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EXAMINING THE SEVERITY OF NATURAL DISASTERS: A STUDY OF LOWER MIDDLE-INCOME COUNTRIES

Abina V P[*] and Meenakshi Rajeev[**]

Abstract

The foremost priority outlined in the Sendai Framework for Disaster Risk Reduction, 2015, underscores the need for a comprehensive understanding of multidimensional disaster risk. In the light of this, the present study tries to examine the disaster risk profiles of Lower Middle-income Countries (LMCs), which account for the largest share in terms of the human cost of natural disasters. By combining three immediate impact indicators, i.e., the percentage of people killed, percentage of people affected and damage cost as a percentage of GDP, an overall disaster severity index was constructed for LMCs for the period 2000-2023,with weights assigned to these indicators following the Multidimensional Poverty Index (MPI) framework developed by Alkire & Foster (2011). The study has found that over time, these countries have faced a wide range of natural disasters, with flooding and storms being the most common among them. Further, the convergence of economic and geographical vulnerabilities is found to have magnified the overall severity of natural disasters faced by LMCs. It has been found that 40% of the countries with a very high natural disaster severity accounted for a GDP per capita of less than $4,000. Furthermore, 66% of them have experienced medium density of natural disasters, with more than 20 events occurring in the past five years. Additionally, 40% of these nations exhibit poverty rates exceeding 30% with all of them sharing a coastal territory. Notably, 60% of them are island countries with high elevation and a significant coastal population. By adopting this comprehensive approach, our research seeks to provide a more accurate and holistic understanding of the severity of natural disasters, which enables a fairer comparison of countries facing different types of natural disasters. Moreover, an understanding of the various dimensions of risk can help policy makers to reduce the future natural disaster risk.

Key Words: *Sendai Framework, Disaster Risk, Incidence, Direct Impact*

Introduction

In recent decades, the world has witnessed a profound and alarming transformation in the form of climate change, that has left an indelible mark on our environment, economies and societies in terms of an increase in the frequency and severity of natural disasters across the world (GAR, 2018; IPCC, 2020). Since 2000, there have occurred8942 major natural disasters the world over, affecting more than 4.53 billion people and claiming1.42 million lives, with total economic damages of $ 4.13 trillion (6% of the world GDP) (EM-DAT, 2024).

However, these natural disaster impacts are not uniform across countries. According to UNDRR[1] Report, 2020, people in developing nations are seven times more likely to be exposed to natural disasters than developed countries with an equivalent population (UNDRR, 2020). Further, most of these nations come under medium to extreme high-risk natural hazard regions in the world

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[1] United Nations office for Disaster Risk Reduction

(UNISDR[2], 2017). Among the less developed nations, both the incidence and impact of natural disasters are high in Lower Middle-income Countries (LMC). For the period 2000-2023, out of the total number of natural disasters, 30% have occurred in LMCs, accounting for 49% of the total disaster-related deaths, with 41% of the total people getting affected (EM-DAT, 2024).However, limited literature exists discussing the severity of natural disasters in LMCs, even though they happen to be the worst affected by natural disasters in terms of both physical and human damage.

Although LMCs remain scattered across various regions of the world, their geographical locations can influence the types and frequencies of natural disasters they experience, which may vary widely within countries and regions due to local climatic patterns and geographical conditions. Given the above backdrop, this paper attempts to provide a general overview of the region-wise occurrence of different types of natural disasters in these countries.

In addition, the present study attempts to quantify the overall severity of natural disasters in these countries with a view to gaining a more comprehensive understanding of the devastating impacts of natural disasters on these nations. Currently, severity is measured based on intensity scale, which varies according to disaster type and is not highly correlated to disaster impacts (Caldera *et al*, 2016). Another common approach to measuring severity is to examine specific impact indicators such as disaster-induced fatalities, population affected, geographical area covered etc. (Gad-el-Hak, 2018; Wirasinghe, 2022). However, one prevalent challenge arising from the use of a single indicator is that it can introduce bias towards certain types of disasters. For instance, floods may disproportionately affect a large population, while earthquakes may lead to a higher loss of life, but impact a smaller proportion of the population. Consequently, relying solely on one indicator may provide a skewed representation of severity, particularly while comparing countries exposed to different types of disasters.

To mitigate this bias and offer a more comprehensive assessment of severity, our study proposes a novel approach. In the present study, the overall assessment of natural disaster severity across LMCs is based on the integration of various direct impact indicators, such as the number of people affected, the death toll and the extent of damages, regardless of the disaster type. To accurately reflect the relative importance of these indicators in capturing the overall severity of a natural disasters, appropriate weights are assigned to each indicator, following the multi-dimensional poverty index framework developed by Alkire & Foster (2011).

This comprehensive approach enables a fairer comparison of countries facing different types of natural disasters. Further, these three indicators have been selected to better align the index with the Sustainable Development Goal 11.5[3] and Sendai Framework for Disaster Risk Reduction, 2015. By measuring the severity over a period, this paper attempts to shed light on the progress of LMCs in achieving these targets, as only six years remain to meet these critical goals. Assessing the current position of LMCs is crucial to understanding the challenges and opportunities involved in enhancing disaster resilience and aligning with the global objective of sustainable development. Moreover,

[2] United Nations office for Disaster Risk Reduction officially changed its name to UN DRR from UN ISDR in May 2019

[3] SDG 11.5 aims at reducing significantly the number of deaths and the number of people affected and substantially reducing the direct economic losses relative to global gross domestic product caused by disasters by 2030.

understanding various dimensions of disaster risk helps policy makers devise appropriate policy interventions towards reducing the future natural disaster risk of these regions.

To achieve this objective, the study has employed the data on disaster impacts with respect to 47 LMCs spanning the period 2000-2023.The study finds that over a period, these countries have faced a wide spectrum of natural disasters, with flooding and storms being the most common among them. Further, the severity of natural disasters is high for those countries with a GDP per capita less than $4000, high disaster density combined with a poverty headcount ratio of more than 30%, and an added challenge of coastal vulnerability and high elevation. It has been identified that Asian countries often top the list in terms of both natural disaster occurrence and severity. However, some countries, such as India, Bangladesh and Iran, have moved over to the medium severity category, despite their accounting for the highest share of disaster occurrences.

Against this backdrop, this paper is structured as follows: Section 2 discusses the relevant literature, followed by Section 3, which presents the conceptual framework. Section 4 details the data and methodology. Finally, Section 5 presents the findings and Section 6 concludes the paper with policy implications, future research directions and the limitations of the study.

Literature Review

Natural disasters come in diverse shapes and sizes, ranging from wildfires that destroy large tracts of forests to epic storms and typhoons that devastate coastal regions and from severe droughts that adversely affect agriculture to catastrophic floodings that displace communities (FAO, 2018). Severity implies the adverse effect of a natural disaster on a community or economy in terms of the number of people being affected or huge death tolls or even greater economic losses.

Traditional assessments of natural disaster severity rely on magnitude scales specific to each type of disaster. Earthquakes, for instance, are evaluated using the Richter scale, while storms and floods have their own distinct measurements like the Saffir-Simpson scale for hurricanes and the Fujita scale for tornadoes. However, relying on physical strength scales does not offer the most accurate representation of a disaster's severity, as these scales only indicate strength, and not overall impact. For example, a powerful cyclone may not cause a significant impact, if it occurs in a remote area with no exposure to human life or property (Caldera *et al*, 2016). Additionally, comparing disasters based on magnitude is challenging. For example, comparing a Richter scale 6 earthquake with a VEI 6 volcanic eruption is not feasible. This difficulty arises because the immediate impact of a natural disaster is not only dependent on the relative strength of the hazard, but also the adaptive and resilient capacity of the respective country and its unique geographical features (Gad-el-Hak, 2018; Wirasinghe, 2022).

In this regard, measuring the disaster severity according to its socio-economic impact is more important than classifying it in terms of intensity or respective magnitude scale. Because, magnitude scale shows merely the relative strength of a disaster and does not explain the socio-economic impacts associated with it, based on a vulnerability profile of the affected area.

Currently, there seems to be no universally accepted method of measuring the severity of a natural disaster. According to Gad-el-Hak (2018), the process of measuring the severity of natural disasters involves five major steps. First, it necessitates the identification of the most influential factors associated with disaster severity. Subsequently, understanding the relationships between these factors becomes crucial. Then the severity is measured using either a single factor or a complex function, with multiple factors incorporated. Following this, the foundation of a disaster severity classification is established, encompassing the determination of the number of severity levels and the corresponding colour coding. Ultimately, the classification of natural disasters is carried out based on their severity levels, providing a comprehensive framework for a universal disaster severity spectrum.

