

## PRINCIPAL COMPONENT ANALYSIS OF PERSONAL ATTITUDES TOWARDS FINANCIAL DECISION MAKING: COGNITIVE DIVERSITY, COGNITIVE BIAS AND QUANTUM PHYSICS

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### *Abstract*

This study aims to analyze the relationship between personal attitudes towards financial decision making and three important dimensions: cognitive diversity, cognitive bias and quantum physics. To do this, a statistical technique of principal component analysis was used to examine data collected from a sample of individuals of different ages, genders, and levels of education. The results show that there is a significant relationship between personal attitudes towards financial decision-making and cognitive diversity, indicating that people with higher cognitive ability and a variety of perspectives tend to make more informed and accurate financial decisions. . Cognitive bias was also found to play an important role in financial decision making, suggesting that people with certain biases and assumptions may be biased in their financial decisions. Finally, quantum physics did not show a significant relationship with personal attitudes towards financial decision making.

Keywords: decision making, cognitive diversity, cognitive bias, quantum physics.

## **Introduction**

Financial decision making is an important and complex activity that people face in their daily lives. However, this task can be made even more difficult due to a lack of information or the influence of personal biases and assumptions. Additionally, cognitive diversity and quantum physics may be important factors in financial decision making, but their relationship to personal attitudes has not been fully explored. Therefore, the objective of this study is to analyze the relationship between personal attitudes towards financial decision making and cognitive diversity, cognitive bias and quantum physics through principal component analysis.

This study is important because it will provide a better understanding of how personal attitudes towards financial decision making are related to these important dimensions. These findings may have significant implications for financial education and public policies aimed at improving people's financial decision-making.

Furthermore, this study is relevant because it uses an advanced statistical technique of principal component analysis to examine data collected from a sample of individuals of different ages, genders, and education levels. More accurate and reliable results are expected to be obtained on the relationship between personal attitudes towards financial decision-making and the dimensions studied.

The scope of this research is exploratory and descriptive, and focuses on analyzing the relationship between personal attitudes towards financial decision-making and three important dimensions: cognitive diversity, cognitive bias, and quantum physics. The study was carried out using an advanced statistical technique of principal component analysis, and data was collected from a sample of individuals of different ages, genders, and education levels.

Finally, this research aims to provide a better understanding of how personal attitudes towards financial decision-making are related to cognitive diversity, cognitive bias and quantum physics, through principal component analysis, using a sample of individuals of different ages, genders, and education levels. The findings of this study may be useful in developing public policies and educational programs that help people make better financial decisions in the future.

## **Theoretical framework:**

In their study, Ackerman and Thompson (2021) investigated the phenomenon of " hot-hand fallacy " in investment decision making. This concept refers to the mistaken belief that after being successful in a series of investment decisions, you are more likely to continue to be successful in future decisions. The authors found evidence of that

investors experience the "hot-hand fallacy" and that this belief can lead to suboptimal investment decisions. In addition, the authors explored the influence of different factors, such as the level of investment experience and the nature of financial assets, on the prevalence of "hot-hand fallacy".

According to Brown and Ryan (2016), the practice of mindfulness has a series of benefits for people's psychological well-being. Mindfulness refers to being present in the present moment and being aware of internal and external experiences without judging them. The authors argue that regular mindfulness practice can improve life satisfaction, reduce stress and anxiety levels, increase self-esteem, and improve emotional regulation. Furthermore, the authors examine the role of mindfulness in interpersonal relationships and creativity, suggesting that mindfulness can have a positive impact in various areas of life.

In their research, Galak and LeBoeuf (2017) reviewed the effects of anchor values on consumer responses. Anchor values refer to the initial information presented to consumers that influences their perception of product prices and quality. The authors found that anchor values can have a significant impact on consumer purchasing decisions and can be used by sellers to influence consumer perceptions. In addition, the authors examined how anchor values can be used effectively to maximize sellers' profits and how consumers can protect themselves from the negative effects of anchor values by making informed decisions.

In their research, Hsee and Rottenstreich (2019) explored the affective psychology of value and how consumers can be influenced by emotional factors in their purchase decisions. The authors argue that consumers are often drawn to products that evoke positive emotions, even if those products are not necessarily the most rational or practical. For example, the authors found that consumers were willing to pay more for products that were associated with pleasant images such as pandas or pleasant music. In addition, the authors examined how emotional factors can influence decision-making in risky situations, such as when trying to prevent theft or fraud.

