Increasing economic losses from natural disasters as a last decade trend

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Abstract. Two main methods were used for this article: individual regression analyses on historical data and a three-stage methodology to estimate direct losses, sector losses, and GDP losses that are attributable to natural disasters. The paper analyses using data from the insurance company Swiss Re on economic losses from natural disasters in recent years. In addition, statistics for 20 years (2002-2022) collected by CRED and the United Nations Office for Disaster Risk Reduction (UNDRR) are analysed. The global losses from natural disasters in the last ten years are also assessed. An upward trend in the annual increase of global economic damage from natural disasters is identified. The largest natural disasters in the world in terms of economic damage 2013-2022 are considered in detail. The data of damage from the listed natural disasters are compared with the economic damage from the earthquake in Turkey in 2023. The article considers the indicator of economic damage caused by natural disasters by region and concludes that it is heterogeneous. The correlation of economic losses of countries with the highest economic losses from natural disasters in the last 20 years with their level of GDP is examined. The World Bank's estimate of annual damage from natural disasters is given. The conclusion gives a forecast for the period from 2022 to 2050 by Ortec Finance to estimate the direct losses, sector losses, and GDP losses that are attributable to natural disasters. Also in the conclusion, confirms the trend of recent decades is the increase in the magnitude of economic losses from natural disasters of global nature, which supports the hypothesis of the study. The conclusion gives a forecast of increase in economic losses from natural disasters in the near future.

1 Introduction

Natural disasters include all major destructive natural events such as hurricanes, earthquakes, droughts and floods. These disruptive natural events have the potential to dramatically change the lives of local populations and result in significant costs for governments, businesses and individual communities. The statistics collected perfectly illustrate the dynamics of the rising costs associated with the impact of natural disasters on the economy of both a single government entity and an entire region. The resulting economic costs associated with natural disasters can be direct and indirect [1]. If direct

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costs are quite transparent and obvious: restoration of destroyed buildings and infrastructure, rescue of people, assistance to victims, etc., then indirect costs include: business interruption, reduction of tourist attractiveness of the region, disruption of trade [2]. The economic damage associated with natural disasters primarily affects individual property owners as well as the community living in the area as a whole. Most of the damage is borne by federal, state and local governments [3].

In recent years, there has been a trend towards a global increase in the scale of natural disasters, which means that the financial damage increases year by year. This idea formed the basis of the hypothesis put forward for discussion: in recent decades, there has been a trend of increasing economic losses from natural disasters at the global level.

The purpose of this article is to establish facts that confirm the correctness of the hypothesis or facts that refute it.

In order to achieve the set goal, the following tasks are addressed in the article.

- research methods are identified;

- the number of natural disasters and economic losses from them are identified;

- the economic consequences of natural disasters are compared with the level of the country's GDP.

2 Materials and methods

Within the framework of writing this analytical paper, two main methods were used: individual regression analyses on historical data and a three-stage methodology to estimate direct losses, sector losses and GDP losses that are attributable to natural disasters [4]. Regression analysis is one of the basic methods for analysing the impact of natural disasters on the global economy [5]. The method is very flexible and versatile, suitable for analysing individual parameters and individual regions. On the other hand, this method is rather one-sided and does not allow assessing all sides of the existing interrelationships, which may lead to a shift in emphasis and, as a result, not a complete picture of the reflection of the results.

The article used studies whose methodology is based on regression analysis, such as: studies of the insurance company Swiss Re; data reported in the bulletin of the Belgian Centre for Research in Catastrophe Epidemiology (CRED). A three-phase methodology to estimate direct losses, sector losses and GDP losses that are attributable to natural disasters covered the forecast period from 2022 to 2050. This model consists of 3 phases.

Phase 1: forecasting economic losses due to natural disasters over the period 2022 - 2050. The analysis is based on global insurance data from eleven geographical regions. These data are obtained using the PREDICT model. The essence of the model: the increase in frequency, as well as the impact of direct economic losses, of extreme weather risks by type of event (e.g. droughts, storms, floods) for different climate scenarios is quantified. The analysis was conducted by Ortec Finance, which has several databases including the UN World Urbanisation Programme, NASA's Socio-Economic Data and Applications Centre (SEDAC), NOAA National Environmental Information Centre climate data and Munich Re's disaster and loss data. The resulting data are recorded as direct economic losses from 2022 to 2050 and denominated in U.S. dollars.

Phase 2: Estimation of future economic losses from natural disasters from 2022 to 2050. Nineteen research papers were reviewed, mapping the impact analyses of natural disasters by sector.

