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The Portfolio Choice in Emergent Markets a Rational or a Behavioral Decision: a Cognitive Answer

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Abstract

The purpose of this study is to explore the relationship between the rational and the behavioral portfolio theories, two theories that describes the decision making process on the domain of portfolio choice, under investors' perception. This will offer a more realistic answer that describes the investors' decision on term of portfolio choice. Our sample contains 30 Tunisian investors who trade at the Tunisian stock exchange (BVMT). We introduce an approach based on cognitive mapping with a series of interviews. We combine both concepts that belong to the mean-variance and the behavioral approach and we explore the interactions between them. We introduce some new notions such as the zone of communication between the two cited theories and the "variables of connection". We demonstrate that investors use the mean-variance theory of portfolio choice but they are affected by their cognitive biases and emotions when making their portfolio choice decision.

Keywords: Mean-variance portfolio Choice, Behavioral Portfolio Choice, cognitive maps, areas of communication, concepts of connection.

1. Introduction

One important bloc of the financial literature is the study of the wealth management and especially the portfolio choice. How should investors constitute their portfolios? A practical answer was advanced by Markowitz (1952, 1959). The portfolio choice is an arbitrage between the risk and the return of an asset. The mean-variance portfolio approach assumes that investors are fully rational. They use a mean-variance optimizer to maximize their utility function which has a concave form reflecting their risk-aversion.

Beyond the mean-variance framework, empirical and experimental researches argue that (Kahneman and Tversky, 1979) investors are normal (Statman, 2005) and they are affected by their psychology when they make decisions. This is the beginning of a new approach: the behavioral finance.

The main-contribution of the behavioral finance on the domain of portfolio management is with no doubt the behavioral portfolio theory initiated by Shefrin and Statman (2000). A theory that derives from some realistic hypothesis: Investors are normal (Statman, 2005) and they use an S-shaped utility function (Kahneman and Tversky, 1979) that reflects their attitudes toward risk. Investors are also influenced by their emotions (Lopes, 1987).

Researches in the financial theory are silent about the relationship between the rational mean-variance theory of portfolio choice and the behavioral portfolio theory (Shefrin and Statman, 2000). There is no specification concerning the existence or not of this relationship. In the case of the presence of such relationships, we interrogate about the nature of this relationship: a relation of complementarities' or

substitutability?

There are two specific objectives of this study. Firstly, we intend to propose a methodology based on cognitive mapping to detect the existence of a relationship between the rational mean-variance theory of portfolio choice and the behavioral one. This will be obtained by the study of interactions between concepts from these two theories and the detection of some area of communication between these theories.

The remainder of this paper is organized as follows. In the second section we provide a review of the literature on the portfolio theories concept. The third deals with methodological details which include data description and the analysis method. Section four discusses the empirical results. The fifth section generates the empirical implications of our study. Finally, the sixth section offers concluding remarks and discusses implications of our findings.

2. Literature review

In financial literature, the rational mean-variance theory of portfolio choice, as prescribed by Markowitz (1952, 1959), is considered as the best approach for the construction and the management of assets. It proposes some quantitative tools such as the mean and the standard deviation to respectively measure the return and the risk of portfolio. The covariance is an important concept since it is very close to the diversification concept.

In a rational framework of portfolio choice, investors act as if they are fully rational. At each time t, investors try to choose stocks that maximize their utility function. This is will be an easier task when using the mean-variance optimizer. However, Markowitz themselves do not follow this men-variance approach (Statman, 2005).

The emergence of the behavioural finance should integrate, in the domain of portfolio management, new dimensions such as investors' psychology (Kahneman and Tversky, 1979, 1991) and emotions (Lopes, 1987). This is the centre of the Behavioral Portfolio Theory (Shefrin and Statman, 2000). This new theory supposes the normality of investors. In their decision making, investors are affected by some psychological biases

From a behavioural point of view, emotions such as hope and fear can affect investor's wealth allocation. This is by the creation of a safety aim excess or a potential aim excess. The Hope emotion may lead to an excess of a "potential aim". In this case, investor will be more attracted to invest on risky assets such as stocks with the highest level of risk and so that can normally generate high return. Inversely, the Fear emotion generates an excess of a "safety aim". In term of portfolio choice, an investor who presents an excess of a safety aim should react as it prescribed by Roy (1952). According to Roy (1952), safety first investor trays to minimize the probability of ruin, it means the probability that his final wealth falls short of a subsistence level s[1].

