Research Article

THE STUDY OF BEHAVIORAL FACTORS IN OPTIMAL PORTFOLIO SELECTION

*Hossein Parsian[1], Hooshang Madani[1], Rashidoddin Rajabi[2] and Esmaill Beigiharchegani[3]
[1]*Department of Management, Qazvin Branch, Islamic Azad University, Qazvin, Iran*
[2]*Young Researchers and Elite Club, Arak Branch, Islamic Azad University, Arak, Iran*
[3]*Faculty of Entrepreneurship, University of Tehran, 16th St. North Kargar Ave., Tehran, Iran*
*Author for Correspondence

ABSTRACT
The purpose of this study is specifying the role of behavioral finance in optimal portfolio selection. In this research accepted companies in Tehran Stock Exchange have been considered for 5 year period (from 2009 to 2013) and by examining 106 companies and using regression and analysis of variance techniques, the effect of behavioral factors in forms of mental accounting and loss aversion in investment stock on selecting the optimal portfolio with high efficiency is compared to standard finance. This research includes one main hypothesis and two sub hypotheses. According to this research the expected return of selected portfolio in behavioral model with an emphasis on mental accounting and loss aversion (as indicators of behavioral factors) has greater return than the standard model, so the result of research confirmed these hypotheses.

Keywords: Behavioral Finance, Standard Finance, Portfolio Selection, Expected Return

INTRODUCTION
Fans of "behavioral finance" strongly believe that awareness of "psychological tendencies" in the field of investment is absolutely essential and have to be investigated further. For those who believe that psychology in financial knowledge has a crucial role in securities markets and investor's decisions, having doubt about validity of behavioral finance is impossible. However, there are still so many academics and experts who are fans of "Financial classic" and not believe in behavioral aspects of human beings and their impact on financial decisions as an independent branch of study. But, the developments of qualitative and quantitative empirical researches in this area reflect the importance of behavioral research in financial markets, especially the capital market. In standard selection process of Portfolio, by determining the acceptable risk, limitations and purposes, the optimal values of assets in accordance with the standard model mean-variance were determined. As per human are exposed to behavioral biases, doing this process by human beings is impossible. For example, people who are exposed to changes in short-term and long-term trends of the shares, change their portfolios. Behavioral finance is a paradigm leading financial markets to be studied by considering models that considers two main assumptions which also limit the traditional paradigm and abandoned any try to interpret the behavior of investors as a psychological perspective. These two assumptions are: 1) The maximization of expected utility 2) Full rationality.

Literature Review

Theoretical Background
Portfolio selection and formation of assets portfolio have been a topic of discussion in financial theories and until the late twentieth century, in this area the majority of financial theories were discussed unsystematically. Markowitz (1952) presented the first stock portfolio theory in order to reduce the risk, evaluate the return of risky assets (model of Mean-Variance) and diversification of portfolio. This theory by assuming the equilibrium of a market results in the development of positive financial theories, such as capital market line of James (1958), capital asset pricing model of Sharp, Lintner and Black (1964), the hypotheses of efficient market by Eugene & Fama (1965) and options price modeling of by black and scholes (1973). In eightieth and ninetieth centuries, Amos Wersky, Daniel Kahneman and Richard Toler identified the irrational behavior of investors and presented the financial behavior theories. The dominant

---

Research Article

paradigm in financial theory is based on the maximization of expected utility and risk aversion. While empirical studies of real world in recent years have criticized the modern financial theories and the hypothesis of rational human beings, psychological studies are different from modern financial theories in description of rational human beings. Other investigations in financial field, such as scientific study of the behavior of stock prices suggest discrepancies in the facts and assumptions of the efficient market. Hence, financial academics who always attempt to recognize the financial market behavior and reason of different events, by using behavioral science intend to investigate the behavior of decision makers in the financial markets. Also, by designing the limitations of rational financial theories for explaining the facts, such as arbitrage restrictions and limitations of human cognitive, the factor of irrational behavior of human beings has been identified as an influencing factor on economic behavior along with other economic variables. In this present study, the impact of behavioral bias and its components on decisions of investors are examined.

