0.204471			

Table 4.6.2 Dividend Yield effect MS

Dependent Variable: LOG_RETURN

Method: Least Squares

Sample: 2/01/2010 1/31/2011

Included observations: 261

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELD	-0.279377	0.190149	-1.469250	0.1430
С	0.026833	0.018692	1.435572	0.1523
R-squared	0.008266	Mean depende	nt var	-0.000575
Adjusted R-squared	0.004437	S.D. dependent var		0.019105
S.E. of regression	0.019063	Akaike info criterion		-5.074506
Sum squared resid	0.094120	Schwarz criterion		-5.047192
Log likelihood	664.2231	Hannan-Quinn criter.		-5.063527
F-statistic	2.158694	Durbin-Watson	stat	1.956005
Prob(F-statistic)	0.142979			

Table 4.6.3 Dividend Yield effect MS

Both in 2009 and 2010, Mediaset issued dividends. Although coefficients differ from zero, especially in the second case, results do not seem to suggest any affection over returns by dividends. Indeed R^2 and $AdjR^2$ do not suggest the possibility that this model help finding relation among returns and dividends.

FINMECCANICA

Dependent Variable: LOG_RETURN Method: Least Squares Sample (adjusted): 2/03/2009 1/31/2012 Included observations: 781 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELD	-0.029201	0.014072	-2.075073	0.0383
С	0.003806	0.002759	1.379388	0.1682
R-squared	0.005497	Mean depende	nt var	-0.001614
Adjusted R-squared	0.004220	S.D. dependent var		0.024917
S.E. of regression	0.024865	Akaike info criterion		-4.548184
Sum squared resid	0.481617	Schwarz criteri	on	-4.536249
Log likelihood	1778.066	Hannan-Quinn criter.		-4.543593
F-statistic	4.305928	Durbin-Watson	stat	1.899479
Prob(F-statistic)	0.038307			

Table 4.6.4 Dividend Yield effect FNC

TELECOM

Dependent Variable: LOG_RETURN Method: Least Squares Date: 09/25/15 Time: 11:56 Sample (adjusted): 2/03/2009 1/31/2014 Included observations: 1303 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVIDEND_YIELD	3.27E-05	0.000135	0.242430	0.8085
С	-0.000114	0.000627	-0.182593	0.8551
R-squared	0.000045	Mean dependent var		-0.000118
Adjusted R-squared	-0.000723	S.D. dependent var		0.022609
S.E. of regression	0.022617	Akaike info criterion		-4.738691
Sum squared resid	0.665502	Schwarz criterion		-4.730752
Log likelihood	3089.257	Hannan-Quinn	criter.	-4.735713

F-statistic	0.058772	Durbin-Watson stat	2.002185
Prob(F-statistic)	0.808485		

Table 4.6.5 Dividend Yield effect TIT

The last two cases examined (Finmeccanica and Telecom) clearly suggest that there exists no influence carried out by dividends over returns, as confirmed by reliable p-values and despite the use of larger samples.

5. The ways we access the market

Whomver decides to approach with financial markets would face different opportunities. If we just think to the Italian Stock Exchange "Borsa Italiana", there is a wide world of opportunities. ETFs, ETC, ETM, Mutual Funds, Derivatives, as well as CW, Bonds and Certificates are the main part of the huge panorama of the Italian Financial Market. Among these multiple choices of the market, I find interesting to focus on ETFs, which are raising instruments in the Italian and worldwide panorama.

5.1 Exchange-Traded Funds

Exchange Traded Funds (ETFs) are funds (or Sicav³⁵) that track indexes like the FTSE MIB, NASDAQ-100 Index, S&P 500, Dow Jones, etc.³⁶ ETFs are represented as stocks into any Stock Exchange, that means they are negotiated as a stock as well. ETFs allow to achieve a yield equal to the benchmark in use. This is possible by means of a passive funds management style. Another feature of ETFs is represented by the capability to show prices adjusted for NAV (Net Asset Value)^{37 38}. ETFs seem to appear as index funds, but they do not try to outperform their corresponding index, that is a feature of an active management strategy. Therefore ETFs do not try to beat the market, they try to be the market. As a consequence, administrative costs of an ETF are supposed to be less than other managed funds because they incur in less management fees³⁹.

The origin of ETFs is ascribed to some Canadian instruments (i.e. the Toronto 100 Index Participation Units - HIPs) by A. Seddik Meziani, but the creator of ETFs is worldwide

³⁵ http://www.borsaitaliana.it/etf/formazione/cosaeunetf/coseunetf.htm

³⁶ http://www.nasdaq.com/investing/etfs/what-are-ETFs.aspx#ixzz3InDzfJKm

³⁷ The Nav represents the mutual fund's price per share or the exchange-traded fund's per share value. The NAV is calculated as the total value of all the securities in its portfolio, divided by the number of fund shares outstanding - http://www.investopedia.com/terms/n/nav.asp

³⁸ http://www.borsaitaliana.it/etf/formazione/cosaeunetf/coseunetf.htm

³⁹ http://www.nasdaq.com/investing/etfs/what-are-ETFs.aspx#ixzz3InDzfJKm

represented by Nathan Most. The first recognized ETF was the Standard & Poor's Depositary Receipts (SPDR), also known as "Spider", based on the S&P500 index. Then, the Barclays Global Investor fascinated by the success obtained by ETFs in the late 90s, created the World Equity Benchmark Shares (WEBS), instruments able to replicate any national Stock Exchange. This leads to the creation of sector ETFs as well ⁴⁰. In 2003, the ETF S&P/MIB Master Unit was born, it was the first ETF over an Italian Stock Exchange index⁴¹. In the same year, the Active ETF raised up in the NYSE⁴², but here the focus is completely concentred over the traditional concept of ETFs.

ETFs are generally divided in: Management Investment Trust, Unit Investment Trust and Grantor Trust. Most of the ETFs are structured on the basis of the first typology (MIT, ed.). In this kind of ETF, managers coordinate activities relative to the underlying. The primary characteristic of MIT typology is the possibility not to hold each stocks of the underlying (the index). Unit Investment Trust differs from Management Investment Trust because of the less flexibility (i.e. no derivatives allowed) and less fees. Finally Grantor Trust is the less manageable typology, because it is not allowed to hold less stocks than those in the portfolios. In the Italian Stock Exchange exists a regulated electronic market dedicated to ETFs, the ETFplus⁴³. The ETFplus consists of: ETFs, structured ETFs, Active ETFs, Exchange Traded Commodities (ETC) and Exchange Traded notes (ETN) ⁴⁴. It has already been stated the meaning of ETFs, while structured ETFs add to the normal activity of an ETF, the possibility to access investment strategies on the basis of a leveraged ETF or a short ETF (this kind of ETF works on falls of the market). On the other hand ETC and ETN are instruments based on derivatives and bonds⁴⁵. Again, this work is focused just on ETF itself.

5.2 Testing the weak form of EMH through the Exchange-traded Funds in Italy

Given that ETFs represent one of the best ways for an investor to access the market, the last analysis performed in this work tries to verify the efficiency of the Italian ETFs operating in the ETFplus market. There exist proofs of the presence of weak form efficiency into the US

⁴² Active ETFs track indexes created by financial managers - Strategie basate su indicatori fondamentali e di volatilità: un'applicazione al mercato europeo degli ETF settoriali, Matteo Paolini, 2010

⁴⁰ Strategie basate su indicatori fondamentali e di volatilità: un'applicazione al mercato europeo degli ETF settoriali, Matteo Paolini, 2010

⁴¹ Comunicato Stampa, Lyxor AM lancia il primo ETF sull'indice S&P/MIB in Borsa Italiana, 10 Novembre 2003

⁴³ Strategie basate su indicatori fondamentali e di volatilità: un'applicazione al mercato europeo degli ETF settoriali, Matteo Paolini, 2010

⁴⁴http://www.borsaitaliana.it/etf/formazione/segmentazioneemicrostrutturamercatoetfplus/etfplussegmentaz ioneemicrostruttura.htm

⁴⁵http://www.borsaitaliana.it/etf/formazione/segmentazioneemicrostrutturamercatoetfplus/etfplussegmentaz ioneemicrostruttura.htm

ETF market⁴⁶, this would lead to think there would be in the Italian one as weel. "So, are the Italian ETFs weak form efficient?" This is the question I would like to answer at the end of this investigation.

ETFs were born to replicate Index's performance. The purpose of the management is to make that total return performance of an ETF trails the total return performance of the benchmark in order to minimize the differential of the return (Tracking Error)⁴⁷. So, the first step in order to consider whether Italian ETFs are parts of an efficient market, is to evaluate ETFs' performance with respect to their underlying indexes.

ETFs' performance has been tested by means of several indicators, Ursula Marchioni of iShares states that there exist two most important indicators: the tracking difference (TD) and the aforementioned tracking error $(TE)^{48}$.

Tracking Difference



Tracking difference shows how a product's performance compares with that of its benchmark over a significant period of time⁴⁹. Tracking difference results can appear positive or negative, underlying the extent to which an ETF outperforms or underperforms its index. The TD is computed as the difference between the

NAV (total return) and the total return of the

index (or benchmark). Because the NAV of ETFs total return includes some expenses, tracking difference typically is negative⁵⁰.

Tracking Errors

The first step is to verify how well ETFs track their indexes. In our case Italian ETFs with available data track all the same index (FTSE MIB). Therefore, following the three estimation process of the Tracking Error known in literature^{51 52}, I calculated the TE of four Italian ETFs

⁴⁶ Testing weak-form e ciency of exchange traded funds market, Gerasimos G. Rompotis, National and Kapodistrian University of Athens, July 2011

⁴⁷ http://www.borsaitaliana.it/etf/formazione/modalitadireplicaetf/modalitadireplicaetf.htm

⁴⁸ How to evaluate ETFs through tracking error and difference, Ursula Marchioni. iShares, 2013

⁴⁹ Understanding tracking difference and tracking error, Vanguard Investments Hong Kong Limited, 2014

⁵⁰ Understanding tracking difference and tracking error, Vanguard Investments Hong Kong Limited, 2014

⁵¹ Tracking S&P 500 index funds. Journal of Portfolio Management, Frino, Gallagher, 2001.

to verify that they follow their indexes at significant level. The tracking errors measure the difference in performance between the ETF and their benchmark indices⁵³. In other words, tracking errors indicate how much variability exists among the individual data points of the ETF average tracking difference over a given period of time. Therefore, commonly, TE is defined as the volatility of the differences in returns between an ETF and its underlying index. Hence, there exist two possibilities: the TE is consistently low, and so, the ETF has been tracking its underlying index (or benchmark) equally well⁵⁴; the TE is not that low, and so it did not track the ETF consistently.

The three ways to calculate the tracking errors are the following:

• The first tracking error is the average of the funds absolute return differences between the ETF and index, or the mean absolute deviation (MAD):

$$TE_{1} = \frac{1}{T} \sum_{t=1}^{T} \left| r_{F,t} - r_{l,t} \right|$$
(34)

• The second TE is the standard deviation of return differences between the ETF and the index:

$$TE_{2} = \sqrt{\frac{1}{T-1} \sum_{t=1}^{T} (RD_{T} - \overline{RD})^{2}}$$
(35)

• The last tracking error is calculated as the standard error of a regression of the ETF returns on the benchmark returns.