In their descriptive theory, Shefrin and Statman (2000, 2003) introduce the mental accounting bias effect. The mental accounting concept has been first used by Thalar (1980). He affirms that the mental accounting attempts to describe the process whereby people code, categorize and evaluate economic outcome. Investors use different mental account and each one has a specific aim. For example, an investor may distinguish between the "safety aim" and the "potential aim". In fact, the behavioural portfolio as initiated by Shefrin and Statman (2000) has the form of a pyramid with two layers. The downside layer's aim is the protection from poverty. And it is a logic answer to the safety aim. The second one is the upside layer with a potential aim's. Each layer has a specific account and the covariance between layers is overlooked (Shefrin and Statman, 2003).

A tentative reading and analysis for the cited theories of portfolio choice proves that each one have some basic concepts that govern the portfolio choice' decision. Table [1] summarizes the basic concepts for each theory.

[1] For more explanations see « The Behavioral Portfolio Theory », Shefrin and Statman (2000).

The mean-variance theory of portfolio choice offered the first systematic treatment of a dilemma that each investor faces: the conflicting objectives of high profit versus low risk (Steinbach C. 2001). Markowitz proposes some quantitative tools to build and manage portfolios. The variance as a measure of risk and the expected return as a measure of return help investors on their portfolio's decision. The covariance between assets and the diversification level are practical tools to manage investor's portfolio. The literature revue argues that these concepts are the basis of the rational mean-variance theory of portfolio choice (Markowitz 1952, 1959). Statman (2005) describes the mean-variance technique as "a practical tool" that aim to help investors to overlap their cognitive bias.

An alternative theory to the mean-variance theory is the behavioral one (Shefrin and Statman, 2000). It is on the basis of some psychological concepts. It is a theory that aims to integrate the role of behavioral concepts. Namely, the "emotions", "safety aim", "potential aim" and "mental accounting" can be considered as the basic concepts in this new framework of portfolio choice. One important question is to interrogate on the existence and the nature of the relationship between these two theories of portfolio choice. Which theory can best describe the investors' decision making in term of portfolio constitution and management?

3. Materials and Methods

We use in this study the cognitive mapping technique. Downs and al. (1973) define the cognitive mapping as "a process composed of a series of psychological transformations by which an individual acquires, codes, stores, recalls, and decodes information about the relative locations and attributes of phenomena in their every day spatial environment". In more general terms, Arthur and Passini (1992) define cognitive map as "an overall mental image or representation of the space and layout of a setting" this means that the cognitive mapping is "the mental structuring process leading to the creation of a cognitive map".

In his pioneering paper, Tolman (1948) argues that rats, like humans, have a mental representation of the world he called a cognitive map. These maps hold detailed spatial information that individuals collect, integrate and use while interacting with the environment. Tolman's work has led to the modern psychological definition of a cognitive map: an overall mental image or representation of the space and layout of a setting (Arthur and Passini, 1992).

Axelrod (1976) introduces the cognitive maps as a formal way to model decision making in social-economic and politic systems. According to Eden and Ackermann, 2004 the cognitive map is a representation of how humans think about a particular issue this is guaranteed by analyzing, arranging the problems and graphically mapping concepts that are interconnected. In addition, it identifies causes and effects and explains causal links. The cognitive maps study perceptions about the world and the way they act to reach human desires with- in their world (Bueno and Salmeron, 2009). It is a mental representation of a person's environment, relied upon during wayfinding (Sharlin et al 2009). It is attractive in the sense that it represents a set of cause–effect relationships where the impact produced by the change of one or several elements over the whole system is studied (Koulouriotis et al., 2003).