History Research Studies

Until the early twentieth century, the psychology as a factor affecting the economic issues is ignored by neoclassical economists. The occurrence of multiple important events in decades of 1930s and 1950s formed the basis of behavioral economics. Development of "experimental economics", make a doubt about the assumptions of economical human beings. Tversky and Kahneman by studying about making decisions in uncertainty conditions clarified the occurrence causes, reasons and effects of human errors in economical dialectics and presented the "prospect theory".

Fernandez *et al.,* (2009) classified behavioral biases into two groups of cognitive biases and emotional biases which both of them cause irrational behavior of human beings. Emotional biases like loss aversion are based on vision and sudden emotions and consequently it is not possible to reform them easily. Cognitive biases, such as availability of error rooted in argument method and getting the information leading to improvement and reducing the decision error. However, Shefrin showed that the portfolio selection with framework of "prospect theory" is different from portfolio selection in the framework of "expected utility theory".

Kahneman and Tversky (1979 and 1992) investigated the new concept in financial behavior of investors to explain the "prospect theory" and new model of that called "cumulative prospect theory". Investors make investment decisions based on profit and loss and it is not based on ultimate value of investments (mental accounting). People more dislike loss compared to pleasing with profit (risk aversion).

Odin (1998) analyzed approximately 10,000 trading account of investors. His findings showed that people have strong tendency to identify a profitable dividends. Weber and Kamerer (1998) also showed that people tend to sell shares with higher value than the purchase prices (winners) in comparison with the shares which are lower than the purchase prices (losers). Thaler and Johnson (1990) and Barbrys *et al.,* (2001) presented a model in which individuals after getting profit in a period of time become reluctant to get loss and after getting loss become more loss aversion. This is called the impact of domestic money.

Weber and Zookhel (2003) stated that investors who begin their day with profits are reluctant to do afternoon risks.

Hence, they are far from possible loss and consequently preserved their previous profit. Shefrin and Astatmn (1985) stated the "tendency phenomenon theory" in which people preserve looser shares for long period and in contrast sell winner shares soon. This behavior is called "fear of regret". They showed that people who lose for a period of time become less risk aversion and in contrast after getting profits, they become more risk aversion. This behavior is called "asymmetrical risk taking".

Shefrin and Astatmn (2000) presented an affirmative pattern of investment portfolio based on behavioral finance with layers of investment pyramid. They claimed that the selection of assets which is based on framework of financial behavior is like pyramid layers that can be explained by considering the purpose of investor and covariance that is exist between the layers. They explained the layers of recommended pyramid by considering the association between risky assets and not risky assets, domestic bias, expected of growth and investor's income.

Research Article

Grynblat and Han (2004) in their study entitled "prospect theory, mental accounting and momentum" considered the tendency of investors for keeping shares with reducing prices. They understood that this behavior is influenced by the perspective theory and mental accounting that causes lower reaction to the information about the gap between intrinsic value and market value of stock is emerged. The convergence of these prices is created through random and gradual evolution of the intrinsic value and updating the reference point. It creates expected equilibrium prices which are called as "momentum".

Yavo and Lee (2010) in a study called "bounded rationality as a loss aversion and optimism" started doing a research about impact of bounded rationality on psychological matching of investors in terms of decision making with incomplete information. They focused on this fact that whether the bounded rationality can lead to loss aversion and future profit optimism. So, they started creating a model considering the psychological process of this event. They found that when the data is incomplete, loss aversion become compatible with optimism and the development of these two phenomena are become significant when the data are more dispersed.

George and Post (2010) in an article named "loss aversion with respect to the reference point depending on situation" started doing a research about loss aversion when the reference point is a random variable depending on the mood or situation. For example, it describes a portfolio manager who is evaluated by risky indicator instead of assigned constant return. In this framework, expectations also depend on reference point negatively or positively. Also, this structure avoids of traditional aversion because there is no result, especially when the expectations and the reference point are the same. They concluded that the reference point consists of an external important factor which is constant. Also, they presented a model, in which the implementation of costs is created towards outer reference point by using data Investment of America, they indicate that this model can explain the diversification of stocks and bonds in a wide range of evaluation factors even if it is more than historical aspect of stock return towards bonds.

