

THE ASSOCIATION BETWEEN NATURAL DISASTERS - TRADE: LITERATURE REVIEW

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ABSTRACT

In this study, a literature review has been conducted to understand the association between natural disasters and trade. The hypothesis of the study is that although natural disasters have a significant impact on trade, they have not been extensively examined in academic literature. The purpose of the study is to determine the accuracy of the claim presented in the hypothesis. Various publications published in the last 12 years, containing pre-defined related keywords, have been analyzed. Studies have been grouped according to the years of publication, sources of disaster data used, level of analysis, methods/models employed, and the results they reached. As a result of this review, the aim is to find the gap in the literature regarding the association between natural disasters and trade, and consequently recommend a road map for future studies. The findings of this review indicate that most studies concluded that natural disasters negatively affect international trade. However, divergent results emerged in studies using different econometric models or focusing on specific contexts. The review highlights the need for diversifying studies in the literature at a micro-level and with different models. To achieve more specific and clear results, future research should examine the factors determining the impact of natural disasters on international trade data separately and increase the diversity in the econometric approaches used. Increasing research on regional and national levels is important for policymakers in high-risk areas. Raising the number of studies is extremely crucial for reducing the impact of natural disasters and developing effective strategies.

Keywords: Literature Review, Natural Disasters, Trade

1. INTRODUCTION

It is well known that natural disasters cause significant loss of life and extensive property damage worldwide. This alarming situation not only results in devastating human losses but also causes substantial structural damages economically. According to EM-DAT, the comprehensive database created by the Centre for Research on the Epidemiology of Disasters (CRED) affiliated with Louvain University, more than 22,000 mass disasters have occurred worldwide since 1900. The impact of natural disasters on trade activities is also at a significant level, undeniably creating an impact area on the global economy. In this context, the intricate association between natural disasters and trade has become a research area that has been of considerable interest and carefully examined in academic studies. The effect of natural disasters on trade can be thoroughly examined in various aspects of economic activities, such as potential problems and difficulties that may arise in the supply chain, inevitable production losses, and fluctuations in trade flows. The primary aim of this study is to conduct a systematic literature review of studies focusing on the association between natural disasters and trade. Although there are many comprehensive systematic literature review studies on the association between natural disasters and the economy, there is a noticeable lack of clarity

in literature review studies examining the specific association between natural disasters and trade. This study examined prominent studies in the existing literature in a general scope, taking into account parameters such as the publication years of the studies, the level of analysis of the study, the journals in which they were published, the methodologies employed, the years examined in the study, and the findings of the study. For this literature review, studies were picked based on such criteria as how closely they related to topic, how detailed their research method was, whether their data sources were reliable, and the currency of the information. After reviewing various studies, it has been observed that interest in the subject matter has increased in the literature since 2010. Therefore, time period for review range has been set between the years 2010-2022. During this period, 19 studies related to the topic have been analyzed. The study aims to determine the scope and content of the topics addressed in the literature, and to create a guide for future research in the field. The study consists of three informative parts in total. The second section includes research methods, findings, and general summaries of the studies. The conclusion part is thoughtfully included in the third section.

2. RESEARCH AND FINDINGS

2.1. RESEARCH METHOD

The literature review was conducted by searching the Google Scholar database using keywords including “natural disasters and trade,” “natural disasters and exports,” and “natural disasters and imports.” The search criteria were deliberately limited to studies published between 2010 and 2022 that focused on the impact of natural disasters on international and local trade. Specifically, studies concentrating on natural disasters and international trade were closely examined. Within this scope, 19 studies that thoroughly examine the impact of natural disasters on trade and stand out were identified. The studies conducted were analyzed by grouping them according to the years of the study, level of analysis, journals in which they were published, methodologies employed, years examined in the study, and findings of the study.

Table 1. Studies Examined According to the Determined Groupings

Title of the Study	Year	Journal	Data Sources for Natural Disasters	Level of Analysis	Method/Model	The years examined	Findings
Climatic natural disasters, political risk, and international trade	2010	Global Environmental Change	Emergency Events Database (EM-DAT)	Global	Gravity	1985-2003	Natural Disasters have Negative Effect on trade
Shaken, Not Stirred: The Impact of Disasters on International Trade	2010	International Economics	Emergency Events Database (EM-DAT)	Global	Gravity	1962-2004	The impact of natural disasters on trade is dependent on political and geographical conditions
Climate Shocks and Exports	2010	American Economic Review	Terrestrial Air Temperature and Precipitation	Global	Panel Data Analysis	1990-2006	The negative impact on trade is present in poor countries, not affecting the rich countries
Coping with loss: the impact of natural disasters on developing countries' trade flows	2012	European Commission Chief Economist Note	Emergency Events Database (EM-DAT)	Global	Gravity	1988-2010	Natural Disasters have Negative Effect on trade
The Economic Impact of Hurricanes in History: Evidence from Sugar Exports in the Caribbean from	2013	Weather, Climate, and Society journal	Hurricane Databases (HUR-DAT)	Regional (Caribbean Countries)	Panel Data Analysis	1700-1960	Natural Disasters have Negative Effect on trade
Global supply chains and natural disasters: implications for international trade	2014	Asia and Global Production Networks	Emergency Events Database (EM-DAT)	Global	Panel Data Analysis	1995-2010	Natural Disasters have Negative Effect on trade
Disasters and Trade: Did Hurricane Katrina Affect US Imports?	2014	International Economics and Economic Policy	Not Specified	National (United States of America)	Cointegration	1983-2008	Natural disasters do not structurally affect trade

