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Impacts of Large Disasters on the Macroeconomy and Financial Markets

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Introduction

On the back of increased trade, diversified production networks and open financial markets, the global economy has been swiftly moving along the path of integration. It happens to be that such integration has provided the basis for major events, for instance, large-scale natural disasters, economic crises and wars, to affect trade partners and the global financial market at high speed. The 2008 Global Financial Crisis, which started in the U.S., quickly dragged the entire global economy into recession, while the 2010 volcano eruption in Iceland paralyzed trade transactions and air traffics across Europe. Japan suffered the Great East Japan Earthquake in March, 2011, and the aftermath struck a huge blow, both economically and socially, to relevant countries including Korea. In other words, such large-scale disasters are no longer regional affairs, but rather matters of global concern. In this regard, this paper takes a closer look at how large-scale disasters influence the macroeconomy and financial markets of the country and other relevant countries.[1]

[1] This report is a summary of the following research paper. An, Jiyoun, Dong-Eun Rhee, Young-Joon Park, and Eun Jung Kang(2012), *Impacts of Large Disasters on Macroeconomy and Financial Markets,* Korea Institute of International Economic Policy 12-11 (in Korean).

Case Studies[2]

Examples of large-scale external shocks have been selected as case studies. The studies include analyses of economic conditions at the time of the disaster, and evaluations of recovery levels after the disaster occurred. The selected cases are as follows: the 9/11 terrorist attacks on the U.S., to look at the impact of terrorism on the economy, Hurricane Katrina in 2005, which led to more damage than necessary due to the U.S. government's inadequate response, the 2008 Sichuan Earthquake in China, which resulted in heavy casualties, and the 2011 Great East Japan Earthquake, which caused unprecedented economic damage. The particular selection of such cases from the U.S. (2), China (1), and Japan (1) can be attributed to the fact that these countries play a major economic role in the international community and are therefore likely to have greatly affected neighboring countries and trade partners. That is to say, large-scale external shocks breaking out in these countries have a stronger global impact than those occurring in other region.

Table 1. Case Studies of Large Disasters

	9/11 Terror	Hurricane Katrina	Sichuan Earthquake	Great East Japan Earthquake
Disaster type	Man-mad disaster (Terror)	Hydrological disaster(Storm)	Geophysical disaster(Earthquake)	Geophysical disaster(Earthquake)
Start date	Sep. 11, 2001	Aug. 29, 2005	May 12, 2000	Mar. 11, 2011
Estimated damage (% of GDP)	27 BIL USD (0.3%)	125 BIL USD (1.0%)	85 BIL USD (1.2%)	210 BIL USD (3.9%)
The number of deaths	about 3,000	1,833	87,476	19,846
Features of damage	Anxiety over terrorism US stock exchanges shut down	Damage to oil facilities	Massive destruction	Supply chain disruption Radiation leakage
Economic environment(before the disaster)	Sluggish economy	Strong economic growth	Strong economic growth	Sluggish economy
Economic environment(after the disaster)	Economic slowdown	Rapid recovery	Rapid recovery	Delayed recovery
The impact on global economy	Global stagnation	High oil prices	No effect	Limited influence on intra-East Asia
Policy responses and implications	- Damage was reduced in scale by rapid federal response. - The people's anxiety over terrorism delayed a recovery in economy. - U.S. Fiscal deficit caused by an increase in defense spending	-Advanced preparation was insufficient. (FEMA's budget was cut by increasing defense spending) -The cost of damage was increased by slow initial federal responses. -However, this paved the way for improvement in disaster recovery system.	-Chinese government worked hard to rebuild the areas affected by the earthquake. Furthermore, they carried out the strategies for developing the affected areas.	-It is feared that the massive expense in rebuilding could lead to weaken fiscal soundness.

Note: General information for natural disasters is from EM-DAT. However, estimated damage data from 9/11 Terror is from OECD(2002).

[2] Summary of Chapter 2 in An, Rhee, Park, and Kang (2012)

The findings show that in the case of Hurricane Katrina and the Sichuan Earthquake, the pace of recovery was considerably swift. This was because both economies were recording steady growth prior to the disasters, and also thanks to increased government spending for damage restoration. The Chinese government in particular invested massive fixed assets to support restoration from the Sichuan Earthquake as well as implement economic development strategies at the same time. Such efforts spurred rapid economic growth in the region, helping Sichuan Province not only recover from the earthquake's damage but also move on to become a key base for growth in Western China. On the contrary, in the case of 9/11 and the Great East Japan Earthquake, increased government spending did not stop economic recovery from being stalled. In the U.S., economic conditions were poor even before the terrorist attacks, and concerns over further attacks as well as the possibility of the U.S. striking Iraq led to steeper drops in consumer confidence, thus the slow economic recovery. The same goes for Japan, as the country was already in the midst of an economic slowdown prior to the earthquake, and the unexpected damage only made recovery even slower. Overall, this comes down to the conclusion that economic conditions at the time of the disaster, industrial characteristics in the area and government response measures are all directly related to the economic impact of a large external shock. One matter of note is that massive government spending on damage restoration may worsen fiscal soundness.

