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The Relationship between Risk and Return Based on the Prospect Theory: Case Study of Selected Companies in Tehran Stock Exchange

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ABSTRACT

In most studies, examining the relationship between risk and return, based on the theory of expected utility, an investor has always been considered as a risk-averse person. While the prospect theory considers both risk aversion and investor risk-taking based on existing realities. The innovation of this paper is to consider the separation of risk-taking behavior from rational one of investors (risk aversion). In this paper, the relationship between risk and return based on the prospect theory for companies of four selected industries during 2001-2020 by panel data and panel quantile regression method has been investigated. Investors' behavior in the prospect theory is sensitive to the reference point. In this paper, the average return on industry assets is considered as a reference point. Hence, the selected companies were divided into two groups of companies with asset returns (ROA) above and below the industry average. The result showed that the investor's behavioral model changed relative to the reference point. Investors are risky below the reference point, contrary to traditional theories of utility. Of course, at returns above the reference point, investors will still be risk-averse. Comparing the results of estimation of two methods (panel data and panel quantile) shows that this situation is also true in different risk quantiles. So that, the sign of the relationship between risk and return at the high and low levels of the reference point is compatible with the theoretical foundations. Therefore, the behavior of investors in selected companies follows the prospect theory.

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1. Introduction

Neoclassical economics defines the principles of economics, but despite this dominance, neoclassical economics has always faced a lot of criticism and suggestions about alternative methods and systematic approaches. One of these approaches is behavioral economics. Behavioral economics is one of the branches of economics knowledge that has been formed to bring economic models closer to external realities. It as a field of economics that integrates economics and psychology in analyzing human behavior, is important for explaining why individuals' decisions and behaviors may not reflect their best interests. A review of the literature has found that behavioral economics has significance for its power to explain individual psychological aspects of the economic decision-making process, both among individuals and institutions.

Thaler investigates people's decision-making and their deviations from conventional flow decision-making theory. Focusing on the studies of Kahneman and Tversky, he referred to these deviations as "anomalies". Thaler also distinguishes between descriptive and normative aspects in economics. While normative theories define rational choice, descriptive theories define real choices (Barberis and Thaler, 2003).

The theory of Thaler that led to him receiving the Nobel Prize is known as **"**nudge theory**"**. The idea of a nudge is that people never make choices in isolation. According to this theory, nudging works on the principle that small actions can have a substantial impact on the behavior of people. Therefore, it is possible to improve them somewhat by recognizing the decision-making behaviors of individuals and organizations (Chapman et al., 2020).

Akerloff states that the deviation is caused by use of heuristics, such as anchoring, availability, and representativeness. He also offers two other reasons. First, behavior of a person has a tendency for inertia. Second, persons utilize rules of thumb. Both may certainly produce acceptable results, on average, but neither is consistent with full rationality and the

maximizing of desired results. Akerloff considers that inertia as an unacceptably high transactions costs of changing behavior (Frantz, 2004).

Economists assume that market behavior is motivated by material incentives and that economic decisions are essentially influenced by self-interest motives and rational behavior. In the traditional economy, the market is efficient, so decisions are made only based on the theory of expected utility. In 1979, Kahneman and Tversky presented a prospect theory that showed how decision-makers sometimes systematically ignored the theory of expected utility.

The important findings of Kahneman and Tversky can be divided into three categories: first, the decision-maker is not concerned with the final values of wealth, but with changes in wealth. The second is the value function (v) for an investor. They consider the S-shaped function which is concave concerning to the axis of profits and convex to the axis of losses. The function indicates a decreasing sensitivity to changes in both directions. There is also a torsion at the point of origin so that it is steeper for losses than for gains.

The third is the weighting function (π). The decision weights (π) indicate the importance of different decisions. The basic form of the weighting function is determined based on two properties of diminishing sensitivity and attractiveness. Diminishing sensitivity shows how individuals change their probabilities between 0 and 1. Because in each decision, there is a "reference point" that people are sensitive and compare their probability of occurrence to it. People are more sensitive to the probabilities near the reference point, and the more they go away from the reference point, the less sensitive people are to the probabilities.

The purpose of this paper is to investigate the relationship between risk and return based on the theory of prospect in Iranian stock exchange companies. In other words, the hypothesis is tested whether the behavior of the shareholders of the firms surveyed is based on the prospect theory, so that they exhibit a risk-averse behavior in the range of profit and risky behavior in the loss range?

Accordingly, the behavior of shareholders in four different industries during 2001-2020 is evaluated using panel data method. In addition, quantile panel regression method is used to investigate the homogeneity of investors' behavior at different levels of risk. Thus, the results of two estimation methods are compared.

The present article is prepared in six sections. The second section presents the theoretical foundations of the prospect theory. Some empirical studies on the topic of the paper are discussed in Section 3. The fourth section presents the econometric model of the relationship between risk and return based on the prospect theory. Then in Section 5, the results of the model estimation are analyzed. The sixth section is devoted to concluding and presenting suggestions.

2. Theoretical Framework

Based on empirical evidence, Kahneman and Tversky showed that the utility function of the investors changes systematically over time. The prospect theory provides a descriptive framework for decision making under risk and uncertainty and provides a more realistic framework than expected utility theory (Kahneman and Tversky, 1992).

In the rational decision-making model, the expected utility function is used to assess the preferences of individuals. This function is the sum of the ultimate utility that one obtains from different choices. Accordingly, if the results of different decisions with X_i are considered and the probability of these conditions being determined with P_i, the expected utility can be shown as follows:

$$EU = \sum_{i=1}^{n} P_i u(X_i) \quad (1)$$

In that, there are various assumptions, such as linearity of utility, uniformity of utility weight of different choices, non-change of preferences over time, risk aversion, and rational decision-making. Although the theory of utility underlies the economic principles of Neoclassical and quantitative economics, it has not been successful in systematically predicting human behavior in decision-making. This is

especially crucial in uncertain and contingent situations (Mosleh Shirazi et al., 2013).

The prospect theory uses two distinct processes known as editing and appraisal. In the editing phase, different decision options are evaluated and ranked according to the subjective rules and in the appraisal phase, the reference point determines the usefulness or disadvantage of the decision. Based on this model, people compare the anticipated consequences of a decision with a reference point and evaluate its utility (Pitcher, 2008).