 $TE_3 = Standard Error$ resulted by the following regression:

$$r_{F,t} = \alpha + \beta r_{l,t} + u_t \tag{36}$$

Where $r_{F,t}$ and $r_{l,t}$ are, respectively, the logarithmic daily return calculated on the NAV of the ETF considered, and the log daily return of the Index considered. RD_T it the absolute

⁵² Measuring the tracking error of exchange traded funds: an unobserved components approach, Giuliano De Rossi, Quantitative analyst, UBS Investment Research, 2012

⁵³ The performance and tracking ability of Exchange Traded Funds, Lars Bassie, Tilburg University – Finance Department, 2012

⁵⁴ Tracking difference and tracking error of ETFs, Investor Education Centre, Hong Kong

difference between $r_{F,t}$ and $r_{l,t}$. The β coefficient of TE_3 measures the co-movement of the returns of the ETF with the benchmark index. The closer this beta coefficient is to 1, the better it performs in tracking the index.

The indicator designed to assess Italian ETFs performance is the TE. Following the three methods and using daily NAV (Net Asset Value) and Daily Log Returns, I computed TEs. The period of observation fluctuates from October, 22 2010 to September, 9 2015. Results are the following:

ETE	INDEX	Tracking	Tracking	Tracking
	INDEA	Error	Error 2	Error 3
AM FT MIB UCITS ETF (FMI.MI)	FTSE MIB	0,017804065	0,015602427	0,027962
DBXT FTSE MIB 1D (XMIB.MI)	FTSE MIB	0,017196159	0,023187612	0,026852
FTSE MIB EUR (IMIB.MI)	FTSE MIB	0,017410839	0,022848089	0,027057
L UC ETF FTS MIB (ETFMIB.MI)	FTSE MIB	0,016827193	0,023198928	0,027283

Table 5.1 Tracking Errors over daily ETFs

The table above leads to observe that tracking errors of the selected ETFs fluctuate around a value 1-3 per cent depending of the estimation process. This leads to think that ETFs well represent the FTSE MIB index, because the deviation from index values is meaningless (0,027962 in the worst case). Results state that selected ETFs track FTSE MIB index at a remarkable level. In other terms, it is possible to affirm that the ETFs performances correspond to FTSE MIB index. Although the evidences suggest that assesses these ETFs is unnecessary once that FTSE MIB index has been already tested.

Information Ratio

Another way to assess the efficiency of ETFs, in terms of trailing indexes, is to compute the Information Ratio (IR).

The IR is an indicator calculated as the ratio between the return differentials and the Tracking Error.

The formula to calculate the IR is the following:

$$IR = \frac{R_P - R_B}{TE_{P,B}} \tag{37}$$

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Where R_P is the ETF return, R_B is the index (or benchmark) return and $TE_{P,B}$ is the tracking error volatility. This indicator includes the weight of return differentials, given the possibility to check the management capability to outperform the index with respect to the risk (the contingent gap between ETF and index).

БТБ	INDEX	IR (using	IR (using	IR (using
EIF	INDEA	TE)	TE 2)	TE 3)
AM FT MIB UCITS ETF (FMI.MI)	FTSE MIB	-4,88165709	-5,570501537	-3,108266282
DBXT FTSE MIB 1D (XMIB.MI)	FTSE MIB	-1,96499468	-1,457259223	-1,258392697
FTSE MIB EUR (IMIB.MI)	FTSE MIB	0,801776152	0,61097432	0,515932877
L UC ETF FTS MIB (ETFMIB.MI)	FTSE MIB	-0,288829199	-0,2095004	-0,178139676

Table 5.2 Information Ratio over Daily ETFs

The IR adjust for return differential, so it gives a better answer with respect of the TE. Table 5.2 underlines the underperformance of three ETFs, with remarkable evidences for the AM FT MIB UCITS ETF, while FTSE MIB EUR shows even positive IR values. As a consequence there exists the possibility that IMIB represents an ETF that outperforms the market. However values are close to zero, that means ETFs well represent their index. This does not hold for AM FT MIB UCITS ETF.

Testing the efficiency of ETFs would be an additional useless work on the basis of TE results. On the other hand, the information ratios suggest the possibility that there exist something wrong with these ETFs, hence an analysis for the weak-form efficiency have been performed in the following paragraphs.

5.3 Weak Hypothesis

Purpose of the analysis: An index is a mathematical construct, so it may not be invested in directly. Exchange-traded funds attempt to track an index in order to transform it into a good that could be object of investment. The aim of the following analysis is to verify the presence of weak efficiency into the ETFplus to verify if these instruments are able to give investors a "cleaning" way to access the market. Therefore the null hypothesis stated is that the prices of ETFs considered follow a random walk. Hereinafter, the two hypothesis that could be proved:

 H_0 : the prices of the Italian ETFs are random over the period of the study – weak – form efficiency H_1 : the prices of the Italian ETFs are not random over the period of the study – inefficiency

5.4 Data

The analysis relative to the ETFs has been realized by means of Standard Italian ETFs data obtained by Yahoo finance ⁵⁵. There exist seven ETFs belonging to the Italian Stock Exchange, but I kept out the Lyxor ETF FTSE Italia Mid Cap D-EUR A/I (ITAMID.MI) because of the small presence of data.

Therefore, ETFs considered are: Amundi FTSE MIB Ucits ETF (FMI.MI), Amundi MSCI Italy Ucits ETF (CI1.MI), Db X-Trackers FTSE MIB Ucits ETF (Dr) (XMIB.MI), IShares FTSE MIB Ucits ETF (CSMIB.MI), Lyxor Ucits ETF FTSE MIB (ETFMIB.MI) and Powershares FTSE Rafi Italy 30 Ucits ETF (PTI.MIB). Even though some of the ETFs' data considered are available since 2007, 2008 and 2003, it is not the same for the others. Therefore, the analysis concerns the period from September, 9 2010 to September, 9 2015.

5.5 Methodology and Results

The analysis follows the guideline of the previous investigations over the Italian market. Autocorrelation test, ADF and PP tests have been carried out to reach the purpose established before.

Name	Symbol	Issuer	Benchmark	Daily	Weekly	Monthly
AMUNDI FTSE MIB UCITS ETF	FMI	AMUNDI	FTSE MIB TR	1224	260	60
AMUNDI MSCI ITALY UCITS ETF	CI1	AMUNDI	MSCI ITALY TRN	929	240	60
DB X-TRACKERS FTSE MIB UCITS ETF (DR)	XMIB	DB-X-TRACKERS	FTSE MIB	1245	261	60
LYXOR UCITS ETF FTSE MIB	ETFMIB	LYXOR INTERNATIONAL ASSET MANAGEMENT S.A	FTSE MIB TRN	1252	261	60
ISHARES FTSE MIB UCITS ETF (ACC)	CSMIB	ISHARES VII	FTSE MIB TR	1186	259	60
POWERSHARES	PTI	POWERSHARES	FTSE RAFI	614	172	60

Here an overview of the characteristics of the Italian ETFs selected:

⁵⁵ http://www.borsaitaliana.it/etf/etf/home.htm

Table 5.3 Profiles of ETFs

Profiles of ETFs underline a lack of available data, not observed before, over Powershares FTSE RAFI ITALY and AMUNDI MSCI ITALY UCITS ETF. Hereinafter it is possible see whether this would lead to inconsistent results.



Table 5.4 Time Series Plots of Daily Prices (ETFs)



Table 5.5 Time Series Plots of Weekly Prices (ETFs)

FMI	CI1





All the plots of ETFs show similar evidences despite the use of different benchmarks. This would mean that all the benchmark used could reliably represent the underlying portfolio.

FMI	CI1


Table 5.7 Time Series Plots of Daily Log Returns (ETFs)

FMI	CI1
-----	-----



Table 5.8 Time Series Plots of Weekly Log Returns (ETFs)

FMI	CI1
-----	-----



Table 5.9 Time Series Plots of Monthly Log Returns (ETFs)

As expected, Log Returns plots show high volatility of data.

Daily analysis

Descriptive Analysis

Symbol	Mean	Median	St.Dev.	Min	Max	Kurtosis	Skewness
FMI	30.10387	30.65750	5.382371	19.87270	41.45000	2.041567	0.148740
CI1	82.86021	84.52000	13.79790	56.78600	111.1200	1.946983	0.057908
XMIB	18.89311	19.22500	3.075260	12.49400	24.62000	1.724829	-0.026387

ETFMIB	18.69343	19.02950	2.968080	12.42000	24.17400	1.749224	-0.060236
CSMIB	59.65849	60.76500	10.66936	39.47270	81.98000	2.033558	0.169626
PTI	4.955149	5.205650	0.825061	2.896000	6.220000	2.469477	-0.695217

Table 5.1.0 Daily Descriptive Analysis (ETFs)

Unit Root test

In order to apply the analysis for unit roots, it has been used log prices.

Augmented Dickey-Fuller Test

The ADF test comes again to help assessing the existence of a unit root in the log prices time series of the six Italian ETFs, or to assess whether the price series are stationary or not. The second case represents inefficiency. These unit root test are carried out with a constant.

The hypothesis that ETFs' prices follow a RW would prove the weak efficiency. The idea is to verify the null hypothesis of the presence of a unit root:

Hence,

$$\begin{cases} H_0: \varphi = 1\\ H_1: |\varphi| < 1 \end{cases}$$

under the null hypothesis $x_t \sim I(1)$, while the alternative is represented by an autoregressive stationary process $(x_t \sim I(0))$.

LEVEL										
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI				
t-Statistic	-1.249632	-1.409246	-1.539639	-1.661770	-1.257970	-1.446427				
Prob.*	0.6546	0.5789	0.5133	0.4506	0.6508	0.5602				
		TEST (CRITICAL	ALUE						
1% level	-3.435484	-3.437175	-3.435394	-3.435365	-3.435654	-3.440788				
5% level	-2.863695	-2.864442	-2.863655	-2.863642	-2.863770	-2.866037				
10% level	-2.567967	-2.568368	-2.567946	-2.567939	-2.568008	-2.569223				

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

Table 5.1.1 ADF Test for Daily log prices - ETFs (level)

All the results of the ETFs underline values smaller than the critical ones. This means that all the ETFs show the presence of a unit root, so the null hypothesis cannot be rejected. P-values confirm results at all significance levels. Hence, it is possible to affirm that the market has been proved to be weak form efficient.

LEVEL										
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI				
t-Statistic	-1.174297	-1.275307	-1.499431	-1.613559	-1.136033	-1.497694				
Prob.*	0.6875	0.6428	0.5338	0.4753	0.7034	0.5343				
		TEST (CRITICAL V	ALUE						
1% level	-3.435484	-3.437175	-3.435394	-3.435365	-3.435654	-3.440788				
5% level	-2.863695	-2.864442	-2.863655	-2.863642	-2.863770	-2.866037				
10% level	-2.567967	-2.568368	-2.567946	-2.567939	-2.568008	-2.569223				

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

Table 5.1.2 PP Test for Daily log prices - ETFs (level)

The PP test, examining the long run effects into the short run dynamic by means of long run variance, confirm the ADF conclusions. Indeed, all the ETFs considered appear to have a unit root, and all p-values affirm that results are significant at 1%, 5% and 10% level.

