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Theoretical-empirical Article

Behavioral Economics and Auto Insurance: The Role of Biases and Heuristics

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Economia Comportamental e Seguros de Automóveis: O Papel dos Vieses e Heurísticas

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ABSTRACT

Objective: this paper analyzes how framing, anchoring, and certainty effects may affect the behavior of the consumer of auto insurance. **Methods:** an experiment was carried out, with the face-to-face application of six versions of a questionnaire with 14 questions, for 163 respondents from an educational institution. Questions were prepared to analyze the existence of the framing effect, the anchoring effect, and the certainty effect, in addition to the deductible effect (present in several insurance products). The theoretical framework of the paper is the behavioral economics. **Results:** younger people, singles, and men are more prone to risk. Although the findings in general corroborate the evidence in the literature, the results of the certainty effect were contrary to expectations. The payment of the deductible increased the respondents' risk aversion. **Conclusions:** the existence of biases and heuristics can cause the purchase of insurance to occur in a non-optimal way. Knowledge of the decision-making process is important for insurers and consumers. It is also relevant for regulators, in order to subsidize measures aimed at market efficiency and consumer protection, through the design of an appropriate choice architecture.

Keywords: behavioral economics; bias; heuristics; insurance.

RESUMO

Objetivo: este trabalho analisa como os efeitos de enquadramento, de ancoragem e de certeza podem influenciar o comportamento do consumidor de seguro de automóveis. **Métodos:** foi realizado um experimento, com a aplicação presencial de seis versões de um questionário com 14 questões, para 163 respondentes de uma instituição de ensino. Foram elaboradas perguntas visando a analisar a existência dos efeitos de ancoragem, de certeza e de enquadramento, além do efeito de franquia (presente em diversos ramos de seguros). O arcabouço teórico do trabalho é a economia comportamental. **Resultados:** as pessoas mais jovens, os(as) solteiros(as) e os homens possuem maior propensão ao risco. Embora os achados de forma geral corroborem as evidências da literatura, os resultados sobre o efeito de certeza foram contrários ao esperado. O pagamento da franquia aumentou a aversão ao risco dos respondentes. **Conclusões:** a existência de vieses e heurísticas pode fazer com que a aquisição de seguros ocorra de forma não ótima. O conhecimento do processo de tomada de decisão é importante para as seguradoras e para os consumidores. Também é relevante para os reguladores, com a finalidade de subsidiar medidas que visem à eficiência do mercado e à proteção dos consumidores, por meio do desenho de uma arquitetura de escolhas adequada.

Palavras-chave: economia comportamental; vieses; heurística; seguros.

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INTRODUCTION

Insurance is a risk management technique aimed at mitigating impacts and avoiding the welfare reduction associated with the possibility of a loss in an environment of uncertainty. In the not-too-distant past, the purchase of insurance was commonly analyzed from the assumptions of full rationality (Watt, Vázquez, & Moreno, 2001). However, as noted by recent and relevant contributions from empirical literature, these assumptions are not always valid. An example is the presentation made by Harrison and Richter (2016) to the special issue of *Journal of Risk and Insurance*. The use of behavioral economics grew over time, providing a more adequate framework to analyze decisions related to the purchase of insurance.

The mark of this change in the theoretical corpus, named the behavioral turn (Muramatsu, 2020), occurred in 1979, when psychologists Daniel Kahneman and Amos Tversky published the article "Prospect Theory: An Analysis of Decision under Risk," in *Econometrica* (Kahneman & Tversky, 1979). The authors presented a theory of decision under risk conditions as an extension of the expected utility theory. That article, which would become a landmark in the literature, radically changed the understanding of the behavior of individuals in face of risk and uncertainty. Its greatest contribution, perhaps, was to show that, under risk conditions, the decisions made by individuals also take into account psychological and emotional aspects. This fact can often lead to choices that go against the result originated from the rational behavior of the '*homo economicus*,' predicted in traditional microeconomic theory.

Kahneman and Tversky showed that people value the losses and gains associated with their decisions differently. The welfare reduction linked to a loss is greater than the increase related to an equivalent gain. As a result, individuals in a gain situation risk less than those in a loss situation. The expectation of loss makes them tend to take more risks, aiming to avoid the reduction of welfare related to the loss scenario. Prospect theory would become one of the foundations of modern behavioral economics. The revolution generated by this milestone was such that, in 2002, Kahneman was awarded the Nobel Prize in Economic Sciences.

Subsequent developments, particularly those on nudges, led to Richard Thaler receiving the award in 2017. According to the classic definition by Thaler and Sunstein (2008), a nudge "is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2008, p. 6).

The theoretical foundation and empirical methodologies of behavioral economics are increasingly relevant to the field of insurance (Richter, Schiller, & Schlesinger, 2014), becoming the hegemonic literature framework in the area. Greater precision in the understanding of the behavior of claimants can be strategic for insurers and consumers alike. Auto insurance revenues had revenues over R$ 35 billion, thus requiring careful analysis, particularly with regard to demand, focus of this article. Understanding the relevant elements for purchase decisions can also provide subsidies for the elaboration of nudges and more adequate choice architectures for both providers and regulators.

It is precisely this point that this work seeks to analyze: how the effects of anchoring, framing, and deductible influence the behavior of the auto insurance consumer. This is an aspect explored little in Brazilian literature. Studies on insurance are rare, especially those using behavioral framework. This theme is studied using a set of 163 respondents from an educational institution. This group was chosen due to heterogeneous age, education, and income characteristics. These variables are associated with risk aversion, which can influence the purchase of insurance (Ledo & Lopes, 2019).

This work is divided into five sections, including this brief introduction. The second presents the theoretical framework and empirical evidence. The main concepts related to biases and heuristics are presented. The third section describes the methodological procedures. Research results are presented in the following section. The fifth and final section brings the conclusions of the study, where the implications of the results for consumers and insurers are analyzed. Some reflections are also made on the design of the adequate choice architecture by the regulators.

THEORETICAL FRAMEWORK AND EMPIRICAL EVIDENCE

The classic studies by Kahneman and Tversky (1979) and Tversky and Kahneman (1992) are the main theoretical framework of this study, given their position as pillars of behavioral economics and modern economic psychology. Moreover, quite didactic presentations, also used here, can be found in Kirchler and Hoelzl (2017) in chapters 2 and 3, and Dhami (2016) in chapter 19.

This section is divided into three parts. In the first, the way in which people recognize the decision-making scenario will be defined. The second part provides

the various biases to which individuals are subjected. Next, it shows how these biases can affect the processes of recognition and attribution of value to prospects. Following, it shows how the outcome of a decision involving the purchase of insurance can be affected by such biases. Finally, the third part presents some relevant empirical results on the subject.

Heuristics, risk aversion, and subjective value attribution

As shown by Kahneman and Tversky (1979) in the work's section 3, the decision-making process is divided into an Editing Phase and an Evaluation Phase. The development of both is necessary for an individual to understand the possible results of their choices and, therefore, of their decision between prospects. "A 'prospect' $(x_i, p_i; \ldots; x_n, p_n)$ is a contract that can produce an outcome x_i, with probability p_i, where $p_1 + p_2 + \ldots p_n = 1$" (Kahneman & Tversky, 1979, p. 263). When people are faced with a decision situation under risk, their prospects are the possible alternatives available for their choice. We should note that, if there is no risk, prospect x has a certain result equal to x.

During the Editing Phase, the individual engages in a preliminary analysis of the options associated with the prospects, which are organized and reformulated in a simplified way for later evaluation and decision-making. It is during this phase that heuristics — decision rules that save time and energy but eventually lead to suboptimal judgments (Kirchler & Hoelzl, 2017) — can affect the understanding of the situation. Editing Phase operations eventually change the perception of events, usually with the choice of a reference point. This simplification occurs automatically and depends on the form, order of presentation, and events that generate the information. This simplification is conditioned by biases prior to the moment of decision (idiosyncratic) and biases originating from external factors (induced).

