Natural-disaster shocks and government's behavior: Evidence from middle-income countries

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A R T I C L E   I N F O

A B S T R A C T

This paper aims to examine the causal relationship between natural disasters, budget deficit, public debt and economic growth for a global panel consisting of 9 middle income countries, using a panel cointegration and a Granger non-causality test. The panel model was used in this study from the period 2000 to 2014. Our results indicate that there is a unidirectional causality from natural disaster measures to budget deficit. However, we notice that there is bidirectional causality between public debt and budget deficit. Natural disasters lead to an increase in public debt to finance reconstruction activities. They aggravate the impact on the budgetary resources which are often limited to absorb the effects of external shocks.

1. Introduction

Due to a variety of factors such as the increasing concentration of population in risk areas, and the absence of warning systems, the economic costs of major disasters are on the rise. They disproportionately affect the developing countries (countries with low- and middle-income according to the World Bank) and may negatively affect economic growth as they destroy the capital and stimulate to focus on resources on assistance and reconstruction. Furthermore, the disasters occur when hazard interacts with physical, social, economic and environmental vulnerabilities [22]. Vulnerability to natural disasters is determined by a set of complex, dynamic influences that include the economic structure of the country and the stage of development. Natural disasters are a development issue, because development policies, both national and international, can really make the difference when it comes to mitigate the impact on poverty, growth and well being. Natural disasters therefore tend to become "total social facts" requiring a multidisciplinary multi-level response. They are characterized by a growing uncertainty whether in terms of their occurrence or severity. Hence with a contemporary society that creates new sources of uncertainty continuously, every traditional risk management approach becomes insufficient and inadequate, thus making the reformulation of the whole management of major risks necessary.

To understand and evaluate the economic consequences of natural disasters, it is necessary to examine pathways by which natural disasters affect the economy and the way through which the societies and economies adapt or ignore these threats. The objective of this study is to investigate the dynamic link between the natural disasters (DMS), the Gross Domestic Product per capita (GDP), the Budget Deficit (BD) and the public debt (DEBT), for 9 middle income countries for the period 2000–2014, by using the co-integration test and causality test.

The rest of the paper is organized as follows: The second section describes the existing literature and put in value our contribution. The third section discusses the data and the methodology, the fourth presents the empirical results. Finally, the conclusion and some political recommendations are given in the sixth section.

2. Literature review

2.1. Economic growth and disasters

The economic consequences of natural disasters depend in large part of the economic development level of the countries affected. Countries with low per capita income levels suffer more consequences from disasters than countries with high per capita income (in terms of economic losses as a percentage of GDP). Various studies have attempted to examine the economic impact of natural disasters in the short and long term. Albalá-Bertrand [1] developed an analytical model of disasters frequency and collected data on a set catastrophic events: 28 cases of major natural disasters in 26 countries from 1960 to 1979. He noted that natural disasters do not affect the level of GDP and not stimulate the inflation rate but increase the gross formation of fixed capital due to reconstruction activities. The agricultural sector remains unaffected, the public deficit and trade deficit increase sharply.

Similarly, Muralidharan and Shah [21] analyzed a dataset of 52 disasters in 32 developed and developing countries during 1980–1995. They found that the disasters for both groups of countries have a significant impact on the short-term growth. In the medium-term, the effect on growth was still significant. Over time, they found that the impact of natural disasters on economic growth was reduced. They also found out the relationship between the disasters and the increase of external debt, the budget deficit and the inflation.

Skidmore & Toya [29] reveals a strong correlation between economic growth and natural disasters during the period 1960–1990. They also notice that natural disaster have a positive relationship with economic growth in the long term. In another study, Jaramillo [15] studied the effects of natural disasters in the short and long term. He showed that natural disasters have a negative impact on economic growth and development.

The impact of the different types of natural disasters on many countries of the world has been studied by Raddatz [28]. He used the Panel Vector Autoregressive (panel VAR) approach and expanded the sample to 112 countries over the period 1975–2006. The results showed that the poorest countries are more vulnerable to climatic events. The study of Raddatz also indicated that foreign aid flows have slightly contributed to mitigate the adverse effects of natural disasters.

By using a set of panel data for the period 1970–2003, Noy [23] showed that the developing countries have faced much larger shock to their macro-economies after a disaster than developed countries. Ferreira and Cunado [9] used the Panel Vector Autoregressive (panel VAR) method to analyze the economic impact of floods in 118 countries between 1985 and 2008. They found that floods shocks tend to have a positive impact on economic growth. Based on a panel of 153 countries over the period 1960–2002, Berlemann and Wenzel [5] found that drought has a negative impact on long-term economic growth in developed and developing countries.

