2177-2576 versão online

Flood Insurance: Propensity and Attitude of Informed People with Disabilities toward Risk

Autoria

Wesley Mendes-da-Silva - mr.mendesdasilva@gmail.com
Mestr e Dout em Admin de Empresas - Fundação Getulio Vargas - Escola de Administração de Empresas de São Paulo
Outro - Outra

Edimilson Costa Lucas - costalucas@yahoo.com

João Vinícius de França Carvalho - jvfcarvalho@usp.br
Outro (Ciências Atuariais) - Universidade de São Paulo
Outro - Outra

Agradecimentos

The first author wishes to thank São Paulo School of Business Administration (FGV/EAESP), University of Texas, Federal University of São Paulo – EPPEN, ADEVA-Association of the Visually Disabled and Friends (in Vila Mariana), and the Father Chico Institute of the Blind and the Father Chico Vicentino High School (in Ipiranga). We would like to thank the participants in the IC2 Institute Survey Seminar. Also we thank the citizens who kindly answered the survey conducted in this study.
Financing: São Paulo Research Foundation-FAPESP (Grants #14/26003-9 and #17/09306-6), National Council for Scientific and Technological Development-CNPq (Grants #309227/2019-4, #47089420148, and #40920520168).

Resumo

The literature documents that individual behavior and climatic change have recently been given more and more space in the definition of company strategies. However, in terms of preparing for catastrophes, few inquiries have been made into the individual propensity to acquire insurance, especially in terms of People with Disabilities (PwD). In this study, we assess the effect of information on the propensity of heads of households to acquire home insurance against forms of natural disasters, particularly flooding. We conduct a survey of over 500 individuals, including blind individuals, to verify the intuition that there is a causal link between the existence of information and the willingness of individuals to acquire flood insurance. The results reveal that visually deficient individuals are approximately 300% more likely to buy this insurance than other individuals. However, when PwD have information regarding the potential risk and harm caused by floods, this marginal effect is attenuated.

Flood Insurance: Propensity and Attitude of Informed People with Disabilities toward Risk

The literature documents that individual behavior and climatic change have recently been given more and more space in the definition of company strategies. However, in terms of preparing for catastrophes, few inquiries have been made into the individual propensity to acquire insurance, especially in terms of People with Disabilities (PwD). In this study, we assess the effect of information on the propensity of heads of households to acquire home insurance against forms of natural disasters, particularly flooding. We conduct a survey of over 500 individuals, including blind individuals, to verify the intuition that there is a causal link between the existence of information and the willingness of individuals to acquire flood insurance. The results reveal that visually deficient individuals are approximately 300% more likely to buy this insurance than other individuals. However, when PwD have information regarding the potential risk and harm caused by floods, this marginal effect is attenuated.

Keywords: People with Disabilities, Climate Change, Insurance, Flooding, Attitude toward Risk.

1. INTRODUCTION

The insurance industry can grow and develop by knowing more about the preferences of individual consumers of financial services dedicated to protecting their well-being (Kunreuther et al., 2013, Petrolia et al., 2013). In parallel to this, beginning even before the 2020 Coronavirus pandemic, insurance companies which act as risk managers and investors have been gradually taking into account environmental, social and governance (ESG) aspects in formulating their corporate strategies (Sherwood & Pollard, 2018), especially due to the impact of climate change on community resilience (Kousky & Michel-Kerjan, 2015, Kousky & Shabman, 2015, PSI, 2019). On the other hand, individual consumers usually make their decisions under ambiguous conditions in terms of the risks involved (Etner et al., 2012). These issues, taken together, are even more important when dealing with vulnerable populations, such as people with disabilities (PwD), and/or those who live in countries with a lack of infrastructure (Hans & Mohanty, 2006, Rooney & White, 2007, Turk & McDermott, 2019).

Over the past four decades, more than 9,000 natural disasters have caused more than two million deaths and economic damage of roughly 2.5 trillion dollars throughout the world (World Meteorological Organization, 2014). Floods and storms have been responsible for almost 80% of the total number of disasters, which have caused 55% of these deaths and 86% of these economic losses, most of which have not been covered by insurance. In this study, we are interested in assessing the effect of information on the propensity of heads of households to acquire home insurance against natural disasters, specifically floods (Anderson, 1974, Rettger & Boisvert, 1979, Browne & Hoyt, 2000, Burby, 2001, Michel-Kerjan & Kousky, 2009, Michel-Kerjan & Kunreuther, 2011, Richler, 2019, Bradt, 2019, Tesselaar et al., 2020). Our research design is based on a survey of over 500 individuals, including blind people (PwD) in the largest city in Latin America: São Paulo, Brazil.

In this article, we will show in an unprecedented manner, that heads of households who are blind are more likely to purchase insurance compared with non-PwD heads of households. However, once they are provided with relevant information, this reduces the marginal effect of the propensity of PwD heads of households to buy flood insurance. In addition, heads of households who state that they reside in risk zones and have experience with the effects of floods on their lives, are more likely to purchase insurance. This paper makes several contributions to the literature, but two can be highlighted. First, the results provide evidence of individual preferences in relation to flood insurance, which is particularly relevant to the work of insurers as well as risk managers, increasing the potential to insure the well-being of the

population in relation to conditions caused by climate change. Second, we provide evidence pertaining to the promotion of financial literacy in terms of insurance services, which stimulates the protection of family assets. We used an intervention with half of the individuals, establishing a treatment designed to verify the impact of information on the propensity to acquire insurance. We also verified the effect of a group of attitudinal factors in relation to risk regarding the propensity to acquire flood insurance.

The current literature has documented various studies about the propensity of individuals to acquire flood insurance (Jaspersen, 2016). However, this study differs from the others in at least three aspects. First, we studied the effect of information on the propensity to acquire flood insurance, and did this in the middle of a design which included an intervention with randomly selected individuals to diminish problems related to selection bias, and other sources of the empirical challenge of endogeneity (Angrist & Pischke, 2009). Second, we included blind individuals, people who are vulnerable due to a physical deficiency, in line with Thill's suggestion (2015), in constructing public policies and/or guiding new financial products. Third, we provide evidence in terms of individual behavior in consuming financial products which are still not often encountered in the market, a central aspect to preventing crises (Keys et al., 2020). In addition, we provide evidence from an emerging economy, emphasizing that a large portion of the world population lives in developing countries, in which the proportion of people in vulnerable conditions, such as PwD, is relatively accentuated.

2. BACKGROUND

2.1 Attitudes in relation to risk and the propensity to acquire flood insurance

The international business media has reported images and stories of devastation due to forest fires in locations which are more prone to these events, such as Australia, the West Coast of the United States, and Portugal. In recent years, the effects that climate change is having on the planet have become evident (Wells, 2019). In this sense, it has become explicit that these situations of devastation will continue to grow with no major corrections in sight. While warnings about the effects of climate change have been issued for decades, recent years have witnessed a growing pressure on companies, investors and even governments to approve and adopt effective climate policies (Rosenbaum, 2005). Within the context of the business community, climate change and the behavior of individuals have become determinant factors in companies' long-term perspectives. After recent disasters related to the climate and resulting events, such as the bankruptcy of large companies as Pacific Gas & Electric in the United States, companies are currently being submitted to growing pressure to increase their efforts to manage operational risks and potential liabilities caused by climate change (Lucas & Mendes-Da-Silva, 2018).

