



Research Paper

## Neurological Functions of CEO Investment based on Varimax Analysis and Rotated Matrix in Q Typology

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### ABSTRACT

Chief executive officers (CEO), as the central pillar directing companies at the capital market level, plays a critical role in making investment decisions to decrease agency costs and maximize shareholders' wealth; however, their psychological attitudes and perceptions lead to different investment functions of these companies in a competitive market. Accordingly, this study aimed to detect the propositional arrays of the investment functions using Q analysis in order to identify the CEOs' mental typology in distinguishing investment functions. The present study was carried out with the participation of 13 CEOs from Tehran Stock Exchange companies during a one-year period (2018-2019). The study encompassed two different phases. In the first phase, content analysis was used to identify the phrase Q of the CEOs' investment functions, resulting in the detection of 18 propositional arrays for the CEO's investment functions. In the second phase, Q analysis was adopted to typify the CEOs' investment functions, which was based on the subjective cognition of the target population and contributed to the development of the approaches in line with the research objectives. The results confirmed the existence of three mental patterns in the CEOs regarding the investment functions in the capital market. Considering the concepts and content of propositional arrays, these mental patterns were 'investment function in stock market indices' as the first mental pattern, 'investment function in risk control' as the second mental pattern, 'strategic investment function' as the third mental pattern. The study results revealed different types of investment functions among the CEOs' of stock exchange companies and thus contributed to the development of financial theories from the perspective of CEOs' cognition. In other words, the detection of the investment functions makes the investment decisions about the companies' stocks in the capital market more secure and the expected return on investment for shareholders and investors more analyzable.

## 1 Introduction

Considering the competitive features of the field, investment approaches, especially companies' investment in the capital market, are of paramount importance in companies as they affect the companies'

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performance, returns, and value and thus change the expectations of investors and other stakeholders [22]. To what extent CEOs' activities are in line with shareholders' tendencies and to what extent managers are successful in creating value and wealth for shareholders is a hotbed for debate. In this regard, understanding the investment approaches could enhance the attractiveness of the capital market. In fact, managers adopting an investment approach spare their efforts to exploit the investment opportunities in order to maximize returns through allocating the resources optimally, making the right decisions, and understanding the market. Accordingly, stakeholders (such as investors, managers, etc.) have always been concerned with techniques to get aware of right investment choices and avoid wasting resources [31]. It would be beneficial to find a level of investment approaches to evaluate corporate performance and thus avoid wasting resources and appropriate investment opportunities [8]. Furthermore, Cen and Doukas [10] elaborate on the key role of CEO's cognitive approaches in the effectiveness of corporate investment and risks, noting that CEOs should consider risk and return as two important factors in investment decisions due to the existence of agency costs and competition in the capital market. In this regard, risk control results in making shareholders' expected returns closer to the companies' actual/performance returns, thereby promoting satisfaction with the corporate performance in comparison to the competitors' and reducing agency costs. In other words, the consequence of CEO's cognitive functions in making decisions about individual approaches is an investment function motivated by the CEO's mental attributes. In addition to detecting the nature of the investment functions of CEO, as a decision maker at the top of the organization, the present study was to identify different types of CEOs' investment functions in the stock exchange companies using the Q analysis and thus extend the financial theories from the perspective of CEOs' cognitive attributes. In other words, this study aimed to typify the CEOs' investment functions in the capital market using the Q analysis, as an analysis based on the recognition of mental patterns. The purpose of the present study was to analyze different types of CEOs' investment approaches using Q Analysis. As a decision maker at the top of the organization, the CEO plays a vital role in developing the companies' functions in a competitive market. If the CEO reaches a thorough understanding of the company, market, stakeholders and investment environment, the investment decisions could increase the returns and earnings of the company more effectively, and this would increase the shareholder and investor's satisfaction [13].

Regarding the relevant literature, it should be noted that some studies (e.g., Bertrand and Schoar, [5]; Hambrick and Mason, [19]; Hambrick, [18]; and Hu and Liu, [2]) confirmed the effect of CEO's cognition on investment functions and counted the differences in the CEO's psychological approaches as a reason for different in investment functions, which promote or decrease the companies' performance in a competitive market. In his research, Hambrick [18], for example, mention that the CEO's experiences, values, and attitudes are internal factors, which, during the professional career course, create a decision-making approach for the managers, resulting in a different investment function from others'. In fact, the corporate investment functions are assumed as an external consequence of the managers' paradoxical approaches, which bring about emotional, cognitive, and perceptual attributes. Such attributes affect the decision maker's (CEO's) perception of a particular situation and how he decides about issues such as investment [12]. Accordingly, in addition to the theoretical foundations of the study in the Section 2, the empirical backgrounds of the study are presented to promote theoretical reasoning and reliance on empirical arguments. In Section 3, the research method, participants, instruments and validity are presented to provide a more coherent explanation of the research. In the fourth section, while identifying propositional arrays using the Q analysis (Q), attempts were made to create different types of the CEOs' investment functions. Finally, Section 5 contains the discussion of the research findings as well as recommendations for future studies.