During the Evaluation Phase, the individual attributes value, from his heuristics, to each prospect based on available information. It depends on the simplification and interpretation of the prospects' risks and probabilities. As Kirchler and Hoelzl (2017) point out in section 3.1, the value function makes the relationship between psychological value and objective results, by representing how people attribute values to losses and gains. Dependence on magnitudes of values and associated probabilities, based on a reference point, exist. This may be associated with prior wealth (Tversky & Kahneman, 1992), which is compared to the wealth after the outcome of their decision.

The degree of risk aversion depends on this comparison between the outcome of the decision and the previous scenario. However, the risk aversion of a loss depends not only on the magnitude of the loss, but also on its value in relation to wealth. Risk aversion, based on the expected utility model (Seog, 2010), can be conceptualized as the characteristic of an individual who prefers a sure result, compared to accepting to enter a lottery (a random result), given that the utility of the expected value of wealth is greater than the expected utility of wealth. In this case, a person's utility function is convex over its whole extent. But this is precisely one of the assumptions questioned by behavioral economics.

Using the terms of Kirchler and Hoelzl (2017), via a weighting function, individuals perceive the objective probabilities and transform them into decision weights, giving rise to what the literature calls probability weighting (Kirchler & Hoelzl, 2017). Individuals thus tend to assign more weight to low probability events. And, conversely, assign less weight to higher probability events. For this reason, the value function assigned to the prospect is concave (convex) for values above (below) the reference point. Thus, the marginal value of gains or losses decreases as their magnitude increases.

Kunreuther, Pauly and McMorrow (2013) point out that a consequence of this behavior is that policyholders can choose insurance with reduced deductibles and may opt for insurance with reimbursement if the claim is not accepted, even if other more suitable options from a financial point of view exist. Thus, one concludes that the prospect theory offers a more faithful description of real consumer behavior. As Wakker, Thaler and Tversky (1997) add, the decision to purchase insurance can be guided mainly by the greater weight that individuals assign to low probability events.

Biases and their impact on decisions

The effect of biases can be observed mainly during the Editing Phase, when the decision-maker processes the information and quantifies the possible results and their probability of occurrence. Biases can change the perception of a prospect, so that when reaching the Assessment Phase, the individual assigns a value to the prospect that may be different from the value assigned in case of no bias, or even the situation of incidence of other biases. Each bias can affect risk perception in a different way, producing different effects on the decision. Three of the most frequent biases observed in decision-making under risk are: the framing, anchoring, and certainty effects (Tversky & Kahneman, 1974). A brief description of these biases is provided below.

Framing effect

This first effect leads individuals to react in different ways to the same situation of choice under uncertainty, according to the way in which the alternatives are presented, whether as a situation of gain or loss. People tend to be risk averse when presented with positive choices (situations involving gains). However, if the same situation is presented as a potential loss, the propensity to accept risk increases.

A classic example of this bias, known as the Asian disease problem, is presented by Tversky and Kahneman (1981), with the hypothetical case of the epidemic of an unusual disease, which is expected to kill 600 people. A first group of respondents had to choose between two types of treatments, presented as follows. With the first treatment, 200 people would be saved. In the second, a 1/3 probability of all 600 people being saved exists, with a 2/3 probability of no one being saved. With this framework, 72% of respondents chose the first alternative and 28% preferred the second. For a second group, the problem was presented differently. In the first alternative, 400 people would die. In the second, there would be a 1/3 probability that no one would die, and a 2/3 probability that all 600 would die. With this presentation, the first alternative was chosen by only 22% (compared to 72% of the presentation made to the first group, even though the alternatives are equivalent).

This result shows that decisions can be influenced by the way a problem is presented, focused on losses or gains. There are effects on the interpretation of the situation. Similarly, in a theme relevant to the object of this study, an individual may feel more inclined to choose an insurance whose deductible has a lower value and a higher premium, rather than an insurance in which the conditions are reversed (high deductible and reduced premium). One of the studies that analyzes the choice of deductible levels in the existence of small magnitude risks in home insurance is Sydnor (2010). An interesting result is that consumers could benefit if insurance is not purchased beyond the optimal for reduced risks. It is possible that the policyholder fails to realize that his decision is being affected by the framing effect.

Anchoring effect

Frequently, individuals may start their estimation of the frequencies and probabilities needed for their judgments from how a problem is presented. This behavior is called the anchoring effect (Kirchler & Hoelzl, 2017). A biased initial assessment of prospects can have important consequences, even if other information is presented later. In particular, this effect can influence financial decisions (Jetter & Walker, 2017), including the purchase of insurance.

This fact can change the value function and decision weights. As a result, deviations from the actual values of the prospectuses may occur. The value function is concave for gains (generating a convex region), and conversely, convex for losses, producing a concave region for those. The second case is more common, as high losses tend to affect the behavior of individuals. Due to risk aversion, the possibility of behavior change caused by disturbances in the value functions — especially in the loss value function — can be mitigated through the purchase of insurance. However, this strategy is sometimes adopted due to bias in the relative perception of risks (Kahneman & Tversky, 1979). That is, the risk profile depends on the value function region. As a result, in the region to the right (left) of the reference point, the individual tends to be averse to (lover of) risk.

Risk perception can also be affected due to a biased assessment of the relationship between joint and disjoint events. The anchoring effect can lead a person to attribute the disjunction feature to events that are actually conjoined, or vice versa. This can lead to certain potentially dangerous risks not being taken into account. Or, in the opposite situation, create aversion to certain risks that, in reality, do not exist. Joint events may have their probability overestimated, whereas underestimation to disjoint events occurs (Tversky & Kahneman, 1974). The availability heuristic can present a manifestation of the anchoring effect and the distortion arising on perception.

Certainty effect

In expected utility theory, the utility of results is weighted by their probability of occurrence. However, variations in the probabilities of losses or gains affect the subjective assessments made by individuals in a non-linear way (Samson, 2017). People would thus attach greater importance to events considered more likely. An example of the certainty effect is presented by Kahneman and Tversky (1979), based on an original elaboration by Maurice Allais in 1953, known as the Allais paradox.

In Problem 1, the first prospect offered is given by (2,500, 33%; 2,400, 66%; 0, 1%). That is, $2,500 can be won at 33% probability, $2,400 at 66% probability, or $0 at 1% probability. The second prospect presents a certain 2,400 gain. When faced with this situation, 82% of respondents preferred the second prospectus, with the certain result.

In Problem 2, the prospects were (2,500, 33%; 0.67%) and (2,400, 34%; 0, 66%). In this situation, 83%

expressed a preference for the first prospect, for which there is a greater probability of a positive result. However, these results meet those of the expected utility theory (Von Neumann & Morgenstern, 1944). This result shows a contradiction in the assessment of the usefulness of prospects, as individuals do not always obey the axioms of rational behavior. Thus, they may not act aiming to maximize their usefulness, given the bias originated from the certainty effect. These individuals are loss-averse when choosing the risk-free prospect in the first problem. This is due to their perception of risk having been affected, in the comparison of scenarios without and with risk, even if this is minimal in relation to the probabilities. As noted by Stewart and Stewart (2001), consumers would be willing to purchase insurance for amounts higher than the actuarially fair value to reduce risk in certain contexts. This would be a situation where the architecture of appropriate choices could increase welfare.

Empirical evidence — Insurance and behavioral economics

By its nature, the purchase of an insurance policy is made under risk condition, with the possibility of an adverse deviation (a loss) in relation to an expected result. This is a situation where the behavioral economics framework can be applied to analyze individual decisions. Dhami (2016) states that decision anomalies, situations in which there are deviations from what is predicted in rational choice models, are quite common in various spheres. Schmidt (2016) presents some examples for the insurance area. Richter, Schiller and Schlesinger (2014) note that insurance markets provide a natural field for analyzing the effects of biases and heuristics given the growing integration between behavioral models and the economics and finance literature. Complementarily, Corcos, Montmarquette and Pannequin (2020) point out in their review that research on insurance clearly directed toward behavioral insurance.

Based on these arguments, this section presents a brief literature review. For a review of experimental studies on insurance demand, the comprehensive study by Jaspersen (2016) exists. Equally noteworthy is the contribution of Richter, Ruß and Schelling (2019), which also highlight how biases and heuristics affect the insurance sector as a whole.