Economists assume that economic decisions are essentially driven by self-interest motivation and rational behavior. Decision-makers use their available information in a rational and organized way to achieve the desired goals by making optimal choices. Also, rational behavior implies that decisions are made in a forward-looking manner and that the consequences of current decisions are fully taken into account. Moreover, it is assumed that these are external incentives that shape economic behavior.

The crucial difference between expected utility and the prospect theory is that concerning monetary benefits and losses, in the theory of expected utility, the existence of a function (such as U) of wealth (w) is assumed for the decision-maker in the current situation. If action "a" with probability "p_i" occurs on different levels of wealth "w_i" and on the other hand, action "b" occurs with probability "q_i" on the same level of wealth, then the decision-maker would prefer action "a" over action "b" if and only if:

$$\sum_i p_i U(w_i) > \sum_i q_i U(w_i) \quad (2)$$

In contrast, the prospect theory proposes the existence of two functions v and π so that the decision-maker strongly prefers action "a" to action "b" if and only if:

$$\sum_i \pi(p_i)\ v(\Delta w_i) > \sum_i \pi(q_i)\ v(\Delta w_i) \quad (3)$$

In equation (3), $\Delta w_i = w_i - w_0$ is the deviation from the reference wealth w_0 (it can be wealth of wish or initial wealth). Also, π is the

weight function of the decision, v stands for the value of the changes in wealth and qi and pi are subjective probabilities.

The prospect theory consists of the value and weight probability function. By determining the parameters of these functions, the form of prospect function can be determined (Pitchr, 2008).

Therefore, the key elements of this theory are 1- a value function that is concave for gains, convex for losses, and 2- a nonlinear transformation of the probability scale, which overweighs small probabilities and underweights moderate and high probabilities. This reflects a weighting probability function.

The value function (v) indicates the characteristics of the prospect theory. In this function, zero-point (origin) is as often a reference point. At points above the reference point, the shape of this function is convex. In other words, the second-order derivative of the value function is negative at this point ($v'' \leq 0$, $x \geq 0$). However, in the lower points than the reference point, the value function is concave and second- order derivative is a value larger than zero ($v'' \geq 0$, $x \leq 0$). This represents a reduction of the sensitivity of this function. The value function for the benefits has a lower slope than losses, which means that ($v'(X) < v'(-X)$, $x \geq 0$). Moreover, the length of the curve in the area of losses is longer than the benefits area.

Accordingly, the value function is as follows (Kahneman and Tversky, 1992):

$$v(X) = \begin{cases} X^{\alpha}, & \text{if } x \geq 0 \\ -\lambda\left(-X^{\beta}\right), & \text{if } x < 0 \end{cases} \quad (4)$$

In equation (4), v(X) represents the value function, α represents a risk factor in the profit, β shows a risk factor in the loss, ʎ stands for the degree of loss avoidance and X represents the expected monetary value of the decision-makers in the gains and losses area. Always, in the function, $\lambda \geq 1$ and $\alpha \leq 1$ and $\beta \geq 0$, so that with increasing α and β, the sensitivity rate in the prospect function decreases. On the other hand, as λ increases the degree of avoidance of risk decreases.

Accordingly, based on the prospect theory, Kahneman and Tversky's findings could be summarized as follows;

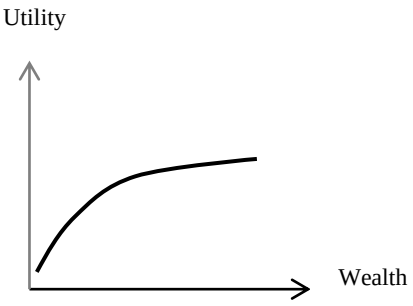
First, the decision-makers do not assess the outcomes according to the amount of final wealth, but rather according to their perception of gains and losses relative to a reference point or target. The current wealth level of decision-makers is often considered as a reference point, so that gains and losses are defined relative to it, but the reference level can be the dream of wealth; the wealth that a person tries to achieve it and its current expectations.

Second, investors are more sensitive to losses than to gains of the same magnitude; that is, they are loss averse. The value function, defined by changes in wealth, has an S-shaped figure. This function is concave to the profit axis and convex to the axis of losses, indicating a decreasing sensitivity to changes in both directions (Dıez-Esteban et al., 2017).

In figure 1, the utility function in both expected utility (part (A)) and the prospect theory (part (B)) is depicted; part (B) explains the concept of diminishing sensitivity. The value function that passes through the reference point is S-shaped and asymmetrical. The value function is steeper for losses than gains indicating that losses outweigh gains.

Part (A) explains the traditional description of the risk-averse investor. More wealth provides more utility, but at a declining rate (as the person gets richer, the curve becomes flat). On the other hand, Part B shows that utility does not depend on the wealth level but on the changes in wealth. Furthermore, on the left side of the zero point (zero indicates no change in current wealth), the curve is convex. This explains that in the area of losses, investors are risk-seeking instead of risk-averse.

Part (A): Traditional Utility Function



Part (B): The Utility Function in Prospect Theory

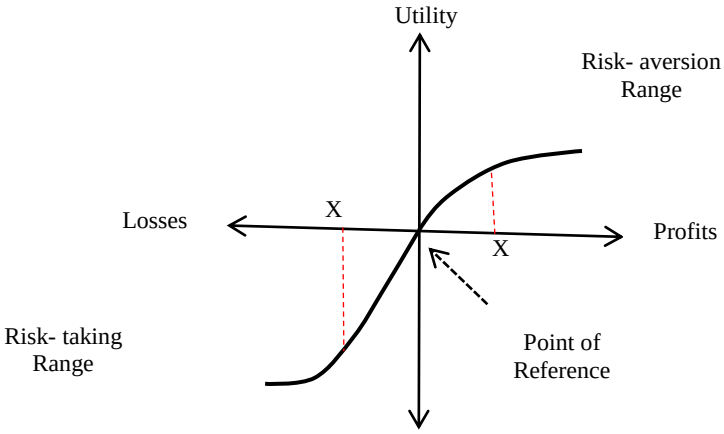


Figure 1. Investigators' Behavior in the Form of Prospect Theory
Source: Buddy Kane (2014).

