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The Impact of Natural Disasters on Economic Growth in Pakistan

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Abstract

This study tried to estimate the impact of natural disaster on economic growth in Pakistan. Natural disasters have a massive effect on social and economic welfare. By using time series data from 1975 to 2010, effects of natural disaster on Economic Growth (Growth in GDP, Growth in Industrial Production and Growth in Agricultural Production) had been estimated. In this study, ADF test was used to test the Stationarity of the series and then OLS method was applied to estimate the impact of natural disasters. Results showed that natural disasters turned down GDP growth 1.483 percent, Agricultural Production Growth descended 1.625 percent, and Industrial Production Growth declined 2.1 percent in the subsequently year.

Keywords: Natural Disaster, Economic Growth, ADF, OLS Method

1. Introduction

A natural disaster can be defined as a natural event that causes an interruption in the functioning of the economic system, with a significant negative impact on assets, production factors, output, employment, or consumption. Examples of such natural events are earthquakes, floods, storms, forceful rainfalls, droughts, heat waves and cold spells, (Stephane Hallegatte and Valentin Przyluski 2010).

In the history, the people of Pakistan had face to intense natural disasters many times. In 1950, more than 2,900 people were killed due to heavy rain. In Punjab, the city of Lahore was badly affected by the flooded water of the River Ravi. More than one million people became homeless as flood destroyed over 100,000 homes. In 1970, a tropical cyclone (Bhola) ruined the terrain of East Pakistan. It was one of the nastiest natural disasters ever recorded. An earth quake hit Kohistan and adjoining areas including Hunza, Swat, and Kashmir in 1974 and over 17,000 injured, and 5,300 people were killed in this incident. In 2000, nearly 120,000 people were suffered by intense drought in Balochistan. On October 8, 2005, an earth quake hit northwestern Pakistan and the area of Kashmir in Pakistan and India. In this earth quack, over 0.73 million people lost their lives and 330,000 people were deprived from shelter. In January 2010, due to land sliding the flow of river was blocked and converted into a dam, which endangered to flood in Attabad and over 20,000 inhabitant of Attabad had to vacate their homes. In 2010, a large area of Pakistan experienced the worst flood in the last 80 years as over twenty million Pakistanis were affected by this flood.

The relationship between economic growth and natural disasters received only inadequate attention up till. The impact of natural disasters on the economy is still debatable. Albala-Bertrand (1993) and Rasmussen (2004) argued that after occurrence of a natural disaster, improvement in agricultural output, capital formation and GDP growth was experienced. But both the studies captured a few events, limited data set and used straightforward statistical techniques. Both the studied explored that continual climatic events such as extreme temperatures, wild fires and draughts had a positive impact on economic growth.

Skidmore and Toya (2002) used thirty years data of eighty nine countries and supported the assertion of negative impact of natural disasters on economic growth. The study reported that meteorological and geological adversities (such as tsunamis, and earthquakes) had adverse effect on economic growth. Raddatz (2007) investigated the exterior reasons for volatility in output of developing countries and declared that natural disasters had negative impact in short run on national income. Noy (2009) used yearly data from 1970 to 2003 and examined the effects of natural disasters on government polices and financial institutions. The study revealed that per capita income, literacy rate, government expenditures, and foreign trade negatively affected by the natural disasters. Berghol and Lujal (2010) explored the economic consequences of natural disasters and how these may be linked to armed civil conflict for the period 1980-2007. The study revealed that geophysical and hydro-meteorological disasters have a negative impact on income growth. The study also investigated the causal relation between natural disaster shocks, income growth fluctuations and onset of armed civil conflict. Khan *et al.* (2010) suggested that the flood has harshly spoiled the natural forests, the public forests and habitat of wildlife and ex-situ protection areas, fish resources and fisheries development infrastructure. The findings suggest that there will be a reversion to use of natural resources for livelihood, as the existing resources with the communities are either washed or are thinned out.

The objectives of the study were to discuss the impact of natural disasters on economic growth, and to analyze the effects of natural disasters on industrial and agricultural growth in Pakistan.

The rest of the paper is planned as follows. Section 2 demonstrates data and methodology to estimate the impact of natural disasters on economic growth. The empirical results are discussed in section 3, and conclusion is explained in section 4.

2. Data and Methodology

The annual data from 1975 to 2010 was used in this study. The data was collected from Publications of the Federal Bureau of Statistics, Islamabad and Natural Disaster Management Authority (NDMA)

In this study, the depictions of variables were as under:

GDP= Growth rate of Gross Domestic Product in Pakistan (In percentage)

IP= Growth rate of Industrial Production in Pakistan (In percentage)

AP= Growth rate of Agricultural Production in Pakistan (In percentage)

D= Dummy variable used for natural disaster. D=1, if natural disaster occurs in a year and D=0 if natural disaster did not occur i.e. a normal year.

2.1. Stationary Tests

In macroeconomics, most of the variables are non-stationary (Hill *et al.* 2001). If a time series is non-stationary, then mean or the variance or both depend on time. If variance depends on time, then it approaches to infinity as time approaches to infinity (Asteriou and Hall, 2006). To test the stationarity of the series, Augmented Dickey Fuller test was applied.