Art and Ayrf (2010) in an article entitled "description the value of loss aversion in decision-making under risk conditions" did five researches show that the loss appears greater than the profit. The results show that only under certain conditions, it is possible to have a pattern showing loss aversion is appeared certainly. However, this model does not appear in the short-term trials. Also, it didn't appear in 10 primary experiments of long-term tests. This pattern has not been observed in Long-term tests. However, the neutral risk behavior is observed in these circumstances in selection among betting in the small size sample.

The Hypothesis of Research

The most specification of behavioral portfolio is that it includes risk free securities and several high risk securities. So, the whole of portfolio is lack of sufficient diversification. In this framework, the optimal portfolio is based on the desires of individual decision maker not the one who maximize the expected return and ultimately desires and emotional biases of human beings have a crucial role in selection of portfolio component.

Therefore, the following research hypotheses were formulated:

The main hypothesis: The selection pattern of investment portfolio based on behavioral finance is much more efficient than the standard model.

The first sub-hypothesis: There is a relation between selection of the optimal portfolio and mentally accounting.

The second sub-hypothesis: There is a relation between selection of the optimal portfolio and loss aversion.

Variables Description and Measurements

Variables of Research

The expected return of the portfolio: Portfolio return of assets is equal to weighted average of return on assets. The weight of return is a portion of applied investment in a mentioned asset. If r_j is a return of jth asset and X_j is Proportion of invested funds in j^{th} asset, then the total return of the portfolio is equal to:

$$R_p = \sum_{j=1}^{N} X_j r_j \qquad \text{Equation (1)}$$

X_j = the total invested amount of money in the Portfolio/amount of investment in j^{th} asset

Research Article

Mental accounting: behavioral bias of investors that consider profit and loss of investment instead of evaluating changes in wealth.

Loss aversion: human beings become more unsatisfied when they have to bear losses than become satisfied when they get profits.

Portfolio optimization, Markowitz model: For the first time, in 1952, Markowitz presented a solving problem model in selection of optimal portfolio on set of assets (the theory of mean–Variance). He identified the issue with quadratic planning by minimizing variance of assets with proviso that expected return is more or equal to a constant amount.

This issue has a functional limitation which due to that the whole weights of assets should equal to one. Also, the weight of each asset in portfolio should be a non-negative real number. The standard form of mean-variance model is as follows: (Markowitz, 1952)

$$\text{Min } Z = \sum_{i=1}^{n} w i^2 \quad \sigma i^2 + \sum_{i=1}^{n} \sum_{\substack{i=1 \\ i \neq j}}^{n} w i \quad w j \quad \sigma i j \qquad \text{Equation (2)}$$

$$\text{S.T: } \sum_{i=1}^{N} w i \left\{ \begin{array}{l} \bar{r} \geq d \\[2ex] \sum_{i=1}^{n} w i = 1 \\[2ex] W_i \geq 0 \end{array} \right.$$

To achieve the efficiency frontier, the minimum amount of (d) should be equal to risk free rate. So, the efficiency frontier is calculated. After calculating it, investor should select a suitable portfolio among set of efficient portfolio. It is clear that from investor's view, accepting more risk means expecting more return.

Research Model

Behavioral model of portfolio choice: The pattern of portfolio selection and behavior of investors have been identified by prospect theory of Kahneman and Tversky. Hence, the investor decision for weight of risky asset depending on reference point and changes of wealth can be explained. The weight of risky asset is considered as θ and consequently the amount of profit or loss of investors (the changes of return compared to previous period) are as follows:

$$X = (1-\theta) \, RF + \theta R_m \qquad \text{Equation (3)}$$

In which that:

X: is mental accounting or changes of return compared to previous period (changes in wealth)

RF: risk free rate of return which is considered as a rate of bonds in this study and is identified by Central Bank annually