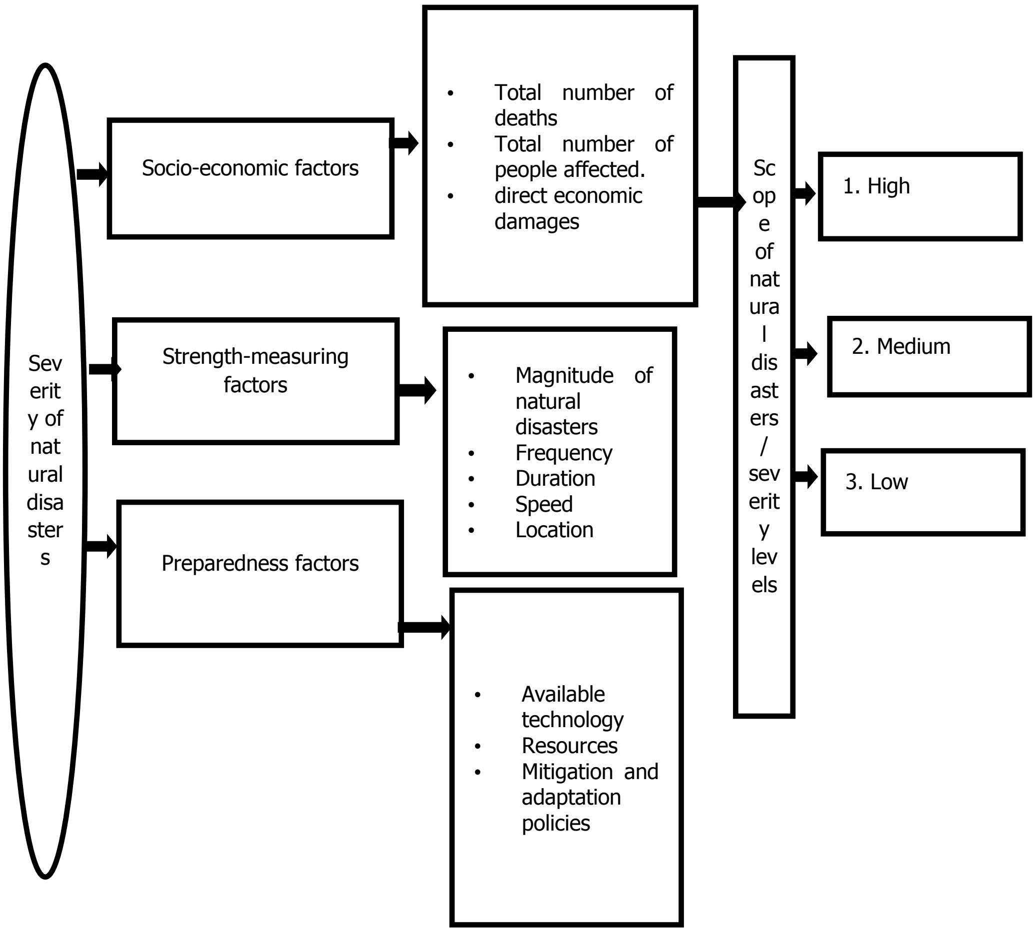
In this regard, identifying the most influential factors related to natural disaster severity is crucial. Wirasinghe (2022) offers a comprehensive classification of these factors into three overarching categories. First, socio-economic factors, which show the impact of natural disasters on human lives and their possessions, such as the number of fatalities, injuries, missing persons, economic losses and the broader societal effects like job and industry losses. Secondly, strength-measuring factors shed light on the power and intensity of the event itself, incorporating elements like magnitude, duration, speed, location, and proximity to populated areas. Lastly, preparedness factors show a region's readiness in the face of natural disasters, encompassing considerations such as technological capabilities, available resources, evacuation protocols, mitigation strategies and the efficiency of response mechanisms (Wirasinghe H J, 2022). A combination of these three factors determines the disaster severity.

However, there is no single, universally accepted method of measuring the severity of natural disasters. The choice of measurement method varies based on factors such as the type of disaster, the surrounding context and the specific objective of the assessment. According to Gad-el-Hak, 2018, the most important factor which determines the scope of a disaster is the number of people affected by it and/or the extent of geographical area covered. Wirasinghe, 2022, considered both human factor (casualties, people affected, including those missing, injured and affected) and damage factor (damage to crops and property) in constructing a universal severity spectrum. Meanwhile, Cavallo, 2021, argues that the most important factor determining severity is mortality. De Boer (1990) has developed a Disaster Severity Scale (DSS) based on seven parameters, i.e., the disaster’s effect on the infrastructure, the cause (man-made/ natural hazard), the impact time, the radius of the disaster area, the number of casualties, the nature of injuries sustained by living victims and the rescue time.

However, the existing literature lacks a comprehensive approach to measuring the overall disaster severity, making it difficult to compare the disaster severity across countries affected by a wide range of natural disasters. Most studies rely on single indicators, particularly disaster-induced mortality, to determine severity, as it captures both disaster strength and a country's adaptive and preparedness capacities. One prevalent challenge arising from the use of a single indicator is that it can introduce bias towards certain types of disasters. For instance, floods may disproportionately affect a large population, while earthquakes may lead to a higher loss of life, but impact a smaller proportion of the population. Consequently, relying solely on one indicator may provide a skewed representation of severity, particularly when comparing countries exposed to different types of disasters. However, there have been no studies so far measuring the overall disaster severity across countries using a combination of impact indicators. Moreover, despite the frequent occurrence of natural disasters in LMCs, there is a notable lack of studies with a specific focus on these regions. Therefore, this paper aims at bridging these gaps by addressing the methodological disparities and making a unique contribution in the process.

CONCEPTUAL FRAMEWORK

Figure 1: Measuring the severity level of natural disasters.



Source: Author's compilation

In the present study, we have opted to measure the severity of natural disasters in respect of LMCs solely based on socio-economic impact indicators, specifically the direct impact indicators. We have not considered the strength determining and preparedness factors owing to the following reasons. Firstly, harmonising diverse magnitude scales across different disaster types is a formidable and complex task. Furthermore, magnitude scale based on physical strength alone is not the best way of explaining the severity level of a disaster, as it only indicates the strength, not impact. Secondly, when it comes to evaluating a country's preparedness level for disasters, the techniques to record preparedness are absent in the global database. Considering these constraints, this study focuses exclusively on direct impact indicators as the primary indicators of assessing level the severity of natural disasters in respect of LMCs.

Methodology

Data Sources and the Study Period

The analysis relies on secondary sources of information. Data related to natural disasters such as the type of natural disasters, period of occurrence, duration, population affected, mortalities and damage related data predominantly sourced from the Emergency Events database (EM-DAT) maintained by the Centre for the Research on the Epidemiology of Disasters (CRED) at the Universitecatholique de Louvain in Belgium.

EM-DAT is a global database on natural and technological disasters. It covers more than 26000 disasters worldwide, spanning from 1900 to the present date. The database records the country-level human and economic losses of disasters, meeting specific criteria, such as 10 or more fatalities, 100 or more affected individuals, declarations of state of emergency, or a call for international assistance.

Selection of Indicators and Severity Estimation

Three indicators have been chosen for measuring the overall natural disaster severity, i.e., disaster-induced fatalities, total people affected (sum of injured, missing persons and affected) and damage cost. Choosing these specific indicators for measuring the severity of disasters is crucial, because they match with both the Sendai Framework for Disaster Risk Reduction[4] and the Sustainable Development Goal (SDG) 11.5. Combining these indicators into a single index will better align it with the global targets of disaster risk reduction. Further, it will provide a comparative perspective and standardise severity.

The study period stretches from2000 to 2023. The severity of natural disasters is estimated for the periods 2000-04, 2005-09, 2010-14, 2015-19, and 2020-2023. In order to avoid the multi collinearity problem, Carl Pearson's correlation coefficient (ρ) is tested. It has been found that they are not highly correlated with each other. The correlation matrix and a brief description of the indicators are given in Appendix 2 and Appendix 3.

As an initial step, we standardise the data by calculating the number of fatalities as a percentage of the population, the proportion of the population affected by natural disasters and direct damages as a percentage of GDP. Given that all these variables share the same measurement scale (expressed in percentage) no additional normalisation procedure is carried out.

Further, following the Multidimensional Poverty Index (MPI[5]) framework (Alkire & Foster 2011), the indicators use a nested weight structure. The weights are based on value judgment of each factor's importance in determining the severity levels. We have assigned large weights (1/2) to fatalities, as compared to other indicators owing to the following reasons. Firstly, the total people affected by natural disasters include those injured, homeless etc. However, assessing injuries can be challenging, especially

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[4] The Sendai Framework sets seven major goals to be achieved by 2030, emphasising the need for significant reductions in factors like fatalities, affected population and economic damages as a percentage of GDP, caused by disasters.

[5] In Multidimensional poverty framework (Alkire *et al*, 2011) the indicators use a nested weight structure: equal weights across dimensions and an equal weight for each indicator within a dimension.

since the definitions are often ambiguous, ranging from minor to severe. Secondly, since the damages might have been inaccurately reported, there is a risk of biased data. Notably, very low-income countries may over-manipulate damage costs for attracting more foreign assistance (Cavallo, 2021). Given the ambiguity in defining injuries and risk of biased damage data, it is better to give more emphasis to disaster-induced fatalities than other indicators (Wirasnge, 2010; Cavallo, 2021). As compared to other indicators, fatalities are easier to calculate and population is more sensitive to disastrous events with high fatalities. Against this backdrop, we have allotted half the weight to disaster-induced fatalities, recognising their clarity and importance in determining the severity of an event. Additionally, equal weights of one-fourth each have been assigned to both the total number of people affected and economic damages, acknowledging their relevance in understanding the broader impacts of disasters.

