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Research Paper

Decline of Auditors' Financial Bias in Decision Making by Professionalism in Auditing: Rough Set Analysis

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ABSTRACT

This research examines the role of professionalism in reducing auditors' financial bias in decision making. The study employs an inductive-deductive approach, combining content analysis and Delphi analysis for data collection. Fourteen audit partners with academic degrees participated over a one-year period (2018-2019). The findings highlight two influential perceptual errors in the Iranian audit profession. The first is the Halo bias, which refers to the failure to separate context from content. The second is memory bias, associated with the experience of fraud detection in financial statements. Gray VIKOR theory analysis identifies audit professional maturity as the most important factor in reducing perceptual bias. The results demonstrate that achieving professional maturity in auditing significantly controls individual perceptual errors and improves auditors' ability to handle pressure and tolerate stress. Enhancing cognitive capabilities in the audit profession facilitates professional and behavioral conceptualization, leading to better career outcomes and improved audit quality. Auditors with enhanced cognitive features are less prone to perceptual biases and errors throughout their careers. This research underscores the importance of professionalism in mitigating financial bias among auditors. It highlights the positive impact of cognitive development on decision making, job performance, and overall audit quality. By emphasizing the significance of professionalism in auditing, this study contributes to a better understanding of the factors influencing auditors' decision-making processes and promotes the continuous improvement of audit practices.

1 Introduction

Entering a professional job such as auditing, which requires judgment and decision-making, entails distinctive attributes, with the ability to control emotions during decision-making being of utmost importance. Auditing, due to its social nature, necessitates auditors who can make professional judgments free from influence, dependency, and behavioral biases [1]. Judgment holds significant value in the auditing profession, consistently emphasized by accounting and auditing standards [2]. However, how can we support auditors in navigating this challenging path of judgment and decision-making? Recognizing the professional characteristics of auditing proves to be an effective and beneficial approach to enhancing auditors' performance. Although the term "professional characteristics" may encompass various interpretations, in

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auditing, it refers to individuals striving to make decisions that benefit the community, devoid of preconceived assumptions and subjectivity, as violating ethical and behavioral principles [3]. Yet, it is crucial to determine the extent to which these characteristics have been identified and how social and behavioral theories have been applied to recognize individual characteristics in the field of auditing. Addressing such questions remains a theoretical gap in the audit profession, as the lack of recognition of auditors' professional behaviors hinders the attainment of the desired quality and quantity in their performance [4].

This research aims to identify a series of behavioral-occupational processes, referred to as professional characteristics in the audit profession, which, upon recognition, are expected to reduce auditors' perceptual bias. In essence, a comprehensive understanding of their job description enables auditors to better cope with the behavioral challenges encountered throughout their career [5]. One notable challenge in the audit profession is auditors' perceptual bias, defined as a tendency to systematically make mental errors during decision-making. Such errors, rooted in cognitive schemas, often result from heuristic behaviors or information processing shortcuts, particularly prevalent in the audit profession [6]. Consequently, this study endeavors to mitigate auditors' perceptual bias through the recognition of their individual characteristics.

The rationale behind conducting this research can be examined from two perspectives. Firstly, the existence of perceptual differences and cognitive biases significantly impacts the nature of audit performance, potentially leading to erroneous statements within this realm. Auditors experiencing perceptual bias, due to their inability to control these conditions, struggle to exercise fair judgment regarding clients' decisions and performances. Recognizing professional characteristics in auditing can partially contribute to controlling perceptual biases, as auditors gain diverse experiences, develop high tolerance and emotional stability, and strive to minimize biases, thereby delivering professional statements based on skills, personal knowledge, evidence, and intuition. Hence, in light of the problem statement, the research questions to be addressed are as follows:

What are the propositions of an auditor's professional characteristics?

What are the propositions of an auditor's perceptual bias characteristics?

Which characteristics of the audit profession can modify auditors' perceptual bias?

2 Theoretical Framework

2.1 Professional characteristics of an audit

In the past two decades, the economy has placed in a position in which the investment on human resources, information technology, research, development and advertisement seems necessary in order to keep the competitive position and ensure the growth of organizations. With the increase of competition, the capability of all resources such as the labor force has undergone a change and its value has also increased due to the change in the business environment [7] The changes have put an increasing pressure on improving the quality of workforce. The audit profession has also no exception from this rule, because today, the social climate affecting capital market strongly emphasizes the role of a capable auditor.

Accordingly, it can be inferred that the professional characteristics in the auditors' approaches can lead to more specialized decisions [8]. The reduced professional skills, the weakness of the profession and the low-quality training for auditors [9] and not paying attention to their emotions [10], are all considered as factors affecting the auditors' professional characteristics. The auditors' professional identities based on the Social Identities Theory, the professional maturity and professional career based on the Job Theories like the Theory of Organizational Maturity, and the Behavioral Theories can be recognized as professional characteristics in the audit. In the audit, an auditor with professional identity emphasizes on his desire and interest in his job as a professional commitment. Maturity is defined as "a criterion of individual ability assessment which makes sense with certain rules based on ethical and behavioral capabilities in the job

area". Savickas & Porfeli [11] define the professional maturity as "people's" readiness to accept responsibilities, job decisions in line with the defined purposes and duties and to cope with the assignments and being accountable for them". The audit's job career refers to a professional path through which the auditor passes and it gives him a pleasant and unpleasant feeling about his performance during his tenure Given the descriptions above, the criteria of the auditors' professional characteristics are determined and given in Table 1.

