Market Rationality: Efficient Market Hypothesis versus Market Anomalies

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Abstract

Market efficiency theory suggests that market is rational and provides correct pricing. That is, the current prices of securities are close to their fundamental values because of either the rational investors or the arbitragers' buy and sell action of underpriced or overpriced stocks. On the other hand, observed market anomalies have a challenge for this argument. They claim that irrational investment activities and the arbitrage opportunities' being limited in markets cause some market anomalies that are inconsistent with efficient market hypothesis. The most commonly seen anomalies are the ''volume'', ''volatility'', ''cash dividends'', ''equity premium puzzle'', and the ''predictability''.

This work is a literature survey, and its main objective is to deal with efficient market theory and market anomalies in order to examine the question ''Are markets rational or not"?

Keywords: *Market Rationality, Efficient Market Hypothesis, Arbitrage, Market Anomalies*

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Introduction

According to the traditional finance, markets are ‘‘rational’’; that is, they are efficient in the sense to reflect the correct prices supporting the efficient market hypothesis. On the other hand, behavioral finance argues about this kind of market rationality with the observed market anomalies that are not explained by the arguments of the efficient market hypothesis. Many researchers including DeBondt and Thaler (1985), Black (1986), De Long et al. (1990), Shleifer and Vishny (1995), Thaler (1987, 1999), etc. exhibited many observed market anomalies. However, despite many observed market anomalies, the efficient market hypothesis is still the dominant paradigm in order to organize and rule the markets. In this sense, the aim of this study is to deal with efficient market theory and market anomalies in order to examine the question ‘‘are markets rational or not"? Because if markets are not rational as traditional finance presumes, all the market rules, dynamics and mechanisms have to be questioned.

The paper will begin with a history of the market efficiency from the start of random-walk theory and the forms of the efficient market hypothesis. Next, the arguments about the concept of arbitrage which is one of the main important assumptions of market efficiency will be elaborated. Finally, observed market anomalies that are not explained by the arguments of the efficient market hypothesis will be presented.

Efficient Market Hypothesis

Historical Development of Efficient Market Hypothesis

We first see the concept of *market efficiency* by Louis Bachelier in 1900. He worked on stock and commodity prices in order to find out if they fluctuated randomly or not. In 1905 Karl Pearson introduced *random-walk*, also known as the *drunkard-walk* concept (Dimson et al., 1998:91-92). Unfortunately, Bachelier’s first attempt showing the difficulty to outguess the market and the random characteristics of the prices and also Pearson’s random-walk concept was ignored or at least no further study had come until 1930s. Cowles (1933) presented the results of analysis of the forecasting efforts of some professional agencies including insurance companies, investment professionals and financial publications which have attempted to predict which specific securities would be most profitable and the future movements of the

stock market itself. He found that these professional agencies have no obvious skills to beat the market. Subsequently, Cowles (1944) continued his research on stock market forecasting and did a similar study, but this time extended the sample period. In his later study, he found that the record of the forecasting agency with the best result is only 3.3% better than the forty years average of the stock market return. Kendall (1953) who for the first time used the term random-walk in finance literature, examined 22 British stock indexes and American commodity prices in order to find out regular price cycles. He found that prices seemed to follow a random-walk; they may go up or go down on any particular day, regardless of what had occurred on the previous day. Roberts (1959) found similar results with American data for both indexes and individual companies and verified that changes in the Dow Jones Index seem to be generated from a cumulated random number. Osborne (1959) demonstrated that US stock prices seemingly have random movements just like molecule particles.

Fama (1965a) discussed some empirical evidence supporting random-walk theory in his doctoral dissertation. Later, he (1965b) presented a condensed, non-technical version of his PhD thesis at the 1965 Management Conference in University of Chicago. Fama (1965b) uphold random-walk theory as an accurate description of reality. He then, challenged proponents of *technical* and *fundamental* analyses in order to prove their arguments. At that time, the technical or fundamental analyses were the commonly used and supported methods in predicting the stock prices by the market professionals.

