International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 11 | Nov - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Impact of Natural Disasters on House Prices: A Global Analysis and Policy Implications

Arpita Jha [1]

This study addresses the limited research on how natural disasters affect house prices by analyzing data from 117 countries between 2000 and 2018, using a panel regression approach to assess these impacts. The results reveal that natural disasters tend to decrease house prices, a finding that holds strong across multiple robustness checks. Specifically, geological disasters are found to have the most significant negative impact on property values. The study also distinguishes between the effects of small and large disasters, with both showing a clear downward effect on house prices. These insights carry important implications for policymakers and investors, as lower house prices in disaster-prone areas may indicate reduced consumption and investment due to the wealth effect, potentially leading to wider economic downturns. To support these regions, economic policymakers might consider measures such as low-tax policies or quantitative easing. The findings also highlight the urgent need for governments to address climate change impacts on the housing market by adopting sustainable technologies and renewable energy sources.

Keywords

Natural Disasters, House Pricing, Climate Change, Statistical model

1. Introduction

Research indicates that the risk of natural disasters is on the rise. For example, locations prone to certain disasters, such as flooding, may double over time. This increasing risk has heightened concerns about the broader economic impacts, especially in sectors like real estate.

This paper aims to offer new insights into how natural disasters affect housing prices, utilizing extensive datasets that encompass both disaster events and housing markets. Unlike earlier studies that generally focus on a single type of disaster, this paper evaluates a variety of disaster types within a unified framework to assess how house prices react to different disasters. Additionally, this research adopts a cross-country perspective to examine the relationship between housing prices and natural disasters, countering the idea that these effects are solely localized. By analyzing this connection at an international level, we consider how natural disasters can influence housing values through increased costs and ownership risks, which may prompt migration flows as potential buyers or residents make decisions based on disaster information—often disseminated through media, particularly during severe events.

Natural disasters can be viewed as negative factors or productivity shocks that lead residents to relocate or discourage new inhabitants, thereby affecting local housing prices. Furthermore, they can impact human capital by diminishing educational quality and productivity, resulting in economic repercussions that can extend to other countries. Disasters are also associated with rising poverty rates, as affected areas may experience the out-migration of wealthier households or an increase in poverty levels among those who remain. Disasters can increase transfer payments, such as unemployment insurance and healthcare costs, which further influence broader economic indicators and growth. Additionally, while disasters primarily impact local economies, they often create spillover effects that can alter growth trajectories for countries, even affecting those with economic ties to disaster-affected regions.

Changes in growth patterns can significantly impact the demand and supply dynamics in housing markets, thus influencing housing prices. Natural disasters also affect labor markets, as employment at both local and national levels often declines following a disaster due to workforce displacement. This shift in labor supply and demand impacts income levels, especially in sectors like construction, with further implications for economic growth. The loss of public capital and shifts in long-term wages can lead to migration and affect housing conditions and prices.

Our analysis reveals that most types of natural disasters negatively impact house prices, with geological and meteorological disasters exerting the strongest effects. Differentiating between small and large disasters yields similar findings. These results are significant in relation to economic inequality, as property ownership is a crucial source of financial security for low- and middle-income households. Furthermore, the results have implications for the banking sector, as natural disasters can jeopardize mortgage repayments and heighten vulnerability within the banking system. Disasters raise default risks for banks by affecting solvency, particularly in the case of geophysical and meteorological events. Additionally, hurricanes may compel banks to reduce lending in response to increased deposit withdrawals, highlighting the importance of reserve requirements.

The connection between natural disasters and housing prices also reflects tenure choices. Following disasters, some households may opt to rent instead of buy, resulting in decreased home prices but elevated rents. This trend aligns with two theories: the "wealth effect," where household wealth diminishes post-disaster, and the "risk effect," where disaster-prone regions experience heightened aversion to homeownership. In the absence of disaster insurance, these events increase exposure risks, prompting households to reduce homeownership. Another contributing factor is that natural disasters alter anticipated costs, including potential fatalities, which are often publicized and shape risk perception. On the supply side, disasters can create short-term housing shortages, temporarily driving up prices, although these may stabilize over time.

This study contributes to the literature examining how housing prices react to disasters. On a broader level, studies have investigated the impact of disasters on housing prices. This paper also connects with research on the wealth effects of disasters, demonstrating how events can influence housing and wealth. Furthermore, it engages with studies regarding the effects of climate change on property prices. Lastly, this research aligns with literature exploring how housing prices determine various social and economic outcomes, affecting mobility, health, and financial stability, with implications for construction and key macroeconomic indicators such as GDP, unemployment, and inflation.