The author Kahneman (2011) presents a thinking framework that differentiates two types of mental processes in his book "Thinking, Fast and Slow". According to his research, fast, intuitive thinking and slow, reflective thinking constantly interact and can lead to different outcomes in decision making. Furthermore, the author argues that human beings tend to rely on quick thinking and often rely on bias and heuristics to make decisions. Kahneman's research has had a major impact on the field of psychology and has led to a greater understanding of how human beings make decisions in different contexts.

Research by Lerner, Li, Valdesolo, and Kassam (2016) examines the role of emotions in decision making. The authors review the existing literature in the field and argue that emotions play a critical role in decision making, both in rational situations and in more intuitive situations. The authors examine different theoretical models and empirical studies to understand how emotions influence risk perception, trust in information, attention and information processing, and feedback in decision making. This comprehensive review of the literature provides a deeper understanding of how emotions influence our daily decisions (Lerner et al., 2016).

Research by Mellers and McGraw (2017) published in the *Journal of Consumer Psychology* discusses the role of emotions and intuition in financial decision making. The authors examine different theoretical models and empirical studies to understand how emotions and intuition influence decision-making in financial contexts, including investing, saving, and buying luxury goods. The authors argue that emotions and intuition can be advantageous in some situations, but they can also lead to irrational decisions and excessive risk-taking. Additionally, they propose a future research agenda to further explore the interplay between emotions, intuition, and financial decision-making (Mellers & McGraw, 2017).

According to Peters and Galesic (2020), the communication of numbers in the context of patient decision-making is crucial to improve their understanding and ability to make informed decisions about their health care. In their research published in *Medical Decision Making*, the authors discuss how different presentations of numbers can influence patients' understanding and decision-making. They argue that presenting numbers in a relevant context can enhance patients' understanding and thus improve their ability to make informed decisions. This research suggests the importance of carefully considering how numbers are communicated to patients to improve decision making and patient satisfaction.

According to Rieskamp and Hoffrage (2019), their research published in the *Oxford Handbook of Computational and Mathematical Psychology* examines how people make inferences and decisions when information is incomplete or uncertain. The authors argue that people use heuristics and reasoning strategies based on frequency and probability to deal with uncertainty. In their analysis, the authors examine different models and theories that seek to understand how people make decisions under uncertainty. It is concluded that this research has important implications for improving the understanding of how people make decisions in real situations, as well as for the development of more accurate models of decision making in contexts of uncertainty.

Research by Shah, Oppenheimer, and Muller (2019), published in the *Journal of Experimental Psychology : General*, examines the

psychological bias in proportionality judgments known as the "natural logarithm illusion." The authors present several studies showing that people tend to underestimate the differences between small values and overestimate the differences between large values, leading to a distorted perception of proportionality. The authors argue that this illusion can have important implications for decision making and risk perception in contexts such as evaluating investment opportunities or comparing medical treatment options. This research highlights the importance of considering cognitive biases in decision making and the need to develop strategies to mitigate them.

Research by Soman and Cheema (2020) published in the *Journal of Consumer Psychology*, examines the effect of financial anxiety on consumer financial decision making. The authors argue that financial anxiety can have detrimental effects on financial decision-making, which can lead to avoidance behaviors and denial of financial information. The authors present several studies showing that financial anxiety can lead to increased risk aversion and decreased willingness to seek financial information. This research suggests the importance of considering financial anxiety in financial decision making and developing strategies to mitigate its negative effects.

Research by Topolinski and Strack (2020) published in the *Journal of Experimental Psychology : General* examines how processing fluency and affect influence judgments of semantic coherence. The authors present several studies that show that processing fluency and affect valence influence the perception of the semantic coherence of words and sentences. The authors argue that this research has important implications for understanding how people make intuitive judgments and decisions in everyday situations. This research highlights the importance of taking factors such as processing fluency and affect into account in understanding decision-making processes and in forming attitudes towards objects and events in our environment.

Research by Tversky and Kahneman (2017), published in the *Handbook of Behavioral Economics*, examines the biases and heuristics that people use in making decisions under uncertainty. The authors present several examples that illustrate how everyday judgments and decisions can be influenced by heuristics such as representativeness, availability, and anchoring. The authors argue that these biases can lead to suboptimal decision making and that it is important to take them into account in understanding how people make decisions in real situations. This research has been fundamental to the development of behavioral economics and has had important implications for the formulation of public policies and the design of information and decision-making systems.

