INTERNATIONAL REAL ESTATE REVIEW

2025 Vol. 28 No. 2: pp. 177 – 205

Trends and Patterns in Housing Price - Natural Disaster Research: A Bibliometric Analysis

Ariyanto Adhi Nugroho
Universitas Sebelas Maret, Indonesia, Email: ariyanto_an@staff.uns.ac.id
Yunastiti Purwaningsih*
Universitas Sebelas Maret, Indonesia, Email: yst_stm13@staff.uns.ac.id;
Lukman Hakim
Universitas Sebelas Maret, Indonesia, Email: lukmanhakim@staff.uns.ac.id
Suryanto Suryanto
Universitas Sebelas Maret, Indonesia, Email: suryanto_feb@staff.uns.ac.id
Laela Rizki Fauzia
Universitas Sebelas Maret, Indonesia,
Email: laelarizkifauzia@student.uns.ac.id

Understanding the trends and patterns of the relationship between housing prices and disasters is crucial for economic impact assessment, risk management, and policy formulation, driven by the unpredictable and urgent nature of disasters. Despite its significance, the conceptualization of these terms remains unclear, with no consensus on their interconnectedness. To address this gap, our study uses a bibliometric analysis of peer-reviewed literature from the Scopus database from 1967 to early 2024. The results show that the literature on the relationship between house prices and natural disasters is still limited, with only 144 articles available. The topic shows a trend of linear increase in annual publications. There are two clustered network maps generated from an analysis through VosViewer. The first cluster focuses on disaster risk assessment and prevention, while the other cluster highlights the relationship between housing prices and natural disasters in the same network. The relationship between housing prices and natural disasters is generally negative, and different disaster impacts require different mitigation strategies based on the socioeconomic conditions of a region. This study emphasizes the need for comprehensive research with the use of region-based cluster analyses

* Corresponding author

to gain deeper insights into the various impacts of natural disasters on housing prices.

Keywords

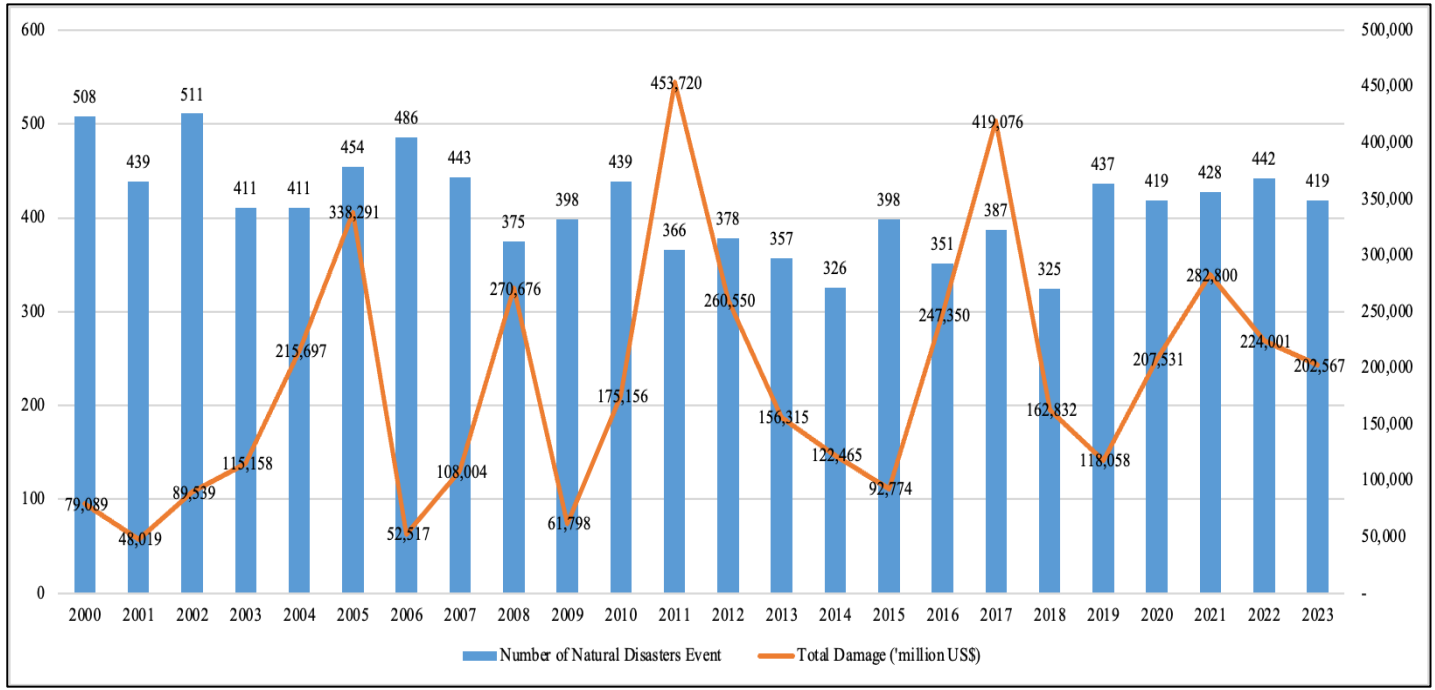
Bibliometric analysis, Natural disaster, Housing price

1. Introduction

Natural disasters often cause significant physical damage to buildings and infrastructure, which negatively affect property values and lower home prices in affected areas. According to Kousky (2010), significant physical damage and increased perceived risk among buyers and investors are the main factors that cause housing prices to decline post-disaster. The period from 2000 to 2023 saw significant fluctuations in the occurrence of natural disasters globally; see Figure 1. Natural disasters include a wide range of events such as earthquakes, floods, hurricanes, droughts, forest fires, tsunamis, and so on and so forth. The frequency of disaster events continues to increase due to various factors, including climate change, population growth, and increasing urbanization, which often puts more people and infrastructure at risk. The total economic damage caused has also increased significantly, which includes direct costs such as damage to infrastructures, homes, and businesses, as well as indirect costs including lost productivity, emergency response expenses, and long-term economic impacts on communities and countries.

All of the data shown clearly indicate that houses, the main asset of the population, are vital, and creating a clear understanding of their insurance needs is vital and determining their insurance needs is crucial. These are especially important after a disaster where the impacts only strengthen the need to preserve property. For example, Bin et al. (2008) propose that disasters cause premiums on property insurance to rise, which leads to potential and actual property owners being less likely to buy property, due to the high insurance cost. According to the analysis and findings in Dixon et al. (2006), high insurance rates have a negative impact on property market activities, which cause an outflow of investment from places prone to disasters and where high insurance rates are expected because the demand for properties is simply low.

Figure 1 Natural Disaster Events and Total Damage Worldwide: 2000 to 2023



Source: Data based on EM-DAT, CRED / UCLouvain, Brussels, Belgium

The unique characteristics of houses are fixity, durability, slow rate of technological change, proneness of neighborhood effects, and sensitivity to credit (O'Sullivan, 2012). Fixity means that a house cannot be moved from one location to another which applies to all houses. However, the durability of houses or resistance to material degradation, means that houses can withstand the test of time. The slow rate of technological change is also a prominent feature because technology in house construction does not change as quickly as other sectors such as information technology. On the same note, all houses are exposed to, or prone to the environmental conditions of the neighborhood. These primarily include the quality of schools and security facilities and public amenities, with all affecting the housing value in one way or another. Finally, there is sensitivity to credit, which refers to house prices being highly dependent on the availability and cost of housing credit. Interest rates or credit policies also tend to have an immense impact on house prices. Then, housing has a dualistic motive, namely investment and consumption. As Arrondel and Lefebvre (2001) state, people buy houses because they are considered to be a consumer good and investment asset.

Government policies for the mitigation of risk of disaster, therefore, contribute a great deal to house price dynamics. In Der Sarkissian et al. (2022), building disaster-resilient infrastructure and having tight regulations on zoning can notably reduce risks and regain confidence in the property market. Besides, the different effects of natural disasters allow for various changes in demographics and the housing market across affected regions to vary with long-term effects (Arrondel and Lefebvre (2001; Graff Zivin et al., 2023). Consequently, Burby et al. (2001) show that effective spatial planning reduces the economic losses caused by disasters and creates some degree of stability in house prices. Innovations in the construction and property industries influence house prices in disaster-prone areas too. According to Cutter et al. (2003), properties developed with disaster-resistant technology and stronger construction materials are valued at higher market prices compared with conventionally built properties. In line with this, Chang et al. (2010) find that houses situated in an area that imposes mitigation technologies against natural hazards demand a higher price premium.