3.1 Sample selection and the interview process

Our sample consists of 30 Tunisian investors who trade or were traded at the Tunisian stock exchange (BVMT). The limit size of our sample derives from the refusal of investors to participate. They explain their refusal by the lack of time and they are seemed none interesting by the topic of the study. For each investor, we realize an interview between 30 minutes to one hour. At the beginning of each interview, we present the aim of our study. We use a semi-directive interview. Each investor was invited to talk about the 8 concepts (variance, covariance, expected return, diversification, emotions, safety aim, potential aim and the mental accounting). The discussion cover the meaning of these concepts from the investor's point of view and whether they affect or not their portfolio choice. After that, we invite each investor to draw his own cognitive

map. A paper with the different cited concepts was distributed and he will link between concepts that can have a relationship between them. He will indicate the orientation of each relationship. The intensity a relationship between two concepts A and B can be week (with a value of 1), moderate (2) or strong (3). During the interview process, we ask investors about any relationship that seemed illogically.

3.2 Analysis method

We concentrate on the interactions between concepts from the mean-variance theory of portfolio choice (Markowitz 1952, 1959) and other from the behavioural portfolio theory of Shefrin and Statman (2000). In our case the number of concepts is 4 from each theory. So, the adjacency matrix should contain 64 proximity's relations.

In individual matrixes, the strength of the relationship between concepts may take four different values:

$$a_{ij} \begin{cases} a_{ij} = 0 \text{ if there is no relationship between the concept } i \text{ and the concept } j \\ a_{ij} = 1 \text{ if there is a week relationship between the concept } i \text{ and the concept } j \\ = ij \text{ there is a moderate relationship between the concept } i \text{ and the concept } j \\ a_{ij} = 3 \text{ if there is a strong relationship between the concept } i \text{ and the concept } j \end{cases}$$

$$\text{where} \quad i:=1,\ldots,8 \text{ and } j:=1,\ldots,8.$$

In the special case, where we aim to detect the interactions between the mean-variance concepts and the behavioural concepts of portfolio choice, each individual matrix contains two zones of communications. We define the "zone of communications" as the special area in the adjacency matrix that detects the influences of the mean-variance concepts (behavioural concepts) on the behavioural concepts (mean-variance concepts). In the first area (The red matrix), a_{ij} represent the strength of the relationship between *i* mean-variance concept on the behavioural concept j. In the second matrix, *i* denote behavioural concept and *j* a mean-variance concept.

To delimit the investors' perception globally, we follow Prigent and al 2008). We construct average maps by calculating the arithmetic mean of the adjacency matrices. As a result, the intensity of the relationships between two concepts may vary between 0 and 3. So that, we can write:

$$a_{ij} \in [0,3] \quad \text{where } i := 1,\ldots,8, \quad j: = 1,\ldots,8 \quad \text{and} \quad i \# j \tag{1}$$

If the two theories are interrelated, in a conceptual form, then there will be some proximity's relation a_{ij} satisfying:

$$a_{ij} \# 0 \text{ where } \quad i: 1,\ldots,4 \text{ and } j: 5,\ldots,8. \text{ (The red matrix)} \tag{2}$$

$$a_{ij} \# 0 \text{ where } \quad i: 5,\ldots,8 \text{ and } j: 1,\ldots,4. \text{ (The blue matrix)} \tag{3}$$

Logically, if there will be some interactions between the mean-variance and the behavioural concepts of portfolio choice, this means that these two theories are linked in the cognitive schema of an investor. For example, if an investor indicates that "Emotions" influence the concept "variance", this means that he is oriented by his emotions in choosing the variance of his portfolio. In order to detect the cognitive relationship between the two theories of portfolio choice, we identify some concepts that link the two theories. We consider them as "connection variables".

The cognitive relationship between two concepts may be absent, week, moderate or intense. And the strength of the relations of proximities affects the quality of the relationship between the two considered theories. This relationship is also an increasing function of the number of the proximities a_{ij} that satisfy conditions (1) and (2).

The first zone of interactions (the red matrix), aims to detect influences exert by mean -variance concepts of portfolio choice on others behavioural concepts. The second area of communication between the two theories is represented by the blue colour. It aims to explore the impact of the behavioural concepts on the mean-variance concepts of portfolio choice.