Title of the Study	Year	Journal	Data Sources for Natural Disasters	Level of Analysis	Method/Model	The years examined	Findings
How do natural and man-made disasters affect international trade? A country-level and industry-level analysis	2015	Journal of Risk Research	Emergency Events Database (EM-DAT)	Global	Gravity	1984-1998	Natural Disasters have Negative Effect on trade
The asymmetric impact of natural disasters on China's bilateral trade	2015	Earth System Sciences	Emergency Events Database (EM-DAT)	National (China)	Gravity	1980-2012	Disasters in China increase exports, but do not have a significant impact on imports
Climate shocks and international trade: Evidence from China	2015	Economics Letters	China Statistical Yearbook	National (China)	Panel Data Analysis	2000-2011	Natural Disasters have Negative Effect on trade
Do Natural Disasters Stimulate International Trade?	2016	International Institute of Social Studies	Emergency Events Database (EM-DAT)	Global	Import demand and export supply	1970-2014	Natural Disasters have Positive Effect on trade
Weather Variations and International Trade	2018	Environmental and Resource Economics	East Anglia's Climate Research Unit	Global	Panel Data Analysis	1992-2014	Natural Disasters have Negative Effect on trade
Floods and Exports: An Empirical Study on Natural Disaster Shocks in Southeast Asia	2018	Economics of Disasters and Climate Change	Emergency Events Database (EM-DAT)	Regional (Southeast Asian Countries)	Gravity	1990-2016	Natural Disasters have Negative Effect on trade
Natural Disasters and Countries' Exports: New Insights from a New (and an Old) Database	2018	The World Economy	EM-DAT, Geophysical and Meteorological Database (GeoMet)	Global	Panel Data Analysis	1979-2000	The type of natural disaster determines the impact on trade
How do natural disasters affect services trade?	2019	WTO Staff Working Paper	EM-DAT, Geological and Meteorological Events (GAME)	Global	Gravity	1979-2010	Natural Disasters have Negative Effect on trade
Natural disasters and trade: the mitigating impact of port substitution	2019	Journal of Economic Geography	US Geological Survey	National (Japan)	Gravity	2011	Natural Disasters have Negative Effect on trade
Natural Disasters and the Reshaping of Global Value Chains	2022	IMF Economic Review	Bündnis Entwicklung Hilft- World Risk Index	National (Japan)	Panel Data Analysis	2011	Natural Disasters have Negative Effect on trade
The nexus between natural disasters, supply chains and trade—Revisiting the role of preferential trade agreements in disaster risk reduction	2022	The World Economy	Emergency Events Database (EM-DAT)	Global	Gravity	2000-2014	It is uncertain whether natural disasters affect trade
Natural disasters, climate change, and structural transformation: A new perspective from international trade	2022	The World Economy	Emergency Events Database (EM-DAT)	Global	Difference-in-differences	1997-2018	Natural disasters do not structurally affect trade

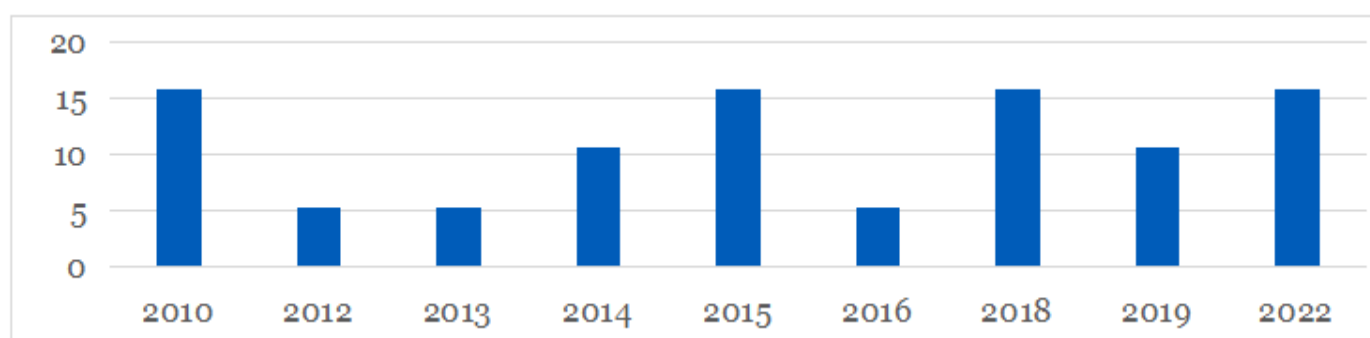
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2.2. RESULTS AND DISCUSSION

Among the published studies, approximately 53% rigorously investigated natural disasters on a global scale, while the remaining 47% focused on a regional/national level. While there are a multitude of studies examining the correlation between natural disasters and the economy, it is the research specifically analyzing the connection between natural disasters and trade that has started gaining prominence in literature since 2010.

In a detailed examination of 19 studies regarding the level of data analysis on natural disasters, it was found that about 63% of them utilized the Emergency Events Database (EM-DAT) as their primary source of information. In about 83% of these EM-DAT-inclusive studies, EM-DAT was the sole data source, while in approximately 17%, data from additional sources was also incorporated.

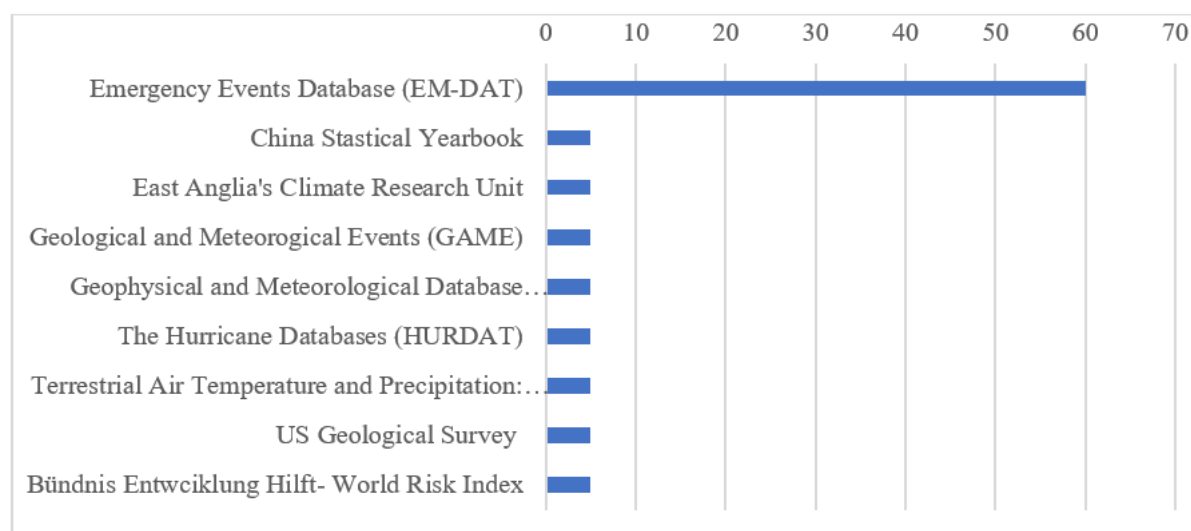
Figure 1. Studies conducted by year (%)



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The remaining studies, comprising about 37%, employed other sources for data, which included Geological and Meteorological Events (GAME), Geophysical and Meteorological Database (GeoMet), Terrestrial Air Temperature and Precipitation, Bündnis Entwicklung Hilft- World Risk Index, US Geological Survey, China Statistical Yearbook, University of East Anglia's Climate Research Unit (CRU), and the Hurricane Research Division (HUR-DAT).