Fama positioned random-walk theory which has appeared in academic journals, but has not been appreciated in later years, against the technical and fundamental analysis which is too complicated for the non-mathematicians. As he declares, the logic behind the technical (chartist) theories is that history tends to repeat itself. That is, if we look at the past behavior of an individual security or a stock market itself, we can foresee their future path by analyzing past sequence of price changes. According to him, it is impossible to gain abnormal profit by looking at the history of the price change series because successive price changes are independent (chartist theories says dependent), exactly what random walk theory says. Moreover, he thought that the market professionals rely on the fundamental analysis rather than technical because the technical analysis has not a secure basis. The assumption of the fundamental analysis approach depends on the belief that security has an intrinsic value other than actual price. Intrinsic value is the value of a security's potential earnings. Some fundamental factors such as quality of management, the overall situation of the industry

in which the firm operates and the economic condition itself can affect a security's potential earnings. Therefore, an analyst can predict the future price of a security by evaluating these fundamental factors by finding out the intrinsic value and comparing it with the security's actual price. If actual price of the security is lower than its intrinsic value, sooner or later the actual price will go up through its intrinsic value and vice versa. Against the logic behind the opponents of fundamental analysis and Fama (1965b:3-4), for the first time in literature, defined an *efficient market* as:

> "a market where there are large numbers of rational profit maximizers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants".

This definition implies that a multitude of rational participants who compete with one another lead to the elimination of discrepancies between the actual prices and intrinsic values even though the latter are hard to estimate. The neutralization process of discrepancies between the actual price and the intrinsic values will cause the actual price fluctuates randomly around its intrinsic value. The actual or expected new information can change the intrinsic value. According to Fama, in this situation, the actual prices will be immediately changed by absorbing the new information and try to find the new level of intrinsic value because of high competition between many intelligent participants. Around the same time, Samuelson (1965:41) demonstrated that the series of successive price changes are independent by claiming that:

> "in a competitive market there is a buyer for every seller and if somebody is sure that a price would rise, it would have already risen"

He inferred that the unpredictability of prices was the sign of efficient working of the stock markets.

Fama (1970) presented a landmark paper on the efficient market which focused on comprehensive review of the theory and beyond the theory to empirical work. He defines market efficiency very clearly (Fama, 1970:383):

> "A market in which prices always fully reflect all available information is called efficient."

According to the definition of the efficient market hypothesis, an efficient market can exist if the following conditions hold (Jones, 1993:626; Shleifer, 2000:2):

i. A large number of rational profit maximizing investors exists who actively participate in the market, hence value securities rationally.

ii. If some investors are not rational, their irrational trades are canceling each other out or rational arbitrageurs eliminate their influence without affecting prices.

iii. Information is costless and widely available to market participants at approximately same time. Investors react quickly and fully to the new information, causing stock prices to adjust accordingly.

The Forms of the Market Efficiency

In the definition of the ''relevant information set'' that prices should reflect, Fama distinguished three nested information sets: past prices, publicly-available information, and all information including private information (Kondak, 1997:36). Efficient market hypothesis is divided into three stages as the weak form, semi-strong form, and the strong form with respect to the availability of the above mentioned three information sets.

Weak form of efficiency claims that the current stock prices already reflect all historical market data such as the past prices and trading volumes (Bodie et al., 2007). The assertion of weak form of efficiency is very much consistent with the findings of researches on random walk hypothesis; that is, the price changes from one time to another are independent (Dixon et al., 1992). In other words, one can not make a superior profit by only examining the historical prices information. Therefore, the technical (trend) analysis which is a technique using the derivation of past price movements in order to find out a meaningful sign to predict the future path of an individual stock or stock market itself is useless (Jones, 1993). However, one can beat the market and make superior profits in the weak form of efficient market by using the fundamental analysis or by insider trading.