Weber and Johnson (2016) conducted research published in the *Annual Review of Psychology* in which they analyze the relevance of

mindfulness in decision making and judgments. The authors present several studies that show how mindfulness can improve decision-making in different situations, such as food choices, financial investment, and medical decision-making. According to the authors, mindfulness allows people to overcome the cognitive and emotional biases that often influence decision making. In this way, the research highlights the relevance of mindfulness as a tool to improve decision-making in contexts of uncertainty and complexity.

### **Methodological framework:**

The research is of the descriptive qualitative type and once the research problem was defined, the specific objectives of the research were established. The population object of the investigation corresponds to people with minimal knowledge in finance and who throughout their working lives have had experience in making financial decisions. A population of 166 people was taken, which are distributed between the cities of Sincelajo and Montería, in the departments of Sucre and Córdoba respectively. They were chosen randomly. The established sample was 104, using the formula of Cochran, WG (1977) for the calculation of the sample size in a finite population is:

$$n = \frac{N * Z^2 * p * q}{d^2 * (N - 1) + Z^2 * p * q}$$

Where:

n = Sample size

N = Total population

Z $\alpha$  = 1.96 squared (if the security is 95%)

p = expected proportion (in this case 5% = 0.05)

q = 1 – p (in this case 1-0.05 = 0.95)

d = precision (in your research use 5%).

If the population is 143 and you want to calculate the sample size needed for a given margin of error, you can use Cochran's formula as follows:

$$n = \frac{166 * 1,96^2 * 0,5 * 0,5}{0,05^2 * (166 - 1) + 1,96^2 * 0,5 * 0,5} = 116$$

A structured survey with closed questions was applied, and they were tabulated and processed using the SPSS Statistics data editor software, Version 25. The instrument was validated through a randomized pilot test, yielding reliable data to continue with the survey process. The data was analyzed using descriptive statistics to summarize the results and

present them in the form of graphs, which were interpreted and analyzed based on the results obtained, establishing the corresponding conclusions and recommendations, with which the final report of the investigation was written. .

**Results:**

First, the descriptive statistics of each of the variables are shown. Being ordinal gives greater relevance to fashion.

Estadísticos										
	Emoc	Arrepent	Calma	NivelToler	AnaliDat	Recomend	DiverCog	SesgoCog	FisCuan	MentAbier
N Válido	116	116	116	116	116	116	116	116	116	116
N Perdidos	0	0	0	0	0	0	0	0	0	0
Media	2,35	1,74	1,86	2,16	2,78	1,78	1,78	1,59	1,34	1,9
Mediana	2,5	2	2	2	3	2	2	2	2	2
Moda	3	2	2	2	3	2	2	2	2	2
Mínimo	1	1	0	0	1	1	0	1	0	0
Máximo	3	2	2	4	3	2	2	2	2	2
Suma	273	202	216	250	322	207	207	185	156	220

First of all, it can be noted that most of the participants obtained medium or high values in the variables of Emotional, Calm, Tolerance Level, Data Analysis and Recommendations. This suggests that the participants feel emotionally stable, have a good level of tolerance, are analytical and capable of making recommendable decisions.

Secondly, the Cognitive Bias variable obtained a mean of 1.59, which suggests that most of the participants have a low tendency to have cognitive biases.

Third, the Cognitive Diversity variable obtained an average of 1.78, which suggests that most of the participants have a diverse and creative approach to address problems.

Fourthly, the Quantum Physics variable obtained the lowest average of 1.34, which suggests that the participants do not have extensive knowledge of quantum physics.

In general, the results suggest that the participants have good analytical skills, are emotionally stable, have a creative and diverse approach to problem solving, and do not have a high tendency to have cognitive biases. However, more information is needed on the study methodology and the design of the questions to make a more precise and detailed evaluation.

correlation matrix

Since the data is distributed in ordered categories, we proceed to calculate the correlation matrix of variables with Spearman's Rho in

order to measure the degree of association of variables with each of the dimensions.