One of the first studies that should be mentioned is Schoemaker and Kunreuther (1979), in which the authors' experiment aimed to compare the predictive capacity of the expected utility model with the then recent prospect theory. Respondents were undergraduate students from a university and clients of an insurance company, who were presented with various combinations of events with severities, probabilities, and deductibles. The results obtained, in general, are in line with the predictions originated from the model proposed by Kahneman and Tversky. Evidence of the relevance of the context in the insurance purchasing process is also found.

Two other studies (Segal, 1988; Wakker, Thaler, & Tversky, 1997) deal with probabilistic insurance, a situation in which there is a small probability that policyholders will not be compensated if a claim occurs. The first work is theoretical in nature and shows that under particular conditions, this situation is consistent with risk aversion and utility function concavity. In the second article — a survey is conducted with undergraduates from a university —, the main result is that people tend to reject this insurance, requiring a more than proportional reduction in the premium in exchange for an increase in risk, which is inconsistent with expected utility theory. This result would be compatible with a weighting function of the prospect theory.

Two interesting cases are reported by Johnson, Hershey, Meszaros and Kunreuther (1993). The authors report a real situation that occurred in 1990. Iben Browning, a self-proclaimed climatologist, predicted the possibility of a severe earthquake on December 3 in the New Madrid region of Missouri (USA). This site was known for having great seismic activity, having been the site of the most severe earthquake ever recorded in North America, in 1811. More than 650,000 policyholders added earthquake coverage to their policies, tripling the amount of this type of coverage. One possible explanation is based on availability heuristics. Due to the propensity for earthquakes of great magnitude, the fact that the government of New Madrid takes actions to mitigate the effects of earthquakes distorted perceptions about the frequency of these events. However, on the foreseen date there was no earthquake. It is interesting to note that the demand for insurance can also increase even after the adverse event does not materialize, as shown in the no-loss experience case, reported by Lin (2020).

The second case reported by Johnson et al. (1993) deals with the framing effect. In 1991, the states of Pennsylvania and New Jersey made changes to their auto insurance legislation, aiming to lower premiums. Two insurance plans became available for choosing. In the first, in the event of an accident, the insured individual has the right to sue the insurer and seek additional financial compensation under the allegation of pain and suffering, in addition to physical damage. In the second plan, much cheaper, the insured person would waive his right to file this process. In New Jersey, standard coverage was the cheapest. The right to sue the insurer would have

to be acquired at an additional cost. In Pennsylvania, the standard coverage was the complete one, and its value could be reduced if the individual waived the possibility of suing. Only 20% of New Jersey's policyholders acquired the right to sue, whereas in Pennsylvania 75% of drivers retained their right to sue. This shows a consequence of the framing effect: significant reduction in the number of more expensive policies by just changing the standard policy to a different framework.

Recently, Gottlieb and Mitchell (2020) studied the effects of the narrow framing effect on long-term care. The authors elaborate a theoretical model that supports a survey applied in a special module of the Health and Retirement Survey (HRS) in 2012. The results of around 1,700 responses show that this bias may be responsible for many individuals purchasing suboptimal insurance plans. Coe, Belbase and Wu (2016) try to understand how the purchase of insurance is decided. The authors combine the use of in-depth interviews and an experiment with 3,302 respondents from Knowledge Networks Internet between 2011 and 2012. They show that the proper use of behavioral economics concepts can increase the demand for life insurance. Highlights include the use of defaults, personalized coverages, presentation of information in a more direct way, and a list of average values necessary for certain coverages.

Something noteworthy is that the literature on risk aversion and insurance purchase determinants has several inconclusive findings. For example, men seem to be more prone to risk than women (Borghans, Heckman, Golsteyn, & Meijers, 2009; Cohen & Einav, 2007). Cohen and Siegelman (2010) claim that the findings in the literature corroborate the existence of a positive relationship between income and demand for insurance. However, this result was not corroborated for auto insurance in Brazil by Peres, Maldonado and Candido (2019). Evidence is unclear with regard to marital status and schooling (Outreville, 2014). The same is true of the effect of age on the demand for insurance (Zietz, 2003). Given this picture, it seems reasonable to incorporate some of these variables in the experimental study and in the econometric procedure carried out here.

This succinct literature review on insurance and behavioral economics, along with comprehensive review articles such as Richter et al. (2019), provided evidence that, when making decisions under risk, individuals are subject to some cognitive biases (such as loss aversion) and judgmental heuristics such as the anchoring effect. This can lead to inadequate choices, resulting in suboptimal insurance purchases. The use of these biases or heuristics can be done unconsciously and/or unintentionally (Berg, 2014; Ogaki & Tanaka, 2019). People can be induced into purposely access these heuristics. This is done without them noticing it, through the way each problem is exposed to them. Evidence that people employ heuristics in a number of decisions exists (Kirchler & Hoelzl, 2017), particularly in the purchase of insurance (Jaspersen, Ragin, & Sydnor, 2019; Jaspersen & Aseervatham, 2017). This is done so the interpretation of situations is simpler and decisions are made more quickly.

No study focusing on this aspect was identified in the Brazilian literature. Even in the international literature, studies on auto insurance from a behavioral perspective are somewhat rare. It is precisely this point that will be explored in the empirical part of this article. Three hypotheses are formulated here, which will be verified using the experimental procedure described below:

H1: There is an anchoring effect on the intention to purchase auto insurance;

H2: There is a framing effect on the intention to purchase auto insurance;

H3: There is a deductible effect on the intention to purchase auto insurance.

To understand which individual characteristics are relevant to the purchase of auto insurance, we also conduct an econometric exercise. Empirical evidence on the role of risk aversion (Jaspersen et al., 2019), income (Cohen & Siegelman, 2010; Peres, Maldonado, & Candido, 2019), marital status and schooling (Outreville, 2014) and age (Zietz, 2003) is diffuse, and for this reason will be analyzed here.

METHODOLOGICAL PROCEDURES

This section presents the methodological procedures. The research instruments used for data collection and the methods used for data treat are also described, in order to test the proposed hypotheses.

Data collection was carried out in person by one of the study's authors between October 1 and October 6, 2018. The sample consisted of students from various courses and lectures offered by B3 Educação, linked to the stock exchange of the same name. This institution offers several courses and lectures related to the capital market, from the most basic to the most advanced, for different audiences, with different degrees of knowledge and previous experience. The target was courses and lectures at different levels and with students of diverse

profiles. Thus, respondents have different levels of knowledge about finance, in addition to heterogeneity about other observable attributes such as gender, income, age, and schooling.

Six versions of the questionnaires were created and given to the research subjects, so that they could voluntarily answer the forms and return them at the end of the lecture or course. Since answers were voluntary, one cannot rule out the possibility that selection into the experiment occurred, as noted by Czibor, Jimenez-Gomez and List (2019). A priori, it is not trivial to know if this caused some kind of bias in the answers. The experiment was carried out in such a way that the different versions of the questionnaire were distributed as evenly as possible in each classroom or lecture hall. Thus, none of the versions should be under- or over-represented in the set of respondents.

Each version of the questionnaire had a set of equal questions and additional questions presenting different content and contexts. The questionnaire was divided into two parts. In the first, the questions aimed to capture the possible incidence of cognitive biases and the effect of framing variations. In general, these questions presented certain situations of choice under uncertainty, linked to auto insurance, for which a decision was requested. This research design is based on the one described by Kahneman and Tversky (1979): "The use of the method relies on the assumption that people often know how they would behave in actual situations of choice, and on the further assumption that the subjects have no special reason to disguise their true preferences" (Kahneman & Tversky, 1979, p. 265).

There was also a question used to measure the risk aversion of each respondent. The questions about the biases selected for this study were taken from articles with similar themes. In general, questions used by Schoemaker and Kunreuther (1979) and Johnson et al. (1993) were used as a basis for the elaboration of the six versions. The statements to some of the questions were adapted to the Brazilian reality, so respondents felt greater contextual proximity to each question.

The second part of the questionnaire was the same and served to establish the sociodemographic profile of the respondents, allowing us to group them according to their observable characteristics. The sociodemographic information collected were: age, marital status, gender, schooling, education area, and income range. Questions about B3 Educação (course currently being attended and number of courses concluded on the institution) and ownership of a vehicle and purchase of insurance (previously and by the time of the survey) were also included.

