



Full length article

## Subjective risk tolerance and numeracy skills: A study in Brazil

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## ABSTRACT

This study is an attempt to identify the influence of numeracy skills on subjective risk tolerance in a group of Brazilian university students ( $n = 308$ ). The primary findings describe a sample with a high level of numeracy skills and medium risk tolerance. It was observed that higher levels of numeracy skills do not correspond to a greater risk tolerance, probably because numeracy skills make people more cautious by giving them insight into the true risks to which they would be exposing themselves. This result was reinforced by a logistic regression analysis, which indicated that lower levels of numeracy were linked with greater predisposition to risk. Also, additional findings were that women had a lower risk tolerance, irrespective of numeracy skills, and that the exposition to financial education courses did not impact on risk behavior.

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## 1. Introduction

As capital markets have evolved, people have gained greater access to a wide range of financial products and the general population is now more active in this market, both with relation to investments and with relation to loans and credit cards (OECD, 2005). However, Lusardi et al. (2010) argue that although acting responsibly with respect to this huge range of products may, to a certain extent, be simple for those who have a basic knowledge of finance, it can be a great challenge to those who have no knowledge of the subject.

Numeracy skills can help people to live and operate in this highly complex financial environment, bearing in mind that financial decisions demand the ability to perform mathematical calculations, including some of the most complex operations (Lusardi, 2012). Wood et al. (2015) define numeracy as the capacity to understand and manipulate basic mathematical concepts, which in turn are important in a wide variety of decision-making situations.

People who have this ability at an advanced level are more able to take the correct decisions, i.e., they have the capacity to make

better choices under risk, primarily due to a more precise subjective feeling for the size of gains and losses or of the probabilities involved in trade-offs (Cokely and Kelley, 2009). At the other end of the scale, a lack of numeracy skills makes it more likely that a person will act in a hasty manner, without seeing the financial risks and with disadvantageous consequences over time. These positive and negative impacts on numeracy are also explored in relation to financial education, which is also often seen as a predictor of good financial behavior (Huston, 2010).

Therefore, in view of the importance of numeracy in the current economic context and considering the lack of studies conducted in developing countries that connect these subjects, the general objective of this study is to identify the influence of numeracy skills on subjective risk tolerance. Specific objectives are: (i) to trace the profile of respondents; (ii) to analyze numeracy skills, risk tolerance and subjective risk tolerance; and (iii) to investigate the relationship between numeracy and subjective risk tolerance and risk tolerance.

The population selected for the study is a sample of students in higher education because it is during this phase of life that people establish their attitudes and consolidate their financial profiles, allowing them to take assertive decisions in the future, particularly with relation to state and private pension plans, such as signing up to company pension funds or pension plans from independent providers, or even making specific individual retirement plans. It is

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also the time when people construct their perceptions and direct their behavior, and these are the people who in the future will be the financial decision-makers who will be active in the economy.

This study represents a step forward in that it does not only trace the participants' risk profiles, but also identifies how differences in their numerical abilities can influence the probability that a given person will be more or less tolerant of risk, bearing in mind that the effect of numeracy is to make correct financial choices more likely.

In addition, this study contributes not only to identifying these probabilities but by exploring individuals' behavior at different risk levels. Most studies point only to variables that impact risk tolerance as a whole, not by exploring the various levels of risk that individuals are likely to run, and whether these levels change the factors that impact their greater likelihood of taking more risks.

Finally, it can be emphasized that this article contributes to stimulate further discussions about the impact of financial education courses for decision-making of financial agents. This theme is still incipient, but deserves the attention of the academy, since financial education for a long time has been considered as a solution to improve individuals' financial behavior, despite studies that question this efficiency (Alsemgeest, 2015).

## 2. Theoretical background

This section starts by presenting the concepts and implications of numeracy, continues with a subsection on risk tolerance and ends by discussing the relationships between risk tolerance, numeracy, and gender.

