EFFICIENT MARKETS: THEORETICAL HYPOTHESES AND EMPIRICAL TESTING

Open topic

ONE QUESTION

- Is there 100 yuan to pick up on the road?
- Answer 1: No. Because if there were, someone would have picked it up by now. (Classical efficient market theory)
- Answer 2: I don't know. Because everyone thinks like that, money is not necessarily someone to pick up. (Grossman - Mr Stiglitz paradox)
- Answer 3: There may be money, but we often can't find it. Because picking up money requires risk or skill. (The New Efficient Market Theory)

POPULAR UNDERSTANDING - THE CONTROVERSIAL POINT OF VIEW

- Arbitrage opportunities in the market are like money on the street.
- If anyone can pick it up without considering the legal and moral constraints, the money will soon be picked up as the news is constantly leaked out.
- Therefore, generally speaking, there is no money waiting to be picked up on the street. If any money is found, it is a rare event.
- There is no universal meaning to any "wealth cheats."

DEBATE

- Grossman and Stiglitz, 1980: Since everyone thought that there was no money to be found on the roads, no one thought about picking up money on the roads, so that if there was money, no one would pick it up. Then a wise man must think of the situation, and he will pick up the money that no one else can think of. So the wise man kept picking up money on the road. But since there are such smart people, and no one else is a fool, the money is quickly picked up.
- Solution: Information gathering costs money.

THE INTRODUCTION

- An early use of computers in the economic field in the 1950s was to analyze economic time series. Business cycle theorists believe that by tracing the development of certain economic variables in time, they can elucidate and predict the development of the economy in boom-and-bust cycles. A natural object of analysis is the performance of stock market prices over time.
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- Maurice Kendall The analysis of Economic Time Series, Part I: Prices, Journal of Statistical Society 96. was surprised to find:
- There is no definite, predictable pattern to share prices, and their movements are almost random. It can go up or down on any given day, regardless of past performance.
- In other words, past data provides no way to predict future price rises or falls!

- Kendall's conclusions have left financial economists in a quandary: is the stock market dominated by an uncertain market psychology? No logic at all?
- Conclusion: **Random changes** in stock prices indicate that markets are **functioning normally or efficiently**, not irrationally. As soon as there is any information indicating that a stock is underpriced and therefore offers a profit opportunity, investors flock to buy the stock and immediately bid up its price to a fair level, where only **ordinary rates** of return can be expected.

EFFECTIVENESS COMES FROM COMPETITION

- Why should we expect stock prices to reflect "all available information"?
- If you are willing to spend time and money on gathering information, it might seem reasonable that you could turn up something that has been overlooked by the rest of the investment community. When information is costly to uncover and analyze, one would expect investment analysis calling for such expenditures to result in an increased expected return.

- Grossman and Stiglitz 1980: They argued that investors will have an incentive to spend time and resources to analyze and uncover new information only if such activity is likely to generate higher investment returns. Thus, in market equilibrium, efficient information-gathering activity should be fruitful.
- Are different markets equally efficient? Emerging markets that are less intensively analyzed than U.S. markets or in which accounting disclosure requirements are less rigorous may be less efficient than U.S. markets. Small stocks that receive relatively little coverage by Wall Street analysts may be less efficiently priced than large ones. Still, while we would not go so far as to say that you absolutely cannot come up with new information, it makes sense to consider and respect your competition.

EXAMPLE

- Consider an investment management fund currently managing a $5 billion portfolio. Suppose that the fund manager can devise a research program that could increase the portfolio rate of return by one-tenth of 1% per year, a seemingly modest amount. This program would increase the dollar return to the portfolio by $5 billion 3 .001, or $5 million. Therefore, the fund would be willing to spend up to $5 million per year on research to increase stock returns by a mere tenth of 1% per year.
- With such large rewards for such small increases in investment performance, it should not be surprising that professional portfolio managers are willing to spend large sums on industry analysts, computer support, and research effort.

- With so many well-backed analysts willing to spend considerable resources on research, easy pickings in the market are rare. Moreover, the incremental rates of return on research activity may be so small that only managers of the largest portfolios will find them worth pursuing.
- Competition among these many well-backed, highly paid, aggressive analysts ensures that, as a general rule, stock prices ought to reflect available information regarding their proper levels.

