History of the Efficient Market
Hypothesis

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Abstract
This paper reviews and summarizes the work of Sewell (2011). The purpose is to investigate the evolution and development of the Efficient Market Hypothesis from its inception as theory of probability to Fama (1965) proposition and revision (Fama, 1970; 1991). It discusses the random walk theory and reports the various research papers that have been written on the subject. This paper also clarifies the debate on the validity of EMH and explains the importance of EMH to finance theory.

Keywords: EMH, history, EMH – Efficient market hypothesis

I. INTRODUCTION

There are various ways to describe the behavior of the stock market. The efficient market is a concept used to describe the stock market by its level of efficiency in disseminating information. This concept is important for basic assumption in many economic and finance models. EMH as suggested by Fama (1965) is a theoretical proposition, and empirically an efficient market does not exist. Various empirical studies showed that the market is not efficient as described by Fama (1958). Fama reviewed and revised his work and
explain the reason empirical studies did not support his proposition.

Fama (1970; 1991) divides market efficiency into three categories of efficiency: weak-form or how well do past returns predict future returns, semi-strong-form or how quickly do security prices reflect public information announcements, and strong-form or how any investors have private information that is not fully reflected in market prices.

There are many practical applications for EMH. For example, stakeholders can measure the performance of the appointed management by observing the stock price. "In major stock market, a rational consensus will be reached as to the share prices which best reflect the prospects for future cash flows" (Bowman, 1994) EMH is of prime importance to the accounting field for performance measurement and financial statement reporting (Bowman, 1994, p2).

In an efficient stock market, information disclosure is a key requirement. If the managements want the stock market to correctly value the company's shares, they must ensure that they provide sufficient information in a timely manner, allowing the market to do so. As Malkiel suggests, "when information arises, the news spreads very quickly and is incorporated into the prices of securities without delay." (Malkiel, 2003)

The purpose of this paper is to investigate the initial concept that leads to the proposition of EMH. People had been intrigued by the probability of beating the market, may it be stocks or other investment market ever since the Middle Ages. One of the first works ever written on the theory of probability is Liber de Ludo Aleae (The Book of Games of Chance) written by Girolamo Cardano a medical doctor from Italy between 1524 to 1550. Furthermore, it is important in the development of the science of probability (Oystein, 1953).

II. EARLY STUDIES ON EMH

A. Random Walk Hypothesis

The random walk hypothesis is a financial theory stating that stock market prices evolve according to a random walk and thus the prices of the stock market cannot be predicted. It is consistent with the efficient-market hypothesis. The idea of random walk was based on Robert Brown observation that grains of pollen suspended in water had a rapid oscillatory motion when viewed under a microscope (Brown, 1828). The theory that stock prices move randomly was officially proposed by Maurice Kendall in his 1953 paper, The Analytics of Economic Time Series, Part 1: Price (Kendall, 1953).

In 1863 a French stockbroker, Jules Regnault, observed that the longer you hold a security, the more you can win or lose on its price variations: the price deviation is directly proportional to the
square root of time (Regnault, 1863).

Louis Bachelier, another Frenchman whose Ph.D. dissertation titled "The Theory of Speculation" (1900) included some remarkable insights and commentary. Bachelier’s work was way ahead of his time and was ignored until it was rediscovered by Savage in 1955. Five years later Karl Pearson, a professor and Fellow of the Royal Society, introduced the term random walk in the letters pages of Nature (Pearson, 1905). Unaware of Bachelier’s work in 1900, Albert Einstein developed the equations for Brownian motion (Einstein, 1905).

In 1923 the English economist John Maynard Keynes clearly stated that investors on financial markets are rewarded not for knowing better than the market what the future has in store, but rather for risk bearing, this is a consequence of the EMH (Keynes, 1923). Frederick MacCauley, an economist, observed that there was a striking similarity between the fluctuations of the stock market and those of a chance curve which may be obtained by throwing a dice (MacCauley, 1925).

Unquestionable proof of the leptokurtic nature of the distribution of returns was given by Maurice Olivier in his Paris doctoral dissertation (Olivier, 1926). Frederick C. Mills, in The Behavior of Prices (Mills, 1927), proved the leptokurtosis of returns. The Wall Street Crash occurred in late October 1929 which, taking into account the full extent and duration of its fallout, was the most devastating stock market crash in the history of the US.

In 1930 Alfred Cowles, 3rd, the American economist and businessman, founded and funded both the Econometric Society and its journal, Econometrica. Two years later, Cowles set up the Cowles Commission for Economic Research. Cowles (1933) analyzed the performance of investment professionals and concluded that stock market forecasters cannot forecast.

Holbrook Working concluded that stock returns behave like numbers from a lottery (Working, 1934). In 1936 Keynes had General Theory of Employment, Interest, and Money (Keynes, 1936) published. He famously compared the stock market with a beauty contest, and also claimed that most investors’ decisions can only be as a result of ‘animal spirits’.