Table 1: Criteria and Definitions of the Professional Characteristics

Definition	Sub-criteria	Main Criterion
Professional identity is considered as one of the components of the social identity which is based on auditors' intuitions and refers to a psychological state in which a person offers unconsciously a re-definition of himself in terms of the present dominant group [12]	Professional Identity	Auditors' Professional Characteristics
Professional maturity in fact refers to an alignment of the personal and internal characteristics of each auditor with the stressful and laborious features of this profession which makes him able to achieve more effective psychological characteristics over time to play a better role in the audit and show more effectiveness in doing his professional duties [13]	Professional Maturity	
From the human resources point of view, the professional career is a model of work- related experiences which defines the individual's quality of work life [14]	Professional Career	

2.2 Perceptual Bias of Auditors

The perceptual bias affects the independent auditors' work in different ways. Firstly, the auditors have main responsibilities to assess a variety of decisions made by different persons. This is, in turn, affected by the perceptual biases. Secondly, the auditors need to know that how the perceptual biases and under what titles affect the decisions of auditors during their auditing? Accounting employees, employees in different categories of the audit, audit managers, the partners responsible for the audit work and the partners responsible for reviewing the audit documents all are those who have the opportunity to inject their biased views in many decisions made during the audit process.

2.3 Review of Literature

Patrick et al [35] examined Realigning Auditors' Accountability: Experimental Evidence. They manipulate auditors' economic accountability to managers by altering who hires the auditor—a manager or an independent third party and auditors' psychological accountability to investors by explicitly stating that the auditor is hired on the investors' behalf. Our design shifts auditors' accountability from managers, who have directional goal preferences, to investors, who prefer judgment accuracy. They find that removing auditors' economic accountability to managers and replacing it with psychological accountability to investors significantly increases audit quality. This increase in audit quality occurs despite the independent third party randomly hiring auditors. In an additional treatment, they incorporate auditor accuracy into the third-party hiring algorithm and find even higher audit quality. Their results suggest that altering auditors' accountability relationships can significantly enhance audit quality.

Mendes et al [15] examined The Perception of Auditors in the Measurement of Instruments Financial Institutions at Fair Value in Financial Institutions. The objective of the research is to analyze the auditors' perception regarding the measurement of the fair value of complex financial instruments level 3 in financial institutions. A questionnaire was applied with a sample of 62 independent auditors with technical qualification in financial institutions of large audit firms among partners. Differences of values were identified that resulted in immaterial issues and an indication of divergences in the measurement of accounting estimates. As a suggestion of improvement in the audit processes. a more robust academic formation and the inclusion of a financial expert in the teams were identified. Kassem [16] Examined Exploring external auditors' perceptions of the motivations behind management fraud in Egypt–a mixed methods approach. The findings revealed that the desire to get remuneration or bonuses and the need to secure financing are

the most common motivations behind management fraud in Egypt. The current study also found other motivations behind management fraud that could be more specific to the Egyptian context.

Plant et al [3] Examined Developing early career professional auditors at work: what are the determinants of success? A qualitative research design was used to collect data through focus group discussions and semi-structured interviews from 65 internal audit stakeholders in South Africa on their experiences of the determinants of workplace learning success for internal auditors. In line with workplace learning theories. it was found that there are five determinants of internal audit workplace success: the learning environment. management support. the early career internal auditors' commitment (attitude and motivation to learn) and a relevant. structured and effective formal workplace learning programmer. Bazideh et al [17] conducted research under the title of "Designing an identity model as a professional audit characteristic in the auditor judgement with a Grounded theory approach". The issue of identity is central in the audit judgment and it is analyzed in four dimensions: individual characteristics; knowledge; skill and experience and the characteristics of the audit firm and considering the causal conditions, background conditions and intervention conditions, the strategies for developing final model are presented.

3 Research Method

The method of the research is descriptive and it is field research in terms of the implementation. The research approach is of inductive-deductive type in terms of the data collection. For this reason, first by studying the theoretical principles of the research, the components and indicators affecting the auditors' professional characteristics and perceptual biases were collected and prepared in the form of a scorecard checklist (Table 4), then based on inductive approach and using the Delphi method, we tried to verify the research's indicators and components. Finally, using the Rough theory method and the Gray Vikor theory, the most effective professional characteristics are presented to reduce perceptual biases. Since the research was faced with, the preferential and uncertain judgements of the experts in completing the questionnaire, both rough theory and gray theory, which are most effective in solving such problems, were used in the research. In other words, the Rough theory was used to create interval numbers and the multiple-criteria decision making methods in the gray zone was used to evaluate the research's items and criteria.

3.1 Statistical Population of the Research

Given the research methodology, a number of 14 individuals of the audit partners having the academic degrees in accounting and behavioral-financial fields, was used in two parts (because there is no Audit Professional Degree in Academic Education in Iran). The experts were asked to examine the determined components in the Delphi analysis. After the Delphi analysis, the members of the Panel were asked to analyze the Rough and the gray theories to prioritize properly the auditors' professional characteristics according to decision-making matrix.

