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Article

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Natural disaster and economic growth in Africa: the role of insurance

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ABSTRACT

This study examines natural disasters' short-run and long-run effects on economic growth. We analysed insurance's short-run and long-run role in the natural disaster-economic growth nexus using 48 African countries from 2000 to 2020. Using a two-step system GMM, the study revealed that natural disasters have a short-term detrimental effect and a favourable long-term impact on economic growth. Regarding the role of insurance in the relationship between natural disasters and economic growth, it should be noted that while insurance and those affected have a positive complementary effect on economic growth in the short run, the long-term effects of insurance and natural disasters on economic growth are negligible. Therefore, regulators must enforce periodic high regulatory capital requirements to ensure the financial stability of insurance markets, especially the non-life market in Africa, and to enable insurers to absorb the unforeseen shocks from natural disasters in Africa. Also, regulators should create insurance coverage awareness through insurance education to promote insurance development and help reduce individuals' and businesses' financial losses upon the occurrence of natural disasters.

IMPACT STATEMENT

During the previous decade, over three thousand annual natural disasters have displaced millions, cost billions, and caused death, injury, and financial loss. These strain economies considerably. As high-income economies suffer from natural disasters, low-income nations are more susceptible and over-rely on help and grants. Aid and subsidies have failed to reconstruct economies following natural catastrophes; therefore, loans and insurance are used. The findings reveal that natural disasters hurt economic growth in the short term but help in the long term. Insurance and those affected have a positive complementary effect on economic growth in the short run, but the long-term effects are negligible. Thus, regulators and governments should safeguard the financial viability of insurance markets, notably the African non-life market, to allow insurers to withstand natural catastrophe shocks, especially in the immediate term. For insurance development and to limit financial losses from natural catastrophes, regulators and governments should educate the public about insurance coverage.

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1. Introduction

Recently, the world has been hit by a series of natural disasters associated with consequences such as death, destruction, and damage to properties. According to the Centre for Research on the Epidemiology of Disasters (2021), in 2019, about 396 natural disasters were reported in the Emergency Events Database (EM-DAT), resulting in an average of about 11,755 deaths, 96 million affected persons, and 130 billion US$ economic damage. Like the rest of the world, Africa has recently been hit with natural disasters. For instance, the 2017 flooding and mudslide in Sierra Leone, the 2019 cyclone Idai in Mozambique, the 2017 storm Dimeo in Zimbabwe, the 2013 cyclone 3 A in Somalia, the 2010 storm Hubert in Madagascar, and the 2010 drought in Somalia caused about 1141, 901, 251, 162, 120, and

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20000 deaths, respectively. This has led to the increasing concerns of individuals and economies dealing with natural disaster events to minimise their adverse economic impact.

While there has been a lot of concern about natural disasters in general, it is still unclear about their economic impact. Empirical literature concludes that the effect of natural disasters on economic growth is through trade, employment, capital accumulation, and consumption (Bui et al., 2014; Gassebner et al., 2010; Leiter et al., 2009; Warr & Aung, 2019). Some empirical literature concludes that natural disasters positively affect economic growth (Ahlerup, 2013; Albala-Bertrand, 1993; Skidmore & Toya, 2002). Ahlerup (2013) and Skidmore and Toya (2002) argue that economies attempting to rebuild after a natural disaster experience drive financial capital injection, technological advancement, quality structures, and institutions. This leads to high productivity and economic growth. Others, on the other hand, conclude that natural disasters adversely impact economic growth (Klomp, 2016; McDermott et al., 2014). These natural disasters result in loss of capital accumulation, loss of lives, and destruction of properties, which reduce productivity, leading to a reduction in economic growth, and others finding no significant effect (Guo et al., 2015). However, the missing link in the literature on the natural disaster-economic growth nexus is the long-run relationship between natural disasters and economic growth and the role of insurance and banks in the natural disaster-economic growth nexus. This study, therefore, seeks to fill that gap on the role insurance plays in the natural disaster-economic growth nexus.

Following natural disaster events, one of the common risk management strategies to reduce the impact of economic damage at the micro and macro levels is the immediate provision of capital, such as aid and grants. These enable firms, individuals, and the government to reinvest in economic activity to smoothen consumption for economic growth in the long run. Nevertheless, aid and grants have been proven insufficient to rebuild an economy after natural disasters, leading to alternative funding sources such as loans and insurance (Sseruyange & Klomp, 2021). Linked to this, Boissinot et al. (2016) argued that the financial system is an important complement to climate policies. In addition to aid, insurance and banks play an essential role in providing funds following natural disaster events. Insurance, for instance, pays for losses such as property damage and loss of life. At the same time, banks also provide loans to enable individuals, firms, and governments to rebuild themselves after natural disaster events. However, this is possible with a well-developed and efficient banking and insurance sector. Linked to this, Zhang and Managi (2020), Paleari (2018), and Melecky and Raddatz (2015) have empirically confirmed that the level of financial development is an essential factor in dealing with the economic damage of natural disasters.

However, an empirical gap exists on the role of insurance in the natural disaster-economic growth nexus and the long-run effect of natural disasters on economic growth (the long-run coefficients capture the effect of natural disaster on economic growth beyond the study period), especially in Africa. Therefore, this paper seeks to examine the role of insurance in the natural disaster-economic growth nexus in Africa. First, this study on Africa is necessary because the most vulnerable population in disaster events are in Africa. Secondly, the occurrence of natural disasters in Africa is likely to increase due to the region's growing population and climate change (Centre for Research on the Epidemiology of Disasters, 2021). Third, insurance plays an intermediary role in providing financial services, driving investment, and ensuring efficient allocation of resources for growth (Alhassan & Biekpe, 2015). However, the insurance market in Africa is relatively underdeveloped.

Using panel data from 48 African countries from 2000 to 2020 and two-step system Generalized Method of Moments (GMM) (because it supports a dynamic model and is more robust to endogeneity, autocorrelation, and heteroscedasticity biases), the study looks at how insurance, natural disasters, and economic development all interact in Africa. Our findings show that natural disasters have a short-term detrimental effect on economic growth. Nevertheless, natural disasters have a favourable long-term impact on economic growth. Regarding the role of insurance in the relationship between natural disasters and economic growth, it should be noted that while insurance and those affected have a positive complementary effect on economic growth in the short run, the long-term effects of insurance and natural disasters on economic growth are negligible.

This study makes a significant contribution to empirical literature and policy-making. First, to the best of our knowledge, this study is the first to introduce the moderating effect of insurance in a natural disaster- economic growth nexus in the empirical literature. Also, from a policy standpoint, regulators

should periodically impose high regulatory capital requirements to stabilise insurance markets, particularly the non-life market in Africa, so that insurers can absorb the unexpected shocks caused by natural disasters on the continent. Additionally, to promote insurance development and assist in reducing financial losses for individuals and businesses in the event of natural catastrophes, regulators should raise awareness of insurance coverage through insurance education.

Following is the format for the remaining sections of the study: Section two examines the empirical studies on financial development and natural disasters, as well as on insurance development and economic growth, and Section three presents the methodology. Section four examines the findings, and Section five concludes the study and offers some policy implications.

