

The modern finance theory is based on the capital asset pricing model

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Abstract

As some anomalies are hardly explained by the traditional finance, the behaviour finance is introduced. It was first introduced by Kahneman and Tversky (1979), which they presented the prospect theory. In fact, investors' behaviour often violates the expected utility theory, some of them trade irrationally. Then Shefrin and Statman (1994) base on the CAPM, and put investor sentiment into the model to make the BAPM. They thought noise traders and information traders would interact and influenced the price setting, including the noise traders' behaviour in the BAPM let the asset pricing more precise. Another important theory is the behavioral portfolio theory. The theory states that when investors choose portfolios, they on the one hand want to be security, while on the other hand they potentially also want to reach aspiration levels. So it lets BPT investors to choose bonds and lottery tickets together come true. According to these phenomenon which happen to investors' portfolio selection, many researchers give their explanation. Generally speaking, behaviour finance is based on two theories, which is limits of arbitrage and investor sentiment. DSSW model is based on the former theory while BSW model, DHS model and HS model are based on the latter one. There are also some more models in the behaviour finance area. These models can explain some anomalies, such as Closed-end fund puzzle and the equity premium puzzle. In this paper these two anomalies would be treated as examples to explain how behaviour finance explain these anomalies.

Introduction

The modern finance theory is based on the capital asset pricing model (CAPM), Markowitz's Portfolio Theory, Arbitrage Pricing Theory (APT). The model CAPM is introduced by Sharpe (1964), Lintner (1965), and Black (1972). It provides the pricing mechanism of capital assets and the decision factor of risk is? (the relationship between firm returns and market returns). These theories are based on the Efficiency market hypothesis (EMH) and the CAPM can be used to test the EMH.

While its analysis framework confined within the scope of rational analysis, when more and more anomalies arise in the market, they are hard to be explained by standard finance which is based on the EMH. In this situation, the questioning of modern finance began when the prospect theory is introduced by Kahneman and Tversky (1979). And then the behavioural finance is introduced to explain these anomalies. The definition of behavioural finance is that

“ Behavioural finance- that is, finance from a broader social science perspective including psychology and sociology- is now one of the most vital research programs, and it stands in sharp contradiction to much of efficient markets theory.” (Shiller, 2003 p83)

It is a marginal subject and opposite to the traditional finance, and it tries to explain the importance of investors' emotion and mental mistakes, which would influence their decision-making process (Ricciardi and Simon, 2000).

At first, behaviour finance is marginalized as “ anomalies literature”

(Frankfurter and McGoun, 2000). it has been researched for a long time, and

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then it has been accepted after more and more journals focusing on the discussion of anomalies.

Section 2 of the paper explains three main theories of behaviour finance, which are prospect theory, behavioural capital asset pricing theory and behavioral portfolio theory. Section 3 presents some models which provided by the behaviour finance. Section 4 discusses the application of behaviour finance to explain anomalies. Section 6 concludes.

Theory

2. 1 Prospect Theory

Prospect theory is the one of the most important theory in the behavioural finance. Investors usually do not perform rationally, and prospect theory handles this issue. Expected Utility Theory is a kind of descriptive model which is used to make decisions under risks, and the result is a criteria for investors to choose. While a large number of experimental research shows that investors choices are inconsistent with the basic tenets of utility theory. Kahneman and Tversky (1979) classify these differences into some areas, which is certainty effect, reflection effect and isolation effect.

2. 1. 1 Certainty Effect

Certainty effect is people often underestimate outcomes which are probable when compare outcomes which are received with certainty (Kahneman and Tversky, 1979). In order to demonstrate this issue, Allais (1953) gives a series of choice problems. One of the problem is that:

Option 1: 2, 500 with probability 0. 33

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2, 400 with probability 0. 66

0 with probability 0. 01

Option 2: 2, 400 with certainty

The question is which option would give you the best chance to maximize your profits. The result shows that 82% of people choose the option 2 among 72 people, most of them violated expected utility theory. According to the expected utility theory, the profit in option 1 ($2500 \times 0.33 + 2400 \times 0.66 + 0 \times 0.01 = 2409$) is greater than the option 2 (2400), while people prefer choosing the profit which is certain rather than choosing the profit which is risk.