Through the theoretical framework of Figure 1, the relationship between risk and return can be analyzed in the prospect theory as follows.

The investor sets a point of reference; so that when expected results are higher than this point (i.e., gains), the individuals refuse to take more risk. Thus, the investor shows a risk- aversion behavior, and risk- returns relation has a positive slope in Figure 2. The greater the difference in returns and the reference point, the more risk-averse the investor becomes. Conversely, when the returns are below the reference point

(i.e., losses), the investor attempts to bridge the gap by taking on more risk. Therefore, the higher the difference between returns and reference point, the more risk the investor takes (Figure 2). Consequently, the investor takes risk-seeking actions so that the relationship between risk and returns has a negative slope. The slope of the curve at each point is an important issue because it measures the intensity of the marginal exchange ratio between risk and returns.

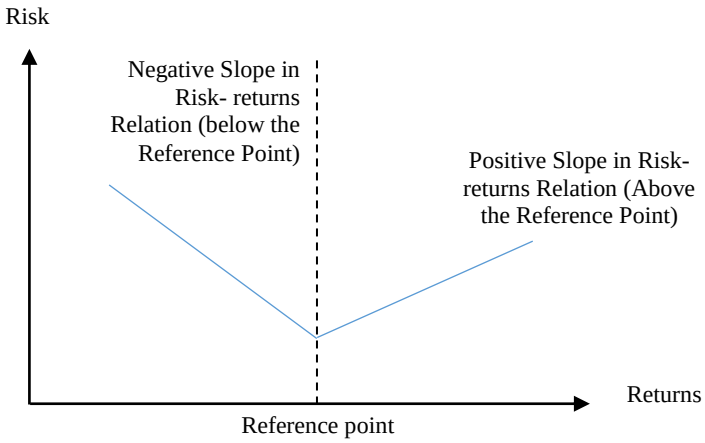


Figure 2. Risk- Returns Hypothesis in Prospect Theory
Source: Chou et al. (2009)

3. Literature Review

In this section, some studies conducted concerning the article subject are discussed. Chung and Hsiang (2005), using Fiegenbaum (1990), examined the behavior of 48 countries between 1994 and 1994 in the U.S. banking industry. Some evidence showed that the theory of prospect explains the exchange between risk and return. Banks are higher than zero revenue threshold are risk averter, while banks below this threshold are risky. They concluded that there is a positive relationship between risk and return for banks that are above the revenue threshold and also, a negative relationship between risk and return for banks under the threshold of income.

Chu et al. (2009) examined risk-taking and risk-averse behavior of corporate executives in the United States. They consider a 20-year sample from 1984 to 2003 with strong evidence offered in support of prospect theory. They showed that there is a negative relationship between risk and return, when explains the exchange between a company's performance is calculated based on the return on assets (ROA) and return on equity (ROE). In conclusion, there is a negative relationship between risk and return in poor performance companies and a positive one for companies with better performance. Finally, the level of risk and return for poor performance companies have been much stronger. Therefore, risk- return paradox can be explained by prospect theory.

Shams et al. (2010) stated the relationship between the disposition effect and cash flow through the performance of investment companies in Tehran stock exchange based on prospect theory from 2003 to 2008. The results showed that investors were more likely to sell profitable stocks and also, they had less tendency to sell loss-making stocks.

Barberis et al. (2014) researched U.S. companies for 1926-2010. The study results showed that prospect theory supports study assumptions and shareholders invest according to stock returns in the past.

Saghafi et al. (2015) investigated the daily data of companies accepted in Tehran Stock Exchange from 1391 to 1392. The results show that following the prediction of prospect theory, investors are risk- averse when the stock is profitable. On the other hand, when they are loss-making, the investors are risk- seeking.

Also, Iqbal and Zulfiqar Ali Shah (2015) studied 450 companies on the Karachi Stock Exchange in Pakistan, excluding financial institutions and 139 non-financial companies for 1995-2011. They used prospect theory to express the negative relationship between risk and return. The results showed that when data sets are tested as a unit, there is a negative correlation between risk and return for companies below the target level, and there is a positive correlation between risk and return for companies above the target level.

Berglind and Westergren (2016) examined the relationship between risk and return for the automobile industry in Sweden for the years 2006 to 2014. Based on results, in the case of large industries, including large companies in the automobile industry, it can also be concluded that prospect theory is once again an explanation of decision making in management.

Esteban et al. (2017) examined a sample including 791 international companies from 21 OECD countries from 2001 to 2013. Using prospect theory, they showed that poor performance companies, which their returns are lower than the target level, are risky. The risk-return relationship is negative for these companies. Nonetheless, for companies whose yield is above the target level, the relationship between risk and return is positive and these companies are risk- averter.

Son and Nguyen (2019) provided empirical facts about the heterogeneity of risk–return trade-offs for firms with different levels of prospect theory value. They considered the impact of prospect theory value, as shown in Barberis et al. (2016), regarding the relationship between idiosyncratic volatility and future returns in the Korean stock market, from July, 2000 to June, 2016. In particular, for stocks whose value has increased, they see a positive but not strong risk–return relationship. In contrast, a robust and significant inverted risk–return relationship exists for stocks that have lost value.

Ohk and Ju (2020) showed that a stock whose past return distribution has a high (low) prospect theory value earns a low (high) subsequent return in the Hong Kong, Singapore and the Japanese stock markets. This study also investigates whether appropriate parameters for the value and probability weighting function are the same for Asian developed stock markets whose investment sentiment, market structure, investment environments, financial openness and regulation are different from each other. For each stock market, this study performs several different sort tests by turning off some components and varying the parameters of the other components of prospect theory function. The results show that for the Asian developed stock markets, the curvature of the S-shaped value

function is relatively more important than the loss aversion and probability weighting components of the prospect theory function. The level of loss aversion for each market is also lower than the original values of Tversky and Kahneman (1992), implying that investors in Asian developed stock markets are less sensitive in their loss domain.