Regional characteristics cause differences in housing market development (Hernández-Murillo et al., 2017; Tuzel and Zhang, 2017). A number of regions are overcoming market slowdown and saturation that are influenced by regional economic conditions, development prospects, geographical conditions, and purchasing power. Furthermore, housing market development is in line with the characteristics of houses, such as location, unit size, age, geographical conditions, and whether the unit is intended for sale or rent to consumers (Belsky, 2009; Canepa and Khaled, 2018; Sullivan, 1994; Tsai, 2019). Purchasing power can also be influenced by social and psychological factors which play an important role in determining post-disaster house prices. Carbone et al. (2006) state that social stigma and trauma experienced by the community can influence the decision to buy or sell property in affected areas. Research by

Atreya and Ferreira (2015) shows that perceived security and quality of life by the people in an affected location greatly influence the value of properties.

While diverse, location is an important factor in determining house value, which Kiel and Zabel (2008) have pointed out as three key drivers: "location, location, and location". Using a methodical content and bibliometric analysis, the two objectives of this research are, first, to track the evolutionary path and complex relationships of the themes that have evolved in housing prices that concern natural disasters over time, and secondly, to track their geographical and sectoral focus. In so doing, the study points to the lacuna in the present research and the imperative necessity for more extensive studies if a proper understanding of the interrelationship between housing prices and disaster events is to be obtained. The derived understanding will in turn be useful for informing policymaking and further research efforts that need to be done to ensure that policies and plans are strategically based on a sound understanding of how disasters impact various housing markets in different locations and sectors. This will provide deeper insights to make them more resilient and better prepared for the impacts.

2. Materials and Methods

2.1 Organization of the Review

We developed and applied strict inclusion criteria based on the article title, abstract, and keywords, and used a multi-step screening process. Figure 2 is a flow chart of the data collection process and outlines the steps, along with the query string inputted for the search. The initial data collection was completed on May 15th, 2024. Scopus is selected since it is compatible with VOSviewer, which is a software used to conduct publication network analyses, and a powerful tool designed for bibliometric analyses which enables a researcher to visually map linkages between various keywords and concepts within a specific research area. It is important to note that VOSviewer can handle data structures downloaded from Scopus, while data from sources like Web of Science, Dimensions, and PubMed are cumbersome to manage because they come in different formats. Besides, Scopus is one of the most important databases because it has a huge collection of peer-reviewed scholarly literature, a reason why the articles for this study have been taken from this source. This selection also precisely fits the topic of the research in the realm of the social sciences as suggested by Mongeon and Paul-Hus (2016). In addition, the social sciences entail a number of disciplines that include political science, urban planning, economics, and geography. More importantly, Scopus has more references and citations compared to the Web of Science as reported by Visser et al. (2021), therefore, it is more comprehensive in responding to the purposes of this study. The Scopus search strategy also includes an advanced search feature to filter the relevant articles.

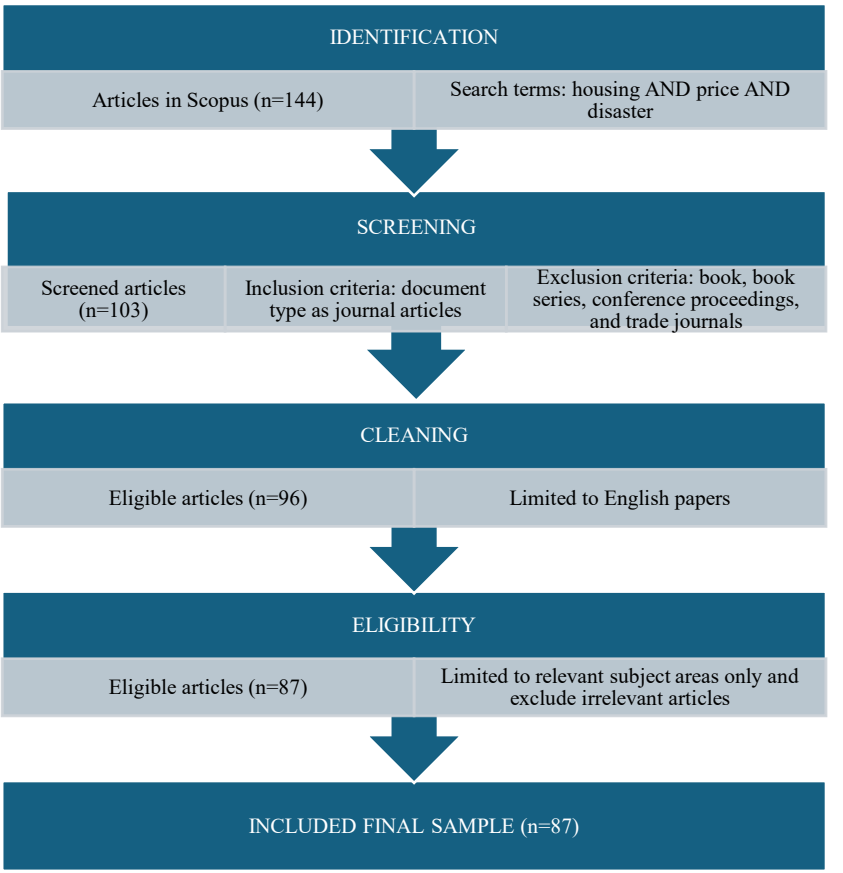
We use the filters in Scopus for subject area to exclude irrelevant disciplines based on the criteria in the screening, cleaning, and eligibility steps until we obtain the final sample of articles for analysis. The first step of the literature search or the identification step is to input two terms into the document search: housing price and disaster. By narrowing the keyword scope down to "housing price" and "disaster", the literature collected will directly align with the research focus, that is, to investigate the relationship between housing prices and natural disasters. The time period of the search is set from 1967, which is the first year that the relevant topics were published, to 2024 which is the most current year at the time of writing. As the results are limited with only 144 articles, we manually evaluate the articles.

The second or screening step is to refine the search based on type of document, including journal and review articles, and books. Book chapters and conference papers are also included as grey literature that can be useful to minimize publication bias (Mahood et al., 2014; Paez, 2017). Both also often contain keywords that are important for bibliometric analyses. All these sources typically provide findings from case studies or have a conceptual theory built upon previous experience. Under the filter bar “source type” in Scopus, the entries for titles of books, book series, conference proceedings, and trade journals are excluded as individual articles to prevent false positives (i.e., duplication of articles) or Type 1 errors. If included, these will cause a false positive in the result, so these are not counted in the search (Sweileh et al., 2017). To address Type I errors, we conduct a manual review of all search results to ensure their relevance to the relationship between housing prices and natural disasters.

Furthermore, to minimize Type II errors or false negative errors, our approach includes utilizing broad search terms such as "housing" and "disaster" to cast a wide net in our initial search. We incorporated related keywords and their variations, such as "property value", "real estate price", and "home value” for housing, and "natural hazard", "catastrophe", and "extreme weather event" for disaster. By conducting iterative searches, we used keywords found in relevant articles to refine and expand our search terms. We used snowballing, and then reviewed the reference lists of highly relevant articles to identify additional studies that may have been missed in the initial database search. Thus, we set a wide timeframe for our search to capture historical trends and patterns. By implementing these measures, we balance inclusivity and accuracy in our literature search, thereby enhancing the validity and comprehensiveness of our bibliometric analysis.

There are about 103 papers retrieved in total at this stage with only journal articles as the type of document.

Figure 2 Data Collection and Retrieval Process



The third or cleaning step is to exclude documents written in languages other than English which resulted in 87 papers. The fourth or eligibility step is to remove the entries that are too removed from the subject of the main topics. The limitation of keywords helps to filter irrelevant studies that might involve general market dynamics or impacts of disasters unrelated to the focus, such as those related to the health care and agricultural sectors. This cleaning process reduces the "noise" of the data and, therefore, enhances the accuracy of the analysis. Specific keywords that are found in the title, abstract, and keyword fields are detailed in Figure 3.

Figure 3 Keyword Search for Articles in Scopus Database

```
(TITLE-ABS-KEY (housing AND price) AND TITLE-ABS-KEY (disaster)) AND
(LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "ECON") OR
LIMIT-TO (SUBJAREA, "ENVI") OR LIMIT-TO (SUBJAREA, "MULT") OR
LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND
(LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English"))
```

Cleaning, sorting, and formatting of bibliographic data were initially done in Microsoft Excel so that the data were ready for the research analysis. Once this was set up, data related to keyword analysis were exported into VOSviewer. While Scopus provides the entries based on the queries, some parameters cannot be found through its online search tools. Hence, the last stage is done manually to exclude duplicate articles, systematic literature review papers, editorial papers, and titles of edited books. The steps used in Benita (2021), Rialti et al. (2019), and Wimbadi and Djalante (2020) are used as reference to carry out the steps in Figure 2 with 87 entries remaining for analysis through a bibliometric analysis.

2.2 Bibliometric Analysis

Bibliometric analysis is an exceptional method used for scientific research, which provides a general view of the tendencies and series of patterns on studies of a certain topic. Using data from citations, journals published, and works indexed, the analysis allows researchers to track the development of research over time, locate leading research centers, and untangle the relationships between key concepts in this field (Visser et al., 2021). It is, however, very important to conduct a parallel systematic literature review (Marzi et al., 2020) for the thoroughness and accuracy of the findings. In the present paper, we adopt an integrated approach with a systematic literature review to address the selection of articles, along with a bibliometric analysis to answer the research questions about housing prices and natural disasters.

