

# RISK TOLERANCE ASSESSMENT IN REAL ASSETS INVESTMENTS: A SCALE VALIDATION IN BRAZIL

## *AValiação da Tolerância ao Risco em Investimentos em Ativos Reais: Uma Validação de Escala no Brasil*

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### ABSTRACT

**Purpose** – Risk tolerance, understood as the willingness of accepting a certain amount of risk which was perceived in an uncertain scenario, has been broadly studied under the framework of personal financial. This research aims to validate a scale for investment risk tolerance when dealing with real assets, in a business context.

**Design/methodology/approach** – A survey was performed with 150 managers, directors, and entrepreneurs who make investment decisions regarding real assets in the commerce, industry, and service sectors. Exploratory factorial analysis was performed was applied to detect the dimensionality of Risk Tolerance construct.

**Findings** – Risk Tolerance in real assets investments is a construct composed by two dimensions, the first factor is related to the familiarity of the decision-maker with the company and its investments, and it was denominated comfort and security, following the original dimension from personal finance research. The second dimension refers to the unpredictability and the complexity of risky investments in real assets, and it was denominated ‘black box effect’. The last factor, however, did not achieve the standards of reliability and it need further research.

**Keywords:** Risk Tolerance, Scale Validation, Decision-Making, Real Assets

## RESUMO

**Objetivo** – A tolerância ao risco, entendida como a disposição de aceitar uma certa quantidade de risco percebida em um cenário incerto, tem sido amplamente estudada no âmbito das finanças pessoais. Esta pesquisa tem como objetivo validar uma escala de tolerância ao risco de investimento ao lidar com ativos reais, em um contexto empresarial.

**Desenho/metodologia/abordagem** – Foi realizada uma pesquisa com 150 gestores, diretores e empresários que tomam decisões de investimento em ativos reais nos setores de comércio, indústria e serviços. Foi realizada análise fatorial exploratória para detectar a dimensionalidade do construto Tolerância ao Risco.

**Resultados** – A tolerância ao risco em investimentos em ativos reais é um construto composto por duas dimensões, o primeiro fator está relacionado à familiaridade do tomador de decisão com a empresa e seus investimentos, e foi denominado conforto e segurança, seguindo a dimensão original de pessoal pesquisa financeira. A segunda dimensão refere-se à imprevisibilidade e à complexidade dos investimentos arriscados em ativos reais, e foi denominada “efeito caixa preta”. O último fator, no entanto, não atingiu os padrões de confiabilidade e necessita de mais pesquisas.

**Palavras-chave:** Tolerância ao Risco, Validação de Escala, Tomada de Decisão, Ativos Reais

## 1 INTRODUCTION

Business decisions are surrounded by both predictable and unpredictable aspects, that is, uncertainty permeates decision-making process. They also define the contribution to the future of organisation both regarding business maintenance and its dissolution in case of a wrong decision. Therefore, it is interesting to study the decision-making process based on uncertainty, particularly those relating to the ability to understand the risks involved into a certain situation. The more complex is the environment in which decision-making is taken, the more variables affect the scenario and therefore, there are more sources of risk to mitigate the target outcomes. However, assessing the risk and, more than that, willing to accept the risks inherent to the decision-making, are associated with behavioral aspects of the decision-maker.

The financial literature has debated and researched the interest of the manager/entrepreneur/investor in understanding their behaviour related to risks (Gava and Vieira, 2006) in both financial as non-financial decisions, in particular understanding the distinction between risk perception and risk tolerance. This literature has not yet completely defined the subtle conceptual difference between risk perception and risk tolerance. However, Havlena and DeSarbo (1991) consider that the risk perception refers to the perceived risk of a possible negative outcome arising due to uncertainty, while risk tolerance refers to the extent of uncertainty the individual is willing to accept when making certain financial and non-financial decisions. The present research focuses on risk tolerance assessment.