3.2 Research Propositions

As described, the present research relying on similar research, determined a number of components to characterize cognitive biases and professional characteristics. In this section, given the continuous studies, the propositions related to each component are presented in Table 4.

3.3 Research Validity

In order to verify the validity of the questionnaires, the content validity method (CVR) was used. Accordingly, 14 individuals of the Panel members were asked to select one of the mentioned items according to three criteria of the research method that is "necessary", "useful but not necessary and necessary. At the end it was found that all criteria were higher than the determined standard criterion (CVR) and they were

verified.

Table 2: The propositions of the researches determined components

Main component	Sub component	Propositions	References
Professional characteristics	Professional maturity	Emotional stability Psychological stress control Openness to experience Problem facilitation Ambiguity tolerance Stress control Control of the Clients' cultureal differences	[18, 19, 20]
	Professional identity	Understanding the nature of independence and impartiality Understanding the nature of professional skepticism Understanding the conflict of interest between the auditor and the Clients. Increase of commitment and responsibility Mental calm for auditing Lack of dependence on Clients Keep ethical values in the audit Dependence on the audit	[21, 22, 17, 12]
	Professional job career	The coordination of auditor with audit characteristics Correct choices in the way of financial statements' audit Behavioral commitment to audit's values Having a chance for professional development Acquire more knowledge in audit Recognizing critical points in audit Professional health of the audit	[23, 13, 14].
Auditor's perceptual bias	Correspondance bais	Perceptual opportunism Self – important Claim to have knowledge Prejudiced mental frameworks Lack of trust to others Extreme pessimism	[24, 25, 4].
	Optimuism bias (availibility)	Surface assumptions (instant) Surface satisfaction (instant) Lack of a clear mental image Over – confidence to Clients Relutance to searching in financial statements Mental simplification of the evidence	[26, 27, 28].
	Halo bias	Behavioral desire to generalizability Lack of separation context from content Lack of emotional stability Fasciant of worthless against the owner Lack of self-esteem aginst the famous owner	[29, 30].
	Memory bias	Having experience indetecting fraud in finoncial statements Belief in institutionalization of opportunism in managers Understanding the weaknesses of accounting standards Belief in control weaknesses Negative perception ont the managers' tenure Understanding the symbolic nature of internal audit control Belief in the corporates' leadership weakness	[31, 32, 33].

Note: in this research, only four perceptual biases were evaluated

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3.4 Procedures of the Rough Set Theory

The Rough sets introduced by Pawlak [34] for the first time, is a valuable mathematical instrument in uncertainty conditions [34]. A Rough number includes usually" Lower Limit", "Upper limit" and " Rough boundary interval" which depends only on the original data. So, there is no need for supplementary data and this can get better understanding of the experts' intended concepts and improve the decision-making objectivity [34]. Suppose that "U" is a reference set including all members, "Y" is an arbitrary member of U and R sets belonging to "t class". R={$G_1, G_2,\ldots, G_t$} which covers all members of U. If these classes are in order as $G_1 < G_2 < \ldots < G_t$, then $\forall\, Y \in U. G_q \in R. 1 \leq q \leq t$.

The Lower Approximation (Apr (G_q)), the Upper Approximation ($\overline{\mathrm{Apr}}(G_q)$) and the Boundary Area (Bnd (G_q))[3] belonging to class G_q are defined as follows:

$$\underline{\mathrm{Apr}}\left(G_q\right) = \cup\{Y \in U | R(Y) \leq G_q\} \tag{1}$$

$$\overline{\mathrm{Apr}}\left(G_q\right) = \cup\{Y \in U | R(Y) \geq G_q\} \tag{2}$$

$$\begin{aligned} \mathrm{Bnd}\left(G_q\right) &= \cup\{Y \in U | R(Y) \neq G_q\} \\ &= \{Y \in U | R(Y) > G_q\} \cup \{Y \in U | R(Y) < G_q\} \end{aligned} \tag{3}$$

Then G_q can be presented using a Rough number RN (G_q)[4] in its corresponding lower and upper limits: (equations 4-6).

$$\underline{\mathrm{Lim}}\left(G_q\right) = \frac{1}{M_L}\sum R(y) | Y \in \underline{\mathrm{Apr}}\left(G_q\right) \tag{4}$$

$$\overline{\mathrm{Lim}}\left(G_q\right) = \frac{1}{M_U}\sum R(y) | Y \in \overline{\mathrm{Apr}}(G_q) \tag{5}$$

$$\mathrm{RN}\left(G_q\right) = \left[\underline{\mathrm{Lim}}\left(G_q\right).\overline{\mathrm{Lim}}\left(G_q\right)\right] \tag{6}$$

Where M_U and M_L are respectively the values of members $\underline{\mathrm{Apr}}\left(G_q\right)$, $\overline{\mathrm{Apr}}(G_q)$

It is clear that the lower and upper limits detemine respectively the mean value of the elements related to upper and lower approximations and their difference is defined as "Rough Boundary Interval".

$$\mathrm{IRBnd}\left(G_q\right) = \overline{\mathrm{Lim}}\left(G_q\right) - \overline{\mathrm{Lim}}\left(G_q\right) \tag{7}$$

The Rough Boundary Interval expresses the ambiguity of "G_q", so that its larger value means more ambiguity, while the smaller value has more accuracy. So the subjective data can be expressed by the Rough numbers [35].