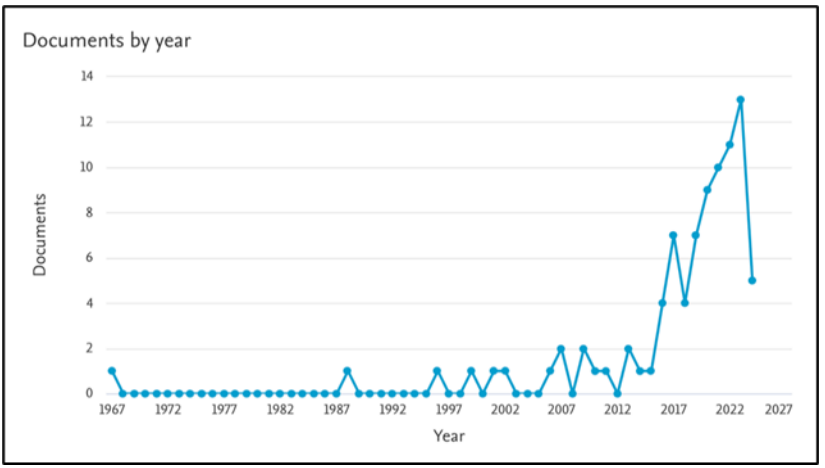
A bibliometric analysis can advance research in this field by investigating how research attention has changed with a more in-depth understanding of the complex relationship between housing prices and natural disasters. By looking at prevailing trends in research, researchers may note aspects that have not been well-studied or understood. This helps in prioritizing research efforts and proper allocation of research resources into the most crucial and appropriate areas (Wong et al., 2022). By grasping these research gaps, researchers can design more focused and meaningful studies to enhance comprehension of the complex interplay between housing prices and natural disasters, while also identifying research lacunae that may warrant further investigation.

3. Results

3.1 Systematic Overview of the Field

The publication trend for research on house prices and disasters retrieved from the Scopus database is plotted in Figure 4. The plot reveals a fascinating pattern: while the first study appeared in 1967, there is a gap in research activity between 1968 and 1987. This is followed by sporadic publications, with a single study in 1988 and another gap until 1995. The landscape began to shift in 2016 with a modest increase of three studies compared to the previous year. This momentum continued in 2017 with an additional three studies. However, 2018 witnessed a slight decline of three studies. Fortunately, the period from 2019 to 2023 shows a steady rise in research output, thus indicating a growing interest in this area. In this study, five studies have been published as of May 15, 2024. It is interesting that 2023 has the highest number of publications (13 studies). This analysis of publication trends provides valuable insights into the evolution of research on the relationship between house prices and disasters.

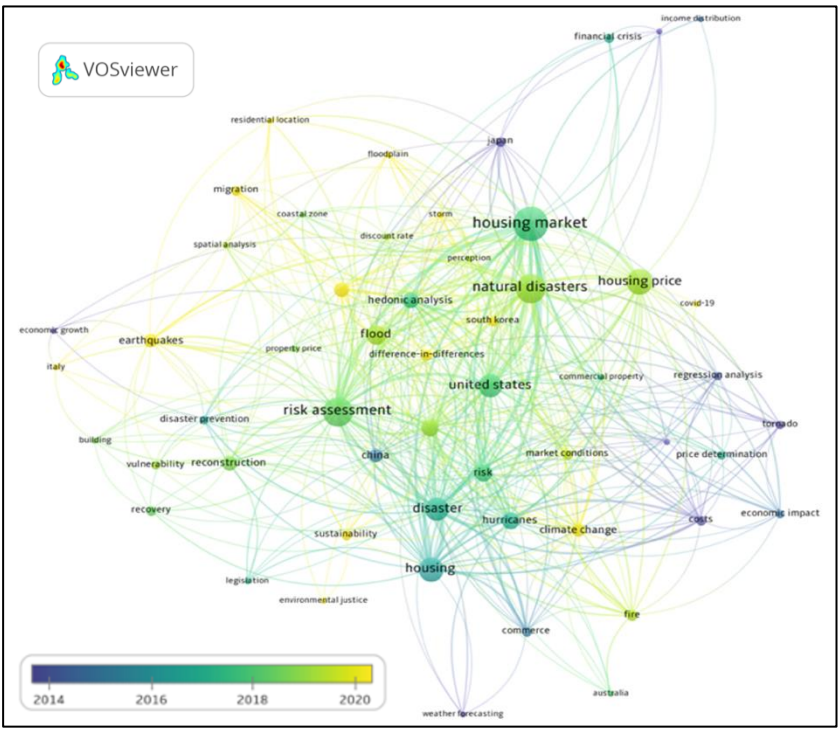
Figure 4 Number of Scopus Documents on House Price and Disaster



Source: Scopus Database (2024)

A cluster map that shows the research trends for house prices and disasters that span over six decades is provided in Figure 5. More recent investigations, which are depicted with a yellow line, suggest that for emerging research endeavours, it is advisable to prioritize a combination of frequency, connectivity, and recentness. Keywords that exhibit significant frequency and connectivity may signify extensive previous research, particularly within recent times. Conversely, in historical contexts, such metrics could imply an exhaustive exploration of the topic, potentially rendering it less suitable for further individual inquiry.

Figure 5 Housing Price and Natural Disaster Trend



3.2 Dominant Publishers, Institutions, Countries, and Authors

Our bibliometric analysis reveals that research on house prices and disasters is published in a wide range of journals, thus reflecting the interdisciplinary nature of this field. These journals represent a cross-section of different disciplines including environmental science (e.g., Natural Hazards), economics (e.g., Real Estate Economics), urban studies (e.g., Journal of Urban Economics), and sustainability (e.g., Sustainability Switzerland), thus indicating the multifaceted nature of housing price and disaster research. The breadth of the studies shows comprehensive coverage of the topic from various perspectives. Many of these journals, such as the Journal of Urban Economics and the Journal of Environmental Economics and Management, are well-respected in their fields, thus suggesting that high-quality research on this topic is being published in influential outlets. The publication patterns reveal sustained interest in the topic over time. For instance, Natural Hazards consistently published relevant articles from 2007 to 2022, with a peak in 2017. This longitudinal coverage allows for tracking the evolution of research in this area. The recent surge in publications in journals like Sustainability Switzerland (three articles in 2021) and the International Journal of Disaster Risk Reduction (two articles in 2022) indicates

growing attention to this topic in the context of sustainability and disaster risk reduction. Table 1 lists the number of publications in the journals of concern.

Table 1 Number of Selected Documents Based on Journal

Journal	Number of Publications
Natural Hazards	5
Sustainability (Switzerland)	4
Real Estate Economics	3
Journal of Urban Economics	3
Regional Science and Urban Economics	3
International Journal of Disaster Risk Reduction	3
Natural Hazards Review	3
Journal of Environmental Economics and Management	3
International Journal of Housing Markets and Analysis	2
Review of Regional Research	2
Caspian Journal of Environmental Sciences; SpringerPlus; Population and Environment; Economics Letters; Journal of Housing Economics; Environment and Planning B: Urban Analytics and City Science; National Tax Journal; Environmental and Resource Economics; Economic History Review; Environmental Science and Pollution Research; Urban Affairs Review; European Journal of Housing Policy; Journal of Real Estate Finance and Economics; Evergreen; Land Economics; Finance a Uver - Czech Journal of Economics and Finance; City; Frontiers in Built Environment; Public Choice; International Journal of Construction Management; Social Sciences; American Behavioral Scientist; Disaster Prevention and Management: An International Journal; International Journal of Disaster Risk Science; Urban Studies; International Journal of Emergency Management; Journal of Public Economics; International Journal of Financial Research; Journal of Regional Science; International Journal of GEOMATE; Jurnal Ekonomi Malaysia; Duke Environmental Law and Policy Forum; Landscape and Urban Planning; International Journal of Urban Sciences; Cities; International Real Estate Review; PLoS ONE; Japanese Economic Review; Property Management; Journal of Behavioral and Experimental Economics ; Computers, Environment and Urban Systems; Construction Management and Economics; Review of Regional Studies; Journal of Economic Dynamics and Control; Review of Urban and Regional Development Studies; Journal of Economic Geography; Southern Economic Journal; ABAC Journal; Studies in Economics and Finance; Journal of European Real Estate Research; The Social Science Journal; Journal of Financial Services Research; Urban Science; Journal of Flood Risk Management; Disasters; and Journal of Forest Economics	1
Total	**87**

Next, we present the most productive authors who examine the relationship between housing price and natural disasters, as shown in Table 2. To provide more context, we present the author background information and area of interest. For example, Lala Ma of the University of Kentucky specializes in urban economics and real estate, and focuses on the impact of natural disasters on the housing markets. Meanwhile, Shawn J. McCoy of the University of Nevada has expertise in environmental economics, particularly in climate change adaptation and disaster resilience. Laura A. Bakkensen of the University of Arizona focuses on research on environmental and urban economics, with emphasis on natural disaster risk and climate change. Furthermore, Jeongseob Kim of the Ulsan National Institute of Science and Technology focuses on urban planning and housing policy, including disaster-related housing issues. Maha Abdelhalim of the Centre Urbanisation Culture Société specializes in urban sociology and housing studies, including post-disaster recovery.