Phase 3: Modelling the wider economic impact of water losses at key dates between 2022 and 2050. Phase 1 and 2 data on economic losses due to natural disaster risk were translated into the E3ME economic model as 'shocks' to identify the economic impact of

disaster risk in 10 key geographic regions. The E3ME model is a dynamic computer-based macroeconomic model of the world's economic and energy systems and environment [6]. The results of the model are displayed in currency terms (total GDP loss in US dollars from 2022 to 2050), percentage of annual GDP and sector level output. The application of this method has been reflected in forecasting the estimation of future economic impacts from natural disasters.

3 Results

According to the insurance company Swiss Re, global economic losses from natural disasters increased to $275 billion in 2022. Swiss Re experts expect this indicator to grow in 2023 [7]. The trend of growth in the number of natural disasters in the world and the increase in economic losses from them is also confirmed by the analysis of data given in the bulletin of the Belgian Centre for Research in Disaster Epidemiology (CRED) for 2022 [8]. Further, in Table 1 we will analyse the statistics for 20 years (2002-2022) collected by CRED and the United Nations Office for Disaster Risk Reduction (UNDRR).

Table 1. Number of natural disasters in the world, units

Natural disaster	2022	Average value for 2002-2021	Change 2022 to the value 2002-2021	Trend
Volcanoes	9	5	+4	↑
Fires	19	11	+8	↑
Extreme temperatures	3	21	-18	↓
Landslides	14	18	-4	↓
Earthquakes	28	27	+1	↑
Floods	223	163	+60	↑
Hurricanes	121	102	+19	↑
Drought	15	16	-1	↓
Total	432	363	+69	↑

The increase in the number of natural disasters in the world is associated with an increase in the number of floods, hurricanes and fires. It is worth noting that floods are the most common natural disaster both in 2022 and in the last decade. Along with the number of natural disasters in the world, the damage caused to the economic system of countries as a consequence of the impact of natural disasters is also increasing, which is reflected in Table 2.

Table 2. Damage from natural disasters in the world

Indicator	2022	Average value for 2002-2021.	Change 2022 to the 2002-2021 value.
Number of fatalities, thousand people	10.5	61.2	-50.7
Number of victims, million people	101.8	193.4	-91.6
Economic loss, billion USD	275.0	153.8	121.2

Thus, the economic damage caused by natural disasters in 2022 increased by $121.2 billion per year compared to the average annual value of the last 20 years. However, it should be noted that at the same time there is a decrease in the number of victims and fatalities by 50.7 thousand and 91.6 million people respectively. The damage caused to the

economy by natural disasters should be considered in the context of the last ten years (Table 3) [9].

Table 3. Damage from natural disasters in the world 2013-2022, billion USD.

Year	Economic loss	Trend to previous year
2013	140.0	-
2014	99.2	↓
2015	151.8	↑
2016	175.0	↑
2017	306.0	↑
2018	160.0	↓
2019	189.1	↑
2020	190.0	↑
2021	252.1	↑
2022	275.0	↑

The graph (Figure 1) clearly shows an upward trend in the annual increase in global economic damage from natural disasters.
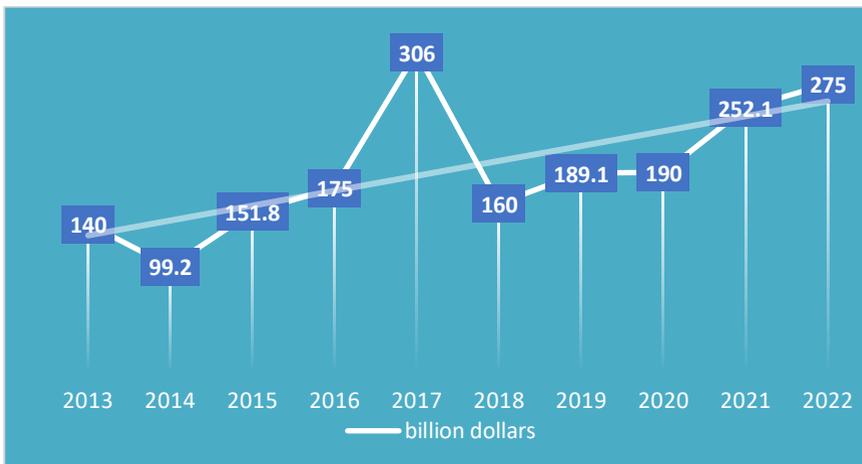

Fig. 1. Global disaster losses from natural disasters 2013-2022, billion USD. Source: authors' own calculations

When considering the damage caused by natural disasters by region, for the year 2022, Asian countries are the leaders, and if we take the figures for the last ten years, the countries of the Americas suffered the most economic damage - Table 4 [10].