However, although climate change causes problems, it also can create opportunities for companies such as insurers (Minoli & Bell, 2003). In the same manner, this affects not only businesses, but individuals and families (Lo, 2013). Furthermore, climate change is not only reflected by wildfires, but a group of other events, including floods (Lucas & Mendes-Da-Silva, 2018). Considering these factors together, and given that the insurance industry can better exploit its potential with better knowledge of the preferences and needs of consumers, and given the lack of studies in the literature in this regard, investigating aspects that affect the consumption of flood insurance appears to be something of relevance. Countless studies in cognitive psychology and behavioral science examine how individuals interact with information related to risk which has low probability but high severity (Kunreuther et al., 2001, Botzen & van den Bergh, 2012). In general, the literature finds that in making decisions associated with risk, individuals tend to neglect low probability risks (Slovic et al., 1977; Lichtenstein et al., 1978). Individuals may also tend to act this way due to various factors, such as their attitude towards risk and the results of previous experience (Johnson et al., 1993; Thaler et al., 1997; Kunreuther et al., 2001; Tom et al., 2007; Browne et al., 2015).

In parallel, the literature documents the lack of preparation in the available infrastructure, something common in emerging economies in relation to natural disasters and climate change, which is an important aspect in ensuring the resilience of communities within these countries (Chou et al., 2004, United Nations Development Program, 2007, Kunreuther & Useem, 2010, United Nations, 2019). In addition, certain vulnerable populations represent important segments that need to be better understood in order to offer products that can ensure their quality of life given the conditions of the infrastructure that is available to react to climate change. A large portion of the world population, roughly 6 billion people (more than 80% of the world population) live in emerging countries, in which the portion of people living in vulnerable conditions, such as PwD, is relatively accentuated (WHO, 2011). In addition to all of this, consumer decisions regarding insurance inevitably require information about the risks and costs involved, something that is frequently presented as a critical aspect in less economically developed countries.

Considering emerging economies and climate change, we should note that rains in Brazil according to The International Disaster Database <www.emdat.be>, have caused disasters which have affected more than 35 million people, leading to 2,158 people dying and economic losses of almost US$ 9,627,500,000. In the largest Brazilian city São Paulo, according to the National Institute of Meteorology (INMET), there have been 5 days of extreme rains annually (> 50 mm per day) during the past decade. These rains can cause floods, directly affecting vulnerable families in the region who are exposed to risk (Marengo et al, 2020). The situation in São Paulo is aggravated due to losses caused by a lack of urban planning in terms of the appropriate use of the land, the disorganized occupation of suburbs, and the impermeability of the riverbanks of the city's two main rivers, the Tietê and the Pinheiros. As a consequence, there is a decrease in the drainage of river waters when there are extreme rains, which historically have occurred in the regions characterized by heightened social and economic vulnerability.

2.2 The role of information in insurance acquisition decisions

Etner et al. (2012) review advances documented by the literature in terms of the theoretical fundamentals of making decisions in ignorance, emphasizing the need for new studies supported by decision-making experiments in the field, as we conduct in this article. In respect to this, Hogarth and Kunreuther (1995) rely on a cost-benefit analysis to guide decisions regarding acquiring insurance. These arguments led Thaler and Tucker (2013) to propose the customization of information available to consumers, as a way to support decision making with information that permits a judgment that effectively reflects economic aspects, such as the substitution cost of assets and the chances of such an event occurring. In the particular case of the risk of floods, according to Bradt (2019), experiments confirm that while many individuals neglect the low probability risks of flooding and do not acquire insurance, others reveal a willingness to pay a premium for flood insurance which exceeds expected losses. This observed behavior violates common theories of decision making which are based on the economic rationality of agents at risk, and assume that individuals make decisions – such as the premiums they are willing to pay for insurance – to maximize their utility or expected return (Botzen & van den Bergh, 2012). The literature about decision making in regard to purchasing insurance is prolific and typically involves an understanding of the psychological aspects related to risk (Jaspersen, 2016). To accomplish this, surveys or experiments are frequently used to obtain evidence of risk aversion, subjective beliefs about the possibilities and probabilities of losses, as well as individual intertemporal preferences (Harrison & Ng, 2019).

Flood insurance is an object of special attention, because it is a type of catastrophic risk. But floods, due to climate change, are becoming more and more frequent. In addition, this is an insurance category which may be strongly motivated by a combination of perceptions of risk based on previous individual events and experiences (Botzen & van den Bergh, 2012). This is

why field studies have been made more frequently in countries which are very exposed to events of this nature, predominantly in more economically developed countries such as the Netherlands (Botzen et al., 2013), with it being less common to find this kind of evidence in emerging countries such as Mali (Elabed & Carter, 2015), Vietnam (Brouwer et al., 2014), and Pakistan (Turner et al., 2014).

These studies have found predominant evidence that people who are more exposed to risk do not act in accordance with the classic economic approach of the Expected Utility Theory, according to which with greater knowledge of risk, people increase their propensity to acquire insurance, paying premiums that are even higher than the expected risk. Flood insurance coverage is low even in economically developed countries (such as the US and the Netherlands). In this way, cases of great expanses of territory without the necessary coverage can lead to elevated costs to society and the need for possible governmental aid after disasters (Michel-Kerjan et al., 2012; Wing et al., 2020). However, the experience of public subsidies resulting in lower premiums than would be actuarially just, may generate adverse selection (Botzen & van den Bergh, 2012). A possible solution would be the government acting as a re-insurer (Jongejan & Barrieu, 2008, Grigg, 2020), because the existence of governmental flood assistance programs could act as a substitute for a private security product, inhibiting the demand for it (Turner et al., 2014).

2.3 PwD and the propensity to acquire insurance

People with deficiencies (PwD) traditionally are viewed as deficient individuals, such as: children born with cerebral palsy, wheelchair users, blind or deaf people, people with intellectual deficiencies or mental health conditions. In addition to these profiles, included in PwD are individuals who have limitations in their capacities due to a wide range of conditions, such as: non-transmissible diseases, infectious diseases, neurological disturbances, and lesions and conditions resulting from aging processes (WHO, 2015, p. 2). In this study we are particularly interested in the behavior of blind individuals when faced with flood risk.

According to a study that considered dozens of countries, conducted by Flaxman et al. (2017), the number of people affected by common causes of losses of vision have increased substantially, especially due to the phenomenon of age transition, which has led to our increasingly more aged population. The inevitable loss of vision due to cataracts (reversible with surgery) and refraction errors (reversible with corrective lenses) continue to cause most cases of blindness and moderate or severe loss of vision in adults over 50. Currently it is estimated that blindness affects 39 million people throughout the world, with 246 million suffering from moderate or severe vision loss. According to the World Health Organization (WHO), and the Brazilian Board of Ophthalmology (CBO), of the total Brazilian population, 23.9% (approximately 45.6 million people) declare that they have some type of deficiency. Among those with declared deficiencies, the most common is visual, which afflicts 3.5% of the population. In second are motor problems (2.3%), followed by intellectual (1.4%) and auditory (1.1%). According to the WHO, the main causes of blindness in Brazil are cataracts, glaucoma, diabetic retinopathy, child blindness and macular degeneration.

There have been growing demands for the social inclusion and protection of PwD, and wealthy countries are not fully prepared to protect those in catastrophic situations (Fox et al., 2007; Hartnett et al., 2008). In this sense, Australia is a pioneer in designing a special program to support those individuals who are classified as invalids (Collings et al., 2016, 2019). Under the National Disability Insurance Scheme, which is entirely costed by this country's national treasury, all people less than 65 who are incapacitated permanently and significantly are eligible for total financing to support all of their needs related to their incapacity (Thill, 2015). The literature has documented various concerns with social protection for PwD, such as health insurance (Wagner, 2015), retirement schemes (Goda et al., 2019), and even the job market (Hill et al., 2016), but there is an important gap in the literature in terms of this vulnerable

public's demands for insurance. Rooney & White (2007) document various recommendations that individuals and the community should adopt to protect PwD against natural disasters. Among the decisions that can be made individually is the acquisition of home insurance, given that the recovery period for material assets is extensive as well as costly. In addition, informing blind people is not something trivial (Dursin, 2012).