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1. EFFICIENT MARKET HYPOTHESIS

In 1965, Eugene Fama of the University of Chicago published an article entitled "Stock Market Price Behavior" in the Journal of Business and put forward the famous efficient market hypothesis.

- According to the hypothesis, in a society full of information exchange and information competition, a piece of specific information can be quickly known by investors in the stock market. As soon as there is any information indicating that a stock is underpriced and therefore offers a profit opportunity, investors flock to buy the stock and immediately bid up its price to a fair level, where only ordinary rates of return can be expected. These "ordinary rates" are simply rates of return commensurate with the risk of the stock.
- Therefore, the notion that stocks already reflect all available information is referred to as the efficient market hypothesis (EMH).
- Efficient market hypothesis (EMH) is the core of quantitative capital market theory and one of the theoretical cornerstones of modern financial economics.

- The return rate of stock price follows the random walk model

$$E(\tilde{r}_{j,t+1} \mid \Phi_t) = E(\tilde{r}_{j,t+1})$$

Φ_t indicates the information set of period T

2. THE HYPOTHESIS CONDITIONS OF THE EFFICIENT MARKET HYPOTHESIS

- Hypothesis 1: No cost of obtaining information
- Hypothesis 2: No cost assumption of transaction process
- Hypothesis 3: The participants are completely rational. Investors are all rational "economic men" who pursue personal utility maximization. They have the same intelligence level, the same analytical ability, and the same interpretation of information. The stock price fluctuation is completely the result of investors' rational expectation based on complete information set.

A FURTHER EXPLANATION OF THE HYPOTHESIS

- 1. All investors in the capital market are rational, they can make rational evaluation of securities, and the market is efficient.
- 2. When some investors are irrational, the randomness of their trading performance will cancel each other out without having any effect on asset prices, because there will be no systematic price deviation.
- 3. Even if these irrational transactions deviate from rational standards in the same way, the existence of rational arbitrageur in competitive market will eliminate its influence on prices and make asset prices return to fundamental value, thus ensuring the effectiveness of capital market. Finally, irrational traders will gradually reduce their wealth and be driven out of the market.

3. THE CONTENT AND ANALYSIS OF THE EFFICIENT MARKET HYPOTHESIS

- (I) Definition:
- Fama's definition of an efficient market:
- **An efficient market is defined as a market where there are large numbers of rational, porfit - maximizers actively competing, with each trying to predict future market values of individual securities, and where important current information almost freely available to all participants.**
- **In a efficient market ,competition among many intelligent participant leads to a situation where ,at any point in time actual prices of individual securities already reflect the effects of information based both on events already occurred and on event which, as of now the market expect to take place in the future.**
- **A market in which prices always "fully reflect" available information is called "efficient"**

VERSIONS OF THE EFFICIENT MARKET HYPOTHESIS

- **The weak-form hypothesis :** The weak-form hypothesis asserts that stock prices already reflect all information that can be derived by examining market trading data such as the history of past prices, trading volume, or short interest. This version of the hypothesis implies that trend analysis is fruitless. Past stock price data are publicly available and virtually costless to obtain. The weak-form hypothesis holds that if such data ever conveyed reliable signals about future performance, all investors already would have learned to exploit the signals. Ultimately, the signals lose their value as they become widely known.
- Corollary 1: If the weak efficient market hypothesis is true, technical analysis of stock prices will not work, and fundamental analysis may help investors to obtain excess profits.

- **The semi-strong form hypothesis** : The semi-strong form hypothesis states that all publicly available information regarding the prospects of a firm must be reflected already in the stock price. Such information includes, in addition to past prices, fundamental data on the firm's product line, quality of management, balance sheet composition, patents held, earning forecasts, and accounting practices. Again, if investors have access to such information from publicly available sources, one would expect it to be reflected in stock prices.
- Corollary 2: If the semi-strong efficient hypothesis is true, then the use of technical analysis and basic analysis in the market is useless, and the inside information may gain excess profits.

- **The strong form hypothesis :** The strong-form version of the efficient market hypothesis states that stock prices reflect all information relevant to the firm, even including information available only to company insiders. This version of the hypothesis is quite extreme. Few would argue with the proposition that corporate officers have access to pertinent information long enough before public release to enable them to profit from trading on that information. Indeed, much of the activity of the Securities and Exchange Commission is directed toward preventing insiders from profiting by exploiting their privileged situation. Rule 10b-5 of the Security Exchange Act of 1934 sets limits on trading by corporate officers, directors, and substantial owners, requiring them to report trades to the SEC.
- Corollary 3: In a strongly efficient market, there is nothing that helps investors make excess profits, not even funds or insiders.