Risk tolerance is influenced by several demographic (Hallahan et al., 2004), psychological, social, cultural (Hsee and Weber, 1999), political (Grable, 2000), age, life cycle (Wang and Hanna, 1997), knowledge, and financial education factors (Bapat, 2020). However, research on other risk tolerance aspects, such as those found by Croy et al. (2010) and Deaves et al. (2007), have found a positive relationship between risk tolerance and the tendency to planning.

The financial literature has focused on studies on risk tolerance with risks and investment returns regarding the risk perceived with the value expected from the said investment. However, there is still discussion in the literature about risk tolerance concerning variation or stability over time, where Van de Venter and Michayluk (2012) state that risk tolerance is influenced by the experience of the economic agent with investments in financial assets over time and, that the variation in the risk tolerance of the economic agent would stabilise over time.



There are few studies on the risk tolerance of the manager/entrepreneur with real asset investment decision-making (Nobre et al., 2018). In this way, risk tolerance is considered a relevant factor in business decision-making. This paper aims to validate a research scale concerning the risk tolerance approach to decision-making strategies for real asset investments.

The work follows a revision of the literature on the proposed theme to explore different conceptions of risk tolerance, then the conceptualisation of the research method involving the definition of the research. The analysis techniques proposed for validating the research scale is Factorial analysis, , and the sample used, moving on to the analysis of the results involving a presentation of the research findings regarding the construction of factors, and finally the final considerations.

## 2 LITERATURE REVIEW

Shades of risk tolerance are identified in individuals due to uncertainty in a decision-making process. Grable (2000) defines risk tolerance as the degree of uncertainty an individual is willing to accept when deciding; it is not a deliberate choice and its determinants are both individual and situational. This concept is based on what Kahneman and Tversky (1979) say about the influence of the psychological factors in decision-making.

It is considered primarily the risk/return ratio in which the individual who is certain of his decisions will be more tolerant of risk and, vice-versa, with these points being the possible limits of each individual. Therefore, investor expectation affects the condition between the expected value and risk perceived. The latter variable, although not varying much in the different domains (Grable and Rabbani, 2014), will be dependent on each individual according to one's degree of risk tolerance.

In this sense, there is a lot of research on the influence of demographic variables with risk tolerance such as gender and ethnicity (Sahm, 2012), work activity, gender, age, income, education, marital status, number of children dependent on income, emotion, and sense of control (Croy et al., 2010; Gava and Vieira, 2006) as the main conditioners of risk tolerance. In Table 1, Nobre (2015) highlighted a summary of the main results of the surveyed variables regarding risk tolerance with the respective researchers.

Table 1. Demographic variables and the impact on risk tolerance

Variable	Research Findings	Authors
Age	Risk tolerance decreases with age.	Wallach and Kogan (1961); McInish (1982); Morin and Suarez (1983); Palsson (1996); Sung and Hanna, (1996a); Donkers and Van Soest (1999); Xiao et al. (2000; 2001); Chaulk et al. (2003); Yao et al. (2004); Hallahan et al. (2004); Fan and Xiao (2006); Deaves et al. (2007); Darnodaran (2009); and Faff et al. (2009)
Gender	Risk tolerance is the highest among men.	Boverie et al. (1994); Jianakoplos and Bernasek (1998), Barsky et al. (1997), Powel and Ansic (1997), Levy et al. (1999); Slovic (1992); Jungermann et al. (1996); Spigner et al. (1993); Flynn et al. (1994); Kristiansen (1990); and Swanson et al. (1995)
Marital Status	Risk tolerance is higher among single people.	Fan and Xiao (2006); Grable and Joo (2004); Hallahan et al. (2004); Hawley and Fujii (1993); Yao et al. (2004); and Roszkowski et al. (1993)
Income	Risk tolerance increases with income.	Chang et al. (2004); Chaulk et al. (2003); Fan and Xiao (2006); Grable (2000); Grable and Joo (1999; 2004); Grable et al. (2004); Hallahan et al. (2004); Sung and Hanna (1996a); Sung and Hanna (1996b); Yao et al. (2004); Yook and Everett (2003); Friedman (1974); Cohn et al. (1975); Blume (1978); Riley and Chow (1992); Grable and Lytton (1999); Schooley and Worden (1996); and Shaw (1996)