In total, 166 responses were obtained. Of these, three respondents completed only one of the questionnaire pages, for that only 163 valid questionnaires were completed.

RESULTS

This section presents brief description of the respondents' sociodemographic characteristics. Next, the results for the questions related to biases and heuristics are presented.

Respondent characteristics

The sample has 163 respondents, 71 women and 92 men. The mean age of respondents is 33.71 years. There are 54% single, 39% married, and 7% divorced. The mean monthly income is 7.9 minimum wages. Of the respondents, 71% have completed higher education or graduate studies, 23% have incomplete higher education, and 6% have completed or incomplete high school education. The results show 3% with a background in biological sciences, 20% in humanities, 32% in exact sciences, and 45% with a background in the business area. In the sample, 107 individuals own or have owned cars. Of those who own a car, 85% have insurance and 15% do not. Of the 163 respondents, 15 own or have owned a car, but never had insurance for these cars.

Question 1 — Risk aversion

As Harrison and Ng (2019) emphasize, risk aversion is one of the natural objects when analyzing the demand for insurance. For this reason, the first question aimed to measure the respondents' level of risk aversion, from their willingness to pay a certain amount to participate in a bet. Similar formulations can be found in Eisenhauer and Ventura (2003), Barsky, Juster, Kimball and Shapiro (1997) and Schubert, Brown, Gysler and Brachinger (1999). The answers were used to calculate the absolute risk aversion coefficient of each respondent, following the methodology of Pratt (1964), treated from this point on as the Arrow-Pratt coefficient. The expression used is presented in expression (1):

$$r_A(x) = -\frac{u''(x)}{u'(x)} \quad (1)$$

In this expression, $r_A(x)$ is the value of the Arrow-Pratt coefficient at point x and $u(x)$ is the value of the individual's utility function at point x.

Based on the formulation presented in Eisenhauer and Ventura (2003), the utility function is given by:

$$u(w) = 0{,}5 * u(w - z) + 0{,}5 * u(w - z + 5000) \quad (2)$$

In (2), w is the individual's wealth and z is the maximum amount they would pay to enter the coin toss competition. As shown by Cruz (2017), it is possible to expand this function by a second order Taylor series and use it as an approximation of the expected utility in the calculation of the Arrow-Pratt coefficient:

$$r_A(\mathrm{w}) = -\frac{u''(w)}{u'(w)} = \frac{-2\mathrm{z} + 5000}{0{,}5 * (2\mathrm{z}^2 - 10000\mathrm{z} + 5000^2)} = \frac{-2\mathrm{z} + 5000}{\mathrm{z}^2 - 5000\mathrm{z} + 12500000} \quad (3)$$

The last step consists of multiplying the Arrow-Pratt coefficient by the mean monthly income range reported by the individuals. This is done to weight the measure of risk, based on the proportion of income they are willing to pay to participate in the lottery. This procedure tries to avoid the problem of associating risk with wealth, pointed out by Schubert et al. (1999).

Risk aversion

As can be seen in Figure 1, most respondents (51%) are in the range from zero to two in the Arrow-Pratt coefficient's value. This corresponds to mild risk aversion. It is also observed that 74% of respondents are concentrated in the risk aversion ranges referring to degrees from mild to moderate (coefficient values between zero and four).

This behavior is consistent with the natural risk aversion characteristic of human beings, as presented by Levy (2015). The author notes that individuals who desire the perpetuation of their genes through their descendants instinctively have their attitudes guided by the risk aversion of their actions. Preferences related to constant risk aversion can thus be understood as evolutionary heuristics developed to maximize the probability of success in the perpetuation of their lineage.

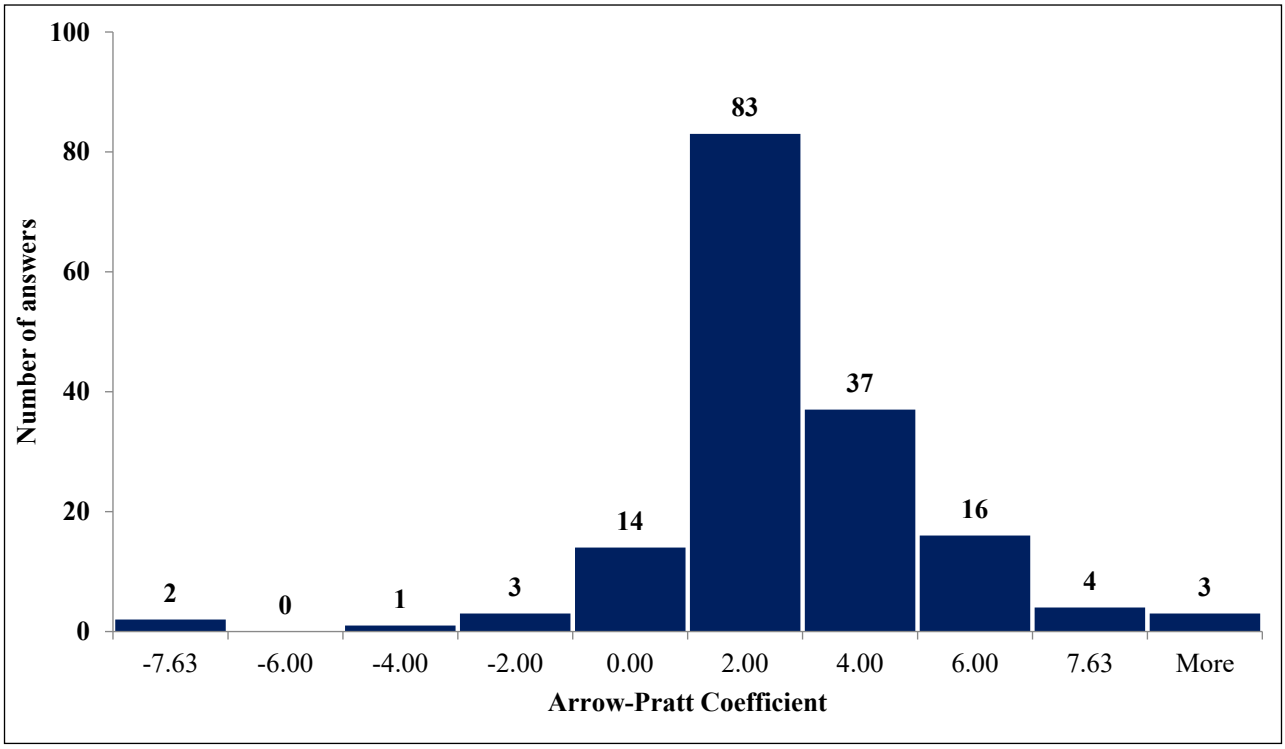

Figure 1. Arrow-Pratt coefficient.
Source: Prepared by the authors.

Risk aversion by age group

After analyzing the risk aversion of the full respondents set, three cuts are made. The first cutout refers to age. There is evidence in the literature (Brooks, Sangiorgi, Hillenbrand, & Money, 2018) that risk aversion tends to increase with age.

As shown in Figure 2, there is reasonable evidence to say that the risk aversion of the respondent group increases with age. The counterintuitive exception to this finding is the range highlighted in red, from 49 to 58 years old. The reason for this unexpected result is associated with the relatively small sample size and, mainly, the presence of two outliers, one aged 54 and the other 55 years old. These individuals answered that they would be willing to pay their own prize amount to enter the bet, which made their risk propensities extremely high. The result was the reduction of the mean of this range to a very low value. If these individuals were excluded from the sample, the Arrow-Pratt coefficient for the age group from 49 to 58 years old would be 2.41, consistent with expectations. These results are in line with the findings of other authors (Brooks et al., 2018; Jianakoplos & Bernasek, 2006).