3. METHOD

3.1 Treatment and subjects

We conduct a survey which has made it possible to collect 532 questionnaires (questions listed in Table 1) which were considered valid during the month of August (usually the month with the least precipitation) 2018 in the city of São Paulo, Brazil. The subjects were adult volunteers, approached randomly in public areas of circulation, who said that they were heads of households. Among the subjects, we also considered PwD. However, to access these individuals (20.3%) we looked for them in two public institutions dedicated to the social integration of blind people located in the city of São Paulo.

Due to our interest in the role of information in the propensity of individuals to acquire flood insurance, our research design included an intervention (Angrist & Pischke, 2009; Kendall, 2003): a treatment group, made up of individuals with some relevant information in terms of making this decision. To accomplish this, we used pictographic resources (Barić et al., 2020) to exhibit informational content to a portion of the subjects, independent of whether they were PwD or not (Table 2). In order to make the exhibited content more intelligible, we hired a radio and TV professional to professionally narrate the text presented to the respondents. Thus, for a portion of the non-PwD individuals, we exhibited a 30 second film, and for the blind individuals we played an audio recording with the same informational content, as follows:

> Life is full of risks. And in respect to them, two things are very important to know: the first is the chance of something bad occurring. And the second is the impact that this will have on our lives. The more serious risks are those which are more probable and have a greater impact, such as floods, which have caused more and more economic losses, as well as deaths throughout the world. Between 1970 and 2012: 8,835 natural disasters in the world caused almost two million deaths; floods and storms were responsible for 79% of all disasters, leading to 55% of the deaths and 86% of the economic losses; and worldwide losses totaled US$ 2.3 trillion.

We included in this content information relative to the risk of floods, such as their frequency and the impacts caused by them according to data from the World Meteorological Organization (2014). For a portion of the non-PwD individuals who watched the video, in addition to the images and sound, there were subtitles for what was being said. The main intention of this audiovisual content was to inform the individual of potential risks and losses related to risk factors pointed out by the Global Risk Report (2018), in which extreme climatic events appear simultaneously with high probability and impact. The questionnaires were applied in locations which made it possible to exhibit the content without diminishing the understanding of the video and/or audio. Thus, in the particular case of blind individuals, a silent location was adopted at the two institutional centers that support blind people.

For both publics, the exhibition was repeated when requested by a subject. Thus, 51.50% of the people interviewed had access to the information (a video for the non-PwD and an audio for the PwD) regarding the risk of natural catastrophes and their consequences, before responding to the questionnaire. As illustrated in Table 2, in the aggregate group of the respondents, the proportion of male individuals was 58.46%, with an average age of 42.41 years old (between 18 and 80 years of age). The group of respondents was a reasonable reflection of the composition of the Brazilian population, given that 89.29% of those interviewed belong to the lower class (Class C), 10.38% to the upper and middle classes (Classes A and B), and just

0.38% in the extreme lower class (Class D). In terms of formal instruction, 22.93% just had elementary education (complete or incomplete), 71.43% had secondary education and just 5.64% were studying in higher education institutions (or have university degrees).

Table 1. Questions Related to Experience and Attitude in Relation to Flood Risk

	Statement	Related literature
Q01	Do you believe the region where you live has flood risk?	Czajkowski et al. (2013)
Q02	Have you already had some flooding on the street where you live?	Kunreuther et al. (2013)
Q03	Have you had material losses due to flooding?	Kunreuther and Michel-Kerjan (2009)
Q04	Have you lost people you know due to floods?	Czajkowski et al. (2013)
Q05	Would you buy some type of flood insurance for your home?	Bradt (2019)
Q06	Have you created or are you creating some type of barriers to prevent flooding in your home?	Kousky (2012)
Q07	I believe that there is never strong flooding where I live	Kunreuther et al. (2013)
Q08	There is no flood risk where I live	Czajkowski et al. (2013)
Q09	I will never be affected by a strong flood where I live	Kunreuther et al. (2013)
Q10	I make preventive barriers to reduce the risk of flooding in my home	Kunreuther and Michel-Kerjan (2009)
Q11	I have the financial conditions to make some type of barrier to prevent flooding each year	Kousky (2012)
Q12	When it rains very heavily, I stay on alert to leave my home if necessary	Kunreuther and Michel-Kerjan (2009)
Q13	My neighbors and I are prepared to leave our homes in case there is a flooding emergency	Burningham et al. (2008)
Q14	I have complete consciousness of the danger posed to my home by strong rains	Czajkowski et al. (2013)
Q15	The number of new buildings in the region has increased substantially	Jha et al. (2011)
Q16	I believe in the opinions of specialists about the chances of heavy rains	Czajkowski et al. (2013)
Q17	Flood insurance is extremely important for my home	Shanteau (1992)
Q18	If insurance against flooding exists, I intend to buy flood insurance for my home	Shanteau (1992)
Q19	I have the financial conditions to buy flood insurance	Kunreuther and Michel-Kerjan (2007)
Q20	I hope for help from the federal government in case of a natural disaster where I live	Kunreuther and Michel-Kerjan (2007)
Q21	I do not see a financial return in buying flood insurance	Shanteau (1992)
Q22	I am interested in purchasing flood insurance for a period of over two years	Kunreuther and Michel-Kerjan (2009)
Q23	I constantly see campaigns in the region where I live warning of the danger of flooding	Michel-Kerjan and Kousky (2009)
Q24	Government educational campaigns about preventing the risk of flooding are important	Michel-Kerjan and Kousky (2009)
Q25	Where I live an alarm is sounded when there is a risk of flooding	Michel-Kerjan and Kousky (2009)
Q26	I see public investment in barriers to prevent flooding in the region where I live	Kunreuther and Michel-Kerjan (2007)

3.2 Empirical models

To study the influence of information on the propensity to buy flood insurance, we used two classes of models. First, we used logit models, with a dummy dependent variable (Q5) listed in Table 1 ("Would you buy some type of flood insurance for your home?"): Buying the insurance = 1, Not Buying = 0. To accomplish this, the responses for the questions which use a Likert scale from 1 to 10 (totally disagree to totally agree) were transformed into a binary scale where 0 was attributed for values between 1 and 5 (tendency to disagree) and 1 for values between 6 and 10 (tendency to agree). Based on this procedure, we used logit regressions according to Equation 1 to identify the determinants of the propensity of individuals to acquire insurance

through their individual profiles, attitudes toward risk, having information or not, and whether or not they have or do not have a visual disability.

$$\widehat{\Pr(Buy)} = \frac{e^{\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_i\right)}}{1 + e^{\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_i\right)}} \quad (1)$$