Serial Correlation Test

 $\begin{cases} H_0: Data \ are \ independently \ distributed \ (the \ correlations \ are \ equal \ to \ zero, so \ any \\ observed \ correlations \ resilt \ from \ randomness) \\ H_1: The \ data \ are \ not \ independently \ distributed \ (serial \ correlation) \end{cases}$

FMI	CI1

	r antai Correlation	AC	FAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	FIUD
ų.	uh	1 -0.015	-0.015	0.2722	0.602		di	1 -0.033	-0.033	0.9963	0.318
¢.	0	2 -0.027	-0.027	1.1471	0.564	E,	l di	2 -0.066	-0.067	5.0091	0.082
ų.	(P	3 -0.027	-0.028	2.0305	0.566	ı (ji	ի սի	3 0.026	0.022	5.6611	0.129
1	<u>"</u>	4 -0.021	-0.023	2.5850	0.629	ų.	l (l	4 -0.038	-0.041	7.0205	0.135
U.	1 1	5 -0.048	-0.050	5.4210	0.367	1	1 2	5 0.018	0.019	7.3177	0.198
1		7 0.002	0.051	9.0539	0.171			5 -0.025	-0.030	7.8974	0.246
		0.002	-0.004	9.0077	0.249			0.017	0.020	0.1094	0.310
ili ili	l ili	9 -0.003	-0.003	9 1424	0.424		l di	9 -0.041	-0.035	10 057	0.346
di la	l ii	10 -0.036	-0.037	10 718	0.380	l di	1 10	10 -0.014	-0.018	10.250	0.419
փ	ի հ	11 0.025	0.028	11.487	0.403	փ	ի դի	11 0.043	0.039	11.977	0.365
ф. –	ılı	12 0.006	0.001	11.532	0.484	1	iji	12 0.005	0.007	12.000	0.446
		13 0.017	0.016	11.898	0.536	11	1	13 -0.004	-0.000	12.017	0.526
¢.	(P	14 -0.029	-0.028	12.928	0.532	El 1	ן פי	14 -0.070	-0.071	16.593	0.278
	1 1	15 0.024	0.022	13.636	0.553	ų.	l t	15 -0.025	-0.029	17.188	0.308
12	1 12	16 0.037	0.044	15.328	0.501		1	16 0.071	0.061	21.978	0.144
1	1 1	1/ 0.04/	0.046	18.075	0.384			17 -0.065	-0.058	25.926	0.076
1	1 1	18 -0.030	-0.025	19.177	0.381	ц. . П.		10 0.032	-0.055	20.002	0.055
1		19 -0.009	-0.009	19.282	0.439			20 0.000	0.022	29.902	0.055
ii ii	1 3	20 0.015	0.023	10.601	0.464	iii ii	l ili	21 -0.007	-0.004	30.020	0.092
in in	1 1	22 0.041	0.003	21 649	0.481	in the second		22 0.023	0.024	30.513	0.107
n in the second se	l ii	23 -0.018	-0.022	22 043	0.518	ı (ji	ի դի	23 0.036	0.030	31.719	0.106
di	լ ո	24 -0.062	-0.060	26.796	0.314	ı (ji	ի դի	24 0.032	0.033	32.678	0.111
di i	0	25 -0.041	-0.036	28.943	0.266		ili	25 -0.018	0.000	32.996	0.131
- III	ի դի	26 0.024	0.021	29.674	0.281		II	26 -0.010	-0.005	33.089	0.160
փ))	27 0.031	0.032	30.880	0.276	l in the second s	•)•	27 0.023	0.010	33.610	0.178
¢.	լ փ	28 -0.042	-0.058	33.050	0.234	l di	¶'	28 -0.037	-0.035	34.906	0.173
i)	1 1	29 0.025	0.021	33.865	0.244	1	12	29 0.018	0.020	35.201	0.198
1	<u>"</u>	30 -0.002	0.004	33.869	0.286			30 -0.011	-0.011	35.325	0.231
2	<u>%</u>	31 -0.036	-0.029	35.516	0.264		1 1 ⁴⁰	31 -0.037	-0.042	30.005	0.223
4	1 1	32 -0.046	-0.052	38.198	0.208	. p.		33 -0.042	-0.032	40 768	0.166
T.		34 0.002	0.001	30.093	0.220	di di		34 -0.050	-0.048	43,160	0.135
Ш.		35 0.002	-0.004	38,716	0.200	1	1 1	35 0.005	-0.019	43.185	0.161
di l	l di	36 -0.030	-0.030	39,850	0.303	l di	լ դի	36 -0.029	-0.026	44.014	0.169
	XM	IB					EIFN	/IIB			
utocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
d.	L	4 0 000	0.000	0.0000	0.700	ų.	•	1 0.009	0.009	0.1024	0.749
ų,			-0.008	v.v886	U./06	1 1				0.0040	0.246
1 1	1	1 -0.008	0.000	1 1210	0.571	1	L 1	2 -0.046	-0.046	2.8048	0.240
0 1		2 -0.029	-0.029	1.1212	0.571	l.		3 -0.046	-0.046	2.8048	0.387
0) 4) 4)		2 -0.029 3 -0.019 4 -0.015	-0.029 -0.019 -0.016	1.1212 1.5670 1.8401	0.571 0.667 0.765			2 -0.046 3 -0.013 4 -0.025	-0.046 -0.013 -0.027	2.8048 3.0289 3.8130 5.7026	0.387
		2 -0.029 3 -0.019 4 -0.015 5 -0.038	-0.029 -0.019 -0.016 -0.039	1.1212 1.5670 1.8401 3.6458	0.571 0.667 0.765 0.601		0 0	2 -0.040 3 -0.013 4 -0.025 5 -0.039 6 0.022	-0.046 -0.013 -0.027 -0.040 0.020	2.8048 3.0289 3.8130 5.7036 6.2880	0.387 0.432 0.336 0.392
•	0 0 0 0	2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021	-0.029 -0.019 -0.016 -0.039 0.019	1.1212 1.5670 1.8401 3.6458 4.2175	0.571 0.667 0.765 0.601 0.647			2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 0.022 7 0.019	-0.046 -0.013 -0.027 -0.040 0.020 0.015	2.8048 3.0289 3.8130 5.7036 6.2880 6.7514	0.240 0.387 0.432 0.336 0.392 0.455
	0 0 0 0 0	2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021 7 0.018	-0.029 -0.019 -0.016 -0.039 0.019 0.016	1.1212 1.5670 1.8401 3.6458 4.2175 4.6297	0.571 0.667 0.765 0.601 0.647 0.705	÷		2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 0.022 7 0.019 8 -0.039	-0.046 -0.013 -0.027 -0.040 0.020 0.015 -0.039	2.8048 3.0289 3.8130 5.7036 6.2880 6.7514 8.6772	0.240 0.387 0.432 0.336 0.392 0.455 0.370
		2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021 7 0.018 8 -0.019	-0.029 -0.019 -0.016 -0.039 0.019 0.016 -0.019	1.1212 1.5670 1.8401 3.6458 4.2175 4.6297 5.0771	0.571 0.667 0.765 0.601 0.647 0.705 0.749			2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 0.022 7 0.019 8 -0.039 9 0.035	-0.046 -0.013 -0.027 -0.040 0.020 0.015 -0.039 0.036	2.8048 3.0289 3.8130 5.7036 6.2880 6.7514 8.6772 10.185	0.240 0.387 0.432 0.336 0.392 0.455 0.370 0.336
0 0 0 0 0	41 41 41 41 41 41 41 41 41 41 41 41 41 4	2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021 7 0.018 8 -0.019 9 0.034	-0.029 -0.019 -0.016 -0.039 0.019 0.016 -0.019 0.034	1.1212 1.5670 1.8401 3.6458 4.2175 4.6297 5.0771 6.4911	0.571 0.667 0.765 0.601 0.647 0.705 0.749 0.690	, , ; ; ; ; ; ; ; ; ; ;	41 41 41 10 10 10 10 10 10 10 10 10 10 10 10 10	2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 0.022 7 0.019 8 -0.039 9 0.035 10 -0.026	-0.046 -0.013 -0.027 -0.040 0.020 0.015 -0.039 0.036 -0.031	2.8048 3.0289 3.8130 5.7036 6.2880 6.7514 8.6772 10.185 11.053	0.240 0.387 0.432 0.336 0.392 0.455 0.370 0.336 0.353
		2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021 7 0.018 8 -0.019 9 0.034 10 -0.003	-0.029 -0.019 -0.016 -0.039 0.019 0.016 -0.019 0.034 -0.034	1.1212 1.5670 1.8401 3.6458 4.2175 4.6297 5.0771 6.4911 6.5060	0.571 0.667 0.765 0.601 0.647 0.705 0.749 0.690 0.771		41 41 41 41 41 41 41 41 41 41 41 41 41 4	2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 0.022 7 0.019 8 -0.039 9 0.035 10 -0.026 11 0.007	-0.046 -0.013 -0.027 -0.040 0.020 0.015 -0.039 0.036 -0.031 0.012	2.8048 3.0289 3.8130 5.7036 6.2880 6.7514 8.6772 10.185 11.053 11.115	0.387 0.432 0.336 0.392 0.455 0.370 0.336 0.353 0.434
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	CSM	1 -0.008 2 -0.029 3 -0.019 4 -0.015 5 -0.038 6 0.021 7 0.018 8 -0.019 9 0.034 10 -0.003 11 0.009 12 -0.015 13 0.013 14 0.011 15 -0.006 16 0.027 17 0.067 18 -0.041 19 -0.024 20 0.022 21 0.001 22 0.027 23 -0.016 24 -0.022 25 -0.057 26 0.011 27 0.031 28 -0.028 29 -0.028 30 0.004 31 0.019 32 -0.028 33 -0.012 34 0.000 35 -0.008 36 -0.018	0.0029 0.0129 0.016 0.039 0.019 0.016 0.019 0.034 0.019 0.034 0.012 0.013 0.012 0.013 0.012 0.013 0.012 0.013 0.012 0.013 0.024 0.021 0.023 0.029 0.021 0.022 0.021 0.022 0.021 0.022 0.021 0.022 0.022 0.021 0.022	1.1212 1.5670 1.8401 3.6458 4.2175 4.6297 6.4911 6.5060 6.6077 6.8817 7.2906 7.2814 8.1843 13.875 15.954 16.709 18.900 18.941 19.247 19.844 23.981 25.335 25.423 26.394 26.413 26.388 27.971 28.153 28.259 28.677	0.571 0.667 0.765 0.601 0.749 0.790 0.749 0.830 0.830 0.885 0.925 0.949 0.943 0.676 0.596 0.610 0.587 0.649 0.687 0.556 0.556 0.605 0.556 0.605 0.605 0.605 0.605 0.671 0.707 0.749 0.771 0.749 0.587 0.556 0.605 0.556 0.605 0.605 0.671 0.707 0.749 0.574 0.574 0.556 0.601 0.556 0.601 0.556 0.601 0.556 0.601 0.556 0.602 0.556 0.602 0.556 0.601 0.574 0.556 0.602 0.556 0.602 0.556 0.602 0.674 0.574 0.556 0.601 0.556 0.602 0.556 0.602 0.674 0.556 0.602 0.556 0.605 0.601 0.576 0.556 0.602 0.556 0.602 0.677 0.556 0.602 0.556 0.605 0.556 0.605 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.556 0.605 0.605 0.556 0.605 0.556 0.605 0.605 0.677 0.556 0.605 0.556 0.605 0.677 0.556 0.605 0.677 0.556 0.605 0.677 0.556 0.605 0.677 0.556 0.605 0.677 0.556 0.605 0.677 0.557 0.605 0.605 0.678 0.677 0.556 0.605 0.677 0.678 0.678 0.678 0.678 0.674 0.556 0.605 0.674 0.677 0.678 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.678 0.677 0.777 0.779 0.774			2 -0.046 3 -0.013 4 -0.025 5 -0.039 6 -0.022 7 0.019 8 -0.039 9 -0.035 10 -0.026 11 0.007 12 -0.019 13 0.027 14 -0.009 15 0.011 16 0.044 17 0.058 18 -0.030 19 -0.039 20 0.024 21 0.019 22 0.027 23 -0.020 24 -0.020 24 -0.020 25 -0.049 26 0.006 27 0.042 28 -0.010 29 -0.021 30 0.010 31 0.010 31 0.010 32 -0.034 33 0.003 34 -0.017 35 -0.034 15 -0.034 15 0.003 15	-0.046 -0.027 -0.027 -0.040 0.020 0.020 0.015 -0.039 0.036 -0.031 0.026 -0.031 0.026 -0.029 0.042 0.026 -0.029 0.042 0.045 0.042 0.045 0.042 0.045 0.042 0.045 0.0	2.8048 3.0289 3.0289 3.8130 5.7036 6.2880 6.7514 8.6772 10.185 11.053 11.115 11.568 12.501 12.612 12.773 15.224 19.490 20.631 12.256 25.745 28.808 31.284 31.284 31.284 31.284 31.982 32.110 33.626 33.637 34.001 35.492	0.347 0.387 0.432 0.392 0.455 0.370 0.336 0.353 0.434 0.487 0.557 0.620 0.508 0.301 0.287 0.274 0.304 0.304 0.304 0.304 0.339 0.366 0.277 0.274 0.304 0.315 0.264 0.305 0.326 0.368 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.368 0.4481 0.326 0.436 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4483 0.4485 0.4483 0.4485

