

Quantifying non-monetary value attributes of property investment: Implication on investors' decision-making in flood risk areas

Abiodun Kolawole Oyetunji^{1,2*}, Chiemela Victor Amaechi^{3,4,5}, Olugbenga Timo Oladirin⁶, and Temitope Omotayo⁷

- ¹ Lancaster Environment Centre (LEC), Lancaster University, Lancaster LA1 4YQ, UK
- ² Department of Estate Management, University of Benin, Benin City 300287, Nigeria
- ³ Department of Construction Management, Global Banking School, Devonshire Street North, Manchester, M12 6JH, UK
- ⁴ School of Engineering, Lancaster University, Bailrigg, Lancaster, LA1 4YR, UK
- ⁵ Institute of Energy Infrastructure, Universiti Tenaga Nasional, Jalan IKRAM-UNITEN, 43000 Kajang, Selangor, Malaysia.
- ⁶ School of Art, Design and Architecture, University of Plymouth, Devon PL4 8AA, UK
- ⁷ School of Built Environment, Engineering and Computing, Leeds Beckett Univ., Leeds LS2 8AG, UK

Abstract

Risk perceptions have a crucial role in influencing people's decisions to adapt to environmental threats. Various outcomes have been achieved by diverse studies that have examined the implication of flood risk on property investment. This present study quantifies three themes (usability, desirability, and marketability) that revolve around non-monetary value attributes of property investment and assesses how their perceptions by property investors could sharpen investment behaviour in areas at risk of flooding. The study areas selected for the investigation were Ikorodu and Ibeju Lekki, an area that is mostly sought-after in Lagos, Nigeria. Data was collected through the distribution of questionnaires administered to the respondents within the study location. Findings from the survey indicate a general agreement on the impact of each thematic factor on property investments vulnerable to floods. Among the statements put forward, the appeal of owning or renting houses in flood-prone areas significantly influences investors' choices. Surprisingly, the study also discovered that these investors exhibited a very low degree of trust and confidence in insurance operations within the study location.

Keywords: decision-making, flood risk, non-monetary, property investment, value attribute

Introduction

Climate change is a very serious threat that affects the environment, and its consequences impact many different aspects of human lives. According to Beniston and Stephenson



(2004), the emergence of weather events in recent decades has highlighted the dangers such as rising temperatures, sea level rise, drought, and flooding connected to climate change. The focus of this present study is flooding related risks. Flooding is a dynamic risk that varies spatially and can occur anywhere globally. Urban sprawl can contribute to an increased risk of flooding (Pitt, 2008), likewise, if drains are unable to cope with persistent rainfall in an environment, flooding may likely occur. Lamond et al. (2010) claimed that human activities could lead to floods. For instance, land development in flood courses, or poorly designed or defective flood defenses.

Climate change has caused flooding to become more frequent and severe, putting more homes at risk. With this in mind, studies have investigated the perception about floods and the dangers that come with living in areas that are prone to flood risk (Beltrán et al., 2018; Hennighausen and Suter, 2020). Gábor et al. (2016) claimed that a connection exists between the rise in the frequency of flooding and the risk of loss of life, property, and economic resources. People believe that an individual who lives within the proximity of a flood risk environment is at fault if their property is flooded. In contrast, the ability to determine whether a property is susceptible or located in a flood zone is not always obvious, especially in newly developed areas. For instance, a property may be flooded even if not located in an area at risk of flooding. According to Gerald-Ugwu et al. (2019), unplanned construction operations have resulted in floods in areas not susceptible to flooding in the first place. However, one may make the case that a person who chooses to reside close to a river or the seaside should recognise the risk inherent in such an occupation.

Besides climate change, urbanisation and infrastructure development increases the pressure on the built environment (Pregnolato et al., 2017). Urbanisation is an essential feature of population growth and development, leading to growing flood risk. For example, the growth of cities is an indicator of development. However, indiscriminate land use for developmental purposes could eventually contribute to more flooding. Indirectly, this is related to population growth and density, leading to city expansion and flooding (Devkota et al., 2014). The population density, especially in the urban areas, could significantly alter the dynamics and complexity of the built environment when it comes to flooding. An increase in surface water runoff is bound to occur as areas become more urbanised, especially if not adequately planned. If the runoff goes uncontrolled, it is not just flooding that is of concern but also environmental pollution such as contaminants.

There are increasing numbers of flood-prone areas due to the development of dwellings, roads, and other forms of infrastructure. According to Dahl et al. (2018), the number of locations that are poised to be affected by flooding will increase over the next twenty years due to climate change. Moreso, an increase in the desire for property ownership may also contribute to an overall rise in the likelihood of flooding (Crichton, 2003; Pitt, 2008). The rate at which new properties are constructed in flood-prone places around the world has reached an almost threefold increase over the last decade (Gerald-Ugwu et al. 2019; Rozer and Surminski 2021). For example, approximately 120,000 new dwellings have been constructed in flood-prone locations in England and Wales over the last ten years (Rozer & Surminski, 2021). As a result, Rozer and Surminski (2021) concluded that the continuous development of real assets in flood-prone areas is the primary element responsible for the



magnitude of losses suffered. Hence the motivation to dwell in close proximity to flood environments could be attributable to people's perception of the risk involved. (Oyetunji et al., 2025).

People's perceptions of risk are essential when making decisions regarding how to adjust to natural hazards (Terpstra et al., 2009). Risk perception is comprised of the concepts, attitudes, judgements, sentiments, cultural influences, along with social dispositions that individuals have regarding potential hazards and the potential benefits that they may offer (Santoro et al., 2019). The perception of risk is also the process by which an individual sees and evaluates dangers and the risks that relate to them (Sullivan-Wiley and Short Gianotti, 2017). In terms of risk reduction, Savadori et al. (2004) affirmed that risk perception may affect decisions taken. When it comes to the risk associated with a situation, people have different opinions (Oyetunji et al., 2023). As regards the factors influencing risk, individuals place varying degrees of importance on them (Oyetunji et al., 2023). This assumes that risk reduction measures are implemented within a framework for decision-making that is both adaptable and responsive, and in which individuals and various aspects of society interact with one another (Slovic et al., 2004). It is the contention of Boholm (2003) that the perception and comprehension of natural disasters by stakeholders are due to social intervention. This explains why Giordano et al. (2013) concluded that variations in risk perceptions have the potential to generate disputes that could potentially impair the efficiency of risk management measures. According to Mind'je et al. (2019) and Oyetunji et al. (2022), perception studies are significant research techniques that could be used to evaluate the impact of flooding on a global scale.