The Field-Weighted Citation Impact (FWCI) provides insight into the relative impact of the work of an author. Analyzing the relationship between productivity (number of publications (NP)) and FWCI reveals interesting patterns. The FWCI scores range from 0.33 to 2.68, thus indicating significant variation in the impact of publications across authors. There is no clear correlation between the NP and FWCI. For instance, Lala Ma has the highest NP of 3 and FWCI of 2.68, while Shawn J. McCoy has fewer publications (2), but has been highly cited, with 72 citations. This perhaps suggests that quality trumps quantity in some cases, where some authors who publish fewer works score high in terms of the FWCI, which indicates that a high level of productivity might not solely determine impact.

Note that even though the FWCI is a good metric, it needs to be considered with other criteria when evaluating the contribution of an author to the field. The Scopus H-index and total link strength (TLS) are further dimensions; that is, the impact of an author and his/her network of collaborations. The present analysis uncovers a variety of different researchers who contribute to housing price and natural disaster research. The diversity in the indicators underlines the complexity of the impact measurement in an interdisciplinary field and highlights the need to consider multiple factors when evaluating scholarly contribution.

3.3 Research Stream on Housing Price and Disaster

Following works such as Gorzeń-Mitka (2020), Lis et al. (2021), and Majeed and Ainin (2021), a co-occurrence analysis is used to determine the frequency that keywords are used in the sample. This approach provides another type of landscape on the relationships of keywords; hence, the VOSviewer is one of the many helpful tools that are utilized by setting options directed toward the specific analysis. This is done by counting all keyword occurrences, using the "full count method". Given that the dataset is relatively small, the minimum

threshold of appearance of keywords is also set to a low value of two, which is lower than the default in VOSviewer. This modification allows for a more detailed analysis and results in 57 keywords included for network construction. However, to focus on the core research topic, general terms like "data," "article," and "algorithm" are excluded.

Table 2 Most Productive Authors

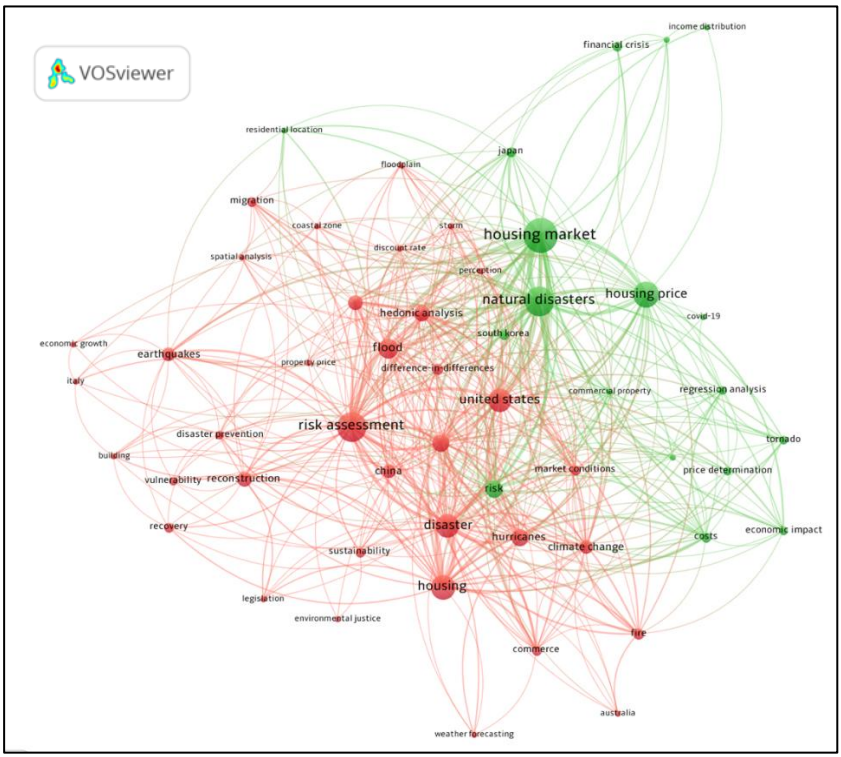
Author	Current Affiliation	FWCI	Scopus H-index	NP	Cit	TLS
Ma, Lala	University of Kentucky, Lexington, United States	2.68	10	3	24	8
McCoy, Shawn J.	University of Nevada, Las Vegas, United States	1.02	8	2	72	3
Bakkensen, Laura A.	The University of Arizona, Tucson, United States	1.97	11	2	23	5
Kim, Jeongseob	Ulsan National Institute of Science and Technology, Ulsan, South Korea	1.02	14	2	21	5
Abdelhalim, Maha	Centre Urbanisation Culture Société, Montreal, Canada	0.33	2	2	8	4
Devaux, Nicolas	Université du Québec à Rimouski, Rimouski, Canada	0.69	5	2	8	4
Dubé, Jean	Université Laval, Quebec, Canada	1.12	19	2	8	4
Kim, Seung Kyum	Korea Advanced Institute of Science and Technology, Daejeon, South Korea	2.38	9	2	8	2
Brotman, Billie Ann	Kennesaw State University, Kennesaw, United States	0.39	5	2	2	1

Notes: FWCI= Field-Weighted Citation Impact; NP= Number of Publication; Cit= Total Citations; and TLS=Total Link Strength

Source: Author's interpretation with VOSviewer and Scopus Database

The resulting visualization in Figure 6 depicts two distinct clusters of research topics related to the relationship between house prices and disasters. These clusters are connected by 483 links with a total link strength of 917. Cluster 1, highlighted in red (see Table 2 for details), appears to focus on risk assessment, with "risk assessment" itself having 47 connections to other keywords within the cluster. Similarly, "disaster" is a prominent keyword in this cluster with 41 links. Intriguingly, "house prices" are positioned within a different cluster. Cluster 2, depicted in green (see Table 3 for details), revolves more around the housing market, with "housing market" having 42 connections. However, "natural disasters" (39 links) and "house prices" (30 links) are also found in this cluster. It is important to note that while "house prices" and "disasters" appear in both clusters, they are not the most dominant keywords in either group. To gain a better understanding of the specific relationship between these two concepts, see detailed visualizations in Figures 7 and 8.

Figure 6 Cluster Network Visualization



The first or red cluster, which represents a core theme, introduces three key subtopics: risk assessment, sustainability, and disaster prevention. These elements are fundamental for evaluating housing resilience and recovery strategies after a disaster. Effective disaster prevention, by putting measures in place such as building codes and hazard mitigation plans, can significantly reduce vulnerability to hazards including floods, hurricanes, and earthquakes. This is particularly important in regions like the United States, Australia, and China, which are frequently impacted by such events. In these areas, climate change and legislation further influence property prices. Hedonic and spatial analyses are used to study price dynamics in floodplains and coastal zones, conduct critical research to understand reconstruction needs, and develop post-disaster building codes.

Meanwhile, market conditions, economic growth, and migration patterns are influenced by factors like weather forecasts, commerce, and environmental justice. These factors contribute to risk perception, which shape how communities view threats such as fires and storms. Additionally, methods like difference-in-differences help with the analysis of the economic impacts of disasters, thus highlighting the interplay among discount rates, property prices,

and extreme weather events. This research is crucial for understanding the economic consequences of disasters, for example, in regions like Italy.

The second or green cluster includes keywords characterized by their occurrence and house price linkage values, thus indicating that this cluster is in the early stages of development. Interconnections between keywords are relatively rare, with 'housing market' being the most prominent with the highest value of 29 occurrences. Interestingly, housing prices as the main topic investigated in this study are only linked to 18 other keywords. The data suggest a valuable opportunity for further exploration of housing and its relationship to disasters, especially considering indicators such as these.