Finally, we have aggregated these indicators by using weighted geometric mean to avoid the dimensional imbalances between the indicators. i.e.,

$\prod_{i=i}^{3} x_i^{w_i}$ (Weighted geometric mean)

ADI= $\sqrt[3]{w1\text{Fatalities}}\ \%\text{of population } \times w2\text{Percenatge of Affected} \times w3\text{Damages \% of GDP}$

Where w1, w2, w3 are the respective weights assigned to each indicator

The ADI[6] index value, ranging from 0 to 1, serves as a comprehensive measure of severity for different countries. The countries are categorised into three distinct severity groups based on their index values. In the High Severity Group, comprising the top quintile, the leading 10 nations exhibit the highest levels of impact. Following this, the subsequent two quintiles include 18 countries forming the Medium Severity Group, signifying a moderate level of impact. Lastly, the Low Severity Group encompasses the remaining 18 nations in the last two quintiles, with index values close to zero, indicating a comparatively lower impact.

Treatment of Countries with Missing Indicators

Following the MPI framework, if a country is missing any of the three indicators, then that indicator cannot be used in the computation of disaster severity. Indicator weights are readjusted accordingly. If three of the indicators are missing, the country is excluded from disaster severity measurement. The present study has excluded LMCs such as, Benin, Jordan, Samoa, Sao Tome and Principe, Kiribati, Micronesia and Uzbekistan, owing to the missing indicators problem.

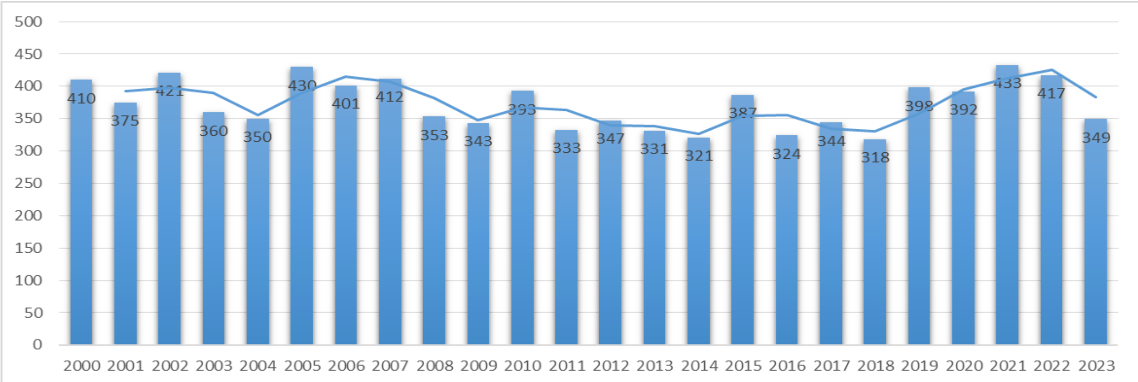
[6] Aggregate Direct Impact

Findings and Discussion

An Overview of Natural Disaster Risk Profile of Lower Middle-Income Countries

The current degree of temperature variation, precipitation level, sea level rise, snow and ice core, atmosphere circulation pattern etc. shows a probable increase in both the incidence and intensity of natural disasters (IPCC, 2001; Freeman, 2003). As depicted in Graph 1, over time, there has been a rise in the number of natural disasters occurring worldwide. If the current trajectory of global warming continues to persist, it is projected that the world will experience a large number of natural disasters in the coming years also (IPCC, 2022).

Graph 1: Total Number of Natural Disasters Occurring in the World (2000-2023)



Source: Author's compilation, using EM-DAT database, 2023

Table 1: Incidence and direct impact of natural disasters on LMCs in comparison with other country category (2000-23)

	Total Deaths (in percentage)	Total Affected (in percentage)	Total Damage (in percentage)	Total number of natural disasters (in percentage)
LMC	49% (0.03%)	41% (67.21%)	8% (7.12%)	30%
UMC	33% (0.02%)	47% (81.69%)	22% (5.33%)	31%
Low Income	4% (0.01%)	9% (74.18%)	1% (5.59%)	11%
High Income	14% (0.02%)	4% (15.44%)	69% (6.29%)	28%

Source: Author's compilation, using EM-DAT database, 2000-2023

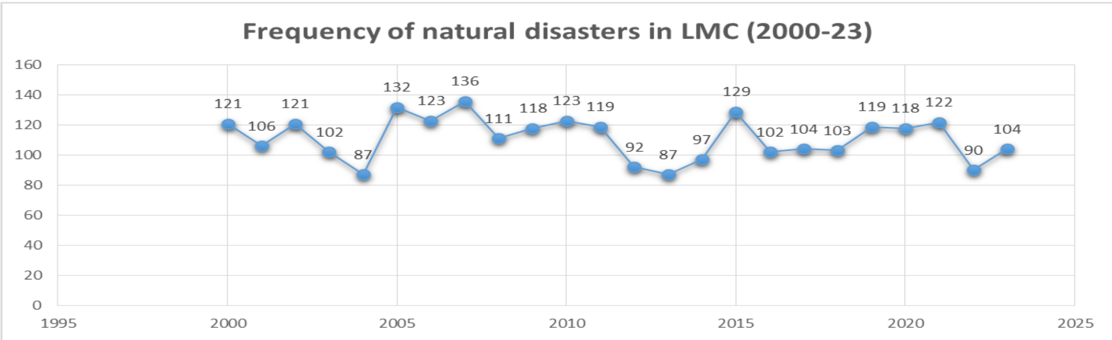
** The larger font size figures depict the proportion of each impact variable within different income group countries, relative to the total number. The values in parentheses denote the percentage of the impact variable in relation to the respective country's population or GDP.*

Table 1 clearly shows that as compared to high- and low-income countries, LMCs account for the largest share in terms of natural disaster occurrences and their impacts. (EM-DAT, 2024). From 2000 through 2023, these countries have witnessed 30% of the total natural disasters occurring in the world, with 49% of the total disaster deaths and 41% of the total population affected by natural disasters (EM-DAT, 2024).

Incidence of Natural Disasters in LMCs (2000-23)

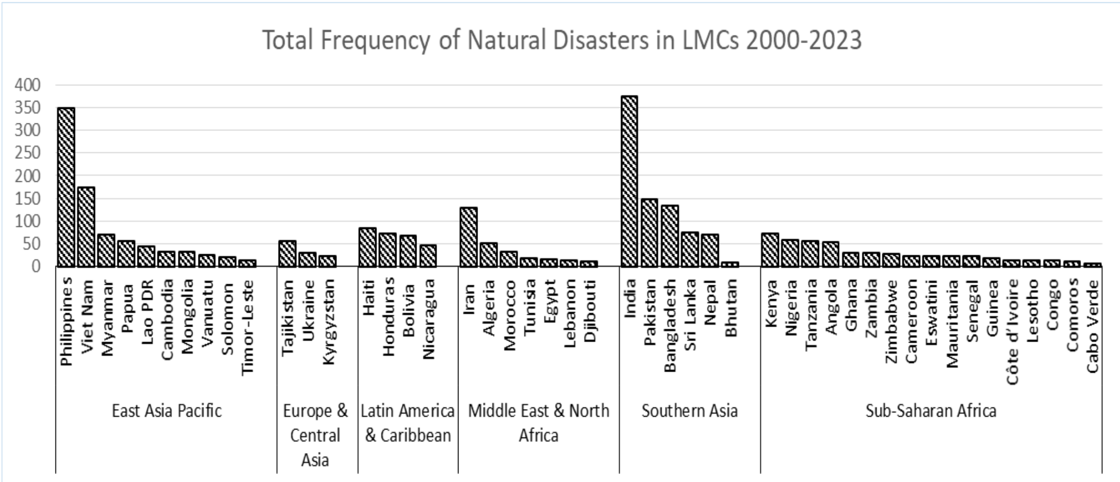
Graph 2 shows that, between 2000 and 2023, a total of 1968 natural disasters have occurred across LMCs (EM-DAT, 2024).