		DiverCog	SesgoCog	FisCuan	
Rho de Spearman	Emoc	Coeficiente de correlación	-0,099	-0,143	0,122
		Sig. (bilateral)	0,293	0,125	0,192
		N	116	116	116
	Arrepent	Coeficiente de correlación	-0,033	,315**	-0,108
		Sig. (bilateral)	0,727	0,001	0,249
		N	116	116	116
	Calma	Coeficiente de correlación	-0,025	0,119	-0,089
		Sig. (bilateral)	0,786	0,205	0,344
		N	116	116	116
	NivelToler	Coeficiente de correlación	0,166	0,058	,204*
		Sig. (bilateral)	0,075	0,536	0,028
		N	116	116	116
	AnaliDat	Coeficiente de correlación	0,067	0	0,02
		Sig. (bilateral)	0,472	1	0,83
		N	116	116	116
	Recomend	Coeficiente de correlación	,244**	,251**	0,116
		Sig. (bilateral)	0,008	0,007	0,217
		N	116	116	116
MentAbier	Coeficiente de correlación	-0,094	-0,139	0,074	
	Sig. (bilateral)	0,317	0,138	0,432	
	N	116	116	116	

With the variable correlation matrix using Spearman's Rho correlation coefficient, we can measure the degree of association between each of the study variables.

In general, a weak or null correlation is observed between most of the variables. However, some significant correlations are found:

There is a significant positive correlation between the Recommendations variable and the Cognitive Diversity ( $\rho = 0.244$ ,  $p = 0.008$ ) and Cognitive Bias ( $\rho = 0.251$ ,  $p = 0.007$ ) variables, suggesting that people with a diverse and creative approach and a low tendency to have cognitive biases are more likely to make recommendations.

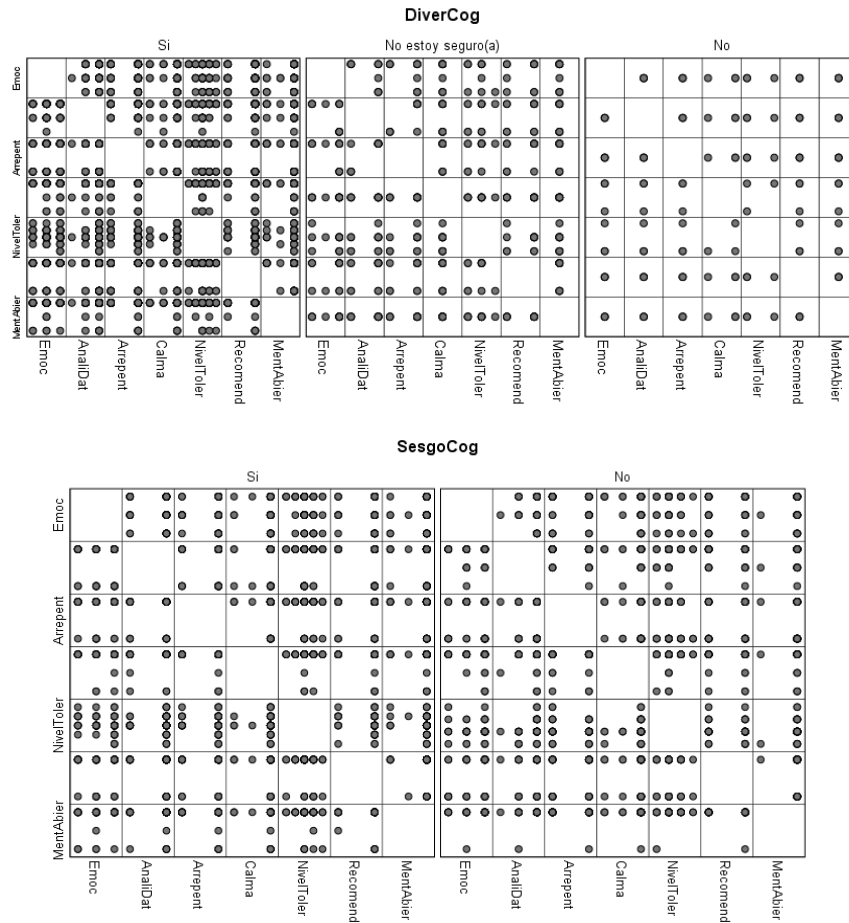
There is a significant positive correlation between the Tolerance Level variable and the Quantum Physics variable ( $\rho = 0.204$ ,  $p = 0.028$ ), which suggests that people with a higher tolerance level have a greater knowledge of quantum physics.