CHARACTERISTICS OF EFFICIENT MARKETS

- **The market has no memory**: As long as the current price contains all the information about the past price, the past memory is of no help to the future price prediction, and the price change is purely random walk, thus negating the technical analysis.
- The change in the price of a security from one stage to the next should be random, so that a change in the price today is not related to a change in the price that occurred yesterday or any day in the past

- Security prices should quickly and accurately reflect new information and information gathered about future pricing.
- **The market price is reliable:** The price of securities has a high elasticity of supply and demand. A small change in price will immediately lead to a change in the relationship between supply and demand, and a new equilibrium will be formed immediately. Therefore, it is impossible to continuously obtain returns that exceed the average level of the market. Various financial illusions, such as making earnings look different because of rights issues or changes in accounting methods, are ineffective in the long run. The more efficient the market, the less financial packaging matters.

4. APPLICATION OF THE EFFICIENT MARKET HYPOTHESIS

- The creation of index funds : Since the market price reflects the real price of a stock given the available information, there is no need to make a futile effort to select a stock. But a single stock cannot spread unsystematic risk, so the market has created a demand for portfolio investment, namely index funds.
- Index fund: A fund that invests in a portfolio based on the principles of an index. The cost of managing index funds is lower than that of other investments, because it eliminates the need for technical analysis tools and the research and data required for basic analysis.
- 1976, vanguard Index Fund, in line with the STANDARD & Poor's 500 index. From 1982 to 1997, it exceeded 85% of active index funds.

5. THE FLAWS OF THE EFFICIENT MARKET HYPOTHESIS

- The efficient market hypothesis embodies the economist's dream market equilibrium completely, but the theory was derived under the given assumptions, on the one hand, assuming that does not accord with reality, on the other hand, the theory cannot be actively guide people's behavior, asking people to do nothing, because under the efficient market, what is also futile. But if people do nothing, how is that information reflected in prices? How can markets be efficient? Moreover, there are various phenomena in financial markets that contradict the efficient market hypothesis.

FLAWS IN THE HYPOTHESIS

- Investor information asymmetry:
- 1. There is too much relevant information in the securities market, and it is impossible for investors to obtain all relevant information in the limited time.
- 2. There is a cost to developing existing but unpublished information, and there is a risk that both individual and institutional investors will abandon the development in anticipation of recession.
- 3. The provider of information may conceal or falsify information in order to amplify or minimize it. In addition, it is difficult for investors without higher education and professional training to make a correct judgment on the available information.

FLAWS IN THE INSPECTION

- Fama1991: market efficiency is untestable.
- Efficient market test must rely on models related to expected returns, such as CAPM and APT. If the actual return does not match the expected return given by the model, the market is invalid.
- The efficiency of the market must be demonstrated at the same time as the related expected return model.
- Paradox: the expected return model is based on the assumption of market efficiency, and when the market efficiency is tested, the expected return model must be assumed to be correct.
- Hawawini and Keim 1995: I hope this problem can be solved in the future.

6. NEW DEVELOPMENTS IN FINANCIAL ECONOMICS

- EMH means that any predictability of prices is either a statistical error that will soon disappear from the sample or is unexploitable due to transaction costs. Therefore technical analysis is useless.
- However, in securities and financial markets, the return rate of assets or asset portfolios with certain characteristics still exceeds the expected return rate after adjusting for risk. This phenomenon, contrary to the EMH, is known as a market anomaly.