Education	Risk tolerance increases with the education.	Gava and Vieira (2006); Chang et al. (2004); Fan and Xiao (2006); Grable (2000); Grable and Joo (1999; 2004); Hallahan et al. (2004); Hawley and Fujii (1993); Sung and Hanna (1996a; 1996b); Yao et al; Baker and Haslem (1974); Haliassos and Bertaut (1995); and Sung and Hanna (1996)
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Source: Nobre (2015)

As seen in Table 1, increased risk tolerance is related with 'Gender', 'Marital status', 'Income', and 'Education', while reduced risk tolerance is associated with 'Age'.

According to Grable and Lytton (1998), in the decision-making processes concerning financial and investment plans, managers need to use four factors: objectives, time frame, financial stability, and risk tolerance. Unlike the first three factors, risk tolerance is subjective and difficult to measure (Grable and Lytton, 1998; Holt and Laury, 2002), considering the difficulty of measuring the feeling when facing a certain decision-making situation.

In this context, the literature still discusses a standard model for measuring the degree of risk tolerance of an individual. Literature on risk tolerance mostly discuss restrictive models dealing with specific scenarios (Grable and Lytton, 2001) and/or direct questions to the individuals on different levels of risk to their well-being.

Analysing the decision-making process for investments, factors such as the comprehension on the investment process, level of security in decision-making, and the notion of risk in a certain action by the individual may enhance understanding of the individual's level of risk tolerance.

Nobre et al. (2018) reinforce that such dimensions bring greater coherence to the investigation of the dimension of risk tolerance on people. The understanding of the process refers to how much the individual believes one understands about the risk involved in a certain decision, the level of security, the degree of perception of being free or protected from risk or loss and the notion of risk, and the personal dimension on the preference or comfort in the face of certain types of risk.

There is no concrete evidence on the stability of individuals' conduct towards risk, because depending on the situations, individuals can make distinct decisions: the same person can accept the risk for a given circumstance, but not for another. Even the time horizon might change the risk tolerance (Nobre et al., 2018). Hence, there are almost infinite possibility of options to be taken, even if they do not bring complete maximisation or expected rationality. Nobre (2015) shows that the difference in shares may reflect different standards for different areas, from the direct relationship between propensity and risk behaviour.

An important aspect in understanding risk tolerance is related to the prospect theory. This theory relates risk to gain or loss, that is, it proposes that individuals are risk-averse for gain situations, but risk-prone to losses. Regarding preferences and how individuals assess risks, the prospect theory is the main reference for any model that intends to know the pricing of assets (Barros and Felipe, 2015; Mineto, 2005). In addition to this, Silva et al. (2008) explain that prospect theory seeks to elucidate the cognitive trends in the decision-making process and explain the assessment of risk and investor behaviour.

The prospect theory is considered an alternative to the utility theory because the people are generally risk-averse to gain and risk-prone to losses. Therefore, they assign different weights to potential gains and losses. The right results are over-weighted in comparison with uncertain results. The utility function is concave for gains and convex for losses, and steeper for losses than for gains. People make the choices about gains and losses from a point of reference (Kahneman and Tversky, 1979).

The subjective measures model faces the problem of the complexity involved with the creation of such measures. Many researchers have used the *Survey of Consumer Finances* (SCF) as a data source for assessing risk tolerance. The objective measures model considers rational choices and asset allocation as a personal choice.



However, objective measures that require the managers to deduct the risk tolerance from an individual based on one's resource allocation present validity problems. Objective measures are descriptive rather than predictive. They ignore the multidimensional nature of the risk and often fail to explain individual's current behaviour (Gava and Vieira, 2006).