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 -0.016	-0.016	0.3164	0.574		ığı –	1 -0.028	-0.028	0.4869	0.485
dı –	l d	2 -0.026	-0.026	1.1315	0.568	di l	di l	2 -0.027	-0.028	0.9304	0.628
du l	l d	3 -0.024	-0.025	1.8059	0.614	փ	n) i	3 0.057	0.056	2.9463	0.400
d.	l i	4 -0.027	-0.028	2.6587	0.616	- (n)	i ja l	4 0.068	0.070	5.7918	0.215
dı	l di	5 -0.050	-0.053	5.6815	0.338	ւի։	- (b)	5 0.040	0.047	6.7612	0.239
փ	l in	6 0.013	0.009	5.8816	0.437	di l	di l	6 -0.076	-0.074	10.373	0.110
փ	փ	7 0.038	0.035	7.6505	0.364	di l	di l	7 -0.070	-0.082	13.417	0.063
ų.	l di	8 -0.024	-0.025	8.3270	0.402		- (b)	8 0.082	0.065	17.617	0.024
փ	փ	9 0.035	0.034	9.8322	0.364	(i		9 -0.024	-0.019	17.978	0.035
ան	l in	10 0.038	0.038	11.523	0.318	վ։	ų l	10 -0.046	-0.027	19.301	0.037
di l	l ú	11 -0.037	-0.032	13,170	0.282			11 -0.020	-0.016	19.541	0.052
փ	l n	12 0.021	0.026	13,700	0.320	ի վ	- (p	12 0.069	0.062	22.571	0.032
du l	l ú	13 -0.020	-0.020	14,164	0.362	վ ի	ų l	13 -0.027	-0.034	23.028	0.041
փ	ի հ	14 0.028	0.032	15,116	0.370		1	14 -0.009	0.005	23.078	0.059
ան	l ú	15 0.011	0.015	15 258	0.433	d i		15 -0.092	-0.091	28.436	0.019
ան	l ú	16 0.013	0.008	15 465	0.491	(i	ų l	16 -0.015	-0.039	28.587	0.027
i i	l ni	17 0.037	0.041	17 087	0.449	վել է	ju j	17 0.020	0.010	28.828	0.036
di la constante de la constante	l ní	18 -0.070	-0.067	23.029	0.189	վ։		18 -0.036	-0.010	29.629	0.041
	1 1	19 -0.011	-0.013	23 176	0.230	ի վ	i pi l	19 0.065	0.089	32.326	0.029
1	l h	20 0.038	0.042	24 939	0.204			20 -0.010	-0.014	32.395	0.039
i i	l ii	21 -0.016	-0.010	25 238	0.237	վել է	u)u	21 0.013	0.011	32.499	0.052
3	l li	22 0.033	0.035	26.500	0.237	1		22 0.007	-0.017	32.527	0.069
1	l li	22 0.033	-0.019	26.794	0.265	ի ի	- (b)	23 0.049	0.056	34.072	0.064
		24 -0.067	-0.074	22,260	0.205	ի կ	- (b)	24 0.071	0.064	37.334	0.041
1 .		25 0.007	0.014	22.203	0.120		di l	25 -0.084	-0.081	41.813	0.019
ili i		26 0.007	0.010	24 707	0.149	վի	ju j	26 0.017	0.016	41.996	0.025
ir.		27 0.002	0.032	24.707	0.116	ւի։	ju j	27 0.037	0.021	42.880	0.027
1		27 -0.003	0.002	34.710	0.140	ի ի	ı))	28 0.054	0.065	44.772	0.023
4°	1	20 -0.045	-0.030	37.109	0.115	ığı	ığı –	29 -0.042	-0.034	45.937	0.024
1		29 0.012	-0.007	37.324	0.130		di l	30 -0.093	-0.085	51.505	0.009
1		30 0.017	0.025	37.070	0.158	տի	11	31 0.041	-0.003	52.601	0.009
1		31 0.002	0.005	37.070	0.190	ի	ı),	32 0.045	0.035	53.903	0.009
T.	I 1	32 -0.016	-0.025	37.993	0.215	di l	l di	33 -0.053	-0.017	55.724	0.008
1	1 1	33 0.012	0.021	38.175	0.246	dı	d,	34 -0.080	-0.053	59.948	0.004
1	1 1	34 -0.012	-0.010	38.338	0.279	ili I	il I	35 0.004	-0.012	59.956	0.005
1	1 1	35 0.010	0.014	38.453	0.316	dı l	d,	36 -0.077	-0.122	63.862	0.003
di.	I W	36 -0.015	-0.023	38.745	0.347						

Table 5.1.3 Serial Correlation of Daily log prices - ETFs

Even for ETFs, results show tendency to be equal to zero, with reliable p-values over many lags. This leads not to reject the null hypothesis, so the weak form efficiency could be confirmed.

Weekly analysis

Descriptive Analysis

Symbol	Average	Median	St.Dev.	Min	Max	Kurtosis	Skewness
FMI	30.21355	30.86250	5.375319	20.21000	41.08000	2.036904	0.122903
CI1	82.75414	82.75414	13.74313	57.58000	109.8900	1.951775	0.132985
XMIB	18.93727	19.29000	3.079632	13.11500	24.45500	1.729187	-0.043066
ETFMIB	18.73949	19.08000	2.972988	12.95300	24.17400	1.751527	-0.074414
CSMIB	59.94001	61.22000	10.60562	40.13000	81.42000	2.028026	0.119471
PTI	4.839880	5.092700	0.891918	2.925300	6.205000	2.078797	-0.508082

Table 5.1.4 Descriptive Analysis of Weekly log prices - ETFs

Unit Root test

Augmented Dickey-Fuller Test

LEVEL										
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI				
t-Statistic	-1.137939	-1.341879	-1.444952	-1.581016	-1.140459	-1.277937				
Prob.*	0.7012	0.6102	0.5600	0.4909	0.7001	0.6394				
		TEST (CRITICAL V	ALUE						
1% level	-3.455486	-3.457630	-3.455387	-3.455387	-3.455585	-3.468749				
5% level	-2.872499	-2.873440	-2.872455	-2.872455	-2.872542	-2.878311				
10% level	-2.572684	-2.573187	-2.572660	-2.572660	-2.572707	-2.575791				

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

Table 5.1.5 ADF Test for Weekly log prices - ETFs (level)

The weekly log prices give back same results as before, strongly confirming the null hypothesis at all significance levels. It is possible to see that high significant p-values confirm results both for the above ADF test that for the below PP test as well.

Philip-Perron Test

LEVEL										
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI				
t-Statistic	-1.142268	-1.258622	-1.512727	-1.593731	-1.160811	-1.337988				
Prob.*	0.6994	0.6490	0.5258	0.4843	0.6917	0.6113				
		TEST (CRITICAL	VALUE						
1% level	-3.455486	-3.457630	-3.455387	-3.455387	-3.455585	-3.468749				
5% level	-2.872499	-2.873440	-2.872455	-2.872455	-2.872542	-2.878311				
10% level	-2.572684	-2.573187	-2.572660	-2.572660	-2.572707	-2.575791				

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

Table 5.1.6 PP Test for Weekly log prices - ETFs (level)

Serial Correlation Test

 $\begin{cases} H_0: Data \ are \ independently \ distributed \ (the \ correlations \ are \ equal \ to \ zero, so \ any \\ observed \ correlations \ resilt \ from \ randomness) \\ H_1: The \ data \ are \ not \ independently \ distributed \ (serial \ correlation) \end{cases}$