2 Literature review

2.1. Theoretical review

Hsiang and Jina (2014) and López, Thomas, and Troncoso (2016) argue that in endogenous growth theory, natural disasters initially have economic consequences both directly (death, displacement, and damages) and indirectly (decreased productivity and loss of wages), but can also drive innovation, human capital accumulation, and institutional improvements. Therefore, contributing to long-term economic growth. Following the endogenous growth theory, Schumpeter (2013) creative destructive theory found support for natural disasters as growth-enhancing indicators in the long run. Cavallo et al. (2013), Khan et al. (2023) contend that the neoclassical growth theories, natural disasters have no significant impact on economic growth, but growth is possible if economies move from a normal growth path, Thus, the neoclassical theory advocates for risk management strategies such as insurance purchases, government interventions and diversification of investments to reduce the vulnerability to natural disasters

2.2. Natural disaster and economic growth

Most empirical studies on the relationship between natural disasters and economic growth conclude that, in the short term, natural disasters have a detrimental impact on economic growth (Felbermayr & Gröschl, 2014; Hsiang & Jina, 2014; Lopez, Thomas, & Troncoso, 2016; Noy, 2009). Linked to this, empirical evidence (Fomby et al., 2013; Noy, 2009) argues that developing economies are more sensitive to the economic impact of natural disasters than developed economies due to financial constraints and limited capacity. For instance, Zhang and Managi (2020) examined the effect of natural disasters on the economic growth of Pacific small island developing states using a sample period of 1976 to 2014 and concluded that these regions are more vulnerable to economic shocks following natural disasters. On the other hand, however, some literature has argued that natural disaster drives economic growth (Crespo Cuaresma et al., 2008; Loayza et al., 2012) due to the reinvestment in capital stocks and the use of advanced technologies following disasters.

One interesting concern about natural disasters and the economic growth nexus is the long-run economic effect of natural disasters, which is still not clear theoretically and empirically. This relationship could be positive, negative, or have no significant impact in the long run (Cavallo et al., 2013; Chhibber & Laajaj, 2013; Klomp, 2015; Noy & duPont, 2016). Berlemann and Wenzel (2018) argued that the permanent negative impact of natural disasters on economic growth is due to a shift in the growth paths of economies to lower-level equilibriums due to human resources and physical capital damage. Furthermore, natural disasters are associated with high opportunity costs and the determent of long-term investments. On the other hand, based on the endogenous growth models explained by Schumpeterian creative destruction theory, natural disasters lead to reconstruction efforts, which drive investments for high economic output in the long run. Due to reconstruction efforts that increase investments and have 'productivity benefits' on the economy over the long term, such models suggest that growth in a disaster-affected area may accelerate after a negative shock (Chhibber & Laajaj, 2013).

2.3. Insurance and economic growth

In the financial and economic environment, insurance is a key driver of growth (Alhassan, 2016). Insurance offers many benefits, such as providing indemnity for financial losses, driving investment, and ensuring efficient resource allocation. However, the empirical literature on the effect of insurance on economic growth provides inconclusive results. Some reveal a positive effect of insurance on economic growth (Arena, 2008; Din et al., 2017; Ege & Bahadir, 2011; Hou et al., 2012; Tong, 2008). On the other hand, others reveal that insurance adversely affects economic growth (Haiss & Sümegi, 2008), and others also reveal a bi-directional relationship (Alhassan, 2016; Beck & Webb, 2003; Pradhan et al., 2015). Han et al. (2010) examined the effect of insurance development on economic growth by employing a dynamic panel of 77 countries for the study period 1994 to 2005. The authors concluded that insurance development positively drives economic growth. Mohy Ul Din et al. (2017) Regupathi and Abu-Bakar (2017), also confirmed a positive effect of insurance on economic growth in the long run for six countries, where they employed a panel auto-regressive distributed lagged (PMG/ARDL) method over the sample period 1980 to 2015. They further concluded that trade openness and stock market development are significant drivers of economic growth.

Apergis and Poufinas (2020) also confirmed a positive effect of insurance development on economic growth using 27 OECD countries from 2006 to 2016. Despite the number of studies supporting the positive effect of insurance on economic growth, some literature reveals the opposite. For instance, Zouhaier (2014) revealed that insurance adversely affects economic growth for economies whose insurance sector development has passed the maximum development threshold. In support of the findings of Zouhaier (2014) and Haiss and Sümegi (2008) argued that the negative effect of insurance on economic growth is attributed to moral hazard and the measure for insurance. Lee et al. (2016) studied how the institutional environment affects the insurance development-economic growth nexus using 40 countries from 1981 to 2010. They revealed that insurance has a negative effect on economic growth in economies with weaker institutional environments.

Contrary to the causality from insurance development to economic growth as reported by most empirical literature, Ward and Zurbruegg (2000) found that insurance drives economic growth for some countries while for some countries, economic growth enhances insurance development using nine OECD countries for the period 1961 to 1996 to test the link between insurance and economic growth. Similar to Ward and Zurbruegg (2000), Chang et al. (2014) argued that the relationship between insurance and economic growth differs amongst different economies. The authors use the bootstrap panel Granger causality test on ten OECD nations to examine the relationship between insurance and economic growth from 1979 to 2006. The study also concludes that while economic growth drives insurance in certain countries, it does not necessarily do so in others when using life and non-life real insurance premiums as indicators of insurance development. While examining the relationship between insurance penetration and economic growth for 19 nations in the Eurozone from 1980 to 2014, Dash et al. (2018). Dash et al. (2018) found a bi-directional relationship between insurance development and economic growth.

2.4. Financial development and natural disasters

Empirical studies have revealed the relevance of the financial system following disaster events (Boissinot et al., 2016; Paleari, 2018). Linked to this, some empirical studies, such as Toya and Skidmore (2007) and McDermott et al. (2014), have concluded that the degree of natural disaster impact depends on the level of financial development. Also, Klomp (2018) argued that natural disasters could affect the financial system of economies because, following disasters, the withdrawal of deposits and demand for credit also increase. This can then affect the solvency risk and credit risk of the financial system.

3. Methodology

This section presents the empirical model and the estimation strategy employed in the study.