The heuristic models offer a demographic and socioeconomic dimension of risk tolerance. Nobre et al. (2017) point out that variables such as age, marital status, income, children, and occupation of the respondent affect risk tolerance. Young, single, and childless individuals tend to accept more risk in their investments, as discussed earlier. Income, on the other hand, has a non-linear effect on risk tolerance: the most risk-tolerant are those who are better able to bear the possible losses from investments of higher risk (Nobre et al., 2017).

### 3 METHODOLOGY

To validate the risk tolerance scale for investment decision-making in real assets, the statements of the Grable and Joo (2004) risk tolerance model were adapted to the situation of investments in real assets. Hence, the researchers need to validate the instrument, not only into Brazilian Portuguese, but also considering the context of corporate investment decisions.

Regarding to data collection, the questionnaire was made available online through *Google Forms* and applied to the group of managers, directors, and entrepreneurs who make investment decisions in real assets. The sample was characterised as non-probabilistic, intentional, and by convenience. Accessing the respondents' profile was complicated, and the survey was done with anyone who would agree to answer the questions. Thus, the total number of respondents was 150 managers. The economic sectors that were researched were trade, industry, and services of the city of Mossoró/RN and Fortaleza/CE through a link by e-mail as well as through *on-site* applications.

The research instrument was adapted from Grable and Joo (2004), it was divided into two blocks. The first referred to the characteristics of the sample such as gender, age, time of work, and sector of the economy. The second part consists of the statements that measure risk tolerance. Table 2 shows the statements and their respective categories of analysis.

Table 2: Risk tolerance statements

Variable	Categories	Description
CS1	Comfort and Security	I feel more comfortable investing my money in my business than in the stock market.
CS2	Comfort and Security	I feel more comfortable investing my money in my business than keeping it in financial investments.
CS3	Comfort and Security	In terms of investment, security is more important than returns.
NR1*	Notion of Risk	When I think about the word 'risk', the term 'loss' comes to mind immediately.
NR2*	Notion of Risk	Making money on the stock market depends on luck.
CI*	Comprehension on Investments	Making investments is a difficult process to understand.

\* Items in reverse scale



Risk tolerance was measured with six statements, of which three were related to 'Comfort and Security', two statements for the 'Notion of Risk' category, and a statement for the 'Comprehension on Investments' category. The scale ranged from 1 to 10, where 1 means 'I completely disagree' and 10 means 'I completely agree'.

As for data analysis, internal validation and reliability of the questionnaire were performed. Thus, the exploratory factor analysis (EFA) was performed to validate the factors' obtained. The validation and reliability processes involved analysis of the correlation matrix, KMO statistics, Bartlett's test for sphericity, anti-image matrix analysis, analysis of total variance explained, analysis of the factors created, and finally, Cronbach's alpha for reliability.

## 4 RESULTS

Table 3 shows the data on gender. About 57.3% of the respondents were male, and the remaining 42.7% were female.

Table 3: Gender

Gender	Frequency	%
Female	64	42.7
Male	86	57.3
Total	150	100.0

Table 4 shows the education level of the respondents. Most respondents, 44.7%, had higher education, followed by the level of expertise/MBA, with 24.7%, and mid-level respondents, with 20.7% of the total. Added to the respondents with only elementary education, these four grades together constitute about 90.7% of the people interviewed.

Table 4: Level of education

	Frequency	%
Elementary School	1	0.7
High School/Technical	31	20.7
Higher Education	67	44.7
Specialisation/MBA	37	24.7
Master's Degree	9	6.0
Doctorate	4	2.7
Post-Doctorate	1	0.7
Total	150	100.0

Table 5 presents the job positions of the respondents. Of total, 80.7% were classified as 'managing partner', followed by directors (12%) and managers (2.7%). Owners and managing partners represent 82.7% of the total respondents, which ensures the pattern sought in research to analyse those who have the power of investment decision-making in business.