Figure 2. Distribution of sources used for natural disasters in studies (%)

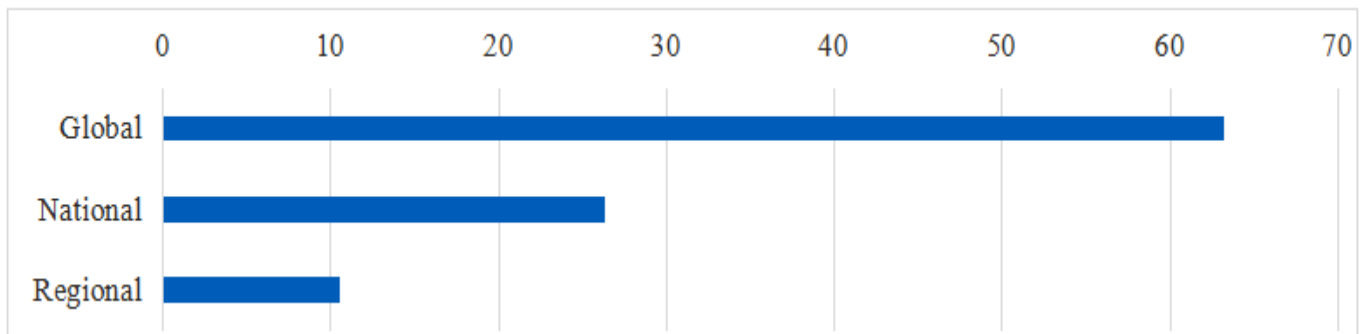


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When analyzing the studies examining the association between international trade and natural disasters in terms of their level of analysis, it was observed that approximately 63% of these studies were conducted at a global scale. These studies aimed to examine the effects of natural disasters on trade worldwide by analyzing data on a broader scale. On the other hand, about 11% of the studies were conducted at a regional level. One of these studies focused on Caribbean countries, while the other examined the impact of natural disasters on trade in Southeast Asian countries (Indonesia, Malaysia, the Philippines, and Thailand). Additionally, around 26% of the studies were conducted at a national level, with 40% of them focusing on China, another 40% on Japan, and the remaining 20% examining the United States. These studies examined the impact of natural disasters on trade in narrower areas and obtained more specific results.

Upon grouping the data used in the studies identified during the literature review according to the adopted method or model, it became apparent that various techniques were employed for data analysis. The most prevalent method was the gravity model, which was utilized in approximately 47% of the studies. Panel data analysis was a technique tested in around 37% of the studies. The "Import demand and export supply" model, the "Difference-in-differences model", and the "Cointegration model" were tested in around 16% of the studies. These methods offer different approaches in analyzing data and obtaining results, thus providing diverse insights.

Figure 3. Studies Based on The Level of Analysis (%)



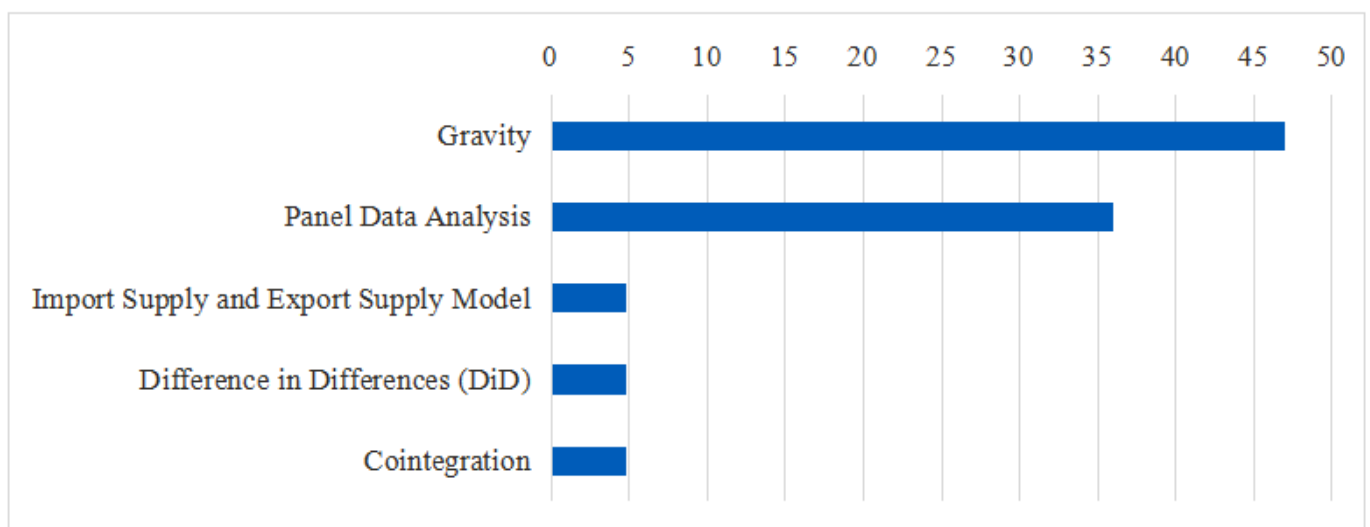
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When examining the models used in the studies, it is observed that five models were used. The most commonly used one among them is the gravity model. This model, used to quantify the trade volume between two countries, incorporates factors such as the countries' economic sizes (typically GDPs) and the geographical distance between them, serving as a proxy for transportation costs. While these are the main variables used in the gravity model, it is observed that different variables are used to strengthen the model depending on the content of the study. In the studies examined, the variables are as follows: Imports, Exports, Climate Disasters, Political Risk, Population, Common Border, Language, Colonialism, Monetary Union and Regional Trade Agreement Status, Natural Disasters, Man-made Disasters, Terrorist Attacks, Trade Costs. It offers a straightforward and easily understandable approach and aligns well with actual trade statistics in many cases.

