# Analysis on the Weak-Form Efficiency of Chinese Stock Market

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*Abstract:* The theme of this paper is an analysis on the weak-form efficiency of the stock market in China. The proposal of the efficient market hypothesis (EMH) as a milestone event has been meaning extremely important to financial markets. Efficient market is not only the symbol of how the financial markets have developed but also their terminal objectives. Since Shanghai and Shenzhen stock exchanges were built at the beginning of the 1990s, Chinese stock market has developed very quickly especially after the split equity structure reform. In order to evaluate the development degree of Chinese stock markets scientifically it is necessary to re-analyze the systematical research on market efficiency of the latest Chinese stock market.

## 1. Introduction

As the foundation of mainstream finance and modern investment theory, Efficient Market Theory, also called Efficient Market Hypothesis (EMH), has aroused wide concern in the field of finance for a long time. Fama (1970) interprets an efficient market as "A market in which prices always 'fully reflect' available information is called 'efficient'". It is necessary to apply the EMH theory into Chinese stock market. Because the Chinese stock market has been established for a relatively short time and it still needs reformation and improvement constantly. Following the EMH, the investment behaviors of the Chinese stock market participants will be more rational and the investment could be more effective. Moreover, the higher efficiency in the securities market will lead to the information of listed companies being captured by investors and absorbed into stock prices faster. In addition, the application of EMH theory by Chinese market helps to regulate the capital markets and business conducts of listed companies and can eventually promote the healthy growth of Chinese economy in the long run.

## 2. The Analytical Method of the Weak-Form Efficiency in Stock Market

## 2.1. The Related Concepts of Testing the Weak-Form Efficiency

Considering the current situation of Chinese stock market, we need to focus on the weak-form efficiency. The research of weak-form efficient market starts with the analysis of historical trends of stock price. People have always believed that there is a change pattern in stock price for a long time. Specifically, technical analysis is analysis of historical data of stock price changes, which find out the law of price variation to predict the future trend of stock prices. Kendall (1953) found that changes in stock prices are completely random when he analyzed the historical data for research. And Kendall reached the conclusion that the change of stock price is "random walk". This conclusion indicates the nature of stock price movement is random and unpredictable, and price changes are independent of each other. That is to say, every time the price movements are unrelated with the previous price changes and have no relation with the next price change. This random variation can be described by the following formula:

$$f(R_{j,t+1}|\Phi_t)=f(R_{j,t+1}) \tag{1}$$

where $f$ = Probability density function of stock price changes

$\Phi t$ = All historical related information set of stock in time t

$R_{j,t+1}$ = Price changes of stock j from time t to time t+1

The equation 1 conveys that the stock price reflects all published information and the stock price changes are independent of each other. Also, the probability density of stock price changes is independent of time.

Some relative concepts need to be clarified in order to interpret the weak-form efficient market hypothesis.

➢ **White noise**

Brooks (2008) stated that a white noise process is one with no discernible structure and it has a constant mean and variance and no serial correlations except for the correlation with its self that is: $\gamma_{t-r}=\delta^2$ if $\gamma_{t-r}=0$.

➢ **Martingale**

Originally, it was designed for a game in which the gambler wins his stake if a coin comes up heads and loses it if the coin comes up tails. The strategy had the gambler double his bet after every loss, so that the first win would recover all previous losses plus win a profit equal to the original stake. In finance, a martingale is a stochastic process {Pt} which satisfies the following condition:

$$E[P_{t+1}|P_t,P_{t-1}\ldots] = P_t \tag{2}$$

where Pt is the stock price at date t.

The equation (2) conveys that tomorrow' price is expected to be equal to today' price considering the history of stock price (Campbell, 1997; p.30).

It can be considered to be equivalent to the weak-form efficient hypothesis.

➢ **Random walk**

A definition of random walk is an analytical concept in the study of the EMH theory: A time series {Pt} is a random walk if it satisfies:

$$P_t = \mu + P_{t-1} + \varepsilon_t \tag{3}$$

where $\mu$ is the drift and $\{\varepsilon_t\}$ is a white noise series. Tsay (2005) interpreted $P_t$ and $P_{t-1}$ as the logarithmic stock price (or index) at time t and t-1, and if $\varepsilon_t$ has symmetric distribution around zero, then given $P_{t-1}$, $P_t$ both have 50% probability to increase or decreased, so $P_t$ would go up or down random.

## 2.2. The Relationship between the Theory of a Weak-Form Efficient Market and the Random Walk Hypothesis

The efficient market hypothesis is associated with the idea of a "random walk" which characterizes a price series where all subsequent price changes represent random departures from previous prices (Malkiel, 2003). Specifically, LeRoy(1989) identified a stochastic process $X_t$ as a martingale with respect to a sequence of information sets It, if $X_t$ has the property

$$E[X_{t+1}|I_t] = X_t \quad \text{or equivalently,}$$

$$E[X_{t+1}|I_t] = mu, \quad X_{t+1} = mu + e_{t+1} \text{ with } E[e_{t+1}|I_t] = 0 \qquad (4)$$

where E(n) represents the expected value of n.

