BS2551 Money Banking and Finance

Efficient Markets Hypothesis: Theory and Evidence

1. INTRODUCTION

- Schleifer (2000) argues, the existence of <u>arbitrage opportunities</u> is a necessary condition that can lead to *market efficiency*.

- The origins of the *Efficient Markets Hypothesis* (EMH) can be traced back to the pioneering theoretical contribution of Louis Bachelier (1900). Bachelier in his remarkable doctoral thesis "La Théorie de La Spéculation" proposed the *random walk* as the fundamental model for financial asset prices many decades before the idea became widely accepted by other academics. Samuelson (1965) initiated the modern literature by proving that asset prices in efficient markets fluctuate randomly, and only in response to new information.

- In this lecture we will analyse the EMH, its implications for investing, and the relevant empirical evidence.

2.   EMH versus operational & allocational efficiency

▪   It should be stressed that the EMH deals with the *information processing efficiency* of financial markets, and not with the standard economic notions of *allocational* and *operational* efficiency.

▪   An <u>allocationally efficient market</u> is one where prices are determined in a way that equates the marginal rates of return (adjusted for risk) for all producers and savers. In such a market, scarce savings are optimally allocated to productive investments in a way that benefits everyone.

▪   <u>Operational efficiency</u> deals with the cost of transferring funds. In the theoretical world of perfect capital markets, transaction costs are assumed to be zero and markets are perfectly liquid, implying perfect operational efficiency.

▪   Market efficiency is less restrictive than the notion of perfect capital markets: *in an efficient market, prices fully and instantaneously reflect all available relevant information.* In

other words, in an informationally efficient market price changes must be unforecastable if they are properly anticipated, i.e. if they fully incorporate the expectations and information of all market participants.

■   A financial market can be informationally efficient without being operationally / allocationally efficient. E.g. there can be imperfect competition in product markets (allocational inefficiency) with a monopolist dominating the market, and still have efficient capital markets, with the equity issued by the monopolist being rationally priced.

3.   The three forms of market efficiency

■   Fama (1970) in a classic paper contributed a great deal to operationalize the concept of market efficiency. Fama defines three types of efficiency, each of which is based on a different notion of what type of information set is understood to be relevant in the phrase: "a market in which prices 'fully reflect' all available *information* is called 'efficient' ".

(i) <u>**Weak-form efficiency**</u>: No investor can earn excess returns by developing trading rules based on historical price or return information. In other words, *technical analysis* or chart reading is not useful to 'beat' the market. *Weak-form efficiency implies that all historical information is fully reflected in the actual asset price.* It also implies that asset prices follow a random walk, meaning that on average there is no correlation between subsequent price changes.

$$P_t = P_{t-1} + u_t \Leftrightarrow P_t - P_{t-1} = u_t \Leftrightarrow \Delta P_t = u_t \ : \ \textbf{Random walk}$$