FMI	Cl1

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
ul i		1 -0 066	-0.066	1 1530	0.283			1 -0.097	-0.097	2.3082	0.129
	1 11	2 0 0 2 6	0.022	1.3299	0.514	ւիս	լին	2 0.063	0.054	3.2766	0.194
i hi	1 1	3 0 045	0.048	1 8644	0.601	1 1	1 1	3 -0.007	0.004	3.2900	0.349
i li		4 0 020	0.026	1.9731	0.741	11	10[1	4 -0.024	-0.028	3.4264	0.489
ulu –	1 1	5 -0.016	-0.016	2.0441	0.843	11	1 1	5 -0.016	-0.020	3.4861	0.625
ulu –	l di	6 -0.025	-0.031	2 2 1 4 8	0.899		i]i	6 0.017	0.017	3.5616	0.736
1.	l di	7 -0.094	-0.100	4.5718	0.712	I <u>I</u> I	10	7 -0.079	-0.075	5.1348	0.644
1	1 1	8 0.015	0.005	4.6365	0.796	ւլի	լին	8 0.067	0.051	6.2620	0.618
	1 10	9 0.017	0.027	4,7108	0.859	10	10	9 -0.035	-0.017	6.5761	0.681
	l di	10 -0.119	-0.108	8.5645	0.574	10		10 -0.079	-0.092	8.1436	0.615
1	1 մո	11 0.055	0.042	9.3778	0.587	i þi	լ դո	11 0.040	0.026	8.5490	0.663
1 1	1 11	12 -0.015	-0.009	9.4359	0.665	I I I	10	12 -0.052	-0.037	9.2481	0.682
I .	1 10	13 0.047	0.048	10.035	0.691	1 1	1 1	13 0.004	-0.007	9.2525	0.754
ան	1 1	14 0.035	0.036	10.369	0.735	1 11	1 1	14 0.069	0.064	10.465	0.727
1	1 11	15 0.022	0.022	10,500	0.787	10	111	15 -0.034	-0.016	10.771	0.769
	1 11	16 -0.005	-0.010	10,508	0.839	111		16 -0.024	-0.045	10.919	0.814
1	1 11	17 -0.000	-0.028	10.508	0.881	ւի	լոր	17 0.071	0.062	12,242	0.785
d i	l ni	18 -0.077	-0 073	12 166	0.839	e i	. เกิ่ม	18 -0 105	-0.076	15 116	0 654
d .	1 10	19 -0.039	-0.045	12 592	0.859	n	1 1	19 0.048	0.010	15 711	0.676
h	1 1	20 0.076	0 077	14 226	0.819	161	1 1	20 0.041	0.060	16 160	0 707
	1 1	21 -0.040	-0.003	14 681	0.839	i li		21 0.006	0.021	16 170	0 760
a l	1 1	22 0.093	0.095	17 133	0 756	111	1 11	22 0.024	0.000	16 325	0 799
6	1 1	23 0.050	0.068	17,840	0.766	in i		23 -0.024	-0 070	18 100	0 752
el ،		24 -0 174	-0.191	26.603	0.323	.H.		24 -0.002	-0.022	20.007	0.601
		25 0.032	-0.013	26,899	0.361			24 -0.000	-0.003	20.097	0.091
uli –		26 -0.054	-0.068	27 755	0.371			26 -0.042	-0.077	20.078	0.710
d i		27 -0.051	-0.038	28 500	0.385			20 -0.003	-0.040	21.045	0.708
al i		28 -0.051	-0.058	29 270	0.398			21 -0.035	-0.038	21.979	0.738
		20 -0.001	-0.000	20.200	0.444	1	1 11	28 -0.012	-0.048	22.010	0.781
ili i		30 -0.032	-0.002	29 695	0.481	L.	I <u>2</u> ".	29 0.054	0.075	22.820	0.785
ili -		31 -0.064	-0 105	30,902	0.471			30 -0.137	-0.149	28.017	0.570
uli -		32 -0.038	-0.008	31 341	0.500	.1.	""	31 -0.022	-0.073	28.150	0.613
		33 -0.000	-0.018	31,366	0.549		'Ľ	32 -0.069	-0.050	29.462	0.596
i hi	1 11	34 0.076	0.035	33 126	0.540	! E .		33 0.171	0.152	37.713	0.262
		35 0.017	0.028	33 212	0.555			34 0.084	0.104	39.704	0.231
i la		36 0 100	0.071	36 268	0.456	<u>'</u>]'		35 0.063	0.065	40.846	0.229
	· F					'4'	ו ייןי	30 -0.031	-0.050	41.122	0.200
	XMI	В					ETFN	1IB			
orrelation	Partial Correlation	AC	PAC	Q-Stat	Prob						
						Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 0 0 40	0.040	0.6000	0.404						
		1 -0.049	-0.049	0.6386	0.424			1 -0.074	-0.074	1 4350	0 231
d i Di	1 🛛 1	1 -0.049 2 0.046	-0.049	0.6386	0.424			1 -0.074	-0.074	1.4359	0.231
1 I D I D I	1 🛛 1	1 -0.049 2 0.046 3 0.028	-0.049 0.044 0.032	0.6386 1.2084 1.4127	0.424 0.547 0.703			1 -0.074 2 0.013 3 0.045	-0.074 0.008 0.046	1.4359 1.4825 2.0129	0.231 0.477 0.570
0 1 01 01	1 1 1 1 1 1 1 1 1 1 1 1 1	1 -0.049 2 0.046 3 0.028 4 0.046	-0.049 0.044 0.032 0.047	0.6386 1.2084 1.4127 1.9693	0.424 0.547 0.703 0.741			1 -0.074 2 0.013 3 0.045 4 0.044	-0.074 0.008 0.046 0.051	1.4359 1.4825 2.0129 2.5352	0.231 0.477 0.570 0.638
101 101 101 101 101		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017	-0.049 0.044 0.032 0.047 -0.015	0.6386 1.2084 1.4127 1.9693 2.0424	0.424 0.547 0.703 0.741 0.843	10 1 1 1 1 1 1 1 1 1		1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022	-0.074 0.008 0.046 0.051 -0.016	1.4359 1.4825 2.0129 2.5352 2.6657	0.231 0.477 0.570 0.638 0.751
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033	-0.049 0.044 0.032 0.047 -0.015 -0.040	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292	0.424 0.547 0.703 0.741 0.843 0.887			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015	-0.074 0.008 0.046 0.051 -0.016 -0.021	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231	0.231 0.477 0.570 0.638 0.751 0.843
() 		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146	0.424 0.547 0.703 0.741 0.843 0.887 0.731			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132	0.231 0.477 0.570 0.638 0.751 0.843 0.671
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861		12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837
	1011 1011 1011 1011 1011 1011 1011 101	1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.644			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618
())) () () () () ()) ()) ()) () () (1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 0.035	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.817 0.861 0.644 0.689	9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096 0.049	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089 8.9499	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 0.035 -0.021	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.817 0.644 0.689 0.747		4	1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089 8.9499 9.1118	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693
4 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 0.035 -0.021 0.047	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762 9.3176	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.689 0.689 0.747 0.749	()))) () ()) ()) ()) ()) ())))))))))))))		1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024 13 0.057	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020 0.059	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089 8.1089 8.1089 9.1118 10.004	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693 0.694
1 () 1) 1) 1) 1) 1) 1) 1) 1		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 -0.021 0.035	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762 9.3176 9.5271	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.864 0.644 0.689 0.747 0.749 0.749	4		1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024 13 0.057 14 0.015	-0.074 0.008 0.046 0.051 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020 0.049 -0.020 0.059 0.022	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089 8.9499 9.1118 10.004 10.069	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693 0.694 0.757
4 · 2 · 2 · 4 · 4 · 4 · 1 · 1 · 2 · 2 · 2 · 2 · 2 · 2 · 2 · 2		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027 15 0.042	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 0.035 0.021 0.047 0.035 0.038	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 9.3176 9.5271 10.016	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.861 0.861 0.864 0.689 0.747 0.749 0.796 0.796			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024 13 0.057 14 0.015 15 0.024	-0.074 0.008 0.046 0.051 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020 0.059 0.022 0.019	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9653 8.1089 8.9499 9.1118 10.004 10.069 10.226	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.675 0.837 0.618 0.627 0.693 0.694 0.757 0.805
()))))))))))))))))))		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 -0.043 -0.095 0.035 -0.021 0.035 0.038 -0.038 -0.000	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762 9.3176 9.5271 10.016 10.016	0.424 0.547 0.703 0.741 0.843 0.847 0.731 0.817 0.861 0.689 0.747 0.749 0.749 0.796 0.819 0.866			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024 13 0.057 14 0.015 15 0.024 16 -0.003	-0.074 0.008 0.046 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020 0.059 0.022 0.019 -0.003	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9635 8.1089 8.1089 8.1089 9.1118 10.004 10.069 10.226 10.228	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.665 0.837 0.618 0.627 0.693 0.694 0.757 0.805 0.854
(()) ()) ()) ()) (()) (()) (()) (()) (1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027 15 0.042 16 0.000 17 -0.011	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 0.035 -0.021 0.047 0.035 0.038 -0.038 -0.000 -0.039	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762 9.5271 10.016 10.016 10.049	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.644 0.689 0.747 0.749 0.796 0.796 0.819 0.866 0.902			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.107 11 0.055 12 -0.024 13 0.057 14 0.015 15 0.024 16 -0.003 17 0.005	-0.074 0.008 0.051 -0.016 -0.021 -0.098 -0.096 0.018 -0.096 0.049 -0.020 0.059 0.022 0.019 -0.003 -0.003 -0.002	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.9132 4.9337 4.9653 8.1089 8.9499 9.1118 10.004 10.069 10.226 10.225	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693 0.694 0.757 0.805 0.854 0.854
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027 15 0.042 16 0.000 17 -0.011 18 -0.036	-0.049 0.044 0.032 0.047 -0.015 -0.094 -0.094 -0.095 0.035 -0.021 0.047 0.035 0.035 -0.021 0.038 -0.039 -0.039 -0.039	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 9.3176 9.5271 10.016 10.016 10.049 10.412	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.689 0.784 0.689 0.747 0.749 0.796 0.796 0.796 0.819 0.866 0.902 0.918			$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	-0.074 0.008 0.051 -0.016 -0.021 -0.098 -0.096 0.049 -0.020 0.049 -0.020 0.059 0.022 0.019 -0.003 -0.002 -0.003 -0.0022 -0.0052	1.4359 1.4825 2.0129 2.5352 2.6657 2.7231 4.91337 4.9653 8.1089 9.1118 10.004 10.069 10.226 10.225 11.134	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693 0.694 0.757 0.805 0.854 0.893 0.889
()))))))))))))))))))		$\begin{array}{ccccccc} 1 & -0.049 \\ 2 & 0.046 \\ 3 & 0.028 \\ 4 & 0.046 \\ 5 & -0.017 \\ 6 & -0.033 \\ 7 & -0.088 \\ 8 & -0.005 \\ 9 & 0.031 \\ 10 & -0.107 \\ 11 & 0.039 \\ 12 & -0.027 \\ 13 & 0.055 \\ 14 & 0.027 \\ 15 & 0.042 \\ 16 & 0.000 \\ 17 & -0.011 \\ 18 & -0.052 \end{array}$	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.012 0.035 -0.021 0.035 -0.021 0.035 0.038 -0.000 -0.039 -0.041 -0.052	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 2.3292 4.4146 4.4204 4.6869 7.8438 8.2699 8.4762 9.3176 9.5271 10.016 10.016 10.042 10.412 11.173	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.861 0.689 0.747 0.749 0.749 0.749 0.749 0.819 0.819 0.819 0.819 0.819 0.819 0.819			$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	-0.074 0.008 0.051 -0.016 -0.021 -0.098 -0.006 0.018 -0.096 0.049 -0.020 0.059 0.022 0.019 -0.003 -0.002 -0.052 -0.052 -0.045	1.4359 1.4825 2.0129 2.5352 2.6667 2.7231 4.9132 4.9337 4.9653 8.1089 9.1118 10.004 10.266 10.228 10.228 10.228 11.134	0.231 0.477 0.570 0.638 0.751 0.843 0.671 0.765 0.837 0.618 0.627 0.693 0.694 0.757 0.805 0.854 0.893 0.889 0.907