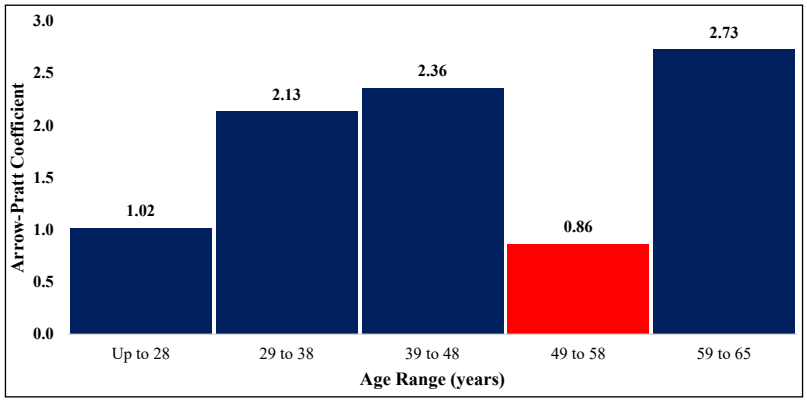

Figure 2. Arrow-Pratt coefficient by age group.
Source: Prepared by the authors.

Risk aversion by gender

The second cut was the analysis of mean risk aversion coefficients by gender. The values found show that, on average, women present risk aversion 26% higher than men (1.87 versus 1.50), as shown in Figure 3. A t-test of means allows rejecting the null hypothesis of equality of means between genders. These results are consistent with the practice verified in car insurance in Brazil. Given the same conditions, the premiums paid by men are higher than those paid by women, as women are less likely to take risky actions. The values obtained are consistent with those reported by Cohen and Einav (2007) in their classic study. But they go against what was reported by Ledo and Lopes (2019), who do not report a significant difference by gender for the Brazilian case. Borghans, Heckman, Golsteyn and Meijers (2009) suggest that a possible explanation for the gender difference is that risk perception is related to cognitive and non-cognitive traits, unequal between genders.

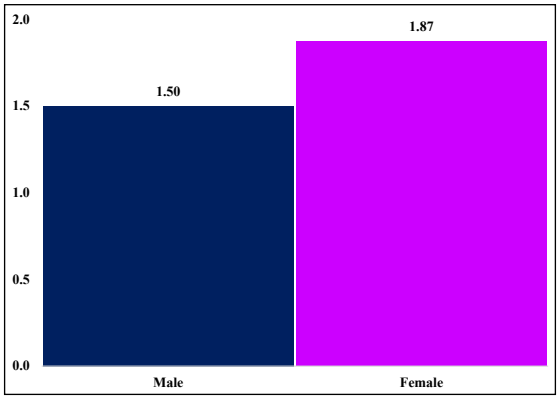

Figure 3. Arrow-Pratt coefficient by gender.
Source: Prepared by the authors.

Risk aversion by marital status

The third refers to the marital status of respondents. The literature (Chaulk, Johnson, & Bulcroft, 2003) provides some evidence that marriage may be associated with a lower risk propensity, although the review by Outreville (2014) suggests that the relationship between risk and marital status is not so unequivocal. Figure 4 shows that married or divorced individuals have greater risk aversion than single individuals. The risk aversion of single individuals was 29% and 27% lower than that of married and divorced people, respectively. A t-test of means with different variances between single individuals and married or divorced group allows us to infer that the means of the two groups are statistically different.

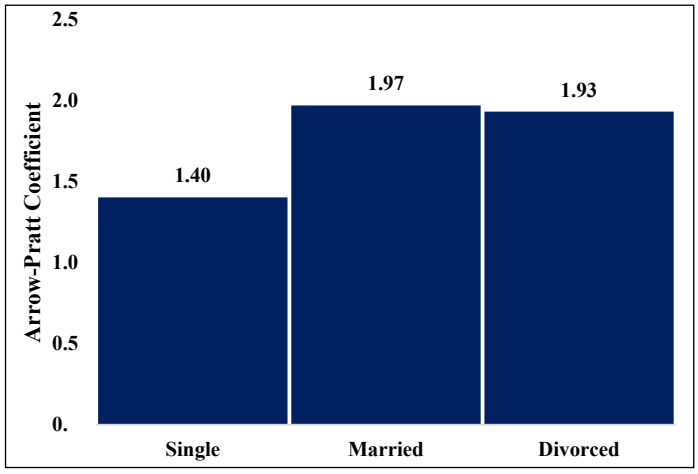

Figure 4. Arrow-Pratt coefficient by marital status.
Source: Prepared by the authors.

Part of the results, in particular the similarity between married and divorced people, may be correlated with the age of the individuals, since, as seen in section "Risk aversion by age group," age holds influence over the risk aversion coefficient. The mean age of single individuals is 26 years. For married people, the mean is 42 years and for divorcees, 44 years. These results are consistent with those found by Irandoust (2017), who reports evidence that married individuals tend to be less risky compared to unmarried individuals.

Question 2 — Anchoring effect

Once the sociodemographic characteristics of the respondents and their profile in relation to risk are presented, the next step is to verify the heuristics. Thus, the objective of this question was to analyze whether the availability heuristic is relevant, testing the existence of the anchoring effect. Robust evidence in the literature (Coe, Belbase, & Wu, 2016; Robinson & Botzen, 2019) argues that this effect can be relevant when purchasing insurance. Based on the experiment by Johnson et al. (1993), it was asked how much respondents would be willing to pay for certain insurance coverage in two locations. Changes were made to the original statement in order to make its context closer to the respondents' references. A similar methodology was employed by Hansen, Jacobsen and Lau (2016) to analyze the propensity to pay for car and home insurance in Denmark.

Each of the six questionnaire templates had a version of the question. The differences were the type of coverage offered and the city where the individual would be, if using the insurance. Two coverages were offered: against accidents, against acts of violence, or a combination of both. The cities for each of the questions were Rio de Janeiro, RJ or Florianópolis, SC.

The responses to the questionnaires, shown in Figure 5, show differences in response patterns given the initial conditions in each case. There is clear evidence of availability heuristics in the responses. Hypothesis *H1* — about the existence of the anchoring effect — cannot be rejected. Respondents who combined the city of Rio de Janeiro with the coverage against acts of violence are willing to pay a much higher average amount than in other cases. Since this municipality has been more associated with cases of violence than Florianópolis, the access of individuals to this information is more frequent, making it recurrent in their memory and causing the availability heuristic to be activated when answering the questionnaire. This causes people to assess risk inappropriately, as pointed out by Baddeley (2019). According to Johnson et al. (1993), these specific causes can significantly increase the value people perceive in insurance.

The feeling of unsafety arising from this context increased the propensity to disburse greater amounts, in exchange for transferring their risk using the insurance contract, when the question joined the words 'Rio de Janeiro' and 'violence,' rather than in the other variations of the question tested. Analogously to what was verified in the original research, from which this question was adapted, the results violate the principle of inclusion. When adding together the amounts that individuals would be willing to pay for individual coverage, the result is more than twice the amount they would be willing to pay for coverage that covers both types of risk. In doing so, individuals make a choice inconsistent with maximizing their expected utility, where the utility of the individual parts added together outweighs the utility of the parts together.

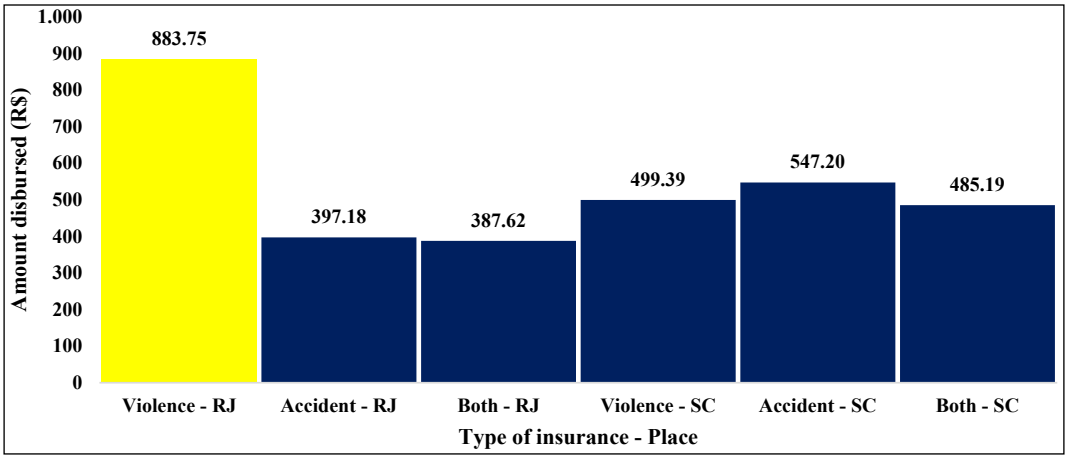

Figure 5. Mean amount disbursed to purchase the insurance coverage offered (R$).
Source: Prepared by the authors.

