



An analysis of stock market efficiency: Developed vs Islamic stock markets using MF-DFA



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HIGHLIGHTS

- Stock market data are multifractal in nature.
- Developed markets tend to show relatively higher efficiency ranking in short term but moderate in long term.
- Islamic markets tend to have moderate to low efficiency ranking over the last decade.
- Among the Islamic markets, Malaysia, Indonesia and Turkey are relatively ranked better than others.
- Efficiency of a market is highly dependent on the stage of stock market development.

ARTICLE INFO

Article history:

Received 2 October 2013
Received in revised form 1 March 2014
Available online 31 March 2014

Keywords:

Islamic finance
Stock market
Efficiency
Multifractal

ABSTRACT

An efficient market has been theoretically proven to be a key component for effective and efficient resource allocation in an economy. This paper incorporates econophysics with Efficient Market Hypothesis to undertake a comparative analysis of Islamic and developed countries' markets by extending the understanding of their multifractal nature. By applying the Multifractal Detrended Fluctuation Analysis (MFDFA) we calculated the generalized Hurst exponents, multifractal scaling exponents and generalized multifractal dimensions for 22 broad market indices. The findings provide a deeper understanding of the markets in Islamic countries, where they have traces of highly efficient performance particularly in crisis periods. A key finding is the empirical evidence of the impact of the 'stage of market development' on the efficiency of the market. If Islamic countries aim to improve the efficiency of resource allocation, an important area to address is to focus, among others, on enhancing the stage of market development.

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1. Introduction

The efficient market hypothesis (EMH) has been a major research area in the literature for understanding and promoting the quality of financial markets. Many studies have been conducted for a better understanding and testing of the EMH by factoring in the adjustment of market prices of assets for all available information. The weak form of efficiency claims that past return and price data is the best predictor of price today, implying that all past publicly available information is factored in the current price. Semi strong efficiency claims in addition to the weak form of price efficiency, the prices instantly reflect new public information. The strong form EMH hypothesis in addition to the semi strong form, takes into account the insider or hidden information in the market price.

The EMH hypothesis implies a random walk movement for prices with either a zero or a positive drift. An inefficient market impacts the resource allocation in the economy, as the price signals tend to understate or overstate the impact of

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new inflow of information Pagan [1]. Post EMH, some argue that a completely efficient market is a Utopian scenario, but recent studies have shown, that financial markets are evolving and becoming more efficient with time [2,3].

Recently ranking the efficiency has evolved as an important information tool for policy makers and regulators to improve the efficiency channeling effective resource allocation to reduce distortions in the economy. Furthermore, it is crucial for the investment management industry for effective risk management purposes.

Owing to the immense importance of market efficiency as a critical tool for a well-functioning market, which contributes towards effective resource allocation and overall investment and growth in the economy, the central aim of this paper is to test the weak-form efficient market hypothesis specific to stock markets in Islamic countries¹ in comparison with the more established markets in the developed countries. Despite the recent trend of stock market development in emerging countries, many argue that Islamic countries' stock exchanges are still infantile. Literature shows that these stock markets, both in MENA and emerging Asian countries, are smaller, less liquid, more volatile, prone to higher risk premium, higher cost of funds, and poorer quality of legal environment and governance [4–9] etc. It may be attributed to the poor quality of information channels, higher trading costs, disintermediation, and less competition due to international investment barriers (protectionism and a lesser integration with world markets). These factors result in a less efficient transformation of market signals.

This paper contributes to the EMH literature in two specific angles: (1) to derive the weak-form efficiency ranking of Islamic countries' stock markets; and (2) relating the ranking to the stage of stock market development as the literature shows the importance of these factors for market efficiency. This research aims to do a comparative study between Islamic countries' stock markets vis-à-vis the markets in the developed countries, which may serve as a guide for policy makers in Islamic countries.

Our study takes a sample of 11 Islamic countries' stock market indices and 11 developed markets' indices. The developed markets selection is based on the classification of country/region as developed by World Bank, and second, the stock market being in the world top 20 by market capitalization and turnover. Daily closing prices are obtained from S&P Broad Equity Market Indices from 1 January 2001 till 31 December 2013. Also, market capitalization and share traded value are used as proxies for the market development indicators.

In order to test for the random walk behavior, as a measure and requirement of weak form efficiency hypothesis, much research has been done to identify the existence of long range dependence in the time series. A popular method to measure the degree of market efficiency is derived from econophysics; de-trended fluctuation analysis (DFA) proposed by Peng et al. [10]. Di Matteo et al. [11,12] and Cajueiro and Tabak [13,14] have approached the ranking of stock market efficiency via monofractal approach. But in contrast to this approach, a plethora of research finds evidence of stock market empirical data being multifractal in nature, where a single scaling exponent is not sufficient and may provide spurious results Mandelbrot [15], Pasquini and Serva [16]; Kwapien et al. [17]; Oswiecimka et al. [18] etc. This study based on the evidence from the literature uses multifractal de-trended fluctuation analysis (MF-DFA) as a generalization of DFA, proposed by Kantelhardt et al. [19], to take into account a global detection of multifractal behavior in measuring long-range dependence. The robust MF-DFA technique allows quantifying the multiple scaling exponent within a time series.

This paper is organized as follows: Section 2 provides the literature review. We introduce data description in Section 3. Methodology is provided in Section 4. We show empirical results and discussions in Section 5 and some concluding remarks in Section 6.

2. Literature review

There are a few studies in empirical finance that have attempted to test the random walk model in stock markets and financial time series. The first testable implication is by examining the stock returns' correlation, where the returns will not be based on its own past to exhibit the random walk behavior. Lo and MacKinlay [20] tested the random walk by using variance ratio test, assuming the variance of returns should have a linear relationship with holding period.

This study focuses on the serial dependence of test in the weak form efficiency of the markets. The seminal work on weak form market efficiency came from Kendall [21] and Fama [22] in which they did not find any correlation in returns, thus reaffirming the weak form EMH. Poterba and Summers [23] conducted a study on the monthly returns for 18 stock markets including US where they found the evidence of positive serial correlation in short term, and negative serial correlation in long term horizon. Their argument is based on the presence of serial correlation due to noise trading. Fama and French [24] using an adjusted OLS model for estimation of autocorrelation observed a U shaped pattern, which is contrary to EMH. Post the earlier studies, Lo [25] using modified rescaled range test (R/S test) supported the random walk hypothesis showing absence of long-term memory in stock prices.

Imported from econophysics, new methods have been developed lately to test the market efficiency by detecting the existence of long-range dependence on the prices. Peng et al. [10] proposed de-trended fluctuation analysis (DFA) to detect long-range dependence.

Horvatic et al. [26] further expanded the applicable scope of this method by demonstrating this method's utility through application on meteorological data. The study convincingly demonstrated that power-law cross-correlations between

¹ Islamic countries have been defined as Muslim majority countries, which are also member of the Organization of Islamic Countries.

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