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## 2 Literature Review

### 2.1 Investment Mentality in Promoting the Effectiveness of Risk Control

Risk is considered as doubtfulness about the future and the possibility of deviating from expectations. It is not associated with human cognition and mentality and threatens the company, especially those operating in a competitive environment, with undesirable economic consequences [4]. A comprehensive plan at the enterprise level is required to decrease the severity and consequences of different risks, thereby guaranteeing the safety of economic activities and providing adequate financial resources to deal with losses. In better words, in order to deal with the various types of risks, individuals' mentality should be adapted and various cognitive-based coverage should be provided through obtaining sufficient information and accurate understanding of their nature. Reaching a level of effectiveness in investment (i.e., a level with risk control) requires a market-based mindset and decision-making content to maximize returns through examining all possible risks, planning, and decision making [37]. To put it in other words, the cognitive recognition of investment to enhance the effectiveness of risk control is a kind of unknown-based management, an approach that encompassed from the decision-maker's perception to individual actions and outcomes and could lead to monitoring and reducing the impact of risk on investment. An effective decision-making process can lead to efficient risk control when it is consistent with the decision maker's mentality and investment horizon, a mentality that encompasses a set of individual's psychological abilities in decision-making and determines the decision-making direction.

### 2.2 Theoretical Approaches to CEO' Investment Performance

Although the traditional financial theory holds that companies should set the maximization of shareholder's wealth as their priority and select positive net present value projects for investment [2], some researchers argue that, due to increased heterogeneity in investment (e.g., expectations, capital market rules, competition, etc.), the exclusive focus on this approach could lead to deviation from the right decision-making path. According to these researchers, the first step is to recognize individuals' ability in the capital market to select investment priorities [9-35-40]. In fact, the difference between the traditional and recent approaches is to understand whether the company's investment and financial decisions are consistent with the manager's cognitive attributes in terms of investment, or whether the manager's investment mindset is aligned with the company's priorities, including the maximization of shareholders' wealth during short and long terms. In this regard, as Cen and Doukas [10] argue, although individual differences in investment vary depending on the CEO's cognitive attributes and risk-taking, their main goal in accordance with the agency theory should be maximizing shareholder's wealth. They also state that management style and risk-taking prioritization are different for managers. A prevailing belief in academic research is that the CEO's personal preferences for risk-taking are likely to influence the company's risk and performance, and this can change the companies' investment policies and strategies [26,30]. Although the manager's risk-taking priorities cannot be observed directly, the previous research has investigated two indirect measurement approaches to determine CEOs' risk-taking priorities: CEO's compensation schemes and CEO's personal characteristics. According the first approach, the CEO's compensation schemes decreases the CEO's risk aversion and, based on Skinner's operant conditioning theory, increase the frequency of bolder decisions because compensation acts as a stimulus and reinforces the CEO's individual motivations for bold investments [29]. Low [27] and Palia [28], however, did not rule out the possibility of wrong estimations of CEO's investment under this approach.

Regarding the second approach, i.e. the influence of the CEO's personal characteristics on investment, some studies (e.g., Donkers et al [14]; Grable [17]; and Wang and Hanna [39]) have documented that the CEO's external (such as age, personal income, wealth, level of education, and gender) and internal (e.g., subjectivity, perception, and emotion control) characteristics influence the acceptance or rejection of risk in investment. On the other hand, some critics, including Wang [39], argue that the manager's past history and characteristics have nothing to do with this issue, and thus are not acceptable indicators of risk-taking priorities and consequently investment functions. A related strand of literature finds that CEOs with higher career experience make more investments even if the internal funds are less. This could be due to the fact that they have a strong social network, and expertise in formulating and implementing investment strategies. Further, diverse career experiences enable managers to obtain right information to choose better investment avenues. In a nutshell, the extant review of literature on corporate investment shows that the firm-specific factors, personal characteristics of CEO and CEO's behaviour with investment cash flow sensitivity plays a vital role in the determination of corporate investment. The upper echelons perspective does not require a focus on TMTs (and a number of significant contributions have examined CEOs or other individual leaders), but attention to executive groups, rather than to individuals, often yields better explanations of organizational outcomes. The second subordinate idea is that the demographic characteristics of executives can be used as valid, albeit incomplete and imprecise, proxies of executives' cognitive frames. Given the great difficulty obtaining conventional psychometric data on top executives (especially those who head major firms), researchers can reliably use the information on executives' functional backgrounds, industry and firm tenures, educational credentials, and affiliations to develop predictions of strategic actions. Granted, the use of demographic indicators leaves us at a loss as to the real psychological and social processes that are driving executive behavior, which is the well-known "black box problem".