Question 3 — Certainty effect and framing effect

How a question is presented can affect the answers. Therefore, depending on the framework, preferences for alternatives may change, since the subjective value and decision weight functions are not linear.

These effects were empirically analyzed with the study of decisions referring to deductibles, in a similar way to Cohen and Einav (2007). To this end, Question 3 was inspired by the formulation of Schoemaker and Kunreuther (1979) and Barth, Hatem and Yang (2004). Two versions were developed. In the first statement (here called Question 3.1), the value of a car and the probability of theft were presented. Four insurance policy options were presented, with decreasing deductibles and increasing premiums. Respondents had to rank the policies in order of attractiveness. The second version (Question 3.2) presented two alternatives, which did not refer to insurance policies, but rather to choices under uncertainty. The first alternative presented a certain value and a 'certain loss' (here understood as the value that could be lost, multiplied by the probability of loss, of 100%). The second alternative had a lower value than the first alternative, also with a 100% loss probability. In other words, the 'certain loss' was smaller. But in this second alternative there was also a small probability of an additional high value loss occurring (in this case the multiplication of both terms mentioned in the previous sentence is called 'uncertain loss'). Thus, the expected value of the loss in the second alternative was lower than in the first alternative.

The answers provide evidence of the impact of the framing effect on the intention to purchase auto insurance.

Question 3.1 — Only certain loss

Respondents to the questionnaires containing Question 3.1 were asked to rank their preference for the four policies presented, on a scale from 1 to 10. Policies A, B, and C had both premium and deductible (certain and uncertain loss). Policy D had no deductible, having only the premium (certain loss). Figures 6A to 6D present the aggregated responses into three levels of attractiveness. Grades 1 to 3 were categorized as 'low,' grades 4 to 7 were categorized as 'medium,' and grades 8 to 10 were categorized as 'high.'

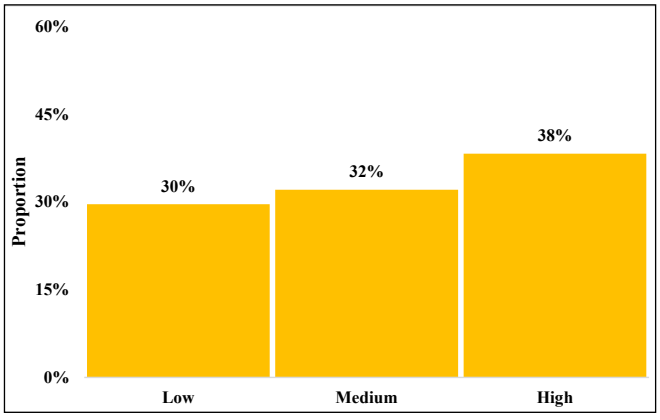

Figure 6A. Grade category, policy type A.
Source: Prepared by the authors.

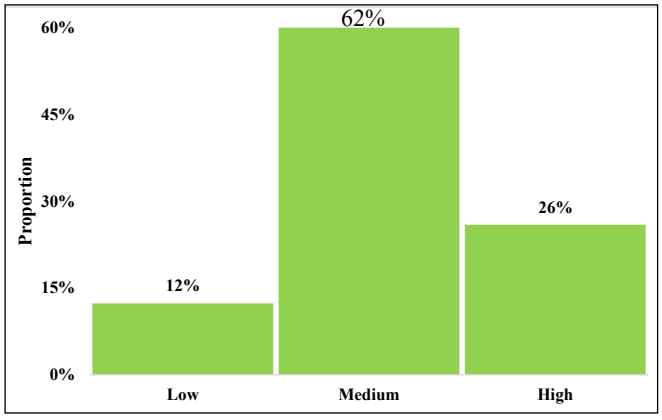

Figure 6B. Grade category, policy type B.
Source: Prepared by the authors.

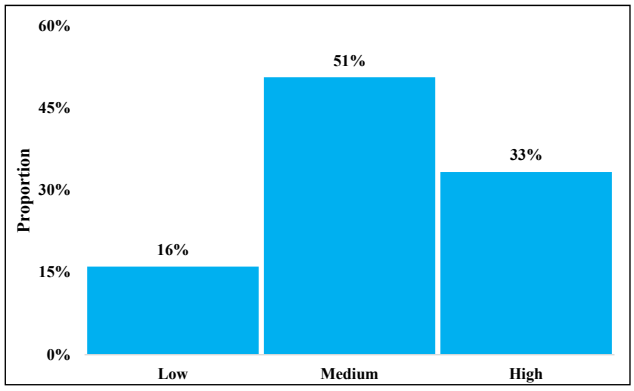

Figure 6C. Grade category, policy type C.
Source: Prepared by the authors.

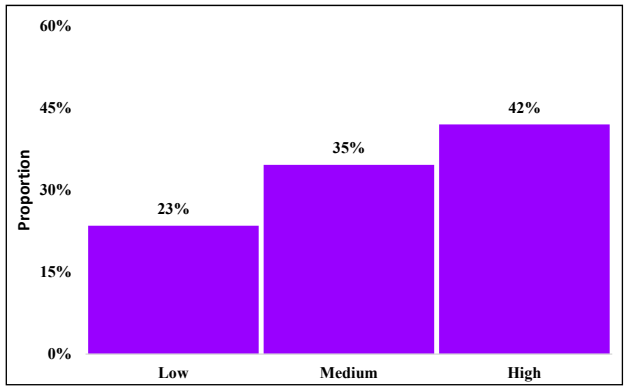

Figure 6D. Grade category, policy type D.
Source: Prepared by the authors.

Overall, the results show that policies A and D were the most attractive to respondents, with 38% and 42% of high scores, respectively. The attractiveness classified as medium to high for policy A (which had the smallest certain loss and the largest uncertain loss) was 7% lower than for policy D (which had only one certain loss, but the highest value between all policies).

These values provide evidence that individuals are more attracted to a policy that has only the certain loss, even if this is significantly greater than the certain loss of another alternative. This may occur due to the certainty effect, as explained by Schoemaker and Kunreuther (1979), in which individuals must be more attracted by results considered as certain, against only probable scenarios.

Respondents rated policy D, which had only the right loss, more times as 'high' and less often as 'low' than the second most attractive policy, policy A. Even for policy A, which had lower premium rates, the uncertainty of the occurrence of an additional loss (deductible payment when triggering the insurance) raised risk aversion to the point that this option was the least attractive. Thus, it can be concluded that people showed greater aversion to risk when they needed to make choices between two prospects that will incur a loss, in which one has some degree of uncertainty as to the final value of the loss and the other offers the certain loss value that will occur. This is called the certainty effect. As Ruß and Schelling (2018), note, it can lead to an overestimation of losses and the acquisition of more expensive coverage.

Question 3.2 — Small certain loss and large uncertain loss

In this formulation of the question, the same choices were shown to the respondents, but reducing them to policies A and D only. The choice of deductible was also eliminated. The original question used by Schoemaker and Kunreuther (1979) was designed to purposely generate 'high interest' in most of the answers related to policies A and D. As seen in the results of the previous section, there was a greater preference of respondents for policies A and D, to the detriment of policies B and C, which in turn obtained 'medium interest' ratings in most responses. However, the results change when only two policies are offered, as shown in Figure 7.