Gray Hierarchy Analysis Process

The gray hierarchy analysis process is one of the most famous and commonly used multiple decision making which is able to measure the level of preferences' consistency and consider the tangible and intangible criteria. The gray relational analysis method is used to select the best choice based on the numbers of criteria. This method, like the Topsis technique and the Vikor technique, starts with a decision matrix but here in addition to distinction between the positive and negative criteria, it also distinguishes between the most desirable value. In this research, because the experts' judgements were subjective and ambiguous, the gray hierarchy analysis process was used. In the following, the gray hierarchy analysis process is presented.

Step 1. Determine the goals, criteria and choices of the research and form the hierarchy structure.
Step 2. Prepare the pairwise comparison questionnaire and collect the experts' opinions.
Step 3. Using the concept of Rough theory to change the experts' preferences to interval numbers and form the interval pairwise comparison matrix like the equation below:

$$M = \begin{bmatrix} [1.1] & [x_{12}^{L}.x_{12}^{U}] & \dots & [x_{1m}^{L}x_{1m}^{U}] \\ [x_{21}^{L}x_{21}^{U}] & [1.1] & \dots & [x_{2m}^{L}x_{2m}^{U}] \\ & & \vdots & \\ [x_{m1}^{L}x_{2m}^{U}] & [\dots & \dots & [1.1] \end{bmatrix} \quad (8)$$

Where, x_{ij}^{L}, Lower limit; x_{ij}^{U}, Upper limit.

Before computing interval numbers, the inconsistency rate of the pairwise comparison questionnaires should be measured and if this rate is acceptable (below 0.1), we can compute the interval numbers.

Step 4. Calculate the weight of each of the research's criteria using the equations (9) and (10)

$$w_i = \left[\sqrt[m]{\prod_{j=1}^{m} x_{ij}^{L}} . \sqrt[m]{\prod_{j=1}^{m} x_{ij}^{U}} \right] \quad (9)$$

$$w_i' = w_i / \max(w_i^{u}) \quad (10)$$

Where, we have: W_1' is a normalized form. Finally, the weight of the research criteria is obtained.

Gray Vikor Method:

Step 1: In the Vikor method, the decision matrix is formed. Since in this research we have used the Gray Vikor method, the Vikor questionnaire completed by the experts must be first changed into the interval numbers using the Rough theory concept, then performs calculations using the Gray Vikor method. In the following the Gray Vikor method is presented:

Step 1: form the interval decision matrix obtained from the Rough theory,

$$D = \begin{bmatrix} [f_{11}^{L}f_{11}^{U}] & [f_{12}^{L}f_{12}^{U}] & \dots & [f_{1m}^{L}f_{1m}^{U}] \\ [f_{21}^{L}f_{21}^{U}] & [f_{22}^{L}f_{22}^{L}] & \dots & [f_{2m}^{L}f_{2m}^{U}] \\ [f_{n1}^{L}f_{n2}^{U}] & [f_{n2}^{L}f_{n2}^{U}] & \dots & [f_{nm}^{L}f_{nm}^{U}] \end{bmatrix} \quad (11)$$

Step 2: determine the best (the most desirable) value f_j^* and the worst value f_j^- in each criterion of matrix D

For positive criterion (with the profit nature), the largest number shows the best value and the smallest value shows the worst value:

$$f_j^* = \mathrm{Max}_i f_{ij}^{U} . f_{ij}^{-} = \mathrm{Min}_i f_{ij}^{L} \quad (12)$$

It is vice versa for negative criterion (with the expense nature):

$$f_j^* = \mathrm{Min}_i f_{ij}^{U} . f_{ij}^{-} = \mathrm{Max}_i f_{ij}^{L} \quad (13)$$

In general, the best and the worst values are obtained as follows:

$$f_j^* = \{(\mathrm{Max}_i f_{ij}^{U} | j \in B) \mathrm{or} (\mathrm{Min}_i f_{ij}^{L} | j \in C)\} \quad (14)$$

$$f_j^- = \{(\mathrm{Min}_i f_{ij}^{L} | j \in B) \mathrm{or} (\mathrm{Max}_i f_{ij}^{U} | j \in C)\} \quad (15)$$

B is a set of positive criteria and C is a set of negative criteria.

Step 3: Calculate values of $[S_i^L S_i^U]$ و $[R_i^L R_i^U]$

$$S_i^L = \sum_{j\in B} W_j^L \left(\frac{f_j^* - f_{ij}^U}{f_j^* - f_j^-}\right) + \sum_{j\in B} W_j^L \left(\frac{f_{ij}^L - f_j^*}{f_j^- - f_j^*}\right) \tag{16}$$

$$S_i^U = \sum_{j\in B} W_j^U \left(\frac{f_j^* - f_{ij}^L}{f_j^* - f_j^-}\right) + \sum_{j\in B} W_j^U \left(\frac{f_{ij}^U - f_j^*}{f_j^- - f_j^*}\right) \tag{17}$$

$$R_i^L = \max_j \begin{cases} W_j^L \left.\frac{f_j^* - f_{ij}^U}{f_j^* - f_j^-}\right| j \in B \\ W_j^L \left.\frac{f_{ij}^L - f_j^*}{f_j^- - f_j^*}\right| j \in C \end{cases} \tag{18}$$

$$R_i^U = \max_j \begin{cases} W_j^U \left.\frac{f_j^* - f_{ij}^L}{f_j^* - f_j^-}\right| j \in B \\ W_j^U \left.\frac{f_{ij}^U - f_j^*}{f_j^- - f_j^*}\right| j \in C \end{cases} \tag{19}$$

Where W_j^L is lower limit and W_j^U is upper limit of each criterion's weight.