Bilsen and Laeven (2020) explored the dynamic consumption and portfolio choice of an individual with prospect theory preferences. In the paper, it is assumed that an individual is loss averse, endogenously updates his reference level over time, and distorts probabilities. They show that, if an individual gives more weight to unlikely unfavorable events, then economic shocks should have a relatively large impact on the annual payment. Then, optimal consumption strategy is rather insensitive to economic shocks. Also, they conclude that an individual with prospect theory preferences has a strong preference to protect current consumption. This feature implies that the portfolio strategy should be very conservative as long as annual wealth is just sufficient to finance future reference levels.

Do Nascimento Junior et al. (2021) analyzed using prospect theory, the narrow framing bias in investment decisions in certain emerging countries: Brazil, China, Russia, Mexico and South Africa. They empirically identified the predictive power of prospect theory for stock returns in all cases. They also found that the probability weighting function is the most important factor in this predictive power. The relationship between prospect theory and stock returns is different in each country and may be influenced by factors associated with cultural aspects.

Eom and Park (2021) investigated the negative relationship between prospect theory value and expected return considering the fat-tail property of the return distribution using stock trading data in markets of the U.S., Japan, China and Korea. The results of both decile portfolio and cross-sectional regression show evidence supporting the hypothesis related to prospect theory value. Based on the results, they suggest that stock groups with the fat-tail property of the return distribution

significantly and consistently support the hypothesis of the negative relationship between prospect theory and expected return in the empirical design using both in-sample and out-of-sample data. This emphasizes that the fat-tail property in the stock return distribution must be considered in the empirical design when investigating the hypothesis related to prospect theory, along with the property of the skewed return distribution.

4. Specified Econometric Model of the Relationship between Risk and Return, Based on Prospect Theory

In this study, based on the theoretical foundations of behavioral economics and especially prospect theory, the behavior of Tehran Stock Exchange companies in the field of the relationship between risk and return is investigated. For this purpose, the Feigenbaum model (1990) and Cho et al. (2009) are used.

Therefore, to achieve the purpose of the paper, the following model is considered:

$$\text{Risk}_{ijt} = a_{ij} + b_j \text{Return}_{ijt} + \varepsilon_{ijt} \quad (5)$$

where j represents the industry and i denotes the company that is a member of that industry and t stands for several years.

Let Return_{ij} and Risk_{ij} denote respectively the mean and standard deviation of ROA for firm i in industry j over a certain sample period.

a_j is the intercept term for industry j, and b_j is the slope coefficient of the risk–return relation for industry j. ε_{it} is the stochastic error.

Accordingly, in each industry, each firm is classified into the above and below groups according to the industry median returns, i.e., the median ROA of all firms in the industries. The above regression is then applied to each of the two groups.

As can be seen, in regression model (5), risk is a function of return. It should be noted that in this paper, the Return on Asset (ROA) Index is used for the return parameter. ROA is defined as follows;

$$\text{Return on assets (ROA)} = \frac{\text{Net profit}}{\text{Total assets}} \quad (6)$$

On the other hand, the standard deviation of the average return on corporate assets (ROA) from the average return on industry assets has been used as a placement variable for the risk parameter (Brown and Fred, 2012):

$$S = \left[\frac{\sum(x-\bar{x})^2}{n-1}\right]^{\frac{1}{2}} \quad (7)$$

where S; standard deviation, X; the amount of each observation in the sample, $\bar{X}$; average observations and n is the number of observations.

In the paper, quantile panel regression method is used to compare the behavior of investors at different levels of risk. In order to investigate the effect of return variable on different risk quantiles (high/ low), the following model is considered:

$$Q_{Risk_{ijt}}\left(\tau \middle| a_{ij}, b_j, Return_{ijt}, \varepsilon_{ijt}\right) = a_{ij} + b_{j\tau} Return_{ijt} + \varepsilon_{ijt} \quad (8)$$

In which the Qτ represents the quantile regression parameter τ-th in the dependent variable and $b_{j\tau}$ shows the quantile regression parameter of the τ-th in the explanatory variable.

Quantile regression is a statistical analysis able to detect more effects than conventional procedures: it does not restrict attention to the conditional mean and therefore it permits to approximate the whole conditional distribution of a response variable. Classical regression focuses on the expectation of a variable Y conditional on the values of a set of variables X, E(Y|X), the so-called regression function. Such a function can be more or less complex, but it restricts exclusively on a specific location of the Y conditional distribution. Quantile regression (QR) extends this approach, allowing one to study the conditional distribution of Y on X at different locations and thus offering a global view on the interrelations between Y and X (Davino et al., 2014).

5. Results Analysis of Model Estimates

In the paper, four industry including metal products, petroleum products, real estate and cement, lime and gypsum industry is considered. Accordingly, the sample consists of a total of 115 member companies of Tehran Stock Exchange, was divided into two groups of companies with

"returns above the industry average" and "returns below the industry average". Therefore, in this paper, 8 models are estimated that in four models of corporate asset returns are higher than the average return of industry and in the other four models, corporate asset returns fall below the average of industry returns. Panel data method is used to estimate the mentioned models. It should be noted that the reference point in this study is considered the average return of the industry.

In estimating the model with pooling data, the type of regression model data is characterized by Chow or F-Limer test. In this test, the assumption of H_0 indicates the selection of pooling compared to the panel data method. The results of this test are shown in Tables 1 and 2 for two groups of companies with lower and higher ROAs than the average of industry returns.

Table 1. F-Limer Test for Companies with Lower Returns than the Industry Average

Industry	Statistics	Probability
Metal Products	2.831	0.000
Petroleum Products	1.756	0.082
Real Estate	7.563	0.000
Cement, Lime and Gypsum	4.901	0.000

Source: Research finding.

Table 2. F-Limer Test for Companies with Higher Returns than the Industry Average

Industry	Statistics	Probability
Metal Products	0.306	0.583
Petroleum Products	2.446	0.04
Real Estate	2.638	0.000
Cement, Lime and Gypsum	12.986	0.000

Source: Research finding.

Considering the probability value of the F-test statistics mentioned in table 1, it is found that for companies with lower ROAs than average return of industry in all four industries by not accepting the assumption H_0, panel data method is chosen to estimate the relationship between risk and return.