Eugen Slutzky showed that sums of independent random variables may be the source of cyclic processes (Slutzky, 1937). In the only paper published before 1960 which found significant inefficiencies, Cowles and Jones found significant evidence of serial correlation in averaged time series indices of stock prices (Cowles and Jones, 1937).

In 1944, in a continuation of his 1933 publication, Cowles again reported that investment professionals do not beat the
market (Cowles, 1944). Holbrook Working showed that in an ideal futures market it would be impossible for any professional forecaster to predict price changes successfully (Working, 1949).

In 1953 Milton Friedman pointed out that, due to arbitrage, the case for the EMH can be made even in situations where the trading strategies of investors are correlated (Friedman, 1953). Kendall (1953) analyzed 22 price-series at weekly intervals and found to his surprise that they were essentially random. Also, he was the first to note the time dependence of the empirical variance (nonstationarity). Around 1955, Leonard Jimmie Savage, who had discovered Bachelier’s 1914 publication in the Chicago or Yale library sent half a dozen ‘blue ditto’ postcards to colleagues, asking ‘does any one of you know him?’ Paul Samuelson was one of the recipients. He couldn’t find the book in the MIT library, but he did discover a copy of Bachelier’s PhD thesis (Bernstein, 1992; Taqqu, 2001).

In 1956 Bachelier’s name reappeared in economics, this time, as an acknowledged forerunner, in a thesis on options-like pricing by a student of MIT, economist Paul A. Samuelson (Mandelbrot and Hudson, 2004). Working (1958) built an anticipatory market model. The following year, Harry Roberts demonstrated that a random walk will look very much like an actual stock series (Harry, 1959). Meanwhile, M. F. M. Osborne showed that the logarithm of common-stock prices follows Brownian motion; and also found evidence of the square root of time rule. Regarding the distribution of returns, he finds ‘a larger “tangential dispersion” in the data at these limits’ (Osborne, 1959).

Larson (1960) presented the results of an application of a new method of time series analysis. He notes that the distribution of price changes is ‘very nearly normally distributed for the central 80 per cent of the data, but there is an excessive number of extreme values.’ Cowles (1960) revisited the results in Cowles and Jones (1937), correcting an error introduced by averaging, and still finds mixed temporal dependence results. Working (1960) showed that the use of averages can introduce autocorrelations not present in the original series.

Houthakker (1961) used stop-loss sell orders and finds patterns. He also found leptokurtosis, nonstationarity and suspected non-linearity. Independently of Working (1960), Alexander (1961) realized that spurious autocorrelation could be introduced by averaging; or if the probability of a rise is not 0.5. He concluded that the random walk model best fits the data, but found leptokurtosis in the distribution of returns. Also, this paper was the first to test for non-linear dependence. In the same year, Muth introduced the rati in 1961.

In 1962 Mandelbrot first proposed that the tails of the distribution of returns follow a power law, in IBM Research Note NC-87 (Mandelbrot, 1962).
Meanwhile, Paul H. Cootner concluded that the stock market is not a random walk (Cootner, 1962). Osborne (1962) investigated deviations of stock prices from a simple random walk, and his results include the fact that stocks tend to be traded in concentrated bursts. Moore found insignificant negative serial correlation of the returns of individual stocks, but a slight positive serial correlation for the index (Moore, 1962).

Jack Treynor wrote his unpublished manuscript ‘Toward a theory of market value of risky assets’, the first paper on the Capital Asset Pricing Model (CAPM (Treynor, 1961)).

Berger and Mandelbrot (1963) proposed a new model for error clustering in telephone circuits, and if their argument is applicable to stock trading, it might afford justification for the Pareto-Levy distribution of stock price changes claimed by Mandelbrot. Granger and Morgenstern (1963) perform spectral analysis on market prices and found that short-run movements of the series obey the simple random walk hypothesis, but that long-run movements do not, and that ‘business cycles’ were of little or no importance. Mandelbrot (1963) presented and tested a new model of price behavior. Unlike Bachelier, he used natural logarithms of prices and also replaced the Gaussian distributions with the more general stable Paretian.


The random walk ideas were later developed by MIT Sloan School of Management professor Paul Cootner in his 1964 book The Random Character of Stock Market Prices (Cootner, 1964) It was popularized by the 1973 book, A Random Walk Down Wall Street, by Burton Malkiel, a Professor of Economics at Princeton University (Malkiel, 1973).

III. CONCLUSION

A market is said to be efficient with respect to an information set if the price ‘fully reflects’ that information set (Fama, 1970). The current debate on the validity of EMH can be resolved if we were to appreciate the importance of having the ability to describe any financial market. Fama (1965) began with a theoretical proposition, surely in
the real world there is no perfect or efficient market but an efficient market is a benchmark. Similar to Mgdiliani & Miller’s theoretical proposition of capital structure the Fama proposition allowed other theories and finance models to function.

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