P_t is the level of the asset price, u_t is an error term: $E[u_t] = 0$,

$Var[u_t] = E[u_t]^2 = \sigma^2$, $Cov[u_t, u_{t-s}] = 0$ for all $s \neq 0$
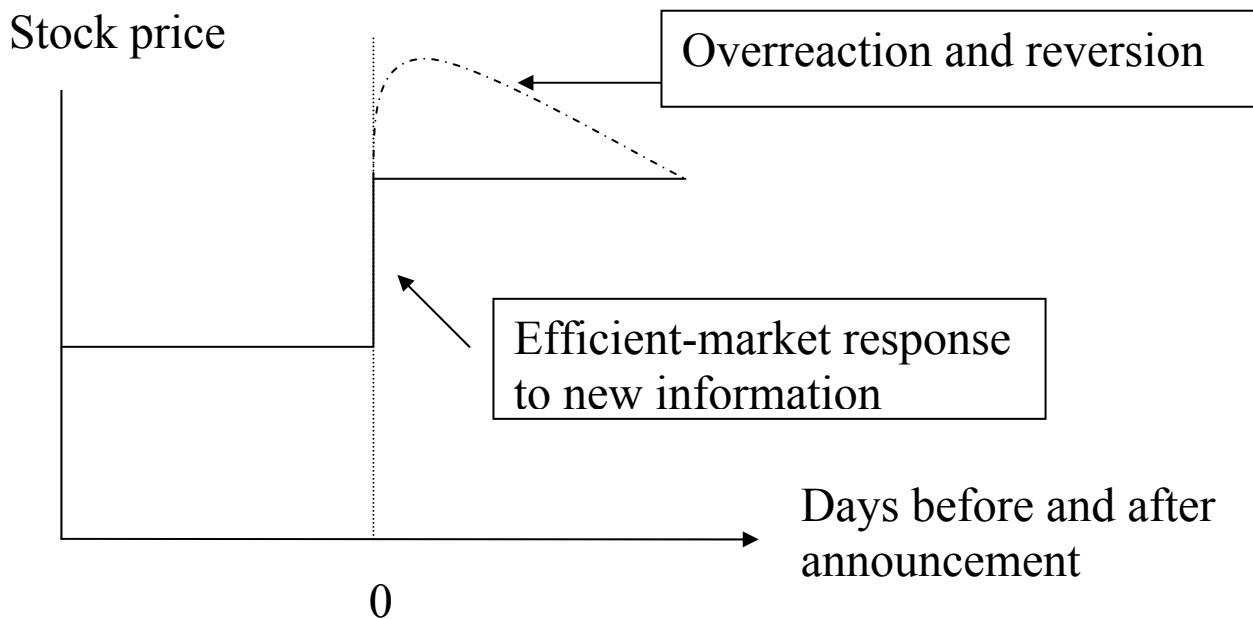
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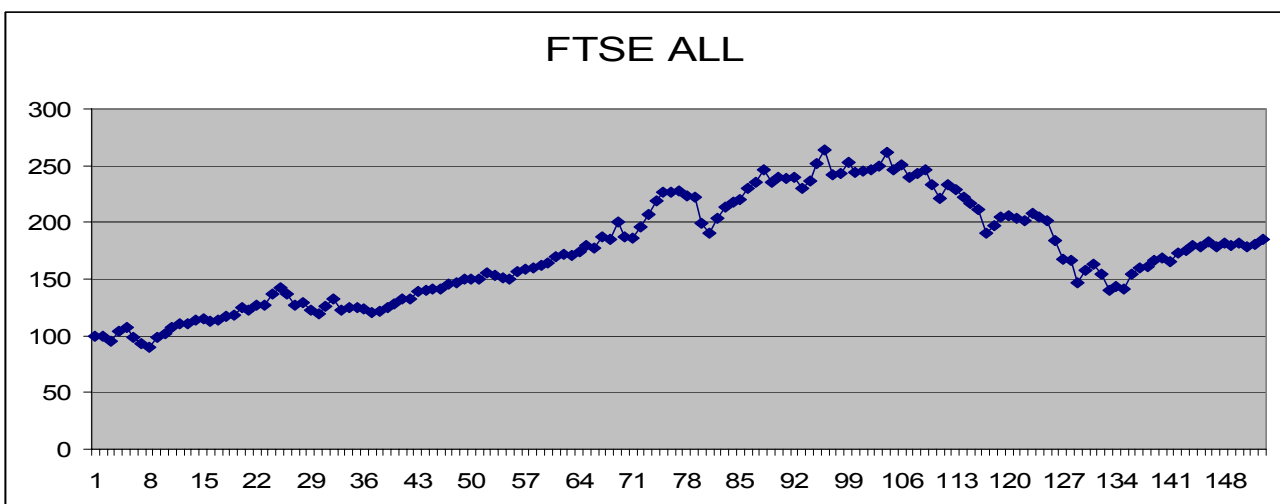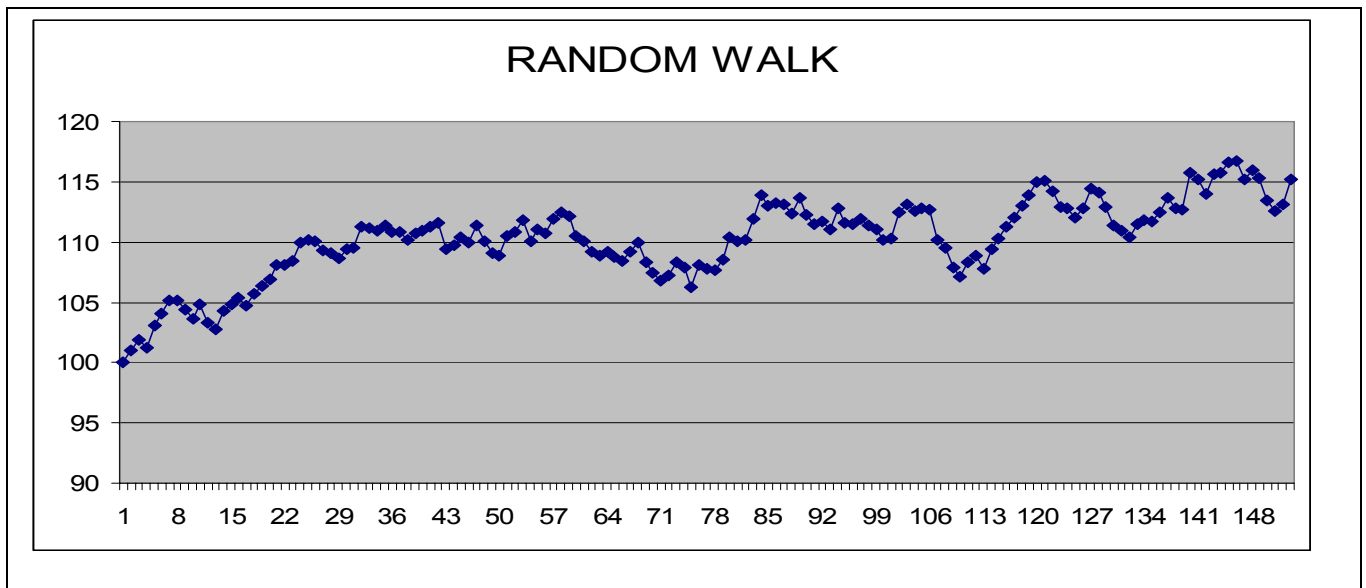
- As Kortian (1995) argues, there are several aspects of modern asset markets trading, which are clearly contrary to the sort of behavior implied by the weak-form efficiency. For instance, the frequent employment of *stop-loss orders* (selling orders which are activated once the asset price has fallen by a particular pre-determined amount), and the development of dynamic hedging strategies, such as *portfolio insurance*, according to which, investors buy in a rising market and sell into a falling one.