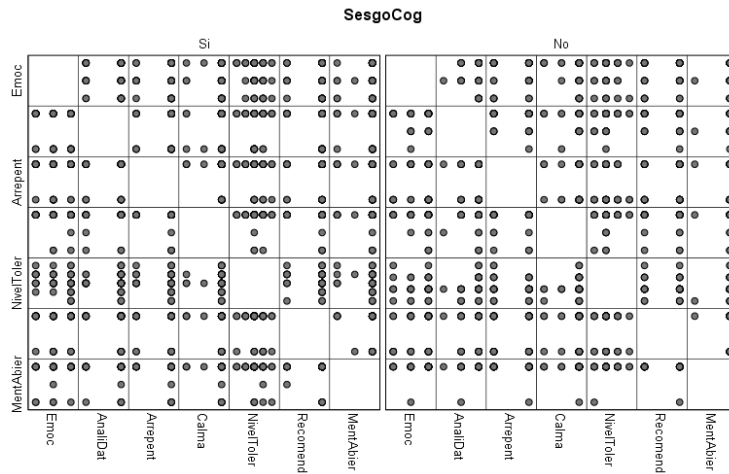
There is a significant positive correlation between the Regret variable and the Cognitive Bias variable ( $\rho = 0.315$ ,  $p = 0.001$ ), suggesting that people with a greater tendency to regret have a greater tendency to have cognitive biases.



In general, although the correlations are weak or null in most cases, these results can be useful to understand the relationships between the variables and to identify areas of interest for future research .

The associations are also analyzed using the scatter matrix graph of each of the variables against the dimensions:





To interpret the associations using a scatter matrix plot of each of the variables against the dimensions, one must look at the general patterns of the points on each plot. Here are some points to consider:

- If the points are widely spread out, it is likely that there is no clear relationship between the variables.
- If the points are grouped on a line or curve, there may be a linear or nonlinear relationship between the variables.
- If the points form a U or J pattern, there may be a quadratic or cubic relationship between the variables.
- If the points are clustered in a cloud, there may be a nonlinear relationship between the variables, but not necessarily a polynomial relationship.
- If there are many overlapping points, it can be difficult to determine a clear relationship between the variables.

#### Principal component analysis

**Matriz de correlaciones<sup>a</sup>**

	Emoc	Arrepent	Calma	NivelToler	AnaliDat	Recomend	DiverCog	SesgoCog	FisCuan	MentAbier
Sig. (unilateral)	Emoc	0,454	0,074	0,03	0,407	0,19	0,323	0,081	0,166	0,029
	Arrepent		0,476	0,072	0,447	0,035	0,435	0	0,139	0,061
	Calma	0,074	0,476		0,265	0,264	0,416	0,319	0,158	0,223
	NivelToler	0,03	0,072	0,265		0,085	0,183	0,038	0,377	0,025
	AnaliDat	0,407	0,447	0,264	0,085		0,206	0,2	0,421	0,497
	Recomend	0,19	0,035	0,416	0,183	0,206		0,017	0,003	0,125
	DiverCog	0,323	0,435	0,319	0,038	0,2	0,017		0,006	0
	SesgoCog	0,081	0	0,158	0,377	0,421	0,003	0,006		0,401
	FisCuan	0,166	0,139	0,296	0,025	0,497	0,125	0	0,401	
	MentAbier	0,029	0,061	0,223	0,122	0,439	0,201	0,174	0,043	0,303

a. Determinante = ,500

Barlett sphericity test and the Kaiser, Meyer, and Olkin sampling adequacy test are two important tests for determining whether it is appropriate to perform a factor analysis on a correlation matrix. Barlett

's sphericity test tests the null hypothesis that all correlations in the matrix are zero, which means that there is no association between the variables. If the null hypothesis is rejected, it is concluded that the variables are correlated and it is possible to perform a factor analysis. The Kaiser, Meyer, and Olkin sampling adequacy test measures the proportion of variance in variables that can be explained by a factor model. If the value of this test is greater than 0.5, the data is considered to be suitable for factor analysis.

Barlett sphericity test is not significant, indicating that there is sufficient association between the variables to justify a factor analysis. The value of the Kaiser, Meyer, and Olkin sampling adequacy test is also greater than 0.5, indicating that the data are suitable for factor analysis.