Graph 2: Total Number of Natural Disasters Occurring in LMCs (2000-2023)



Source: Author's compilation, using EM-DAT database (2000-23)

Graph 3: Total Number of Natural Disasters Occurring in LMCs: A Region-Wise Classification (2000–23)



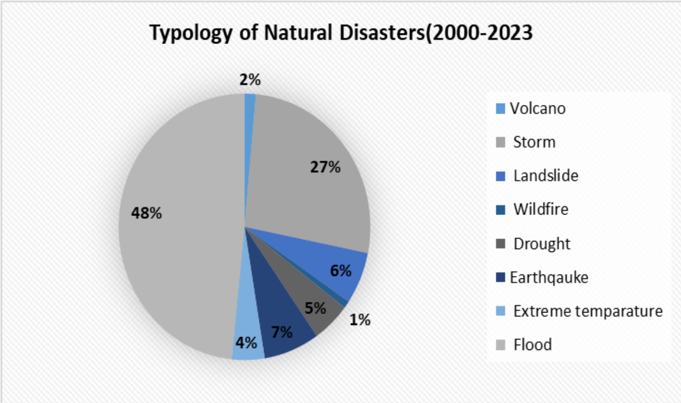
Source: Author's compilation, using EM-DAT database for the period 2000-23

Geographically, these countries are scattered across various regions, mostly in the Asian and African continents, with a very few countries situated in the Latin American and Caribbean regions. Graph 3 shows a region-wise picture of total number of natural disaster occurrence in LMCs for the period 2000-2023. It is evident that LMCs located in the Asian continent, such as India (376), the Philippines (349), Vietnam (173) and Pakistan (147) exhibit a higher likelihood of experiencing such events. Conversely, countries like Djibouti (10) and Lebanon (12) Comoros (10) and Cabo Verde (7) in the African region, have experienced a notably lower frequency of natural disasters (EM-DAT, 2024).

Even though the frequency of natural disasters occurring is high in countries like India, Philippines, Vietnam and Pakistan, the frequency of natural disasters occurring relative to their land area (disaster density) is very low in these countries. Whereas, countries such as Comoros, Cabo Verde, Haiti, Sri Lanka, Eswatini, Djibouti and Philippines shows a high disaster density.

Typology of Natural Disasters in LMCs (2000-2023)

Graph 4: Types of natural disasters occurring in LMCs (2000-23)

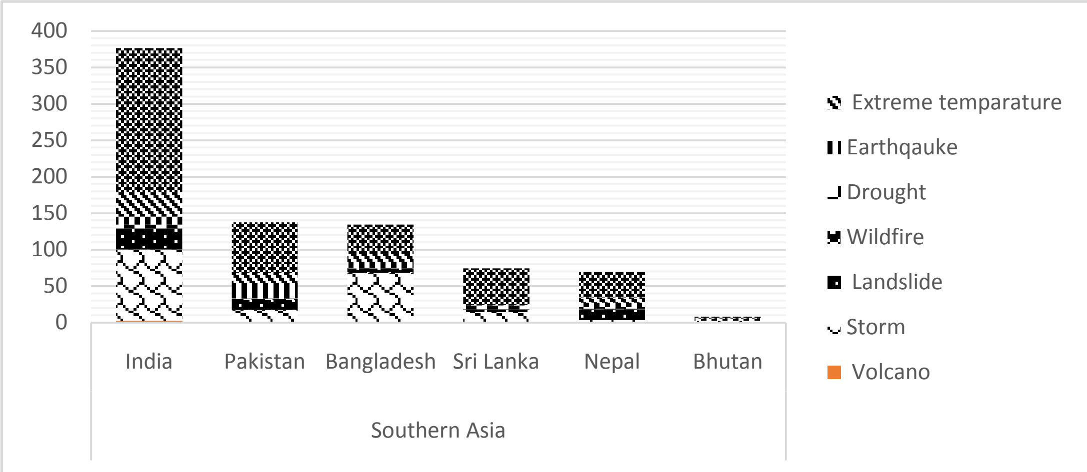


Source: Author's compilation, using EM-DAT database for the period 2000-23.

For the period 2000-23, out of the total number of natural disasters, floods account for 48%, followed by storms (27%), earthquakes (7%), landslides (6%), droughts (5%) and extreme temperature events (4%) and wildfire and volcanic activity (2%). (EM-DAT,2022).An in-depth examination of the typology of natural disasters for each LMC shows that countries in the East Asia and Pacific region are more vulnerable to storms than floods. Among these, earthquakes commonly occur in the Philippines and Papua New Guinea. On the other hand, South Asian countries display a higher risk of being exposed to floods than storms. Even though sub-Saharan African nations experience flooding more frequently than other disasters, it has been found that, on an average, these nations experience more drought periods than other LMCs (EM-DATA, 2024).This indicates that the likelihood of natural disasters occurring and their intensity is mainly determined by the geographical features of a given country (W N Adger, 1999; Kellenberg and A Mobarak, 2011). The features like continent, elevation, distance from equator, presence of tectonic plates and mountains etc., influence the typology of natural disasters that a country experiences (Khan, 2005).

Graph 5 illustrates that Southern Asian countries are more prone to floods, storms and landslides. Countries such as Nepal and Bhutan are characterised by the presence of the Himalayan mountain ranges. These regions are prone to landslides, avalanches and glacial lake outburst floods (CIA, 2023). Bangladesh, a low-lying coastal country with a high elevation, is prone to riverine floodings and cyclones (IPCC, 2001). Both India and Pakistan have diverse landscapes, ranging from mountains and plateaus to fertile plains and deserts. The northern parts of India are surrounded by the Himalayas, which includes some of the world's highest peaks, including Mount Everest. Furthermore, it has a long coastline along the Arabian Sea to the west and the Bay of Bengal to the east. These coastal areas are vulnerable to cyclones, storm surges and coastal erosion (Harris, 2021). Likewise, Pakistan has the Balochistan Plateau, with coastal areas along the Arabian Sea, making it vulnerable to cyclones, Furthermore, it is located just above the tropic of cancer, resulting in a continental type of climate in the country (Wladimir, 1936).

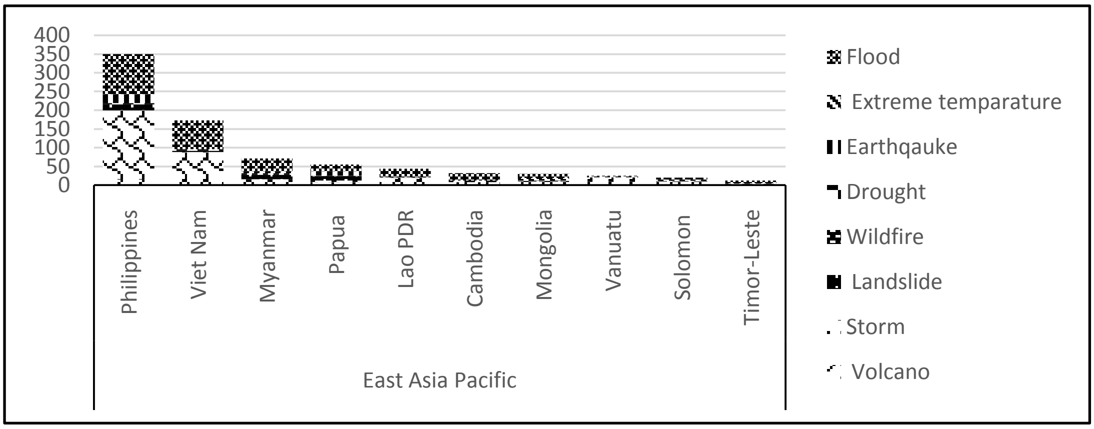
Graph 5: Typology of Natural Disasters Occurring in South Asian LMCs (2000-2023).



Source: Author's compilation, using EM-DAT database for the period 2000-23

As demonstrated in Graph 6, Storms are more specific to the East Asia Pacific region, although they are also affected by flooding and earthquakes. Countries such as the Philippines are composed of numerous islands, making them vulnerable to tsunamis, volcanic eruptions, typhoons and coastal flooding. Additionally, Vietnam, Papua New Guinea, the Philippines and Vanuatu are vulnerable to volcanic eruptions due to their geological characteristics.

Graph 6: Typology of Natural Disasters occurring in LMCs in the East Asia Pacific Region (2000-23)

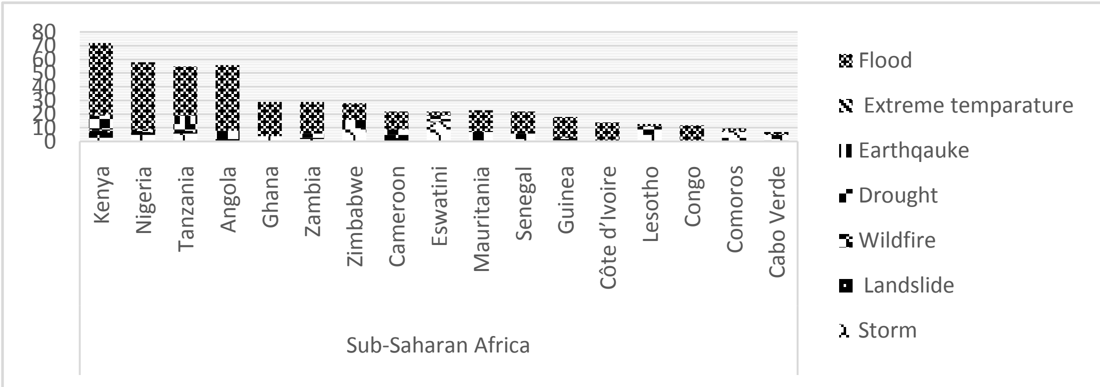


Source: Author's compilation, using EM-DAT database, 2000-2023

Graph 7 indicates that, similar to other LMCs, floods are comparatively high in Sub-Saharan African countries as well. In addition to these, the region accounts for the highest number of drought periods. The coastal West African countries, such as Ghana and Senegal, are susceptible to coastal erosion and flooding, especially during the rainy season and tropical cyclones. Whereas, the East African countries, like Kenya and Tanzania, are part of the East African Rift system, with geological activity, including earthquakes and volcanic eruptions.