R_m: Rate of return in a market

θ: Weight of risky asset

Fernandez and *et al*., clarified the hypothesis of portfolio selection which is based on Kahneman and Tversky's model and concluded that their recommended model is more appropriate than classic's models. In their recommended model, the value function is defined as below:

$$v(x) = \begin{cases} \lambda^+ - \lambda^+ e^{-\alpha x}, & if.x \geq 0 \\ \lambda^- e^{\alpha x} - \lambda^-, & if.x \prec 0 \end{cases} \qquad \text{Equation (4)}$$

In this model, (α) indicates coefficient of general risk aversion which is a qualitative variable and be assigned in likret, in this study, (α) is equal to 3. Since $\lambda^- > \lambda^+ > 0$, the value function in loss section has a greater slope, so (λ) indicates loss aversion. (X) Shows changes in wealth and introduced the concept of mental accounting of investors.

Research Article

Investors assign the weight of risky asset by maximizing expected utility (V). In addition, individual preferences are determined by changes in wealth. The expected value of the human's choice is as

$$V = \int_{-\infty}^{+\infty} v(x) \frac{d}{dx} \pi\big(f(x)\big) dx$$

following: Equation (5)

In which that:

V(x) is expected value of (X) event and $\pi(f(x))$ is a probable cumulative weight of (X) event which is based on probable weighting function.

After selecting of investment portfolio in framework of behavioral finance, the return and risk of recommended portfolio of behavioral and standard model are calculated to evaluate the results. With regards to quantitative nature of research and type of statistical distribution, statistical tests (parametric and nonparametric) are used.

Since the objective is to select the optimal portfolio of investment portfolios, the average market return is calculated for five year period.

If the return of firm is higher than average return of market, so the asset is high risk. Return and risk of indicator will be calculated as a portfolio of risky asset annually. Then the average of return and risk as well as risk free rate of return is used in selecting portfolio as the input of two behavioral and standard model of portfolio selection.

Thereafter, the return and risk of portfolios which are resulted of two models are compared and evaluation of behavioral model is started.

As stated in the final model of selecting behavioral portfolio, behavioral model of portfolio selection in addition to return and risk has mental accounting and loss aversion aspects.

The variable of loss aversion is evaluated by (λ). Because the negative (λ) is greater than positive (λ), the concept of loss aversion is applied in output of optimal value function. So, by changing the amount of positive and negative (λ) can evaluate the impact of loss aversion concept. Recommended amount of Kahneman and Tversky and Fernandez model of (λ) are existed in behavioral model of ($\lambda+=1$) and ($\lambda- = -2.25$). In order to measure and evaluate the impact of loss aversion, mentioned variables should be equal to 0 or 1.

MATERIALS AND METHODS
Research Methodology
Study Population and Sample

Classified financial audited data gathering from companies listed in Tehran Stock Exchange during 2009-2013 are used in order to test hypotheses of this study. In order to select the sample, following constraints were applied to companies assigned in statistical society:

 I. The company had to present in stock market during 2009 to 2013
 II. The company shouldn't be part of banks, insurance and financial intermediaries
III. Due to increasing comparability, the financial period of these companies is ended to March. The reason of this restriction is that time periods are the same in calculating variables. Also, conditions and seasonal factors are not affecting in selection of factors and variables.
IV. The company's fiscal year does not change during the study period.
 V. Trading symbol is active and there shares are traded at least once a year.

As a result of the elimination of systematic sampling, 106 companies of statistical society were selected to test.

Data Analysis Method

To analyze the data of this study, first data are analyzed in terms of a description. This section contains statistics of centralization and distribution of data. Sectional regression through least of partial squares is used to test the hypotheses of this study. All tests have been done through statistical software including Spss17 and Matlab.

Research Article

Descriptive Analysis of the Variables

The Period of this research is from 2009 to 2013 for 5 years. The total sample companies is 106 Companies listed in Tehran stock market. In total 530 observations are collected in terms of assigned variables. The results were used in the formation of the portfolio depending on behavioral patterns and standards. The results of the descriptive analysis of observed variables among total observations can be seen in the table (1).