Second, given the dependent variable of the monthly premium that the head of household would be willing to pay for home flood insurance (Q40), we conduct additional analyses via a quantile regression (Koenker and Hallock, 2001), given that the price distribution has been revealed to be asymmetric. The main advantage of this class of models, in relation to a standard regression, is the possibility of estimating the effects of independent variables on the quantiles of the y response variable, without losing more degrees of freedom (Koenker and Hallock, 2001). The quantiles, denoted by τ, refer to the position where an observation is, within the ordered series of data. Thus, we can define the τth quantile, $Q(\tau)$, of a random variable y, which has a cumulative distribution probability $F(y)$, as shown in Equation (2):

$$Q(\tau) = \inf\{y : F(y) \geq \tau\} \quad (2)$$

Table 2. Social Profile of the Respondents

		Non Blind people			Blind people		
	Full	N	Informed (N=220)	Uniformed (N=204)	N	Informed (N=54)	Uniformed (N=54)
(Q29) How many years have you lived in the same place?	22.16	22.34	21.60	23.15	21.43	20.56	22.30
(Q30) Gender (Male = 1)	0.58	0.57	0.51	0.64	0.63	0.65	0.61
(Q32) Age (years)	42.41	43.17	43.18	43.17	39.40	40.69	38.11
(Q29) Besides you, how many people live in your	2.72	2.62	2.76	2.46	3.13	3.19	3.07
(Q36) # of children	0.69	0.71	0.75	0.67	0.61	0.59	0.63
(Q38) Type of home (House = 1, Otherwise = 0)	0.86	0.89	0.88	0.89	0.75	0.80	0.70
(Q39) Do you own your home (Yes = 1, No = 0)	0.52	0.50	0.52	0.49	0.61	0.63	0.59
(Q40) What monthly premium would you pay for flood insurance for your home (in R$)?	26.97	286.934	36.31	20.48	20.19	27.69	12.69

Source: Prepared by the authors based on collected data. Note: This table presents descriptive statistics of the 532 voluntary respondents (108 are blind PwD), all are heads of households in the city of São Paulo. Roughly half of each subsample was presented with an informative video (or audio for PwD) about the relative risks of floods.

In Equation 2, inf refers to the lowest value of y that satisfies the given inequality. This approach may be written as a minimization problem for a group of $\hat{\beta}_\tau$ parameters of a quantile regression, given by Equation 3:

$$\hat{\beta}_\tau = argmin_\beta \left(\sum_{i:y_i > \beta x_i} \tau |y_i - \beta x_i| + \sum_{i:y_i < \beta x_i} (1-\tau) |y_i - \beta x_i| \right) \quad (3)$$

4. RESULTS

Table 3 presents the aggregate of the subsamples of PwD and non-PwD individuals, the profile of the respondents (Panel A), and the typical values found in terms of the attitudes of the heads of households (Panel B) in regard to the risk of flooding, in accordance with the variables presented in Table 1. In other words, we present our data considering the aggregate of 532 respondents and for the subsamples of 424 non-PwD individuals and 108 PwD individuals, informed by the treatment, i.e. the informative video (or audio) about the risk of flooding

together with the significance of statistic t. We found that approximately 36%, of the aggregate respondents, stated that they reside in regions with imminent risk of flooding (Q01). We noted that 17% of the respondents stated that they had past experience with flooding where they live (Q02), with 7% saying that they had suffered material losses due to flooding (Q03), and 13% saying that friends or close acquaintances had died in floods (Q04), independent of their condition of being blind or not ($p > 0.1$).

When asked whether they were willing to acquire flood insurance to protect their home against flooding (Q05), 17% of the 532 heads of households stated that they were, with there being no difference observed between the PwD and non-PwD responses ($p > 0.1$). But, in considering the non-PwD subsample, it appears that the treatment positively affected their *a priori* willingness to acquire flood insurance ($p < 0.1$). The questions listed in Panel B of Table 3 represent the attitude of the respondents towards the risk of flooding near their homes. We observe that the proportion of respondents who attributed points between 7 and 10 were more frequent for questions Q24 (Governmental educational campaigns about preventing the risk of flooding are important), Q16 (I believe in the opinions of specialists about the chances of heavy rains), Q08 (There is no flood risk where I live) and Q15 (The number of new buildings in the region has increased substantially).

According to Panel B of Table 2, for seven of the questions regarding the attitude of individuals towards flood risk we did not find differences ($p > 0.1$) between Non-PwD individuals and PwD. That is, the fact of being blind or not does not seem to influence the opinion of the individuals in respect to: whether there are risks where they live (Q08; 5.48; $p > 0.1$); being totally conscious of the danger that heavy rains pose to their homes (Q14; 5.77; $p > 0.1$); perceiving that the number of new buildings in the region has increased substantially (Q15; 5.97; $p > 0.1$); expecting help from the government in some type of natural disaster occurs where they live (Q20; 2.60; $p > 0.1$); not perceiving the financial return of buying insurance (Q21; 5.33; $p > 0.1$); being interested in purchasing flood insurance for more than two years (Q22; 2.34; $p > 0.1$); or constantly seeing campaigns near where they live alerting them about the dangers of flooding (Q23; 3.22; $p > 0.1$). Also in Table 2, when we consider the results of the PwD and Non-PwD subsamples, verifying the influence of the treatment, we can perceive that: among Non-PwD individuals, the portion of individuals who are willing to acquire insurance (Q05) was 20% among individuals who were submitted to the treatment, while this percentage was 15% among individuals who did not receive the treatment ($p < 0.1$). Meanwhile, when considering the subsample of blind individuals, we did not verify a significant effect of the treatment ($p > 0.1$) on the portion of individuals who were willing to acquire flood insurance for their homes.

4.2 Propensity to acquire flood insurance for their homes

We estimated five different logit models to find the best fit for the data, and we discussed the statistical significance as well as the economic importance of the estimated coefficients (Miller & Rodgers, 2008). Table 4 presents the estimated coefficients for five simulation situations, with the dependent dummy variable being the propensity to acquire flood insurance for their homes (Q05). In Model I we considered all of the studied variables (see Table 1). In Model II, besides the studied variables, the treatment interactions (the individual being informed *a priori* about catastrophes) and having a visual disability ($Information_i \times Blind_i$) were added, as well as the interaction between these two variables with the respondent's gender ($Information_i \times Blind_i \times Gender_i$). Models III, IV and V were simulated using a backward stepwise procedure. The first considered all of the studied variables, including the interactions, and in the second we did not consider the interactions. In Model V, using the backward stepwise procedure, we considered all of the proposed variables and interactions with the exception of the $Information_i \times Blind_i \times Gender_i$ interaction. In all of the models, the Hosmer-

Lemeshow (H-L) test did not reject the null hypothesis of the existence of an association between the observed and forecast variables. Therefore, we can assume that models fit the data well. However, in analyzing the model fit measures, we found that Model V presented the most verisimilitude (highest verisimilitude log (-1,338,735), and lower AIC (317.0747), and BIC (364.6234).

Table 3. Descriptive Statistics of the Studied Variables.