Panel Data Analysis considers the variability in data over time as well as across different individuals or groups. It is especially suitable for studies involving data collection from varied individuals or groups over different time periods. This robust tool is capable of handling both time-related and individual variation, making it excellent for studying complex economic situations. However, challenges may arise related to the accessibility of appropriate data, the ability to generalize findings, and the often-intricate process of dealing with panel data.

Import Supply and Export Supply Model aims to comprehend the factors affecting a country's decision to import or export a specific commodity. That model can predict a country's trade tendencies under specific economic circumstances, yet it often relies on a range of assumptions which may not always reflect real-world scenarios.

Figure 4. Methods/Models Used in the Studies (%)



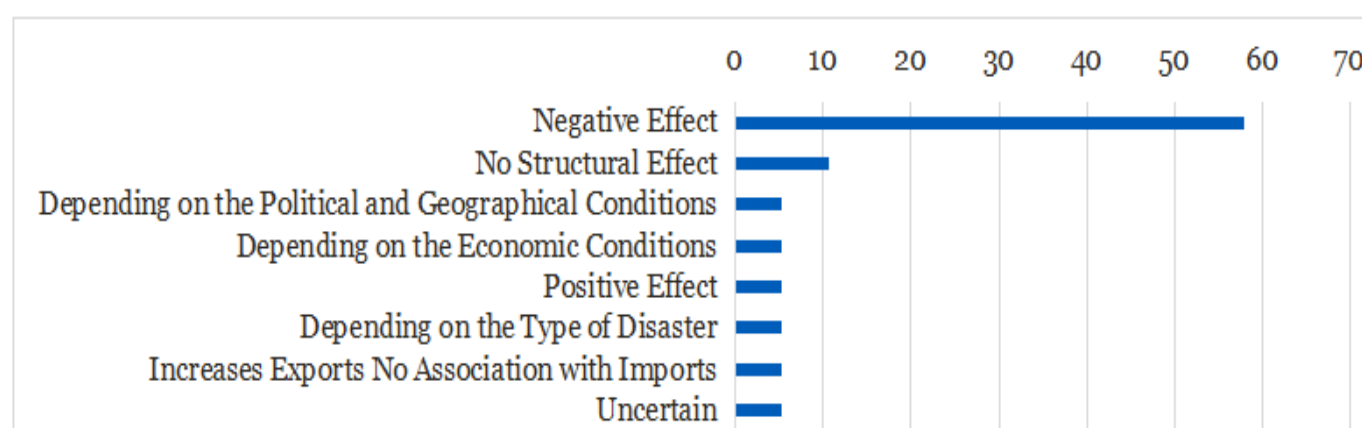
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Difference in Differences (DiD) method is used to gauge how disparities between two groups evolve over time. It is often applied to measure the impact of a policy change or an intervention. DiD employs control groups to isolate the effects of policy changes or interventions, enabling direct impact measurement. However, its proper execution demands meticulous experimental design and selection of suitable control groups. It also relies on the “parallel trends” assumption, implying that without any intervention, the intervention and control groups would follow a similar trend.

Cointegration is used to explore the long-term relationship among two or more time-series variables. It is particularly capable of tackling the issue of “non-stationarity”, a common phenomenon in time series data. To correctly apply this model, the variables must be co-stationary, which can be a challenge, and the model might require a substantial dataset.

Upon examining the findings of the aforementioned publications, approximately 58% of the analyzed studies concluded that natural disasters have a negative impact on international trade. About 11% of the studies determined that natural disasters do not induce any structural impact. One study which used the “import demand and export supply” model found that, contrary to the prevailing view in the literature, natural disasters can have a positive effect on trade. This represents around 5% of the studies. In another study, representing around 5% of the total, it was discovered that the influence of natural disasters on trade can vary depending on certain factors such as a country’s level of democratization and geographical size. Similarly, another study, constituting about 5%, determined the effect on trade could be influenced by a country’s economic condition. A further study, representing around 5%, which examined four different types of natural disasters separately, concluded that the impact on trade differs based on the type of disaster. One study, also representing around 5% of the total, specifically examining China, found that natural disasters increase exports but reduce imports in the country. Finally, another study, constituting about 5% of the total, presented inconsistent data regarding the impact of natural disasters on the global supply chain. This comprehensive literature review demonstrates that the findings regarding the impact of natural disasters on international trade may vary depending on different variables, methods, and areas of analysis, reflecting the complexity of the issue.

Figure 5. Distribution according to the findings of the studies (%)



Source: Created by the Author

2.3. GENERAL OVERVIEWS OF THE STUDIES

The reviewed studies in the literature review have been summarized in the context of their general scope. The publications were included in this study by being sorted according to their publication date. The summaries of the studies are as follows:

The research paper titled “Climate Shocks and Exports” (Jones & Olken, 2010), featured in the American Economic Review, delved into the connection between climate shocks and global trade. The primary aim of this study was to scrutinize and assess the impact of climate shocks on exports, utilizing international trade data. Panel regression analysis served as the method employed in the research. Data from 1900 to 2006 was evaluated, with climate data gathered on a monthly basis

from “Terrestrial Air Temperature and Precipitation.” The study’s results revealed that high temperatures significantly affected the exports of economically disadvantaged countries, while having no discernable impact on the exports of wealthier countries. However, it was noted that the economies of affluent countries would also experience effects since their imports were influenced, despite their exports remaining unaffected by temperature. The study found that a temperature increase of one degree led to a reduction in the export growth rate of a financially struggling country by 2.0 to 5.7 percent. A sector-by-sector analysis of temperature effects showed that the impacts were predominantly observed in agricultural product exports and light manufacturing. This research is considered one of the most important studies on the subject in the literature.

The article “Shaken, Not Stirred: The Impact of Disasters on International Trade” (Gassebner, Keck, & Tech, 2010) was published in the Review of International Economics and analyzed the effects of disasters on international trade. The article aims to examine the impact of major disasters on import and export flows using the gravity model. Data on trade were examined for 170 countries between 1962 and 2004, and data on natural disasters were taken from EMDAT. Approximately 300,000 observations were made in the study. Two important findings were obtained in the study. Firstly, It was found that the lower a country’s democratic values, the higher the import loss. However, the type of government did not have an effect on export losses. One of the most important comparisons related to the findings was made between Costa Rica and Togo. Following a disaster that occurred in Costa Rica, a democratic and developing country, in 2001, exports decreased by 3.9%, and imports increased by 3.2%. In Togo, which has the same physical size and an autocratic government, exports decreased by 3.7% and imports by 6.2% after the disaster. Another result obtained is that the physical size of a country is also important, especially for exporters.