Also, based on table 2, the number of F-test statistics and probability value obtained for companies with higher ROAs than the average return of industry in the metal products industry is determined to estimate the model, it is necessary to use the common effects method. Table 2 shows that in the real estate, petroleum products as well as cement, lime and

gypsum industries, assumption H_0 is not accepted and in companies above the average return of industry, panel data method is chosen to estimate the relationship between risk and return.

The results of Hausman test are presented for two groups of companies with higher and lower than the average return of industry in Tables 3 and 4, respectively. The Hausman test is used to select between fixed and random effects methods in panel data. The H_0 assumption of this test indicates the existence of random effects and hypothesis H_1 indicates the existence of fixed effects.

Table 3. Hausman Test for Companies with Higher Returns than Industry Average

Industry	Chi-Sq. Statistic	Probability
Petroleum Products	0.012	0.911
Real Estate	6.016	0.014
Cement, Lime and Gypsum	21.992	0.000

Source: Research finding.

According to tables 3, test statistics and probability value for companies with higher returns than industry average in real estate as well as cement, lime and gypsum industries show that the H_0 assumption of accepting random effects is rejected. Therefore, in both industries, fixed effects method is used to estimate the model. While, in petroleum products industry, H_0 assumption of Hausman test is accepted and random effects method is selected.

Also, the results displayed in table 4 show that for all companies with lower returns than industry average except metal products industry, H_0 assumption of Hausman test is rejected and fixed effects method is used.

Table 4. Hausman Test for Companies with Lower Returns than Industry Average

Industry	Chi-Sq. Statistic	Probability
Metal Products	0.246	0.619
Petroleum Products	2.692	0.100
Real Estate	3.171	0.074
Cement, Lime and Gypsum	3.859	0.049

Source: Research finding.

The nature of the pooling data requires that the problem of variance heterogeneity occurs. This problem has crucial effects on the significance of coefficients and standard deviation. To solve this problem, the model

estimation has been done by Expanded Generalized Least Squares (EGLS).

Tables 5 and 6 show the results of model estimation through Eviews 10 during the period 2001-2020, for two categories of companies with a higher and lower return than the industry average.

The results of Table 5 show that the coefficient of return on assets (ROA), for all companies in question, whose asset returns are higher than the average return of industry is statistically significant and positive at 99% confidence level. Therefore, according to the results of the model estimation, the variable coefficient of return on assets is positive for all four industries, which shows a positive relationship between risk and return for these companies. This shows that in all four industries, the companies in the mentioned domain are risk-averse. In this regard, the behavior of companies in the metal products, petroleum products, real estate and cement, lime and gypsum industry, whose asset returns are higher than the average return of the industry, is by the prospect theory.

Table 5. Model Estimation in Companies with Higher Returns than the Industry Average

Industry	Estimated Model	Coefficients	Standard-Deviation	Coefficient of Determination
Metal products	Common Effects	0.141 (0.000) *	0.033	0.38
Petroleum Products	Random Effects	0.207 (0/000) *	0.007	0.90
Real Estate	Fixed Effects	0.091 (0.000) *	0.005	0.65
Cement, Lime and Gypsum	Fixed Effects	0.057 (0.000) *	0.004	0.71

Source: Research finding.
Note: *: significant at the 99% confidence interval. Coefficients in parentheses indicates the probability

Also, coefficient of determination for companies in the metal products industry whose asset returns are higher than the average return of the industry shows that the explanatory variable of asset return (ROA) explains about 38% of the risk changes. Also, coefficient of determination for companies in the petroleum products industry shows that the explanatory variable of asset return (ROA) explains about 90% of the risk changes. The value of this coefficient is equal to 0.65 for real

estate industry companies whose asset returns are higher than the average return of the industry. Finally, coefficient of determination for cement, lime and gypsum industry companies is about 0.71 and it can be concluded that the explanatory variable of asset return (ROA) explains about 71% of the risk changes in companies of the mentioned industry whose asset returns are higher than the average return of industry.

Table 6. Results of Model in Companies with Lower Returns than the Industry Average

Industry	Estimated Model	Coefficients	Standard Deviation	Coefficient of Determination
Metal products	Random Effects	-0.152 (0.000) *	0.007	0.59
Petroleum Products	Fixed Effects	-0.039 (0.008) *	0.014	0.14
Real Estate	Fixed Effects	-0.025 (0.000) *	0.006	0.38
Cement, Lime and Gypsum	Fixed Effects	-0.007 (0.07) **	0.004	0.24

Source: Research finding.
Note: **: significant at the 90% confidence interval, *: significant at the 99% confidence interval. Coefficients in parentheses indicates the probability.

The results of Table (6) show that for all four industries studied, the variable coefficient of return on assets is negative, which indicates the negative relationship between risk and return for companies in these industries. This indicates that the companies whose asset returns are lower than the industry average are risky. In this regard, it can be said that the behavior of companies in the metal products industry, petroleum products, real estate as well as cement, lime and gypsum industries, whose asset returns are lower than industry average are by the prospect theory. Based on the determination coefficient in different industries, companies whose asset returns are lower than the industry average, about 59% of the risk changes in the metal products industry, 14% in the petroleum products industry, 38% in the real estate industry and 24% of the risk changes in the cement, lime and gypsum industry are explained by the variable of asset returns.

Therefore, the coefficient of asset returns coefficient (ROA) in all 8 models met for the 4 studied industry (and for both categories of companies with higher and lower than average return of industry) corresponds to the theoretical foundations presented by the prospect theory. In general, it can be observed that the t-statistic for total coefficients is located outside the critical area. Therefore, the zero

hypothesis that "the coefficients are meaningless" is not accepted. Consequently, the asset return variable significantly affects the risk for companies whose asset returns are lower than the average return of industry in the negative direction and for companies whose asset returns are higher than the average industry asset returns in a positive direction.

The graphical relationship between risk and return in the four industries studied is depicted in Figures 3 to 6. As can be seen for companies with higher returns than the industry average, the figure has a positive slope. This indicates a positive relationship between risk and return for these companies. On the other hand, the figure has a negative slope for companies with lower returns than average industry. In other words, the prospect theory on the relationship between risk and return in all four industries of metal products, petroleum products, real estate and cement, lime and gypsum is approved.