### **2.3 Research Background**

Abernethly et al [1] conducted a study during 2001-2015 and analyzed 3047 observations based on the company-year. Assuming that strong corporate identity aligns CEO's decision-making practices with priorities such as maximizing shareholder's wealth, the researchers conclude that the retired CEOs' strong identity is associated with reduced investment in research and development and decreased investment approaches to social responsibilities. They also found that the retired CEOs' strong identity leads to a higher level of financial transparency and less opportunistic behaviours. Finally, it was revealed that differences in subjective approaches at different tenure stages for CEOs lead to differences in investment performance, even with high organizational commitment. In their research entitled "CEO Personal Investment Decisions and Firm Risk" carried out during 2006-2009, Cen and Doukas [10] created and analyzed 3392 observations by company-year. In addition to presenting a novel way to measure managers' risk prioritization based on personal allocation of deferred compensations, the findings showed that managers' behaviors were reinforced based on compensations, thereby making bolder investment behaviors. Hu and Liu [21] conducted a to examine the effect of CEO's professional career on corporate investment decisions. It was assumed that the CEO with a higher career is likely to face fewer funding constraints. The study was carried out during 2000-2010 on 563 companies in China's stock exchange market. The results indicated that companies with CEOs having a diverse career are less sensitive to cash flow-investment and mostly use outer-organization funds such as bank loans and commercial credit. These effects are tangible and noticeable in companies with financial constraints. Dideh Khani and Mehrali Zadeh [13] conducted a study The statistical population of this study encompassed all active joint investment funds in Tehran Stock Exchange and their managers, of which 89

funds and their managers were selected as the study sample using Cochran method. Data were collected from Minnesota Multiphasic Personality Inventory and data on daily return on funds in 2010. The results confirmed a significant relationship between the five personality types (depression, mania, psychotic symptoms, psychoasthenia or exhaustion, and mental fatigue, and paranoia) and fund risk including value at risk and semi-variance. It was also concluded that personality type had a moderating effect on the above relationships. Asgar Nejad and Peymani [4] conducted a study to investigate the impact of effective risk management on companies' financial performance and to detect the mediating role of intellectual capital and financial leverage in the relationship between the concerned variables. The study was carried out during 2008-2013 on 190 companies listed in Tehran Stock Exchange. The results indicated that effective risk management had a positive effect on the rate of return on assets as well as the market value growth. Financial leverage just mediated the relationship between effective risk management and the rate of return on assets. Furthermore, the mediating role of intellectual capital was also confirmed for the relationship between effective risk management and market value growth.

### 3 Methodology

Regarding to the nature of the study examining the types of CEOs' investment approaches in the capital market, the mixed method was adopted for the data collection because a set of cognitive features of the investment function should be recognized through using meta-analysis and they then should be classified using mind-mining Q analysis. Due to its quantitative and qualitative nature, Q method was the most compatible with the study objectives. The method contains both descriptive and analytical statistics. Besides detecting different viewpoints, the Q method can illustrate the degree of acceptance of each viewpoint by experts. Since the main objective of this technique is to reveal different patterns of thinking, not to count individuals with different thoughts, it is similar to qualitative method [7]. To sum up, the present study used content analysis for the previous texts and studies during the process of collecting propositions to detect theoretical propositions of CEOs' investment functions. Throughout the process of discovering the mindsets, quantitative approach and Q analysis based on factor analysis were employed. In terms of the study setting, it is a field-library research. In other words, given its subject of the study, whatever existed on this issue in different formats and was called the discourse space was compiled based on the content analysis.

#### 3.1 Statistical Population of the Study

With regard to the nature of the present study aiming identifying the Q propositions of the CEOs' investment function, the Q analysis based on factor loadings was used to classify managers' mental patterns. Accordingly, the statistical population of the study encompassed those managers who had a degree in accounting and financial management, and had the experience as a CEO of stock companies. Convenient sampling method was used to select the samples. It should be mentioned that, the terms 'statistical population' and 'statistical sample' in the Q method do not bear the same meaning as in quantitative research. In this method, the statistical sample needs not to be randomly selected from the statistical population. On the other hand, individuals are selected consciously because of their particular viewpoint regarding the study subject. A small sample size is also considered in this method as the goal is to analyze a small number in depth, not to analyze a large number of individuals superficially. In this type of research, individuals are selected from among those who either are somehow connected to the research topic or hold particular beliefs. In other words, the sample selection phase in the Q method is equivalent to the selection of a statistical sample in quantitative research, which is purposive and non-

random [33]. To this end, 13 CEOs of the companies listed in Tehran Stock Exchange who hold an accounting and financial management degree with more than 5 years of work experience were included in the Q analysis. Since this type of analysis is based on judgmental analysis, the researchers spared their efforts to select the CEOs meeting the inclusion criteria from different companies in order to engage a variety of perspectives in the analyses.

### 3.2 Validity and Reliability of Q Propositions and Research Questions

In terms of validity, given the fact that the texts were collected from similar articles and sources, the validity of the identified propositions was confirmed. With regard to the CVR validity, the 20 participants were included in the qualitative analyses, and the validity was again confirmed. To determine the reliability of the Q propositions, the test-retest method, as a valid method in the Q analyses, was used. After two stages of being submitted to the ten participants, the correlation coefficient of the rating table was estimated to be 2%, thereby confirming the reliability.