Semi-strong form of efficiency states that, in addition to the past prices, all publicly available information including fundamental data on the firm's product line, earnings forecasts, dividends, stock split announcements, quality of management, balance sheet composition, patents held, accounting practices etc., should be fully reflected in security prices. Thus, one can not make a superior profit by using the fundamental analysis in the market which is efficient in the semi-strong form. It is obvious that technical analysis can not work at the semi-strong form of efficient market because, if a market is efficient in the semi-strong form, it is also efficient in the weak

form, because past prices are also publicly available information (Dixon et al., 1992; Bodie et al., 2007). However, insider traders can make superior profits in semi-strong form of efficiency.

Strong form of efficiency states that market prices reflect all information including both the past prices and the all publicly available information, and plus all private information. In such a market, prices would always be fair and any investor, even insider traders, can not beat the market (Brealey et al., 1999). Again, none of the technical and/or fundamental analysts can beat the market to make an abnormal return in strong form of efficiency because, if a market is efficient in the strong-form, it must be efficient in both the weak form and the semi-strong form. Thus, the techniques that do not work in the weak form and the semi-strong form efficient markets naturally can not work in strong form efficient markets. Figure 1 exhibits the three nested information sets and the types of market efficiency.

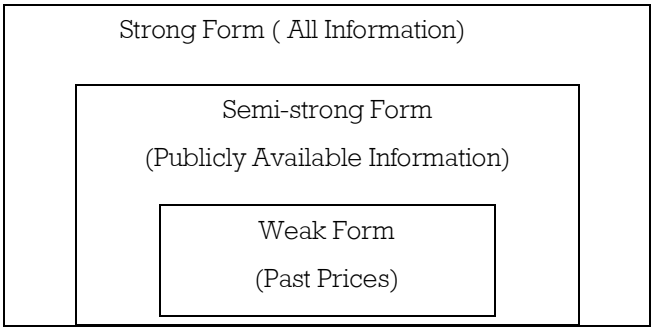

Figure 1: Cumulative levels of market efficiency and the information associated with each level (Jones, 1993:628)

Market Efficiency and the Arbitrage

The efficient market hypothesis has *three* basic assumptions. *First*, investors are rational; that is, they value the securities with respect to their fundamental value. As discussed at the previous section, when investors learn something about a security, they immediately reflect this knowledge to the price of that security. *Second*, some investors may be irrational; however, their investing activities are in the random fashion and uncorrelated; therefore, their trading cancels each other without affecting the price. The logic behind this assumption is that investors' trading activities are poorly correlated with each other. *Third*, if they are highly correlated with each other,

which means if they do not cancel their irrational activities out, this time some professional *arbitragers* eliminate their activities, and make profits. In short, efficient market hypothesis says that the current prices of securities are close to their fundamental values because of either the rational investors or the arbitragers' buy and sell action of under or overpriced stocks (Shleifer, 2000). However, some empirical evidence tells a different story. Black (1986) called the irrational investment activities as a *noise*, because investors value the securities on a noise rather than by using the information about the securities. Moreover, according to De Long et al. (1990), the beliefs of irrational investors' affect the securities' prices and more importantly create a risk which causes to block the willingness of arbitragers to position against the irrational investors in order to gain a profit which they called a *noise trader risk*.

The logic behind the noise trader risk is the unpredictability of noise traders' future opinions. An arbitrager will give up or be afraid of an arbitrage, because of the possibility of noise traders' continuation of irrational investing activities. That is, an arbitrager who buys an underpriced security relative to its fundamental value has not ignored the possibility of the continuation of the noise trader pessimism in the near future. Otherwise, when they need to sell the security in order to liquidate the investment they will face an unexpected loss. This situation is also valid for securities which are overpriced relative to their fundamental values. An arbitrager who sells an overpriced security in short thinks it will soon lose value and he or she can buy it at the low value relative to its selling price. However, again, an arbitrager must be aware of the possibility of noise trader optimism continuing in the near future (De Long et al., 1990).