Table 5: Position in the company

	Frequency	%
Owner	3	2.0
Managing Partner	121	80.7
Founding Partner	1	0.7
Manager	4	2.7
Executive	3	2.0
Director	18	12.0
Total	150	100.0

Table 6 shows the percentage of respondents who said they own more than one business. Of respondents, 62.7% said they owned diversified businesses, that is, having a business activity other than the main one developed in their enterprises. About 37.3% informed that they do not have multiple businesses.

Table 6: Multiple business

	Frequency	%
Yes	94	62.7
No	56	37.3
Total	150	100.0

#### 4.1 Factors

To identify common factors among the interrelated variables of the study, exploratory factorial analysis (EFA) was performed, since it is efficient to reduce observable variables in a set of factors of risk tolerance, which might be different in a real assets decision-making context. The parameters used for EFA are presented in Table 7. The adequacy process of the factor analysis needs to follow certain criteria so that the analysis via this instrument is statistically possible. The main steps are analysis of the correlation matrix, verification of the KMO statistic, and the Bartlett's test for sphericity, and anti-image matrix analysis.

Table 7: Parameters of the exploratory factorial analysis

Parameter	Option
Rotation	Varimax
Extraction	Analysis of the principal component
No. of factors	Eigenvalues and Scree plot

Varimax rotation was chosen because it maximises the variation between the weights of each factor, that is, this rotation minimises the number of variables that have high factor loads in one factor. In the extraction of the factors, the principal component analysis (PCA) was chosen due to factor construction with variables with high correlation. Thus, the factors constructed explain most of the variance in the sample. It is worth noting that the second factor constructed will not be correlated with the former (Fávero et al., 2009).

The factors that presented eigenvalue greater than or equal to 1 and percentage of the variance explained with the level desired, that is, the latent root criterion and the percentage were chosen. The two criteria used coincided with the choice of the number of factors.

Following the criteria detailed above, the results suggest the suitability of data to EFA. At the preliminary analysis of the data, the KMO indicator presented a value of 0.6, indicating reasonable adequacy of the sample size for factor analysis. Bartlett's test for sphericity showed a  $\chi^2$  of 132.223 with a significance of 0.000, indicating a relationship between the indicators of the research.

It is noteworthy that the greatest positive correlation between the variables is of 0.596 between 'CS 2' and 'CS 1' relating to the questions 'I feel more comfortable investing my money in my business than keeping it in financial investments' and 'I feel more comfortable in investing my money in my business than in the stock market', respectively. These components refer to the state of the individual when making an investment, referring to the feeling of familiarity in investment decision-making. The lowest negative correlation is of -0.063 between 'CS 3' and 'NR1' concerning the questions 'In terms of investment, security is more important than returns' and 'When I think about the word "risk", the term "loss" comes to mind immediately', respectively. Thus, there is a weak linear correlation, indicating that the personal view of each manager or preferences regarding the types of risk follows in a disproportionate order to the perceived state of comfort and security.

The anti-image matrix values were then observed as shown in Table 8. The values below 0.5 are eliminated and factor analysis is performed again. All indicators obtained values that indicate the suitability for factor analysis, except for indicator of the 'NR2' variable (0.467a). Therefore, the smallest indicator of the measure of sampling adequacy (MSA) corresponds to 0.467 and the largest corresponds to 0.669. Even considering the recommendation to keep only correlation values above 0.5, the decision to keep NR2 in the model was because it has importance for the original model of Grable and Joo (2004).

Table 8: Anti-image correlation of RT variables studied

	CI	CS1	CS2	NR1	NR2	CS3
CI	0.669a	-0.179	-0.033	-0.293	-0.156	-0.001
CS1	-0.179	0.581a	-0.556	0.000	0.111	-0.040
CS2	-0.033	-0.556	0.584a	0.014	-0.099	-0.203
NR1	-0.293	0.000	0.014	0.599a	-0.141	-0.281
NR2	-0.156	0.111	-0.099	-0.141	0.467a	0.130
CS3	-0.001	-0.040	-0.203	-0.281	0.130	0.646a

The EFA was performed with six items indicated by both the KMO and by the matrices of covariance and anti-image correlation. Once the adequacy of the technique was measured, it was observed that two components can be generated with eigenvalue equal to or greater than 1, an index which determines the significance of the component for the explanation of the instrument variance. Table 9 shows the generation of the components and their respective eigenvalues.