Full sample (N = 532)†			Non-PwD (N = 424)‡				PwD (N = 108)			
Variable	Avg.	t	Avg.	t	Informed (N = 220)	Uninformed (N = 204)	Avg.	t	Informed (N = 54)	Uninformed (N = 54)
Panel A: Profile of the respondent										
Q01	0.36	**	0.38	*	0.43	0.33	0.29	*	0.35	0.22
Q02	0.17	***	0.2	*	0.24	0.16	0.03	**	0.06	0
Q03	0.07	***	0.09	*	0.12	0.05	0		0	0
Q04	0.13		0.13		0.14	0.13	0.13		0.15	0.11
Q05	0.17		0.17	*	0.20	0.15	0.18		0.17	0.19
Q06	0.03	**	0.04	*	0.05	0.02	0.01		0	0.02
Panel B: Attitude in regard to risk from flooding										
Q07	5.16	*	5.08		4.95	5.24	5.44		5.37	5.5
Q08	5.48		5.46	*	5.08	5.88	5.56		5.35	5.78
Q09	4.68	***	4.55	*	4.08	5.06	5.17	**	4.81	5.52
Q10	2.2	***	2.32	*	2.46	2.16	1.75		1.85	1.65
Q11	2.37	***	2.16	*	2.27	2.03	3.22		3.31	3.13
Q12	4.04	***	4.33	*	4.9	3.73	2.89		3.11	2.67
Q13	3.39	***	3.54	*	3.88	3.17	2.81		2.94	2.67
Q14	5.77		5.77		5.79	5.76	5.75	*	5.5	6
Q15	5.97		5.91		5.9	5.92	6.21		6.41	6.02
Q16	7.17	***	7.02	*	6.73	7.33	7.77		7.57	7.96
Q17	3.4	**	3.5	*	3.82	3.16	2.98	***	3.43	2.54
Q18	2.93	**	3.01	*	3.16	2.84	2.63	***	3.02	2.24
Q19	2.73	***	2.54	*	2.7	2.37	3.46		3.76	3.17
Q20	2.6		2.58		2.58	2.58	2.68		2.81	2.54
Q21	5.33		5.37	*	5.13	5.62	5.18		5.24	5.11
Q22	2.34		2.33	*	2.58	2.05	2.38	*	2.63	2.13
Q23	3.22		3.21	*	3	3.42	3.28	*	3	3.56
Q24	8.68	***	8.57		8.64	8.5	9.11	**	9.35	8.87
Q25	1.31	***	1.38	*	1.46	1.28	1.04	**	1.07	1
Q26	3.54	***	3.38	*	3.11	3.68	4.15	**	3.72	4.57

Source: Prepared by the authors based on collected data. Note: This table presents average values collected for the variables considered in this study (see Table 1). †Represents the aggregate of 532 respondents, made up of 424 heads of households who do not have visual disabilities (Non-PwD individuals) and 108 heads of households who are blind (PwD). The *t* statistic in the full sample column is related to verifying the average difference between PWD and non-PWD individuals. ‡Represents the average values for the variables in the subsample of Non-PWD individuals, the t statistic represents the difference between individuals whose decisions were informed by the video (or audio) and those who were uninformed about the risk of flooding. ***p<0.01; **p<0.05; *p<0.1.

In addition, we verified that more than 88% of the classifications via Model V were correct according to Table 4. Therefore, we concentrated the discussion on the estimated coefficients in this model. In order to illustrate the predictive capacity of Model V, we noted that the area under the ROC curve was 0.9017, suggesting the important predictive capacity of

Buy, the marginal effect of the studied variables on the probability of the ith head of household being willing to buy some type of home flood insurance. According to the estimates for Model V, maintaining the other fixed variables, the fact that an individual is blind ($Blind_i = 1$) increases the propensity to acquire home flood insurance by approximately 329.74% ($\hat{\beta} \approx 1.458; p < 0.01$). However, the effect of being blind on the propensity to buy insurance depends on the treatment. That is, $Blind_i \times Treatment_i$ tends to soften the marginal positive effect on the propensity of the individual to acquire flood insurance ($\hat{\beta} \approx -1.394; p < 0.05$), and vice versa.

Table 4. Estimated Models of the Propensity to Acquire Flood Insurance (logit).

	I	II	III	IV	V
Treatment	-.0685428	.3711051			
Blind	.8739541	1.980477***	1.401535***	.7628864**	1.458065***
Social	-.0374291	-.2774647			
Treatment×Blind		-1.395644			-1.394037**
Treatment×Blind×Gender		-1.523188	-1.87129***		
Q01	1.357853***	1.394921***	1.506687***	1.575448***	1.571963***
Q02	.8258718**	1.026495***	.9097013***	.7862808**	.9671923***
Q03	.987163***	.9293299*	1.054623**	.9208089*	
Q04	.9131728***	1.05684***	.9366665***	.9039058***	.9653149***
Q06	-1.965555**	-2.228052**	-2.13471**	-2.240117***	-2.511298***
Q07	-.1480397	-.1357675			
Q08	-.1394221	-.1259198			
Q09	-1.29658***	-1.48870***	-1.39747***	-1.32279***	-1.40836***
Q10	-.1033841	-.0648275			
Q11	-.0247891	.341642			
Q12	.6723936*	.5176926	.5570464*	.7212935**	.8327147***
Q13	.3936758	.398369			
Q14	-.1846823	-.3590715			
Q15	.2105784	.3408015			
Q16	.0185825	.0770416			
Q17	.1050078	.2739288			
Q18	1.506604***	1.706705***	1.613984***	1.503479***	1.587246***
Q19	-.4973481	-.4657054			
Q20	.2515554	.283141			
Q21	.5450684*	.5787416**			
Q22	1.60508***	1.578588***	1.52854***	1.41233***	1.629604***
Q23	-.3709007	-.5338807			
Q24	2.206659*	2.421131**	1.961951*	1.941797*	
Q26	-.6876012	-.8107204	-.8443206*		
Q29	-.1739937	-.1791834			
Gender	.1440375	.3060126			
Married (Yes = 1)	.2778611	.2777569			
Age (years)	-.088609	.00779			
House or apt?	-.404564	-.3623466			
Owned or rented?	.3654651	.2576983			
Constant	-5.009422**	-5.792279**	-5.36328***	-5.463774***	-3.583264***
Log-likelihood	-142.81321	-138.37018	-134.54811	-148.94886	-133.8735
AIC	353.6264	348.7404	317.0962	321.8977	317.0747
BIC	499.0323	502.6995	372.9692	373.2174	364.6234
H-L(p-value)	0.7220	0.6835	0.7807	0.5998	0.6027
Correct classification rate	87.78%	89.29%	89.10%	86.84%	88.17%
Pseudo R^2	0.4207	0.4388	0.4137	0.3959	0.3964
N	532	532	532	532	532

Source: Authors' calculations based on the data collected in this study. Note: This table presents the estimated coefficients for the logit model, the dependent variable, and the propensity to acquire flood insurance (Q05). ***p<0.01; **p<0.05; *p<0.1.

In Panel A in Table 3 we verified that, in a non-statistically significant manner, the portion of PwD who stated that they were willing to acquire insurance was lower for the individuals submitted to the treatment. Thus, for a blind individual who was submitted to the treatment, the chance of buying insurance $\widehat{Pr(Buy)}$ increases 7.25% in relation to Non-PwD individuals, i.e.: $\widehat{\beta_2} \approx 1.46 + \widehat{\beta_4} \approx -1.39 = 0.07 \therefore e^{0.07} = 1.0725$. Therefore, among blind people we identified that one of the factors that seems to inhibit their willingness to buy insurance after receiving this information is that the individual is induced to reflect about his or her exposure to flood risk, and given this opportunity the individual perceives that the future is riskier and therefore there is no reason to place resources in something that will not return benefits, because the risk of not remaining alive to benefit from the insurance coverage is considerable. Or in other words, the way in which a blind individual perceives reality in his or her surroundings, or how information is received may be substantially different (Dursin, 2012, Proulx, 2020).