- Such strategies base investment decisions on past asset price movements. Their presence is also consistent with the view that investors can often behave in a destabilising

manner, moving the asset price away from its intrinsic (fundamental) value rather than towards it.

(ii) Semistrong-form efficiency: No investor can earn excess returns from trading rules based on any publicly available information. Examples of publicly available information are annual reports and financial statements of companies, reports in the financial press, and historical data. *Semistrong-form efficiency implies that all publicly available information is fully reflected in the actual asset price.*

With semistrong efficiency, the market's reaction to new relevant information should be instantaneous and unbiased, without any systematic pattern of under or overreaction. It also implies that *fundamental analysis*, based on using public financial information, shouldn't produce abnormal returns.

Stock price

Overreaction and reversion

Efficient-market response to new information

Days before and after announcement

0

(ii) Strong-form efficiency: No investor can earn excess returns using any information, whether publicly available or private information. *Strong-form efficiency implies that all information is fully reflected in the actual asset price.* The strong-form efficiency is very strong indeed! It implies that corporate insiders cannot profit using private information. For example, suppose that we know that our firm has just made an important technological discovery. Strong-form efficiency implies that prices will have adjusted (so that no profit) before we even had a chance to trade upon the news.

H: the set that includes the history of prices or returns

P: the set that includes publicly available information

A: the set that includes all available info (private & public)

$H \subset P \subset A$: H is a subset of P, which is a subset of A

▪ All three forms of efficiency imply that investors, trading on the respective information set, should be unable to realise average excess returns above the 'normal rate'. The normal rate is typically the rate of return justified by an (equilibrium) asset pricing model, such as the CAPM, APT, three-factor model, etc.

▪ If the abnormal return is unforecastable (and in this sense 'random') conditional on the chosen information set, then the EMH is not rejected.

▪ *Joint hypothesis problem*: Since tests of the EMH using abnormal returns must assume an equilibrium model (to define normal returns), if EMH is rejected it could be *either*

because the market is truly inefficient, *or* because an incorrect equilibrium model has been assumed. This implies that we can never be sure of rejecting the EMH as such.

4.   EMH and bubbles

▪   A consequence of the EMH is that asset prices are always at levels justified by their underlying fundamentals.

▪   However, many episodes in financial history suggest that during some periods asset prices move out-of-step with the underlying fundamentals, e.g. periods of bubbles and crashes. Such periods typically feature high volatility in real output.

▪   Continuing rises in asset prices, followed by crashes, apparently inexplicable by changes in fundamentals have been around since the time of the Dutch "Tulipmania" of 1636-1637, and the South Sea bubble of 1720.

■   Recent examples of bubbles include the late 1980s bubble in the Japanese property and equity market, and the late 1990s internet bubble in most major stock markets.

■   The next figure plots the FTSE All Shares index and a stock price index representing only software stocks. Notice the huge increase in the value of software firms since 1996, followed by the subsequent collapse on early 2000.