3.1. Empirical model

Due to the existence of a dynamic panel, endogeneity, cross-sectional dependency, and heteroscedasticity (see Tables 3, 5, 6, and 7) in the dataset, from preliminary statistical analysis, the study adopted the two-step system GMM. The empirical model is given by:

$$GDP_{it} = \beta_0 + \beta_1 GDP_{it1} + \beta_2 Natural\ \ Disater_{it} + \beta_3 TradeOpenness_{it} + \beta_4 Infla_{it} + \beta_5 ExchangR_{it} + \beta_6 Education\ \ years_{it} + \beta_7 MCS_{it} + \beta_8 FDI_{it} + \gamma_{it} \quad (1)$$

$$GDP_{it} = \alpha_0 + \alpha_1 GDP_{it1} + \alpha_3 Natural\ \ Disater_{it} + \beta_4 Insurance\ \ Penertration_{it} + \alpha_5 (Natural\ \ Disaster * Insurance\ \ Penetration)_{it} + \alpha_6 TradeOpenness_{it} + \alpha_7 Infla_{it} + \alpha_8 ExchangeR_{it} + \alpha_9 Education\ \ years_{it} + \alpha_{10} MCS_{it} + \alpha_{11} FDI_{it} + \varepsilon_{it} \quad (2)$$

Following Qudrat-Ullah and Nevo (2021) and Paudyal et al. (2002), the long-run coefficients for the significant natural disaster proxies will be estimated with the following formula;

$$\frac{\beta_2 (Natural\ \ Disater_{it})}{1\beta_1 (GDP_{it1})} \quad (3)$$

The long-run coefficients capture the effect of natural disaster on economic growth beyond the study period (Qudrat-Ullah & Nevo, 2021). From Equations 1 and 2, GDP_{it} is the log of real gross domestic product for country *i* at time *t*; $GDPrat_{it1}$ is the first lag of the log of real gross domestic product for country *i* at time *t*; $Natural\ \ Disater_{it}$ for country *i* at time *t* is proxied by the total number of death, total affected (sum of the number injured and the number of homeless) and the total number of damages from all natural disasters (earthquake, flood, drought, landslide, epidemic, extreme temperature and storm); $TradeOpenness_{it}$ for country *i* at time *t* is measured as the ratio of the sum of imports and exports to GDP; $Infla_{it}$ is the inflation rate for country *i* at time *t*; $ExchangR_{it}$ is the exchange rate for country *i* at time *t*; $Education\ \ years_{it}$ of country *i* at time *t* is proxied with the compulsory education duration years and primary education duration years. We use compulsory education duration years and primary education duration years because most African countries have to implement compulsory education at the basic level to meet sustainable development goals. Also, the majority of the citizens of African countries mostly have only primary education. MCS_{it} is the mobile phone subscription per 100 persons for country *i* at time *t*, and this is used as a proxy for communication infrastructure; FDI_{it} is the foreign direct investment for country *i* at time *t* measured with the ratio of FDI inflows to gross domestic product (GDP); $Insurance\ \ Penertration_{it}$ is the life and non-life insurance penetration for country *i* at time *t* measured with the ratio of gross premiums to gross domestic product (GDP).

We expect the coefficient of $GDPrate_{it1}$ to be positive in both Equations 1 and 2. Moreover, the coefficient of $Natural\ \ Disater_{it}$ in both Equations are expected to be negative because natural disasters cause damages that slow down labour productivity leading to a decline in growth. Expected signs of $TradeOpenness_{it}$ coefficient in both Equations is positive because trade openness measures the level of a country's involvement in international trade. Therefore, a high level of trade openness implies increased productivity, employment, investment and production efficiency, and easy access to international markets.

Furthermore, the coefficients of $Infla_{it}$ and $Education\ \ years_{it}$ in both Equations are expected to be negative because a high inflation rate increases the cost of borrowing and reduces returns on business which discourages investment for economic growth. Also, long years of education imply a decline in the active labour force, which reduces labour productivity, leading to a decline in economic growth. Coefficients of MCS_{it} and FDI_{it} are expected to be positive in both Equations. This is because school enrollment implies highly skilled human capital to drive productivity, and mobile phone user subscriptions reduce transaction costs for operational efficiency. Also, FDI inflows create employment, transfer technology, and drive productivity, increasing economic growth. Finally, positive expected signs for insurance penetration and the interaction of insurance penetration and natural disaster. This is because insurance provides indemnity for damages, enabling firms and individuals to start operations for

Table 1. Variables description.

Variables	Description	Measure	Source
GDP	Gross Domestic Product	Natural log of real GDP	World Development Indicator (WDI)
Natural disaster	Natural disaster	Death, Total damage amount and total persons affected	Emergency Events Database (EM-DAT)
Trade openness	Trade openness	ratio of sum of imports and exports to gross domestic product (GDP)	WDI
Infla	Inflation	Inflation rate	WDI
ExchangeR	Exchange rate	Exchange rate	WDI
Education years	Education years	compulsory education duration and primary school duration	WDI
MCS	Mobile phone subscription	mobile phone subscription per 100 persons	WDI
FDI	Foreign direct investment	FDI inflows as a percentage of gross domestic product (GDP)	WDI
Insurance Penetration	Insurance Penetration	life and non-life insurance penetration as a percentage of GDP	WDI

productivity, which drives economic growth. A summarised description of the regression variables is presented in Table 1.

3.2. Estimation procedure

Panel data modelling has issues of unobserved heterogeneity, which is mainly addressed by taking the first difference or using the demeaning process. However, the demeaning process to eliminate the unobserved heterogeneity creates a correlation between the independent variables and the error term, which results in bias and inconsistent estimates (Nickell, 1981) following the subtraction of the mean values of the dependent and independent variables from the respective variables. An alternative to the demeaning process to address its drawback is the first difference, which removes the constant term and the unobserved heterogeneity. However, there is an endogeneity issue following the inclusion of the lagged dependent variable (Blundell et al., 2001; Bond, 2002).

Therefore, the ordinary least squares (OLS), generalised least squares (GLS), and within-group (WG) estimators provide a bias and inconsistent estimate in such situations. As a result, Anderson and Hsiao (1981) proposed the instrumental variable estimator by using the second and third lags as instruments for the lagged dependent variable. However, this estimation technique produces a biased and inconsistent estimate when the dynamic panel has a large number of entities (N) and small time series observations (T) (Ahn & Schmidt, 1995; Alonso-Borrego & Arellano, 1999; Bond, 2002).

Also, another drawback of the instrumental variable estimator is that it fails to exploit all the instruments for the endogenous variables and cannot address heteroscedasticity (Arellano & Bond, 1991). The dynamic panel model estimator (differenced generalised methods of moments (GMM) proposed by Arellano and Bond (1991) addresses these drawbacks and also allows for the use of external instruments to produce a more efficient and unbiased estimate.

However, the Arellano and Bond (1991) approach eliminates time-invariant regressors, which are addressed by Arellano and Bover (1995) and Blundell and Bond (1998) using the system GMM. The system GMM and Arellano and Bond (1991) approaches are used in situations when; (1) panel data has a large number of entities but a small time series, (2) the model is dynamic; thus, a lagged dependent variable has a predictor power, (3) independent variables are not strictly exogenous, (4) fixed individual effects and, (5) evidence of heteroscedasticity and cross-section dependency.

This present study also uses system GMM for the regression analysis because system GMM is more robust to endogeneity, autocorrelation, cross-section dependency, and heteroscedasticity. Secondly, the high correlation coefficient (0.9997) (see Table 3) between the dependent variable and its lag shows persistence in the model. According to Asongu, LeRoux and Nwachukwu (2019), a correlation coefficient between the dependent variable and its lagged model above 0.8 shows persistency in the model. Third, the number of entities in the panel data is greater than the number of time series observations. Finally, the study aims to find long-run estimates of natural disasters' effects on economic growth.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std	Min	Max
GDP(log)	1,080	3.975	7.047	62.076	123.140
Death	1,134	127.112	828.197	0	20011
Affected	1,134	296261.4	1106602	0	1.50e 07
Damage	1,134	19742.75	227990.2	0	7034506
Trade openness	879	0.149	0.394	0.001	3.140
Inflation	1,015	8.963	27.708	9.798	513.907
Exchange rate	1,097	4.637	2.378	3.113	22.629
Compulsory education	1,134	6.608	3.595	0	12
Primary education	1,134	6.095	0.528	4	7
mobile subscription	1,090	50.094	44.544	1	198.152
FDI	1,041	4.527	7.983	11.625	103.337
Life penetration	772	0.755	1.949	0.00	15.381
Non-life Penetration	817	0.719	0.508	0.003	3.031

Note. GDP Gross domestic product; FDI Foreign direct investment.