So, in assuming that $X_t$ is in It, then if $X_t$ is a martingale, the best forecast of $X_{t+1}$ based on current information It would be $X_t$. If the process is a fair game, then the expected gain from forecasting $X_{t+1}$ based on current information It is zero.

The equation (4) shows that if a variable in an investor's information set can be used to predict future returns the martingale model is violated, and returns cannot follow a fair game. "A stochastic process is identified as a random walk if it satisfies the martingale conditions and also that there is no dependence involving the higher conditional moments of $X_{t+1}$", stated by Williams (Williams, 2005).

As we mentioned above, the weak-form efficient hypothesis is equivalent to a martingale process in which current prices reflect all information available in patterns of historical prices, and future price movements cannot be derived from an examination of historical prices. Therefore, the weak-form efficiency is associated with random walk behavior of "log stock prices" and equivalently no serial correlation in returns.

## 3. Reasons of Low Efficiency in Chinese Market

Through the above empirical analysis, Chinese stock market is still in the stage of low efficiency. There are many reasons causing this situation.

First of all, the Chinese stock market system is not mature. The establishment of Chinese securities is government-guided and catch-up type which is under the situation that market economy is undeveloped, the credit mechanism is not complete and the property rights are ambiguous. Due to the support of government, issuing shares is a financing method which is low cost and small risk for listed companies. Because of this, listed company is particularly preferred the equity financing. For investors, the support and protection of government increases their expectations for earnings which are accompanied by excessive speculation, insider trading and market manipulation or other violations. According to the above analysis, we can say that the defect of system is the root reason of low efficiency in Chinese stock market.

Another reason is the defects of information disclosure system. In an efficient market, market participants are able to have timely and accurate access to all the information and use it to estimate the stock price. Therefore, the information disclosure system will determine the market efficiency. However, in China, the disclosure of information is distorted, delayed and inadequate which seriously impact on market efficiency. Also, the timely disclosure of information determines whether the investors are able to adjust positions to reduce investment risk in time. However, at present, many of the listed companies do not disclose significant events in time which seriously damage the interests of investors.

The third reason is government regulation lag. As a matter of fact, the legalization and socialization of regulatory system is an important guarantee for the healthy operation of the securities market. In China, there is a big loophole in the securities market regulation. First, the China Securities Regulatory Commission has approval rights of company applying for listing, the

share reform, merger and acquisition of listed companies, while it also has direct supervision and management rights. Under such situation, the overlapping rights make the government's regulations lack objectivity. Second, the management is relatively simple and lacks of strength from the community and the public. Third, because the system is imperfect, the behaviors in the stock market lack necessary legal constraints which lead to the arbitrage opportunities.

Finally, the investors' behaviors are not standardized. Specifically, the majority of participants in Chinese stock market are individual investors who are short of relevant expertise knowledge, which will lead to their non-rational investment and then affect market efficiency.

## 4. Providing some Executable Policies to Improve Market Efficiency

According to the reasons mentioned above, we need to provide some executable policies to improve Chinese stock market efficiency.

Firstly, it is necessary to introduce market-oriented operation mechanism. Through the above analysis, excessive government "protection" is the root reason causing low efficiency in Chinese securities market. In order to solve this problem, some appropriate measures should be taken.

Secondly, financial supervision department should frame strong policies and regulations to strengthen the supervision of information disclosure of listed companies. At the same time, we must increase the social regulation and give full play to the positive role of media. Moreover, it is important to ensure the objectivity and authenticity of financial reports of listed companies which are audited by accounting firms.

Furthermore, improving the quality of investors is necessary. For most medium and small investors, they should fully understand the risks of stock market investment. Also, they need to be trained through relevant professional knowledge about investment. For institutional investors, it is obvious that they possess a large number of idle funds. Therefore, institutional investors' investment decisions and direction will affect most medium and small investors' decisions. Considering this situation, we should strengthen the supervision of institutional investors, to prevent the use of their advantages to guide market direction for private interest.

Last but not least, the internationalization of securities markets favors the investment in the global market for higher profits. In the meantime, it is beneficial for financiers to get funds at a lower cost. Internationalization of securities markets is the inevitable economic and financial development trend, in line with the general direction of Chinese stock market reform.

## 5. Conclusion

This paper analyzes the weak-form efficiency of Chinese stock market using Shanghai and Shenzhen stock indices. Because the Chinese stock market is one of the fastest growing emerging markets in the world, especially after the split share reform, we aim to update the relevant test results of whether Chinese stock market has satisfied the weak-form efficient market hypothesis.

To sum up, there is no significant evidence against the weak-form efficiency of Chinese stock market. According to the low efficiency in Chinese stock market, we analyze reasons and provide some executable policies to improve stock market efficiency.

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