In order to calculate the intensity of the effect of each concept on others concepts, we calculate the weight of each concept as bellow. We inspire from the graph theory the weight of each concept. In a first, step we

calculate this weight according to the lines in each zone of communication. The formulation of weights is described by the next two formulas:

The weight of the mean-variance concepts is calculated from the first zone (the red matrix) and it is the summation of the each line of this matrix. Each mean-variance concept *i* has the next weight w_i :

$$w_i = \sum_{j=5}^{8} a_{ij} \quad and \quad i \in \{1,2,3,4\} \tag{4}$$

The weight (w_i) can serves as a measure of the intensity of influences exert by the mean-variance concept *i* on all other behavioral concepts. The weight of the behavioural concepts is generated from the second area of communication (the blue matrix). Each behavioural concept has the next weight w_j :

$$w'_i = \sum_{j=1}^{4} a_{ij} \text{ and } j \in \{5,6,7,8\} \tag{5}$$

The weight(w'_i) can serve as a measure of the intensity of influences exerts by the behavioural concept *i* on all other mean-variance concepts.

Logically, these weights reflect the capacity of each variable to link the two theories of portfolio choice in the cognitive schema of investors from our sample. For more appreciation, we should integrate a new component that measures the weight of influences exert by other variables on a specific concept *i*. we formulate these weight as bellow:

The weight of influences received by the mean-variance concept *j* and exerted by the behavioural concepts is calculated from the second area of communication (the blue matrix) as the summation of each column of this matrix.

$$w''_j = \sum_{i=5}^{8} a_{ij} \; and \; j \in \{1,2,3,4\} \tag{6}$$

The weight of influences received by the behavioural concept *j* and exerted by the mean-variance concepts is calculated from the first area of communication (the red matrix) as the summation of each column of this matrix.

$$w'''_j = \sum_{i=5}^{8} a_{ij} \; and \; j \in \{5,6,7,8\} \tag{7}$$

The utility of the calculation of these weight is to judge on the presence or not of a cognitive relationship between the two theories. It reflects also the weight of each concept on each area of communication. The final step in our analysis is the isolation of the most central concepts that govern the portfolio choice decision. This objective may be attained by the calculation of a total weight for all the concepts in each area of communication. We define the total weight of a Rational mean-variance concept $i=j \in \{1,2,3,4\}$ asw_{TRi}:

$$w_{Ti} = w_i + w''_i \tag{8}$$

While, total weight of a Behavioural concept $i=j \in \{5,6,7,8\}$ as w_{TBi} as:

$$w_{TBi} = w4_i + w'''_i \tag{9}$$

4. Results and discussions

Table [3] shows the different possible interactions between all considered concepts of the portfolio choice theories. The adjacency matrix shows two areas of communication between the rational and the behavioural concepts of portfolio choice. In a first step, we study the impact of the rational mean-variance concepts on the behavioural concepts (this matrix is represented by the red colour). Then, we explore the influence of the behavioural concepts on the rational one (this matrix is represented by the blue colour).

Our results show that the mean-variance concept "Diversification" affects all the behavioural concepts (Emotions, Potential aim, Safety aim and Mental accounting). In their cognitions, the diversification is closed to the safety aim.

In a cognitive map, a relationship between concept A and B means that A is the explanation of B or B is the consequence of A (see Prigent and al, 2008). In our case, "Emotions" explain the level of the variance of their portfolio (a_{51}= 0.40). It affects also the technical concepts "Covariance" and "Expected Return". This

relationship goes into an intensity of 0.90. As it predicted by Statman (2005), "investors are normal" and they are affected by their psychology when constructing and managing their portfolio.

The "Potential aim" and the "Safety aim" can govern the portfolio choice. Investors from our sample consider that the existence of a safety aim or a potential aim affect the diversification level. However, these two factors do not have the same weight in the cognitive universe of investors. The "safety first investors" are more attracted by the diversification strategy. This is because they essay to conserve a subsistence level as it described by "the safety first theory" of Roy (1952).

Our result corroborates the theoretical predictions of the behavioural portfolio theory (Shefrin and Statman, 2000). The most intense relationship in the first area of communications is between "Emotions" concept and the "diversification" concept (a_{54}= 1.80). This result may be explained by the low financial education of Tunisian investors. Discussions with them during the interview let us concluding that there are more familiar with the "Diversification" concept. The majority of interviewees know that "the diversification is beneficial in the sense that it can reduce the risk of our portfolio". This may also explain the week relationships between the technical terms "variance", "covariance" and "expected return".