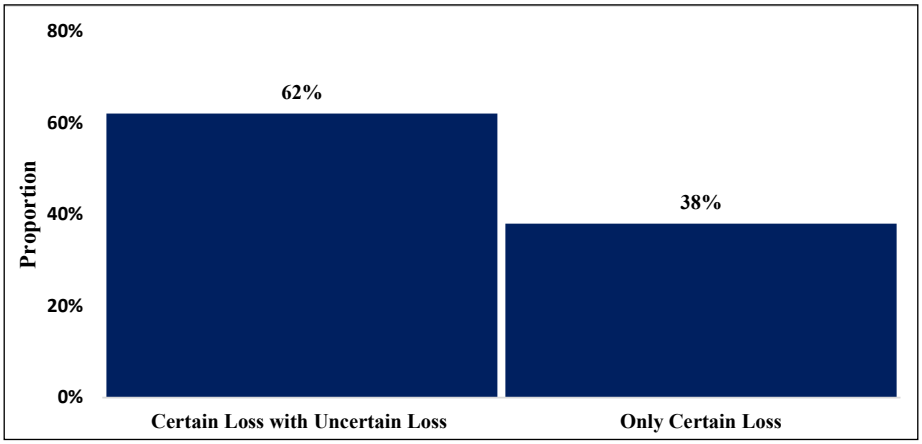

Figure 7. Proportion of preferences for a certain loss or a chance of uncertain loss.
Source: Prepared by the authors.

Interest in the higher risk policy, referring to policy A in the previous question (certain small value loss, but uncertain loss of very high value), was 24% higher than in policy D, with lower risk (only one certain loss, with a value higher than the certain loss of the other alternative). These results may suggest that uncertain loss aversion was not verified, contradicting previously obtained results for very similar questions. But the possibility that agents' risk aversion was influenced by the scenarios presented cannot be excluded either. Likewise, the architecture of choices may have played some role in the alternatives chosen by respondents.

The results presented here are consistent with the original research findings. Preferences about the options were inverted due to the change in the framing of the questions. These findings corroborate the evidence of the framing effect in the intention to purchase an auto insurance policy. For this reason, hypothesis *H2*.

According to Schoemaker and Kunreuther (1979), once the context of choosing insurance is removed, the importance of the deductible effect is reduced. On the other hand, evidence that this effect is important in the insurance market exists since it can affect decision-making in different ways, by choosing both the coverage value and the magnitude of the deductible. This important result provides evidence that sub-optimal decisions can be taken by claimants.

Question 4 — Certainty effect and deductible effect

In order to try to mitigate the effects of moral hazard by policyholders, insurers use mechanisms to share the loss with the insured, the most common example being the insurance deductible. However, individuals tend to avoid deductible policies, even if they prove to be considerably more advantageous. For example, this empirical result, which contradicts the theoretical prediction of Mossin (1968), is reported by Collier, Schwartz, Kunreuther and Michel-Kerjan (2017). This rejection occurs because the deductible is interpreted as a possibility of additional financial loss, in addition to the payment of the insurance premium. This behavior is called deductible effect, not allowing us to reject *H3*.

Insurers may choose to present the deductible in other ways in order to avoid customer rejection. Two of these ways are increasing the value of fees charged on pure premiums or using a reimbursement mechanism if the insurance is not activated during a certain period. Insurance policies with the reimbursement mechanism are more attractive than deductible insurances, as they do not cause the deductible effect. More respondents (45%) preferred insurance with a deductible compared to those (39%) who preferred insurance with future reimbursement.

This difference is probably because reimbursement insurance presents a considerably higher initial premium than deductible insurance. The higher premium makes for a greater feeling of immediate loss on the refund option. There may be greater aversion at the time of choice. It should be noted that in the two frameworks of Question 4, in order to be eligible to receive reimbursement or to pay the deductible, there is a condition linked to the occurrence or not of the claim. Therefore, financial gain or loss is an uncertain event. Only the payment of the prize is a certain event. Figures 8A and 8B show that there was a more expressive preference for the policy with the smallest certain loss — that is, with the lowest premium, which generates the least sense of loss.

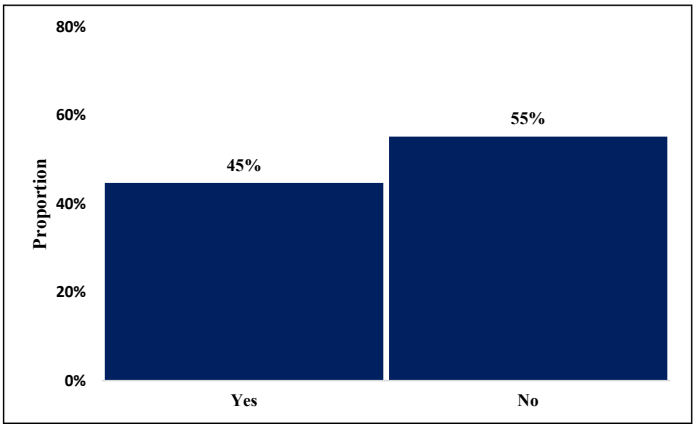

Figure 8A. Proportion of individuals who would agree to take out the insurance policies offered. Insurance with a R$ 1,800 premium and R$ 1,000 deductible for a car worth R$ 20,000.
Source: Prepared by the authors.

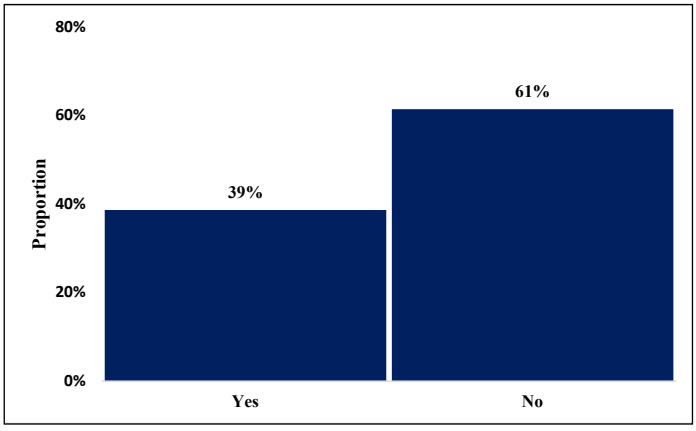

Figure 8B. Proportion of individuals who would agree to take out the insurance policies offered. Insurance with a R$ 2,800 premium and a possible R$ 1,000 reimbursement for a car worth R$ 20,000.
Source: Prepared by the authors.

This result can be interpreted as evidence of the certainty effect. For a policy with reimbursement to be more attractive, reimbursement must be received to offset the higher premium, an event that may not occur. This can increase risk aversion and lead to choosing the lowest risk choice, which is the policy with the lowest certain loss.

Are individual characteristics important for purchasing insurance?

Knowing how individual characteristics influence the decision to purchase insurance is important. Thus, customized and more efficient nudges can be designed. With this in mind, a limited dependent variable (probit) model was estimated. The characteristics that may have influenced the acquisition of insurance by the research subjects were used as the dependent variables.

The binary dependent variable was constructed by combining the information from Question 13 (owning a car) and Question 14 (having or not having insurance) of the questionnaires. Note that these questions refer to the actual past decision on insurance, rather than the hypothetical decision to purchase insurance under certain conditions. Given that a positive answer to the second of these questions depends on the answer to the first, it was considered that those who have insurance stated that they own or have owned a car and that they are or had been insured. Conversely, it is considered that only individuals who, owning a vehicle, have not acquired this protection are not insured.

As dependent variables, a continuous variable (Arrow-Pratt coefficient) and four categorical variables were used, all divided into three ranges. The first is marital status, which assumes a value of one for single individuals and zero for married and divorced people. The second is age, divided into three groups: up to 25 years old, 26 to 40 years old, and 41+. The third is schooling. The first range includes individuals who have, at most, incomplete higher education. The second range covers people with a college degree. The last individuals have graduate degrees. Finally, the first income bracket includes people who earn up to three minimum wages (MW). The second includes respondents who have income from three to ten MW. In the third group are people with income above ten MW. For these last three categorical variables, the reference dummies are those in the highest ranges. Table 1 presents the results of the model, run on the Stata 17.0 software.

The estimated coefficients for the Arrow-Pratt coefficient, marital status, income, and age range were not significant. The two coefficients referring to schooling were significant at 1%, with relative signs and magnitudes within expectations.

Table 1. Probit model: acquisition of insurance.