The article “Climatic natural disasters, political risk, and international trade” (Reuveny & Oh, 2010) published in the Global Environmental Change journal examines the association between natural disasters, political risk, and international trade. The article statistically analyzes the effects of climate-related natural disasters and political risk on bilateral trade in various countries using a gravity model. 116 countries were examined, and data from 1985 to 2003 were analyzed. Data on natural disasters are taken from EM-DAT. The study found that if climate change increases the frequency of climate-related disasters as predicted by science, economic globalization could decline. The impact of this could spread to the macroeconomies of many countries due to the critical role of international trade in the global system. As a result, natural disasters or increased political risk in importing or exporting countries reduce bilateral trade. Countries with lower political risk experience a smaller decrease in trade flow when hit by natural disasters compared to the average. On the other hand, countries with higher political risk face a larger decrease in trade flow than the average during natural disasters. Based on the empirical findings of the study, trade helps the global economy withstand negative shocks such as natural disasters by enabling countries to provide each other with emergency goods and aid, and facilitating recovery efforts. The study is one of the most cited works in the literature on the possible effects of natural disasters on trade. As of April 1, 2023, it has received 152 citations.

The article “Coping with loss: the impact of natural disasters on developing countries’ trade flows” (Cernat, 2012) was published as a European Commission Chief Economist Note and discusses the impact of natural disasters on trade flows in developing countries. The study investigates the impact of natural disasters on the exports of trading countries. Data on natural disasters were obtained from the Emergency Events Database (EM-DAT). Two main distinctions were made in the study, resulting in the creation of two different models to analyze the data. In the first model, developing countries were treated as a whole. In the second model, small developing countries were specifically evaluated, with the definition of a “small” country being one with a population of less than 20 million. The gravity modeling technique was used to test the data. The study found that 9% decrease in exports was observed as a result of the disasters. When specifically examining the impact on the exports of small countries, it was found that the decrease was 22%, indicating that the effect of natural disasters on the exports of small countries differs from that on larger developing countries. The negative effect of disasters was felt for an average of about 3 years in small developing countries.

The article “The Economic Impact of Hurricanes in History: Evidence from Sugar Exports in the Caribbean from 1700 to 1960” (Mohan & Strobl, 2013) was published in the *Weather, Climate, and Society* journal and investigates the economic impact of hurricanes on sugar exports in the Caribbean from 1700 to 1960. Panel regression analysis served as the method employed in the research. The article examines the tropical cyclone events affecting the Caribbean colonies/countries between 1700 and 1960 and their impact on sugar exports. Data from 1700 to 1850 were obtained by examining academic studies on the period, while data from 1851 to 1960 were obtained from the National Hurricane Center’s HURDAT dataset. The primary aim of the study is to provide quantitative evidence of the economic impact of hurricanes, an important natural and largely unpredictable phenomenon that shaped the economic history of the Caribbean. To do this, hurricane event data were combined with historical sugar export data in a regression framework over the 1700-1960 period. The results suggest that hurricanes had significant negative economic consequences for Caribbean sugar colonies. In general, the study confirms historical documents that argue that hurricanes had a major impact on the sugar industry in the Caribbean.

The article “Global supply chains and natural disasters: implications for international trade” (Puzzello & Raschky, 2014) was published in *Asia and Global Production Networks* and examines the implications of natural disasters on global supply chains and international trade. The study examines data from 1995 to 2010, during which time 5,479 major natural disasters occurred according to the Emergency Events Database (EM-DAT). The study focuses on all-natural disasters rather than a specific event. The aim of the study is to determine the impact of supply chain disruptions due to major natural disasters on exports. The study aims to create models that can understand the impact of failures in the supply chains of countries that export or import when local economies are hit by disasters. Additionally, the study creates a comprehensive model by modeling the impact of disasters in countries outside the trading pair. The study found that exports significantly decreased, especially when major disasters occurred. The natural disasters that have the most significant impact on a country’s supply chains and trade are earthquakes, tsunamis, storms, and floods. The study also emphasizes that it is not all-natural disasters but only major ones that affect international trade.

The article titled “Disasters and Trade: Did Hurricane Katrina Affect US Imports?” (Parsons, 2014) was published in the journal “*International Economics and Economic Policy*” and examines the impact of Hurricane Katrina on US imports. The main aim of the study was to investigate the extent to which Hurricane Katrina affected the import of the United States in 2005. The article focused on a single developed country. It was stated that the fact that articles examining the association between natural disasters and trade collectively examined many countries and many disasters prevented accurate determinations regarding the association between natural disasters and trade. For this reason, the impact of a single disaster in a single country was examined in the study. Panel data analysis was used to test the data in the article. Data between the first quarter of 1983 and the second quarter of 2008 were examined. The reason for choosing this period was that it was when the recession officially ended in November 1982. The reason for only examining imports is that export supply models are rare and generally lack solid theoretical foundations. According to the results obtained in the study, it was seen that the estimated demand was robust during the period covering Hurricane Katrina. In this context, it was concluded that the hurricane did not have a significant effect on US imports, which is contrary to the pre-evidence that natural disasters can cause a break in import demand. Therefore, it is stated in the study that decision-making mechanisms in the United States did not pursue any macro policies to smooth out trade balance fluctuations even in the biggest American disasters.

The research article “How do natural and man-made disasters affect international trade? A country-level and industry-level analysis” (Oh, 2015) was published in the *Journal of Risk Research* and examines the impact of natural and man-made disasters on international trade, using a gravity equation model to compare the effects of these two types of disasters. The study examines data from 53 countries between 1984 and 1998, with a total of 17,828 observations. The study aims to measure the effects of natural and man-made disasters on international trade and make a comparison between the two types of disasters. According to the results, natural disasters significantly decrease

trade flows, while man-made disasters have mixed effects. The study also examines the impact of disasters on international trade according to the socioeconomic status of the trade pairs. Natural disasters negatively affect bilateral trade and increase trading costs. On the other hand, technological disasters and terrorist attacks in developed countries increase trade with other developed countries but do not result in an increase in trade with less developed countries. Therefore, the study's most important finding is that a country's socioeconomic status is crucial in international trade during times of disasters. The article highlights the relatively new recognition of the importance of natural disasters, technological disasters, and terrorist attacks in international business compared to financial and political risks. The article suggests that disaster risk assessment and planning should be an integrated effort between firms and governments to minimize direct and indirect damages and enhance operational flexibility. Overall, the study provides an original contribution to the literature by examining disasters comparatively and from an international business perspective.