2. Proposed Method

The modelling approach here treats housing index values as a function of specific housing price determinants. Specifically, the model is defined as:

$$\Delta \log(P_{it}) = a\Delta Control_{i,t-1} + \sum_{k=1} b_k ND_{i,t+1-k} + c\Delta \log(P_{i,t-1}) + \eta_i + \eta_t + v_{it} \quad (1)$$

where *i* denotes the country, *t* the year, *P* is an indicator of the housing prices (index), *ND* is natural disasters, *Control* is a vector of the determinants of housing prices, such as aggregate personal income, the unemployment rate, population size, real interest rates, construction costs, and the Gini index. ηi and ηt denote country and year fixed effects, respectively, capturing potential discrepancies across country locations and over time which are not taken into account by the country characteristics or country housing conditions. Finally, *v* is the error term. (Equation 1) is

carried out using the Generalized Method of Moments (GMM), as recommended by Arellano and Bover (1995) and Blundell and Bond (1998), to handle potential endogeneity—whether from reverse causality between house prices and natural disasters (though unlikely), or from correlations between price drivers and the error term.

A unique feature of this study is that the model assesses the effects not only of aggregate natural disasters but also by disaster type. This is because different types of disasters may impact housing prices differently, as the expectations and risk perceptions of potential homeowners vary by disaster type. These differences may be influenced by national institutional contexts, major policy decisions (e.g., from central banks or fiscal authorities), and insurance responses. Furthermore, certain disasters may receive more extensive news coverage and information, affecting the response of potential homeowners.

The study examines data from 117 countries (see Appendix) over the period 2000-2018, using housing price indexes as a stand-in for housing prices. House price data were sourced from databases such as the Bank for International Settlements (BIS) and the Organisation for Economic Co-operation and Development (OECD) for developed nations, while the Global Market Information Database provided data for other countries. For measuring natural disasters, the analysis follows Noy's (2009) approach, which considers the disaster's impact relative to the size of the economy. The disaster measure is standardized by dividing the number of affected people by the population size of the prior year and the disaster's direct cost by the previous year's GDP (to avoid biases from post-disaster impacts on current-year values). Additionally, to account for timing, disasters occurring within a year are weighted more heavily than those from prior years, with the measure adjusted by the month in which the disaster occurred, using the formula Cost × (12–M)/12 (Klomp and Valckx, 2014). This disaster measure is further divided by each country's land area to normalize for size, as larger countries have a higher likelihood of experiencing a disaster. The natural disaster data is derived from the Emergency Events Database (EM-DAT), managed by the Center for Research on the Epidemiology of Disasters (CRED).

For inclusion in EM-DAT, a disaster must meet at least one criterion: a) 10 or more fatalities, b) 100 or more people affected, c) declaration of a state of emergency, or d) request for international aid. The dataset, covering 2000-2018, includes various disaster types such as geophysical (e.g., earthquakes, volcanic activity), meteorological (e.g., extreme temperatures, storms), hydrological (e.g., floods, landslides), climatological (e.g., droughts, wildfires), and biological (e.g., epidemics, infestations). Table 1 provides a detailed breakdown of disaster types. This natural disaster variable has been widely used in previous studies as a proxy for disaster impacts (Toya and Skidmore, 2007; Cavallo et al., 2013). Since other control variables are on a quarterly basis, the disaster data is converted into quarterly values by averaging over the three months of each quarter.

Table 1 Categories and frequency of Natural Disasters in Percentage

Types of disasters	Frequency
Geophysical	35%
Meteorological	23%
Hydrological	11%
Climatological	13%
Biological	5%

Source: Based on natural disaster events that occurred in the 117 countries and over the time span under study.

Regarding the control variables, quarterly data includes: i) personal income per capita (calculated as total income fromall sources, which encompasses net earnings, rental income, personal dividends, and personal interest income); all nominal values are adjusted to real values by dividing by the consumer price index; ii) real interest rates for

construction and housing loans (determined as the difference between nominal interest rates and inflation); iii) housing construction costs (measured by the costs of materials and labor per square meter); iv) unemployment rate; and v) the Gini coefficient, which is sourced from the Standardized World Income Inequality Database (SWIID) provided by Solt (2014). The Gini coefficient is favored for measuring income inequality due to its greater availability and comparability for cross-country analyses (Bergh and Nilsson, 2010). Additionally, SWIID data account for uncertainties in predicted inequality measures through multiple imputation estimation methods that automate the Monte Carlo simulation process and average the results to derive the final inequality measure (Solt, 2014). Since the Gini coefficient ranges from 0 to 100, it is transformed into an unbounded measure using [Gini/(100-Gini)], and this measure is then converted into its natural logarithm. Higher Gini values indicate a level of inequality that is closer to the maximum, and vice versa.

This section examines the impact of the frequency of natural disasters. Specifically, the analysis distinguishes between large and small natural disasters based on their frequency. To do this, the overall natural disaster variable is replaced with two new variables: large natural disasters (LNDs) and small natural disasters (SNDs). LNDs are defined as those disasters that occur with a frequency above the median damage level for the year, while SNDs are those with a frequency below the median damage level. The cutoff for distinguishing between LNDs and SNDs is set at damages amounting to 100 thousand US dollars. The new findings, presented in Table 2 within a multivariate framework, indicate that LNDs have a significantly greater impact on housing prices.