Step 4: Calculate values of $\left[Q_i^L Q_i^U\right]$

$$Q_i^L = \nu\left(\frac{S_i^L - S^*}{S^- - S^*}\right) + (1-\nu)\left(\frac{R_i^L - R^*}{R^- - R^*}\right) \tag{20}$$

$$Q_i^U = \nu\left(\frac{S_i^U - S^*}{S^- - S^*}\right) + (1-\nu)\left(\frac{R_i^U - R^*}{R^- - R^*}\right) \tag{21}$$

$S^* = \mathrm{Min}_i S_i^L$ ،$S^- = \mathrm{Max} S_i^U$ ، $R^* = \mathrm{Min}_i R_i^L$ ، $R^* = \mathrm{Max}_i R_i^U$

Q *is a cumulative index. in addition.* v *indicates the weight of the maximum criterion policy and is shown a*

Shown as $\nu \in [0.1]$: usually $\nu = \frac{0}{5}$

Step 5: Ranking choices according to S, R and Q.

Since the Gray Vikor method suggests the interval weights for the choices of the research, the weight of the choices, similar to Vikor method, cannot be easily ranked according to Q index. In order to rank the interval weights, there are several ways that are described below.

$$A = [a_1 . a_2]; B[b_1 . b_2] \tag{22}$$

$$C = [c_1 . c_2] = A - B = [a_1 - b_2 . a_2 - b_1] \tag{23}$$

$$\mathrm{IF} \frac{|c_1|}{c_2 - c_1} < \frac{|c_2|}{c_2 - c_1} \rightarrow \mathrm{Then}\ A > B \tag{24}$$

$$\mathrm{IF} \frac{|c_1|}{c_2 - c_1} < \frac{|c_2|}{c_2 - c_1} \rightarrow \mathrm{Then}\ A \leq B \tag{25}$$

4 Empirical Results

In this section, in order to analyze and interpret the main question of the research which states that "Are the auditors' perceptual biases moderated according to the professional audit characteristics? first the Delphi analysis is used to accept/delete related propositions, then it will be analyzed according to Rough theory in the next section.

4.1 Delphi Analysis

In this section, in order to determine the research propositions in the model, first the determined components of the research in the form of a scorecard checklist according to Table (5) are distributed among 14 experts who were selected using the homogeneous sampling method to determine whether their opinions related to

determined characteristics about the perceptual biases and professional characteristics get the required score.

Table 3: Delphi Analysis of the Research Variables and Criteria

Main component	Sub-component		Quantitative calculation		
			Mean	Agreement	Comfort/ Eliminate/Merge
Professional characteristics	Professional maturity	Emotional stability	5/33	0/83	**Comfort**
		Openness to experience	5/16	0/69	**Comfort**
		Simplification of problems	3/75	0/29	**Eliminate**
		Psychological stress control	5/16	0/65	**Merge**
		Ambiguity tolerance	5/33	0/85	
		Stress control	5	0/61	**Comfort**
		Control of the Clients' cultural differences	4/25	0/37	**Eliminate**
	Professional identity	Understanding the nature of independence and impartiality	5/58	0/88	**Merge**
		Understanding the nature of professional scepticism	5/10	0/69	
		Understanding the conflict of interest between the auditor and the Client	5/63	0/84	**Comfort**
		Increase of commitment and responsibility	5/26	0/7	**Comfort**
		Mental calm for auditing	4/16	0/42	**Eliminate**
		Keep ethical values in the audit	5/13	0/62	**Comfort**
		Dependence on the audit	4/04	0/31	**Eliminate**
		Lack of dependence on Clients	5/29	0/74	**Comfort**
	Job career	Having a chance for professional development	4/15	0/48	**Eliminate**
		Acquire more knowledge in audit	4/05	0/45	**Eliminate**
		Recognizing critical points in audit	5/12	0/67	**Comfort**
		The coordination of auditor with audit characteristics	5/34	0/8	**Comfort**
		Correct choices in the way of financial statement's audit	3/88	0/2	**Eliminate**
		Behavioural commitment to audit's values	5/16	0/65	**Comfort**
		Professional health of the audit	5	0/61	**Comfort**
Auditor's perceptual bias	Correspondence bias	Perceptual opportunism	5.41	0.74	**Comfort**
		Self – important	3/91	0/35	**Eliminate**
		Claim to have knowledge	4/08	0/33	**Eliminate**
		Prejudiced mental frameworks	3/41	0/25	**Eliminate**
		Lack of trust to others	5/33	0/83	**Comfort**
		Extreme pessimism	5/5	0/85	**Comfort**
	Optimistic bias	Surface assumptions (instant)	5/21	0/69	**Comfort**
		Surface satisfaction (instant)	5/58	0/89	**Comfort**
		Lack of a clear mental image	4/08	0/33	**Eliminate**
		Over – confidence to Clients	5/5	0/85	**Comfort**
		Reluctance to searching in financial statements	5/41	0/74	**Comfort**
		Mental simplification of the evidence	3/41	0/25	**Eliminate**
	Halo bias	Behavioural desire to generalizability	5/16	0/69	**Comfort**
		Lack of separation context from content	5/33	0/85	**Comfort**
		Lack of emotional stability	4/50	0/41	**Eliminate**
		Fascinated by the owner's emotional attractions	5/5	0/85	**Comfort**
		Feeling of worthless against the owner	3/75	0/29	**Eliminate**
		Lack of self-esteem against the famous owner	5/14	0/70	**Comfort**
	Memory bias	Having experience in detecting fraud	5/5	0/86	**Comfort**
		Belief in institutionalization of opportunism	5/15	0/64	**Comfort**
		weaknesses of accounting standards	4/44	0/48	**Eliminate**
		Belief in control weaknesses	5/13	0/62	**Comfort**
		Negative perception on the managers' tenure	5/20	0/78	**Comfort**
		Understanding the symbolic nature of internal audit Control	5/26	0/7	**Comfort**
		Belief in the corporates' leadership weakness	3/81	0/2	**Eliminate**