The article "The asymmetric impact of natural disasters on China's bilateral trade" (Meng, Yang, Shi, & Jeager, 2015) was published in the *Natural Hazards and Earth System Sciences* journal and investigates the asymmetric impact of natural disasters on China's bilateral trade. A gravity model adapted to national conditions was used in the study to examine the impact of natural disasters in China and trade partner countries on China's imports and exports. Statistical data for China and trade partners from 1980 to 2012 were analyzed. The study used a gravity model. According to the findings of the study, disasters in China increase exports but do not have a significant impact on imports. However, an increase in disasters in China's trade partner countries reduces both China's imports and exports. The development levels and land areas of China's partners are important in determining the size of the disaster effects on China's bilateral trade. If the partner country affected by the disaster is developed, the declines in China's bilateral imports and exports deepen. Additionally, if the affected partner has a larger land area, the decline in China's bilateral imports is less, but the decline in bilateral exports is greater.

The article "Climate shocks and international trade: Evidence from China" (Li, Xiang, & Gu, 2015) was published in the *Economics Letters* journal and presents evidence on the association between climate shocks and international trade in China. The study examines the effects of climate shocks on international trade in China. The aim of the study is to identify the impact and depth of weather shocks on international trade. Data related to weather were obtained from the China Statistical Yearbook. The study analyzes data from 2000 to 2011, Panel method is used as the methodology in the study. According to the results obtained in the study, there are significant climate impacts on exports, but very little impact on imports. Poorer, hotter, and non-coastal cities are found to be more affected by weather changes. Additionally, the results of the study suggest that climate shocks have significant impacts on China's exports, revealing the high cost of potential climate change. The study also suggests that this may demonstrate China's "great country effect," affecting not only its own wealth but also global welfare by raising prices and reducing the number of products exported to the world market.

The article "Do Natural Disasters Stimulate International Trade?" (Li & van Bergeijk, 2016) was published in the *International Institute of Social Studies* journal and examines whether natural disasters have a stimulating effect on international trade. The dataset used in the study covers 63 countries from 1970 to 2014, and the "import demand and export supply" approach is used to test the data. The study finds that natural disasters have a positive impact on import demand (1.6%) and export supply (1.9%). The study suggests that the increase in imports is due to the need to purchase products for reconstruction after natural disasters. For exports, the study suggests that more autocratic regimes may prioritize the survival and reconstruction of the export sector. The study's findings challenge the general perception that natural disasters have a negative impact on trade and highlight the positive effects that can occur. The study also recommends further research on different countries and time periods to fully understand the impact of natural disasters on international trade.

The article "Weather Variations and International Trade" (Dallmann, 2018) was published in the *Environmental and Resource Economics* journal and investigates the association between weather

variations and international trade. Panel data analysis was used as the method in the study. The data of 134 countries between 1992 and 2014 were examined in the study. The weather-related data were obtained from the University of East Anglia's Climate Research Unit. The data were analyzed using panel data methodology. The study tested specific characteristics that make countries vulnerable to weather shocks, including income level, location, initial weather conditions, institutional quality, transportation costs, and free trade agreements. In addition, another aspect examined in the study was the channels through which weather changes affect production and productivity and thus affect bilateral trade. In addition to the country analysis, the impact of temperature on 95 different products was also examined in the study to identify which products are sensitive to weather conditions. This identifies which products are sensitive to weather conditions. Finally, another aspect investigated was whether adaptation measures can reduce future impacts. The aim of the study was to understand whether temperature and precipitation changes have an impact on bilateral trade within the scope of the data. According to the findings, higher temperature changes in the exporting country and temperature differences between the exporting and importing countries were found to reduce total bilateral trade. Another result seen in the study is that this situation is higher for exporters with low-quality institutions and closer to the equator. When the analysis was done at the product level, it was seen that the negative effect of temperature is dominant, but the effects vary from product to product in a negative and positive context. The agricultural sector, the manufacturing sector, especially the metal and textile sectors, are among the most affected sectors. In long-term analysis, the results show that the temperature in the exporting country has a permanent effect for up to 20 years. The study titled "Floods and Exports: An Empirical Study on Natural Disaster Shocks in Southeast Asia" (Tembata & Takeuchi, 2018) was published in the Economics of Disasters and Climate Change journal and empirically analyzes the impact of floods on exports in Southeast Asia. The study examines the impact of floods and storms on trade. The data used was between 2004 and 2016, and a total of four countries were included in the study: Indonesia, Malaysia, the Philippines, and Thailand. The study differs from climate impact research in that most of the literature focuses on agriculture, while this study examines the effects of weather shocks on both agricultural and non-agricultural products. Export data were separated into agricultural and manufacturing product groups to investigate the effects of disasters by sector. The results show that natural disasters have a significant impact on exports, with floods and storms reducing export values. The impact of floods was seen to occur within one month of the disaster. The findings also show that the sudden impact of floods led to an average decrease of 3-5% in bilateral export values from Southeast Asian countries. The study emphasizes the need for commercial organizations and policymakers to pay more attention to climate-related risks in international trade.

The article "Natural Disasters and Countries' Exports: New Insights from a New (and an Old) Database" (El Hadri, Mirza, & Rabaud, 2018) was published by The World Economy journal and provides new insights into the association between natural disasters and countries' exports, using a new and an old database. The main focus of the study is to examine and determine the impact of a disaster on a country's total exports due to a reduction in its resource capacities, such as labor capacity, agricultural products, and public infrastructure. Panel data analysis was used to test the data available in the study. The data analyzed in the study covers the years 1979-2000, and the natural disasters examined were earthquakes, floods, extreme temperatures, and storms. The main point that distinguishes the study from the general literature is the sources of the data analyzed. In this study, the data were taken from both EM-DAT and Geophysical and Meteorological Database (GeoMet) to compare the results systematically. The comparison was made to determine the impact of using data from different sources on the results of the study. The findings of the study show that there is a clear negative impact on a country's exports after earthquakes, regardless of the country's economic or political characteristics. For storms, no significant impact was observed on exports regardless of the country's characteristics or the intensity of the event. Floods were found to have a negative impact on the exports of small countries, especially when floods are severe. An ambiguous effect was observed for extreme temperatures.