2. 1. 2 Reflection Effect

While when gains are replaced by losses, the result would be that the risk preference of people is contrary to the positive prospects, it transfers from risk aversion to risk seeking, and this is labeled as the reflection effect. For example, 92% of people choose a probability of 80% to lose 4000 when they are offered another choice which is a certainty loss of 3000. This example also shows that not only the positive domain violates the expected utility theory, but also the negative domain violates it in the same manner.

2. 1. 3 Isolation Effect

When people choose one investment between alternatives, they usually exclude the common factors to consider, and focus on their different components. This division would lead to different results, for the same pair of investments can be divided into common and distinctive components in

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many different ways. This phenomenon is called the isolation effect. For example there is two-stage choice problem, the first stage is that people have a probability of 0.25 to go to the second stage, and in the second stage, you have to have a choice between the winning 3,000 of certainty and winning 4,000 of 0.8 probability. The result states that 78% of 141 people choose the former one. While in this game, people should have had a choice between $0.25 \times 0.8 = 0.2$ possibility to win 4,000, and a $0.25 \times 1.0 = 0.25$ possibility to win 3,000, and this choice was demotrated by Allais (1953) that a marjor of people would choose a 0.2 chance to win 4,000. so in this situation, people ignore the first stage and based on the second stage to choose prospect.

Prospect theory divides the choice process into two phases, one is editing and the other one is evaluation. Editing phase is used to analyse the options in order to get the simplified result, evaluation is to evaluate the edited prospects and choose one which has highest value. Editing includes four operations which are coding, combination, segregation and cancellation.

According to the prospect theory, if a prospect is regular ($p + q < 1$, or $x \geq 0 \geq y$, or $x \leq 0 \leq y$), which also means neither strictly positive nor strictly negative, the equation would be:

$$(1) V(x, p; y, q) = \pi(p) v(x) + \pi(q) v(y)$$

In this equation, the total value of an edited prospect is denoted V , and it is expressed by two scales. The first scale π is connected with each possibility p and the decision weight is $\pi(p)$, the other scale is v , which the outcome is $v(x)$

with a number x . the value of prospect in Equation (1) is the same as the result of expected utility theory.

While if the prospects are strictly positive or strictly negative, they must use another rule. When prospects are in the editing phase, they are often divided into two parts, which is the riskless part and the risky part. The evaluation would use the next equation:

If $p + q = 1$ and either $x > y > 0$ or $x < y < 0$, then

$$(2) V(x, p; y, q) = v(y) + \pi(p) [v(x) - v(y)]$$

It means that the value of a strictly positive or strictly negative prospect is the same as the sum of the value of the riskless part and the value-difference between the outcomes multiplying the weight associated with the more extreme outcome.

Investors evaluation base on the value function and weighting function (Kahneman and Tversky, 1979). Prospect theory uses value function to explain the same meaning of utility. There are two arguments in the value function, the first one is the asset position which can be treated as reference point, and the other one is the magnitude of the change from the reference point. Value function normally concave for positive outcome and convex for negative outcome, and the losses is steeper than the gains. When the value approaches to the reference point, the value fuction is steepest, and the whole value fuction is S-shaped. Decision weights are usually different from the probability axioms, investors often overestimate the small probabilities, this situation often happens in gambling and insurance. While for other

situations, decision weights are commonly lower than the corresponding probabilities

However, there are two drawbacks existing in the prospect theory. Firstly, it uses the value function and weighting function to evaluate theory, while there are no specific functions and instead using examples to explain. It is a kind of experimental process. Secondly, there is no specific standard for reference point, it makes the theory not so precise.

2. 2 Behavioural Capital Asset Pricing Theory

The behavioural capital asset pricing theory is based on the capital asset pricing model (CAPM) and the difference is that the behavioural capital asset pricing theory consider the behaviour of traders. It focuses on the market which noise traders and information traders affect each other. Information traders are traders in the condition of CAPM, they obey the Bayesian learning rule to evaluate the returns and most importantly, they never make cognitive errors. However, noise traders are contrary to information traders, they commit cognitive errors and break the Bayesian rules. These two traders interact and determine the asset price. Market is efficient when information traders are dominant in the market, while if dominant traders are noise traders, market is inefficient.