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		$\begin{array}{ccccccc} 1 & -0.049 \\ 2 & 0.046 \\ 3 & 0.028 \\ 4 & 0.046 \\ 5 & -0.017 \\ 6 & -0.033 \\ 7 & -0.088 \\ 8 & -0.005 \\ 9 & 0.031 \\ 10 & -0.107 \\ 11 & 0.039 \\ 12 & -0.027 \\ 13 & 0.055 \\ 14 & 0.027 \\ 13 & 0.055 \\ 14 & 0.027 \\ 15 & 0.042 \\ 16 & 0.000 \\ 17 & -0.011 \\ 18 & -0.036 \\ 19 & -0.052 \\ 20 & 0.080 \\ 21 & -0.035 \\ 22 & 0.091 \\ 23 & 0.020 \\ 24 & -0.60 \\ 25 & 0.007 \end{array}$	-0.049 0.044 0.032 0.047 -0.015 -0.040 -0.094 -0.095 0.035 -0.021 0.047 0.035 -0.021 0.038 -0.000 -0.039 -0.047 -0.052 0.083 -0.000 0.092 0.038 -0.091	0.6386 1.2084 1.4127 1.9693 2.0424 2.3292 4.4146 4.6869 7.8438 8.2699 8.4762 9.5271 10.016 10.016 10.016 10.016 10.049 10.412 11.173 13.003 13.355 15.746 15.857 23.296	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.644 0.689 0.749 0.749 0.749 0.749 0.749 0.749 0.749 0.866 0.902 0.918 0.877 0.896 0.918 0.877 0.896 0.828 0.828 0.826 0.828 0.826 0.503 0.503 0.500	4. 		$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	-0.074 0.008 0.046 0.051 -0.021 -0.098 -0.006 0.018 -0.096 0.029 0.029 0.029 0.022 -0.022 -0.022 -0.022 -0.022 -0.022 -0.045 0.066 0.113 0.057 -0.189 -0.189 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.139 -0.022 -0.045 -0.051 -0.051 -0.051 -0.021 -0.021 -0.020 -0.005	1.4359 1.4825 2.0129 2.5352 2.6657 4.9132 4.9337 8.1089 8.9499 9.1118 10.004 10.026 10.228 10.235 10.235 11.134 11.468 12.710 13.375 16.759 17.023 25.462 25.469	0.231 0.477 0.570 0.638 0.751 0.843 0.618 0.627 0.694 0.757 0.805 0.854 0.694 0.893 0.893 0.893 0.893 0.895 0.893 0.895
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		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027 15 0.042 16 0.000 17 -0.011 18 -0.036 19 -0.52 20 0.080 12 -0.035 22 0.091 23 0.020 24 -0.160 25 0.007 26 -0.068 29 -0.027 30 -0.029 31 -0.029 31 -0.029 31 -0.029 33 -0.029 33 -0.029 34 0.0553 35 0.047 35 0.047 36 -0.410 35 0.047 36 -0.410 35 0.047 36 -0.410 36 -0.410 36 -0.410 37 -0.059 38 -0.053 35 0.047 36 -0.410 36 -0.410 36 -0.410 36 -0.410 37 -0.059 38 -0.053 35 0.047 36 -0.410 36 -0.410 36 -0.410 36 -0.410 37 -0.059 36 -0.053 35 0.047 36 -0.410 36 -0.410 36 -0.053 35 0.047 36 -0.410 36 -0.053 35 0.047 36 -0.410 36 -0.410 36 -0.053 35 0.047 36 -0.410 36 -0.053 35 0.047 36 -0.410 36 -0.053 35 0.047 36 -0.053 35 0.047 35 0.047 36 -0.053 35 0.047 36 -0.053 35 0.047 35 0.047 36 -0.053 35 0.047 36 -0.053 35 0.047 36 -0.053 35 0.047 36 -0.053 35 0.047 37 -0.055 35 0.047 35 0.047 36 0.047 37 0.059 37 0.059 37 0.059 37 0.059 37 0.057 37	-0.049 0.044 0.032 -0.047 -0.015 -0.040 -0.094 -0.094 -0.094 -0.092 0.035 -0.021 0.035 -0.021 0.035 -0.021 0.035 -0.021 0.035 -0.021 0.035 -0.038 -0.000 -0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 0.038 -0.000 -0.041 -0.015 -0.022 -0.041 -0.015 -0.027 -0.041 -0.015 -0.027 -0.001 -0.011 -0.016 -0.027 -0.001 -0.018 -0.002 -0.024 -0.025 -0.024 -0.025 -0.027 -0.025 -0.027 -0.025 -0.027 -0.025 -0.027 -0.025 -0.027 -0.025 -0.027 -0.024 -0.027 -0.024 -0.024 -0.027 -0.024 -0.0	0.6386 1.2084 1.4127 1.1693 2.0424 2.3292 4.4146 4.4204 4.4204 4.4204 4.4204 9.3176 9.5271 10.016 10.016 10.016 10.016 10.042 11.173 3.035 15.746 25.511 23.306 24.479 22.5511 26.587 22.5511 26.589 27.090 28.5551 29.255 30.723 29.255 30.723 29.255 30.723 29.255 30.725 29.255 30.725 29.255 30.725 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.755 30.7555 30.7555 30.7555 30.7555 30.7555 30.7555 30.75555 30.75555 30.7555555555555555555555555555555555555	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.644 0.689 0.747 0.749 0.749 0.819 0.819 0.902 0.918 0.902 0.918 0.877 0.896 0.828 0.828 0.861 0.503 0.503 0.560 0.546 0.524 0.524 0.566 0.655 0.605 0.658 0.658 0.658 0.653 0.658 0.658 0.653 0.511 0.511 0.511 0.555 0.606 0.555 0.605 0.555 0.605 0.658 0.658 0.658 0.653 0.511 0.511 0.555 0.605 0.555 0.605 0.658 0.658 0.658 0.6511 0.511 0.511 0.511 0.555 0.605 0.555 0.605 0.658 0.658 0.6511 0.511 0.511 0.555 0.605 0.658 0.658 0.653 0.658 0.658 0.653 0.511 0.558 0.658 0.658 0.655 0.555 0.605 0.658 0.658 0.658 0.6511 0.511 0.554 0.555 0.605 0.658 0.658 0.658 0.658 0.6511 0.511 0.558 0.658 0.658 0.6511 0.551 0.555 0.655 0.555 0.655 0.655 0.555 0.655 0.55			$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	-0.074 0.088 0.046 0.051 -0.016 -0.021 -0.020 0.049 -0.020 0.049 -0.022 0.019 -0.022 0.019 -0.022 0.049 -0.022 0.049 -0.022 -0.045 0.066 -0.018 0.057 -0.080 -0.080 -0.025 -0.080 -0.025 -0.080 -0.025 -0.080 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.025 -0.081 -0.025 -0.025 -0.081 -0.025 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.025 -0.081 -0.081 -0.025 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.025 -0.025 -0.081 -0.025 -0.081 -0.025 -0.081 -0.081 -0.025 -0.081 -0.085	1.4359 1.4825 2.0129 2.5657 2.7231 4.9137 4.9653 8.1089 8.9499 9.1118 10.004 10.226 10.225 11.134 11.468 12.710 13.375 16.759 25.462 26.586 28.374 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.574 28.575 28.5777 28.5777 28.5777 28.5777 28.57777 28.5777777777777777777777777777777777777	0.231 0.477 0.570 0.638 0.671 0.648 0.627 0.693 0.694 0.627 0.805 0.854 0.893 0.893 0.899 0.907 0.889 0.895 0.777 0.808 0.893 0.899 0.895 0.777 0.488 0.484 0.488 0.488 0.488 0.488 0.488 0.454 0.454 0.554 0.554 0.554 0.555
4 p p p p p d p p p p p p p p p p p p p		$\begin{array}{ccccccc} 1 & -0.049 \\ 2 & 0.046 \\ 3 & 0.028 \\ 4 & 0.046 \\ 5 & -0.017 \\ 6 & -0.033 \\ 7 & -0.088 \\ 8 & -0.005 \\ 9 & 0.031 \\ 10 & -0.107 \\ 11 & 0.039 \\ 11 & 0.039 \\ 12 & -0.027 \\ 13 & 0.055 \\ 14 & 0.027 \\ 15 & 0.042 \\ 16 & 0.000 \\ 17 & -0.011 \\ 18 & -0.036 \\ 19 & -0.052 \\ 20 & 0.080 \\ 17 & -0.011 \\ 18 & -0.036 \\ 19 & -0.052 \\ 20 & 0.080 \\ 21 & -0.035 \\ 22 & 0.091 \\ 23 & 0.020 \\ 24 & -0.160 \\ 25 & 0.007 \\ 26 & -0.068 \\ 29 & -0.053 \\ 27 & -0.059 \\ 28 & -0.068 \\ 29 & -0.027 \\ 30 & -0.029 \\ 31 & -0.072 \\ 32 & -0.035 \\ 33 & 0.006 \\ 34 & 0.053 \\ 35 & 0.047 \\ 36 & 0.119 \\ \end{array}$	-0.049 0.044 0.032 -0.047 -0.015 -0.040 -0.094 -0.095 -0.021 0.043 -0.095 -0.021 0.047 0.035 -0.021 0.038 -0.000 -0.038 -0.000 -0.041 -0.052 0.038 -0.000 0.092 0.038 -0.001 -0.054 -0.074 -0.054 -0.054 -0.057 -0.001 -0.057 -0.001 -0.050 0.022 0.035 0.022 -0.010 -0.050 -0.022 -0.010 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.022 -0.050 -0.050 -0.050 -0.051 -0.052 -0.052 -0.052 -0.054 -0.052 -0.054 -0.052 -0.054 -0.052 -0.052 -0.054 -0.052	0.6386 1.2084 1.4127 1.3693 2.0424 2.3292 9.3176 8.4762 9.3176 9.5271 10.016 10.016 10.016 10.049 10.412 11.173 13.055 15.746 15.857 15.746 15.857 15.746 15.857 23.291 23.306 24.479 25.511 23.306 24.889 27.340 28.885 29.255 29.265 29.275 29	0.424 0.547 0.703 0.741 0.843 0.837 0.731 0.817 0.861 0.649 0.747 0.796 0.819 0.796 0.819 0.902 0.918 0.918 0.896 0.828 0.828 0.851 0.503 0.560 0.524 0.566 0.655 0.575 0.606 0.654 0.654 0.652 0.672 0.511			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.057 12 -0.024 13 0.057 14 0.015 15 0.024 16 -0.034 20 0.066 21 -0.048 22 0.030 24 -0.171 25 -0.046 27 -0.041 28 -0.030 24 -0.017 29 -0.034 20 -0.062 31 -0.062 32 -0.055 33 -0.062 32 -0.053 33 -0.062 35 0.033 36 0.104	-0.074 -0.074 0.088 0.046 0.051 -0.016 -0.021 -0.020 0.049 -0.020 0.049 -0.020 0.022 0.019 -0.022 0.022 0.022 -0.052 -0.025 -0.025 -0.025 -0.025 -0.025 -0.025 0.025 -0.025 0.057 -0.025 0.057 -0.025 0.057 -0.080 -0.057 -0.080 -0.052 0.057 -0.080 -0.057 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.025 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.025 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.052 -0.080 -0.022 -0.052 -0.080 -0.052 -0.080 -0.022 -0.052 -0.080 -0.022 -0.052 -0.025 -0.080 -0.022 -0.025 -0.080 -0.022 -0.025 -0	1.4359 1.4825 2.0129 2.5657 2.7231 4.9132 4.9132 4.9653 8.1089 8.9499 9.1118 10.004 10.226 10.235 11.134 11.468 10.235 11.134 11.468 12.710 13.375 16.759 17.023 25.462 25.469 26.031 28.367 28.374 29.534 30.283 30.290 31.617 31.956 35.231	0.231 0.477 0.570 0.638 0.638 0.671 0.765 0.837 0.694 0.757 0.805 0.854 0.854 0.854 0.854 0.854 0.854 0.890 0.855 0.438 0.551 0.551 0.554 0.551 0.554
		1 -0.049 2 0.046 3 0.028 4 0.046 5 -0.017 6 -0.033 7 -0.088 8 -0.005 9 0.031 10 -0.107 11 0.039 12 -0.027 13 0.055 14 0.027 15 0.042 16 0.000 17 -0.011 18 -0.036 19 -0.052 20 0.080 21 -0.035 23 0.020 24 -0.160 25 0.007 26 -0.063 27 -0.059 28 -0.063 27 -0.059 28 -0.063 27 -0.059 28 -0.063 29 -0.027 30 -0.029 31 -0.072 32 -0.035 33 0.006 34 0.053 35 0.047 36 0.119	-0.049 0.044 0.032 -0.040 -0.015 -0.040 -0.094 -0.012 0.043 -0.095 -0.021 0.047 0.035 -0.021 0.047 0.038 -0.000 -0.038 -0.000 -0.038 -0.047 0.038 -0.047 0.038 -0.047 -0.052 0.083 -0.092 0.038 -0.092 0.038 -0.074 -0.018 -0.027 -0.027 -0.001 -0.116 -0.020 -0.020 -0.020 -0.020 -0.020 -0.021 -0.021 -0.027 -0.021 -0.027 -0.029	0.6386 1.2084 1.4127 1.3693 2.0424 4.23292 4.4146 4.6869 9.5271 10.016 9.5271 10.016 9.5271 10.016 10.049 9.5271 10.016 10.049 9.5271 10.016 10.049 9.5271 10.016 10.5746 15.857 23.291 23.306 24.479 25.511 23.306 27.300 28.855 29.265 29.275	0.424 0.547 0.703 0.741 0.843 0.887 0.731 0.817 0.861 0.644 0.689 0.749 0.749 0.749 0.749 0.749 0.749 0.866 0.902 0.918 0.877 0.896 0.918 0.828 0.861 0.503 0.560 0.549 0.546 0.564 0.556 0.658 0.658 0.658 0.658 0.672 0.511			1 -0.074 2 0.013 3 0.045 4 0.044 5 -0.022 6 -0.015 7 -0.090 8 0.009 9 0.011 10 -0.105 12 -0.024 13 0.057 14 0.015 16 -0.033 17 0.056 24 -0.044 20 0.094 22 0.019 23 -0.034 26 -0.070 28 -0.070 29 -0.034 30 -0.055 34 0.066 33 -0.055 34 0.066 33 -0.055 34 0.066 35 0.033 36 0.104	-0.074 -0.074 0.008 0.046 0.051 -0.021 -0.016 -0.021 -0.098 -0.006 0.049 -0.020 0.059 0.022 0.019 -0.022 0.019 -0.022 0.019 -0.022 0.022 0.022 0.022 0.033 0.057 -0.088 -0.025 0.024 0.033 0.024 0.025 0.024 0.035 0.024 0.025 0.025 0.024 0.035 0.024 0.025 0.006 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.005 0.025 0.035	1.4359 1.4825 2.0129 2.5352 2.6667 2.7231 4.9132 4.9337 4.9653 8.1089 9.1118 10.004 10.226 10.226 10.225 11.134 11.468 12.710 13.375 16.759 17.023 25.469 26.097 26.586 28.031 28.367 28.374 30.283 30.290 31.617 31.956 35.231	0.23 0.47 0.67 0.68 0.75 0.84 0.69 0.69 0.85 0.80 0.80 0.80 0.88 0.90 0.89 0.89