There has always been some degree of impact that floods have had on property markets (Troy & Romm, 2004; Worthington, 2008; Akbar et al., 2015). The duration of the flood, the depth of the flood, and the regularity with which flood occurs are all factors that could potentially influence the impact (Minnery & Smith, 1996, Queensland Floods Science, Engineering and Technology Panel, 2012). Atreya et al. (2013) concluded that the perceived danger of flooding could affect the price of homes. Accordingly, Bernstein et al. (2019) and Baldauf et al. (2020), concluded that there is a correlation between being less likely to experience flooding and having much higher property prices. Real estate markets react to flooding, with findings suggesting inconsistent results. For instance, Babcock and Mitchell (1980) and Shrubsole et al. (1997) reported that floods did not pose a significant impact on property investment. Studies have shown that flooding could have a positive effect on property prices (Tobin & Montz, 1990; Lambley & Cordery, 1991; PRC, 1992; Tobin & Montz, 1994; Lambley & Cordery, 1997), or a negative impact (Bin & Kruse, 2006; Turnbull et al., 2013; Harrison et al., 2001; Eves, 2004; Soentato & Proverbs, 2004; Zhang & Leonard, 2019). Despite the negative effects of flooding, there is still a growing desire for real estate investments in locations at flood risk (Oyetunji et al., 2023). This is because people continue to require real estate, and new developments continue to appear daily to accommodate this growing need (Oyetunji et al., 2025).

The study is intended to analyse how the sense of value held by property investors can influence the decisions they make about investments in areas prone to flood risk. This impression is investigated from the lens of property investors, who had property



investment(s) in the study areas. The primary focus was on their perceptions regarding non-monetary value in connection to real estate investment. The research study provides answers to the research question that is posed, which is: how does ambiguity in risk perceptions on usability, desirability, and marketability of property contribute to judgements regarding investment in flood-risk zones? This paper is structured into five sections. Section 1 detailed the introductory background to the research, and section 2 revolved around the literature review conceptualised for the study. In section 3, the methodology used for achieving the research objectives was put forward. Section 4 covered the discussion of results while the concluding section is detailed in section 5.

Conceptualisation of Value

Value is an abstract construct which does not have strict limits or boundaries. For instance, in ethics, value measures the extent of the significance of something or an action. This will guide in determining what steps to take or the importance of alternatives. According to Oyetunji (2022), values influence people's behaviour. Diverse classifications and types of value exist. For instance, values could be aesthetic, theoretical, financial, political, religious, personal, universal or cultural (Canatan, 2004; Kale, 2004). According to economic theory, the value of a property converges when the forces of supply meet those of demand. This suggests that property value is determined by what the market will bear at any given time. Flooding has been described as an environmental hazard that could influence the value attributable to property investment. Horn and McShane (2013) pointed out that flooding can significantly impact the value of properties. This study adopts value as a representative of the normative beliefs that guide or motivate attitudes or actions.

The value of property investment may change over time. Changes in property value due to detrimental environmental conditions such as floods may be a source of concern for real estate investors' (Mundy, 1990; Lamond, 2008). Determining the value of already flooded property investments or those at risk of flooding could also be challenging to property valuers (Bond, 2000; Lamond et al., 2010). This is so because many professionals have minimal or no experience valuing flooded properties. Likewise, there is no available practical guidance on this (Lamond et al., 2010). Previous research has studied the influence of flood risk on property investment from a monetary viewpoint. However, no one considers that investment might not yield an expected return, particularly if such property is impaired by flooding. It is imperative to understand the perception of property stakeholders such as private investors and estate agents about the market and the value attributable to investment that could be affected by flooding.

There are several means of conceptualising value. In determining value, the consumer is an important factor, and one of the ways to determine value is the perception of the market by them. Likewise, value could be quantified or qualified in monetary and nonmonetary terms. Market perception that quantifies or qualifies value in non-monetary terms could guide or motivate actions or behaviour towards the monetary aspect of value. Since property investment is a fixed resource, its usefulness is limited by location. Thus, the need to use property, the desire to own property, and the motivation to exchange rights in a property, will tend to be locally shaped. The idea of usability,



desirability, and marketability of property investment as deployed in this study revolves around non-monetary value perception based on the influence of flooding on real estate investments.

Bhattacharya-Mis and Lamond (2016) have explored these three criteria to investigate the vulnerability of commercial property values in flood risks areas in the United Kingdom. In the property market, these criteria could overlap because several indicators may interact with one another. Bhattacharya-Mis (2014) treated these criteria by overlapping them to determine the vulnerability of values of commercial property affected by flooding. However, for the purpose of this study, each criteria investigated will be treated in isolation. The rationale for adopting this approach is to investigate the independent contribution of each attribute to decisions to invest in flood risk areas.

There are diverse ways by which people perceive value. If people experience flooding repeatedly, their perceptions of property value may change. The property market perceptions investigated in this study are of non-monetary (economic) value. The perceptions of value as deployed in this present research are patterned following the investigation undertaken by Bhattacharya-Mis and Lamond (2015; 2016). They include the property use value of the property, the desire/demand for the property, and the ability of the property to exchange hands in the market. In this present research context, demand is described as the desirability backed by a willingness and ability to pay for the same. Thus, both demand and desirability are used interchangeably in this study. For this purpose, the non-monetary-based perceptions of the values of property investment from the self and market perceptions explored in this study are usability (use of property investment), desirability (demand for property investment), and marketability (exchange of property investment).

Bhattacharya-Mis and Lamond (2016) stressed that a property investment's usability, desirability, and marketability depend on factors related to the property's physical attributes, economic characteristics, nature, and the extent to which it is exposed to risk. There is a need to distinguish between the characteristics of property investment based on non-monetary value perceptions that were deployed as this study's central theme. According to Shackel (1991) and Keinonen (1997), usability may be defined in several ways. The usability of property investment could be described as those factors that promote the functionality of purpose and the accessibility of property investment. A property's desirability can be described as those factors that could make real estate attractive to prospective investors and their ability to pay for such. That could influence the demand for owning or renting a real property investment. For instance, an investor can desire to own or rent a property when an assessment is made based on a review of its flood history, structural finishes, and how it can adapt to withstand risk. The research theme adopted for this study is shown in Figure 1.