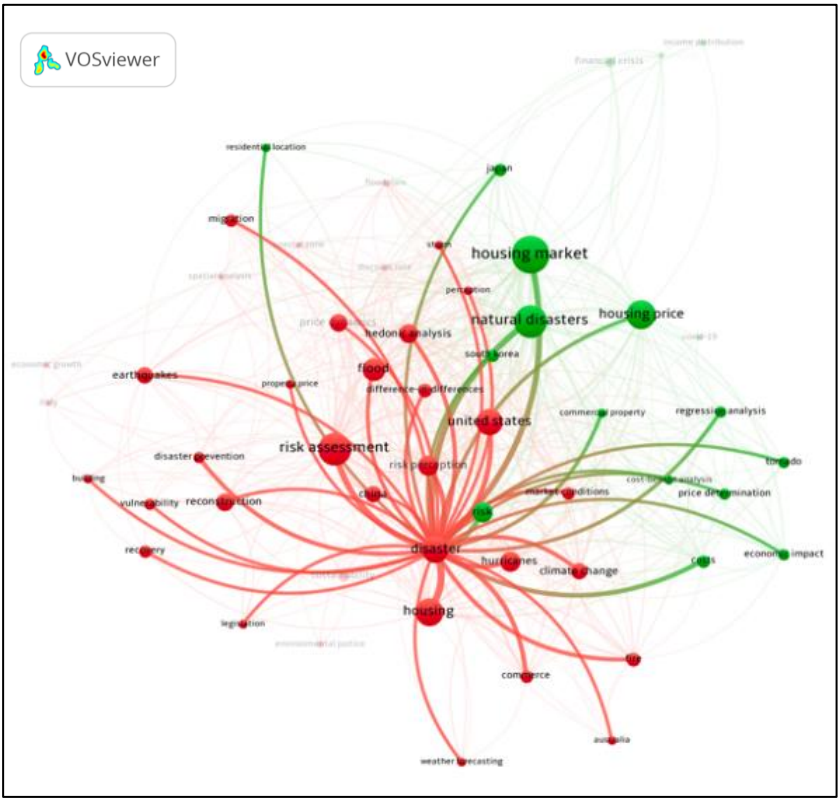
The relationships between disasters and other keywords can be identified from the red cluster in Figure 7. The network shows that disasters and housing are connected in the same cluster, as well as with other clusters where housing prices are present. Conversely, Figure 8 shows the connections from the perspective of housing prices. It is clear that not all disaster-related events directly impact housing prices, even though there are many interconnections among disasters, housing prices, and other related factors. For example, while disasters may not directly influence income distribution, housing prices are often affected by them. This discrepancy underscores the complex and multifaceted relationship between disasters and housing markets. Disasters typically affect housing prices through the physical destruction of property, changes in demand driven by risk perception, and population migration patterns. The demand for accommodation due to income distribution, on the other hand, rests on economic conditions and market forces. In this respect, any examination of the effects of catastrophes on housing prices has to cautiously differentiate between direct and indirect impacts when examining how catastrophes affect housing prices. More importantly, such a critical appreciation helps to create focussed strategies of disaster mitigation and recovery, which consider both immediate and long-term economic impacts on the housing market.

3.4 Geographical Distribution of Objects and Location Gaps

The minimum criteria for co-authorship in the bibliometric analysis is “one document produced by a country”; that is, for a country to be recognized in a co-authorship, at least one published document is officially attributed to an institution or authors from that country. The document does not need to be cited for the country to be counted in the analysis. Even if a document received zero citations, it still qualifies for inclusion in the co-authorship network. This threshold is set to ensure that each country that produces homeownership studies would be represented in VOSviewer, even when a country has the least contribution to the database, as established by Mulyadi and Ubaidillah (2024), with only one uncited manuscript. Therefore, cross-country collaboration unites various perspectives and different expertise that might contribute to enhancing

the quality and innovative characteristics of the research work. Working together, two or more researchers from different countries may integrate their unique insights and methodologies into more robust and comprehensive studies (Wagner and Leydesdorff, 2005).

Figure 7 Network Visualization for Disasters

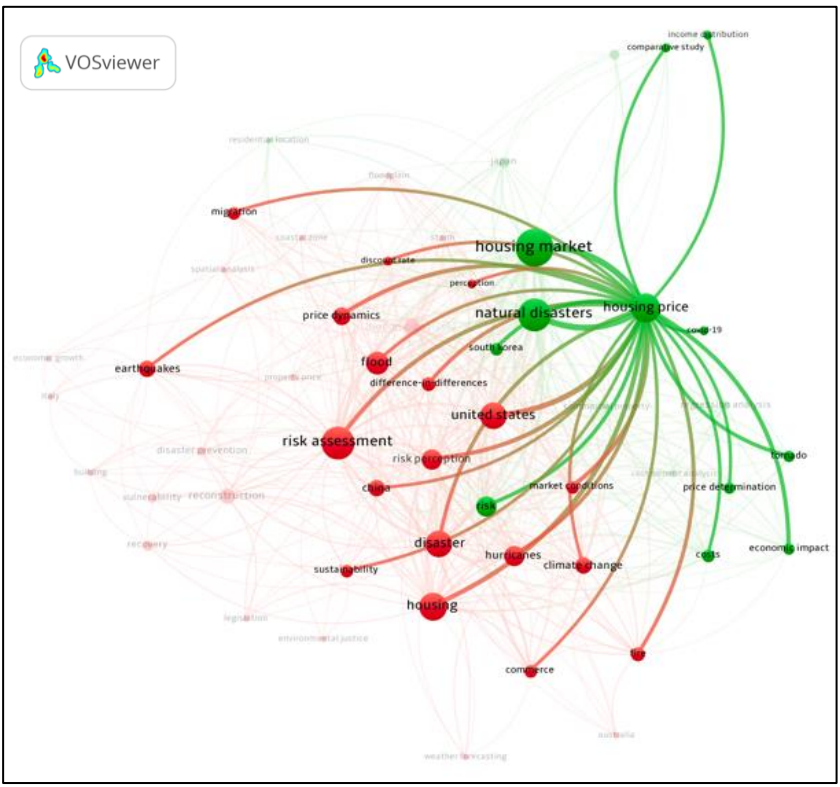


Housing and natural disasters are both global issues that demand international solutions. Co-authorship networks can thus help examine exactly how the countries are working together to resolve these issues and pinpoint some areas where collaboration is especially lacking. This understanding is important for developing more effective and coordinated global responses (Sylvan Katz and Martin, 1997). By understanding the geographical distribution of research studies and identifying location gaps, policymakers and funding bodies can better allocate resources to underrepresented regions. This can help build local research capacities and ensure that all regions have the relevant knowledge and tools, such as to mitigate the impacts of natural disasters on housing.

Figure 9 shows the countries that are the reference objects for the research carried out. Of these countries, the United States has the highest research output

compared to the other ten countries, namely Taiwan, Indonesia, Italy, Germany, Japan, Hong Kong, China, the United Kingdom, Turkey, and Australia. Thus, the United States has the largest node in the VOSviewer visualization which indicates that the country has made significant contributions to research on house prices in the context of natural disasters. Apart from the United States, Indonesia is the latest research object, namely in 2022 which is marked in yellow.

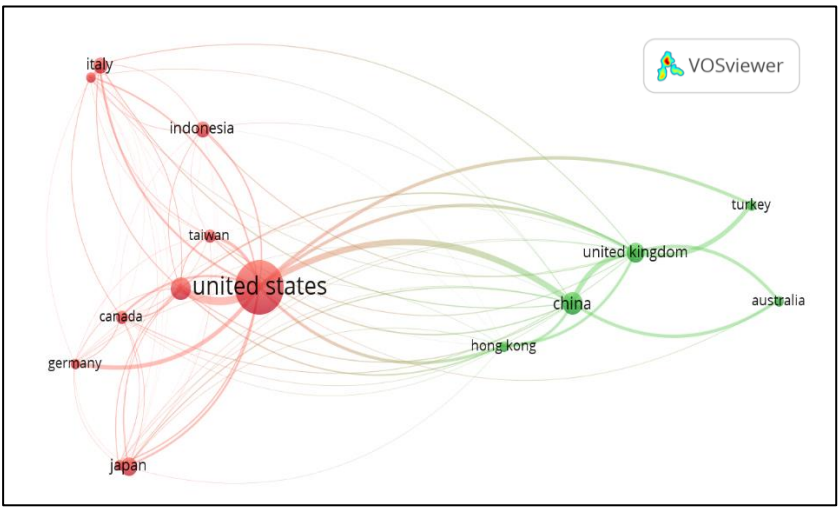
Figure 8 Network Visualization for Housing Price



Examining the geographical distribution of the co-authorship networks highlights the regions that are actively contributing to research. The results highlight a concentration of research efforts in developed countries such as the United States, China, South Korea, and the United Kingdom, pointing to a potential geographical bias. The United States has the highest number of research outputs (N = 44) and citations (Cit = 492), and total link strength (TLS = 511.8), thus indicating its dominant role and impact in this research field. China and South Korea follow, each with 8 research outputs, but China exhibits higher a TLS (262.99) compared to South Korea (213.35). The United Kingdom also makes a strong contribution with 6 research outputs, 40 citations, and a TLS of 249.43. This concentration suggests that expertise and resources are

predominantly available in these regions, which lead to a higher impact and visibility of their research. In turn, areas like Africa, South America, and parts of Asia-except for East Asia-are underrepresented in this domain of research and therefore constitute key geographical gaps in studies that concern house prices and natural disasters. This might reveal important location gaps where contextual knowledge of utmost importance may be missing. Such a gap is likely to lead to a lack of localized responses, which are crucial for dealing with region-specific issues (Cvitanovic et al., 2015).