In addition to the marginal effects of being blind and the treatment that a portion of the respondents was submitted to, we verified the effects due to variables in the individual's profile, as well as the individual's attitude towards flood risk and the probability of acquiring flood insurance. Thus, we verified that individuals who stated that they live in zones at greater risk from flooding (Q01) had a 381.15% greater chance of acquiring insurance ($\hat{\beta} \approx 1.571, p < 0.01$), as well as the fact that they had already experienced flooding in the street where they lived (Q02) which also increases their propensity to acquire insurance ($\hat{\beta} \approx 0.967, p < 0.01$) by 163%, which was also observed for those who had lost persons they knew (Q04) in floods ($\hat{\beta} \approx 0.965, p < 0.01$), which increases the chance of buying insurance by 162.48%. These findings are in keeping with the principle of resistance to change in risk behavior (Slovic et al.,1982), or in other words, individuals attribute greater value to a perceived certainty. These people, in general, expect some kind of loss in order to show an interest in insurance, corroborating the results of Kunreuther et al. (2013) and Czajkowski et al. (2013).

In dealing with attitudes in relation to flood risk, the results of Model V suggest three aspects that influence the probability of acquiring insurance. First, individuals who underestimate risk believe that they will never be affected by the effects of flooding (Q09), reducing their propensity to acquire insurance ($\hat{\beta} \approx -1.408, p < 0.01$) by 75.54%, in accordance with the principal of an excess of confidence in risk behavior (Fischhoff et al., 1977; Kunreuther and Slovic, 1978; Slovic, 1984). Second, individuals who state that they pay special attention to the behavior of the rain in order to abandon their houses if necessary (Q12) seem to have a greater propensity to acquire insurance ($\hat{\beta} \approx 0.832, p < 0.01$) in agreement with Weinstein (1980). Third, individuals who state they have a preference for acquiring protection for more longer time periods (at least two years) are more likely to pay for insurance ($\hat{\beta} \approx 1.629, p < 0.01$).

4.3 Additional analyses

Given that the propensity to acquire insurance is influenced by the premium that the consumer will have to pay, we decided to also conduct analyses with the dependent variable being the price which consumers would be willing to pay in order to acquire flood protection for their homes (Kousky et al., 2017). To accomplish this, we used OLS and quantile regression models. Table 5 displays the estimated coefficients for OLS (Model VII) and quantile regressions: 25% (Model VIII), 50% (Model IX), and 75% (Model X) via a stepwise procedure. We verified the effect of some variables which did (or did not) become insignificant via OLS in accordance with the percentage of the price distribution, where the marginal effect is altered in accordance

with the adopted percentile. For example, having access to information has a significant impact only on those in the 75 percentile, or in other words, people who have information are those in the 75 percentile of the price distribution. In lower percentiles, it was not significant ($p < 0.1$). In accordance with the percentile of the insurance premium, the marginal effect was different for some relevant independent variables (see Table 1). In other words, maintaining the other variables constant, if a financial product exists which offers protection against flooding (Q18), those who are willing to pay R$ 8 more for the first quartile's price range, pay R$ 20 more for the second quartile and R$ 29.60 more for the third quartile.

Table 5. Estimated Models for the Monthly Premiums for Flood Insurance (OLS and quantile).

	VII	VIII	IX	X
Variable	OLS	QREG25	QREG50	QREG75
Q12	8.7225*			14.4**
	(4.3189)			(6.0275)
Treatment	11.1258***			12**
	(3.3737)			(4.9704)
Q37	3.5344***			4.8***
	(1.0581)			(1.5545)
Q17	11.9836**		15***	
	(5.2629)		(3.62523)	
Q25	34.2711**		85***	66.8***
	(13.9484)		(10.1104)	(21.0999)
Q24	-13.9566*			
	(7.1704)			
Degree	-2.9298*			-4.8**
	(1.6489)			(2.2297)
Q18	17.5501**	8***	20***	29.6***
	(6.1552)	(1.6810)	(4.2135)	(8.0031)
Q02	11.6804**			18**
	(4.9085)			(7.6285)
Q22	13.0074*			
	(7.0885)			
Q04	11.7266**			
	(5.2082)			
Q06	35.2315***	10***	50***	33.2**
	(9.8804)	(3.0324)	(6.9597)	(14.8388)
Q07	-10.4729**			
	(3.6558)			
Age (years)	-9.6138*			
	(5.4755)			
Q14	-6.5176*			-8.8*
	(3.5109)			(5.1109)
Buy		7***	15***	
		(1.5247)	(3.7639)	
Q01			15***	28.4***
			(2.9092)	(6.0753)
Q10				39.2***
				(10.8619)
Constant	86.9514***			32.8**
	(24.3549)			(11.8105)
	R^2=0.2673	pseudo-R^2=0.0118	pseudo-R^2=0.1496	pseudo-R^2=0.2644

Source: Authors' calculations based on data collected for this study. Note: This table presents the estimated coefficients for the OLS and quantile regression models for quartiles and the maximum acceptable monthly

premium dependent variable (Q40). The standard errors of the estimates appear between the parentheses. ***p<0.01; **p<0.05; *p<0.1.

In addition, in accordance with Kousky (2012) and Kunreuther et al (2009), situations associated with living in risk can influence individuals in terms of their perceptions of the occurrence of extreme events. In this respect, people who invest more in prevention, those who construct some type of barrier to protect their homes from flooding (Q06 and Q10), are willing to pay 75% of the highest premiums for insurance. Furthermore, in accordance with Kunreuther et al (2009), the individual state of alert to abandon home in case of necessity (Q12), reinforces the relevance of attitudes related to risks associated with concern about losses, in addition to the context effect (Hershey & Schoemaker, 1980). Variables which were not significant via OLS, such as Q1 and Q10, came to represent the median and third quartile. The quantile regression presents a form that can be used for each percentage of the dependent variable (price) distribution.

5. CONCLUDING REMARKS

This study contributes to the literature of strategies for companies concerned with how their performance may be affected by individual choices interacting with the context of accelerating climate change. Based on our results, company managers, entrepreneurs and makers of public policy can learn about the influence of making relevant information available to heads of households for individual decisions regarding risk. Specifically, we have studied in an unprecedented manner, the impact of information on the propensity of heads of households, including PwD and non-PwD individuals, to purchase flood insurance. Based on this unique data from more than 500 individuals who live in the largest city in Latin America, our results reveal mainly that, in aggregate, people who live in risk zones who have previous experience with flooding are more likely to purchase insurance. In addition, on one hand blind people are more likely to acquire this type of insurance compared to non-PwD individuals. On the other hand, the increase in the probability of acquiring insurance is attenuated when blind people receive relevant information about the risks and consequent impacts of flooding. Future studies can explore particular aspects of the role played by information in consumer decision making, above all in terms of blind citizens.

References

Anderson, D. R. (1974). The National Flood Insurance Program: Problems and Potential, *Journal of Risk and Insurance*, 41(4), 579-599.

Angrist, J.D., Pischke, J.S. (2009). *Mostly Harmless Econometrics: Am Empiricist Companion*. Princeton Press.

Barić, D., Havârneanu, G.M., Măirean, C. (2020). Attitudes of learner drivers toward safety at level crossings: Do they change after a 360° video-based educational intervention?. *Transportation Research Part F: Traffic Psychology and Behaviour*, 69, 335-348. https://doi.org/10.1016/j.trf.2020.01.018

Botzen, W. J. W., van den Bergh, J. C. J. M. (2012). Risk attitudes to low-probability climate change risks: WTP for flood insurance. *Journal of Economic Behavior & Organization*, 82(1), 151–166.

Botzen, W. J., de Boer, J., & Terpstra, T. (2013). Framing of risk and preferences for annual and multi-year flood insurance. *Journal of Economic Psychology*, 39, 357–375.

Bradt, J. (2019). Comparing the effects of behaviorally informed interventions on flood insurance demand: An experimental analysis of 'boosts' and 'nudges'. *Behavioural Public Policy*, 1-31.