Table 2 GMM Estimation (Role of Large and Small Natural Disasters)

Variable	Large disasters	Small disasters
Natural disasters	-0.287***	-0.145***
	[0.00]	[0.01]
ΔPersonal income per capita	0.297***	0.235***
	[0.00]	[0.00]
ΔReal interest rates	-0.105***	-0.063**
	[0.01]	[0.04]
ΔHousing construction costs	-0.184***	-0.121**
	[0.00]	[0.05]
ΔUnemployment rate	-0.263***	-0.192***
	[0.00]	[0.00]
ΔIncome inequality	-0.291***	-0.227***
	[0.00]	[0.00]
Diagnostics		
Adj. R^2	0.74	0.56
LM test	[0.00]	[0.00]
Hansen test	[0.99]	[0.97]
No. of instruments	27	24
No. of countries	86	71
No. of observations	6,536	5,396

Notes: Figures in brackets denote *p*-values.
**: p<0.05; *** p<0.01.

3. Conclusion

This study contributes new insights into how natural disasters affect house prices. While previous research has concentrated on specific types of disasters, particularly floods, and their influence on housing prices, this study provides a broader perspective by examining a variety of natural disaster types across 117 countries from 2000 to 2018. The results indicate that natural disasters generally lead to decreased house prices, with findings consistently validated through various robustness tests. Among the different types of disasters, geological events were found to have the most significant negative impact on housing prices, a trend that remains consistent when considering fatal and large disasters.

These findings carry important implications for policymakers and property investors. Given that natural hazards are expected to become more severe and frequent due to global climate change, they will significantly impact house prices. Insurance policies must explicitly address how natural disasters can drive down housing values, leading to a need for innovative solutions and increased awareness of natural hazards globally. Additionally, national policies should adapt insurance systems for natural hazards in relation to the housing market, facilitating a systematic risk transfer to combat climate change effectively. The global insurance landscape varies significantly due to differing cultural approaches to natural hazards, and any necessary adjustments to cope with changing weather conditions should adhere to a 'change in diversity' approach to achieve effective adaptation across countries.

The results also provide valuable insights for banking institutions. Lower house prices may prompt individuals and business owners facing financial losses to withdraw deposits and seek loans for reconstruction. Consequently, banks could play a crucial role by increasing liquidity and credit availability in response to disaster impacts. This increased demand for loans often leads banks to raise deposit rates to secure additional funding for lending in the aftermath of disasters. Additionally, the findings highlight potential shifts in home ownership and migration patterns, as lower house prices could lead households with limited access to credit to reconsider their housing choices, ultimately affecting both sectoral and overall economic dynamics.

Moreover, declining house prices in disaster-stricken countries may result in reduced consumption and investment, further negatively impacting the real economy. In response, economic policymakers might consider implementing low-tax strategies or quantitative easing measures to provide liquidity for affected areas.

Lastly, a limitation of this research is that further empirical analysis could have investigated the impact of various natural disasters on housing prices by examining housing supply indices, such as new sales and transactions. This would represent an interesting avenue for future research; however, two methodological challenges arise. First, data availability is a significant issue for most countries studied. Second, for accuracy, the data should focus specifically on areas impacted by disasters rather than entire countries, which complicates data collection.

References

[1] Baez, J., de la Fuente, A. and Santos, I. (2010). Do Natural Disasters Affect Human Capital? An Assessment Based on Existing Empirical Evidence. IZA Discussion Paper, No. 5164, Bonn: Institute for the Study of Labor.

[2] Bin, O. and Landry, C.E. (2013). Changes in Implicit Floor Risk Premiums: Empirical Evidence from the Housing Market. Journal of Environmental Economics and Management, 65, 361-376.

[3] Bos, J., Li, R. and Sanders, M. (2018). Hazardous Lending: The Impact of Natural Disasters on Banks' Asset Portfolio. GSBE Research Paper, No. 21.

[4] Daniel, V.E., Florax, R.J. and Rietveld, P. (2009). Flooding Risk and Housing Values: An Economic Assessment of Environmental Hazard. Ecological Economics, 69, 355-365.

[5] Deryugina, T. (2017). The Fiscal Cost of Hurricanes: Disaster Aid Versus Social Insurance. American Economic Journal: Economic Policy, 9(3), 168-198.

[6] Di Tella, R., Galiani, S. and Schargrodsky, E. (2007). The Formation of Beliefs: Evidence from the Allocation of Land Titles to Squatters. Quarterly Journal of Economics, 122, 209-241.

[7] Dietz, R.D. and Haurin, D.R. (2003). The Social and Private Micro-Level Consequences of Homeownership. Journal of Urban Economics, 54, 401-450.

[8] Dlugosz, J., Gam, Y.K., Gopalan, R. and Skrastins, J. (2018). Decision-Making Delegation in Banks. Journal of Political Economy, 7, 101-139.

[9] Drakos, K. and Kutan, A.M. (2003). Regional Effects of Terrorism on Tourism in Three Mediterranean Countries. Journal of Conflict Resolution, 47, 621-641.

[10] Gibson, M., Mullins, J. and Hill, A. (2018). Climate Change and Flood Beliefs: Evidence from New York Real Estate. Working Paper, Department of Economics, University of Massachusetts.

[11] Goodman, L.S. and Mayer, C. (2018). Homeownership and the American Dream. Journal of Economic Perspectives, 32, 31-58.