### 2.1. Numeracy

There is a great deal of discussion about what should be taught to children while at school. Skwarchuk et al. (2014) argue that introducing children to the concepts of numeracy early increases their chances of success in academic life. Additionally, Peters (2012) states that this knowledge is of help in decision-making because it allows for calculations to be understood at all levels of activity, ranging from share pricing to counting calories. Street et al. (2005) consider that numeracy can be understood as the capability to interpret and utilize numbers in daily life, whether at home, at work, or in society in general, or as the inclination to employ numerical concepts to solve problems. People who lack numeracy skills may have a lower quality of life than those who do not, since they have a more superficial understanding of financial issues (Smit and Mji, 2012). Lusardi (2012) adds that this type of ability is associated with financial decision-making, making it even more relevant, since many governments and employers are increasingly concerned with the responsibility to save and invest. Additionally, some authors, such as Hunt and Wittmann (2008), argue that numeracy skills are among the most influential elements of education because they contribute to the economic prosperity of the entire country.

However, according to Lusardi (2012), this issue remains a source of concern, since several different studies undertaken in a variety of countries have reported low levels of numeracy among the general population and in certain strata of the population the deficiency is critical, although better performance has been observed in Germany, Holland and New Zealand. For example, a study by Lipkus et al. (2001) investigated the numeracy skills of a population with high educational levels. These authors interviewed 463 people and observed that around 40% of them were unable to solve basic problems of probability or convert a percentage into a proportion. Huhmann and McQuitty (2009) conducted a study with the objective of constructing a theoretical explanation of the issue, starting from a combination

of cognitive abilities and theories on consumer knowledge and the results of previous studies that had investigated difficulties with financial services. They were able to observe a series of antecedents and consequences of numeracy skills, showing that experience with financial instruments and familiarity with them, motivation with relation to personal finances, cultural differences and psychographic influences were among the antecedents. The flip side was that their major finding related to their primary outcome, quality of financial management, showed that people with better numeracy skills had a greater capacity for processing financial information.

### 2.2. Risk tolerance

Every day people are faced with the need to take decisions that are very often surrounded by uncertainties. As such, unless a result is 100% guaranteed, all decisions involve an element of risk (Roszkowski and Grable, 2010). According to Hanna and Lindamood (2004), financial risk tolerance is an important issue because consumers who are unfamiliar with the subject may exhibit behavior that is too conservative to make the ideal choices and can consider that taking a financial risk is the exact opposite of financial wellbeing. From this perspective risk tolerance can be understood as "willingness to 'take a chance'" (Roszkowski and Grable, 2010) or the amount of uncertainty of return on investment that an investor is inclined to accept (Anbar and Eker, 2010). Additionally, researchers such as Brennan and Kraus (1976), Walls and Dyer (1996), and Barsky et al. (1997) claim that risk tolerance is the inverse of risk aversion, i.e., people who are more risk averse will have lower risk tolerance (Faff et al., 2008). Along these lines, in addition to its importance in personal investment decisions, Nofsinger (2005) reported that there is a link between risk tolerance and historical investment market performance, since people very often invest greater sums after making money and stop taking risks after suffering losses.

Despite the relevance of the subject and the large number of studies investigating it, several authors have illustrated the difficulties involved in measuring risk tolerance and there is no consensus in the literature on the best measurement to use (Grable and Lytton, 2001; Hanna and Lindamood, 2004; Yao et al., 2005). Notwithstanding, some measures are better known and more widely used, such as the Survey of Financial Risk Tolerance (SOFRT), created by Roszkowski (1992). Roszkowski and Grable (2009) used this scale in a project to help financial advisors to make investment recommendations consistent with each client's tolerance of risk. It comprises 51 items that vary from 0 (extreme risk aversion) to 100 (extreme risk tolerance), including questions on minimum acceptable return, minimum probability of success, preference for different investments, etc. Several other authors (Ding and Devaney, 2000; Xiao et al., 2001; Yao et al., 2004, 2005) have used the Survey of Consumer Finances (SCF), which includes a question on how much risk the respondent is willing to take with relation to investments. However, Hanna et al. (2001) found that this measure only includes investment options and does not take into account subjective aspects, real behavior, or different scenarios. They therefore attempted to improve this measure, proposing a model of "Subjective Risk Tolerance", by combining the SCF with a measure proposed by Barsky et al. (1997), in which they had identified three potential defects: ambiguity with relation to taxes, difficulties with differentiation of levels of risk aversion, and ambiguity with relation to the alternatives a respondent would have after choosing the 50%–50% option and suffering the worse outcome. They therefore revised the questions used in the previous measures and added other questions with the intention of describing some preliminary patterns of risk tolerance. Working from the assumption that the principal requirement for analysis

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