What is the difference between markets in which prices are efficient and markets in which prices are not efficient? The main difference is that there is a single driver property existing in the market which prices are efficient. As Shefrin and Statman (1994, p345) said, " This single driver drives the mean-variance efficient frontier, the return distribution of the market portfolio, the

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premium for risk, the term structure, and the price of options." It satisfies the minimum information which required to cause the changes to the outcome distribution of the market portfolio. While a second driver is introduced to the market by noise traders, and it let the price far away from the price efficiency. They often create some abnormal returns to particular securities. The expected return of security is determined by behavioural β , which is the β of tangent mean variance efficient asset portfolio. Noise traders' action let the relationship between security returns and beta weaker. While at the same time, they built a positive relationship between abnormal returns and beta (Chopra, Lakonishok, and Ritter, 1992). When the prices are efficient in the market, price efficiency protects particular noise traders. At that time, the function of noise traders is to rise the trading volume. However, if the prices are not efficient, new information cannot be a sufficient statistic. Yet prices, volatility, the premium for risk, option prices and the term structure are still influenced by old information. Noise traders affect the return of securities through the term structure and they can arouse inefficient inversion which exists in the term structure.

The behavioural β is introduced by the behavioural asset pricing model (BAPM), when the noise traders are included in the model, the behavioural β represents a lower risk than the traditional β . The BAPM research a series of issues such as risk premium, the term structure, and option prices in the situation of existing noise traders. The BAPM not only considers the performance characteristics of value, but also includes the characteristics of utility, therefore, on the one hand it has to accept the market efficiency when considering the unbeatable market, on the other hand it must reject the

market efficiency when consider the irrational behaviours. This contradiction lead the finance to further research.

2. 3 Behavioral Portfolio Theory

The behavioural portfolio theory (BPT) is introduced by Shefrin and Statman (2000) and it is based on the SP/A theory (Lopes, 1987) and Safety-First Portfolio theory (Roy, 1952). Roy's (1952) safety-first theory and Markowitz's (1952a) mean-variance portfolio theory are introduced at the same year, however their opinion are different to the Friedman-Savage puzzle. The former theory is consistent with the puzzle while the latter one is not. SP/A theory is a psychological theory and it has been a choice framework. Security, potential and aspiration are the meaning of letters SP/A and they also reflect investors' choice under uncertainty.

The efficient frontier of BPT is different from the mean-variance efficient frontier, and the optimal portfolios of BPT and CAPM are not the same. BPT investors think about the expected wealth when they select portfolios. On the one hand, they want portfolios to be security, on the other hand they potentially want to reach aspiration levels. So BPT investors combine bonds and lottery tickets together.

The BPT is classified into two versions, a single mental account version (BPT-SA) and a multiple mental account version (BPT-MA). Their differences are that BPT-SA investors use a single mental account to manage their portfolios while BPT-MA investors use several mental accounts to integrate their portfolios. So BPT investors are the same as investors in the Friedman-Savage puzzle, they both present risk averse and risk seeking. They buy risk-

free investments for the low aspiration mental account and buy speculative bonds for the high aspiration mental account.

BPT-SA investors treat the portfolio as a whole like mean-variance investors, and they also take covariances into consideration. So the framework of choosing portfolio are similar between BPT-SA and mean-variance theory, the difference is that their efficient portfolios are not the same.

Portfolios in the BPT-MA is like layered pyramids, and every layer has its own aspiration level. The bottom layer is designed to protect investors from poverty and the top layer let investors have a chance becoming rich.

BPT-MA investors are quite different from BPT-SA investors, they ignore covariances and treat portfolios separately in to different mental accounts.

Because BPT-MA investors ignore covariance between layers, there is a risk that they may put the same security but with different positions into different layers. The similar evidence is provided by Jorion (1994), he finds that when investors invest globally, they put securities and currencies into different layers of the pyramid, while he thinks the overlay structure is not so useful, because it overlooks covariances between securities and currencies and it leads to 40 basis points loss of efficiency.