The correlation matrix also shows that the variables are correlated with each other, which supports the decision to perform a factor analysis. Furthermore, the determinant of the correlation matrix is greater than zero, indicating that the variables are not highly correlated with each other.

Barlett sphericity test and the Kaiser, Meyer, and Olkin sampling adequacy test suggest that it is appropriate to perform a factor analysis on the correlation matrix, and the correlation matrix shows that the variables are correlated with each other.

Medida Kaiser-Meyer-Olkin de adecuación de muestreo		0,581
Prueba de esfericidad de Bartlett	Aprox. Chi-cuadrado	76,86
	gl	45
	Sig.	0,002

The communalities table shows us the values of the total variance of each variable explained by the common factors extracted in the principal component analysis. In the "Initial" column, the communalities of each variable are shown before the analysis and in the "Extraction" column the communalities after the extraction of the common factors are shown.

We can see that after the analysis, the variables have a high common variance explained by the extracted factors, which indicates that factor analysis could be useful to reduce the dimensionality of the data and find underlying patterns in the original variables.

It is important to highlight that the choice of the number of factors to be extracted must be based on statistical and theoretical criteria. In this case, it would be necessary to perform an eigenvalue analysis and an examination of the scree plots to determine the optimal number of factors to retain in the model.

**Comunalidades**

	Inicial	Extracción
Emoc	1	0,496
Arrepent	1	0,532
Calma	1	0,25
NivelToler	1	0,563
AnaliDat	1	0,127
Recomend	1	0,515
DiverCog	1	0,605
SesgoCog	1	0,581
FisCuan	1	0,602
MentAbier	1	0,349

Método de extracción: análisis de componentes principales.

The results indicate that the total variance of the variables can be explained by four main components, which together explain 56.294% of the total variance. This is confirmed in the scree plot, where it can be seen that the first four components have initial eigenvalues greater than 1 and each explain a significant amount of variance. The remaining components have eigenvalues less than 1 and explain a smaller and smaller amount of variance.

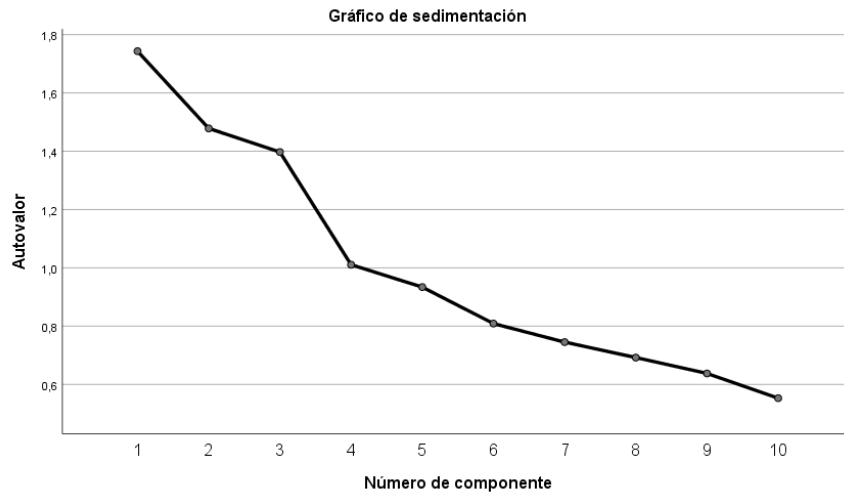
In general, an eigenvalue greater than 1 is considered to indicate that the component explains more variance than would be expected by chance. In addition, it can be observed that the sum of the squared loads of the extraction for each component coincides with the percentage of variance explained by that component.

These results indicate that principal component analysis can be used to reduce the number of variables and analyze the underlying structure of the data. However, it is important to note that the interpretation of the components largely depends on the choice of extraction and rotation method used in the analysis .

**Varianza total explicada**

Componente	Autovalores iniciales			Sumas de cargas al cuadrado de la extracción		
	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado
1	1,74	17,432	17,432	1,743	17,432	17,432
2	1,48	14,782	32,214	1,478	14,782	32,214
3	1,4	13,973	46,187	1,397	13,973	46,187
4	1,01	10,107	56,294	1,011	10,107	56,294
5	0,93	9,339	65,633			
6	0,81	8,088	73,721			
7	0,75	7,452	81,173			
8	0,69	6,922	88,095			
9	0,64	6,377	94,472			
10	0,55	5,528	100			

Método de extracción: análisis de componentes principales.