Brouwer, R., Tinh, B. D., Tuan, T. H., Magnussen, K., Navrud, S. (2014). Modeling demand for catastrophic flood risk insurance in coastal zones in Vietnam using choice experiments. *Environment and Development Economics*, 19(2), 228–249. https://doi.org/10.1017/S1355770X13000405

Browne, M. J., C. Knoller, Richter, A. (2015). Behavioral bias and the demand for bicycle and flood insurance. *Journal of Risk and Uncertainty*, 50(2), 141–160.

Browne, M.J., Hoyt, R.E. (2000). The Demand for Flood Insurance: Empirical Evidence. *Journal of Risk and Uncertainty*, 20(3), 291-306.

Burby, R.J. (2001). Flood insurance and floodplain management: The US experience. *Environmental Hazards*, 3(3-4), 111-122.

Burningham, K., Fielding, J., Thrush, D. (2008). 'It'll never happen to me': understanding public awareness of local food risk. *Disasters*, 32(2), 216-238. https://doi.org/10.1111/j.1467-7717.2007.01036.x

Chou, Y.-J., Huang, N., Lee, C.-H., Tsai, S.-L., Chen, L.-S., Chang, H.-J. (2004). Who Is at Risk of Death in an Earthquake? *American Journal of Epidemiology*, 160(7), 688–695.

Collings, S., Dew, A., Dowse, L. (2016). Support planning with people with intellectual disability and complex support needs in the Australian National Disability Insurance Scheme. *Journal of Intellectual and Developmental Disability*, 41(3), 272-276.

Collings, S., Dew, A., Dowse, L. (2019). "They need to be able to have walked in our shoes": What people with intellectual disability say about National Disability Insurance Scheme planning. *Journal of Intellectual and Developmental Disability*, 44(1), 1-12.

Czajkowski, J., Kunreuther, H., Michel-Kerjan, E. (2013). Quantifying riverine and storm-surge flood risk by single-family residence: Application to Texas. *Risk Analysis*, 33(12), 2092-2110.

Dursin, A.G. (2012). Information Design and Education for Visually Impaired and Blind People. *Procedia-Social and Behavioral Sciences*, 46, 5568-5572.

Elabed, G., Carter, M. R. (2015). Compound-risk aversion, ambiguity and the willingness to pay for microinsurance. *Journal of Economic Behavior & Organization*, 118, 150–166.

Etner, J., Jeleva, M., Tallon, J.M. (2012). Decision Theory Under Ambiguity. *Journal of Economic Surveys*, 26(2), 234-270. https://doi.org/10.1111/j.1467-6419.2010.00641.x

Fischhoff, B.; Slovic, P.; Lichtenstein, S. (1977). Knowing with certainty: The appropriateness of extreme confidence. *Journal of Experimental Psychology: Human Perception and Performance*, 3(4), 552-564.

Flaxman, S.R. et al. (2017). Global causes of blindness and distance vision impairment 1990–2020: a systematic review and meta-analysis. *The Lancet Global Health*, 5(12), PE1221-E1234.

Fox, M.H., White, G.W., Rooney, C., & Rowland, J. (2007). Disaster Preparedness and Response for Persons with Mobility Impairments: Results from the University of Kansas Nobody Left Behind Project. *Journal of Disability Policy Studies*, 17(4), 196-205.

Goda, G. S., Shoven, J. B., Slavov, S. N. (2019). Work incentives in the Social Security Disability benefit formula. *Journal of Pension Economics and Finance*, 18(2), 165–189.

Grigg, N.S. (2020). Providing Effective Means to Reform the National Flood Insurance Program through Risk Mapping. *Journal of Sustainable Water in the Built Environment*, 6(2), 02520001

Hans, A., Mohanty, R. (2006). Disasters, disability and technology. *Development*, 49(4), 119-122.

Harrison, G. W., Ng, J. M. (2019). Behavioral insurance and economic theory: A literature review. *Risk Management and Insurance Review*, 22(2), 133–182. https://doi.org/10.1111/rmir.12119

Hartnett, J., Mendelsohn, S., Morris, M. (2008). Disability and economic inclusion: Democratic principles and promises. In Building a better economic future: A progress report for individuals with disabilities and their families in America. Manchester, NH: Community Economic Development Press.

Hershey, J.C., Schoemaker, P.J.H. (1980). Risk taking and problem context in the domain of losses: An expected-utility analysis. *Journal of Risk and Insurance*, 47, 111-132.

Hill, M.J., Maestas, N., Mullen, K.J. (2016). Employer accommodation and labor supply of disabled workers. *Labour Economics*, 41, 291–303. https://doi.org/10.1016/j.labeco.2016.05.013

Hogarth, R.M., Kunreuther, H. (1995). Decision making under ignorance: Arguing with yourself. *Journal of Risk and Uncertainty*, 10(1), 15–36.

Jaspersen, J.G. (2016). Hypothetical surveys and experimental studies of insurance demand: A review. *Journal of Risk and Insurance*, 83(1), 217–255. https://doi.org/10.1111/jori.12100

Jha, A., Lamond, J., Bloch, R., Bhattacharya, N., Lopez, A., Papachristodoulou, N., Bird, A., Proverbs, D., Davies, J., & Barker, R. (2011). Five Feet High and Rising Cities and Flooding in the 21st Century.

Johnson, E.J., Hershey, J., Meszaros, J. (1993). Framing, Probability Distortions, and Insurance Decisions. *Journal of Risk & Uncertainty*, 7(1), 35–51.

Jongejan, R., Barrieu, P. (2008). Insuring Large-Scale Floods in the Netherlands. *The Geneva Papers on Risk and Insurance - Issues and Practice*, 33(2), 250–268. https://doi.org/10.1057/gpp.2008.10

Kendall, J.M. (2003). Designing a research project: randomised controlled trials and their principles. *Emerg Med J*, 20, 164–168. https://doi.org/10.1136/emj.20.2.164

Keys, B.J., Mahoney, N., Yang, H. (2020). What Determines Consumer Financial Distress? Place- and Person-Based Factors. NBER Working Paper. https://doi.org/10.3386/w26808

Koenker, R., Hallock, K.F. (2001). Quantile regression. *Journal of Economic Perspectives*, 15(4), 143-156.

Kousky, C. (2012). Informing Climate Adaptation: A Review of the Economic Cost of Natural Disasters, There are Determinants, and Risk Reduction Options. Resources for the Future Discussion Paper. DP 12-28. Available at: <https://media.rff.org/documents/RFF-DP-12-28.pdf>

Kousky, C., Lingle, B., Shabman, L. (2017). The Pricing of Flood Insurance. *Journal of Extreme Events*, 4(2), 1750001. https://doi.org/10.1142/S2345737617500014

Kousky, C., Michel-Kerjan, E. (2015). Examining Flood Insurance Claims in the United States: Six Key Findings. *Journal of Risk and Insurance*, 84(3).

Kousky, C., Shabman, L. (2015). A Proposed Design for Community Flood Insurance. Resources for the Future-RFF Report. Available at: https://media.rff.org/archive/files/document/file/RFF-Rpt-KouskyShabman-CommunityFloodIns_0.pdf

Kunreuther, H., and E. Michel-Kerjan (2009). At War with the Weather: Managing Large-Scale Risks in a New Era of Catastrophes. New York: MIT Press.

Kunreuther, H., Michel-Kerjan, E. (2007). Assessing, Managing and Benefiting from Global Interdependent Risks: The Case of Terrorism and Natural Disasters. 2007 Create Symposium.