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Pro
ıdı.	l di	1 -0.073	-0.073	1.3874	0.239	:	ւի	լ լի	1 0.073	0.073	0.9282	0.3
ւիս	լոր	2 0.066	0.061	2.5477	0.280		id i	1 10	2 -0.056	-0.061	1.4709	0.4
111	1 1	3 0.022	0.031	2.6704	0.445		i di i	1 10	3 -0.067	-0.059	2.2599	0.5
1 11	1 1	4 0.028	0.028	2.8855	0.577		1 1	1 1	4 -0.003	0.003	2.2616	0.6
ı di i	101	5 -0.029	-0.028	3.1031	0.684		11	1 10	5 -0.024	-0.032	2.3690	0.7
ı (L	101	6 -0.036	-0.045	3.4561	0.750		i (ji i	լ ի	6 0.035	0.035	2.5870	0.8
ug i		7 -0.080	-0.084	5.1523	0.641		ւիս	լ ի	7 0.046	0.038	2.9628	0.8
111	1 1	8 0.008	0.003	5.1710	0.739		ւիս	ի դիս	8 0.063	0.058	3.6901	0.8
- iji	լի	9 0.021	0.037	5.2897	0.808		- IQ I	1 10	9 -0.032	-0.032	3.8733	0.9
e i		10 -0.107	-0.099	8.3985	0.590			1 1	10 -0.018	-0.002	3.9319	0.9
ւիս	լի	11 0.052	0.037	9.1364	0.609		i þi	1 1	11 0.082	0.091	5.1885	0.9
ı (l	1 10	12 -0.034	-0.024	9.4590	0.663			[]	12 -0.158	-0.180	9.8519	0.6
ւիս	լ դի	13 0.066	0.056	10.669	0.639		1 1	1 10	13 0.002	0.041	9.8529	0.7
1 1	1 10	14 0.002	0.013	10.670	0.712		1 1	1 10	14 -0.001	-0.021	9.8532	0.7
ւիս	1 10	15 0.049	0.041	11.343	0.728		ւիս	ի ին	15 0.081	0.063	11.117	0.1
111	1 10	16 -0.015	-0.015	11.404	0.784		i þi	1 1	16 0.083	0.084	12.446	0.1
id i	1 10	17 -0.045	-0.074	11.961	0.802		ւիս	1 10	17 0.045	0.028	12.844	0.1
1 1	1 11	18 0.008	0.009	11.979	0.848		ւիս	լ լիս	18 0.053	0.079	13.385	0.1
u di u	101	19 -0.049	-0.039	12.644	0.856		i di i	1 10	19 -0.048	-0.055	13.837	0.7
ւիս	ի դիս	20 0.045	0.047	13.218	0.868		i (Li i	1 1 1	20 -0.045	0.005	14.241	0.8
1 1	լին	21 0.005	0.033	13.224	0.901		יום	ים ו	21 0.092	0.091	15.914	0.7
ւի	լի	22 0.070	0.065	14.640	0.877		i þi	1 10	22 0.060	0.012	16.629	0.7
	1 1	23 0.019	0.033	14.739	0.904		i di i	1 10	23 -0.060	-0.040	17.346	0.7
 •		24 -0.173	-0.210	23.359	0.499		i þi	ի ին	24 0.070	0.050	18.325	0.7
1 11	1 11	25 0.040	0.022	23.811	0.530			1 10	25 0.020	0.020	18.402	0.8
ug i	1 101	26 -0.041	-0.034	24.293	0.559		ւիս	ի ին	26 0.064	0.055	19.239	0.8
		27 -0.116	-0.117	28.213	0.400		u li i	i <u>n</u> i	27 -0.106	-0.098	21.538	0.7
ut i	1 10	28 -0.039	-0.028	28.658	0.430		E I	(<u></u>]	28 -0.126	-0.102	24.855	0.6
10	1 10	29 -0.023	-0.027	28.809	0.475		C	[]	29 -0.126	-0.138	28.176	0.5
i di i	1 10	30 -0.030	-0.011	29.078	0.514		 	[]	30 -0.146	-0.150	32.662	0.3
ul i	101	31 -0.025	-0.058	29,258	0.556		ւլիս	1 10	31 0.032	0.016	32.878	0.3
ud i	1 10	32 -0.060	-0.032	30.314	0.552		ւիս	1 10	32 0.062	-0.032	33.706	0.3
ili –	1 10	33 -0.007	-0.025	30.327	0.601		ւիս	լ դի	33 0.042	0.042	34.094	0.4
. 6	b	34 0.156	0.109	37.614	0.307		i d i		34 -0.027	-0.005	34.248	0.4
10	1 1	35 0.016	0.052	37.689	0.347		i 🛛 i	1 10	35 -0.077	-0.076	35.558	0.4
i la	լ նո	36 0.101	0.066	40,758	0.269		ı (t) i		36 -0.058	-0.002	36.286	0.4

Table 5.1.7 Serial Correlation of Weekly log prices - ETFs

Each ETF show less tendency to zero AC, and increasing p-values results as lags increase. The AC and PAC appear both negative and positive correlated but close to zero, leading not to reject the null hypothesis. Hence ETFs do appear to be weak form efficient.

Monthly analysis

Symbol	Average	Median	St.Dev.	Min	Max	Kurtosis	Skewness
FMI	30.41930	31.34750	5.464673	20.31500	40.49000	1.853019	0.079101
CI1	83.17748	85.13000	13.62263	57.81000	108.5000	1.854691	0.093383
XMIB	19.00788	19.42750	3.109806	13.20500	24.13000	1.636921	-0.060405
ETFMIB	18.82170	19.22500	2.992595	13.02700	23.77800	1.649958	-0.099583
CSMIB	60.40863	62.23500	10.74446	40.33000	80.23000	1.861766	0.067873
PTI	4.598062	4.617550	0.916963	2.989700	6.150000	1.557294	0.012218

Descriptive Analysis

Table 5.1.8 Descriptive Analysis of Monthly ETFs

Unit Root test

Augmented Dickey-Fuller Test

			LEVEL			
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI
t-Statistic	-0.946420	-1.147735	-1.320984	-1.418300	-1.011838	-1.207373
Prob.*	0.7664	0.6910	0.6142	0.5674	0.7436	0.6657
		TEST (CRITICAL V	ALUE		
1% level	-3.546099	-3.546099	-3.546099	-3.546099	-3.546099	-3.546099
5% level	-2.911730	-2.911730	-2.911730	-2.911730	-2.911730	-2.911730
10% level	-2.593551	-2.593551	-2.593551	-2.593551	-2.593551	-2.593551

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

Table 5.1.9 ADF Test for Monthly log prices - ETFs (level)

ADF test over Monthly log prices of the selected ETFs show, again, the impossibility to reject the null hypothesis. Results appear really strong especially for the FMI.MI, that shows a statistic value of -0.946420, on the basis of a p-value of 0.7664.

Philip-Perron Test

			LEVEL			
	FMI	CI1	XMIB	ETFMIB	CSMIB	PTI
t-Statistic	-1.033526	-1.147735	-1.425537	-1.524286	-1.075665	-1.207373
Prob.*	0.7357	0.6910	0.5638	0.5145	0.7198	0.6657
		TEST (CRITICAL V	ALUE		
1% level	-3.546099	-3.546099	-3.546099	-3.546099	-3.546099	-3.546099
5% level	-2.911730	-2.911730	-2.911730	-2.911730	-2.911730	-2.911730
10% level	-2.593551	-2.593551	-2.593551	-2.593551	-2.593551	-2.593551

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

Table 5.2.0 PP Test for Monthly log prices - ETFs (level)

Here, as before in the ADF test, results show the possibility to be able to approve the weak efficiency of the ETFs considered.