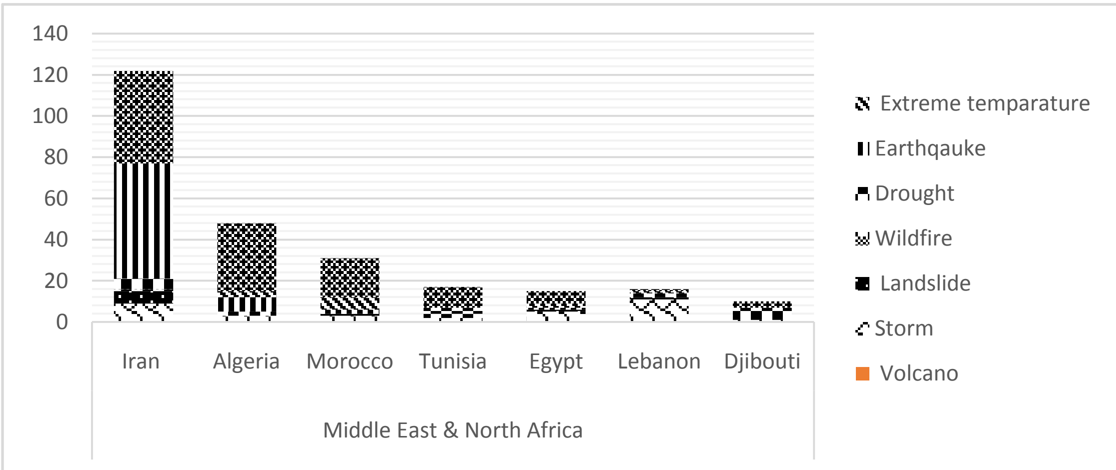
Graph 8 illustrates the various types of natural disasters occurring within the LMCs in the Middle East and North Africa region. The presence of tectonic plates makes Iran one of the high- risk earthquake-prone countries, whereas Djibouti is characterised by arid/ desert climate, accounting for the highest drought period as compared to other LMCs. However, occasionally it receives heavy rainfall, leading to a high risk of flash floods in the country, owing to its topographic features and seasonal riverbeds.

Graph 7: Typology of Natural Disasters Occurring in LMCs in the Sub-Saharan Region (2000-23)



Source: Author's compilation, using EM-DAT database, 2000-23

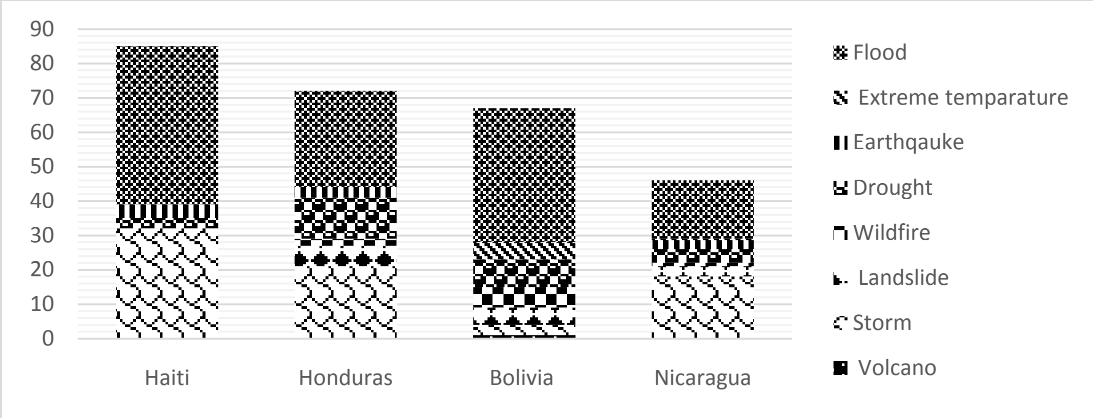
Graph 8: Typology of Natural Disasters Occurring in LMCs in the Middle East & North Africa (2000-23)



Source: Author's compilation, using EM-DAT database, 2000-23.

Some of the LMCs are in the Latin American and Caribbean region as well. It includes Bolivia, which is situated along the Andes Mountain range and is vulnerable to landslides, volcanic eruptions and earthquakes. The remaining nations in this region include Caribbean island countries, such as Haiti, Nicaragua and Honduras, which are subject to hurricanes and tropical storms as well as related problems such as coastal erosion and floods. Honduras is the only country in Central America devoid of volcanoes. But it lies in the hurricane belt with many storms occurring in a year (CIA, 2023; Harris, 2021; Wladimir*,* 1936). As shown in Graph 9 below.

Graph 9: Typology of Natural Disasters Occurring in LMCs in the Latin America & Caribbean (2000-23)



Source: Author's compilation, using EM-DAT database.

So far, we have discussed the frequency of different types of natural disasters occurring in LMCs. But, simply discussing the frequency of various types of natural disasters is insufficient when it comes to assessing the full economic impact. To gain a more comprehensive understanding of the devastating consequences of natural disasters in these nations, it is crucial also to gauge the severity levels of these events.

Severity Levels of Natural Disasters in LMCs

The countries are categorised into three distinct severity groups based on their ADI index values, as presented in Table 2, Table 3 and Table 4. It has been found that over these years, Asian countries have topped the list in terms of experiencing severe natural disasters. This is primarily due to a high frequency of occurrence of such events in the region compared to others. A continent-wise analysis shows that compared to Africa, on an average, Asia is more likely to experience 28.5% of natural disasters in a year. Furthermore, the natural disaster risk is substantially high for small island countries and low-lying coastal states. Thirteen out of the twenty-five small island countries in the world are disaster-prone. (IPCC, 2001; Freeman, 2003).

Table 2: Top Ten Countries with High Severity Associated Natural Disasters

Countries with High Severity of Natural Disasters									
2000-04		**2005-09**		**2010-14**		**2015-19**		**2020-23**	
Country	ADI	Country	ADI	Country	ADI	Country	ADI	Country	ADI
Sri Lanka	0.852	Myanmar	0.915	Haiti	0.610	Nepal	0.948	Haiti	0.420
Tajikistan	0.428	Pakistan	0.378	Philippines	0.591	Haiti	0.565	Honduras	0.220
Cambodia	0.338	Tajikistan	0.365	Honduras	0.389	Zimbabwe	0.220	Vanuatu	0.144
Mongolia	0.297	Bangladesh	0.207	Cambodia	0.298	Myanmar	0.183	Comoros	0.117
India	0.221	Philippines	0.201	Solomon Is.	0.238	Sri Lanka	0.152	Nicaragua	0.115
Bangladesh	0.219	Honduras	0.196	Pakistan	0.225	Vanuatu	0.150	Morocco	0.110
Haiti	0.211	Mongolia	0.154	Zimbabwe	0.170	Lao PDR	0.129	Timor-Leste	0.102
Vanuatu	0.186	Viet Nam	0.151	Sri Lanka	0.164	Mongolia	0.121	Solomon Is.	0.100
Iran	0.171	Haiti	0.147	Bolivia	0.139	Papua	0.119	Philippines	0.097
Zimbabwe	0.152	Bolivia	0.123	Lao PDR	0.127	Eswatini	0.119	Pakistan	0.066

Author’s calculation, using EM-DAT Database 2000-2023.

Table 3: Countries with Medium Severity Associated Natural Disasters

Countries with Medium Severity of Natural Disasters									
2000-04		**2005-09**		**2010-14**		**2015-19**		**2020-23**	
Country	ADI	Country	ADI	Country	ADI	Country	ADI	Country	ADI
Algeria	0.131	Nepal	0.111	Vanuatu	0.102	Viet Nam	0.112	Myanmar	0.054
Bolivia	0.113	Comoros	0.088	Viet Nam	0.071	Comoros	0.104	Kenya	0.050
Philippines	0.106	Lao PDR	0.087	Kenya	0.059	India	0.103	Tanzania	0.046
Viet Nam	0.102	Kyrgyzstan	0.082	Comoros	0.058	Philippines	0.102	Bangladesh	0.046
Honduras	0.082	Solomon Is.	0.081	India	0.057	Bolivia	0.081	Nigeria	0.045
Nepal	0.042	Vanuatu	0.080	Tajikistan	0.046	Cambodia	0.075	Nepal	0.041
Kenya	0.042	India	0.076	Nicaragua	0.030	Kenya	0.072	India	0.039
Senegal	0.032	Papua New	0.063	Nepal	0.030	Iran	0.071	Cambodia	0.034
Myanmar	0.027	Ukraine	0.036	Myanmar	0.029	Bangladesh	0.069	Mauritania	0.033
Mauritania	0.025	Iran	0.018	Papua New	0.025	Timor-Leste	0.056	Bolivia	0.033
Morocco	0.024	Zambia	0.017	Mauritania	0.024	Mauritania	0.044	Iran	0.032
Nicaragua	0.023	Sri Lanka	0.016	Bangladesh	0.024	Solomon Is.	0.043	Sri Lanka	0.029
Lao PDR	0.020	Algeria	0.015	Angola	0.024	Tanzania	0.037	Viet Nam	0.028
Pakistan	0.020	Kenya	0.012	Iran	0.022	Cabo	0.037	Papua	0.025
Angola	0.017	Zimbabwe	0.011	Nigeria	0.021	Morocco	0.026	Cabo	0.021
Papua	0.016	Cambodia	0.009	Senegal	0.020	Pakistan	0.018	Mongolia	0.016
Tanzania	0.015	Angola	0.005	Ukraine	0.019	Nicaragua	0.017	Cameroon	0.012
Cabo Verde	0.014	Nicaragua	0.005	Morocco	0.013	Honduras	0.015	Angola	0.012