The research questions of the current study can be stated as follows:

1. What are the Q propositions of CEOs' investment functions in the capital market?
2. How are the Q propositions of CEOs' investment functions in the capital market ranked?
3. What is the typology of CEOs' investment functions in the capital market?

### 3.3 Q Method

Regardless of the paradigms of their emergence and their classification into quantitative, qualitative, or mixed, research methods, as a means in conducting applied studies or developing knowledge boundaries, have played a significant role in human life and development. The Q method is considered as an analysis method based on the mental patterns of the target community in any study, which play a vital role in expanding and conceptualizing the purpose of a study. Cottle et al [11] also introduced this method as a technique to detect individuals' mentality. The Q methodology is a technique enabling the researcher to first detect and classify individual perceptions and beliefs, and then classify groups of individuals with regard to their perceptions. This technique mainly aims to reveal different patterns of thinking, not to count the number of individuals with different thoughts [11]. This feature brings this methodology close to qualitative research methods. In addition, the Q methodology also has a quantitative dimension as it uses statistical methods such as factor analysis and principal component analysis to classify individuals. According to Danaei Fard et al. [7] "The Q methodology is a scientific framework for research on individuals' mentality and how they perceive different issues." They believe that it focuses on the participants' subjective perspectives. "Using this methodology and applying its predefined steps, the researcher would be able to reveal individuals' mentality and their thought patterns for different issues. In such an analysis, the participants are not selected through probability sampling methods, but rather a small sample size is selected purposefully. This feature makes it close to qualitative methods as well [7]. With the help of this method, one could delve into the participants' mentality more deeply because of its data collection technique (sorting). The major difference between the Q methodology and other research methods in social sciences is that individuals, not variables, are analyzed in the Q methodology. This method consists of five phases. In the first phase, library studies pave the way for the investigation of the research literature and the following phases. The first phase provides the researcher with a deeper understanding of the subject. In the second phase, validity and reliability are assessed using expert comments and methods such as critical evaluation of research-related issues. The results of the first and second phases form the discourse space. The third phase should be organized

by evaluating and summarizing the contents of the discourse space in order to select a sample of phrases as a Q sample. As McQueen and Thomas suggested, 2 to 3 phrases are sufficient for the Q sample. Doner, however, argues that the appropriate number of phrases for the findings to be statistically valid ranges from 10 to 60. In the fourth phase, participants sort and classify Q deck. In fact, this is the data collection phase. In the last phase, the data are analyzed using the Q Factor Analysis and the interpretation of the extracted factors. It should be noted that there is a population in quantitative studies for the results to be applied as well as a sample that is randomly selected and generally represents the concerned population. The Q method lacks such a population and sample, and the sample is usually selected from individuals who either have something to do with the research topic or hold particular beliefs [6]. Another limitation of the traditional study of individual differences between persons is that inferences about what a person is like in absolute terms are not warranted on the basis of that person's relative position on a particular variable compared to other persons Q-methodology provides a better understanding of the actual concerns and priorities within each worldview, because it treats the entire configuration of statements that the participant him-/herself has compared and sorted, rather than disparate statements or variables, as the basis of inter-individual comparison. For instance, although the individual differences approach would suggest that some individuals have a more selfish outlook on life than others, all of the actual worldviews that did in fact emerge from this study included humanitarian values and attitudes among their priorities. All of the worldviews also incorporated a degree of cynicism about the extent to which people have moral integrity and self-insight, while there was much more variation in views of the goodness or benevolence of human nature in a more general and abstract sense (which might be thought of as a more basic potentiality that is not always fully realized) [6].

### 3.4 Detecting Q Propositions in CEOs' Investment

In this phase, content analysis was used to identify the Q proposition or discourse space for different types of CEOs' investment functions. Studying similar literature and articles, the researchers were to detect the types of propositions for the CEOs' investment functions based on studies conducted in Iran and other countries, as shown below.

**Table 1:** Q Propositions or Research Discourse Space

No.	Codes	Q propositions	References
1	Z1	Development of manufacturing infrastructure	[8]
2	Z2	Optimal allocation of resources	[36]
3	Z3	Development of stock cycle models	[8]
4	Z4	Regular distribution of returns over time	[41]
5	Z5	Development of trans-regional exports	[36]
6	Z6	Portfolio Management	[8], [41]
7	Z7	Optimizing expected returns	[10]
8	Z8	Ownership investment	[8]
9	Z9	Development of joint investment projects	[10]
10	Z10	Development of investment policy statements	[21]; [15]
11	Z11	Fulfilling shareholders' expected desirability	[36]
12	Z12	Reducing volatility of stock returns	[25]
13	Z13	Establishing joint investment funds	[8]
14	Z14	Investment in government's macro projects	[8]
15	Z15	Controlling the balance between asset price and market efficiency	[34]
16	Z16	Launching new production lines	[8]
17	Z17	Optimizing investments in growth / value stocks	[10]
18	Z18	Development of financial mediation indicators	[25]

As it can be observed, 18 research discourse were created for the Q analysis, which were written on cards that were completely identical in appearance (shape, color, size, font, writing style, etc.). The cards were submitted to the participants who were instructed to place each card on the chart according to the instructions (rating from 0 to +1). The following table shows the ranking of the propositions, i.e. the Q analysis pattern.