CLASSICAL FINANCE

- Classical finance was developed on the basis of the rational man hypothesis and the efficient market hypothesis. With further development, the analytical framework of general equilibrium (Arrow and Debreu, 1954) and no arbitrage pricing theory [1] was introduced, and a large number of original theories were incorporated into the system as an opportunity. It includes Markowiz's portfolio theory, Modigliani-Miller's corporate finance theory, Sharpe's capital asset pricing theory, Fama's efficient market theory, Black -- Scholes -- Merton's option pricing theory and Ross's arbitrage pricing theory. The development of classical financial theories has well explained the pricing problems and the operation mechanism of financial markets, especially the latter has become the model of classical finance. Classical finance, which was born in the middle of the 20th century, gradually became the foundation of modern finance. And its good explanatory power and a large number of very fruitful research literature established the dominant position in the field of financial investment[1] The most basic underlying asset of financial assets generally determines its own price under the equilibrium framework, while the pricing of financial derivatives follows the no-arbitrage pricing principle (Zhang Shengping et al., 2003)

- As a theory describing price reflecting information, efficient market theory mainly focuses on the explanation of price's reaction ability, degree and speed to various information that affect prices, namely, the efficiency of the market. In the mid-1950's and early 1960's many scholars, consciously or unconsciously, accumulated evidence that the behavior of common stocks and other speculative prices could be approximated by a random walk, and this evidence led economists to engage in some rational discussions, resulting in the theory of efficient markets as described by the random walk. In fact, The random walk model was first described and tested in 1900 by France's Bachelier, whose contributions were ignored for more than 60 years. The "fundamental principle" of price behaviour, he argues, is speculation, and the expected profit for the speculator should be zero. This should be regarded as a "fair game", which is basically a martingale [1] according to the modern theory of stochastic process.
- [1] If the efficient market hypothesis holds, it means that the dynamic law of asset prices in a capital market with sound functions and unimpeded information can be described by (submartingale), that is, the best estimate of the future price of an asset is its current price corrected by a "fair" expected rate of return. Under this assumption, attempts to use past prices or public information about future economic conditions to predict the price of a security are doomed to failure. In fact, a large number of financial theories, including asset pricing model and Black-Scholes option pricing formula, are premised on the efficient market hypothesis. Along this line, a large number of empirical studies have followed to validate "efficient markets".

- The efficient market hypothesis that when various can affect the price of new information, the stock traders can also receive information and to assess its impact on stock price, and then immediately trading action, make shares with the emergence of new information to adjust quickly, the share price is overvalued or undervalued, can only maintain in a state of equilibrium, Market participants only get risk-adjusted market returns. According to this hypothesis, three efficient market forms are summarized [1] : weak efficient market (the price of securities assets can fully and timely reflect the relevant historical information); Semi-strong efficient market (the price of securities assets can fully and timely reflect the relevant historical information and public information); Strong efficient markets (prices reflect historical, public and inside information). After that, EMH developed vigorously, its connotation deepened and its extension expanded, and finally became one of the pillar theories of modern financial economics.

AN ANOMALY IN THE BOND MARKET

- In addition to the stock market, the bond market and the futures market also appear market anomalies that cannot be explained by the rational model and the efficient market hypothesis.

- The discovery of these market anomalies not only contributes a lot to the efficient market hypothesis and financial theory academically, but also has important practical significance to the establishment of investment ideas and the design of investment strategies in the stock market. However, the efficient market hypothesis has been embarrassed to explain the financial anomalies. Because of this, its explanatory power as a mainstream financial theory has also declined as the market anomalies have been gradually discovered. The challenges to the theoretical basis of EMH are as follows: it is difficult to establish the assumption that investors are completely rational. In fact, people in the real world are bounded rational and their behavioral biases are systematic. The actual market arbitrage [1] is limited and risky, and the arbitrage also faces uncertainty from future asset prices. The challenges to EMH experience test are as follows: the overreaction of financial asset price puts forward a powerful challenge to the weak efficient market theory; The small firm effect obviously violates the semi-strong efficient market hypothesis. Finally, the assumption that prices do not react in the absence of information has come under attack: research has shown that other forces besides information are driving the movements of stock prices.

- [1] Shleifer and Vishney put forward arbitrage restrictions, arguing that due to the existence of many objective constraints, the market behaviors of irrational traders cannot be offset. Arbitrage does not maintain the equilibrium of the security market as the mainstream financial theory believes, and the market is not efficient. Arbitrage is limited mainly by (1) time constraints. If an investor can sell short and borrowings securities from a brokerage firm, he will buy back the securities to repay the brokerage firm within 30 days, but if the price does not move within 30 days or moves in the opposite direction, 30 days after the rational return, the arbitrage will fail. (2) If all the arbitrages are carried out in the same direction, it will be difficult to borrow securities if short selling occurs, so the arbitrage is not valid; (3) transaction cost and limitation of time and space (4) restrictive provisions of laws and policies, etc.