Table 1: Results of a descriptive analysis of the variables in the observations

	Count	Minimum	Maximum	Mean	Standard deviation
The expected value	530	-0.21	78.39	3.9865	10.26 359
Mental accounting	530	-1.079	8.98	-0.3659	1.78956
Return on equity	530	0.002	10.36	1.2786	0.85693

The descriptive statistics related to the return of stock in table 1 show that the stocks of some statistical sample companies don't have return in some periods. Because the least amount of this variable is zero. The calculated average of this variable is positive and shows that the statistical samples companies give positive return to investors. After calculating variables, behavioral and standard portfolios were formed to analysis and test the hypotheses. In order to be aware of general conditions of completed portfolios, the descriptive analysis of these portfolios is presented in table 2 and 3.

RESULTS AND DISCUSSION

The Results of Testing Main and Sub Hypotheses

The purpose of this research is doing comparative study of portfolio utility selection based on behavioral pattern and standard. In the hypothesis, by considering expected return of the portfolio we claim that an investment portfolio selection model based on behavioral finance assumptions, has more expected return than the standard model.

For main hypothesis, two sub hypotheses have been considered that difference among standard and behavioral portfolios is based on behavioral factors of investors.

In these sub-hypotheses, mental accounting and risk aversion are expressed as a reason of different decision of investors and the relations between these factors and selection of optimal portfolio have been considered through regression model.

Table 2: Results of a descriptive analysis of selected variables of portfolio based on standard model

		Return	Risk	Expected Value
Incoming stock to portfolio	No.	325	325	325
	Min	0.16	-3.59	0.00
	Max	4.37	7.01	72.85
	Mean	1.8562	.1824	3.8562
	Standard Deviation	0.43221	1.16718	7.71821
Non- Incoming stock to portfolio	No.	205	205	205
	Min	0.00	-2.63	-0.25
	Max	10.36	7.36	80.32
	Mean	1.2786	0.51234	5.6325
	Standard Deviation	1.17483	1.56846	12.37598
Total	No.	530	530	530
	Min	0.00	-3.59	-0.25
	Max	10.36	7.36	80.32
	Mean	1.5674	0.34737	4.74435
	Standard Deviation	0.86767	1.32751	10.36521

Research Article

Table 3: Results of descriptive analysis of selected variables of portfolio based on behavioral model

		Return	Risk	Expected Value
Incoming stock to portfolio	No.	385	385	385
	Min	0.00	-3.26	0.00
	Max	3.21	2.56	78.98
	Mean	1.1222	0.1030	4.2719
	Standard Deviation	0.38189	0.64916	10.31320
Non- Incoming stock to portfolio	No.	145	145	145
	Min	.16	-3.59	-0.25
	Max	10.36	7.36	80.32
	Mean	2.0126	.59174	5.1078
	Standard Deviation	1.26878	1.92748	10.35469
Total	No.	530	530	530
	Min	0.00	-3.59	-0.25
	Max	10.36	7.36	80.32
	Mean	1.5674	0.34737	5.2168
	Standard Deviation	0.86767	1.32751	10.36521

In first and second sub-hypotheses related to main hypothesis, the expected value (as a return representative of optimal portfolio) is a function of behavioral factors in selection of portfolio. The results of testing main and sub hypotheses are shown in table 4.

Table 4: The results of statistical analysis to test the sub-hypothesis of main hypotheses

Significant level. F	Constant	F Statistics	Watson Statistics	Durbin	Adjusted R^2
0.000	3.697	10.564	2.324		0.338

	β(not standardize)	t- Statistics	Significant level (P-value)	Multi linearity tests tolerance	variance inflation factor
Mental accounting (X)	0.476	3.896	0.000	0.714	1.479
Risk aversion (λ)	0.21	1.363	0.047	0.714	1.479

In order to show the results of fitting the data, regression model is presented in the first section of above table. The results show that the regression coefficient of determination is 0.338, and this model could explain 33.8 percent of changes in dependent variable through changes in independent variables. Watson-Doorbin statistic is between 1.5 and 2.5.So, there is no correlation between the errors of the regression model.

According to F-statistic, the decision is made about results of analyzing the variance of Regression (ANOVA), the significant level of F-statistic is less than error level of test (α=0/05). So, the assumption of H0 is rejected and estimated regression is significant statistically and the relations between variables of research are linear.