Figure 1: Conceptualisation of value (author's design)

A prospective investor may need property and wish to put it to a specific use (usability); however, such an investor could not pay to acquire the property, then the desirability for such property is non-existent. The marketability of property investment does not necessarily correspond to the price of the commodity in the market. The marketability of a property could be determined by how investors perceive the property as a potential investment by balancing risk and profit potential. This could inform us of the time on the property market, that is, the exchange time on the market. One can use the information gained to evaluate a property based on an understanding or knowledge of the local property market.

Since Bhattacharya-Mis and Lamond (2016) study argued that decision on property investment in flood risk environments could be influenced by investors' perception of usability, desirability, and marketability, this present study investigates the effects of flooding on the values (based on these three concepts) of residential housing markets in two flood-prone local government areas (Ibeju Lekki and Ikorodu) of Lagos State, Nigeria. This was done through investigations from the perspectives of private investors and property agents. To achieve the aim of the research, the study explores the potential of flood risk to influence the usability of residential properties. It also assesses the effect of flooding on the investors' desirability (demand) for residential properties. Then, an examination of the impact of flooding on the marketability (transactions completion times) of residential properties was also carried out. A person can use the information that they have received to evaluate a property based on their comprehension or knowledge of the property market in their area. The perception of flood danger is another factor that contributes to improved flood management (Birkholz et al. 2014; Santoro et al. 2019).

PACIFIC RIM PROPERTY RESEARCH JOURNAL **2025**, VOL.30, No.1, 34-56





Figure 2: Flooded properties in Ibeju Lekki, Lagos



Figure 3: Flooded properties in Ikorodu, Lagos

The field survey identified some properties that were flooded during the site visits (see Figures 2 and 3) and the authors presumed that the flood risks may have an implication on the insurance of these investments. As a result, the primary inquiry that is investigated in this study is whether the utility, desirability, as well as marketability of property investment, have a substantial impact on influencing decisions regarding residential property investment in regions that have the potential for flooding.

Research Methods

The purpose of this study is to investigate the factors that influence the decision to invest in flood-prone locations to evaluate the decision-making behaviour of individuals regarding property investment in flood-prone areas. To accomplish this, it was necessary to have an awareness of the perspectives held by property investors regarding the category of property values (which was employed in this study) that have the potential to impact investment choices.



Understanding the impact that flooding has on the decisions to invest in real estate is the premise on which this study is built. The decision to invest in real estate is reliant on the perception that property investors have of how flood risk impacts property. In order to fulfill the condition, it was necessary to gather information concerning the selfperceptions of property investors concerning their actions in the real estate market. The perceptions of the real estate market that are presented in this study are based on the data that was obtained from the field survey, through the distribution of questionnaires to the participants. Adopting Lagos State, Nigeria as a representative case, this study analyses the perspectives of property investors about the risk of flooding within the residential neighbourhoods located in two local government areas: Ikorodu and Ibeju Lekki. The map of the study area is shown in Figure 4.



Figure 4: Map depicting the study area of Lagos State (Ikorodu and Ibeju Lekki)

The perceptions of the target population are the basis used in reporting the findings in this research. A mixed-method data collection process was deployed in the research. Through the utilisation of this approach involving a combination of closed and openended, the study gains an in-depth knowledge of the research subject and acquires a comprehensive understanding of the research questions (Patton, 2002). The mixedmethod approach has been successfully implemented in several studies that have been conducted on the built environment (Lessing et al., 2017; Durdyev et al., 2019; Harris et al., 2019). It was not possible to conduct direct measurements of all the variables that related to the respondents' perceptions. Several authors, including Oppenheim (1992), Creswell (2009), and Bhattacharya-Mis and Lamond (2016), have proposed methods, such as the Likert scale, to gain an understanding of customers' preferences. This questionnaire survey was used to gather information for the study and the result validated for the study.

The questionnaire was administered to property investors within the study location in order to arrive at a more validated result for the study findings. The questionnaire was



administered using a combination of online surveys and paper-based distribution, ensuring broad participation. Although the data for this study was gathered using a structured questionnaire survey, only questionnaires containing relevant answers were essential to the study. They were validly reported as a valuable response to the research. 111 questionnaires were distributed to the property investors, with 89(80.18%) returned, and 75(84.27%) considered valid. The returned rate suggests that investors may have a greater interest in the research topic, possibly due to their direct financial exposure to flood risks. Hence, the responses which formed the basis of the research findings for this present study were obtained from 75 property investors.

A 5-point Likert scale was used to collect the responses of the surveyed respondents to the 17 statements put forward. After conducting a literature search and pilot study, 17 statements were derived. A simple regression analysis was performed to determine the impact on investment decisions. Each of the responses was assigned to a code of F1 and F17. Due to the nature of the study, each of the three dependent variables was handled as if it were a separate entity from one another. On the other hand, it is important to point out that because research was conducted on human perception, there is a high probability that they may be associated with one another and may likely require them to be treated. The data collected from the study were used to analyse concerns concerning the marketability, desirability, and usability of property investment. Following in the footsteps of Bhattacharya-Mis and Lamond (2016), the purpose of this study was to investigate the significance that can be attributed to these notions in terms of altering the value of investments that are susceptible to flooding in Lagos, Nigeria. To evaluate the respondents' perceptions of value, a 17-item (statements) profile was utilised (see Table 1).

Code	Factors	Statements
F1	Usa	Flooding can always cause a decline in property demand, hence
	abil	affecting
	lity	its use
F2		Properties exposed to flood risk will always experience loss in
		income
		due to limited use
F3		The actual location of a property within a flood risk zone can help
		determine how best property is used
F4		The presence of flooding can negatively affect the use to which a
		property
		is put
F5		Easier availability and accessibility of flood insurance can encourage
		more investment and property use in flood risk areas
F6		Longer recovery times from flood risk can affect property investment
		leading to loss of use and income
F7	De abi	It is difficult to get improved capital or rental value for property
	sir lit	disrupted

 Table 1: Statements for measuring the impact of flooding on property investments

PACIFIC RIM PROPERTY RESEARCH JOURNAL



2025, VOL.30, No.1, 34-56

		by flood in areas of lower demand (desirability)
F8		Cheaper insurance premiums can positively influence the desire to rent/own flood risk properties
F9		The presence of flood risk has a great influence on the desirability to own/rent a property
F10		Flexible lease terms can positively influence the desirability of property liable to flooding
F11		The desirability (demand) of a flood plain investment can be negatively affected due to loss of income
F12	Mark ity	Properties having a higher expected rate of income will be easily marketable despite being in flood risk zones
F13	cetabil	The suitability of the property for mortgage finance makes it more attractive and marketable despite being in a flood risk zone
F14		The persistence of flooding will always affect the marketability of property investment
F15		The actual location of a property within flood risk zones plays a significant role in its marketability
F16		Investing in flood mitigation actions will aid the sale/letting of properties affected by flooding, which in turn improves marketing time
F17		Once a property is disrupted by flood risk, it becomes difficult to market for a higher price, even if flood protection is installed



Figure 5: Non-monetary value perceptions deployed to assess flood impact on property investment



For this study, three (3) hypotheses were put forward:

H1: There is a significant relationship between the *"usability of property investment"* and *"decisions to invest in flood risk areas"*?