Table 3. Correlation matrix.

	growth	L.growth	Death	Affected	Damage	Non-life	Trade O	Inflation	ExchangeR	CompulsoryEdu	Primaryedu	Mobile	FDI
growth	1												
L.growth	0.9997	1											
Death	0.003	0.002	1										
Affected	0.053	0.056	0.096	1									
Damage	0.044	0.043	0.017	0.062	1								
Non-life	0.372	0.369	0.086	0.012	0.045	1							
Trade O.	0.629	0.635	0.024	0.026	0.034	0.113	1						
Inflation	0.030	0.078	0.004	0.074	0.007	0.080	0.024	1					
ExchangeR	0.712	0.713	0.088	0.032	0.053	0.474	0.494	0.101	1				
CompulsoryEdu	0.071	0.063	0.039	0.132	0.025	0.070	0.036	0.057	0.002	1			
Primaryedu	0.166	0.167	0.009	0.094	0.019	0.290	0.083	0.107	0.240	0.184	1		
Mobile	0.061	0.068	0.091	0.088	0.002	0.342	0.222	0.114	0.215	0.222	0.105	1	
FDI	0.206	0.214	0.020	0.026	0.011	0.077	0.193	0.035	0.056	0.045	0.054	0.028	1

NB:Trade O.trade openness; ExchangeR exchange rate; CompulsoryEdu compulsory education duration; Primary edu primary education duration; Mobile mobile users subscription.

System GMM uses both internal and external instruments. The internal instruments are the lags of the endogenous variables, and the external instruments are the exogenous regressors (Baum, 2013). Therefore, for this study, the internal instruments are the lags of the endogenous variable, and the external instruments are the exogenous regressors.

4. Data and preliminary statistical analysis

4.1. Data

48 African countries for the study period 2000 to 2020 are used for the regression analysis in this study. Data for a natural disaster is sourced from the Emergency Events Database (EM-DAT), while data on development indicators is obtained from the World Development Indicators. The Emergency Events Database (EM-DAT) contains data on disasters resulting from natural events, technology, and complex disasters. However, for the purpose of this study, only disasters from natural events are considered.

4.2. Descriptive statistics

The descriptive statistics of the regression variables are presented in Table 2. This includes the regression variables' sample observation, mean, standard deviation, and minimum and maximum. From Table 2, on average, the economic market size of African countries grows by 3.98% for the study period 2000 to 2020. This shows a low growth rate relative to developed economies that record double-digit economic growth rates. For the same study period, during natural disasters, on average, about 127 and 296261 people died and got affected, respectively. The affected include those who get injured and those who become homeless during natural disasters. The average economic damage from natural disasters costs about $19742.75.

For the regression analysis, the outcomes of natural disasters (death, total affected, and total damage) are divided by the urban population to obtain the rate of the disastrous outcomes. Urban population is used because the growth of the urban population in Africa produces a greater percentage of people who are vulnerable to natural disasters (Centre for Research on the Epidemiology of Disasters, 2021; Skidmore & Lim, 2020). In addition, a summary of compulsory education duration and primary education shows that, on average, the number of years for primary education and compulsory education is six years. Also, it is observed that there are potential outliers in trade openness, inflation, and exchange rate, so these variables are winsorized at the 10^{th} and 95^{th} percentiles, 10^{th} and 95^{th} percentiles, and 25^{th} and 75^{th} percentiles, respectively, for the regression analysis based on the details of the summary statistics. For the regression results, 48 African countries were used in this study due to missing data points.

4.3. Preliminary statistical analysis

Before the regression analysis, a correlation matrix is performed to check for multicollinearity, and this is presented in Table 3. From Table 3, all the correlation coefficients are less than 0.5. This implies that there is no evidence of multicollinearity with the independent variables, and this is confirmed by the variance inflation factors, where all the variance inflation factors are less than 10 in Table 4. The high correlation coefficient between the lag of GDP and itself (0.999) shows a dynamic model.

Another condition for a system GMM estimator is the evidence of fixed individual effects. Therefore, evidence of fixed individual effects is presented using the Hausman test in Table 5. In Table 5, the significance of the p-values under all the models for the effect of natural disasters on economic growth and the role of insurance on the effect of natural disasters on economic growth show a rejection of the null hypothesis that a random effect is appropriate to conclude that a fixed individual effect is appropriate. This implies that all the regression models under the effect of natural disasters on economic growth and the role of insurance on the effect of natural disasters on economic growth have fixed individual effects.

Furthermore, tests for cross-section and heteroscedasticity using the Peasaran test for cross-section dependencies and the Greene test for heteroscedasticity are presented in Tables 6 and 7 respectively. These results provide another justification for the use system GMM. From Tables 6 and 7, there is evidence of cross-section dependencies and heteroscedasticity across all the models. Evidence of fixed effects, heteroscedasticity, and cross-section dependencies justifies the use of system GMM for a more robust analysis, aside from the model being dynamic. Also, system GMM is used in this study because T N.

4.4. Empirical analysis

This section presents the empirical results of the short and long-run dynamic model estimates of the effect of natural disasters on economic growth and the role of insurance on the effect of natural

Table 4. Varaince inflation factor (VIF).

	With Insurance		Without Insurance	
Variable	VIF	1/VIF	VIF	1/VIF
GDP	3.79	0.264	2.99	0.334
Exchange rate	3.6	0.278	2.8	0.357
Non-life insurance	2.87	0.348		
Life insurance	2.68	0.373		
Trade openness	1.98	0.505	1.74	0.574
Primary education(years)	1.51	0.663	1.37	0.730
Mobile subscription	1.38	0.727	1.32	0.755
Compulsory education(years)	1.36	0.735	1.37	0.732
Inflation	1.3	0.768	1.22	0.822
Foreign direct investment	1.14	0.873	1.16	0.863
Affected	1.14	0.874	1.05	0.954
Damage	1.1	0.908	1.01	0.991
Death	1.05	0.952	1.03	0.972
Mean	1.92		1.55	

Note. GDP Gross domestic product; FDI Foreign direct investment.

Table 5. Hausman specification test.

Models	Hausman-Test Statistics
Model 1	43.24**
Model 2	42.98**
Model 3	42.32**
Model 4	39.61**
Model 5	44.35**
Model 6	46.04**

** denotes 5% significance level.

Table 6. Pesaran cross section (CD) dependence test.