According to the results, the estimated coefficient for the variable of mental accounting is 0.476, with a 0.000 significance level. This finding states a direct significant relationship between this mentioned variable and expected value from individuals' perspective. The estimated coefficient of risk aversion variable is 0.21 which is significant statistically considering the significant level. Based on the above findings, it appears that mental accounting can be a factor in humans mind to get optimal portfolio.

Therefore, the first and second sub-hypotheses are accepted in confidence level of 95 %. So, the resulting regression model is presented as follows:

Max (V) =3.697+.0476(X) +.021(λ) +ε0

Research Article

Conclusion

In this study in addition to explaining the concepts of behavioral finance, the selection of portfolio model based on behavioral finance and standard model are compared. The most important financial concepts include mental accounting and risk aversion. The researches of Kahnmen and Tversky (1979) and Fernandez (2009) suggest that the model of portfolio selection depending on behavioral finance has more efficiency than Markowitz model. The evaluation of portfolio behavior based on Tehran Stock Exchange identifies that portfolio selection depending on behavioral finance has more efficiency than financial assumptions of classic model. This is because the risk of investment is an important factor in mentioned models. Also, mental accounting has a crucial role in forming expectations of people in investment decisions.

Finding and Recommendations

According to the results of this research which state the risk of financial behavior model lead to reducing the risk of portfolio, the modern financial behavior models should be more emphasized. The attempt of researchers to consider behavioral biases and decision patterns of people as a principal in economic and financial analysis in recent years especially after world economic crisis reveals the importance of financial behavior model including two sections of affirmative and prescriptive. As mentioned before, the behavioral model of portfolio selection in all tests results in creating portfolios with fewer risks which focus on importance of mental accounting. So, it is recommended that researches and capital market investors have fewer risks in creating portfolio through financial behavior concepts of portfolio model. With respect to the economic developments in the financial and monetary sector, it is recommended to use other financial and economic indicators for calculation. Also, it is recommended to usage other methods of value calculation under risk in order to use sustainable indicators data or changes in periods of selecting data and return and risk calculation can lead to different results and other findings to explain and develop the portfolio selection models of Iranian financial markets.

REFERENCES

Ert Eyal and Ido Erev (2010). On the Descriptive Value of Loss Aversion in Decision under Risk. *Harvard Business School* Working Paper, No. 10-056.

EslamiBidgoli S, GhalibafAsl H and Hahaliasghar M (2008). A Model for Overreaction to EPS Shocks in the Stock Markets. *26th International Conference of System Dynamics Society, Athens, Greek*.

Fernandes Jose, Pena, Juan I and Benjamin Tabak (2009). Behavior Finance and Estimation Risk in Stochastic Portfolio Optimization. Banco Central Do Brasil, Working Paper No. 184

Giorgi Enrico G De and Thierry Post (2010). Loss Aversion with a State-dependent Reference Point. Swiss Finance Institute, Research Paper No. 07-14.

Kahneman Daniel and Amos Tversky (1979). Prospect Theory, an Analsis of Decision under Risk. *Econometrica* **47**(2).

Kahneman Daniel, Tversky Amos and Slovic Paul (1982). *Judgment under Uncertainty: Heuristic and Biases* (Cambridge University Press).

Odean Terrance (1998). Are Investor Reluctant to Realize their Losses. *The Journal of Finance* **53**(5).

Odean Terrance (1999). Do Investors Trade Too Much?. *The American Economic Review* **89**(5).

Shefrin Hersh and Statman M (2000). Behavioral Portfolio Theory. *Journal of Financial and Quantitative Analysis* **35**(2).

Statman Meir (1999). Behavioral Finance: Past Battles and Future Engagements. *Financial Analysts Journal* 18–27.

Weber Martin and Heiko Zuchel (2003). How Do Prior Outcomes Affect Risk Attitude. Manhein University, Working Paper, No. 98.

Yao Jing and Duan Li (2010). Bounded Rationality as a Source of Loss Aversion and Optimism: A Study of Psycological Adaptation under Incompelete Information. Available: http://ssrn.com/abstract:1636122.