The article “How do natural disasters affect services trade?” (Xu & Kouwoaye, 2019), published by the World Trade Organization, is the first to examine the impact of natural disasters on services trade in the literature. The gravity model was used in the study. Natural disasters were measured using two different sets of variables, namely, their human casualty and economic loss, and their geophysical and meteorological magnitudes. Capital-intensive service sectors, such as transportation and communication, are most affected by a major natural disaster’s negative impact on communication exports for up to five years after the disaster. The data covers the years 1995–2012. Data on natural disasters are taken from EM-DAT. All-natural disasters are considered in general. The results of the study show that natural disasters cause a decrease in service trade exports by 2% to 3%. However, concrete data on imports could not be obtained, as the study states that affected countries may need more service imports to meet their consumption needs, but major disasters can also disrupt trade infrastructure and impair service imports. Another important point mentioned in the study is that natural disasters that disrupt economic activities and hinder international service trade can create serious challenges for developing countries’ development process. One of the most striking results of the study is that the negative impact of natural disasters on service trade is larger than the impact on merchandise trade, as shown by statistical tests. This can be explained by the fact that trade in services faces higher costs and is more heavily reliant on physical infrastructure for cross-border delivery. Natural disasters causing damage to infrastructure and disrupting economic activities, therefore, affect service trade more severely. Another point investigated in the study is whether openness in service trade mitigates or aggravates the impact of natural disasters. The results show that although countries with higher service trade restrictions tend to import and export fewer services in general, these countries tend to import relatively more services after a major natural disaster. This may be due to the fact that countries with higher trade restrictions are less prepared for disasters and thus require more service imports to respond to and recover from a major natural disaster.

The study “Natural disasters and trade: the mitigating impact of port substitution” (Hamano & Vermeulen, 2019) was published in the *Journal of Economic Geography* and examines the mitigating impact of port substitution on the association between natural disasters and trade. The study examines the impact of natural disasters on exports at the port level. The study employed a gravity modeling approach to analyze the data. Japanese customs data were used to test the model, and the study examined the extent to which there was a change in port usage after the Great East Japan Earthquake of 2011. The study found that at least 40% of exports were diverted to other ports as a result of the earthquake. The findings suggest that external variability in transportation costs and fixed export costs specific to each port cause exports to shift from one port to another. One of the most significant implications of the study is that the results should inform decision-making processes for policymakers. When storms and earthquakes occur regularly, preparedness for natural disasters becomes a global issue rather than a concern for individual countries. The recovery of economies and the resumption of trade after natural disasters depend on the infrastructure available, such as alternative routes and options for firms. The study points out that businesses have continuity plans, but these plans are dependent on existing infrastructure, such as ports and roads, making decision-making mechanisms important. Another focus of the study is the importance of the type of product in port substitution. The study therefore focuses on export data at the port level, with an emphasis on the impact on international trade. The study found that the effect of port substitution was most significant for technology products that are important in supply chain networks, while there was no such effect for products that have larger domestic transport costs and can be stored for longer periods.

The study “Natural Disasters and the Reshaping of Global Value Chains” (Freund, Mattoo, Mulabdic, & Ruta, 2022) was published in the *IMF Economic Review* and analyzes the effects of natural disasters on global value chains, and explores how firms respond to natural disasters by reshaping their production processes and sourcing strategies. The aim of the study is to understand the long-term effects of natural disasters on global value chains. In this context, the practices of firms in the automotive and electronics sectors were examined after the 2011 earthquake in the Tōhoku region of Japan. The study investigated whether the 2011 earthquake led to diversification of imports from

Japan and reshoring or nearshoring of production by more dependent importers. The results of the study show that countries that were more dependent on Japanese suppliers before the earthquake experienced larger declines in imports from Japan after the earthquake. When the decline was examined by product, it was found that the decline in intermediate goods and electronics was less pronounced compared to final products. Another important point expressed in the study is that, despite the decline in trade flows after the natural disaster, supplier companies in Japan did not re-shore, nearshore, or diversify production to reduce risk. In summary, the study provides insights into the effects of natural disasters on global value chains and highlights the resilience of established association and supply chains, even after a significant shock.

The article “The nexus between natural disasters, supply chains and trade—Revisiting the role of preferential trade agreements in disaster risk reduction” (Permani & Xu, 2022) was published by The World Economy journal and examines the nexus between natural disasters, supply chains, and trade, and revisits the role of preferential trade agreements in reducing disaster risk. The data of 42 countries between 2000 and 2014 were analyzed using the gravity model. The main purpose of the study is to understand the impact of natural disasters on global value chains and to examine whether a country’s Preferential Trade Agreements with its trading partners can mitigate the effects of natural disasters on the global value chains. According to the results of the study, there is strong evidence of a positive association between the depth of trade agreements and the global value chains. The study finds that a natural disaster in an exporting country increases the impact of the disaster on trade. This situation supports the idea that the development of regional and global value chains can create a risk profile that increases economic vulnerability in the event of a disaster in a highly interdependent region.

The research paper titled “Natural disasters, climate change, and structural transformation: A new perspective from international trade” (Wu, 2022), published by The World Economy journal, offers a fresh outlook on the connection between natural disasters, climate change, and structural transformation through the lens of global trade. Utilizing a “Difference-in-differences” modeling technique, the study analyzes a panel dataset spanning 158 countries from 1997 to 2018. natural disaster data come from the Emergency Events Database (EMDAT). The study aims to investigate the long-term consequences of natural disasters on economies. To achieve this, the economic effects of natural disasters are empirically explored within various time frames. One key finding of the research is that climate-related disasters trigger a structural decline in the short term but don’t hinder structural growth in the long run. The magnitude of natural disaster impacts depends on a country’s overall development level and trade openness. For instance, more developed, higher-income, or more internationally traded countries are less affected by natural disasters. The study also finds that economic development and trade openness significantly influence the impact of natural disasters. Developed or high-income countries are less affected by natural disasters compared to their developing or low-income counterparts, as per the statistical analysis. Trade openness is shown to mitigate disaster damages and foster economic resilience to such natural shocks.