Variable	CD-test
Growth	127.768**
Death	6.538**
Affected	1.72
Damage	1.473
Non-life insurance	5.759**
Trade openness	67.503**
Inflation	24.586**
Exchange rate	40.399**
Compulsory education years	94.386**
Primary education years	0.192
Mobile users subscribers	154.547**
FDI	6.689**

** denotes 5% significance level.

Table 7. Greene test for heteroscedasticity.

Models	Heteroscedasticity χ^2-statistics
Model 1	81898.80**
Model 2	81777.92**
Model 3	81769.57**
Model 4	14533.67**
Model 5	14550.22**
Model 6	14516.38**

** denotes 5% significance level.

disasters on economic growth. The significance of the results is justified at a 5% significance level due to its high explanatory power.

4.4.1. Regression analysis of the effect of natural disasters on economic growth

Models 1, 2 and 3 under Table 8 present the empirical results on the effect of natural disasters on economic growth using the number of deaths (death), the number of people affected (affected), and total damage (damage), respectively, as proxies for natural disasters. In contrast, Table 9 provides dynamic long-run estimates of the link between natural disasters and economic growth by focusing only on the significant natural disaster variables in Table 8. The significance of the results is selected at 5% because it has more predictive power.

From Table 8, the significant p-value of the F-statistics across the models shows that the regression models are valid and reliable. Also, the insignificant p-value of the Hansen J test indicates that the instruments (18 instruments) used in regression analysis are valid, and the instruments (18) being less than the number of countries (48) confirms the validity of the system GMM model used. The significant positive relationship between the dependent variable (economic growth) and its lag in Table 8 confirms that the model is dynamic. Also, death, the total number affected, damage, primary education duration years, mobile phone subscriptions, inflation, and the exchange rate significantly negatively affect economic growth at a 5% significance level. On the other hand, FDI is positively significant at 5% across all models, while trade openness has a significant positive impact on economic growth only under models 1 and 3 at a 5% significance level.

The long-run effect focus is only on the significant variables of the natural disaster, as presented in Table 9. In Table 9, the total number of deaths, individuals affected, and total damage have a significant positive long-run effect on economic growth.

Table 8. Effect of natural disaster on economic growth.

	(1)	(2)	(3)
Variables	1	2	3
Constant	1.434**	1.460**	1.482**
	(0.486)	(0.493)	(0.485)
L.GDP	1.072**	1.072**	1.073**
	(0.012)	(0.012)	(0.019)
Death	0.212**		
	(0.091)		
Affected		0.005**	
		(0.002)	
Damage			0.043**
			(0.011)
Trade openness	0.478**	0.499	0.503**
	(0.225)	(0.252)	(0.241)
Inflation	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
Exchange rate	0.031**	0.023**	0.030**
	(0.0106)	(0.0109)	(0.0108)
Compulsory education duration	0.003	0.003	0.003
	(0.002)	(0.002)	(0.002)
Primary education duration	0.054**	0.052**	0.055**
	(0.013)	(0.013)	(0.013)
Mobile phone subscriptions	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
FDI	0.001**	0.001***	0.001**
	(0.001)	(0.001)	(0.001)
F-statistics	1623.91**	1644.97**	1604.47**
AR(2) (Prob z)	0.360	0.365	0.360
Hansen J (Prob χ^2)	0.925	0.932	0.960
Instruments	18	18	18
Observations	783	783	783
Number of Countries	48	48	48

Note. GDP Gross domestic product; FDI Foreign direct investment.
Robust standard errors in parentheses.
** denotes 5% significance level.

Table 9. Long-run dynamic panel estimates of the effect of natural disaster on economic growth.

VARIABLES	Long-Run Estimates
Death 2.960**	
(1.180)	
Affected	0.069**
	(0.028)
Damage	0.591**
	(0.231)

** denotes 5% significance level.

4.4.2. Regression analysis of the role of insurance on the natural disaster and economic growth nexus

Regarding the role of insurance in the natural disaster-economic growth nexus, insurance in this study is non-life insurance because non-life insurance responds more to catastrophic events than life insurance. Models 4, 5 and 6 under Table 10 present the role of non-life insurance in the natural disaster-economic growth nexus, while Table 11 provides the dynamic long-run estimates of the role of non-life insurance in the natural disaster-economic growth nexus by focusing only on the significant interactive terms in Table 10. The significance of the results is selected at 5% because it has more predictive power.

From Table 10, the significant p-value of the F-statistics across the models shows that the regression models are valid and reliable. Also, the insignificant p-value of the Hansen J test shows that the instruments used in regression analysis are valid. The significant positive relationship between the dependent variable (economic growth) and its lag across all models under Table 10 also confirms that the model is dynamic. Also, death, damage, trade openness, FDI, and exchange rate do not significantly impact economic growth, which is different from the results in Table 8. This may be due to adding the interactive term and the insurance variable. Also, insurance does not significantly affect economic growth across all the models. However, the adverse effects of natural disasters proxied by total affect, primary education duration years, mobile phone subscriptions, and inflation on economic growth are consistent with the

Table 10. The role of insurance in the natural disaster and economic growth nexus.

	(4)	(5)	(6)
VARIABLES	4	5	6
Constant	1.069	1.179	1.177
	(0.588)	(0.643)	(0.652)
L.GDP	1.059**	1.064**	1.064**
	(0.023)	(0.025)	(0.026)
Death	0.245		
	(0.697)		
Affected		0.014**	
		(0.005)	
Damage			0.104
			(0.274)
Non-life insurance	0.023	0.025	0.025
	(0.021)	(0.021)	(0.021)
Death*Non-life insurance	0.134		
	(1.167)		
Affected* Non-life insurance		0.014**	
		(0.007)	
Damage* Non-life insurance			0.243
			(0.191)
Trade openness	0.453	0.474	0.473
	(0.236)	(0.251)	(0.256)
Inflation	0.001***	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
Exchange rate	0.033	0.034	0.034
	(0.018)	(0.018)	(0.018)
Compulsory education duration	0.004**	0.004**	0.004**
	(0.002)	(0.002)	(0.002)
Primary education duration	0.056**	0.057**	0.057**
	(0.018)	(0.020)	(0.021)
Mobile phone subscriptions	0.001**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)
FDI	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
F-statistics	1086.58	763.83	1532.05
Prob F	0.000	0.000	0.000
AR(2)(Prob z)	0.515	0.574	0.543
Hansen J (Prob χ^2)	0.897	0.889	0.890
Instruments	16	16	16
Observations	650	650	650
Number of countries	42	42	42

Note. GDP Gross domestic product; FDI Foreign direct investment. Robust standard errors in parentheses ** denotes 5% significance level.

Table 11. Long-run dynamic panel estimates of the role of insurance on the natural disaster and economic growth nexus.

Variable	Long-run estimate
Affected* Non-life insurance	0.227
	(0.139)

results under Table 8, as discussed previously. On the interactive term, non-life insurance does not significantly moderate the effect of death and damages following a disaster on economic growth. However, non-life insurance positively and significantly moderates the effect of total affected on economic growth following disaster events at a 5% significance level.

On the long-run estimates in Table 11, non-life insurance does not significantly moderate the effect of the total affected on economic growth in the long run.