Author’s calculation, using EM-DAT Database 2000-2023

Table 4: Countries with Low severity Associated Natural Disasters

Countries with Low severity of Natural Disasters									
2000-04		2005-09		2010-14		2015-19		2020-23	
Country	ADI	Country	ADI	Country	ADI	Country	ADI	Country	ADI
Eswatini	0.0085	Timor	0.0055	Kyrgyzstan	0.0122	Ghana	0.0112	Zimbabwe	0.0121
Ukraine	0.0077	Senegal	0.0052	Cabo Verde	0.0059	Zambia	0.0104	Eswatini	0.0091
Solomon Is.	0.0060	Mauritania	0.0044	Cameroon	0.0043	Kyrgyzstan	0.0101	Zambia	0.0086
Comoros	0.0059	Cabo Verde	0.0038	Tanzania	0.0041	Algeria	0.0099	Tajikistan	0.0074
Bhutan	0.0059	Tanzania	0.0036	Lesotho	0.0034	Senegal	0.0096	Kyrgyzstan	0.0069
Guinea	0.0058	Tunisia	0.0029	Bhutan	0.0031	Nigeria	0.0082	Ukraine	0.0057
Timor	0.0057	Ghana	0.0025	Algeria	0.0026	Tajikistan	0.0081	Tunisia	0.0045
Djibouti	0.0053	Eswatini	0.0023	Guinea	0.0022	Angola	0.0075	Guinea	0.0040
Kyrgyzstan	0.0048	Djibouti	0.0018	Ghana	0.0013	Tunisia	0.0044	Senegal	0.0035
Tunisia	0.0043	Cameroon	0.0018	Djibouti	0.0013	Cameroon	0.0038	Djibouti	0.0027
Ghana	0.0042	Lesotho	0.0010	Egypt	0.0006	Djibouti	0.0031	Algeria	0.0023
Nigeria	0.0030	Guinea	0.0008	Zambia	0.0005	Ukraine	0.0030	Bhutan	0.0015
Zambia	0.0023	Bhutan	0.0006	Congo,Rep.	0.0004	Guinea	0.0023	Congo,Rep	0.0015
Lesotho	0.0013	Congo,Rep.	0.0005	Eswatini	0.0004	Egypt	0.0020	Lao PDR	0.0013
Cameroon	0.0011	Morocco	0.0004	Mongolia	0.0004	Lebanon	0.0017	Lesotho	0.0011
Lebanon	0.0007	Egypt	0.0004	Côte d’	0.0002	Lesotho	0.0013	Egypt	0.0009
Egypt	0.0005	Nigeria	0.0004	Timor	0.0002	Congo,Rep	0.0004	Lebanon	0.0007
Congo,Rep.	0.0003	Côte d’	0.0002	Tunisia	0.0002	Côte d’	0.0004	Ghana	0.0003
Côte d’	0.0001	Lebanon	0.0000	Lebanon	0.0000	Bhutan	0.0001	Côte d’	0.0002

Author’s calculation, using EM-DAT Database 2000-2023

A closer observation of the geographical characteristics of those LMCs with high severity of natural disasters shows that significant portions of these countries are situated within the tropical climate zone[7] with an added challenge of coastal vulnerability (Wladimir*,* 1936). All these countries share coastal territory and 40% of them are island nations, with their own specific set of vulnerabilities.

Table 5: Geographical features and the severity of natural disasters

Severity Level	Frequency			Disaster density			Geographical location		
	f<10	10-20	f>20	High	Medium	Low	Island	Maritime	Land lock
High	56%	22%	22%	33%	67%	0%	60%	40%	0%
Medium	47%	32%	21%	26%	36%	37%	17%	66%	17%
Low	90%	10%	0%	5%	35%	60%	0%	58%	42%

Source: Author’s Compilation, using EM-DAT database 2020-23.

7 The tropical climate zone, characterised by its proximity to the equator, is known for its unique meteorological and environmental conditions. These regions experience high temperatures year-round and are susceptible to a range of weather-related natural disasters such as hurricanes, typhoons and monsoons. The warm ocean waters in these areas provide the energy needed to fuel these intense storms, making them particularly prone to devastating cyclones and heavy rainfall, which can lead to flooding and landslides.

Island countries such as Haiti, East Timor, the Solomon Islands, and Vanuatu are consistently listed as high-severity nations. These countries heavily depend on coastal resources for their livelihoods and their limited land area makes them particularly susceptible to natural disasters such as hurricanes and floods. It further results in devastating consequences to their infrastructure and populations due to their isolation and limited resources for disaster preparedness and response (SIMS, 2019; Harris, I O, 2021; FAO, 2020). Similarly, Honduras and the Philippines are situated in the cyclone belt, a region prone to tropical cyclones or hurricanes. This geographical positioning exposes them to a higher risk of experiencing powerful and destructive storms. The Philippines, in particular, is one of the most cyclone-prone countries globally, facing a relentless threat of typhoons every year (Harris, I O, 2021; Honduras DRP, 2015; FAO, 2020). Pakistan, on the other hand, has a distinctive geographical location. It lies just above the Tropic of Cancer and displays a continental climate. Unlike the island nations or those situated in the cyclone belt, Pakistan's primary natural disaster concerns include earthquakes, floods and droughts. The country's position at the convergence of several tectonic plates makes it highly susceptible to seismic activity, leading to earthquakes of varying magnitudes. Moreover, the monsoon season brings heavy rainfall, leading to frequent flooding and landslides. Conversely, parts of Pakistan also suffer from drought conditions due to irregular precipitation patterns (Harris, I O, 2021).

Disaster density (disaster frequency per land area) also indicates that countries with high natural disaster severity also exhibit a high disaster density. It has been identified that 66% of the countries in the high severity category are characterised by a medium natural disaster density followed by 34% of the countries with a high disaster density, whereas 60% of the countries in the low severity category account for a low natural disaster density. Only 5% of the countries show a high disaster density and 35% show a medium disaster density. Furthermore, none of the low-severity category countries is an island nation despite 58% of them sharing coastal territory. Table 5 clearly shows that 90% of the countries in the low severity category are exposed to less than 10 natural disasters over these years. Whereas, when it comes to countries with a medium to high severity, 22% of these countries are exposed to more than 20 natural disasters for the same period.

Table 6: Magnitude of Earthquakes and Their Differencing Impacts in Selected LMCs

Country	Magnitude	Deaths (10 cr. population)	People affected (10000 population)	Damages (% of GDP)
India	5.7	0.232378	0.459721	0.008868
	6.7	0.597461	0.080717	0.003779
	6.9	8.903021	4.572337	0.000001
	7.3	1.511716	5.816874	0.000001
	7.6	113.3333	1.356035	0.118933
	7.7	1854.032	58.58955	0.48711
	9.1	1442.694	5.761549	0.178059
Iran	4.9	2.366722	0.0142	0.007869
	5.2	2.970571	0.04127	0.000609
	5.6	3.550083	0.267676	0.000545
	5.6	2.274706	29.31232	0.002259
	5.7	10.19642	4.654893	0.01046
	6.1	88.3891	22.64697	0.016855
	6.4	872.0111	13.50278	0.032935
	6.4	395.7351	7.959449	0.156978
	6.5	337.1598	16.53123	0.170663
	6.6	39432.15	39.3833	0.278125
	7.3	525.4122	24.73224	0.201714
Nepal	5.7	19.64149	9.823364	
	5.7	515.2434	100.4945	
	6.9	25.67262	61.59559	
	7.3	499.813	0.879381	
	7.8	31984.41	2042.613	23.66131
Philippines	6	8.152174	0.274185	0.00171
	6.1	22.64493	1.408967	0.01626
	6.7	115.2681	32.67055	0.004431
	7.1	230.6918	323.1916	0.025252

Source: Author’s compilation, using EM-DAT database

Geography not only determines a country's susceptibility to disasters, but also influences the relative strength of natural disasters striking a region, which can be measured by using magnitude scales. The relationship between the magnitude of natural disasters and their direct impact is a complex issue, largely due to data limitations and the inherent variability in the types and magnitudes of such disasters across different countries. Moreover, not all countries are equally susceptible to the same type of natural disasters. Considering these limitations, we aim at illustrating the linkage between disaster magnitude and direct impact for selected countries, using storm and earthquake data. The most commonly used scales for measuring the magnitude of earthquakes is the Richter scale value and Saffir-Simpson scale for measuring hurricane wind (Gad-el-Hak, 2018). These examples are demonstrated in Table 6 and Table 7.