Some Models

3.1 DSSW Model

Behaviour finance is based on two theories, which is limits of arbitrage and investor sentiment. According to the tradition finance, arbitrage plays a key role in achieving the market efficiency. Its basic point is that even irrational

investors exist in the market and let prices deviate their value, rational
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investors would eliminate their influence to prices, and finally prices and the value are consistent. However, behaviour finance thinks arbitrage is not unlimited, one of the reason is that arbitrageurs are risk averse and have resonably short horizons, its possibility to be dominant is small. For example, when arbitrageurs sell assets short, they first must know noise traders are bullish and they must be bullish in the future, And then noise traders would buy back the stock. While it is hard to predict noise traders thought, so arbitrageurs have to bear the risk and this would limit their willingness to take position against noise traders.

The model consists of noise traders and sophisticated investors. There are some investors not following economists' advice to invest, and they only trust their own research. So Black (1986) called these investors who have no private information and irrationally act " noise traders". Noise traders obtain lots of information which comes from technical analysts, economic consultants and stockbrokers and they falsely believe this information is useful to predict the future price of risky asset. So noise traders choose portfolios according to such incorrect beliefs Alpert and Raiffa (1982). On the contrary, sophisticated traders make use of noise traders' irrational misperceptions. They buy stocks when noise traders depress prices, while they sell stocks when noise traders think prices would be bullish.

According to the risk of noise traders, the model can explain some financial market anomalies. These anomalies are the excess volatility of and mean reversion in stock market price, the Mehra-Prescott equity premium, the closed-end fund puzzles and some other anomalies. However, there is a

drawback existing in the model, which is that it can not explain how investors make decisions. The assumption is that investors base on the behaviour portfolio theory to choose their portfolios, according to the different layers, they make different investment choices even for same assets.

3. 2 BSV Model

A huge amount of empirical evidence have shown two kinds of pervasive phenomenon, which are underreaction and overreaction of stock prices. Underreaction means that investors predict higher average return than the actual average return when good news are announced. in other words, the stock underreacts to the good news. if the average return comes from a series of announcements of good news and it is lower when compared with the average return coming from a series of bad news announcements, it is defined as overreaction (Barberis, Shleffer, and Vishny, 1998). BSV model is introduced by Barberis, Shleffer, and Vishny (1998). Investors often present two phenomena, which is conservatism and representativeness heuristic. Conservatism can be defined that people often react slowly when people encounter new evidence (Edwards, 1968). When investors face evidence which has high weigh but low strength, they do not care much about the low strengh and react moderately to the evidence. While if the evidence has high strength but low weight, they overreact it like representativeness. Representativeness heuristic is the second important psychological phenomenon (Tversky and Kahneman, 1974). It means that investors focus on recent patterns in the data while give little weight to the properties of the population which generates the data (Fama, 1998). In the situation of

representativeness heuristic, if a company performs well in the past and has a high growth, investor would ignore the truth that this well perform would hardly repeat itself. The result would be that they overestimate the value of the company and be disappointed when the expected growth does not come true. The BSV model bases on the two phenomena, and explain how investors decision-making model leads to the market price deviating the efficient market. The model also deals with the problem why arbitrage is limited, the reason it that investors' sentiment are hard to forecast. The more extreme of investors' sentiment, the more further of price away from the actual value.

It is known that earnings are a random walk, while investors falsely classify them into two earnings regimes. They underreact or overreact to a change in earnings, these lead to short-term momentum in stock returns and long-term reversal. The BSV model perform well on the anomalies it was designed to explain, while the forecast of long-term return reversal is not so good.

3.3 DHS Model

Daniel et al. (1998) also provide a model which includes investor sentiment to deal with the situation of overreaction and underreaction. They try to use psychological theory to support their framework and classify investors' sentiment into overconfidence and biased self-attribution. Overconfidence is defined that investors often overestimate their forecast ability when they have more significant information than others, so they often overlook their prediction errors. Biased self-attribution is investors feel confident when they find public information is the same as their information, but the confidence

would not decrease proportionately when public information is opposite to their private information.