The mental accounting bias exerts an influence on the choice of the variance and the covariance. The majority of interviewees affirm that they use they mental accounting when choosing between assets. For example, if an investor realise successive losses, then he will be more prone to invest in risky assets. The relationship between the mental accounting and the covariance is characterised by week intensity. This is due to the cognitive illusion of the Tunisian investors. The majority of them ignore the role of covariance.

Our results highlight that the diversification level is a consequence of the mental accounting bias. This relationship goes until a value of 1.7. It is clear that the "diversification" concept is closed to the behavioural concepts. It may be considered as a "Concept of connection" between these two theories of portfolio choice since it is a function of all the behavioural concepts in our cognitive model.

In the second area of communication, we find that influences aren't very intense. Only the mean-variance concept "diversification" intensely affects the safety aim [a_{47} = *2.1*].

4.1. Concepts weights based analysis

We use weights w_i to study the intensity of the influences exert by the mean-variance concepts on the behavioral concepts. Inversely, we use weights w'_i to measure the effects of behavioral concepts on the rational mean-variance concepts.

We find that the "Diversification" is the most active concept on the first area of communication with a weight of (4.50). Discussions with investors from our sample let us deducting that this concept is very clear in their minds. The covariance and variance seem having a week influences on behavioral concepts.

The "Mental accounting" bias and "Emotions" exert influences on the mean-variance concept respectively with a weight of (4.50) and (4.00). We find also that the "Safety aim" is more active than the "Potential aim". Departing from this finding, we can predict that the Tunisian investors are "safety first investors" as described by Roy (1952).

Table [5] summarizes the received influences' weight of concepts. It is observable that the "Diversification" and the "Safety aim" are the most receiver concepts. There weights w''_4 and w''_6 reflect that they are the most influenced concepts. As it mentioned before, the Tunisian investors are aware about the role of the "diversification" of their portfolio. They tend to avoid losses and the majority of them are attracted by a "safety aim".

We notice that investors' emotions and mental accounting have a law weight $(w''_5 = 1.20)$ and $(w''_9 = 1.40)$. Our finding may be explained by the fact of their behavioral nature. There are generally spontaneous mechanisms.

The total weight of concepts can be held as a criterion to detect their capacity on linking the two theories of portfolio choice. Table [6] shows that the "Diversification" can be considered as the best variable of

connection that can assure the linking action. The behavioural concept "Safety aim" and the "Mental accounting" can reinforce this relationship. The "Variance "and the "Covariance", two concepts with a technical aspect have the lowest total weights.

Figure [1] represents the average cognitive map of investors. We only draw the cognitive maps that correspond to the zones of communications in order to detect all the relationships between the mean-variance concepts of portfolio choice and the behavioural concepts. The most remarkable thing is that these concepts are combined together in the cognitive schema of investors. The results highlight the impact of psychological factors on the portfolio choice's decision. For example, the investors' "Emotions" can orient his choice in term of portfolio level of diversification. Our results confirm the theoretical predictions of the Lopes' (1987) two factors theory. Emotions affect the decision making process. In the case of portfolio choice, Emotions stimulate the presence of a safety aim or a potential aim that affect the wealth's allocation.

It's clear that investors are not fully rational to act as prescribed by the mean-variance theory when constructing their portfolios. Our finding highlights that the mean-variance concepts are present in their spatial cognitive but they are frapped by their psychology and emotions. We can affirm that the two theories of portfolio choice are cognitively interrelated. The existence of concepts from both theories argues that is a complementarities' relationship.

5. Empirical implications

Traditional managers of portfolio exploit information about the stock market while the behavioural managers exploit investors' behaviour (Russell J.F., 1998). This is because as we mentioned before, the literature is silent about the existence and the nature of the relationships between these two theories of portfolio choice. We find that, in the real word of portfolio choice, investors combine between the two theories of portfolio choice. In their cognitive schema, concepts are linked and their choices on terms of portfolio's diversification, volatility's level… are affected by the investors emotions, the presence of a potential or safety aims and by his mental accounting.

It is time now to generate some models that both exploit the market information and the investors' behaviour. Models that should be useful (practical) and that integrate investor's psychology and emotions.