Table 4. Natural disasters on continents: comparing 2022 with 2013-2021 annual averages.

Region	Share of economic damage, %		Change 2022 to 2013-2021 average	Trend
	2022	2013-2021		
Asia	18.9	42.5	-23.6	↓
America	58.9	45.5	13.4	↑
Africa	0	0.9	-0.9	↓
Europe	20.7	8.4	12.3	↑
Oceania	1.5	2.7	-1.2	↓

We will take a closer look at the largest natural disasters in the world in terms of economic damage 2013-2022 (in billions of US dollars) (Figure 2).
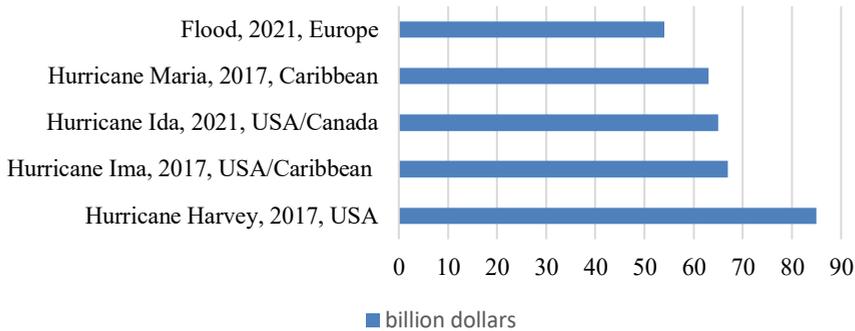

Fig. 2. World's largest natural disasters by economic damage 2013-2022. Source: authors' own calculations.

When comparing the damage from the listed natural disasters [11, 12] with the economic damage from the earthquake in Turkey (2023), the latter is higher: the earthquakes in Turkey caused damage of $88 billion, which is about 10% of the country's GDP [13]. This estimate includes the costs of providing assistance to the victims, rescuing people, rebuilding infrastructure, financing measures for state support of business, etc. [14].

Thus, the trend of increasing economic damage from natural disasters from year to year is indirectly confirmed. To get a general opinion about the level of economic damage within a country's economy, let us consider the ratio of economic losses of countries with the greatest economic losses from natural disasters over the last 20 years in relation to their level of GDP - Table 5 [15]. In its assessment, the World Bank states the annual damage from natural disasters at $520 billion.

Table 5. Countries with the highest economic losses from natural disasters as a proportion of GDP for 2003-2023

Country	Size of economic losses in relation to the country's GDP, in per cent, %
Mongolia	2.8
Cuba	4.5
Honduras	7
Nicaragua	3.6
Puerto Rico	12.2
Haiti	17.5
Tajikistan	2.7
El Salvador	4.2
North Korea	7.4
Georgia	3.5

Ortec Finance has conducted an analysis of direct losses, sector losses and GDP losses that are attributable to natural disasters. Based on the results of this analysis, it was found that by 2050, economic losses from natural disasters will reach $5.6 trillion. At the same time, the amount of economic damage is not uniform across regions - Table 6. This is influenced by a combination of several factors: infrastructure and type of development, geographical location, economic-forming industries, measures taken by the government, etc. This is due to a combination of factors, such as infrastructure and type of construction,

specific features of geographical location, economically important industries, measures taken by the government, etc.

Table 6. Projected economic losses of some countries from natural phenomena in 2050

Country	Total GDP losses, billion USD	Average annual GDP losses, %
USA	3719	0.5
China	1144	0.2
Australia	312	0.6
UK	153	0.1
Philippines	124	0.7
Canada	108	0.2
UAE	27	0.1

Thus, Australia, the Philippines, and the US are projected to experience an average economic contraction of between 0.5 per cent and 0.6 per cent of annual GDP between now and 2050. Other countries, such as the UAE and the UK, are projected to have an average annual impact on GDP of only 0.1 per cent.

4 Conclusions

Summarising the results of the analysis, we can say that in recent decades there is a trend, an increase in the scale of economic losses from natural disasters of global nature, which confirms the hypothesis defined at the beginning of the study. This trend originated long ago. Studies by organisations such as Swiss Re, CRED, United Nations Office for Disaster Risk Reduction (UNDRR), Ortec Finance show that over the last 10 years there has been a steady increase in the damage caused to the global economic system by natural disasters. Moreover, according to certain forecasts, the increase in economic losses from natural disasters will not decrease in the near future, but will only gain momentum.

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