Moreover, besides the risk that mispricing becomes more extreme by the noise trader, there is another limitation against an arbitrage. That is, who makes the arbitrage? Fama (1965a, 1965b) viewed the arbitrage as an activity which involves a large number of investors taking small position against mispricing. According to Shleifer and Vishny (1995), it is an activity which is done by relatively few and highly informed professional investors who use the resources of outside investors to take a large position. If this view is true, then an arbitrager has to attract outside funds in order to make an arbitrage in a market because the greater deviation from the fundamental value needs greater funds for an arbitrage activity. However, usually investors are not well informed about markets and only few of them can distinguish a good arbitrager from the bad one and they evaluate the performance of the arbitrager with respect to his or her past track records. Therefore, investors supply limited resources to arbitragers and increase or decrease the limits or even withdraw the funds causing the arbitrage position to shut down before it has profit. As a result, despite the greater mispricing of securities from their fundamental values gives a

chance to have a superior profit to an arbitrager and brings prices close to their fundamental values, arbitragers avoid such an activity (Shleifer et al., 1995).

The Market Anomalies

There are many observed market movements that are not explained by the arguments of the efficient market hypothesis. In the standard finance theory, such market movements that are inconsistent with the efficient market hypothesis are called *anomalies* (Bostanc», 2003). According to Tversky and Kahneman (1986:252) *"an anomaly is a deviation from the presently accepted paradigms that is too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system".*

The most commonly seen anomalies are (Thaler, 1999:13-14):

i. Volume
ii. Volatility
iii. Cash Dividends
iv. The Equity Premium Puzzle
v. Predictability

Volume

If investors are rational as stated in the expected utility theory and the efficient market hypothesis, they do not trade too much except when they need liquidity and have desire to re-shape their portfolios. We expect too little investing activities by only using the publicly available information from the rational investors; however, we visualize millions of buying and selling orders in stock markets even when no apparent reasons exist. For example, New York Stock Exchange (NYSE)'s total volume is approximately 5-6 billions in a normal day where around 3600 stocks are listed. In such a market, it is impossible to explain the exchange of the 700 millions IBM shares in a day even there was no reason. Which information is used by the seller and why does not the buyer have that information if they invest by using all the available information (Bostanc», 2003; Oran, 2008; Thaler, 1999)?

Volatility

In the standard finance theory, the value of a stock is found by discounting its expected future dividends to present. From the efficient market point of view, the price of a security changes only when there is dividend expectation or when new information has arrived. However, there are too many cases of excess volatility observed in stock markets that could not explained by market efficiency perspectives (Oran, 2008). LeRoy and Porter (1981) and Shiller (1981) studied S&P 500 Index, DJIA and some *blue chip* stocks and showed that the volatility in securities is five to thirteen times higher than the changes in present value of future dividends.

Cash Dividends

According to Black (1986), dividend policy is a tool through which managers can communicate with company's shareholders especially for the things that they do not want to say sharply and quickly. Therefore, it has been always an important indicator for the determination of market price. The commonly used dividend policies are cash-dividend, stock-dividend, stock-splits and stock-repurchase plans (Brealey et al., 1999). According to Miller and Modigliani (1961), dividend policy is irrelevant in determining the value of the company and its stock price under the no tax world assumption. Unfortunately, we do not have this kind of ''perfect world''; on the contrary, tax concerns always exist. At this point, the cash-dividend anomaly occurs. That is, if the company wants to give stock to its shareholders as dividends and if the shareholders want to realize their gains by selling the stock, then it is subject to capital gain. It is valid both for the stock-splits and stock-repurchases by the company. Moreover, capital gains are subject to tax only when realization happens. However, in most countries, cash dividends are subject to higher income tax rates than capital gain. Nonetheless, cash dividends are more preferable than others despite higher tax disadvantage (Miller, 1986). Moreover, when the company announces a cash dividend program, its stock price rises (Long, 1978). While, whether the reason for this is market inefficiency is highly controversial, it remains as an anomaly and needs to be answered (Thaler, 1999).