The Augmented Dickey Fuller test was commonly used because extra lagged terms of the dependent variable can be included in order to eliminate autocorrelation. On the basis of Akaike Information Criteria (AIC) or Schwartz Bayesian Criteria (SBC) decision was made that how many extra lagged dependent variables were included to capture autocorrelation. In order to test for unit root through Augmented Dickey Fuller test (ADF), the following equation was used to determine the unit root.

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + u_t \quad (1)$$

2.2. Ordinary Least Squares

To explore the impact of natural disasters on GDP growth, Industrial growth, and Agricultural growth the Ordinary Least Squares method was applied. As least squares method has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis.

In this study, the following models were specified:

Model 1:

$GDP = \beta_1 + \beta_2 D(-1)$

GDP = %Growth in Gross Domestic Product

D= Dummy variable used for natural disaster. D=1, if natural disaster occurred in a year and D=0 if natural disaster did not occur.

Model 2:

$IP = \beta_1 + \beta_2 D(-1)$

IP = %Growth in Industrial Production Production

D= Dummy variable used for natural disaster. D=1, if natural disaster occurred in a year and D=0 if natural disaster did not occur.

Model 3:

$AP = \beta_1 + \beta_2 D(-1)$

AP = %Growth in Agricultural Production

D= Dummy variable used for natural disaster. D=1, if natural disaster occurred in a year and D=0 if natural disaster did not occur.

3. Empirical Results

3.1. Stationarity Test

In the time series analysis, it was obligatory to test the time series whether it was stationary or non-stationary. The study applied Augmented Dickey Fuller test for checking the stationarity of the data. The results showed that all the series were found stationary at level and first difference as shown in Table 1.

Table 1: ADF unit root test results (level, 1st difference and Intercept& Trend and Intercept).

Variables	Level	1st difference
GDP	-3.029510**	-5.530689*
AP	-7.165889*	-7.165889*
IP	-5.749331*	-5.749331*
*MacKinnon critical values for rejection of hypothesis of a unit root		
1 % Level	-4.2505	
5 % Level	-2.9472	

* Implies 1 % level of significance, ** Implies 5 % level of significance.

3.2. Model 1

The OLS estimates showed that there was a significant negative impact of Natural Disaster occurred in in a year on the GDP growth rate of the subsequently year.

$GDP = \beta_1 + \beta_2 D(-1) + \epsilon_t$

GDP= 5.8 -1.438D(-1)

Result revealed in Table 2 that if there was a normal year then GDP growth equal to 5.8 percent and due to occurrence of natural disaster GDP growth condensed to 4.362 (5.8-1.438) percent.

Table 2: Ordinary Least Squares Results

Dependent Variable: GDP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(-1)	-1.483	0.6249	-2.3734	0.02341
C	5.8	0.3608	16.0744	1.87118
Durbin-Watson stat	1.860	F-statistic		5.63341

3.3. Model 2

The OLS estimates showed that there was a negative effect of Natural Disaster at 10% of significance level on the IP growth rate of the next year.

$IP = \beta_1 + \beta_2 D(-1) + \epsilon_t$

IP= 6.675 -2.108D(-1)

Result revealed in Table 3 that if there was a usual year then IP growth equal to 6.675 percent and if natural disaster takes place then IP growth reduced to 4.567 (6.675-2.108) percent.

Table 3: Ordinary Least Squares Results

Dependent Variable: IP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(-1)	-2.10833	1.267889	-1.662869	0.1055
C	6.675000	0.732016	9.118651	0.0000
Durbin-Watson stat	2.21	F-statistic		2.765133

3.4. Model 3

The OLS estimates showed that there was a insignificant negative impact of Natural Disaster occurred in in a year on the AP growth rate of the later year as t-Statistic was very low.

$AP = \beta_1 + \beta_2 D(-1) + \epsilon_t$

AP= 4.2 -1.625D(-1)

Result revealed in Table 4 that if there was a normal year then ADP growth equal to 4.2 percent and due to occurrence of natural disaster AP growth condensed to 2.575 (4.2 -1.625) percent.

Table 4: Ordinary Least Squares Results

Dependent Variable: AP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(-1)	-1.625	1.292	-1.2568	0.217
C	4.200	0.746	5.6266	0.00
Durbin-Watson stat	1.7486	F-statistic	3.976	

The results of above estimated models are consistent to findings of Skidmore and Toya (2002), Raddatz (2007), Noy (2009), Berghol and Lujal (2010), and Khan *et al* (2010) but contrasted with the investigation of the Albala-Bertrand (1993) and Rasmussen (2004).

4. Conclusion

This study tried to estimate the negative impact of natural disasters along with other macro variables on output using Augmented Dickey Fuller (ADF) test and the Ordinary Least Squares method. The results showed that that Natural Disasters had a significant negative impact on GDP growth rate and Industrial Production growth rate but insignificant negative effects of Agricultural production growth rate.

It is suggested that the Government of Pakistan should take necessary actions to minimize the effects of such natural disasters. The infrastructure which is helping to control the losses of such natural disasters should be constructed. For this, both soft and hard adaptations policies should be implemented. The soft adaptation strategy includes educating and training local people through seminars how to plan and move during evacuation and help the community. The hard adaptation policy include better watershed, an improved irrigation system, modern sewage systems, quality transportation systems and disaster prevention infrastructure.

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