4.5. Discussion of results

In Tables 8 and 10, the significant negative impact of natural disaster variables on economic growth across all the models implies that the occurrence of natural disasters would result in loss of capital accumulation, loss of lives and destruction of properties which reduces productivity leading to a reduction in economic growth in the short run. This finding is consistent with prior literature (Duqi et al., 2021; Joseph, 2022; Klomp & Valckx, 2014; Qureshi et al., 2019; Songwathana, 2018), which also concluded that natural disasters adversely affect growth in the short run. On the control variables, the negative

effect of human capital (primary school education and compulsory school duration) on economic growth in Tables 8 and 10 may be explained by the reduction in the number of the active labour force available due to long years of education, which may lead to a reduction in labour productivity. Therefore, a fall in economic growth. This contradicts previous literature on human capital on economic growth (Fang & Chen, 2017; Qadri & Waheed, 2013), which revealed that human capital drives innovation and managerial capability for enhanced growth. Also, the negative effect of mobile phone subscriptions on economic growth may be due to the high mobile user cost associated with using mobile phones in Africa. The negative effect of inflation on economic growth in Table 8 is consistent with the regression results in Table 10. This implies that high inflation reduces economic growth because a high inflation rate implies a high cost of borrowing, slows down business activities and reduces investment returns, discouraging investment. Therefore, leading to an adverse impact on economic growth. This result also confirms previous studies such as (Mengistu, 2009; Reece & Sam, 2012) that revealed a negative effect of inflation on economic growth. Furthermore, higher trade openness (see Tables 8 and 10) is widely acknowledged to boost economic growth by boosting productivity, employment, investment, and production efficiency and improving access to foreign markets. This confirms existing literature (Fang & Chen, 2017; Huchet-Bourdon et al., 2018; Keho, 2017; Ulaşan, 2015) on the positive effect of trade openness on economic growth. Finally, the positive effect of FDI on economic growth (see Tables 8 and 10) may be explained by the employment opportunities, tax revenue and high productivity associated with FDI inflows. This confirms existing literature on FDI and economic growth (Dinh et al., 2019; Osei & Kim, 2020).

Furthermore, the insignificant impact of non-life insurance on economic growth under Table 10 shows that the significance of insurance in national output may depend on other factors or may be due to the underdeveloped nature of the insurance sector in Africa. This finding is consistent with Haiss and Sümegi (2008) and Omoke (2012). Also, the positive interactive term of non-life insurance and affected economic growth indicates that insurance and natural disaster are complements in driving economic growth. This is because, after natural disaster occurrences, non-life insurance especially provides financial indemnification for losses, which helps affected individuals and firms rebuild their economic activities for more productivity and leads to higher output. This finding is consistent with Toya and Skidmore (2007) and McDermott et al. (2014), who revealed that financial institutions are relevant for economic growth following natural disasters.

For the long-run effect of natural disaster (for only significant natural disaster variables in Table 8) on economic growth in Table 9, the total number of deaths, individuals affected, and total damage have a significant positive long-run effect on economic growth. This finding supports the Schumpeter creative destruction hypothesis, similar to previous empirical findings like Chhibber and Laajaj (2013) and Qureshi et al. (2019). This positive long-run effect of natural disasters on economic growth may be explained by reconstruction efforts by affected economies that drive financial capital injection, technological advancement, quality structures, and institutions, leading to high productivity and economic growth. For the long-run moderating effect of natural disaster and insurance on economic growth (for only significant natural disaster-insurance interactive terms in Table 10) on economic growth in Table 11, insurance is not significant enough to complement the effect of disaster in Africa. This may be due to Africa's underdeveloped insurance sector and the short-term nature of the non-life insurance business.

5. Conclusions and recommendations

This study examined the effect of natural disasters on economic growth and the role of insurance. From the regression results, natural disaster, inflation, longer primary education duration, longer compulsory education duration, and high mobile user costs inhibit economic output. However, trade openness and FDI drive economic growth. In the long-run, natural disaster positively affects economic growth due to the reconstructive efforts which drive financial injections for economic activities.

Furthermore, non-life insurance has no significant effect on economic growth, but insurance and natural disaster (total affected) are complements in driving economic growth. In the long run, non-life insurance and disaster have no complementary effect on economic growth. From the conclusions of this study, regulators and governments should ensure the financial stability of insurance markets, especially

the non-life market in Africa, to enable insurers to absorb the unforeseen shocks from natural disasters in Africa. Also, regulators and governments should create insurance coverage awareness through insurance education to promote insurance development and help reduce individuals' and business' financial losses upon the occurrence of natural disasters. Also, funds should be set aside for self-insurance in addition to insurance to be able to cope with the long-run effects of natural disasters.

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Data availability statement

Data for this study would be provided upon request.

References

Dinh, T. T.-H., Vo, D. H., The Vo, A., & Nguyen, T. C. (2019). Foreign direct investment and economic growth in the short run and long run: Empirical evidence from developing countries. *Journal of Risk and Financial Management*, *12*(4), 176. https://doi.org/10.3390/jrfm12040176

Ahlerup, P. (2013). Are natural disasters good for economic growth? Working Papers in Economics, No 553, School of Business, Economics and Law, University of Gothenburg. Retrieved May 13, 2021, from https://core.ac.uk/download/pdf/16335993.pdf

Ahn, S. C., & Schmidt, P. (1995). Efficient estimation of models for dynamic panel data. *Journal of Econometrics*, *68*(1), 5–27. https://doi.org/10.1016/0304-4076(94)01641-C

Albala-Bertrand, J.-M. (1993). *Political economy of large natural disasters: With special reference to developing countries*. OUP Catalogue, Oxford University Press.

Alhassan, A. L., & Biekpe, N. (2015). Efficiency, productivity and returns to scale economies in the non-life insurance market in South Africa. *The Geneva Papers on Risk and Insurance - Issues and Practice*, *40*(3), 493–515. https://doi.org/10.1057/gpp.2

Alhassan, A. L. (2016). Insurance market development and economic growth: Exploring causality in 8 selected African countries. *International Journal of Social Economics*, *43*(3), 321–339. https://doi.org/10.1108/IJSE-09-2014-0182

Alonso-Borrego, C., & Arellano, M. (1999). Symmetrically normalized instrumental-variable estimation using panel data. *Journal of Business & Economic Statistics*, *17*(1), 36–49. https://doi.org/10.2307/1392237

Anderson, T. W., & Hsiao, C. (1981). Estimation of dynamic models with error components. *Journal of the American Statistical Association*, *76*(375), 598–606. https://doi.org/10.1080/01621459.1981.10477691

Apergis, N., & Poufinas, T. (2020). The role of insurance growth in economic growth: Fresh evidence from a panel of OECD countries. *The North American Journal of Economics and Finance*, *53*, 101217. https://doi.org/10.1016/j.najef.2020.101217

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Arena, M. (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *Journal of Risk and Insurance*, *75*(4), 921–946. https://doi.org/10.1111/j.1539-6975.2008.00291.x

Baum, C. F. (2013). Dynamic panel data estimators. *Applied Econometrics*, 1–50.