According to information obtained from the table above, from a total of 47 items, 16 items with a mean below 5 (according to 7-point Likert Scale) and a coefficient of agreement below 0.5 were deleted. The deleted indicators include:

Table 4: Deleted Items

Items	Sub-components
Facilitating problems Control the Clients' cultural differences	Professional maturity
Mental calm for auditing Dependency on the audit profession	Professional identity
A chance for professional development Getting more knowledge in the audit profession Proper choices in the way of financial statements' audit	Career path
Self-importance Claiming to have knowledge Biased subjective frameworks	Correspondance bias
Lack of a clear mental image Mental simplification of evidence	Optimistic bias
Emotional instability Having a feel of worthless against the Client	Halo bias
Recognition of accounting standards' weaknesses Believing the weakness of the corporates' leadership	Memory bias

Moreover, 4 items were combined that are shown in Table 5.

Table 5: Combined Items

Merged items	Title of new item	
Psychological stress control	Control of stress and ambiguity	Professional maturity
Ambiguity tolerance		
Understanding the nature of independence and impartiality	Professional impartiality and skepticism	Professional identity
Understanding the nature of professional scepticism		

Table 6: The Results of Gray Hierarchy Analysis Process

Components	Weight of components		Items	Code	Weight of items		Final weight	
	Upper limit	Lower limit			Upper limit	Lower limit	Upper limit	Lower limit
Correspondence bias	0.79	0.94	Opportunism Lack of trust Extreme pessimism	(C1) (C2) (C3)	0.309 0.772 0.323	0.501 1 0.463	0.268 0.693 0.320	0.501 1 0.463
Optimistic bias	0.69	0.87	Mental assumption Satisfaction Over-confidence Lack of searching	(C4) (C5) (C6) (C7)	0.331 0.279 0.789 0.435	0.457 0.315 0.944 0.631	0.320 0.219 0.643 0.339	0.457 0.315 0.944 0.621
Halo bias	0.74	0.91	Generalizability Context from content Fascinated by the owner Lack of self – esteem	(C8) (C9) (C10) (C11)	0.563 0.299 0.243 0.218	0.839 0.421 0.326 0.284	0.549 0.176 0.193 0.161	0.839 0.421 0.326 0.284
Memory bias	0.71	0.89	Detecting fraud Opportunism Control weakness Negative perception Understanding the symbolic nature	(C12) (C13) (C14) (C15) (C16)	0.372 0.156 0.769 0.430 0.309	0.430 0.229 0.919 0.604 0.501	0.268 0.119 0.613 0.321 0.268	0.426 0.224 0.919 0.604 0.501

4.3 Rough Theory Analysis

In this section, the weights of the research's criteria and propositions were computed using the gray hierarchy analysis process. For this reason, after forming the pairwise comparison matrix, the experts' opinions were collected. In the next step, the inconsistency rate of each of the pairwise comparison matrices was determined. If the inconsistency of the pairwise comparison questionnaires is in standard limit (below 0.1), the next step can be started, otherwise the questionnaires will be returned to the experts for reviewing. After confirming consistency rate of the pairwise comparison questionnaires using the Rough theory (equation 1-6), the experts' opinions turned into the interval numbers. Finally using the equations 8-10, the weights of criteria were obtained. The results obtained from the calculations of the gray hierarchy analysis process are shown in Table 8. It should be noted that based on the determined accepted and deleted items.

In the next step, after computing the weight of the criteria, decision matrix will be formed to solve the problem. In order to form the interval decision matrix, first the experts' opinions on situation of each of the propositions (items) were collected using the Vikor questionnaire. The results are shown in Table 7. Because of the lack of pages, only the opinions of 5 experts are given in Table 7.