Table 9: Eigenvalues and Total variance explained

Components	Initial eigenvalues		
	Total	Variance %	Cumulative %
<b>1</b>	<b>2.089</b>	<b>34.816</b>	<b>34.816</b>
<b>2</b>	<b>1.245</b>	<b>20.745</b>	<b>55.561</b>
3	0.982	16.363	71.924
4	0.749	12.478	84.402
5	0.553	9.215	93.617
6	0.383	6.383	100.000



Table 9 shows that the components 1 and 2 are responsible for 55.56% of the total variance of components. Table 10 shows the construction of the components extracted by the variance analysis, performed through the varimax rotation. Component 1 was corroborated the factor from personal finance studies and was denominated 'Comfort and Security', while component 2 was called 'black box effect', as those reverse statements relate to the idea that risky investments are complex processes with mysterious contents to the decision makers, that produce unpredictable returns, depending on lucky.

Table 10: Matrix of the rotating component of the studied TR variables

	Component	
	1	2
CS1: 'I feel more comfortable investing my money in my business than on the stock market.'	0.833	
CS2: 'I feel more comfortable investing my money in my business than keeping it in financial investments.'	0.828	
CS3: 'In terms of investment, security is more important than the returns.'	0.563	
NR1: 'When I think of the word "risk", the term "loss" immediately comes to mind.'		0.716
NR2: 'Making money on the stock market depends on luck.'		0.682
IC: 'Making investments is a difficult process to understand.'		0.673
Cronbach's alpha	0.608	0.488

Table 10 illustrates that component 1 is made of three items that identify the comfort and security in investing in the investor's own business. Cronbach's alpha resulted in 0.608, which is acceptable for research in applied social sciences (Hair et al., 2009) and thus shows reasonable consistency of construction. Cronbach's alpha coefficient is a model that aims to provide a reliability analysis of a questionnaire developed in research, thus measuring the correlation between responses generated in the survey through the variance of individual items and by the sum of the items.

Table 10 shows that items CS 1, 2, and 3 aim to identify the comfort and security of the manager/entrepreneur in investing in his business or the stock market or financial investments, as well as the knowledge of their perception of the security relationship of investments with their returns. It can be highlighted that in all items of the Comfort and Security component, the more the respondent scores close to or equal to 10 (maximum value), the managers/entrepreneurs demonstrate that they are comfortable and feel safe in real asset investments. This may indicate that in investment, the manager/entrepreneur feel secure in investing in their business, even if that means maintaining profitability below what the stock market offers, as well as the returns of bank investments.

The correlation between the items of factor 1, Comfort and Security, are shown in Table 11. The main diagonal brings the means and standard deviations of each item, while in the other columns are the correlations between the component items. The correlation matrix does not show multicollinearity or singularity, that is, the examination of the matrix does not reveal variables with coefficients greater than 0.9, indicating no information overlap from the indicators that form the component. In this way, all correlations were positive with values between 0.227 and 0.596.

Table 11: Correlation, mean and standard deviation of items of Factor 1

	CS1	CS2	CS3
CS1	<b>7.2467 (1.99643)</b>		
CS2	0.596	<b>6.82 (2.10168)</b>	
CS3	0.227	0.295	<b>6.46 (2.77242)</b>



In Table 11, the items in component 1 showed low standard deviations, indicating a low dispersion of items concerning the mean. Data in the table show a moderate correlation between the items CS1 and CS2 (0.596), individuals that show confidence in investing in their own business instead of the stock market or other bank investments. Correlation of CS2 and CS1 with CS3 are considered weak. The relationship of the manager/entrepreneur who prioritise security instead of rentability with investment in the business instead of bank investments showed a low ratio; and the relationship of the manager/entrepreneur who prioritise security over investment instead of returns investing in the business instead of stock markets also had a low ratio.