**Table 2:** Ranking of Q Propositions

4-	3-	2-	1-	0	1+	2+	3+	4+

Strongly agree.....strongly disagree

## 4 Findings

This section reveals the findings of performing the current research.

### 4.1 Q Analysis

After sorting the cards by the research participants, the way each participant rated the Q-sample expressions on the Q-graph was recorded and collected using a special form similar to the table above, which was developed for this purpose. For example, the ratings of participant No. 4 are presented in the following table, indicating the highest correlation with the most prominent factor, i.e. Proposition Z7.

**Table 3:** Ranking of Q Propositions (Participant # 1)

4-	3-	2-	1-	0	1+	2+	3+	4+
Z5	Z18	Z13	Z16	Z1	Z17	Z2	Z6	Z7
		Z9	Z4	Z3	Z15	Z11		
			Z8	Z14	Z12			
				Z10				

Similar tables of Q propositions were also prepared for the other participants in this study. The data extracted from the Q ratings were collected for the SPSS software and entered into the data processing space to run factor analysis. Accordingly, the data was used for the factor analysis of the Q propositions to determine decision makers’ mental patterns.

### 4.1 Q Factor Analysis

Correlation matrix, as a conventional technique, was used to perform factor analysis of Q propositions. The factors (Q propositions) were rotated using the Varimax method, which is a kind of orthogonal rotation. In fact, this method is highly reliable in detecting simple structures of variables used for the factor analysis [32]. According to this method, the numbers extracted from the Q factor analysis are based on the principal component method. In Q methodology, participants with the same level of agreement or disagreement in ranking the Q propositions have a similar mentality; hence, this method classifies individuals with regard to the proximity of their mentality and runs statistical analysis. In order to determine the mental patterns, the outputs of the factor analysis should be specified based on eigenvalue and communality.

**Table 4:** Detected Mental Patterns

Mental patterns	First eigenvalues			sum of squares for extracted loads			sum of squares for final rotated loads		
	Eigen-values	Variance (%)	Cumulative variance (%)	Eigen-values	Variance (%)	Cumulative variance (%)	Eigen-values	Variance (%)	Cumulative variance (%)
1	3.534	23.790	23.790	3.534	23.790	23.790	3.107	30.008	30.008
2	2.810	20.232	244.02	2.810	20.232	244.02	1.867	25.106	455.11
3	1.485	16.665	760.68	1.485	16.665	760.68	1.783	21.076	6.197
4	0.924	10.548	23.571						
5	0.899	7.789	479.02						
6	0.813	5.412	684.43						
7	0.748	4.850	689.28						
8	0.719	3.090	692.37						
9	0.617	2.611	794.98						
10	0.533	2.017	497.00						
11	0.342	1.569	398.57						
12	0.211	1.110	399.68						
13	0.094	0.317	00.100						

Table 4 shows three identified mental patterns according to the participants' viewpoints, whose eigenvalues are  $>1$ . These three mental patterns could explain 76.19% of the variance. According to the results, the highest eigenvalues of the mental pattern were estimated for the first factor with a variance percentage of 30.008, followed by the second factor with a variance percentage of 25.106 and the third factor with a variance percentage of 21.076. Absolute value  $\left| \frac{1/96}{\sqrt{n}} \right|$  should be used in order to determine the significance of the factor loading of each mental pattern, where  $\sqrt{n}$  refers to the detected Q propositions. The following equation is then used for calculation:

$$\text{Sign} = \left| \frac{1/96}{\sqrt{18}} \right| \cong 0/462$$

Given the significant level of factor loadings estimated based on the number of Q2 propositions was 0.462, the factor loadings must be  $> 0.462$  in order to place the participants in each of the mental patterns.

**Table 5:** Rotated Matrix of Mental Patterns

Participants	First mental pattern	Second mental pattern	Third mental pattern
1	0.117	0.442	0.185
2	0.212	0.166	0.811
3	0.577	0.137	0.165
4	0.118	-0.015	0.465
5	0.480	0.229	0.076
6	0.265	0.517	0.172
7	0.652	0.122	0.146
8	-0.019	0.302	0.516
9	0.812	0.105	0.305
10	0.311	0.713	0.120
11	0.490	0.122	0.132
12	0.023	0.098	0.549
13	0.087	0.466	0.451

As shown in the table below, the participants 3, 5, 7, 9, and 11 were placed as the ones with the first mental pattern. The participants 1, 6, 10, and 13 were identified with the second mental pattern, and the participants 2, 4, 8, and 12 were considered as individuals holding the third mental pattern.