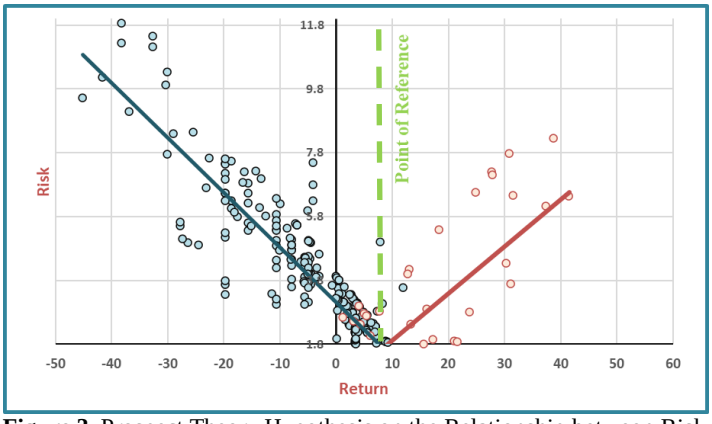


Figure 3. Prospect Theory Hypothesis on the Relationship between Risk and Return in the Metal Products Industry
Source: Research finding.

Figure 3 reveals the fact that the reference point in the metal products industry is approximately 9.3. Namely, asset returns of about 9.3% are considered a reference point for the industry.

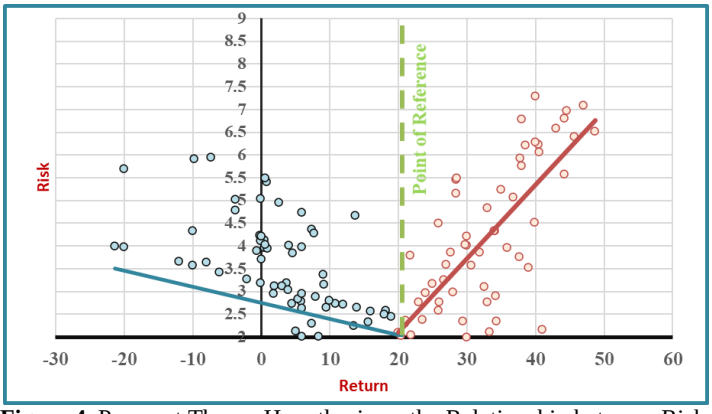


Figure 4. Prospect Theory Hypothesis on the Relationship between Risk and Return in Petroleum Products Industry
Source: Research finding.

In the petroleum products industry, asset returns of about 21% are considered as a reference point for the industry. This is clearly shown in Figure 4.

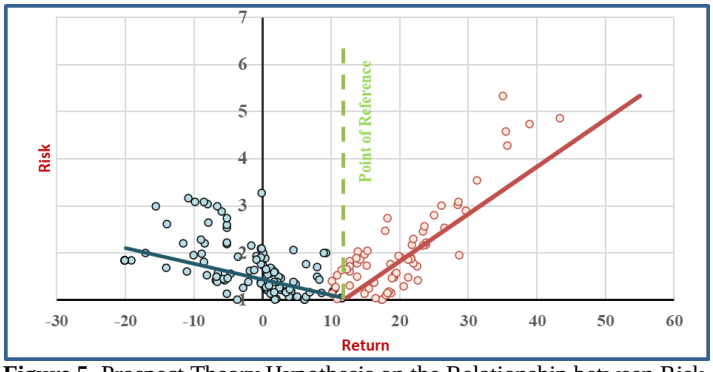


Figure 5. Prospect Theory Hypothesis on the Relationship between Risk and Return in Real Estate Industry
Source: Research finding.

In Figure 5, the reference point is depicted in the real estate industry. As it is taken from the figure, asset returns of about 11.6% are chosen as a reference point in the industry.

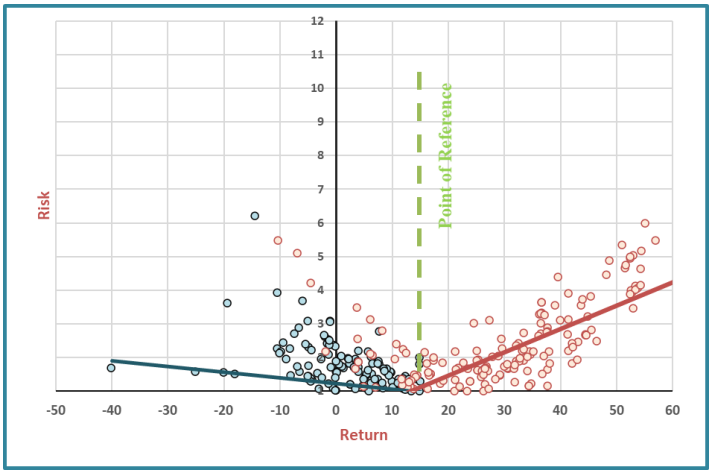


Figure 6. Prospect Theory Hypothesis on the Relationship between Risk and Return in Cement, Lime and Gypsum Industry
Source: Research finding.

The same situation about cement, lime and gypsum industry is shown in figure 6. In this industry, asset returns of about 15% are considered as a reference point for cement, lime and gypsum industry.

The investigating of above figures shows that the slope of the risk-return line in different industries is not similar, which shows the different reactions of stock exchange companies to the risks in the market. The difference in the reaction of stock exchange companies can be due to differences in the composition of shareholders and the degree of companies' dependency on the public sector. In companies with a high part of their capital funded by the government, the risk-taking of managers of these companies is also quite different.

To prevent spurious regression, the stationary test of variables must be performed, first. On the other hand, by examining the stationary of regression residuals, regression can be estimated without fear of its falseness based on the level of time series variables.

In this way, if the residuals of regression are stationary, the resulting regression is also trusted and the variables are stationary (Gujarati, 2012). Therefore, to investigate the validity of estimated regression models, a unit root test has been performed on the components of the model error

using Im, Pesaran and Shin (IPS) tests. The results are presented in tables 7 and 8 for two categories of companies with higher and lower returns than the industry average.