Dependent variable: purchase of insurance	
Arrow-Pratt coefficient	-0.0655
	0.076
Marital status	-0.0473
	(0.467)
Age range 1	0.0334
	(0.674)
Age range 2	0.3105
	(0.460)
Schooling range 1	-1.6585***
	(0.519)
Schooling range 2	-1.1999***
	(0.454)
Wage range 1	0.0956
	(0.548)
Wage range 2	-0.0085
	(0.460)
Constant	1.9749***
	(0.611)
Pseudo R^2	0.1929
N	103

Note. Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Prepared by the authors.

That is, lower education reduces the probability of having car insurance. The results can be visualized in another way, using the margins command, which allows the effects of the variables to be isolated, calculated in the mean values presented in Table 2. For example, it is about 1.5 times more likely that a person from the third schooling range has insurance, compared to a person from the first income range (0.9805/0.6573). Tests of means between the dummies of categorical variables, carried out two by two, show that there is no statistically significant difference between the marginal effects for income and age at 1% significance.

For the schooling variable, there is a difference between the first and second grades and between the first and third ranges, but not between the first and second. Taken together, these results provide evidence that, for this particular sample, the only significant variable for the ownership of auto insurance is the individuals' income. However, it should be noted that the sample is relatively small, which always requires caution when interpreting the results. These results provide some elements to conjecture that any nudges aimed at increasing the purchase of insurance should be different by income bracket, but not for the other variables.

Table 2. Marginal effects.

	Margin	Standard error	z	p>z
Schooling				
Range 1	0.6573	0.1237	5.3100	0.0000
Range 2	0.8061	0.0686	11.7600	0.0000
Range 3	0.9805	0.0188	52.2400	0.0000
Income				
Range 1	0.9214	0.0489	18.8600	0.0000
Range 2	0.9050	0.0400	22.6400	0.0000
Range 3	0.9064	0.0788	11.5100	0.0000
Age				
Range 1	0.8755	0.1025	8.5400	0.0000
Range 2	0.9236	0.0380	24.3200	0.0000
Range 3	0.8685	0.0795	10.9300	0.0000

Note. Source: Prepared by the authors.

FINAL CONSIDERATIONS

This study conducted an experiment to analyze how framing, anchoring, and certainty effects can influence the behavior of automobile insurance consumers, in a way that is supposed to be original in the Brazilian literature. The theoretical framework originates from behavioral economics. This area of knowledge, originated from the renowned works of Kahneman and Tversky, provides theoretical subsidies and sophisticated tools to understand consumer behavior. This is especially true in cases of decision under risk conditions in which the consumers' choices may actually violate rationality assumptions.

Purchasing insurance is a risky decision. Methodologies based on the fundamentals of behavioral economics are a promising field of research, as shown in the review by Jaspersen (2016). Complementarily, Richter et al. (2019) note that the purchase of insurance is the result of a complex decision-making process, in which behavioral factors play an important role. The understanding of how consumers decide to purchase their policies are of great interest to the insurance market.

Initially, the Arrow-Pratt risk aversion coefficient was calculated. The results show that biases and heuristics can affect the judgment of insurance buyers. Evidences were found that allow us not to refute the three working hypotheses, and which, in general, corroborate previous studies carried out in other countries: framing effect — Brown, Kling, Mullainathan and Wrobel (2008) and Johnson et al. (1993); certainty effect – Kahneman and Tversky (1979); anchoring effect – Jetter and Walker (2017); greater risk aversion for women – Cohen and Einav (2007); and influence of schooling – Coe et al. (2016). In particular, it was also possible to verify that the context (in this case, the association of certain locations with risk events) was relevant to explain the decisions to purchase insurance.

An important result was obtained from the answers to Question 3.1, in which the deductible payment seems to have influenced the respondents' risk aversion. This evidence seems to fill a gap in the literature pointed out by Mol, Botzen and Blasch (2020). The findings on deductibles are somewhat different from those verified by Kunreuther and Pauly (2020), who did not find evidence of preference for lower deductibles when observing health insurance.

Unconscious or not, these biases and heuristics are responsible for insurance acquisition in a non-optimal way, incompatible with the risk elements (associated probability and severity). According to Johnson et al. (1993), the existence of such biases can cause insurance markets not to function efficiently, or reduce the demand for insurance, reducing welfare (Kremer, Rao, & Schilbach, 2019). In particular, the results for the deductible effect give rise to the argument that an adequate choice architecture can increase market efficiency, reducing the possibility of sub-optimal choices by consumers. Chandra, Handel and Schwartzstein (2019) present several situations with evidence that policyholders respond to nudges. A possible example, based on the arguments of Robinson, Botzen, Kunreuther and Chaudhry (2021), would be defaults on deductible choices.

Complementarily, the results of the econometric procedure, albeit very cautiously, shed some light on which consumer characteristics could be used to eventually stimulate the demand for insurance. For example, there is evidence of differences by schooling, but not by income level.

Understanding the mechanisms that influence consumer decisions for certain products is essential for market solutions to be able to generate more efficient resource allocation, as well as more efficient risk management strategies. There are direct impacts on the various agents involved. This is particularly true on the insurance supply side, as companies can offer more suitable products and turn this knowledge into a competitive advantage. As Jaspersen and Aseervatham (2017) note, a more adequate understanding of the demand patterns for insurance can make providers — insurance companies — improve their results via a more precise targeting of their expenses. These firms could also exploit consumer biases when selling insurance.

For regulators, this knowledge is also important to try to protect the consumer and make the insurance market work more adequately (Richter, Ruß, & Schelling, 2019). This can be done either via the mandatory provision of relevant information for decision-making or an eventual standardization of the way this information is made available. The reasons are the results found for the framing effect (in which the form of presentation of policies had an impact on consumer decisions) and for the deductible effect. There is thus room to improve the design of policies and insurance contracts.

Welfare gains may occur if regulators base their actions on some elements of behavioral economics (Baker & Siegelman, 2013). As Dudley and Xie (2020) precisely point out, an architecture of regulatory choices must be developed to both induce choices that maximize individual welfare and serve public interests. It is a complex and imperative task, as even regulators are not free from bias. Caution must be taken, particularly at a time when the Brazilian insurance market is undergoing a deregulation process and the entry of new actors. Benartzi et al. (2017) list several conditions for public actions linked to the architecture of choices to be successful.

Finally, it is important that claimants can correctly understand the risk elements involved in an insurance contract. There is evidence of the positive role that financial education can play in this case (Xiao & Porto, 2019).

Understanding consumer behavior and demand determinants is even more necessary in the insurance field. The individual's perception of the risks to which they are exposed depends on a series of internal and external factors, as shown by the results. Therefore, it is up to the insurance market to seek a better understanding of the behaviors that contribute to attitudes of risk aversion or propensity, resulting from cognitive biases present in individuals (Kunreuther, Pauly, & McMorrow, 2013). This is an aspect also pointed out by Sydnor (2010), when analyzing real data on homeowners insurance in the USA. However, the author also notes that any changes on the demand side could lead to changes on the supply side, with the creation of mechanisms that allow separating customers by risk profile.

Thus, the market design and product offer must be able to incorporate these behaviors and, thus, be able to mitigate and transfer risks more efficiently. The elaboration of nudges is a possible field of action for regulators to address in future research projects, as these help improve the efficiency of the markets. There are successful experiences in socially responsible retirement investments (Hoffmann, Cam, & Camilleri, 2019) and educational finance policies (Marx & Turner, 2019), that the insurance area can learn from.

This study has some limitations. The small sample size forced the aggregation of some variables into categories and reduced the robustness of some statistical analyses. Most of the questions refer to hypothetical choices, which may not always correspond to the actual choices made by consumers. Due to the time available to the research subjects, the number of questions had to be reduced, which prevented other characteristics from being explored. Finally, only one type of insurance was discussed, which reduces the eventual generalization of the results, given that the profile of applicants for other types of insurance may be different. Further studies may come to employ real databases of insurers, with an increase in the database, either in the number of individuals or in the period analyzed. Further applying the methods in this article to other types of insurance also remains open. Finally, as behavioral aspects of demand impact companies, it can be very interesting to study how this affects the supply side, that is, insurance companies.

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