Beck, T., & Webb, I. (2003). Economic, demographic, and institutional determinants of life insurance consumption across countries. *The World Bank Economic Review*, *17*(1), 51–88. https://doi.org/10.1093/wber/lhg011

Berlemann, M., & Wenzel, D. (2018). Hurricanes, economic growth and transmission channels: Empirical evidence for countries on differing levels of development. *World Development*, *105*, 231–247. https://doi.org/10.1016/j.worlddev.2017.12.020

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Blundell, R., Bond, S., & Windmeijer, F. (2001). Estimation in dynamic panel data models: improving on the performance of the standard GMM estimator. IFS Working Papers, No. W00/12. Institute For Fiscal Studies.

Boissinot, J., Huber, D., & Lame, G. (2016). Finance and climate: The transition to a low-carbon and climate-resilient economy from a financial sector perspective. *OECD Journal: Financial Market Trends*, *2015*(1), 7–23.

Bond, S. R. (2002). Dynamic panel data models: A guide to micro data methods and practice. *Portuguese Economic Journal*, *1*(2), 141–162. https://doi.org/10.1007/s10258-002-0009-9

Bui, A. T., Dungey, M., Nguyen, C. V., & Pham, T. P. (2014). The impact of natural disasters on household income, expenditure, poverty and inequality: Evidence from Vietnam. *Applied Economics*, *46*(15), 1751–1766. https://doi.org/10.1080/00036846.2014.884706

Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic natural disasters and economic growth. *The Review of Economics and Statistics*, *95*(5), 1549–1561. https://doi.org/10.1162/REST_a_00413

Centre for Research on the Epidemiology of Disasters (CRED) CfRotEo. (2021). *Disaster year in review 2020: Global trends and perspectives*. Retrieved May 13, 2021 from https://emdat.be/sites/default/files/adsr_2020.pdf

Chang, T., Lee, C.-C., & Chang, C.-H. (2014). Does insurance activity promote economic growth? Further evidence based on bootstrap panel Granger causality test. *The European Journal of Finance*, *20*(12), 1187–1210. https://doi.org/10.1080/1351847X.2012.757555

Chhibber, A., & Laajaj, R. (2013). *The interlinkages between natural disasters and economic development. The economic impacts of natural disasters*. Oxford University Press.

Crespo Cuaresma, J., Hlouskova, J., & Obersteiner, M. (2008). Natural disasters as creative destruction? Evidence from developing countries. *Economic Inquiry*, *46*(2), 214–226. https://doi.org/10.1111/j.1465-7295.2007.00063.x

Dash, S., Pradhan, R. P., Maradana, R. P., Gaurav, K., Zaki, D. B., & Jayakumar, M. (2018). Insurance market penetration and economic growth in Eurozone countries: Time series evidence on causality. *Future Business Journal*, *4*(1), 50–67. https://doi.org/10.1016/j.fbj.2017.11.005

Din, S. M., Abu-Bakar, A., & Regupathi, A. (2017). Does insurance promote economic growth: A comparative study of developed and emerging/developing economies. *Cogent Economics & Finance*, *5*(1), 1390029. https://doi.org/10.1080/23322039.2017.1390029

Duqi, A., McGowan, D., Onali, E., & Torluccio, G. (2021). Natural disasters and economic growth: The role of banking market structure. *Journal of Corporate Finance*, *71*, 102101. https://doi.org/10.1016/j.jcorpfin.2021.102101

Ege, I., & Bahadir, T. (2011). The relationship between insurance sector and economic growth: An econometric analysis. *International Journal of Economic Research*, *2*(2), 1–9.

Fang, Z., & Chen, Y. (2017). Human capital and energy in economic growth–Evidence from Chinese provincial data. *Energy Economics*, *68*, 340–358. https://doi.org/10.1016/j.eneco.2017.10.007

Felbermayr, G., & Gröschl, J. (2014). Naturally negative: The growth effects of natural disasters. *Journal of Development Economics*, *111*, 92–106. https://doi.org/10.1016/j.jdeveco.2014.07.004

Fomby, T., Ikeda, Y., & Loayza, N. V. (2013). The growth aftermath of natural disasters. *Journal of Applied Econometrics*, *28*(3), 412–434. https://doi.org/10.1002/jae.1273

Gassebner, M., Keck, A., & Teh, R. (2010). Shaken, not stirred: The impact of disasters on international trade. *Review of International Economics*, *18*(2), 351–368. https://doi.org/10.1111/j.1467-9396.2010.00868.x

Guo, J., Liu, H., Wu, X., Gu, J., Song, S., & Tang, Y. (2015). Natural disasters, economic growth and sustainable development in china-An empirical study using provincial panel data. *Sustainability*, *7*(12), 16783–16800. https://doi.org/10.3390/su71215847

Haiss, P., & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: A theoretical and empirical analysis. *Empirica*, *35*(4), 405–431. https://doi.org/10.1007/s10663-008-9075-2

Han, L., Li, D., Moshirian, F., & Tian, Y. (2010). Insurance development and economic growth. *The Geneva Papers on Risk and Insurance - Issues and Practice*, *35*(2), 183–199. https://doi.org/10.1057/gpp.2010.4

Hou, H., Cheng, S.-Y., & Yu, C.-P. (2012). Life insurance and Euro zone's economic growth. *Procedia - Social and Behavioral Sciences*, *57*, 126–131. https://doi.org/10.1016/j.sbspro.2012.09.1165

Hsiang, S. M., & Jina, A. S. (2014). *The causal effect of environmental catastrophe on long-run economic growth: Evidence from 6,700 cyclones*. National Research Bureau of Economic Research Working Papers, No. 20352.

Hsiang, S. M., & Jina, A. S. (2014). *The causal effect of environmental catastrophe on long-run economic growth: Evidence from 6,700 cyclones (No. w20352)*. National Bureau of Economic Research.

Huchet-Bourdon, M., Le Mouël, C., & Vijil, M. (2018). The relationship between trade openness and economic growth: Some new insights on the openness measurement issue. *The World Economy*, *41*(1), 59–76. https://doi.org/10.1111/twec.12586

Joseph, I.-L. (2022). The effect of natural disaster on economic growth: Evidence from a major earthquake in Haiti. *World Development*, *159*, 106053. https://doi.org/10.1016/j.worlddev.2022.106053

Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance*, *5*(1), 1332820. https://doi.org/10.1080/23322039.2017.1332820

Khan, M. T. I., Anwar, S., Sarkodie, S. A., Yaseen, M. R., & Nadeem, A. M. (2023). Do natural disasters affect economic growth? The role of human capital, foreign direct investment, and infrastructure dynamics. *Heliyon*, *9*(1), e12911. https://doi.org/10.1016/j.heliyon.2023.e12911

Klomp, J. (2015). Sovereign risk and natural disasters in emerging markets. *Emerging Markets Finance and Trade*, *51*(6), 1326–1341. https://doi.org/10.1080/1540496X.2015.1011530

Klomp, J. (2016). Economic development and natural disasters: A satellite data analysis. *Global Environmental Change*, *36*, 67–88. https://doi.org/10.1016/j.gloenvcha.2015.11.001