H2: There is a significant relationship between the "desirability of property investment" and "decisions to invest in flood risk areas"?

H3: There is a significant relationship between the *"marketability of property investment"* and *"decisions to invest in flood risk areas"*?

Results and Discussion

The results of this study are presented in this section. Figure 6 provides insights into the demographic characteristics of property investors and their experience in real estate investment, which are crucial in understanding how non-monetary value attributes - usability, desirability, and marketability - shape investment decisions in flood-prone areas.



Figure 6: Descriptive statistics of the respondents

Most of the respondents are male (48%), followed by female investors (36%), while a smaller proportion (16%) preferred not to disclose their gender. This distribution suggests that property investment in flood-risk areas may be primarily influenced by male investors, though the presence of female investors highlights a growing diversity in the sector. In terms of age, the data reveals that the largest proportion of respondents (41.33%) are within the 41-50 years category, followed by those above 60 years (32%) and those aged 51-60 years (22.67%). Notably, younger investors are significantly underrepresented, with only 4% in the 31-40 years and none in the 18-30 years. This trend indicates that property investment in these areas is predominantly undertaken by older, more experienced individuals who may be better positioned to assess and manage flood-related risks.



Marital status also appears to play a role in investment decisions, with married respondents making up the overwhelming majority (68%), followed by widowed investors (14.67%), divorced individuals (6.66%), and those who preferred not to disclose their marital status (8%). Investors who are single accounted for only 2.67% of the sample. The high percentage of married investors suggests that long-term stability and security are likely important considerations in property investment, even in areas vulnerable to flooding. The Figure further indicates that the respondents possess varying levels of experience in real estate investment. The highest proportions of investors (28% each) have between 6-8 years and over 11 years of experience, while 21.33% have 9-11 years of experience. A smaller percentage (14.67%) falls within the 3-5 years range, and only 8% have less than three years of experience. This suggests that most investors in these flood-prone areas are seasoned professionals who may have developed strategies to navigate the risks associated with flooding.

Table 2 examines the impact of non-monetary value attributes - usability, desirability, and marketability - on investment decisions in flood-risk areas. Multiple regression analyses were conducted to determine the significance of various factors within these themes. The results provide insights into how these attributes influence investor behavior and property investment viability in at-risk locations.

Moda1		R	S E	Sia	р	R ²	ANOVA	
s		D	5. E	Sig	К		F	Sig.
	Constan	3.131	1.708	0.071				
	t							
Usi	F1	-0.502	0.308	0.108				
abili	F2	0.234	0.283	0.410	0.318	0.101	1.275	0.280
ity	F3	-0.203	0.290	0.487				
	F4	0.383	0.225	0.093				
	F5	0.208	0.151	0.173				
	F6	-0.041	0.298	0.891				
	Constan	1.406	1.430	0.329	0.459	0.210	2 (()	0.005
De	t							
sira	F7	0.318	0.219	0.150				
bili	F8	0.574	0.154	0.000	0.458	0.210	3.662	0.005
ty	F9	-0.093	0.251	0.712	-			
	F10	-0.155	0.166	0.354				
	F11	-0.058	0.232	0.802				
	Constan	1.674	1.474	2.60				
M	t							
ark	F12	0.018	0.213	0.935				
etab	F13	-0.191	0.244	0.438	0.204	0.042	0.494	0.811
vilitį	F14	0.010	0.154	0.950				
Ч	F15	0.212	0.208	0.311				

Table 2: Likelihood of investing in flood-risk areas



F16 F17	0.252	0.236	0.291		
1.17	0.115	0.170	0.524		

B = unstandardized beta; *S*.*E*. = standard error; *Sig*. = significance

The statistical analysis presented in Table 2 highlights key factors influencing investment decisions in flood-prone areas. The regression model for property usability (Model 1) reveals that usability is positively influenced by factors F2, F4, and F5, while factors F1, F3, and F6 exert a negative effect. However, the model's explanatory power remains relatively low, accounting for only 31.8% of the variation in the data, as indicated by the R-value. The R² value further suggests that usability accounts for just 10.1% of the variation in investment decisions, indicating a weak predictive relationship. Furthermore, the regression model fails to significantly predict the dependent variable, as the statistical significance exceeds the 0.05 threshold (p > 0.0005). A multiple regression analysis conducted on factors F1 to F6 shows that none of the predictors significantly influence investment decisions, as all p-values exceed 0.05. The hypothesis (H1), which postulates that property usability significantly impacts investment decisions in flood-risk areas, is not supported given its non-significant p-value of 0.280. The regression equation developed for this model is:

Decisions to invest in flood risk areas = 3.131 - 0.502(F1) + 0.234(F2) - 0.203(F3) + 0.383(F4) + 0.208(F5) - 0.041(F6)

For property desirability (Model 2), the regression results suggest that desirability is positively influenced by factors F7 and F8, whereas factors F9, F10, and F11 negatively impact investment decisions. The model demonstrates a moderate explanatory power, with an R-value indicating that 45.8% of the variance is accounted for. However, the R² value suggests that desirability accounts for only 21% of the variation in investment decisions, which remains relatively low. Unlike usability, this model shows significant predictive capacity, as the regression model's p-value is below the 0.05 threshold. A multiple regression analysis conducted on factors F7 through F11 further supports this finding, with F = 3.662, p < 0.0005, and an R² value of 0.210, suggesting a statistically significant impact of desirability factors on investment decisions. The hypothesis (H2), which examines whether desirability significantly influences investment decisions in flood-prone areas, is accepted with a significance value of 0.005. This confirms that desirability plays a crucial role in shaping investment behaviour. The regression equation for this model is expressed as:

Decisions to invest in flood risk areas = 1.406 + 0.318(F7) + 0.574(F8) - 0.093(F9) - 0.155(F10) - 0.058(F11)