6. Conclusion

The rational mean-variance theory (Markowitz 1952, 1959) affirms that investors are rational enough, so they can maximize their utility function. They use a practical tool "the mean-variance" optimizer. However, with the emergence of behavioural finance, the domain of portfolio management should integrate new dimensions such as investors' psychology (Kahneman and Tversky, 1979) and emotions (Lopes, 1987).

In this study we demonstrate that these two theories are interrelated in the cognitive schema of investors from our sample. We use a methodology based on cognitive mapping. The originality of our study derives from the creation of two communications' zones and the detection of some "concepts of connection". Our results show the existence of complementarities between the rational and the behavioural theories of portfolio choice since the average cognitive map demonstrate the presence of both technical concepts and other behavioural concepts. They use the mean-variance technique and it will be moderated by their emotions and psychological state.

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Table1. The basic concepts from the rational and the behavioral portfolio theories

Theories	**Basic concepts**
Mean-Variance Theory	Variance, Covariance, Expected return and Diversification
Behavioral Portfolio Theory	Emotions, Safety aim, Potential aim and Mental accounting

Table2. The form of the adjacency matrix

C_i / C_j	j_1: **Variance**	j_2: **Covariance**	j_3: **Expected Return**	j_4: **Diversification**	j_5: **Emotions**	j_6: **Potential aim**	j_7: **Safety aim**	j_8: **Mental accounting**
i_1: **Variance**	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	a_{16}	a_{17}	a_{18}
i_2: **Covariance**	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	a_{26}	a_{27}	a_{28}
i_3: **Expected Return**	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	a_{36}	a_{37}	a_{38}
i_4: **Diversification**	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}	a_{46}	a_{47}	a_{48}
i_5: **Emotions**	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	a_{56}	a_{57}	a_{58}
i_6: **Potential aim**	a_{61}	a_{62}	a_{63}	a_{64}	a_{65}	a_{66}	a_{67}	a_{68}
i_7: **Safety aim**	a_{71}	a_{72}	a_{73}	a_{74}	a_{75}	a_{76}	a_{77}	a_{78}
$_8$: **Mental accounting**	a_{81}	a_{82}	a_{83}	a_{84}	a_{85}	a_{86}	a_{87}	a_{88}

Table 3. The adjacency matrix and the zones of interactions between the two theories of portfolio choice

	Var.	Cov.	Exp. R	Divers.	Emot.	Pot.	Saf.	Ment.
Var.	0	0,5	0,9	0,6	**0,1**	**0**	**0,5**	**0.6**
Cov	0,2	0	0,3	0,2	**0**	**0,2**	**0,2**	**0,1**
Exp. R	0,2	0,2	0	0	**0,2**	**0.9**	**1,2**	**0**
Divers.	0,4	0,1	0,3	0	**0,9**	**0,8**	**2,1**	**0.7**
Emot.	**0,4**	**0,9**	**0,9**	**1,8**	0	1,8	2,5	0
Pot.	**0,5**	**0,7**	**0,5**	**0,7**	1,7	0	0,6	0
Saf.	**0,7**	**0,7**	**0,4**	**1,7**	2,1	1,3	0	0,7
Ment.	**1,4**	**0.2**	**1,2**	**1,7**	1,5	1,7	1,5	0

Table 4. The influences' weights of concepts

Concepts	w_i and w'_i
Variance	1.20
Covariance	0.50
Expected Return	2.30
Diversification	4.50
Emotions	4.00
Potential aim	2.40
Safety aim	3.50
Mental accounting	4.50

Table 5. The received influences' weights of concepts

Concepts	w''_i *and* w'''_i
Variance	*3.00*
Covariance	*2.50*
Expected Return	*3.00*
Diversification	*5.90*
Emotions	*1.20*
Potential aim	*1.90*
Safety aim	*4.00*
Mental accounting	*1.40*

Table 6. Concepts' classification

Rank	**Concepts**	**Total weight**	**Nature**
1	Diversification	10.40	R.C
2	Safety aim	7.50	B.C
3	Mental accounting	5.90	B.C
4	Expected Return	5.30	R.C
5	Emotions	5.20	B.C
6	Potential aim	4.30	B.C
7	Variance	4.20	R.C
8	Covariance	3.00	R.C