Table 7. Unit Root Tests for Error Component in Companies with Returns above the Industry Average

Industry	Test Statistics	Probability
Metal Products	-3.624	0.000
Petroleum Products	-2.086	0.018
Real Estate	-3.434	0.000
Cement, Lime and Gypsum	-3.301	0.000

Source: Research finding.

The zero hypothesis of this test is non- stationary or presence of unit root in regression residuals. According to the probabilities obtained in table 7, for companies whose asset returns are higher than the average return of industry in all 4 industries, it is clear that the zero hypothesis is rejected and therefore the residuals are stationary.

Also, according to the probabilities obtained in Table 8, for companies in four all industries, whose asset returns are lower than the average industry, the residuals of 4 models estimated for these companies are stationary. Therefore, the variables of the 8 estimated models are stationary and the regression obtained from the estimation of the models will not be spurious.

Table 8. Unit Root Test of Model Error Components for Companies with Returns below the Industry Average

Industry	Test Statistics	Probability
Metal Products	-12.554	0.000
Petroleum Products	-7.832	0.000
Real Estate	-7.169	0.000
Cement, Lime and Gypsum	-4.507	0.000

Source: Research finding.

The estimation results of model 8 for two groups of companies with lower and higher returns than the industry average is shown in tables 9 and 10, respectively. The results examine the final effect of explanatory variable on the dependent variable in different distribution deciles. By doing so, the accuracy of the estimate is much higher and the estimated results in each decile can be seen, separately.

According to Table 9, for real estate companies, the variable coefficient of return in quantile regression has also been negative. This indicates that for returns lower than industry average, the investors still have a risk- taking behavior in accordance with the prospect theory. The results show that the sign of this coefficient is negative in all quantile deciles and confirms the above claim. The results also reflect that in high-risk deciles, the absolute magnitude of the coefficient of return variable increases. This reveals the fact that investors at higher levels of risk accept large amounts of risk despite the lack of return. In addition, in high- risk deciles, the significant level of return variable increases compared to the 10th quantile. This result provides stronger evidence to confirm vision theory at high risk levels.

Also, for companies in the metal products industry, there is a negative and statistically significant relationship between risk and return in all risk quantiles. Therefore, for these companies at high and low levels of risk, the theory of prospect is confirmed. The investigation of the absolute magnitude of the variable coefficient of return also shows that with increasing the risk level, there is an almost increasing trend. This indicates the strengthening of the necessary evidence to confirm the prospect theory at high levels of risk.

In the group of petroleum companies with returns lower than the average return of the industry, although there is still a negative relationship between risk and return in all risk quantiles, the variable coefficient of return in the 50th quantile is statistically significant at 90% confidence level. In the 60th to 90th quantiles, the variable coefficient of return is statistically significant at 99% confidence level. Therefore, based on the results of quantile panel regression, the prospect theory in the group of petroleum companies is only approved for high risk levels.

Table 9. Results of Model for Companies with Lower Returns than the Industry Average (Quantile Regression)

Industry		Quantiles								
		10^{th}	20^{th}	30^{th}	40^{th}	50^{th}	60^{th}	70^{th}	80^{th}	90^{th}
Metal Product	Coefficients	-0.12	-0.14	-0.17	-0.18	-0.18	-0.19	-0.19	-0.18	-0.18
	Probability	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Petroleum Product	Coefficients	-0.03	-0.03	-0.05	-0.06	-0.07	-0.09	-0.07	-0.06	-0.04
	Probability	0.35	0.46	0.28	0.17	0.06	0.00	0.00	0.00	0.00
Real Estate	Coefficients	-0.03	-0.05	-0.07	-0.07	-0.08	-0.08	-0.08	-0.08	-0.06
	Probability	0.16	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cement, Lime and Gypsum	Coefficients	-0.01	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.02	0.00
	Probability	0.39	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.84

Source: Research finding.

Also, the results of Table 9 show that for those companies in the cement, gypsum and lime industry that have lower returns than the industry average, there is a negative relationship between risk and returns at all different levels of risk (high/low). In this regard, the results of quantile panel regression method are completely consistent with the previous results mentioned in Table 6. Therefore, in this industry, shareholder behavior continues to follow the theory of prospect. The significant level of coefficients also reflects the fact that with the exception of two extreme quantiles (10th and 90th quantiles), in other different risk deciles, the variable coefficient of return is significant statistically at 95% confidence level.

Table 10. Results of Model in Companies with Higher Returns than the Industry Average (Quantile Regression)

Industry		Quantiles								
		10^{th}	20^{th}	30^{th}	40^{th}	50^{th}	60^{th}	70^{th}	80^{th}	90^{th}
Metal Product	Coefficients	0.18	0.16	0.18	0.14	0.11	0.16	0.18	0.16	0.14
	Probability	0.02	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Petroleum Product	Coefficients	0.10	0.12	0.13	0.15	0.15	0.15	0.17	0.18	0.22
	Probability	0.20	0.11	0.04	0.00	0.00	0.00	0.00	0.01	0.00
Real Estate	Coefficients	0.05	0.09	0.07	0.08	0.09	0.09	0.10	0.10	0.11
	Probability	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cement, Lime and Gypsum	Coefficients	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.08
	Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Research finding.

The results of Table 10, at different levels of quantile for all companies with higher return than the industry average (in the four studied industries) show the strong and positive effect of the relationship between risk and return. In this regard, the results of quantile panel are compatible with panel data method. In other words, the results reflect the fact that if different levels of risk (high/low) are taken into account, the positive relationship between risk and return in this group of companies still confirms the prospect theory.

All coefficients in the extreme quantiles are also statistically significant (except for the first quantile of the petroleum industry). Moreover, in all studied industries, with increasing the level of risk, the significance of return coefficient increases, indicating the strengthening of the necessary evidence to confirm the theory of prospect. The results also show that in the petroleum and real estate industries in high-risk deciles, the absolute value of the variable coefficient of return dramatically increases. So that, the value of this coefficient for the ninth quantile is more than twice its value in the first quantile. This indicates that investors at higher risks accept large amounts of risk despite low returns.

The trend of changes in ROA coefficient in different risk deciles for two groups of companies with higher and lower returns than the industry average is depicted in figure 7 and 8, respectively.