Regarding marketability (Model 3), the regression analysis shows that factors F12, F14, F15, F16, and F17 positively influence investment decisions, while F13 exerts a negative effect. However, the model exhibits weak explanatory power, accounting for only 20.4% of the variation in the data, as indicated by the R-value. The R² value further demonstrates that marketability explains only 4.2% of the variation in investment decisions, indicating a minimal effect. The statistical significance of the regression



model suggests that marketability does not significantly predict investment decisions, as the p-value exceeds the 0.05 threshold. A multiple regression analysis conducted on factors F12 to F17 confirms these findings, with F = 0.494, p > 0.0005, and $R^2 = 0.042$. The hypothesis (H3), which proposes that marketability significantly influences investment decisions in flood-prone areas, is not supported, given its non-significant p-value of 0.811. The regression equation for this model is formulated as:

Decisions to invest in flood risk areas = 1.674 + 0.018(F12) - 0.191(F13) + 0.010(F14) + 0.212(F15) - 0.252(F16) + 0.113(F17)

The responses from property investors also provide additional insights into their attitudes towards insurance as a risk management strategy. None of the investors reported having insurance coverage for their properties, indicating a general reluctance to adopt formal financial protection mechanisms. The reasons being that it is a very expensive and that they don't get flooded regularly. Although they acknowledged the potential benefits of insurance in facilitating recovery after flood events, they expressed scepticism about its practicality. The prevailing perception is that the insurance market in Nigeria is underdeveloped, characterised by low participation and limited awareness of its advantages. Investors noted that high premiums serve as a deterrent, discouraging them from integrating insurance into their investment portfolios.

Existing literature supports the role of insurance in mitigating the financial impact of flooding. The Intergovernmental Panel on Climate Change (1990) highlights that insurance participation can reduce flood-related financial losses, while Lamond et al. (2019) emphasise its role in ensuring timely compensation and recovery. Similarly, Kreibich et al. (2007) suggest that risk mitigation strategies are influenced by the regulatory environment of the insurance sector. However, despite these theoretical benefits, the study findings reveal that investors in Nigeria do not perceive insurance as a viable strategy. Many respondents believe that insurance premiums are exorbitant relative to the infrequent occurrence of flooding, making it an unattractive option. Others noted that past experiences with insurance firms suggest inefficiencies in claims processing, further eroding confidence in the sector.

The reluctance of property investors to engage with insurance underscores broader challenges within the Nigerian insurance industry. According to Lamond and Penning-Rowsell (2014), several flood risk management measures have been implemented globally to mitigate financial losses, yet similar initiatives remain limited in Nigeria. Investors in this study expressed doubts about the sustainability of the local insurance system, citing its high costs and lack of accessibility. Most respondents argued that the financial burden of insurance premiums outweighs its perceived benefits, leading to widespread non-participation. Some even described the quotes they received from insurance firms as unreasonable, reinforcing their decision to forgo coverage.



The study findings suggest that the usability, desirability, and marketability of property investments play varying roles in influencing investment decisions in flood-prone areas. While desirability is a significant predictor, usability and marketability exhibit weaker associations with investment behaviour. Additionally, the absence of insurance adoption among property investors highlights a critical gap in Nigeria's flood risk management framework. Addressing these challenges requires targeted interventions, such as improved public awareness campaigns, more affordable insurance options, and regulatory reforms to enhance trust in the insurance sector. Integrating these measures, policymakers can create a more resilient investment environment in flood-risk areas, ultimately fostering sustainable real estate development.

Discussion of Findings

Beyond financial considerations, non-monetary value attributes play a crucial role in shaping investors' decision-making in flood-risk areas. While economic factors such as insurance premiums and income loss remain primary determinants, intangible elements related to property usability, desirability, and marketability also contribute to investment behavior. The findings of this study highlight the nuanced ways in which these non-monetary factors interact with economic considerations to influence investment decisions. The analysis of the likelihood of investing in flood-risk areas demonstrates varying degrees of influence across the three key constructs: usability, desirability, and marketability. The results indicate that desirability has the strongest predictive power ($R^2 = 0.210$), while usability ($R^2 = 0.101$) and marketability ($R^2 = 0.042$) exhibit weaker explanatory capacities. This suggests that investors are more concerned with factors influencing the desirability of flood-prone properties than those related to their usability or marketability.

The usability model, despite its weak explanatory power ($R^2 = 0.101$), suggests that property function plays a role in investment considerations. The non-significance of F1 (decline in property demand due to flooding) and F2 (income loss from limited property use) challenges the assumption that flood risk automatically leads to functional obsolescence. Instead, the marginal significance of F4 (flooding negatively affecting property use, p = 0.093) suggests that usability constraints may be more relevant in specific contexts, such as properties with prolonged flood exposure or inadequate drainage infrastructure. Investors may assess usability based on adaptability rather than outright rejection of flood-prone properties. For example, residential properties designed with elevated structures or adaptive use strategies (e.g., mixed-use development, elevated parking, or water-resistant materials) may still retain value despite flood risk. This implies that investors, rather than dismissing flood-risk properties outright, may integrate flood adaptation into their decision-making framework. However, given the low significance of usability predictors, it is likely that investors perceive usability challenges as manageable risks rather than deal-breakers. Within the usability model, no individual factor exhibited statistical significance at the conventional p < 0.05 threshold. Although F4 (presence of flooding affecting property use) demonstrated a marginal significance (p = 0.093), its impact remains inconclusive.



This suggests that while flooding may influence property usability, it does not significantly deter investment on its own. Similarly, F5 (availability of flood insurance), which was expected to encourage investment by mitigating perceived risk, was not statistically significant (p = 0.173). This finding implies that while insurance may be a facilitating factor, it is not a primary determinant in investors' decision-making.