Kunreuther, H., Novemsky, N., Kahneman, D. (2001). Making Low Probabilities Useful. *The Journal of Risk and Uncertainty*, 23(2), 103–120.

Kunreuther, H., Slovic, P. (1978). Economics, psychology and protective behavior. *American Economic Review*, 68(2), 64-69.

Kunreuther, H., Useem, M. (2010). *Learning from Catasprophes: Strategies for Reaction and Response*. 1 ed. Wharton School Publishing.

Kunreuther, H.C., Pauly, M.V., McMorrow, S. (2013). *Insurance & Behavioral Economics*. Cambridge.

Lichtenstein, S., Slovic, P., Fischhoff, B., Layman, M., Combs, B. (1978). Judged Frequency of Lethal Events. *Journal of Experimental Psychology: Human Learning and Memory*, 4(6), 551–578.

Lo, A.Y. (2013). Household Preference and Financial Commitment to Flood Insurance in South-East Queensland. *Australian Economic Review*, 46(2).

Lucas, E.C., Mendes-Da-Silva, W. (2018). Impact of climate on firm value: Evidence from the electric power industry in Brazil. *Energy*, 153, 359-368. https://doi.org/10.1016/j.energy.2018.04.024

Marengo, J.A., Alves, L.M., Ambrizzi, T., Young, A., Barreto, N.J.C., Ramos, A.M. (2020). Trends in extreme rainfall and hydrogeometeorological disasters in the Metropolitan Area of São Paulo: a review. Annals of the New York Academy of Science. https://doi.org/10.1111/nyas.14307

Michel-Kerjan, E., Kunreuther, H. (2011). Redesigning flood insurance. *Science*, 333(6041), 408-409.

Michel-Kerjan, E., Lemoyne de Forges, S., Kunreuth er, H. (2012). Policy Tenure Under the U.S. National Flood Insurance Program (NFIP). *Risk Analysis*, 32(4), 644–658.

Michel-Kerjan, E.; Kousky, C. (2009). Come Rain or Shine: Evidence on Flood Insurance Purchases in Florida. *Journal of Risk and Insurance*, 77, 369-397.

Miller, J.E., Rodgers, Y.V.M. (2008). Economic importance and statistical significance: Guidelines for communicating empirical research. *Feminist Economics*, 14(2), 117-149.

Minoli, D.M., Bell, J.N.B. (2003). Insurance as an alternative environmental regulator: findings from a retrospective pollution claims survey. *Business Strategy and the Environment*, 12, 107-117.

Petrolia, D.R., Landry, C.E., Coble, K.H. (2013). Risk preferences, risk perceptions, and flood insurance. *Land Economics*, 89(2), 227-245.

Proulx, M. (2020). How blind people see the world. Available at: https://vimeo.com/140795575

PSI-Principles for Sustainable Insurance (2019). Global guidance on the integration of environmental, social and governance risks into insurance underwriting, Working Paper. Available at: https://www.unepfi.org/psi/underwriting-esg-risks/

Rettger, M.J., Boisvert, R.N. (1979). Flood Insurance or Disaster Loans: An Economic Evaluation. *American Journal of Agricultural Economics*, 61(3).
Richler, J. (2019). Nudge to flood insurance. *Nature Climate Change*, 9(12), 906.
Rooney, C., White, G.W. (2007). Consumer Perspective: Narrative Analysis of a Disaster Preparedness and Emergency Response Survey From Persons With Mobility Impairments. *Journal of Disability Policy Studies*, 17(4), 206–215.
Rosenbaum, W. (2005). The Developmental and Environmental Impacts of the National Flood Insurance Program: A Review of Literature. American Institutes for Research, Working Paper.
Shanteau, J. (1992). Decision Making Under Risk: Applications to Insurance Purchasing. In NA - Advances in Consumer Research Volume 19, eds. John F. Sherry, Jr. and Brian Sternthal, Provo, UT.
Sherwood, M.W., Pollard, J.L. (2018). The risk-adjusted return potential of integrating ESG strategies into emerging market equities. *Journal of Sustainable Finance & Investment*, 8(1), 26-44.
Slovic, P. (1984). Facts vs fears: Understanding perceived risks, Washington, D.C.: Science and Public Policy Seminar, Federation of Behavioral, Psychological and Cognitive Sciences.
Slovic, P., Fischhoff, B., Lichtenstein, S. (1982). Facts versus fears: Understanding perceived risks. In D. Kahneman, P. Slovic, and A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases*, Cambridge: Cambridge University Press.
Slovic, P., Fischhoff, B., Lichtenstein, S., Corrigan, B., Combs, B. (1977). Preference for Insuring Against Probable Small Losses: Insurance Implications. *Journal of Risk and Insurance* (pre-1986); Malvern, 44(2), 237–258.
Tesselaar, M., Botzen, W.J.W., Aerts, J.C.J.H. (2020). Impacts of climate change and remote natural catastrophes on EU flood insurance markets: An analysis of soft and hard reinsurance markets for flood coverage. *Atmosphere*, 11(2),146.
Thaler, R., Tucker, W. (2013). Smarter Information, Smarter Consumers. *Harvard Business Review*.
Thaler, R., Tversky, A., Kahneman, D., Schwartz, A. (1997). The Effect of Myopia and Loss Aversion on Risk Taking: An Experimental Test. *The Quarterly Journal of Economics*, 112(2), 647–661.
Thill, C. (2015). Listening for policy change: how the voices of disabled people shaped Australia's National Disability Insurance Scheme. *Disability and Society*, 30(1), 15-28.
Tom, S.M., C.R. Fox, C. Trepel, Poldrack, R.A. (2007). The neural basis of loss aversion in decision-making under risk. *Science*, 315(5811), 515–518.
Turk, M.A., McDermott, S. (2019). People with disability and health care insurance plans. *Disability and Health Journal*, 12(3), 335-336.
Turner, G., Said, F., & Afzal, U. (2014). Microinsurance Demand After a Rare Flood Event: Evidence From a Field Experiment in Pakistan. *The Geneva Papers on Risk and Insurance - Issues and Practice*, 39(2), 201–223. https://doi.org/10.1057/gpp.2014.8
United Nations (2019). Human Development Report 2019-Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century. Available at: http://hdr.undp.org/sites/default/files/hdr2019.pdf
United Nations Development Program (2007). Human Development Report 2007/2008 - Fighting climate change: Human solidarity in a divided world.
Wagner, K. L. (2015). Medicaid expansions for the working age disabled: Revisiting the crowd-out of private health insurance. *Journal of Health Economics*, 40, 69–82.
Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology*, 39(5), 806–820. https://doi.org/10.1037/0022-3514.39.5.806
Wells, K. (2019). Steps to Reduce the Risk of Wildfires in California: Three experts share their views on what policy makers can do. *Wall Street Journal*, Nov192019. Available at: https://www.wsj.com/articles/steps-to-reduce-the-risk-of-wildfires-in-california-11574209097
WHO-World Health Organization. (2011). World Report on Disability 2011. ISBN 978 92 4 068521 5. Available at: https://www.who.int/disabilities/world_report/2011/report.pdf
WHO-World Health Organization. (2015). WHO Global Disability Action Plan 2014-2021: Better Health for All People with Disability.
Wing, O.E.J., Pinter, N., Bates, P.D., & Kousky, C. (2020). New insights into US flood vulnerability revealed from flood insurance big data. *Nature Communications*, 11(1),1444.

World Meteorological Organization. (2014). Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970-2012).