Table 7: The Experts' Opinions on Each of the Items Based on Each Criterion

	Opportunism (C1)	Lack of trust (C2)	Extreme pessimism (C3)	Assumptions (C4)	Satisfaction (C5)	Over-confidence (C6)	Lack of searching (C7)	Generalizability (C8)	Lack of separation of context from content (C9)	Fascinated by the owner (C10)	Lack of self – esteem (C11)	Detecting fraud (C12)	Opportunism (C13)	Control weakness (C14)	Negative perception (C15)	Symbolic perception (C16)
Participant (1) as a decision maker																
A1	4	12	14	14	11	16	13	13	13	12	10	9	12	13	11	15
A2	15	12	12	16	19	17	13	17	14	15	15	12	12	15	16	11
A3	10	8	12	14	12	11	10	9	13	15	10	11	14	12	10	11
Participant (2) as a decision maker																
A1	12	14	14	12	10	19	12	9	14	19	13	13	12	15	16	11
A2	18	14	14	20	16	13	13	15	12	10	9	12	13	11	15	16
A3	13	14	10	14	10	5	8	14	10	2	8	11	13	12	10	10

Due to the limitations of the pages of the article, the points were given by two experts.

After distributing questionnaires and analyzing experts' opinions on each of the items (auditors' perceptual biases) in each proposition, the decision matrix is formed to analyze the problem (professional identity, professional maturity and job career). To form a decision- making table for the problem, first the analyses of 14 experts' opinions in this research should be turned into the interval numbers. For this change, the equations 8-15 are used. The gray hierarchy analysis process is one of the most famous and commonly used multiple decision making which is able to measure the level of preferences' consistency and consider the tangible and intangible criteria. The gray relational analysis method is used to select the best choice based on the numbers of criteria. This method, like the Topsis technique and the Vikor technique, starts with a

decision matrix but here in addition to distinction between the positive and negative criteria, it also distinguishes between the most desirable value. In this research, because the experts' judgements were subjective and ambiguous, the gray hierarchy analysis process was used. In the following, the gray hierarchy analysis process is presented. Since the Gray Vikor method suggests the interval weights for the choices of the research, the weight of the choices, similar to Vikor method, cannot be easily ranked according to Q index. Table 8 shows the interval decision matrix obtained from the Rough method:

Table 8: The Interval Decision Matrix of the Rough Theory

Professional	Opportunism(1)		Lack of trust(2)		Extreme pessimism(3)		Assumptions(4)		Satisfaction(5)		Over-confidence(6)		Lack of searching(7)		Generalizability(8)	
	(L)	(U)	(L)	(U)	(L)	(U)	(L)	(U)	(L)	(U)	(L)	(U)	(L)	(U)	(L)	(U)
A1	23	37	24.10	38.18	25	40	21	34	25	39	22	36	21.20	34.08	21	35
A2	20	32	23	37	24.12	38.60	17.87	29.40	23	37	21	34.90	25	39.92	19	31
A3	21.74	34.58	21	34	22	35	18	30	19	31	23	37	25	39	21	34

As shown in the table above, the decision related to auditors' perceptual bias determined that the lack of separation context from content as Halo bias and the experience of discovering fraud in financial statements as memory bias have been the most important factors of auditors' perceptual biases which indicates that the auditors are more likely to experience these two kinds of biases in the audit profession. However, there are items that in turn obtain relatively high scores and depending on the person's perceptual characteristics, they may exhibit a certain bias at the given time. In the following, to analyze the gray vikor method, items of the research will be evaluated. The first step in the gray vikor method after forming decision matrix, is to determine the optimal positive value (f_j^*) and the optimal negative value (f_j^-) in each of the criteria of the decision matrix. Table (9) shows the results as follows:

Table 9: Determine the Most Effective and the Less Effective Proposition of the Perceptual Bias

	Opportunism	Lack of trust	Extreme pessimism	Assumptions	satisfaction	Over-confidence	Lack of searching	Generalizability	Lack of separation of context	Fascinated by the owner	Lack of self -esteem	Detecting fraud	Opportunism	Control weakness	Negative perception	Symbolic perception
f_j^*	60.5	52	54.7	52	49.5	47.5	55.7	62.2	68	48	49.7	66	47.7	50.7	56.2	50.5
f_j^-	45.25	40	43.75	45.75	38	33.35	39	41.25	60.25	31.25	38.25	59.5	38	32.5	28.25	29

After determining the most effective and the less effective case, it was found that from a total of the scores related to experts' decision matrix in respect to auditors' perceptual bias, the highest rate of optimality was belonged to both criteria, lack of separating context from content and having experience of discovering fraud in financial statements as Halo bias and memory bias and the lowest rate of bias was belonged to understanding the symbolic nature of internal audit control as memory bias which indicates that the auditors have the minimum rate of bias compared to internal auditors working in the companies. In the following of

the gray vikor method analysis, the final step will be implemented, i.e. first the indicators S_i^U, S_i^L, R_i^U, R_i^L are calculated according to equations (16)- (19), then by determining the indicators, the main indicator of gray vikor, Q, is determined using the equations 20-21. Table (10) shows the results of the calculations.