Table 7: Magnitude of Storm and Its Impacts on Selected LMCs

Event Name	Country	Dis.Mag. Value (Kph)	Deaths (10 cr. population)	People affected (10000 population)	Damages (% of GDP)
Tropical cyclone 'Tauktae'	India	222	14.1	4.9742	0.05546
Tropical storm 'Titli'		126	6.2	2.1928	0.041415
Cyclone 'Nisarga'		120	0.43	0.0537	0.036962
Tropical storm 'Phethai'		100	0.58	0.073	0.004502
Typhoon 'Goni' (Rolly)	Philippines	315	27.6	299.1679	0.158742
Tropical cyclone 'Noru' (Karding)		195	14.9	80.2549	0.015027
Tropical Cyclone 'Vongfong' (Ambo)		185	4.46	51.5853	0.009809
Tropical depression 'Ofel'		55	2.67	0.0223	0.000058
Typhoon 'Molave' (Quinta)	Viet Nam	145	42.4	46.5604	0.188477
Tropical storm 'Noul' (Leon)		85	6.21	12.9334	0.011518
Tropical cyclone 'Sinlaku'		75	2.07	1.0347	0.00008

Source: Author's compilation, using EM-DAT database

It is observed that the intensity of natural disasters, as depicted by their magnitude scale, bears a direct relationship with the immediate consequences they cause. Table 6 and Table 7 clearly show that when the magnitude of earthquake and storm increases, so does the resultant impact, while a lower magnitude corresponds to a milder impact.

Like the magnitude scale, the immediate impact of natural disasters varies according to the type of disaster. For example, if a country is more prone to sudden-onset events like earthquakes, the immediate impact in terms of fatalities and damage can be high. Conversely, if it is prone to slow-onset events like droughts, the immediate impact can be lesser. However, these slow-onset events may persist in the country for a long period of time, with many indirect consequences for the economy and people affected by such disasters. Even though the mortality and damage costs are low, the number of people getting affected by such disasters can be very high, as reflected in the below given Table 8.

Table 8: Natural Disaster Impact by Type (LMCs 2018-22)

Disaster Type	Disaster Sub Type	Damage (000 US $)	Affected	Death	Number of Natural Disaster
Climatological		*52490*	*1464927*	*12.89*	*39*
	Glacial lake outburst	113403	12.00	125	2
	Drought	62966	2188899	2.96	26
	Wildfire	16653	20067.82	16	11
Geophysical		*50902*	*82118*	*59.47*	*51*
	Earthquake	62931	82394.95	75.38	40
	Volcanic Activity	7879	89221.10	0.10	10
	Mass movement (dry)		0.00	17	1
Hydrological		*171463*	*384994*	*58.70*	*293*
	Flood	188866	423363	61.60	266
	Mass movement (wet)		6990.81	30.11	27
Meteorological		*210908*	*591197*	*31.39*	*169*
	Storm	231451	645473	31.18	154
	Extreme temperature	0.00	33966	33.53	15

Source: Author's compilation, using EM-DAT database (2018-2022)

***Deaths, Affected and Damages are adjusted to the frequency of natural disasters*

In contrast to this, natural disasters with identical magnitude scan lead to differential impacts across LMCs. This highlights the nuanced nature of the relationship between disaster magnitude and its direct impacts in various regions. For example, in 2004, a 9.1 magnitude earthquake killed 2 people in Bangladesh and 1 person in Kenya (less than 0.1% of the population), whereas, a similar magnitude earthquake killed 16,389 people (14 people per 1 lakh population) in India and 35,399 people (1,816 people per 1 lakh population) in Sri Lanka. Similarly, the 2004 Indian Ocean tsunami affected 14 countries, including several LMCs such as India, Sri Lanka, Myanmar and Tanzania. Although the tsunami struck with the same force (a massive undersea earthquake with a magnitude of 9.1–9.3), its impacts were distributed unequally. For example, in India, about 16,400 people lost their lives. Sri Lanka suffered around 35,000 fatalities. Myanmar recorded approximately 61 deaths, while Tanzania saw around 10 fatalities. The disparity in impacts underscores the uneven distribution of the disaster's severity, despite the uniform force of the tsunami. Some other examples are illustrated in Table 9 and Table 10.

Table 9: Natural Disasters with Similar Magnitudes, but Differential Impacts across LMCs

Dis Mag Value: Richter Scale 6			
Country	**Deaths (In 10 cr.population)**	**People Affected (In 10000 population)**	**Damages (% of GDP)**
Haiti	154.4	35.7197	
India	0.14	0.0214	
Iran	6.93	2.6667	0.023722
Nepal	20	9.991	
Pakistan	17.5	5.8398	0.005999
Philippines	22.65	1.4092	0.014445
Tajikistan	51.3	0.1026	
Papua New Guinea	268	1.979	0.30048

Source: Author’s compilation, using EM-DAT database.

Table 10: Natural Disasters with Similar Magnitudes of Wind Storm, but Differential Impacts across LMCs

Event Name	Country	Dis.Mag. Value (Kph)	Deaths (In 10 cr. population)	People affected (In 10000 population)	Damages (% of GDP)
Tropical cyclone 'Sinlaku'	Lao PDR	75	0	1.36	
Tropical storm 'Basyang' (Sanba)	Philippines		0	23.4	0.0009
Tropical cyclone 'Sinlaku'	Viet Nam		2.1	1.03	0.00008
Tropical storm 'Megi' (Agaton)	Philippines	80	303	202	0.01096
Tropical storm 'Etau' (Tonyo)	Viet Nam		2	0.51	0.00183
Tropical storm 'Koguma'	Viet Nam	90-100	1	0.07	0.00325
Tropical storm 'Sitrang'	Bangladesh		20.7	59.04	
Tropical storm 'Phethai'	India		0.5	0.073	0.00450
Cyclone 'Mandous'	Sri Lanka		9.3	2.93	
Tropical cyclone 'Kompasu' (Maring)	Philippines		51.8	100	0.02939
Tropical cyclone 'Seroja-21'	Timor-Leste		3103	1087	
Tropical cyclone 'Bulbul'	Bangladesh	130	24.2	15.19	0.0025
Storm 'Nalgae' (Paeng)	Philippines		138.7	292	0.0120
Typhoon 'Molave' (Quinta)	Viet Nam	145	42.4	46.56	0.1884
Cyclone 'Yaas'	Bangladesh		1.7	76.76	
Tropical cyclone 'Phanfone' (Ursula)	Philippines		57.1	298.71	0.0045
Cyclone 'Yaas'	India	155	1.3	11.54	0.1188
Typhoon 'Molave' (Quinta)	Philippines		27.6	79.18	0.0274
Tropical cyclone 'Eloise'	Zimbabwe		18.8	1.5	0.0001
Cyclone 'Kenneth'	Comoros	185	1011.4	4365	0.3294
Cyclone 'Amphan'	India		6.4	128.90	0.6085
Tropical Cyclone 'Vongfong' (Ambo)	Philippines		4.4	51.58	0.0098

Source: Author's compilation, using EM-DAT database.

Tables 9 and 10 illustrate that countries affected by disasters of a similar magnitude have experienced varying impacts. It indicates that the severity of natural disasters across LMCs is not only determined by geographical and strength determining factors, but also is significantly intensified by a combination of inherent natural hazard risks and the pre-existing socio-economic conditions of LMCs.

The immediate impacts of natural disasters are closely related to the economic conditions of a country. A stronger economy, with a higher level of GDP, can absorb the economic shocks caused by natural disasters more effectively than countries with comparatively lower levels of GDP. It is mainly because a higher income level leads to a higher demand for safety. As a result, when income levels increase, people tend to prioritise safety and can afford better safety measures, such as improved housing, advanced security systems, and safer transportation options. Similarly, countries' adaptive capacity can enhance with a higher GDP per capita through the allocation of resources towards resilient infrastructure, high-quality buildings and modernised early warning systems. It further helps mitigate the potential losses from natural disasters to a greater extent. Although Asian countries are listed among the top ten countries in terms of the severity of natural disasters over the years, it has been observed that countries like India, Bangladesh and Iran have moved over to the medium severity category, despite accounting for the highest share of disaster occurrences. This shift is mainly attributed to the significant improvements brought about in disaster preparedness in these countries, driven by the devastating impacts they have experienced from natural disasters every year. For example, Iran is an earthquake-prone country. Earthquake-induced mortality tends to increase when there are weak construction quality and building code regulations. In 2003, a 6.8 magnitude earthquake killed 2700 people in Algeria. In contrast, Iran suffered only 261 deaths from a 6.4 magnitude earthquake in 2002 (EM-DAT, 2024). This significant difference in mortality rates is largely attributed to the disaster preparedness on the part of Iran. Iran's building codes are comparable to the US standards in terms of effectively reducing earthquake-induced mortalities (Anbarci, 2004).