The Equity Premium Puzzle

Mehra and Prescott (1985) compared the historical returns of stocks and Treasury Bills (T-Bills) for the first time in the United States using relevant data dating back to 1926. Later, it was updated by Mehra (2003) extending the historical data from

1889 to 2000, and including data from the United Kingdom, Japan, Germany, and France. The average yearly return of the market index in the United States was 7.9% after inflation adjustment, where the T-Bills' average annual real return was only 1% between the years 1889 and 2000. This means that about 6.9% equity premium has been realized in every year for about a period of 110 years in the USA. The premium between the market index and the relatively riskless security is so dramatic in the period between 1926 and 2000. The mean real return of market index was 8.7% where the inflation adjusted rate of return of T-bills was only 0.7%. It simply means that if you invest 1$ in the market in 1926, it becomes nominally 2,586.52$ and 266.47$ after the inflation adjustment in 2000. On the other hand, if you invest in T-bills rather than market index in the USA, your 1$ becomes 16.56$ nominally and only 1.71$ in real terms in 2000. Furthermore, we realize same type of equity premiums in England, Japan, Germany and France where the average inflation adjusted premium between market index and these countries' government bonds varies from 6.6% to 4.6%.

To sum up, we have a clear picture as shown in the real data that stocks outperformed T-bills with a high margin what Mehra and Prescott (1985) called "the equity premium puzzle". In such a case, why do not people invest all their savings in stocks rather than holding T-bills? Benartzi and Thaler (1995) explained this puzzle-anomaly with the notion of *myopic loss aversion* and the *mental accounting* which are the factors affecting the investors' psychology.

Predictability

According to efficient market theory, it is impossible to predict the future path of the security prices by using the available information in the market. However, there are numerous types of empirical evidence suggesting that it can be possible to predict future prices by utilizing, for example, dividend yields, price-earnings ratio, earnings-price ratio, price-to-book ratios, earnings announcements, size of the company, share repurchases, initial public offerings, etc. (Thaler, 1999).

Rozeff (1984) and Fama and French (1988) used dividend yields (D/P) and found out meaningful clues to predict the future returns of stocks; that is, if the yield is high, then the stock return will be high.

Campbell and Shiller (1988) used earnings-price ratio (E/P) and found E/P ratio is a powerful tool for the prediction of stock return especially when the past earnings averaged over 10 years.

Basu (1977) used price-earnings (P/E) and found that stocks that have low P/E ratio tend to outperform over the stocks that have a relatively high P/E ratio relatively.

Lakonishok, Shleifer, Vishny (1994) used price-to-book ratios (P/B) and found that the stocks with low P/B provided higher return than the stocks with high P/B.

Ball and Brown (1968) noted for the first time a delayed reaction to the earnings announcements that cause a possible prediction of abnormal return. They labeled this under-reaction fact as *post-earnings-announcement drift* which is later confirmed by Foster et al. (1984) and Bernard and Thomas (1989). A large part of the post-earnings-announcement drift occurs within 60 trading days despite some evidence of occurrence within up to 180 trading days (Bernard et al., 1989). The under-reaction of the stock prices to the publicly available, easy to reach earning announcements varies between 5.3% and 2.8% relative to the size of the company causing larger post-announcement drift (Foster et al., 1984). Similar to the earnings announcements, Michaely et al. (1995) investigated the effect of dividend omissions and initiations over the market price and found a long-term drift after the dividend initiations, but mainly for omissions announcements.