Desirability, as measured by rental and capital value trends, flexibility in lease terms, and overall demand for property, exhibits stronger predictive power ($R^2 = 0.210$) compared to usability and marketability. The significance of F8 (cheaper insurance premiums positively influencing desirability, p = 0.000 indicates that investors view insurance accessibility not just as a financial tool, but as a confidence-enhancing mechanism that mitigates perceived risks. This suggests that desirability is not solely dictated by flood risk itself, but by the presence of risk management strategies that make investment more appealing. However, the non-significance of F9 (flood risk reducing desirability, p = 0.712) and F11 (income loss reducing desirability, p = 0.802) suggests a divergence between perception and financial reality. This finding challenges the conventional wisdom that flood-prone properties are inherently undesirable. Instead, desirability appears to be contingent on perceived risk mitigation strategies rather than the presence of flood risk itself. This has implications for urban planners and policymakers, as it suggests that investors may be willing to accept flood-risk properties if appropriate protective measures (e.g., flood barriers, drainage improvement) are in place. The desirability model presents a more robust explanatory framework, with F8 (cheaper insurance premiums positively influencing investment decisions) being the only statistically significant factor (p = 0.000). This finding reinforces the notion that financial incentives, particularly reductions in insurance costs, can significantly enhance the attractiveness of flood-prone properties. In contrast, F9 (flood risk influencing desirability), F10 (flexible lease terms), and F11 (income loss affecting desirability) failed to achieve significance, suggesting that while these variables are theoretically relevant, their actual impact on investment decisions is limited. The overall significance of the desirability model (p = 0.005) indicates that investors prioritise financial feasibility over other perceived desirability constraints.

Marketability, as an investment determinant, appears to have the weakest influence on decision-making, as evidenced by its low R² value (0.042) and non-significant ANOVA result (p = 0.811). None of the individual marketability factors demonstrated statistical significance, highlighting the limited role that marketing considerations play in shaping investment preferences for flood-risk areas. This finding may suggest that investors perceive marketing challenges as secondary to more pressing financial and usability concerns. These findings suggest that financial considerations, particularly the cost of insurance, play a more significant role in shaping investment decisions in flood-risk areas than usability or marketability factors. While flooding may impact the functional use and desirability of properties, these effects alone do not necessarily deter investment unless they translate into increased financial burdens or reduced returns. The marketability model, which exhibited the weakest explanatory power ($R^2 = 0.042$), suggests that flood risk has minimal direct influence on the ability to sell or let properties in affected areas. The non-significance of all marketability factors, including F12 (higher income properties being more marketable despite flood risk, p > 0.05) and F16 (flood mitigation improving marketability, p > 0.05), suggests that investors may not prioritize



marketability as a key decision-making factor. This finding is particularly relevant when considering the liquidity of real estate assets in flood-prone regions. While some investors may anticipate reduced demand for resale or rental, the lack of statistical significance in marketability factors implies that marketability is not a primary concern in flood risk investment decisions. This suggests that investors may adopt a longer-term perspective, focusing on sustained income generation rather than short-term liquidity. Additionally, the lack of significance for F17 (difficulty marketing flooded properties even with flood protection, p > 0.05) challenges the assumption that flood protection automatically enhances marketability. Instead, the ability to sell or rent a property may be influenced by broader market conditions, investor sentiment, and overall economic stability, rather than flood risk alone.

Implications for research and practice

The paper would add to the research particularly coming from an undeveloped country. The findings indicate that while economic factors remain central to decision-making, non-monetary attributes such as perceived usability, desirability, and marketability also shape investment behavior. Investors do not solely assess flood-risk properties based on financial costs but also consider adaptive potential, risk perception, and long-term viability. For policymakers, the results highlight the importance of promoting risk adaptation measures rather than simply discouraging investment in flood-prone areas. Since desirability is significantly influenced by insurance premiums, governmentbacked subsidized insurance schemes or incentives for flood-resistant building materials could enhance investment confidence. Similarly, improving public infrastructure to reduce flood vulnerability may indirectly enhance both desirability and usability, thereby influencing investment flows into high-risk areas. From an investor perspective, the findings suggest that the presence of flood risk does not inherently make a property unviable. Instead, decision-making appears to be influenced by the availability of mitigation strategies and adaptive infrastructure. As such, investors may focus on properties with higher resilience, flexible leasing conditions, and lower insurance costs rather than outright avoiding flood-prone areas. The study demonstrates that non-monetary attributes should not be overlooked in flood-risk property investment analysis. While direct financial impacts such as insurance costs and income losses remain important, factors such as perceived usability, desirability, and marketability collectively shape investment decisions.

Conclusions

This study investigated how people perceive the risk of flooding and how that impression affects their decisions regarding real estate investments. Pertinent thematic statements revolving on the desirability, usability, and marketability of residential properties in areas at risk of flooding for investment purposes were formulated for the study. These three themes (desirability, usability, and marketability) were investigated to discover the relationship that coexists between them and decision-making regarding flood risk. According to the findings of the study, there is a connection between the impression of flood danger, insurance, property leases, and property desirability, and the implications that these factors have for decision-making regarding property



investment. As an additional point of emphasis, it has been stressed that having an awareness of this connection is essential to extend the lifespan of a real estate investment. In most cases, the value of an investment in real estate is attributed to measurable physical features and market forces, with perception and behavioural aspects receiving minimal consideration. This study proposes a three-part conceptualisation approach, with the sole aim of determining the perception of flood risk and its implication on decisions about residential property investment. This was evaluated by considering the useability, desirability, and marketability value of the investigated properties. The study methodology was developed to cope with the challenge of determining these impacts in situations where market transaction databanks are not available.

This research makes a significant contribution to the body of knowledge by gaining an understanding of the perceptions of flood risk held by stakeholders and incorporating those perceptions into their property investment decision-making process. The study is essential for individual and corporate property owners who seek to maintain the value of their investment portfolios due to the ability of real estate investment to generate income and as well hedge against inflation. The study found that investors within the study area have a low affinity for insurance as a means of property securitisation in case of eventuality. It was concluded that government participation in insurance schemes would be beneficial to the property markets and would increase the overall level of trust that people have in flood risk management. To effectively advise investors on the risks associated with property investments, professionals working in the built environment will need to make investments in the acquisition of insurance knowledge and maintain close relationships with insurance companies. It is also necessary for property investors to increase their level of expertise, and the most effective approach to accomplish this would be to constantly seek pre-investment counsel and information that is readily available to the public. Based on the study, it is pertinent to note that future research could explore additional moderating variables, such as government incentives, risk perception, and adaptive property strategies, to further refine the understanding of investment behavior in flood-prone areas. Furthermore, future research could also explore how investor behavior evolves over time in response to climate adaptation policies and changes in flood risk perception.

Acknowledgements

Author Contributions: Conceptualization, A.K.O., R.B.A., and C.V.A.; methodology, A.K.O. and C.V.A.; software, A.K.O.; validation, A.K.O., and C.V.A.; formal analysis, A.K.O., R.B.A., O.T.O and T.O; investigation, A.K.O., and C.V.A.; resources, A.K.O.; data curation, A.K.O.; writing—original draft preparation, A.K.O; writing—review and editing, A.K.O., C.V.A., R.B.A., O.T.O and T.O; visualization, A.K.O., and C.V.A.; supervision, A.K.O. R.B.A., O.T.O and T.O; project administration, A.K.O., and R.B.A.; funding acquisition, R.B.A and A.K.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Tertiary Education Trust Fund (TETFUND), Nigeria. The funding support of Lancaster Environment Centre, Lancaster University is also well appreciated.