3.LIMITATIONS

This study presents a detailed literature review but acknowledges certain limitations. First, a potential selection bias exists in the studies reviewed due to subjective inclusion criteria. The use of Google Scholar as the primary database might have resulted in overlooking certain related research. Second, the broad subject matter may result in gaps in the review, particularly regarding certain regions or disaster types. Lastly, despite a systematic approach, researcher bias may be present in study categorization and interpretation, a common issue in literature reviews addressed by transparency in methods and decisions. Despite these, this study contributes to understanding the trade impact of natural disasters. Future research should address these limitations, considering various time frames, data sources, and a more diverse range of locations and disaster types.

4.CONCLUSION

After conducting a systematic literature review, 19 prominent studies rigorously analyzing the intricate association between natural disasters and trade were thoroughly examined. Many of these

comprehensive studies utilized EM-DAT data from the prestigious Centre for Research on the Epidemiology of Disasters (CRED) and the reliable gravity model for data analysis. A significant portion of the studies predominantly focused on global data. Meanwhile, the rest of the compelling studies targeted specific regions or individual countries.

When meticulously evaluating the results of these studies, various outcomes have been observed. However, the majority of the studies have conclusively determined that natural disasters indeed have a detrimental impact on international trade. In contrast, different results have been discovered in studies that specifically limit the context of the country, disaster, or both, and utilize econometric models other than the widely used gravity model. This intriguing situation highlights the crucial need for diversifying studies in the literature at a more detailed micro-level and with different models.

Publications examining the association between natural disasters and trade aim to determine the direction and magnitude of the impact of natural disasters on trade. In a significant portion of these studies, it has been found that natural disasters have a substantial effect on international trade, negatively impacting supply chains and reducing countries' competitiveness. In this context, many studies have revealed that the destruction and impact of natural disasters. These studies demonstrate the importance of international cooperation for decision-making mechanisms. This highlights the need to develop international trade policies against natural disasters accordingly. Overall, the findings from these studies allow policymakers and businesses to make rational decisions in response to the potential effects of natural disasters on trade.

Another focus of some studies is which regions and sectors are most affected by disasters. These studies show which sectors are more impacted by natural disasters. As a result, they reveal which businesses and policymakers in a region or country need to develop more strategies to minimize risks related to natural disasters. These studies play a critical role in determining investment decisions and resource allocation, as they provide an understanding of which sectors are more affected by natural disasters.

The type of disaster is also crucial in the natural disasters-trade association. Studies in the literature have assessed if and how specific disasters impact trade. These investigations enable determining the damage caused by each disaster to trade.

Indeed, light has been shed on the intricate connection between natural disasters and trade through the findings of this study, but more importantly, significant potential for practical application in real-world scenarios is carried by these findings. There are a number of valuable inferences that can be drawn from this understanding that can substantially benefit disaster management strategies and policy formation. For instance, the knowledge of which regions and sectors are more severely affected by natural disasters can provide the cornerstone for targeted disaster management strategies. This is a crucial insight for policymakers who could then prioritize the establishment of resilient infrastructures in these high-risk regions, along with promoting industries that demonstrate greater resilience to natural calamities. The in-depth comprehension of how specific disaster types impact trade could provide a guideline for risk assessment and mitigation strategies. As a result, both businesses and policymakers would be empowered to prioritize threats based on their potential to disrupt trade and direct resources for risk mitigation accordingly. The crucial role of international cooperation is further underlined by these findings, given the substantial influence of natural disasters on global trade. This knowledge could act as the foundation for governments negotiating trade policies, ensuring that the implications of natural disasters are taken into consideration. Such agreements might encompass measures like temporary tariff relief or financial assistance, designed to support countries that have suffered extensively due to a disaster. An opportunity has also been identified for governments and businesses to allocate more investment towards developing disaster-resilient infrastructure. This approach is particularly relevant for regions and sectors that are more vulnerable to the repercussions of natural disasters, as such investment could help minimize economic and trade-related losses induced by these events. Given the escalating frequency and intensity of climate-related disasters, The significance of sustainable development and proactive climate action is also reemphasized by this study. To counteract the future impact of such disasters on trade, it's imperative that sustainability and climate resilience become integral to long-term strategies adopt-

ed by governments and businesses. In conclusion, while contributing to academic literature, these findings also carry with them important practical implications. Policymakers and businesses, by leveraging these insights, can take preemptive measures to counter the negative effects of natural disasters on trade, and in doing so, nurture a more resilient and sustainable global economy.

The necessity for a more extensive body of research to deepen the understanding of the complex interplay between natural disasters and trade is indeed suggested by these enlightening findings. Here are some suggestions for future studies that might enrich the existing literature:

Greater detail exploration of certain economic, environmental, or sociopolitical variables should be encouraged when considering the influence of natural disasters on trade. For instance, examining a country economic openness, resilience, the relative scale or frequency of disasters, or the presence of disaster management policies and institutions, could present crucial variables in econometric models. By doing so, fresh insights might be unearthed into how these variables interact with the effect of natural disasters on trade. There's also a call for methodological diversity in this area of research. For example, adopting machine learning techniques could help dissect large and complex datasets related to natural disasters and trade. Furthermore, the use of models that demonstrate the delayed effects or unexpected shifts resulting from natural disasters on trade could yield more nuanced results. Future research would also benefit from examining individual countries or regions more closely, especially those prone to particular types of natural disasters or possessing unique trade dynamics. In addition, a comprehensive examination of trade-dependent economies like may reveal how these trade-reliant countries mitigate the effects of natural disasters. Additionally, conducting more detailed studies at regional or national levels can help provide clearer guidelines for policymakers, particularly in regions frequently afflicted by natural disasters. These studies could concentrate on specific types of natural disasters prevalent in certain regions, analyzing how these disaster types uniquely impact different sectors of trade. To conclude, while substantial progress has been made in this area, there remains a need for more detailed and targeted research. The ongoing exploration of the significant impacts of natural disasters is essential for devising effective strategies to mitigate their effects. It is hoped that these findings inspire further research and inquiry into this critically important domain.

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