Figure 9 Cross-country Co-authorship Network: 1967 to 2024



Working out these geographical gaps will certainly increase the inclusivity of research. In such a scenario, different regional representation ensures that the results are more globally relevant and applicable. Such inclusivity has the additional advantage of empowering local researchers and communities through their involvement in the research process, with consideration of specific needs and conditions. In this respect, Dahdouh-Guebas et al. (2022) provide insight into how one can understand and deal with gaps in geographical distribution and location toward improving global research networks. This will, in turn, encourage developed and developing regions to work in collaboration for the betterment of research quality and equitable distribution of the benefits stemming thereof from scientific advancement. As Glänzel and Schoepflin (1999) state, the attractiveness of globally co-authored distributions shows that logical collaboration is profitable for both developing and industrialized nations. Concurring to Glänzel and Schubert (2004), Fraunhofer Institute of Systems and Innovation Research, Idea Consult, and University of Sussex, Brighton, UK (2009), and Sylvan Katz and Martin (1997), the sort of collaboration that influences the nature of the collaboration determines how broadly a research paper is cited, with international collaborations resulting in twice as many citations than research conducted only within a single country.

4. Discussion

The analysis reveals significant findings regarding the conceptual framework of housing prices and natural disasters. Research on the relationship of housing prices and natural disasters has grown significantly over time, particularly in recent years. Early studies mainly addressed macroeconomic and regulatory impacts, and built the foundational understanding of how disasters influence housing markets. In 2016, studies focused on disasters like floods and earthquakes, mainly on direct effects such those that calamities have on housing values. Proceeding from more recent works up to 2024, including climate change and global crises such as the COVID-19 pandemic, the field has been able to adapt to the emergence of challenges. The literature progression evidences a movement from broad analyses down to detailed studies, with advanced methodologies for very accurate assessments of the disaster impacts. There is also an increasing focus on regional case studies, especially countries that are prone to disasters, such as the United States, South Korea, and Australia, that provide lessons with respect to how local factors impact housing price volatility. This change further underlines the need for localized and evidence-based approaches toward disaster management and policy formulation.

Bibliographic analyses have been conducted for several different types of natural disasters. Some studies have considered only a single type of disaster. Others, in turn, study the cumulative effect of several events and various influences on house price. For example, conjoined disasters such as floods and landslides (Agarwal et al., 2023) or the joint effects of floods, earthquakes, eruptions, and storms (Wisner et al., 2003) have been studied. Most of these studies find that the impact of natural disasters and housing prices is negative, especially in cases of floods, which often report adverse effects on house prices (AbdelHalim et al., 2021; Bakkensen et al., 2019). Other types of disasters, such as earthquakes (Fekrazad, 2019; Keskin et al., 2017; Naoi et al., 2009), volcanic eruptions (Echegaray-Aveiga et al., 2020), hurricanes (Carbone et al., 2006; Hamideh et al., 2021), fires (Kiel and Matheson, 2018), and landslides (Kim et al., 2017), show a negative effect on house prices. However, some studies show that these effects are not universal; for example, Cheung et al. (2018) show that some disasters have a positive effect on house prices. Meanwhile, tsunamis which have caused many deaths (Syamsidik et al., 2017) and nuclear disasters (Ando et al., 2017), do not significantly affect house prices.

The severity of disasters, housing location, and other regional factors influence these outcomes, with location being a primary determinant of property prices (Kopczewska and Ćwiakowski, 2021). For example, houses in the mountains tend to be more vulnerable to landslides, so house price growth is slower than that in areas that are not prone to landslides, although houses in these locations have added value, namely as a place to relax and recreate (Kim et al., 2017). Meanwhile, in areas that have been affected by a tsunami disaster, residents still

choose to live in that area because they prefer to live close to their place of work, or base their decision on family members, or rental or land prices so that tsunamis are not the main factor in choosing a place to live (Syamsidik et al., 2017).

The varying findings underscore the critical role of regional characteristics, and severity and type of disaster in shaping economic effects on housing markets. Such studies are valuable for stakeholders, and provide insights into potential losses and guide the development of effective disaster mitigation strategies. Understanding vulnerability is the primary aim of disaster prevention according to Wisner et al. (2003). Agarwal et al. (2023) also state that financial aid can be given to minimize the loss of human life. Pezzica et al. (2021) state that the identification of key stakeholders who can handle the real estate markets after disasters is also of grave importance.

The aim here is to show that effective management of disaster impacts on housing markets requires tailored approaches towards the peculiar characteristics of various natural disasters. Cortés and Strahan (2017) provide evidence that shows response strategies are only effective based on the nature of the disaster and specific regional factors that involve financial support mechanisms at the heart of recovery efforts and maintenance of market equilibria. Click or tap here to enter text.Such financial intervention needs to balance immediate disaster relief and continued recovery support while ensuring speed of implementation and accessibility. As Agarwal et al. (2023) state, highlighting the historical occurrence of disasters and projected future risk is an influential factor in property pricing. This is in line with Seo et al. (2021), their findings on the relationship between disaster risk awareness and risk discounting for housing values have key implications. Insurance among others becomes a very important stabilizing force after disasters (Bin et al., 2008; Hennighausen et al., 2023; Nyce et al., 2015), hence creating the demand for an advanced framework of risk assessment, which considers both climate projection and geographical considerations. Moreover, the urban development sector plays a very important role in disaster risk reduction, and there is evidence that applications of disaster-resistant urban design principles and strong infrastructure systems go a long way in ensuring that disasters are more contained, as shown by Pezzica et al. (2021).

The literature highlights several areas that remain underexplored, especially concerning geographic coverage, which is notably limited. There is a significant absence of comprehensive studies in developing and island countries, and regions affected by various types of disasters, that examine location as an important characteristic of the housing market, where different regions have their own distinct characteristics. Furthermore, the impacts of natural disasters differ based on the severity of the disasters and geographical features of each area, which means that not all regions will experience the same effects (Modica et al., 2021; Masiero and Santarossa, 2020; Fekrazad, 2019; Cheung et al., 2018; Kawawaki and Ota, 1996). Consequently, there is a lack of research on

the long-term recovery patterns of housing markets post-disaster and integrating climate change projections into housing market analyses, which have diverse characteristics.

The paper emphasizes the need for more thorough future research along with specific recommendations that facilitate further discussion. By applying cluster analyses to segment markets with similar characteristics, researchers can draw on different market segments that comprise buyer behaviors, preferences, and needs for housing that vary across a range of those affected by natural disasters. In addition, cluster analyses can show patterns in data that may include how natural disasters have affected the prices or demand for houses in certain areas and hence provide further details into the short- and long-term impacts of such events. Cluster analyses present findings to certain groups that will allow policymakers and property developers to develop better mitigation strategies. For instance, disaster-prone areas may need different approaches than other places that are less prone to disasters. Also, policies related to disaster resilience for housing should consider the unique characteristics of the affected populations. In natural disasters, clusters can facilitate optimal risk modeling through the classification of areas by geography, demographics, and disaster history. Each of these research gaps provides significant opportunities through which further studies can better enhance current knowledge about the impacts of disasters on housing markets.

Our approach in this study has been inclusive, with the aim to capture all relevant research studies regardless of the investigated country. However, the following factors have naturally influenced the journal selection: (1) our use of the Scopus database means that only journals indexed in Scopus are included. This potentially excludes some regional or newer journals not yet indexed in Scopus; (2) articles included are based on their relevance towards the relationship between housing prices and disasters, rather than on the reputation or impact factor of the journal. This approach ensures that relevant articles from less prominent journals are not overlooked; (4) our search is limited to English-language publications, which may have excluded relevant research published in other languages; and (5) while we did not set a specific start date for our search, the temporal distribution of our results (from 2007 to 2023) reflects the period when this topic gained significant academic attention. This inclusive approach allows for a comprehensive field view, which captures established research trends and emerging perspectives across various disciplines relevant to housing prices and disasters.

5. Conclusion

We have identified two distinct subtopics within this research area: environmental risk mitigation (Figure 7, red cluster) and economic aspects of housing (Figure 8, green cluster). Both subtopics share structural similarity, and

comprise groups of keywords that represent different focal points, such as risk assessment, disaster prevention, and environmental justice, as well as different research methods and geographic contexts. Our analysis establishes that housing prices and natural disasters should be treated as separate but interconnected phenomena, with risk management playing a crucial role in stabilizing housing markets in the face of disasters. The bi-dimensional keyword network illustrates that while disasters and housing prices are distinct concepts, natural disasters serve as a common factor that influence both themes.