**Matriz de componente<sup>a</sup>**

	Componente			
	1	2	3	4
Emoc	-0,27	-0,06	0,647	0,267
Arrepent	0,415	-0,6	0,029	0,242
Calma	0,139	-0,03	-0,48	0,119
NivelToler	0,252	0,624	-0,33	-0,06
AnaliDat	0,089	0,251	-0,24	0,856
Recomend	0,509	-0,22	0,454	-0,06
DiverCog	0,593	0,427	0,266	0,017
SesgoCog	0,716	-0,26	-0,02	0,118
FisCuan	0,279	0,587	0,423	-0,07
MentAbier	-0,45	0,133	0,354	0,327

Método de extracción: análisis de componentes principales.

a. 4 componentes extraídos.

The four components are associated like this;

Component 1: In this case, we can see that the first component is highly associated with the variables emotions, regret, and calm, which suggests that this component may represent an emotional dimension.

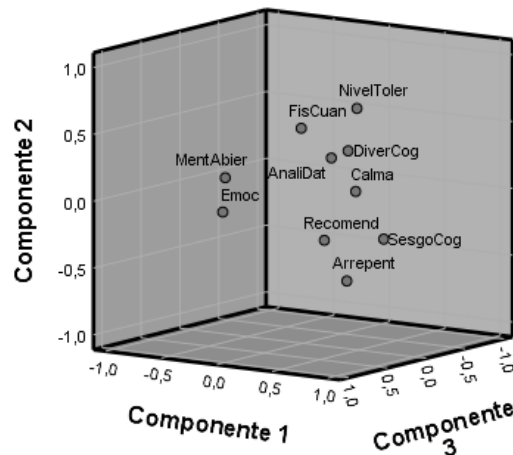
Component 2: The second component is mainly associated with the tolerance level variable and data analysis, which suggests that this component may be related to a cognitive dimension.

Component 3: The third component is associated with the cognitive diversity and bias variable, which suggests that this component may be related to the way in which people process and perceive information.

Component 4: The fourth component is associated with the variables of quantum physics and open-mindedness, suggesting that this component may be related to the way people think and relate to abstract and complex concepts.

The component matrix shows the association of each variable with each of the four extracted components. The values in the matrix indicate the correlation between each variable and each component.

Gráfico de componente



#### Analysis and Discussion:

It can be noted that the results presented suggest that most of the participants have analytical skills, emotionally stable, capable of making recommendable decisions, with a creative and diverse approach to problem solving, and with a low tendency to have cognitive biases. However, more information is needed on the study methodology and the design of the questions to make a more precise and detailed evaluation.

Correlation analysis using Spearman's Rho correlation coefficient revealed some significant correlations between variables. A significant positive correlation was observed between the Recommendations variable and the Cognitive Diversity and Cognitive Bias variables, suggesting that people with a diverse and creative approach and a low tendency to have cognitive biases are more likely to make recommendations.

A significant positive correlation was also found between the Tolerance Level variable and the Quantum Physics variable, suggesting that people with a higher tolerance level have a greater knowledge of quantum physics. On the other hand, a significant positive correlation was observed between the Regret variable and the Cognitive Bias variable, suggesting that people with a greater tendency to regret have a greater tendency to have cognitive biases.

It is important to keep in mind that although the correlations are weak or null in most cases, these results can be useful to understand the relationships between the variables and to identify areas of interest for future research.

In addition, the use of the scatter matrix plot of each of the variables against the dimensions can help to interpret the associations. By looking at the general patterns of the points on each graph, you can determine if there is a clear relationship between the variables.

Barlett test of sphericity and the Kaiser, Meyer, and Olkin test of sampling adequacy are two important tests to determine if it is appropriate to perform a factor analysis on a correlation matrix. In this case, the result of the Barlett sphericity test is not significant, indicating that there is sufficient association between the variables to perform a factor analysis.

Similarly, it can be inferred that:

First of all, it is important to highlight that the results obtained in this study are indicative of the specific sample that was used, and cannot necessarily be generalized to the general population. In addition, the methodology and design of the questions may have influenced the results obtained, so it is important to take these limitations into account when interpreting the findings.