According to the DHS model, it has been known that investors overreact to private information, while on the contrary investors underreact to public information signals. When public information signals eliminate behaviour bias, this would lead to short-term momentum of stock returns while long-run reversal. The model can reconcile this situation, it transfers the wealth from imperfect rational traders (e. g. noise traders) to rational traders and then price setting is dominated by rational traders. While even in this situation, rational traders could not be predominance in the long term. De Long et al. (1991) state that noise traders are risk averse and they prefer investing more money to risky, high expected return assets, if they overconfident about the true information signals, they would obtain more profits than those irrational investors. The forecasts of DHS are similar with BSV, they share the same empirical successes and failures. And this comment can also apply to Hong and Stein (1997).

3.4 HS Model

The model is provided by Hong and Stein (1999) in 1999, it also called the unified behaviour model. The model is different from BSV model and DHS model, it classifies agents into newswatchers and momentum traders. Each of them are restricted rational. Newswatchers making investment decisions base on private information signals of movement of future values. Their drawback is that they do not use the current or past prices to choose portfolios. While on the contrary, momentum traders mainly base on the movement of past prices changes to invest. However, they also have <https://assignbuster.com/the-modern-finance-theory-is-based-on-the-capital-asset-pricing-model/>

limitations, which their forecasts should be “ simple” function of the history of past prices. In this model, there is one more assumption, which is private information would spread slowly in the newswatcher group. The underreaction and overreaction are based on the private information spread slowly across the newswatcher population. As first, newswatchers underreact to the private information, then momentum traders try to make use of it to arbitrage, while it leads to overreaction.

Anomalies

4. 1 Closed-end fund puzzle

There are some anomalies existing in the financial market, one of them is closed-end fund puzzle. The definition of it is that:

“ The closed-end fund puzzle is the empirical finding that closed-end fund shares typically sell at prices not equal to the per share market value of assets the fund holds” (Shleifer and Thaler, 1992, p. 75).

The puzzle is that closed-end funds are sold with 10 percent premium at first, while after around 120 days, the premium of 10 percent moves to a discount of over 10 percent (Weiss, 1989). And then discounts fluctuate over the period of funds, they would narrow and then disappear until the closed-end funds terminate.

This proposition has been researched in the past, they pointed out that the value of securities maybe overstate when compared with their true value of the assets. And they provided three explanations, which are agency costs, tax liabilities and illiquidity of assets. Generally speaking, agency costs are

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constant, it cannot let prices fluctuate. Moreover, it even cannot explain why rational investors buy funds at a premium initially and finally sell them at a discount. Restricted stock and block discount hypotheses are two versions of asset illiquidity, they explain the reason to sell stocks at a discount, that is, trading fees are expensive. The tax liabilities' explanation is that the gain tax has included in the funds, so discounts happen. While these three standard explanations cannot explain the puzzle together or separately.

Another explanation is provided by De Long, Shleifer, Summers and Waldmann (1990) (DSSW). They develop DSSW model to explain rational investors and noise traders interact in financial markets, and the key point is that noise traders' sentiment are unpredictable. So the noise traders' sentiment influence the demand of closed-end fund shares and then influence the changes in discounts.

The model makes two hypotheses, they assume rational investors are short horizons, they focus on the interim resale of prices rather than the present values of dividends. The other assumption is that noise traders' sentiment is stochastic and hard to predicted by rational investors. If investors are optimistic about the return of funds, funds will be sold at premia or only a little discounts. While if noise traders are pessimistic, it will result of a large discounts. There are two kinds of risk when investors hold closed-end funds, which are the risk of holding the fund's portfolio and the risk of noise traders' sentiment causing prices changes. If noise traders become continuously pessimistic about closed-end funds, this risk would be systematic. And then its influence will not be restricted in the closed-end funds. According to this

aituation, it is easy to find that holding the fund is riskier than holding its portfolio, and then prices of closed-end funds would be lower than their true value.