This study explores the evolution of housing prices and disasters, and focuses on risk mitigation from an environmental perspective and housing from an economic perspective. The work identifies two main research themes: disaster and housing price, with disaster comprising risk management and governance. Researchers often use difference-in-differences models to analyze disasters, which can capture how house prices respond to natural disasters. Various types of natural disasters have been studied, with some focusing on a single type, others on two, and a few analyzing more than three types within one study.

The analysis of various studies on natural disasters reveals a complex relationship between these events and housing prices. While most research primarily focuses on individual types of disasters, some studies have examined multiple disasters concurrently, highlighting the wide-ranging impacts on property markets. Natural disasters generally lead to a decrease in house prices, with the extent of this impact influenced by regional factors, proximity to the epicenter of the disaster, and specific property characteristics. Financial assistance and effective disaster policies can mitigate some of the negative effects and influence market dynamics, as observed in flood-prone areas.

Looking ahead, key recommendations include developing comprehensive disaster preparedness policies, improving financial assistance programs, enhancing stakeholder coordination, and investing in research for understudied areas. These actions can foster resilient housing markets in disaster-prone regions while protecting stakeholder interests. The analysis emphasizes the intricate relationship between natural disasters and housing markets, thus advocating for integrated strategies that balance immediate response and long-term stability. Future research and policy should aim to address existing gaps and build on proven successful strategies. Successful disaster management policies include resilient building standards, property buyout programs, and disaster insurance pools, which enhance community resilience and market stability. Coordination among stakeholders—government agencies, insurance providers, and community organizations—is crucial for effective disaster response.

Future studies could implement cluster analyses, where there is consideration between the geographical distribution and regional differences thus highlighting the need for more inclusive and comprehensive research, particularly in underrepresented areas, to better inform stakeholders and

enhance global disaster mitigation strategies. These findings underscore the importance of understanding the multifaceted impacts of natural disasters on housing markets to develop effective policies and support systems for affected communities.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could appear to influence the work reported in this paper.

References

AbdelHalim, M., Dubé, J., and Devaux, N. (2021). The Spatial and Temporal Decomposition of the Effect of Floods on Single-Family House Prices: A Laval, Canada Case Study. *Sustainability (Switzerland)*, 13(9), 5088. https://doi.org/10.3390/su13095088

Agarwal, P., Sahoo, D., Parida, Y., Ranjan Paltasingh, K., and Roy Chowdhury, J. (2023). Land use changes and natural disaster fatalities: Empirical analysis for India. *Ecological Indicators*, 154. https://doi.org/10.1016/j.ecolind.2023.110525

Arrondel, L., and Lefebvre, B. (2001). Consumption and Investment Motives in Housing Wealth Accumulation: A French Study. *Journal of Urban Economics*, 50(1), 112–137. https://doi.org/10.1006/juec.2000.2209

Atreya, A., and Ferreira, S. (2015). Seeing is Believing? Evidence from Property Prices in Inundated Areas. *Risk Analysis*, 35(5), 828–848. https://doi.org/10.1111/risa.12307

Bakkensen, L. A., Ding, X., and Ma, L. (2019). Flood Risk and Salience: New Evidence from the Sunshine State. *Southern Economic Journal*, 85(4), 1132–1158. https://doi.org/10.1002/soej.12327

Belsky, E. S. (2009). Demographics, Markets, and the Future of Housing Demand. *Journal of Housing Research*, 18(2), 99–119. https://doi.org/10.1080/10835547.2009.12092006

Benita, F. (2021). Human mobility behavior in COVID-19: A systematic literature review and bibliometric analysis. *Sustainable Cities and Society*, 70. https://doi.org/10.1016/j.scs.2021.102916

Bin, O., Kruse, J. B., and Landry, C. E. (2008). FLOOD HAZARDS, INSURANCE RATES, AND AMENITIES: EVIDENCE FROM THE COASTAL HOUSING MARKET. *Journal of Risk and Insurance*, 75(1), 63–82. https://doi.org/10.1111/j.1539-6975.2007.00248.x

Burby, R. J., Nelson, A. C., Parker, D., and Handmer, J. (2001). Urban Containment Policy and Exposure to Natural Hazards: Is There a Connection? *Journal of Environmental Planning and Management*, 44(4), 475–490. https://doi.org/10.1080/09640560120060911

Canepa, A., and Khaled, F. (2018). Housing, Housing Finance and Credit Risk. *International Journal of Financial Studies*, 6(2), 50. https://doi.org/10.3390/ijfs6020050

Carbone, J. C., Hallstrom, D. G., and Smith, V. K. (2006). Can Natural Experiments Measure Behavioral Responses to Environmental Risks? *Environmental and Resource Economics*, 33(3), 273–297. https://doi.org/10.1007/s10640-005-3610-4

Chang, Y., Wilkinson, S., Potangaroa, R., and Seville, E. (2010). Resourcing challenges for post-disaster housing reconstruction: A comparative analysis. *Building Research and Information*, 38(3), 247–264. https://doi.org/10.1080/09613211003693945

Cheung, R., Wetherell, D., and Whitaker, S. (2018). Induced earthquakes and housing markets: Evidence from Oklahoma. *Regional Science and Urban Economics*, 69, 153–166. https://doi.org/10.1016/j.regsciurbeco.2018.01.004

Cortés, K. R., and Strahan, P. E. (2017). Tracing out capital flows: How financially integrated banks respond to natural disasters. *Journal of Financial Economics*, 125(1), 182–199. https://doi.org/10.1016/j.jfineco.2017.04.011

Cutter, S. L., Boruff, B. J., and Lynn Shirley, W. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*, 84(2), 242–261. https://doi.org/10.1111/1540-6237.8402002

Cvitanovic, C., Hobday, A. J., van Kerkhoff, L., Wilson, S. K., Dobbs, K., and Marshall, N. A. (2015). Improving knowledge exchange among scientists and decision-makers to facilitate the adaptive governance of marine resources: A review of knowledge and research needs. *Ocean and Coastal Management,* 112, 25–35. https://doi.org/10.1016/j.ocecoaman.2015.05.002

Dahdouh-Guebas, F., Mafaziya Nijamdeen, T. W. G. F., Hugé, J., Dahdouh-Guebas, Y., Di Nitto, D., Hamza, A. J., Kodikara Arachchilage, S., Koedam, N., Mancilla García, M., Mohamed, M. O. S., Mostert, L., Munga, C. N., Poti, M., Satyanarayana, B., Stiers, I., Van Puyvelde, K., Vanhove, M. P. M., Vande Velde, K., and Ratsimbazafy, H. A. (2022). The Mangal Play: A serious game

to experience multi-stakeholder decision-making in complex mangrove social-ecological systems. *Frontiers in Marine Science*, 9. https://doi.org/10.3389/fmars.2022.909793

Der Sarkissian, R., Al Sayah, M. J., Abdallah, C., Zaninetti, J. M., and Nedjai, R. (2022). Land Use Planning to Reduce Flood Risk: Opportunities, Challenges and Uncertainties in Developing Countries. *Sensors*, 22(18). https://doi.org/10.3390/s22186957

Dixon, L., Clancy, N., Seabury, S. A., and Overton, A. (2006). *The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications*. Available at: https://www.rand.org/pubs/technical_reports/TR300.html#document-details

Echegaray-Aveiga, R. C., Rodríguez-Espinosa, F., Toulkeridis, T., and Echegaray-Aveiga, R. D. (2020). Possible effects of potential lahars from Cotopaxi volcano on housing market prices. *Journal of Applied Volcanology*, 9(4). https://doi.org/10.1186/s13617-020-00093-1

Fekrazad, A. (2019). Earthquake-risk salience and housing prices: Evidence from California. *Journal of Behavioral and Experimental Economics*, 78, 104–113. https://doi.org/10.1016/j.socec.2019.01.001

Fraunhofer Institute of Systems and Innovation Research, Idea Consult, and University of Sussex, Brighton, UK (2009). *The Impact of Collaboration on Europe's Scientific and Technological Performance*. Available at: https://ec.europa.eu/invest-in-research/pdf/download_en/final_report_spa2.pdf

Glänzel, W., and Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and social sciences. *Information Processing and Management*, 35(1), 31–44. https://doi.org/10.1016/S0306-4573(98)00028-4

Glänzel, W., and Schubert, A. (2004). 'Analysing Scientific Networks Through Co-Authorship'. in Moed, H.F., Glänzel, W., and Schmoch U. (eds.) *Handbook of Quantitative Science and Technology Research*. Dordrecht: Springer pp. 257–276. https://doi.org/https://doi.org/10.1007/1-4020-2755-9_12

Gorzeń-Mitka, I. (2020). The latest streams of research on communication in risk management: a large-scale literature review based on co-occurrence data. *Scientific Papers of Silesian University of Technology. Organization and Management Series*, 2020(149), 219–237. https://doi.org/10.29119/1641-3466.2020.149.20

Graff Zivin, J., Liao, Y., and Panassié, Y. (2023). How hurricanes sweep up housing markets: Evidence from Florida. *Journal of Environmental Economics and Management*, 118.https://doi.org/10.1016/j.jeem.2022.102770