Serial Correlation Test

 $\begin{cases} H_0: Data are independently distributed (the correlations are equal to zero, so any observed correlations resilt from randomness)$ $<math>H_1: The \ data \ are \ not \ independently \ distributed \ (serial \ correlation) \end{cases}$

FMI	CI1
Autocorrelation Partial Correlation AC PAC Q-Stat Prob	Autocorrelation Partial Correlation AC PAC Q-Stat Prob
I I I 0.067 0.067 0.2801 0.597 I I I I 0.067 0.067 0.2801 0.597 I I I I 0.045 0.064 1.3051 0.728 I I I I I 0.066 0.018 1.3072 0.860 I I I I I 4 0.006 0.018 1.3072 0.860 I I I I 4 0.006 0.018 1.3072 0.860 I I I I 6 0.016 0.010 1.6760 0.947 I I I I 8 0.049 0.038 5.3822 0.716 I I I I 0.139 0.164 9.4399 0.491 I I I 0.190 0.125 10.133 0.604 I I I 0.019 0.041 0.131 0.614 9.050 I I I 0	I I 1 0.020 0.0262 0.872 I I 2 0.126 0.127 1.0442 0.592 I I I 3 0.023 0.029 1.0447 0.897 I I I I 4 0.003 -0.021 1.0847 0.897 I I I I I 4 -0.003 -0.021 1.0847 0.897 I I I I 6 -0.006 -0.064 1.4149 0.922 I I I 6 -0.006 -0.006 1.4214 0.965 I I I 9 0.176 0.102 9.4559 0.396 I I I 10 0.150 0.102 1.139 0.347 I I I I 14 0.009 -0.103 1.1638 0.558 I I I I I 14 0.009 11.637 0.475 I I I I I<
XMIB	ETFMIB
Autocorrelation Partial Correlation AC PAC Q-Stat Prob	Autocorrelation Partial Correlation AC PAC Q-Stat Prob
I I I 0.096 0.096 0.5830 0.445 I I I I 0.096 0.096 1.0610 0.588 I I I I 3 0.020 0.039 1.0866 0.780 I I I I I 0.027 0.012 1.1336 0.889 I I I I 0.027 0.012 1.1336 0.889 I I I I 0.027 0.012 1.336 0.889 I I I I I 0.027 0.012 1.5251 0.910 I I I I 0.017 0.152 1.8613 0.932 I I I I 0.019 7.6098 0.574 I I I I 0.019 7.6098 0.515 0.647 I I I I 0.030 0.033 9.7218 0.717 I I I I I 0.018 0.029	1 1 0.097 0.097 0.5972 0.440 1 1 2 0.118 0.129 1.4951 0.474 1 1 3 0.034 0.061 1.5719 0.666 1 1 1 3 0.034 0.061 1.5719 0.666 1 1 1 4 0.017 -0.050 1.8899 0.841 1 1 1 5 -0.067 -0.057 1.8899 0.842 1 1 1 8 0.069 0.124 6.3286 0.612 1 1 9 0.168 0.098 8.319 0.496 1 1 1 9 0.168 0.098 8.319 0.496 1 1 1 10 0.133 0.162 9.6920 0.468 1 1 1 10 0.133 0.162 9.6920 0.468 1 1 1 1 0.0039 0.040 10.402 0.661 1 1 <t< th=""></t<>
CSMIB	PTI

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	_	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Pr
1 1 1	1 1 1 1	1 0.034	0.034	0.0748	0.784	-	(b (1 0.084	0.084	0.4452	0.
	1 10 1	2 -0.144	-0.145	1.4073	0.495				2 -0.154	-0.162	1.9589	0.3
1 j 1	1 1 1 1	3 0.064	0.076	1.6743	0.643		1 🛛 1	1 1 1 1	3 0.046	0.077	2.0989	0.5
- I 🗍 I	1 1	4 0.021	-0.006	1.7045	0.790		1 🛛 1		4 0.049	0.012	2.2577	0.6
101		5 -0.058	-0.040	1.9355	0.858		1 1 1		5 0.009	0.023	2.2633	0.8
1 1	1 1 1	6 0.006	0.009	1.9384	0.925		1 1 1		6 0.013	0.016	2.2746	0.8
		7 -0.256	-0.280	6.5239	0.480			· ·	7 -0.288	-0.302	8.0828	0.3
1 j 1	1 1 10 1	8 0.061	0.110	6.7929	0.559		1 🗐 I		8 0.141	0.238	9.5108	0.3
i 🗖 i	1 1 10 1	9 0.184	0.105	9.2630	0.413		1 🗐 I	1 1	9 0.154	0.005	11.249	0.2
1 🗖 1	1 1	10 0.125	0.183	10.422	0.404		1 🗐 1	i = i	10 0.084	0.185	11.770	0.3
1 🚺 1	1 1 1	11 -0.032	-0.008	10.500	0.486		1 1	1 1 1 1	11 -0.004	-0.025	11.771	0.3
101	1 1 1	12 -0.070	-0.108	10.880	0.539		1 j 1	1 1 1 1	12 0.036	0.052	11.874	0.4
1 1 1	1 1 1	13 0.018	0.012	10.907	0.619		1.1.1	1 1 1 1	13 -0.012	-0.027	11.886	0.5
1 1	1 1 1	14 -0.005	-0.103	10.909	0.693		1 1 1	1 1 1 1	14 0.071	-0.028	12.299	0.5
1 🚺 1	1 1 1	15 -0.047	0.055	11.094	0.746		101	1 1	15 -0.092	0.001	12.997	0.6
1 🚺 1	1 1 1	16 -0.033	0.022	11.188	0.798		10	1 10 1	16 -0.108	-0.106	13.980	0.6
1 🗖 1	101	17 -0.129	-0.099	12.629	0.761		1.1.1	1 1 1 1	17 -0.023	0.047	14.025	0.6
ı 🗖 i	1 1	18 0.167	0.167	15.087	0.656		1 🛛 1		18 0.070	-0.022	14.458	0.6
1 1 1	1 10 1	19 0.082	-0.085	15.692	0.678		1 p 1	ı = ı	19 0.100	0.159	15.363	0.6
1 🗖 1		20 -0.112	-0.042	16.858	0.662		1 1	1 1	20 -0.004	-0.098	15.365	0.7
1.1.1	1 11	21 0.033	0.033	16.964	0.713		1 🗖 1	1 1 1 1	21 -0.103	-0.038	16.368	0.7
1 1	1 161	22 -0.011	-0.076	16.977	0.765		101		22 -0.073	-0.172	16.896	0.7
i 🖬 i	1 10 1	23 -0.150	-0.076	19,245	0.687		101	1 1 1	23 -0.050	-0.089	17.145	0.8
1.1.1	1 1	24 0.063	0.001	19 652	0 7 1 6		1 1 1	1 1 🗐 1	24 0.050	0.118	17.405	0.8
i 🖬 i		25 -0.115	-0.065	21.052	0.690		101	idii	25 -0.067	-0.088	17.880	0.8
	1 1	26 -0 128	-0.075	22 849	0.641		· 🗖 ·		26 -0.177	-0.017	21.315	0.7
		27 0 090	0.015	23 768	0.643		1 🖬 1	1 1 1 1	27 0.107	0.057	22.606	0.7
, Ei	l unfi	28 -0.026	-0.090	23 849	0.689		1 1		28 -0.016	-0.158	22.635	0.7

Table 5.2.1 Serial Correlation of Monthly log prices - ETFs

Each ETF, analysed on the basis of Monthly data, show less tendency to zero AC, and increasing p-values results as lags increase. The AC and PAC appear both negative and positive correlated, leading not to reject the null hypothesis. Again, ETFs do appear to be weak form efficient.

Conclusions

The analysis carried out has shown some significance relative to the efficiency of the Italian market. Although there exist proofs of the weak efficiency of the market, few indexes and companies rejected the random walk hypothesis. This leads not to completely confirm the efficiency of the market. The analysis for the semi-strong form has been computed observing the dividend yields impact over returns, showing absence of any influence by dividends announcement (or issues). Hence, it is possible to think at the Italian market as a weak and semi-strong form efficient market. Therefore, as underlined by a long literature, the efficient market hypothesis has been strongly challenged. A part from the evidences emerged by econometrics analysis, that can, or cannot, be proved nowadays, one of the big deal that the EMH has to face. is represented by renowned traders that are in contact with many investors whose ask for advice. I take my personal experience as an example. During a seminar at Giotto SIM in Padua, I listened the trader Giovanni Borsi explaining easily this concept: movements of masses represent a profitable information that some traders could get in advance because investors literally told them what they are going to do. This could represent an information that the trader himself obtains to beat the market. Moreover Borsi, actually focused on Banca Monte dei Paschi di Siena issue, explained that he usually speaks with some professionals of the Bank with whom he compares his forecasting thoughts about future trends over the BMPS.MI. Beyond the fact that during all the seminar I could not avoid to think that Borsi was just showing his skills to scrape together clients, I want to make some considerations on his speech. Indeed, even if a single, or a few groups of traders, really got some information in advice with respect to the market, this would not mean that they are able to exploit them. The investors that ask them for advice would make their own finally move, more or less linked to rational or irrational thoughts. There exist no possibility that all investors gathered could outperform in turn the market on the basis of a well-known anomalies of the market. Borsi himself underlined that investors try to exploit the January effect yet. The consequence is just that everyone tries to buy or sell at the same time, so none becomes able to beat the market. However Borsi stated that knowing these attitude of investors, he beat the market with a move in advance based on investors' information. The problem is that if all traders with "information in advance" think to the same moves, hence there is no information to exploit, they will generate the same flow in the market. Clearly the confuse and twisted speech underlined could be interpreted as a chess game in which investors should know at least three or four moves to do in advice with respect to the market. The existence in past of certain anomalies could not be deny, but as the same Borsi explained, nowadays practically feasibility shows that investors do not be able to exploit them to beat the

market. That means the investors themselves, as part of the market, canceled the anomalies. This could lead to agree with Andrew Lo's theory of an Adaptive Market⁵⁶ in which the efficiency of the market depends on the environment. However the Adaptive Market theory is none other than an extension of the efficient market hypothesis. Again, Borsi stated that, basically, him could not periodically gain from the market just by carrying out some strategies. He affirmed that this game would be effective just when it is played at full time, but I imagine investors would join at least the seven or eight sleeping hours. A part from jokes, maybe the real potshots of the EMH are represented by financial crisis. In fact an efficient market is supposed to include all the available public information (semi-strong efficiency). The problem occurs when public information do not reflect the real situation of a market because of forgery or other issues. However my opinion is that these kind of troubles are characteristic of a strong form of efficiency, that is not object of the current debate.

After this parenthesis is useful to go back on the current results, aware of the fact that there exist other approaches to assess the EMH, but the econometrics one is the approach assumed to be more reliable under my point of view. As asserted by Edwards Deming, what count are data.

Results obtained suggest that not all the component owned by the Italian Stock Exchange respect the random walk hypothesis, few analysis revealed the presence of serial correlation among prices rather than the absence of unit roots as a proof of the non-efficiency. If we look just at the specific case of the ETFplus market, results suggests a good degree of weak form efficiency on the basis of the represented Italian ETFs.

Many time the truth is somewhere in-between. So, is it possible that the market is efficient but some exogenous events can briefly affect the market leaving it to remain efficient? In other words, is it possible that the inefficiency of the market is so temporary that could not be classified as inefficiency?

My conclusion will not be somewhere in-between. Considering the whole analysis performed the Italian Market results at least weak form efficient. The possibility to outperform the market do not appear so evident to classified the market out of the first two forms defined by Fama. Obviously the present analysis is a drop in the bucket compared with the whole literature generated by the EMH, but it represents a recent proof of the fact that the complexity of any market, especially the Italian one, could not be so easily interpreted. To approach with financial markets means to be aware of the possibility to face markets with a variety of treats and non-physical walls that an inexpert investors could suffer. Beyond the

⁵⁶ A theory developed in 2004 by Andrew Lo (MIT) that tries to gather the efficient market hypothesis to the behavioral finance.

trading possibility the market was born to exchange financial instruments and support companies in which someone trust. The starting point to approach any market is to know it. The weak form efficiency of the Italian market, and the awareness that it includes some potshots, supplies the basic knowledge that anyone need to be a conscious investor, or analyst, or any other financial professional going near this interesting field.

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