Informed Consent Statement: Informed consent was obtained from the respondents involved in the study. Written informed consent has been obtained from the respondents to publish this paper.

Institutional Ethics Approval: There was institutional ethics approval from Lancaster University obtained to conduct this study. The ethical considerations included the confidentiality of respondents.

Data Availability Statement: The data will be made available upon reasonable request, but it is being used to produce other publications from the research.

Acknowledgments: The authors acknowledge the support given by the author's institutions and the funders. The support from the industry experts and respondents for the administrative and technical support are all acknowledged.

Conflicts of Interest: The authors make a declaration that no conflict of interest exist.

References

Akbar, D., Rolfe, J., Small, G., & Hossain, R. (2015). Assessing flood impacts on the regional property markets in Queensland, Australia. *Australasian Journal of Regional Studies*. 21(2):160-177. <u>https://hdl.handle.net/10018/1038439</u>

Atreya, A., Ferreira, S., & Kriesel, W. (2013). Forgetting the flood? An analysis of the flood risk discount over time. *Land Economics* 89(4):577-596. <u>https://doi.org/10.1353/lde.2013.0040</u>

Babcock, M. & Mitchell, B. (1980). Impact of flood hazard on residential property values in Galt (Cambridge), Ontario. *Journal of the American Water Resources Association*, *16*(3):532-537. https://doi.org/10.1111/j.1752-1688.1980.tb03908.x

Baldauf, M., Garlappi, L., & Yannelis, C. (2020). Does climate change affect real estate prices? Only if you believe in it. *The Review of Financial Studies*, 33(3):1256-1295. <u>https://doi.org/10.1093/rfs/hhz073</u>

Beltrán, Allan; Maddison, David; Elliott, Robert J. R. Is Flood Risk Capitalised Into Property Values?, *Ecological Economics*, Volume 146, 2018, Pages 668-685, ISSN 0921-8009, https://doi.org/10.1016/j.ecolecon.2017.12.015.

Beniston, M. & Stephenson, D.B. (2004). Extreme climatic events and their evolution under changing climatic conditions. *Global and Planetary Change*, 44, 1-9. <u>https://doi.org/10.1016/j.gloplacha.2004.06.001</u>

Bernstein, A., Gustafson, M.T., & Lewis, R. (2019). Disaster on the horizon: The price effect of sea level rise. *Journal of Financial Economics*, 134(2):253-272. https://doi.org/10.2139/ssrn.3073842



Bhattacharya-Mis, N. (2014). A model to investigate the impact of flooding on the vulnerability of value of commercial properties. A doctoral thesis submitted to the University of Wolverhampton.

Bhattacharya-Mis, N. & Lamond, J.E (2016). Risk perception and vulnerability of value: a study in the context of commercial property sector. *Int. Journal of Strategic Property Mgt.* 20(3):252–264. https://doi.org/10.3846/1648715x.2016.1188174

Bin, O. & Kruse, J. (2006). Real estate market response to coastal flood hazards. *Nat. Haz.Review*, 7(4):137-144. <u>https://doi.org/10.1061/(ASCE)1527-6988(2006)7:4(137)</u>

Birkholz, S., Muro, M., Jeffrey, P., & Smith, H. M. (2014). Rethinking the relationship between flood risk perception and flood management. *Science of the total environment*, 478, 12-20. https://doi.org/10.1016/j.scitotenv.2014.01.061

Bond, S. (2000). *Estimating stigma of ex-contaminated land: The "buyer beware" principle reigns*. Sixth Pacific Rim Real Estate Society Conference, Sydney, Australia 23-27 January.

Creswell, J.W. (2009). *Research design qualitative, quantitative and mixed methods approaches*. 3rd Ed. London: Sage Publications Ltd.

Crichton, D. (2003). *Flood risk and insurance in England & Wales: Are there lessons to be learned from Scotland?* Benfield Greig Hazard Research Centre, Department of Earth Sciences, University College London, London.

Dahl, K., Cleetus, R., Spanger-Siegfried, E., Udvardy, A., & Worth, P. (2018). *Underwater rising seas, chronic floods, and the implications for US coastal real estate*. June, 1–27.

Durdyev, S., Hosseini, M.R., Martek, I., Ismail, S. & Arashpour, M. (2019). Barriers to the use of integrated project delivery (IPD): A quantified model for Malaysia. *Engineering, Construction and Architectural Management,* 27(1):186-204. <u>https://doi.org/10.1108/ECAM-12-2018-0535</u>

Eves, C. (2004). The impact of flooding on residential property buyer behaviour: An England and Australian comparison of flood affected property. *Structural Survey*, 22(2), 84-94. <u>https://doi.org/10.1108/02630800410538613</u>

Gerald-ugwu, G.C., Egolum, C.C., & Emoh, I. (2019). An investigation of factors accelerating rise in building in the flood prone areas of Port-Harcourt. *Iconic Research and Engineering Journals*. 3(1):375–384.

Green, C.H. & Penning-Rowsell, E.C. (1989). Flooding and the quantification of intangibles. *Journal of the Institution of Water and Environmental Management, 3*(1):27-30. https://doi.org/10.1111/j.1747-6593.1989.tb01363.x

Gutman, J. (1982). A means-end chain model based on consumer categorization processes. *Journal of Marketing*, 46(2):60-72. https://doi.org/10.1177/002224298204600207

Harris, J., Durdyev, S., Tokbolat, S., Ismail, S., Kandymov, N. & Mohandes, S.R. (2019). Understanding construction stakeholders' experience and attitudes toward use of the



structurally insulated panels (SIPs) in New Zealand. *Sustainability*, 11(5458):1-14. <u>https://doi.org/10.3390/su11195458</u>

Harrison, D.M., Smersh, G.T., & Schwartz, A.L. (2001). Environmental determinants of housing prices: The impact of flood zone status. *Journal of Real Estate Research*, 21(1/2), 3-20. https://doi.org/10.1080/10835547.2001.12091045

Hennighausen, Hannah and Suter, Jordan F. "Flood Risk Perception in the Housing Market and the Impact of a Major Flood Event." *Land Economics*, vol. 96 no. 3, 2020, p. 366-383. Project MUSE <u>muse.jhu.edu/article/758939</u>

Horn, D. & Mcshane, M. (2013). Flooding the market. *Nature Climate Change* 3(11):945-947. <u>https://ssrn.com/abstract=2351253</u>

Keinonen, T. (1997). *One-dimensional usability - Influence of usability on consumers' product preference*. Taideteollinen korkeakoulu, UIAH A 21, Helsinki.