Hamideh, S., Peacock, W. G., and Zandt, S. Van. (2021). Housing type matters for pace of recovery: Evidence from Hurricane Ike. *International Journal of Disaster Risk Reduction*, 57. https://doi.org/10.1016/j.ijdrr.2021.102149
Hennighausen, H., Liao, Y., Nolte, C., and Pollack, A. (2023). Flood insurance reforms, housing market dynamics, and adaptation to climate risks. *Journal of Housing Economics*, 62. https://doi.org/10.1016/j.jhe.2023.101953

Hernández-Murillo, R., Owyang, M. T., and Rubio, M. (2017). Clustered housing cycles. *Regional Science and Urban Economics*, 66, 185–197. https://doi.org/10.1016/j.regsciurbeco.2017.06.003

Kawawaki, Y. and Ota, M. (1996). The influence of the Great Hanshin–Awaji Earthquake on the local housing market. *Review of Urban and Regional Development Studies,* 8(2), 220–233. https://doi.org/https://doi.org/10.1111/j.1467-940X.1996.tb00119.x

Keskin, B., Dunning, R., and Watkins, C. (2017). Modelling the impact of earthquake activity on real estate values: a multi-level approach. *Journal of European Real Estate Research*, 10(1), 73–90. https://doi.org/10.1108/JERER-03-2016-0014

Kiel, K. A., and Matheson, V. A. (2018). The effect of natural disasters on housing prices: An examination of the Fourmile Canyon fire. *Journal of Forest Economics*, 33, 1–7. https://doi.org/10.1016/j.jfe.2018.09.002

Kiel, K. A., and Zabel, J. E. (2008). Location, location, location: The 3L Approach to house price determination. *Journal of Housing Economics*, 17(2), 175–190. https://doi.org/10.1016/j.jhe.2007.12.002

Kim, J., Park, J., Yoon, D. K., and Cho, G. H. (2017). Amenity or hazard? The effects of landslide hazard on property value in Woomyeon Nature Park area, Korea. *Landscape and Urban Planning*, 157, 523–531. https://doi.org/10.1016/j.landurbplan.2016.07.012

Kopczewska, K., and Ćwiakowski, P. (2021). Spatio-temporal stability of housing submarkets. Tracking spatial location of clusters of geographically weighted regression estimates of price determinants. *Land Use Policy*, 103. https://doi.org/10.1016/j.landusepol.2021.105292

Kousky, C. (2010). Learning from Extreme Events: Risk Perceptions after the Flood. *Land Economics*, 86(3), 395–422. https://www.jstor.org/stable/27821435

Lis, A., Bello, K., and Górka, J. (2021). Albania as an object and a context of research in economic sciences: Bibliometric analysis. *Economics And Law*, 20(1). https://doi.org/10.12775/EiP.2021.009

Mahood, Q., Van Eerd, D., and Irvin, E. (2014). Searching for grey literature for systematic reviews: Challenges and benefits. *Research Synthesis Methods*, 5(3), 221–234. https://doi.org/10.1002/jrsm.1106

Majeed, N., and Ainin, S. (2021). Visualizing the evolution and landscape of socio-economic impact research. *Quality and Quantity*, 55(2), 637–659. https://doi.org/10.1007/s11135-020-01020-7

Marzi, G., Caputo, A., Garces, E., and Dabić, M. (2020). A Three Decade Mixed-Method Bibliometric Investigation of the IEEE Transactions on Engineering Management. *IEEE Transactions on Engineering Management*, 67(1), 4–17. https://doi.org/10.1109/TEM.2018.2870648

Masiero, G. and Santarossa, M. (2020). Earthquakes, grants, and public expenditure: How municipalities respond to natural disasters. *Journal of Regional Science,* 60(3), 481–516. https://doi.org/10.1111/jors.12462

Modica, M., Zoboli, R., Meroni, F., Pessina, V., Squarcina, T., and Locati, M. (2021). 'Near miss' housing market response to the 2012 northern Italy earthquake: The role of housing quality and risk perception. *Urban Studies*, 58(11), 2293–2309. https://doi.org/10.1177/0042098020943490

Mongeon, P., and Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: a comparative analysis. *Scientometrics*, 106(1), 213–228. https://doi.org/10.1007/s11192-015-1765-5

Mulyadi, M., and Ubaidillah, N. Z. (2024). Beyond the numbers: Unveiling trends in homeownership research. *Multidisciplinary Reviews*, 7(2). https://doi.org/10.31893/multirev.2024039

Naoi, M., Seko, M., and Sumita, K. (2009). Earthquake risk and housing prices in Japan: Evidence before and after massive earthquakes. *Regional Science and Urban Economics*, 39(6), 658–669. https://doi.org/10.1016/j.regsciurbeco.2009.08.002

Nyce, C., Dumm, R. E., Stacy Sirmans, G., and Smersh, G. (2015). The Capitalization of Insurance Premiums in House Prices. *Journal of Risk and Insurance*, 82(4), 891–919. https://doi.org/10.1111/jori.12041

O'Sullivan, A. (2012). *Urban Economics* (8th ed.). Irwin: McGraw-Hill

Paez, A. (2017). Gray literature: An important resource in systematic reviews. *Journal of Evidence-Based Medicine*, 10(3), 233–240. https://doi.org/10.1111/jebm.12266

Pezzica, C., Cutini, V., and Bleil de Souza, C. (2021). Mind the gap: State of the art on decision-making related to post-disaster housing assistance.

International Journal of Disaster Risk Reduction, 53. https://doi.org/10.1016/j.ijdrr.2020.101975

Rialti, R., Marzi, G., Ciappei, C., and Busso, D. (2019). Big data and dynamic capabilities: a bibliometric analysis and systematic literature review. *Management Decision*, 57(8), 2052–2068. https://doi.org/10.1108/MD-07-2018-0821

Seo, J., Oh, J., and Kim, J. (2021). Flood risk awareness and property values: evidences from Seoul, South Korea. *International Journal of Urban Sciences*, 25(2), 233–251. https://doi.org/10.1080/12265934.2020.1850324

Sullivan, O. (1994). Processes of Housing Access: A Dynamic Approach to Housing Consumption. *Sociology*, 28(3), 679–697. https://doi.org/https://doi.org/10.1177/0038038594028003003

Sweileh, W. M., Al-Jabi, S. W., AbuTaha, A. S., Zyoud, S. H., Anayah, F. M. A., and Sawalha, A. F. (2017). Bibliometric analysis of worldwide scientific literature in mobile - health: 2006-2016. *BMC Medical Informatics and Decision Making*, 17(72). https://doi.org/10.1186/s12911-017-0476-7

Syamsidik, Oktari, R. S., Munadi, K., Arief, S., and Fajri, I. Z. (2017). Changes in coastal land use and the reasons for selecting places to live in Banda Aceh 10 years after the 2004 Indian Ocean tsunami. *Natural Hazards*, 88(3), 1503–1521. https://doi.org/10.1007/s11069-017-2930-3

Sylvan Katz, J. and Martin, B. R. (1997). What is research collaboration? *Research Policy,* 26(1), 1-18. https://doi.org/10.1016/S0048-7333(96)00917-1

Tsai, I. C. (2019). Relationships among regional housing markets: Evidence on adjustments of housing burden. *Economic Modelling*, 78, 309–318. https://doi.org/10.1016/j.econmod.2018.09.026

Tuzel, S., and Zhang, M.B. (2017). Local Risk, Local Factors, and Asset Prices. *Journal of Finance*, 72(1), 325–370. https://doi.org/10.1111/jofi.12465

Visser, M., van Eck, N. J., and Waltman, L. (2021). Large-scale comparison of bibliographic data sources: Scopus, Web of Science, Dimensions, Crossref, and Microsoft Academic. *Quantitative Science Studies*, 2(1), 20–41. https://doi.org/10.1162/qss_a_00112

Wagner, C. S., and Leydesdorff, L. (2005). Network structure, self-organization, and the growth of international collaboration in science. *Research Policy*, 34(10), 1608–1618. https://doi.org/10.1016/j.respol.2005.08.002

Wimbadi, R. W., and Djalante, R. (2020). From decarbonization to low carbon development and transition: A systematic literature review of the

conceptualization of moving toward net-zero carbon dioxide emission (1995–2019). *Journal of Cleaner Production*, 256. https://doi.org/10.1016/j.jclepro.2020.120307

Wisner, B., Blaikie, P., Cannon, T., and Davis, I. (2003). *At Risk Natural Hazards, People's Vulnerability and Disasters.* NY: Routledge.

Wong, E. C., Maher, A. R., Motala, A., Ross, R., Akinniranye, O., Larkin, J., and Hempel, S. (2022). Methods for Identifying Health Research Gaps, Needs, and Priorities: a Scoping Review. *Journal of General Internal Medicine*, 37, 198–205. https://doi.org/10.1007/s11606-021-07064-1