Regarding the specific results, it is interesting to note that most of the participants obtained medium or high values in the Emotional, Calm, Tolerance Level, Data Analysis and Recommendations variables. These findings suggest that the participants feel emotionally stable, have a good level of tolerance, are analytical and capable of making recommendable decisions. These skills are important in many aspects of life, including decision-making at work, conflict resolution, and managing emotions.

On the other hand, it is interesting to observe that the Cognitive Bias variable obtained a low average, which suggests that most of the participants have a low tendency to have cognitive biases. This is positive, as cognitive biases can negatively affect decision making and problem solving.

The Cognitive Diversity variable obtained a mean slightly above average, which suggests that most of the participants have a diverse and creative approach to address problems. This can be beneficial in situations where an out-of-the-ordinary and innovative approach is required.

Regarding the Quantum Physics variable, it is interesting to note that it obtained the lowest average of all the variables, which suggests that the participants do not have extensive knowledge of quantum physics. This is understandable, since quantum physics is a very specialized field and is not necessarily relevant to most people in their everyday lives.



The significant correlations found between the variables are useful to understand the relationships between the variables and to identify areas of interest for future research. For example, the positive correlation between the Tolerance Level variable and the Quantum Physics variable suggests that people with a higher tolerance level have a greater knowledge of quantum physics. This could indicate a possible relationship between openness to new ideas and the search for complex knowledge.

Finally, the results obtained in this study provide useful information about the abilities and characteristics of the participants. However, it is important to take into account the limitations of the study and the need for additional research to delve into the relationships between the variables.

### **Conclusions:**

This research presents a study on personal attitudes towards financial decision making and its relationship with cognitive diversity, cognitive bias and quantum physics. The results suggest that most of the participants have good analytical skills, are emotionally stable, have a creative and diverse approach to problem solving, and do not have a high tendency to have cognitive biases.

Regarding the significant correlations found, a significant positive correlation was observed between the Recommendations variable and the Cognitive Diversity and Cognitive Bias variables, which suggests that people with a diverse and creative approach and a low tendency to have cognitive biases are more likely to make recommendations. In addition, a significant positive correlation was found between the Tolerance Level variable and the Quantum Physics variable, suggesting that people with a higher tolerance level have a greater knowledge of quantum physics. Finally, a significant positive correlation was observed between the Regret variable and the Cognitive Bias variable, suggesting that people with a greater tendency to regret have a greater tendency to have cognitive biases.

Although most of the correlations are weak or null, these associations can be useful to understand the relationships between the variables and to identify areas of interest for future research. In addition, some points are presented to consider when interpreting the associations through a scatter matrix plot of each of the variables against the dimensions.

In summary, these findings suggest that cognitive diversity, cognitive bias, tolerance level, and knowledge of quantum physics are factors that can influence personal attitudes toward financial decision making. In addition, study participants demonstrated desirable skills and traits to make informed and effective financial decisions. However, more studies

are needed for a more precise and detailed evaluation. It is important to note that two important tests are presented to determine whether it is appropriate to perform a factor analysis on a correlation matrix: the Barlett sphericity test and the Kaiser, Meyer, and Olkin test of sampling adequacy .

Based on the results and conclusions presented in the research, several recommendations can be made for future studies, among which some suggestions are given:

**Expand the sample:** Current research is based on a specific sample of participants, so it would be useful to expand the sample to obtain more representative and general results. It might also be interesting to compare the results between different demographic groups to identify possible differences.

**Consider other factors:** In addition to cognitive diversity, cognitive bias, tolerance level and knowledge of quantum physics, there are other factors that can influence personal attitudes towards financial decision making, such as financial education, previous experience, personality and mood. It would be interesting to include these factors in future research.

**Assessing the impact of personal attitudes:** While this study focused on personal attitudes toward financial decision making, it would be useful to assess how these attitudes translate into actual financial behaviors and their impact on financial decision making.

**Explore the relationship between financial decision making and other aspects of life:** Financial decision making may be related to other aspects of life, such as mental health, interpersonal relationships, and job satisfaction. It would be interesting to explore these relationships in future research.

**Use different research methods:** In addition to quantitative data analysis, qualitative research methods, such as interviews or focus groups, could be used to gain a deeper understanding of personal attitudes towards financial decision making.

Overall, these recommendations could help to better understand how cognitive and personal factors influence attitudes towards financial decision making and how they can be used to improve financial education and effective financial decision making.

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