Banz (1981) and Reinganum (1981) showed another surprising anomaly, ''size effect'', against the market efficiency. That is, the average stock returns of the smaller firms' portfolio is higher than that of larger firms' portfolio by an average of 10.3% annually. Many subsequent empirical studies also suggest that the existence of the inverse relationship between the size of the firm and the average return of the firms' stocks. Two of them are Arbel and Strebel's (1982) study about the *neglected firm effect*, and Amihud and Mendelson's (1986) study labeled *liquidity effect*. Actually, both the neglected firm effect and the liquidity effect are highly related to the *size effect*; indeed probably a result of it. That is, because the information about the small firms is less available, they can be neglected by the institutional investors causing lower liquidity in these stocks. Thus, these non-brand names, less liquid, unpopular kind of stocks may provide an abnormal return especially in January.

Another anomaly which needs to be clarified is the negative performance of the initial public offerings (IPOs) in the long run which is asserted by Ritter (1991) and Loughran and Ritter (1995). After a careful evaluation of over 1500 IPOs in the USA in the period between 1975 and 1984, Ritter (1991) found that if an investor bought from IPOs and held it for 3 years, his or her terminal value of the 1$ purchased stock would be 1.3447$ whereas his or her terminal value of the 1$ worth of matching firms' stock became 1.6186$. IPOs' underperformance was around 16.9%.

Perhaps the most highly debated and controversial anomaly against the market efficiency is the *overreaction hypothesis*. DeBondt and Thaler (1985, 1987) investigated the future performance of the past losers and past winners. They formed a portfolio consisting of top 50 extreme stock winners and 50 extreme stock losers from NYSE in the period 1926-1982. Prior losers' portfolio outperformed by an average of 31.9% over the prior winners' portfolio within the three-to-five year period. Abnormal returns especially for the losers' portfolio occurred mostly in January. Dreman and Berry (1995) confirmed the overreaction and asserted a *mispricing-correction hypothesis* which is the process of the investors' correcting action of the over or under-valued prices (original misprice) through its fundamental value in the long run.

Besides all these anomalies about the predictability of stock prices, there are also anomalies about the seasonal movements in security prices. Very briefly, the day-of the week effect or weekend effect is the anomaly of positive stock return in Fridays and the negative stock return in Mondays. The intra-day anomaly is related with the continuous positive or negative stock return measurable in the specific hours or minutes. The January-effect anomaly is the fact that returns of the securities are higher in the January than the other months of the year. It is observed especially for the stocks which have low P/E ratio, and which are past losers or small size firms. The intra-month anomaly is the different return levels of second part of the month (days from 15 through 30) relative to the first part of the month or vice versa in any month of the year. The turn-of-the-month anomaly is the higher stock return in the last couple of days of previous month plus the first couple of days of the current month relative to the other days of the month in any month of the year. The turn-of-the-year anomaly is the higher stock return in the last couple of days of December plus the first couple of days of January relative to the other days of the year. The holiday's anomaly is related with the abnormal returns of stocks before the start of various holidays (Özmen 1997; Barak, 2008). Also, there are other anomalies related with weather, emotional state of human beings, geomagnetic storm, etc. (Oran, 2008).

Conclusion

There is no question about the existence of empirically observable market anomalies. Even, Fama (1991) accepts their existence. The question is whether these occur because of inefficiency of the market or some other problems and by chance. It is easy to discover an anomaly inconsistent with the efficient market hypothesis; however, highly difficult to explain the reason for their occurrence. Two views have been proposed to explain the anomaly. One side lead by Fama and French (1998)

claimed that the resulting problems (anomalies) are caused by asset pricing theories, or they can be attributed to chance. The other perspective lead by Kahneman and Tversky (1979) tries to explain anomalies by behavioral approaches. According to behavioral approach, investors suffer some cognitive limitations when they have to make decisions. Those cognitive limitations cause erroneous (irrational) investment decisions. Investors' systematic erroneous investment decisions are the barriers in front of arbitrage which cause inefficient markets.

Market rationality is the dominant paradigm in order to organize and rule the markets, and if Fama and French (1998)'s perspective is not true, then these market rules, dynamics and mechanisms will be questioned. However, there is an ongoing debate about the possible reasons of observed market anomalies and whether they are the powerful sign for inefficiency of the market or not. Still, there is much to be done in this area.

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