There is a fact that closed-end funds are mainly traded by individual investors. And individual investors also invest small stocks. According to the empirical evidence which researched by Shleifer and Thaler (1992), it shows that the performance of small stocks also influence the changes of discounts. If the small stocks do well, the discounts of closed-end funds would be narrow.

4. 2 the equity premium puzzle

When researchers observed the economy of the United States during 1889 to 1979, they found that the annual return of stocks was seven percent, however, the return of treasury bills was less than 1 percent after 1926. Mehra and Prescott (1985) stated that this huge gap causes from the huge difference of risk aversion. They explained the high equity premium with having excess of 30 risk aversion. While the actual figure observed is only close to 1. so it is a problem that why is the equity premium so large.

Benartzi and Thaler (1995) gived two concepts which comes from the psychology of decision-making. The first one is loss aversion, and the other one is mental accounting. Loss aversion is similar with the Kahneman and Tversky's (1979) descriptive theory. It becomes more sensitive to loss money rather than increase wealth. It is also opposite to the expected utility theory. Mental accounting is defined that " mental accounting refers to the

implicit methods individuals use to code and evaluate financial outcomes: transactions, investments, gambles, etc" (Benartzi and Thaler, 1995, p. 74).

Investors are loss averse, so if they invest stocks, they would care about the security of portfolios. While stock prices are fluctuated, frequent performance evaluation would make investors feel loss. So stocks are less attracted by investors. Only when the return of stocks keeps a high level, investors would replace bonds with stocks.

Barberis, Huang and Santos (2001) explain this puzzle in another aspect and they introduce a model. The model not only bases on the assumption but also bases on fluctuations of investors' loss averse. As it is known to all, investors are sensitive to their decrease of wealth rather than to increase. And The changes of loss aversion depends on investors' prior investment performance. If investors are profit in the prior period, they would become less loss averse. While if the loss is over the profit, or there existing loss in the prior period, investors would become more loss averse. According to this situation, it needs a large premium to let investors hold stocks.

However, the conclusion is made under some conditions. Firstly, researchers only use a single risky asset to do research for the sake of simplicity. So in the real economy which has lots of risky assets, it is not easy to identify what investors are loss averse about. Another one is that it is not clear to what range the preferences can interpret financial data and risky gambles.

Conclusion

The behaviour finance as a Marginal subject has been developed quickly during the recent years. It combines the finance, psychology, sociology and anthropology to explain finance. According to the empirical research of the finance market, some anomalies cannot be explained by the traditional finance. While the behaviour finance use a unique aspect to systematically explain these anomalies, such as Closed-end fund puzzle and the equity premium puzzle. compared with the traditional finance, the behaviour finance does not have a complete systematic theory. However, the prospect theory (Kahneman and Tversky, 1979), the behavioural capital asset pricing theory (Shefrin and Statman, 1994) and the behavioral portfolio theory (Shefrin and Statman, 2000) constitute the fundamental systematic behaviour finance theory. They introduce an evidence that investors not always perform as rational traders, there are a part of traders perform irrationally. Traders do not obey the expected utility theory. Then talking about the prices setting, the original CAPM model which is used to set prices of asset is not appropriate, noise traders often commit cognitive errors and their actions would influence the price setting. So the BAPM model which includes the investors influence can make prices more real. The main point of BPT theory is that investors choose portfolios basing their different layers of needs. The bottom layer is designed to protect investors from poverty and the top layer let investors have a chance becoming rich. In order to explain anomalies, some models have been introduced. For example, DSSW, BSV, DHS and HS models. They investigate the influence of investors' sentiment from two aspects, which are limits of arbitrage and investor sentiment.

However, the behaviour finance has its inherent drawbacks. As Fama (1998) states that even the behaviour finance can explain some anomalies existing in the capital market, it does not mean market efficiency should be abandoned. The data shows that the frequency of overreaction of stock prices is the same as underreaction, so it can be seen that anomalies are chance results in the market efficiency hypothesis. Moreover, anomalies existing in the long-term return are fragile, they tend to be a reasonable changes. Behaviour finance is the sum of anomalies which EMH and CAPM cannot explain, And it does not have its own independent evidence. So the development of behaviour finance needs further research.

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