Lambley, D.B. & Cordery, I. (1991). *Effects of floods on the housing market in Sydney. In International Hydrology and Water Resources Symposium* (National Conference Publication 91/19) (pp. 863-866). Barton, Australia: The Institution of Engineers Australia.

Lamond, J.E. (2008). *The impact of flooding on the value of residential property in the UK*. PhD Thesis. Wolverhampton: University of Wolverhampton

Lamond, J., Proverbs, D., & Hammond, F. (2010). The impact of flooding on the price of residential property: A transactional analysis of the UK market. *Housing Studies*, 25(3), 335–356. <u>https://doi.org/10.1080/02673031003711543</u>

Lessing, B., Thurnell, D. & Durdyev, S. (2017). Main factors causing delays in large construction projects: Evidence from New Zealand. *Journal of Management, Economics and Industrial Organization*, 1(2):63-82. <u>https://doi.org/10.31039/jomeino.2017.1.2.5</u>

Mind'je, R., Li, L., Amanambu, A. C., Nahayo, L., Nsengiyumva, J. B., Gasirabo, A., & Mindje, M. (2019). Flood susceptibility modeling and hazard perception in Rwanda. *International journal of disaster risk reduction*, *38*, 101211. <u>https://doi.org/10.1016/j.ijdrr.2019.101211</u>.

Minnery, J.R. & Smith, D.I. (1996). *Climate change, flooding and urban infrastructure*. In Bosma, W.J., Pearman, G.I. and Manning, M.R. (eds.), Greenhouse. Coping with Climate Change, CISRO, Australia, 235-247.

Mundy, B. (1990). The impact of hazardous materials on property value. *The Appraisal Journal* 60(2):155-162. <u>http://doi.org/10.1038/nclimate2025</u>

Oppenheim, A. (1992). *Questionnaire design, interviewing and attitude measurement*. Continuum: London



Oyetunji, AK, Oluleye, IB, Olukolajo, MA & Chan, DWM (2022). 'Is green good: Unveiling the latent benefits of sustainable housing delivery', *Cities*, vol. 129, 103809. https://doi.org/10.1016/j.cities.2022.103809

Patton, M.Q. (2002). *Qualitative research and evaluation methods*. Sage, Thousand Oaks, CA. Pitt, M. (2008). *The Pitt review - Learning lessons from the 2007 floods*. Cabinet office, London.

PRC (Property Research Centre). (1992). *Effect of flooding on residential property values*. (Final Report to the Upper Parramatta River Catchment Trust). Hawkesbury, Sydney: Faculty of Business and Land Economy, University of Western Sydney.

Queensland Flood Science, Engineering and Technology Panel (2012). *Understanding the flood*. <u>http://www.chiefscientist.qld.gov.au/publications</u>. Accessed on 13 Jan 2020

Rözer, V. & Surminski, S. (2021). Current and future flood risk of new build homes across different socio-economic neighbourhoods in England and Wales. *Environmental Res. Letters*. *16*,*1*–*16*. <u>https://doi.org/10.1088/1748-9326/abec04</u>

Santoro, S., Pluchinotta, I., Pagano, A., Pengal, P., Cokan, B., & Giordano, R. (2019). Assessing stakeholders' risk perception to promote Nature Based Solutions as flood protection strategies: The case of the Glinščica river (Slovenia). *Science of the total environment*, 655, 188-201. https://doi.org/10.1016/j.scitotenv.2018.11.116

Shackel, B. (1991). *Usability – context, framework, design and* evaluation. In Shackel, B. and Richardson, S. (Eds), Human Factors for Informatics Usability, Cambridge University Press, Cambridge, pp. 21-38.

Shrubsole, D., Green, M., & Scherer, J. (1997). The actual and perceived effects of floodplain land-use regulations on residential property values in London, Ontario. *Canadian Geographer*, *41*(2):173-193. <u>https://doi.org/10.1111/j.1541-0064.1997.tb01156.x</u>

Soentato, R. & Proverbs, D.G. (2004). Impact of flood characteristics on damage caused to UK domestic properties: The perceptions of building surveyors. *Structural Survey*, 22(2):95-104. <u>https://doi.org/10.1108/02630800410538622</u>

Terpstra, T., Lindell, M.K., & Gutteling, J.M. (2009). Does communicating (flood) risk affect (flood) risk perceptions? Results of a quasi-experimental study. *Risk Analysis*. 29(8):1141-1155. https://doi.org/10.1111/j.1539-6924.2009.01252.x

Tobin, G.A. & Montz, B.E. (1990). Response of the real estate market to frequent flooding: The case of Des Plaines, Illinois. *Bulletin of the Illinois Geographical Society*. 33(2):11-21. <u>https://digitalcommons.usf.edu/geo_facpub/131</u>

Tobin, G.A. & Montz, B.E. (1994). The flood hazard and dynamics of the urban residential land market. *Journal of the American Water Resources Association*, 30(4):673-685. <u>https://doi.org/10.1111/j.1752-1688.1994.tb03322.x</u>



Troy, A., & Romm, J. (2004). Assessing the price effects of flood hazard disclosure under the California natural hazards disclosure law (AB 1195). *Journal of Environmental Planning & Mgt* 47(1), 137-162. <u>https://doi.org/10.1080/0964056042000189844</u>

Turnbull, G.K., Zahirovic-Herbert, V., & Mothorpe, C. (2013). Flooding and liquidity on the Bayou: The capitalization of flood risk into house value and ease-of-sale. *Real Estate Econs*. 41(1):103–129. https://doi.org/10.1111/j.1540-6229.2012.00338.x

Worthington, A.C. (2008). The impact of natural events and disasters on the Australian stock market: A GARCH-M analysis of storms, floods, cyclones, earthquakes and bushfires. *Global Bus. & Econs* Review, 10(1):1–10. https://doi.org/10.1504/GBER.2008.016824

Zhang, L. & Leonard, T. (2019). Flood hazards impact on neighborhood house prices. The *Journal of Real Estate Finance and Economics*, *58*(4):656–674. <u>https://doi.org/10.1007/s11146-018-9664-1</u>