Table 10: The Analysis of the Gray Vikor Method's Indicators

Professional characteristic	S_i^U	S_i^L	R_i^U	R_i^L	Q_i^U	Q_i^L
Professional maturity	1.027661	2.187882	0.217261	0.78379	0.356110	0.637281
Professional identity	1.119820	2.210621	0.372688	0.66382	0.47839	0.832730
Job career	1.473082	2.382901	0.59889	1	0.64732	0.947362
Indexes			S^*	S^-	R^*	R^-
Value of indexes			0.554622	2.738271	0.301317	1

Given the results obtained from Table 11, the items which are considered in this research according to index Q, indicate that the maximum value of Q was belonged to the job career component (A3) and the minimum value was belonged to the professional maturity component (A1). It should be noted that based on ranking of Q index, the component with the minimum value, professional maturity (A1), can play a main role in moderating the auditors' perceptual biases as the most important priority.

5 Conclusion

Different theories have supported the necessity of the audit process as a main element for production and presentation of financial information. Regarding the place of audit, there is almost a consensus that the audit has a significant role in increasing the investors and the shareholders' decision-making power using the behavioral and professional mechanisms. In fact, different studies and theories such as supervisory theory, rational expectations theory, information theory and insurance hypothesis have justified the importance of the audit process as a main element for production and presentation of financial information. But despite all these assertions, the question arises that how much can an auditor be effecive on producing information content from the corporates' financial performances? Do the auditors experience constraints such as perceptual biases? Certainly, the audit profession like other jobs due to its responsinility and decision-making natures, will experience the behavioral biases.

However, the recognition of these constraints and attention to the conceptual understanding of auditors' professional behaviors can greatly help improve the transparent information community (Valiyan et al.), [13] iven the preliminary descriptions above, the purpose of the research is to adjust and moderate auditors' perceptual biases based on professional audit characteristics using the Rough theory. In this research, relying on the concepts of perceptual biases and professional charactristics, first it is tried to identify the components and the related indicators with participation of Panel's members, then based on the Rough theory, the effectiveness of the auditors' professional charactristics on perceptual biases are evaluated. According to the content analysis in the researches such as Rahnavard & Khalili Pour [19]; Bamber & Lyer [21]; Bauer [22]; Liu et al [23]; Valiyan et al., [13], three criteria: professional maturity, professional identity and job career were identified as the components of the professional charactristics. Then according to the researches such as Nolder & Kadous [24]; Jones et al., [25]; Hormozi et al., [4]; Olsen & Gold [26]; Baars & Gage [27] Moore et al., [29] and Craig et al., [33], four kinds of biases: Optimism (availability), Halo and memory biases were identified. In the second part of the analysis after determining items, the Delphi analysis was performed and from a total of 47 items related to the professional biases and charactristics, 16 items were deleted and 4 items were combined.

According to the Rough analysis, because the items of peceptual bias were the goal of the research, they incorporated in the Delphi analysis as a subject. The purpose of the research is to adjust and moderate auditors' perceptual biases based on professional audit characteristics using the Rough theory. The Results show that the auditors are more likely to encounter Halo bias in their career path, because they don't have

the ability to separate context from content due to the characteristics in the audit. They may also encounter this kind of bias when reviewing the Clients' statements and they may avoid from complete reviews. On the contrary, an auditor with a Halo bias may have strict comments only by observing an error in the disclosure without doing a more accurate detection of accounts. The biases cause that the auditors do not use their expertises and professional behaviours and only use their own favorited features in their statements. On the other hand, based on the previous mental experiences in detecting a fraud in the financial statements, the auditor will experience another kind of bias, memory bias.

This kind of bias is based more on individual experiences over time which though it can be useful, it can cause that the auditor incorporates his mental sensitivity in his decision making, the sensitivity that is institutionalized in auditor's mind based on the previous experiences. This causes that the auditor's perception affected by mental schemas. Finally, the results of the gray vikor analysis that is an analytical method to choice the most effective professional audit characteristic to reduce the perceptual biases showed that the professional maturity is the most important component of professional characteristics which contributes significantly in reducing the auditors' perceptual biases. An auditor with professional maturity is able to create a more desirable conformation between the inherent characteristics and his expectations with the stressful characteristics and his career responsibilities and able to show more dynamism both mentally and physically. It causes that the auditor gains more efficient psychological characteristics in decision-making and judgement about the performance of the Clients. Accordingly, he shows more efficiency in performing his duties and responsibilities and controling perceptual biases. The intuition has definitely obtained over the years of experience. It causes that a person is less likely to experience perceptual biases and thus makes more confident decisions. The results obtained from the research are in consistent with the researches of Rezayee et al [12]; Valiyan et al [13] and Guiral et al [32] only in terms of the content and concept.

According to the results, it is suggested that the development of cognitive characteristics in the audit profession can help the auditors' behavioral and specialized conceptualization in more desirable job career and improve the quality of their audit reviews. In other words, development of cognitive characteristics creates more special and mental coherence between the individual characteristics and the technical skills in the auditor's decision making and increases their tolerance and stress control in critical conditions. It is also recommended that by holding cognitive-perceptual courses and MBTI personality types, the auditors are helped to better understand the power of reasoning and change of moods and emotions in the audit reviews and try to overcome these problems in different times to not experience temporary and constant biases. It is necessary to avoid of perceptual biases in the audit by recognizing the traps such as worthless trap or idealism trap.

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