R.C: Rational mean-variance concept B.C: Behavioral concept

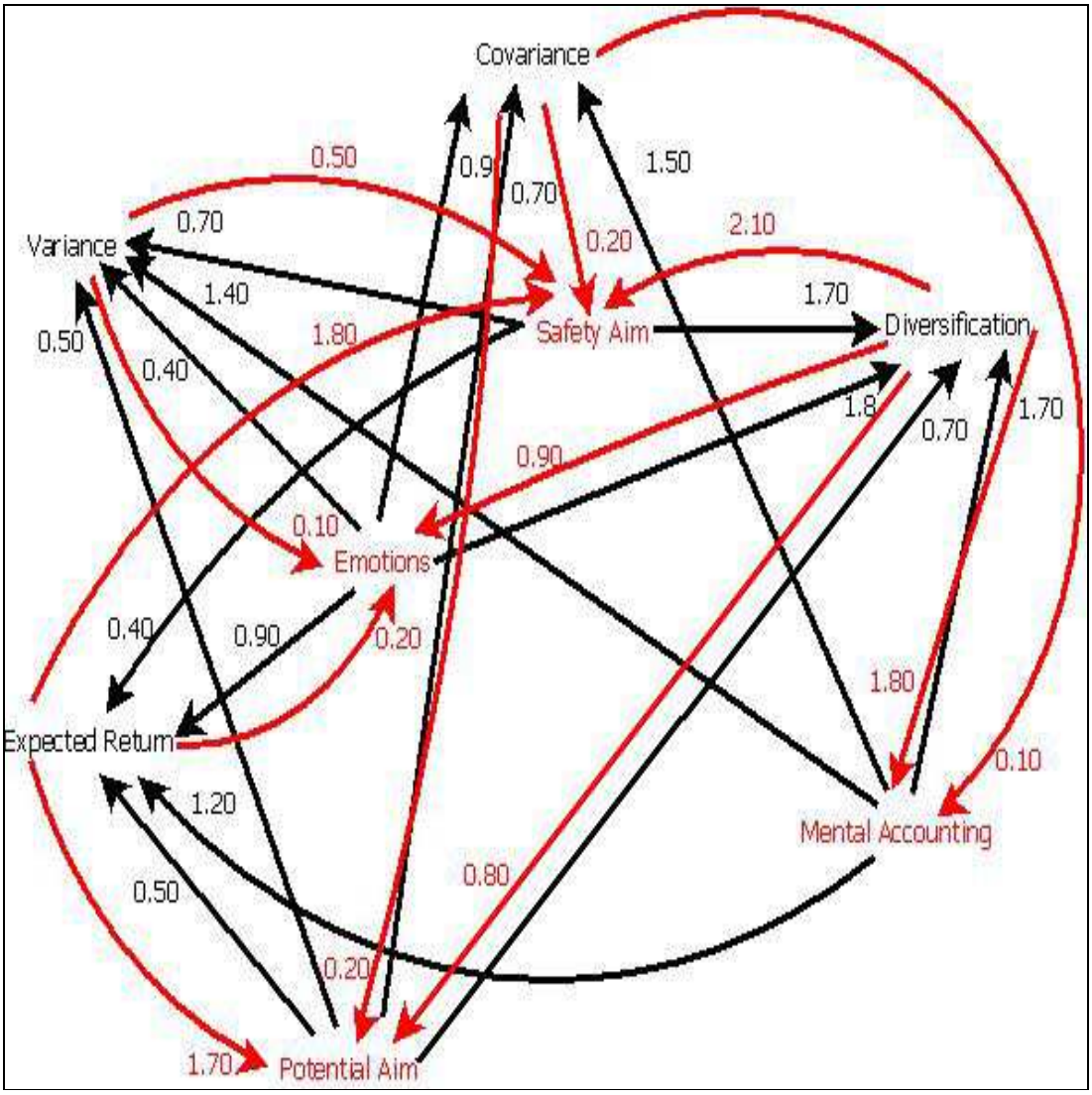

Figure 1: The average cognitive map of Tunisian investors

The red color represents influences exert by mean-variance concepts to behavioral concepts.

The black color represents influences exert by behavioral concepts to mean-variance concepts