The second factor, the “Black box effect”, was composed by three items. Cronbach’s alpha resulted in 0.488 (see Table 10), which is unacceptable for research in applied social sciences (Hair et al., 2009) and thus shows the inconsistency of the construction. This means that the adapted scale to identify the understanding of the investment and the notion of risk of the investor in real asset investments needs further research. The items CI, NR1, and NR2 aim at identifying the understanding of the investment, that is, how difficult the manager/entrepreneur considers the investment decision is. The notion of risk of the manager/entrepreneur in identifying what comes to mind when talking about risk and whether the manager/entrepreneur believes that investing in the stock market depend on luck. This may indicate that managers/entrepreneurs, when investing, consider making investments to be easy or difficult to understand. It is important to point out that the manager/entrepreneur understands that the investment process is easily understood, and such a feeling may offer a greater possibility of ignoring important variables while investing.

However, when the manager/entrepreneur finds the investment process difficult to understand, they may infer that they have no control over all the variables that influence the investment process. This makes them more cautious concerning possible chances of loss. That might be an effect of the company’s size, as decision makers of those companies differ substantially from the others, especially regarding their autonomy, perception of restrictions that can interfere with the company’s operation, frequency with which they make decisions, among other aspects (Santos & Dacorso, 2016).

Table 12: Correlation, mean and standard deviation of items of Factor 2

	CI	NR1	NR2
CI	<b>5.4933 (3.12545)</b>		
NR1	0.351	<b>5.6533 (3.01002)</b>	
NR2	0.191	0.168	<b>4.3133 (2.58840)</b>

Table 12 shows the correlation between the items of component 2. The main column holds the means and standard deviations corresponding to each factor item, while the other columns present the correlations between the factor indicators. Thus, in all variables, the standard deviations were smaller than the means of the respective items, indicating low dispersion. The correlations were low, however significant.

## 5 CONCLUSIONS

This research aims to validate a scale for investment risk tolerance when dealing with real assets, in a business context. Through the EFA, it was possible to identify two factors to measure risk tolerance, the first factor is related to the familiarity of the decision-maker with the company, and it was denominated comfort and security, following the original dimension from personal finance research. The second factor refers to the unpredictability and the complexity of risky investments in real assets, and it was denominated ‘black box effect’.



The instrument presented some peculiarities, as it presented the KMO test acceptable for applied social science research, as well as acceptable MSA. Therefore, the factor 'Comfort and Security' presented reasonable and acceptable reliability. However, the factor 'black box effect' presented an unacceptable reliability even for applied social sciences standards. This research suggests that this factor should be expanded to improve the application and verification of results to measure the notion of risk and understanding of the investment applied to real asset investment decision-making.

This study adapts a general risk tolerance scale, used mostly for personal investments, into a risk tolerance scale for real assets, which is the most common investment decision making for business. Like other scale studies, the results obtained represent only one step in solving problems related to risk tolerance in this specific context.

The current study also has some limitations. In that sense, it is registered the fact that the range of investments in organizations of different sizes and budgets might have influenced the data dispersion and that requires the study to be analysed with due restraint in relation to the generalization of the results. Therefore, as an opportunity for future research, it is recommended that the instrument is reapplied in other groups of homogeneous samples, in order to reinforce its validity.

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3. Development of theoretical propositions (theoretical work)			√	√
4. Theoretical foundation / Literature review	√	√		
5. Definition of methodological procedures			√	√
6. Data collection	√	√		
7. Statistical analysis			√	√
8. Analysis and interpretation of data	√	√	√	√
9. Critical revision of the manuscript			√	√
10. Manuscript writing	√	√	√	√
11. Other (please specify)				

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