## 4.2 Scores and Factor Arrays of Each Mental Pattern

In this section, each of the three mental patterns is ranked concerning the scores of the Q propositions. This could contribute to a better interpretation of the results and the definition of the conceptual codes to infer expert judgments.

### 4.2.1 Scores and Factor Arrays of the First Mental Pattern

The Q and factor loadings tables were used to evaluate the scores of the mental patterns. The SPSS software was employed to calculate the factor scores and rank them to extract the Q propositions (how cards are arranged in each mental pattern). Table 10 shows how the factor propositions of the first mental pattern were identified.

**Table 6:** Propositions of the First Mental Pattern in Ranking Q Propositions

4-	3-	2-	1-	0	1+	2+	3+	4+
Z1	Z16	Z9	Z14	Z7	Z3	Z13	Z17	Z11
		Z10	Z12	Z6	Z8	Z18		
			Z5	Z4	Z2			
				Z15				

According to the rotated matrix, the participants 3, 5, 7, 9, and 11 who share the same factor or first mental pattern, introduced the following attributes as the most effective features of the CEOs’ investment functions: optimal allocation of resources (Z2), optimizing investments in growth / value stocks (Z17), fulfilling shareholders’ expected desirability (Z11), development of financial mediation indicators(Z18), ownership investment(Z8), development of stock cycle models (Z3), and establishing joint investment funds(Z13).

This group, however, regarded the following factors as the least effective ones in terms of the CEOs’ investment functions: development of manufacturing infrastructure (Z1), investment in government’s macro projects (Z14), launching new production lines (Z16), development of investment policy statements, development of joint investment projects (Z9), development of trans-regional exports (Z5), reducing volatility of stock returns (Z12). With regard to the ranking of the Q propositions in the first mental pattern as well as its nature, a code called ‘investment function in stock market indices can be created since the propositions considered as the most effective by the participants with the first mental pattern are more based on CEOs’ approaches toward the development of returns-relevant investment and the fulfillment of the shareholder’s expectations of greater returns on investment in companies. The following table lists the propositional arrays of the investment approaches in the first mental pattern.

**Table 7:** Propositional Arrays of Investment Approaches in the First Mental Pattern

Mental patterns	Propositional arrays
Investment functions in stock market indicators	Optimal allocation of resources
	Optimizing Investments in Growth / Value Stocks
	Fulfilling shareholders’ expected desirability
	Development of financial mediation indicators
	Ownership investment
	Development of stock cycle models
	Establishing joint investment funds

#### 4.2.2 Scores and Factor Arrays of the Second Mental Pattern

In Table 8, the factor propositions of the second mental pattern can determine the participants' approach to this mental pattern. Based on the rotated matrix, the participants 1, 6, 10, and 13 who share the same factor or the second mental pattern identified the following cases as the most effective features of the CEOs' investment functions: reducing volatility of stock returns (Z12), regular distribution of returns over time (Z4), portfolio management (Z6), optimizing expected returns (Z7), and controlling the balance between asset price and market efficiency (Z15).

**Table 8:** Propositions of the Second Mental Pattern in Ranking Q Propositions

4-	3-	2-	1-	0	1+	2+	3+	4+
Z5	Z9	Z16	Z8	Z2	Z15	Z6	Z7	Z12
		Z10	Z1	Z17	Z3	Z4		
			Z14	Z18	Z11			
				Z13				

In this group, the least effective factors were ownership investment (Z8), development of manufacturing infrastructure (Z1), investment in government's macro projects (Z14), launching new production lines (Z16), development of investment policy statements (Z10), development of joint investment projects (Z9), and development of trans-regional exports (Z5).

With regard to the ranking of the Q propositions in the first mental pattern as well as its nature, a code called 'investment function in risk control' can be created since the propositions considered as the most effective by the participants with the second mental pattern are more based on CEOs' approaches toward controlling the volatility and creating a balance in stock performance to control the risks. The table below presents the propositional arrays of the investment approaches in the second mental pattern.

**Table 9:** Propositional Arrays of Investment Approaches in the Second Mental Pattern

Mental patterns	Propositional arrays
Investment functions in controlling risk	Reducing volatility of stock returns
	Regular distribution of returns over time
	Portfolio Management
	Optimizing expected returns
	Controlling the balance between asset price and market efficiency

#### 4.2.3 Scores and Factor Arrays of the Third Mental Pattern

As shown in Table 10, the factor propositions of the third mental pattern can determine the participants' approach to this mental pattern.