2.2. Other economic impacts

Natural disaster have changed the performance of key economic variables of the affected country, such as the changes in GDP, the balance of payments, the level of public debt, and the investment rate. Reduction of gross domestic product is a result of the decrease in the production in the affected sectors. This is due to a decline in exports and increased in imports hence weakening the trade balance and that of payments.

So, natural disasters have a significant impact on revenues and public expenditures, which have rarely been quantitatively examined. A better estimate of the fiscal cost allows governments to insure directly against disaster losses and to assess cost-benefit of various mitigation programs.

Heger et al. [12] presented the main macroeconomic effects of disasters in the Caribbean islands over the period 1970–2006. They found that natural disasters have a negative effect on economic growth, a deteriorating the fiscal balance and external balances in long run.

Noy & Nualsri [24] estimated the tax consequences of natural disasters by using a panel VAR methodology for the period 1990–2005. They found that government behavior following disasters is different between the two groups. In developed countries, governments increase expenditure and reduce taxes after a major disaster. While in developing countries, governments largely decrease spending and increase revenues.

Bluedorn [6] studied the evolution of capital flows following large natural disasters during the period between 1960 to 2002. He found that disasters generate some inflows (mostly international aid, but also other types of flows such as remittances).

For an overview of previous studies, see Table 1.

2.3. Economic effects and vulnerability

According to the theories of risk, the elements of natural disasters are classified into three categories: hazard, exposure and vulnerability. The risk analysis is to identify the type of risks affecting an area with intensity and specific recurrence. The exposure assessment is to analyze the relevant factors (population, assets) exposed to relevant risks in a given area.

The vulnerability is seen as a key concept for disaster risks. It represents the interface between exposure to physical threats and capacity of people and communities to cope with these threats [31]. So, vulnerability refers to the sensitivity of a community at risk, including factors that represent hazard sensitivity. These factors of vulnerability are grouped under physical, economic, social and environmental vulnerabilities that determine the probability and the magnitude of the damage caused by the impact of a given hazard. Vulnerability is determined by various factors such as physical, social, economic, and environmental factors, which determine the probability and the magnitude of the damage caused by the impact of a given hazard. Poor countries are not only exposed to risk, but also more vulnerable than rich countries and the most deprived in these countries are the most vulnerable.

Resilience is an assessment of long-term trends of vulnerability in relation with the adaptability capacity and the ability of individuals or groups to respond or rebound from stress and specific impacts (Jepson & Colburn[16]).

On the basis of assessments of risks of disaster and its determinants, measures of risk management can be systematically anticipated for the reduction of risks and the transfer of risk.

3. Data and empirical methodology

3.1. Description of data and data sources

We collected annual data on natural disasters and the macroeconomic variables for 9 middle-income countries (Argentina, Colombia, Morocco, Malaysia, Mexico, Peru, Philippines, Thailand, and Tunisia) over the period 2000–2014.

We used relative data on Gross Domestic Product per capita (GDP), Budget Deficit (BD) and public debt (DEBT), which are obtained from the World Bank 'On the world development indicators' (WDI).

The data on natural disasters are available from the EM-DAT data managed by the Centre for Research on Epidemiology of Disasters (CRED). The natural disasters reported in the database include drought, floods, earthquake and storms. We followed the step of Noy [23], by constructing measures of damage (DM) to capture the particular effects of severe disasters: (1) the number of people killed (KIL); (2) the number of people affected (AFF); and (3) the amount of direct damage (DAM). Our measure is based on the month in which the disaster occurs.

The measures of the number of people killed and affected are divided by the population size and the direct cost measure of the disaster by last year's GDP.

The disaster measures (DMS) are calculated based on the cost measure (DM) and the onset of the month (OM): DMS=DM (12-OM)/12.

3.2. Methodology

On the basis of modern econometric techniques, we study the relation of causality between natural disasters (DMS), Gross Domestic Product per capita (GDP), Budget Deficit (BD) and public debt (DEBT).

This procedure includes the following steps: first, a test of unit root on the data of panel is accomplished to identify stability (order of integration) of variables of chronological series. Second, a test of cointegration in panel is carried out to determine the existence of a