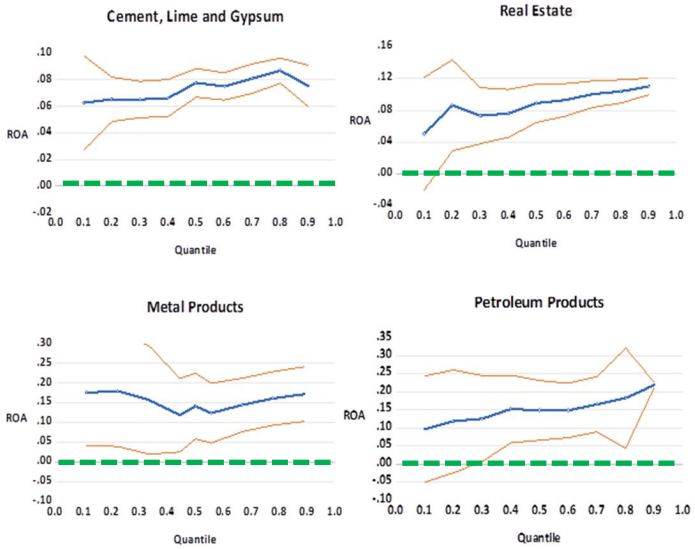


Figure 7. Quantile Estimations in Companies with Higher Returns than the Industry Average
Source: Research finding.

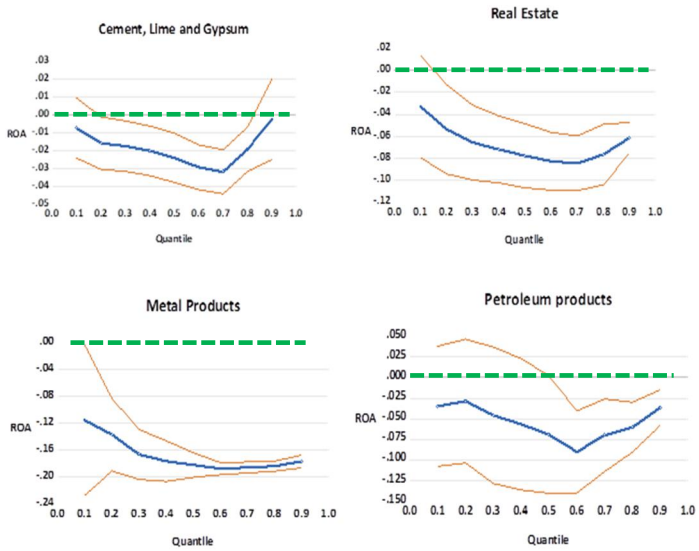


Figure 8. Quantile Estimations in Companies with Lower Returns than the Industry Average
Source: Research finding.

6. Conclusion

This study presented theoretical foundations related to prospect theory and stated that investors have different behaviors around the reference point due to the tendency to risk aversion and the tendency to avoid losses. The average return on industry assets was selected as the reference point; therefore, the relationship between risk and return on assets for the four selected industries of Tehran Stock Exchange during 2001 and 2020 was studied based on the prospect theory. Based on the theoretical foundations of the research subject and the empirical background studied, the relationship between asset returns and risk was considered as a linear relationship.

The innovation of this paper compared to Cho et al. (2009) was the separation of the relationship between risk and returns in different industries. Since the return of stock exchange companies in different industries sometimes has some differences, therefore, it seems that the reference point of investors will also be different among different industries. The results of the article also showed that in some of these industries the reference point has a significant difference with other industries. Therefore, the separation of regression models for different industries can be effective in better explaining the investor's behavior (risk aversion or risk taking).

The results of the model estimation showed that the shareholders' behavior of selected companies in Tehran Stock Exchange follows the prospect theory. Also, the evidence showed that prospect theory explains the exchange between risk and return. In such a way that companies' shareholders whose asset returns are higher than the average return on industry assets are risk-averse, because there is a positive relationship between risk and return for selected companies of Tehran Stock Exchange that are above the reference level. Graphical analysis of panel data regression estimated results (Figures 3 to 6) for all four industries confirmed this evidence, completely. These figures reveal the fact that the reference points are different in four industries. Therefore, results of

the paper confirm Kahneman and Tversky (1979) which argue that different shareholders have different reference point.

Based on estimation results, there is a negative relationship between risk and return for selected companies of Tehran Stock Exchange that are below the reference level. Therefore, the shareholders of these companies are risky and the results of this study illustrated that selected companies in Tehran Stock Exchange can be categorized based on the prospect theory. On the other hand, companies with higher returns than the average industry in all four studied industries are faced with risk aversion conditions. That is, shareholders accept higher risks only on the condition of higher returns.

Accordingly, it is suggested that the mentioned companies provide accurate and timely financial reports. Also, by clarifying the information about the company's shares, they reduce the risk of their stock market to meet the willingness of shareholders.

Moreover, the results indicated that in all four studied industries, companies whose returns are lower than the industry average have some kind of risk-taking behavior. Consequently, the shareholders of these companies are loss-averse; namely, shareholders with the hope of minimizing their losses, accept the risk of holding shares of these companies. Hence it is suggested that shareholders in the loss zone (returns lower than the industry average) revise the holding of loss-making stocks based on the theory of expected utility and act rationally in the field of holding these kinds of shares.

The estimation results of panel quantile regression showed that for companies with returns higher than the industry average at different levels of risk, the relationship between risk and return has always been positive. This situation was observed in figure 7 for different quantile deciles. Also, in companies with lower returns than the industry average, the behavior of investors in different risk deciles was homogeneous. This fact was well illustrated in Figure 8. Therefore, quantile regression estimation indicates that the effect of return on risk variable at different quantiles is completely consistent with the results of panel data

estimation. Therefore, the process of decision-making for investor at all levels of risk (high/low) follows the theory of prospect.

Total results reveal the fact that investor behavior is sensitive to the reference point (average return of industry) and will cause behavior change from risk-taking to risk aversion. To be specific, investors' attitude toward risk acceptance (regardless of risk aversion or risk-taking behavior) depends on the reference point. Both areas of profit and loss can be separated by using the reference point for investors' behavior. Ultimately, like this study method, it is necessary to use separate econometric models for profit and loss areas in investigating the relationship between risk and return.

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