**Table 10:** Propositions of the Third Mental Pattern in Ranking Q Propositions

4-	3-	2-	1-	0	1+	2+	3+	4+
Z13	Z3	Z18	Z2	Z12	Z14	Z10	Z16	Z9
		Z8	Z17	Z6	Z5	Z1		
			Z11	Z7	Z15			
				Z4				

Based on the rotated matrix, the participants 2, 4, 8, and 12 who share the same factor or the third mental pattern reported the following cases as the most effective features of the CEOs' investment functions: development of joint investment projects (Z9), launching new production lines (Z16), devel-

opment of investment policy statements (Z10), investment in government’s macro projects (Z14), development of manufacturing infrastructure (Z1), and development of trans-regional exports (Z5); however, the least effective factors for this group were establishing joint investment funds(Z13), development of stock cycle models (Z3), development of financial mediation indicators(Z18), ownership investment(Z8), optimal allocation of resources (Z2), optimizing investments in growth / value stocks (Z17), and fulfilling shareholders’ expected desirability (Z11).

With regard to the ranking of the Q propositions in the third mental pattern as well as its nature, a code called ‘strategic investment function can be created since the propositions considered as the most effective by the participants with the third mental pattern are mostly based on strategic and long-term approaches. The following table shows the propositional arrays of the investment approaches in the third mental pattern.

**Table 11:** Propositional Arrays of Investment Approaches in the Third Mental Pattern

Mental patterns	Propositional arrays
Strategic investment functions	Development of manufacturing infrastructure
	Investment in government’s macro projects
	Launching new production lines
	Development of investment policy statements
	Development of joint investment projects
	Development of trans-regional exports

### 4.3 Interpretation of Mental Patterns

#### 4.3.1 First Mental Pattern

The analysis of the propositions made by the participants with the first mental pattern revealed that investment function in stock market indices is of paramount importance as an approach in the CEO's decisions. Adopting this approach, the managers of capital market companies seek to create efficiency in the capital market through following the recent news and information, and, in line with the efficient market hypothesis, they believe that financial markets are dynamic if they enjoy financial and operational transparency to enhance investors and shareholders’ decision making power [25]. In this approach, the managers are not only to meet the shareholders’ expected desirability through optimally allocating resources to assets but to promote the company’s stock in the list of growth and value-based companies in order to attract more shareholders and market share. Priority of the investment approach in capital market indices enables the CEO to promote the financial mediation indices as he seeks to develop company’s performance at the market level by increasing and creating multiple holding, leasing and investment companies [41]. Such CEOs also spare their efforts to drive their investment level from mere production to ownership investments in line with changes in the economy and the capital market, while maintaining monetary value and providing the investors with more expected returns on equity, thereby making them more optimistic towards the future of the company. This could also improve the stock volatility cycle and decrease the gap between the expected return and actual stock returns. Note that they also focus on joint investment funds because investment in these funds, as one of the main investment mechanisms in financial markets, raises the risk awareness and enhances the expected return on investment for shareholders, which could in turn promote trust and confidence in the capital market [15].

#### 4.3.2 Second Mental Pattern

As detected through the analysis of propositional arrays made by the participants with the second mental pattern, investment function in risk control is critical as an approach in the CEO's decisions. Risk

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control has always been one of the main development strategies of the capital market, which makes the company keep its competitive status in the capital market. This approach refers to the systematic function of management policies, procedures, and processes for the analysis, evaluation and control operations, which, besides decreasing stock return volatility, optimizes shareholders' expected returns [4]. In other words, the management of an effective risk-based investment approach is assumed as a dynamic control system contributing to the regular distribution of returns at specific intervals and creates more balance between market price and market efficiency [20]. To put it in other words, the function of investment in implicit risk control is not usually inferred as a strategic management process; however, they are considered as a specific effort to create a bumper to absorb and transmit economic shocks [16]. Such a function expresses a level of the CEO's partial viewpoint towards investment in risk control and is not only used to limit losses but also to identify, develop, and exploit potential opportunities in the capital market, provided through risk control for the company. It should be noted that this approach is a powerful means for defense and attack in a competitive market, which can be effective in increasing the success of a company [3].

### 4.3.3 Third Mental Pattern

The analysis of the propositions made by the participants with the third mental pattern indicated that strategic investment function is an approach in the CEO's decisions. Strategic investment functions play a broader role than the conventional functions in the operations of companies operating in the capital market. Accordingly, the CEO always seeks to develop the production and investment infrastructure of capital assets [24]. Strategic investment functions are an attitude based on infrastructure development to gain greater market share in the future, an attitude that would lead to establishing and launching new manufacturing lines. According to this approach, export development usually is trans-regional, as it is the CEO's approach to the development of global markets for its products. Such companies are mostly not involved in attracting liquidity at a national market level and strive to reach greater achievements by contracting with government's macro projects and investing in foreign projects [34]. These managers always spare their efforts to develop investment policy statements since they believe that such statements could greatly contribute to making strategies with long-term and short-term goals aligned. In fact, the development of the statements outlines a coherent framework of the potential prospects and constraints for companies to reach their concerned strategies and enables investors and financial analysts to better understand the CEOs' performance. The development of these policies would also contribute to making CEOs' other decision-making approaches in investment dynamic and provide better allocation of resources for the future performance of the company.