Klomp, J. (2018). Do natural catastrophes shake microfinance institutions? Using a new measure of MFI risk. *International Journal of Disaster Risk Reduction*, *27*, 380–390. https://doi.org/10.1016/j.ijdrr.2017.10.026

Klomp, J., & Valckx, K. (2014). Natural disasters and economic growth: A meta-analysis. *Global Environmental Change*, *26*, 183–195. https://doi.org/10.1016/j.gloenvcha.2014.02.006

Lee, C.-C., Chang, C.-H., Arouri, M., & Lee, C.-C. (2016). Economic growth and insurance development: The role of institutional environments. *Economic Modelling*, *59*, 361–369. https://doi.org/10.1016/j.econmod.2016.08.010

Leiter, A. M., Oberhofer, H., & Raschky, P. A. (2009). Creative disasters? Flooding effects on capital, labour and productivity within European firms. *Environmental and Resource Economics*, *43*(3), 333–350. https://doi.org/10.1007/s10640-009-9273-9

Loayza, N. V., Olaberría, E., Rigolini, J., & Christiaensen, L. (2012). Natural disasters and growth: Going beyond the averages. *World Development*, *40*(7), 1317–1336. https://doi.org/10.1016/j.worlddev.2012.03.002

Lopez, R., Thomas, V., & Troncoso, P. (2016). *Economic growth, natural disasters and climate change: New empirical estimates. Working Papers, wp434.*, University of Chile, Department of Economics.

Lopez, R., Thomas, V., & Troncoso, P. (2016). *Economic growth, natural disasters and climate change: New empirical estimates* (No. wp434).

McDermott, T. K., Barry, F., & Tol, R. S. (2014). Disasters and development: Natural disasters, credit constraints, and economic growth. *Oxford Economic Papers*, *66*(3), 750–773. https://doi.org/10.1093/oep/gpt034

Melecky, M., & Raddatz, C. (2015). Fiscal responses after catastrophes and the enabling role of financial development. *The World Bank Economic Review*, *29*(1), 129–149. https://doi.org/10.1093/wber/lht041

Mengistu, A. A. (2009). *The roles of human capital and physical infrastructure on FDI inflow: Empirical evidence from east Asia and sub Saharan Africa* [Paper presentation]. CSAE Conference Paper.

Mohy Ul Din, S., Regupathi, A., & Abu-Bakar, A. (2017). Insurance effect on economic growth–Among economies in various phases of development. *Review of International Business and Strategy*, *27*(4), 501–519. https://doi.org/10.1108/RIBS-02-2017-0010

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, *49*(6), 1417–1426. https://doi.org/10.2307/1911408

Noy, I. (2009). The macroeconomic consequences of disasters. *Journal of Development Economics*, *88*(2), 221–231. https://doi.org/10.1016/j.jdeveco.2008.02.005

Noy, I., & duPont, W, IV. (2016). The long-term consequences of natural disasters—A summary of the literature. SEF Working Paper 4981, School of Economics and Finance, Victoria Business School.

Omoke, P. C. (2012). Insurance market activity and economic growth: Evidence from Nigeria. *Acta Universitatis Danubius*, *8*(2), 34–47.

Osei, M. J., & Kim, J. (2020). Foreign direct investment and economic growth: Is more financial development better? *Economic Modelling*, *93*, 154–161. https://doi.org/10.1016/j.econmod.2020.07.009

Paleari, S. (2018). Natural disasters in Italy: Do we invest enough in risk prevention and mitigation? *International Journal of Environmental Studies*, *75*(4), 673–687. https://doi.org/10.1080/00207233.2017.1418995

Paudyal, K., Guney, Y., & Antonious, A. (2002). *Determinants of corporate capital structure: Evidence from European countries*. Working Paper, Center for Empirical Research in Finance, Department of Economics and Finance.

Pradhan, R. P., Arvin, M. B., & Norman, N. R. (2015). Insurance development and the finance-growth nexus: Evidence from 34 OECD countries. *Journal of Multinational Financial Management*, *31*, 1–22. https://doi.org/10.1016/j.mulfin.2015.02.001

Qadri, F. S., & Waheed, A. (2013). Human capital and economic growth: Cross-country evidence from low-, middle- and high-income countries. *Progress in Development Studies*, *13*(2), 89–104. https://doi.org/10.1177/1464993412466503

Qudrat-Ullah, H., & Nevo, C. M. (2021). The impact of renewable energy consumption and environmental sustainability on economic growth in Africa. *Energy Reports*, *7*, 3877–3886. https://doi.org/10.1016/j.egyr.2021.05.083

Qureshi, M. I., Yusoff, R. M., Hishan, S. S., Alam, A., Zaman, K., & Rasli, A. M. (2019). Natural disasters and Malaysian economic growth: Policy reforms for disasters management. *Environmental Science and Pollution Research International*, *26*(15), 15496–15509. https://doi.org/10.1007/s11356-019-04866-z

Reece, C., & Sam, A. G. (2012). Impact of pension privatization on foreign direct investment. *World Development*, *40*(2), 291–302. https://doi.org/10.1016/j.worlddev.2011.06.003

Schumpeter, J. A. (2013). *Capitalism, socialism and democracy*. Routledge.

Sseruyange, J., & Klomp, J. (2021). Natural disasters and economic growth: The mitigating role of microfinance institutions. *Sustainability*, *13*(9), 5055. https://doi.org/10.3390/su13095055

Skidmore, M., & Lim, J. (2020). *Natural disasters and their impact on cities*. Oxford University Press.

Skidmore, M., & Toya, H. (2002). Do natural disasters promote long-run growth? *Economic Inquiry*, *40*(4), 664–687. https://doi.org/10.1093/ei/40.4.664

Songwathana, K. (2018). The relationship between natural disaster and economic development: A panel data analysis. *Procedia Engineering*, *212*, 1068–1074. https://doi.org/10.1016/j.proeng.2018.01.138

Tong, H. (2008). *An investigation of the insurance sector's contribution to economic growth*. The University of Nebraska-Lincoln.

Toya, H., & Skidmore, M. (2007). Economic development and the impacts of natural disasters. *Economics Letters*, *94*(1), 20–25. https://doi.org/10.1016/j.econlet.2006.06.020

Ulaşan, B. (2015). Trade openness and economic growth: Panel evidence. *Applied Economics Letters*, *22*(2), 163–167. https://doi.org/10.1080/13504851.2014.931914

Ward, D., & Zurbruegg, R. (2000). Does insurance promote economic growth? Evidence from OECD countries. *The Journal of Risk and Insurance*, *67*(4), 489–506. https://doi.org/10.2307/253847

Warr, P., & Aung, L. L. (2019). Poverty and inequality impact of a natural disaster: Myanmar's 2008 cyclone Nargis. *World Development*, *122*, 446–461. https://doi.org/10.1016/j.worlddev.2019.05.016

Zhang, D., & Managi, S. (2020). Financial development, natural disasters, and economics of the Pacific small island states. *Economic Analysis and Policy*, *66*, 168–181. https://doi.org/10.1016/j.eap.2020.04.003

Zouhaier, H. (2014). Insurance and economic growth. *Journal of Economics and Sustainable Development*, *5*(12), 102–113.