Table 11: Economic Factors and the Severity of Natural Disasters in LMCs

Severity Level	**GDP Per Capita**			**Multi-Dimensional Poverty Head Count Ratio**			
	< 4000	**4000-8000**	**>8000**	**<10%**	**10%-20%**	**20%-30%**	**>30%**
High	40%	60%	0%	20%	30%	10%	40%
Medium	22%	50%	27%	29%	16%	11%	44%
Low	36%	21%	43%	33%	15%	26%	26%

Source: Author's Compilation, using EM-DAT database and WDI[8] for the period 2020-23.

It has been noticed that LMCs experiencing a high level of natural disaster severity typically exhibit low GDP per capita. Notably, Haiti and Vanuatu both have experienced extremely severe natural disasters consistently over the period, with a GDP per capita of less than $3000.

However, some of the economic factors can exacerbate the impacts of natural disasters. Poverty and inequality often top the list. Lack of resources and infrastructure, low literacy levels and inadequate social security nets restricts the poor from following early warning systems and enable speedy recovery from disaster impacts (Margaret M McMahon, 2007). Being in a disadvantaged position, the poor always bear a disproportionate impact of natural disasters than non–poor in terms of mortality, injuries, illness and relative property damages (Sanderson, 2000; Attzs, 2008; Mallickb, 2013). In this regard, high levels of poverty play a crucial role in influencing the severity of natural disasters in respect of LMCs. It has been noticed that LMCs experiencing a high level of natural disaster severity typically exhibit low GDP per capita and high poverty rates. Table 11 shows that 40% of the countries facing high severity and 44% countries facing medium severity of natural disasters for the period 2020 to 2023 have recorded a multi-dimensional poverty rate exceeding 30%. This underscores the alarming intersection of severity of natural disasters and economic backwardness of countries. These nations frequently contend with the challenge of constrained financial resources, coupled with socioeconomic vulnerabilities and insufficient infrastructure facilities.

[8] World Development Indicators

CONCLUSION

This study tries to analyse the severity of natural disasters with respect to LMCs, by looking into the aggregate direct impacts of natural disasters over the years 2000-2023. It is found that these nations, due to their diverse geographical conditions, are faced with a wide spectrum of natural disasters, with flooding and storms being the most common among them. Moreover, the likelihood of occurrence of various types of natural disasters and their intensity is mainly determined by the geographical features of a country such as elevation, distance from the equator, presence of tectonic plates and mountains etc. It has been identified that LMCs in the East Asia and Pacific region are more vulnerable to storms than floods. Among these, earthquakes commonly occur in the Philippines and Papua New Guinea. On the other hand, South Asian countries are exposed to a higher risk of flooding than storms. Even though sub-Saharan African nations experience flooding more frequently than other disasters, it has been found that, on an average, these nations experience more drought periods than other LMCs (EM-DATA, 2024).

However, the impacts of these disasters are not uniform across these countries. It has been found that over these years, Asian countries have topped the list in terms of experiencing the severity of natural disasters. However, countries like India, Bangladesh and Iran have moved over to the medium severity category, despite accounting for the highest share in disaster occurrences. This shift is mainly attributed to the significant improvements in disaster preparedness in these countries, driven by the devastating impacts they have experienced from natural disasters every year. This disparity in disaster impacts is the result of a multifaceted interplay of various factors. Mainly, it covers economic, geographical and strength determining factors. Economic indicators, such as lower GDP per capita and higher poverty rates, play a crucial role in this regard. Additionally, geographical factors, including coastal-specific vulnerabilities, tropical climate, and the frequency of hazardous events, further exacerbate disaster severity. When these vulnerabilities converge, the aggregate impact of natural disasters becomes notably more pronounced in these countries. This underscores the complexity of the challenge these nations face.

It has been found that 40% of the countries with a very high natural disaster severity exhibit a GDP per capita of less than $4000. Among these high-severity LMCs, 66% have accounted for a medium density of natural disasters, with more than 20 natural disasters occurring in the last five years. Additionally, 40% of these nations display poverty rates exceeding 30%, with all of them sharing a coastal territory. Notably, 60% of these countries are islands with a high elevation and a significant coastal population, whereas 43% of the countries with a low natural disaster severity account for a GDP per capita of more than $8000 and none of them is an island country, though 58% have coastal territory with a medium to low elevation. The geographical features make these countries less disaster-prone, as compared to other LMCs. Moreover, it has been found that none of these countries has witnessed more than 20 natural disasters over the last five years. Additionally, 90% of them have been exposed to less than 10 disasters, with 60% experiencing a low disaster density. Further, as compared to countries with a high to medium severity, there are fewer low-severity countries with more than 30% of multidimensional poverty and 35% of these countries have a poverty rate of less than 10%, while only 26% account for a poverty rate of more than 30%, which is comparatively low. These observations clearly demonstrate that the convergence of economic and geographical vulnerabilities magnifies the overall severity of natural disasters faced by LMCs.

Policy Implications

Understanding the natural disaster risks faced by Lower Middle-income Countries can help policymakers formulate effective disaster management policies. By knowing what types of disasters are likely to occur and where they are most likely to happen, policymakers can make smarter decisions to protect people and reduce the adverse impacts of natural disasters. This knowledge can also guide the creation of sound disaster management policies aimed at reducing future disaster risks. Moreover, construction of an overall disaster severity index helps facilitate a fairer comparison of countries affected by different types of natural disasters.

Moreover, the Sendai Framework for Disaster Risk Reduction has set targets for 2030. There are only six years remaining to meet these targets. Therefore, it is essential to understand the position of these countries in achieving these goals and to identify the hindrances that restrict them from doing so. Assessing the severity of natural disasters in LMCs is crucial for understanding the challenges and opportunities they face in enhancing disaster resilience and aligning with global objectives for sustainable development.

Limitations of the Study and Directions for Future Research

Owing to data constraints, this study has attempted to measure the overall natural disaster severity faced by LMCs based on immediate impact indicators. The strength-determining and preparedness factors have been excluded because currently there exist no globally accepted techniques for recording a country's preparedness for disasters and harmonising diverse magnitude scales across different disaster types. Further, a very long-term trend in disaster occurrence and impacts before 2000 has not been considered, as EM-DAT treats data before 2000 as historical and subject to bias. Additionally, disaster-specific severity has not been studied because some countries have not experienced certain types of disasters every five years.

Based on a descriptive analysis, it has been found that a complex interplay of social, economic and geographical factors determines the degree of severity of natural disasters faced by LMCs. However, there are many potential factors which influence disaster severity beyond just a country's income and wealth, including the quality of governance, institutions and human development etc. Currently, there exist relatively few studies that discuss the nexus between socio-economic development, the quality of institutions and good governance in determining disaster severity. Future research should incorporate these additional factors, such as good governance, enhanced disaster preparedness prompted by the devastating impacts observed in previous years etc. Uncovering the nexus between socio-economic factors, institutions and the quality of governance and determining disaster impacts is vital for a comprehensive understanding of the complexities surrounding disaster severity and for developing more effective mitigation and response strategies in these regions.

Appendix 1

List of LMCs

Lower-Middle Income Economies ($1,136 TO $4,465)

Angola	Jordan*	Philippines	Eswatini
Algeria	India	Samoa*	Ghana
Bangladesh	Iran, Islamic Rep	São Tomé and Principe*	Guinea
Benin*	Kenya	Senegal	Haiti
Bhutan	Kiribati*	Solomon Islands	Nepal
Bolivia	Kyrgyz Republic	Sri Lanka	Nicaragua
Cabo Verde	Lao PDR	Tanzania	Nigeria
Cambodia	Lebanon	Tajikistan	Pakistan
Cameroon	Lesotho	Timor-Leste	Zambia
Comoros	Mauritania	Tunisia	Zimbabwe
Congo, Rep.	Micronesia, Fed. Sts.*	Ukraine	Honduras
Côte d'Ivoire	Mongolia	Uzbekistan*	Papua New Guinea
Djibouti	Morocco	Vanuatu	
Egypt, Arab Rep.	Myanmar	Vietnam	

Source: World Bank, 2023

Note: Countries marked with an asterisk (*) are excluded from the present study due to the lack of data on natural disasters for the specified period.

Appendix-2

Correlation Matrix (Relation between disaster severity variables in LMCs (2000-23)

Severity variables	Total deaths	Damage cost	Total affected
Total deaths	1	0.451*	0.408*
Damage cost	0.451*	1	0.466*
Total affected	0.408*	0.466*	1

Note: ** denotes significance at the 1% level.*

Source: *Author's calculation, using EM-DAT Database.*

Appendix- 3

A Brief Description about the Indicators Selected for Measuring the Severity

Indicator Name	Brief Description
Number of deaths	Persons confirmed as dead and persons missing and presumed dead
Number of total affected	Those who seek immediate assistance after a natural disaster. Sum of injured, homeless, and affected
Total Damage cost	Estimates on damage to property, infrastructure and crops

Source: EM-DAT Database, 2024.

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