## 5 Conclusion

The survival in any competitive market depends on the existence of approaches to identify and respond appropriately to the market in order to maintain or promote the company's competitive position in the market, especially the capital market [23]. Regardless of the limited financial resources and the existing uncertainties, CEOs as corporate leaders must adopt measures not only to control potential risks in the market but also to maximize the investors and shareholders' interests through developing market indices and production infrastructures [36]. In accordance with the agency theories, since CEOs are the agents for shareholders' interests, understanding their investment approaches to preserve and maximize shareholders and investors' returns could enhance the dynamics and attractiveness of investment in the capital market. In the present study, the purpose was to examine the typology of the CEOs' investment

functions in the capital market. Based on the statistical analysis of 18 propositional arrays made by 13 CEOs of the stock exchange companies, three mental patterns of investment approaches were extracted. In this regard, there were 5, 4, and 4 participants in this study with the first, second, and third mental pattern, respectively. The study results revealed that the first mental pattern of the CEOs' investment approaches is based on the investment functions in stock market indices, indicating that the participants holding this mental pattern assume that the CEOs focus on developing stock market indices in the capital market. This approach can be considered as an operational approach to the CEOs' investment functions as the CEO, as an analyst, identifies the market volatilities and make attempts to have fair pricing in order to add attractiveness to the capital market and attract a greater number of shareholders and investors through optimal allocation of resources to assets. Such managers always concentrate on the monetary value and strive to meet shareholders' expectations of greater returns through developing the ownership investments. The existence of an investment approach in the form of joint funds is another measure adopted by the CEOs to increase shareholder's capital gains.

This type of investment is to aggregate capital for the optimal allocation of the resources to maximize return on investment. Furthermore, the second mental pattern was called the investment function in risk control, which was based on controlling stock return volatility to decrease the gap between the actual and expected returns. In fact, this approach is an analytic approach to risk and return, which underpins the companies' growth in a competitive market. In other words, investment function in risk control is a structured approach to manage uncertainties by adopting measures such as risk identification, risk assessment, risk response planning, risk monitoring, and risk control in order to optimize expected returns and control the balance between the price and market efficiency. This approach helps managers identify potential risks such as increased volatility in shareholders' expected returns in order to have appropriate plans to minimize the negative impacts, thereby enhancing shareholder's satisfaction with investment in the company. The implications of managerial discretion for upper echelons theory are straightforward and profound: upper echelons theory offers good predictions of organizational outcomes in direct proportion to how much managerial discretion exists. If a great deal of discretion is present, then managerial characteristics will become reflected in strategy and performance. If, however, discretion is lacking, executive characteristics do not much matter. Several studies have shown that managerial discretion is a pivotal moderator of upper echelons predictions. Although the prevailing image is of CEOs carrying very heavy loads and operating under great pressure, the reality is that executives' (including CEOs') jobs differ widely in how difficult they are. For example, some CEOs operate in munificent environments, with well-fortified strategic positions, and have very capable subordinates, whereas others have none of these cushions.

Finally, the results revealed that the third mental pattern is a strategic investment function as the CEOs adopting this approach always strive to create a more promising future for investing and attracting financial resources by increasing the investment on their infrastructure and technology development. Developing policy statements, they are also to bridge the gap between strategies and goals for future success. This approach allows capital assets to be used to expand production and export operations so that companies can achieve greater success through strategies such as consortium. This group of managers are concerned with international and cross-border levels and always focus on developing research and development mechanisms to expand exports globally. These functions make the company launch new manufacturing lines to increase future profitability and drive the company toward global development, where investment on foreign projects is assumed as a competitive advantage, thereby making the company overcome its competitors.

Regarding the first mental pattern, the managers are recommended to consult with stock exchange advisers and brokers to enhance the effectiveness of their investment decisions. Such specialized advisors help managers to better understand the capital market and the economic changes as well as their impacts on the stock market so that the managers could establish affiliated, holding and leasing companies to develop their financial services alongside effective funds. Such decisions may promote the company's position in the competitive market, as managers adopting this approach spare their efforts to maintain a level of stock value and growth in the capital market by optimal allocation of resources to assets. Considering the second mental pattern and given the various risks caused by increasing environmental changes in Iran's capital market, companies are also suggested to have separate units for effective risk management, which, in the form of specialized committees, encompass identification, decision-making, planning, and evaluation phases. These committees can also provide the managers with specialized investment advisers since they as teams operating across borders can detect capital market changes and offer the best option for controlling risk and earning greater returns in companies with regard to existing market threats and opportunities. Finally, from the perspective of the third mental pattern, managers should consider the two aforementioned approaches as well as strategic decision-making approaches in the form of future prospects and investment policy statements, as the changes at the economy and market levels exclude companies not holding a smart outlook from the competition. These approaches are intertwined with investment in capital assets for the future development and growth of the company in international markets. Accordingly, in addition to the development of technical and investment infrastructures, the development of the knowledge level should be considered, which would create greater dynamics in the international arena and offer innovative functions.

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