Direct Effects and International Spillover Effects on the Macroeconomy: Dynamic Panel GMM Analysis[3]

This chapter, using the Dynamic Panel GMM Analysis, analyzes the impact of disasters on economic growth and exports, centered on the external shock case studies mentioned in Chapter 2. In particular, the analysis takes into account the geographic distance and trade dependence of neighboring countries with regard to the disaster area, so as to measure the impact on economic growth and exports in relevant countries. Existing studies mostly remain focused on economic impacts within the countries that experienced the disaster. Large-scale external shocks, however, are as much likely to affect other countries. This analysis, the first of its kind, holds significance in that it can help gain insight into how disasters in Japan, the U.S. and China, all countries closely related to Korea, affect the Korean economy.

Econometric analysis using country panel data from 68 countries (Table 2) revealed that 9/11 had a negative impact on economic growth and exports in the U.S., as well as in other countries with close economic ties. The reason for this could be that while the finance industry quickly restored the infrastructure physically damaged by the terrorist attacks, the loss in human resources undermined potential growth in major financial hubs including the U.S. As for Hurricane Katrina, the destruction of harbor facilities seems to have negatively affected neighboring countries. Another factor that dampened economic growth in the U.S. could have been the aftermath of increased fiscal spending. In the case of the Great East Japan Earthquake, the disas-

[3] Summary of Chapter 3 in An, Rhee, Park, and Kang (2012).

ter is continuing to negatively influence the Japanese economy, and it also had a negative impact on growth in economically close countries. Large-scale external shocks tend to have a continuous negative impact, or at least a year-long impact, on the affected economy. The case of the terrorist attacks in particular had a greater negative impact on the economies of the U.S. and other countries, compared to natural disasters. This seems to have been caused by the loss of human capital in the finance industry, which took a longer time to recover.

Table 2. Effects of Large Disasters on GDP growth rates

	Geo. Dist.			Econ. Dist.		
	Quarter	1 Year	3 Years	Quarter	1 Year	3 Years
	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth rates(-1)	0.699***	0.698***	0.700***	0.700***	0.696***	0.701***
	(0.040)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
Japan Earthquake: Japan	-2.030***	-1.985***	-2.203***	-2.041***	-1.993***	-1.897***
	(0.148)	(0.171)	(0.196)	(0.138)	(0.168)	(0.164)
Hurricane Katrina: USA	0.032	-0.163	-0.418***	0.028	-0.168	-0.475***
	(0.069)	(0.104)	(0.075)	(0.073)	(0.103)	(0.081)
9/11 Terror: USA	-0.477**	-0.593***	-0.056	-0.475**	-0.599***	-0.104
	(0.237)	(0.138)	(0.100)	(0.236)	(0.138)	(0.106)
Japan Earthquake: Geo. Dist.	0.048**	-0.030**	-0.048***			
	(0.022)	(0.015)	(0.018)			
Hurricane Katrina: Geo. Dist.	-0.002	0.036**	0.043***			
	(0.023)	(0.015)	(0.015)			
9/11 Terror: Geo. Dist.	-0.069**	-0.033	0.023**			
	(0.032)	(0.023)	(0.011)			
Japan Earthquake: Econ. Dist.				0.752	-8.575*	-1.697
				(1.902)	(4.941)	(2.403)
Hurricane Katrina: Econ. Dist.				0.198	0.997	1.117
				(1.675)	(1.157)	(0.704)
9/11 Terror: Econ. Dist.				-2.507***	-2.232	-0.077
				(0.931)	(1.694)	(0.827)
Economic Crisis	-0.364***	-0.374***	-0.335***	-0.373***	-0.382***	-0.361***
	(0.118)	(0.119)	(0.116)	(0.118)	(0.119)	(0.116)
Global Financial Crisis	-1.877***	-1.879***	-1.761***	-1.871***	-1.889***	-1.836***
	(0.245)	(0.248)	(0.235)	(0.245)	(0.248)	(0.246)
Euro Crisis	-0.393***	-0.149	0.15	-0.328***	-0.161	-0.241*
	(0.104)	(0.133)	(0.166)	(0.101)	(0.142)	(0.126)
Constant	1.268***	1.269***	1.164***	1.264***	1.286***	1.235***
	(0.176)	(0.176)	(0.157)	(0.175)	(0.179)	(0.173)
Observations	5,526	5,526	5,526	5,526	5,526	5,526
Number of Countries	68	68	68	68	68	68
Number of Instrument Variables	47	47	47	47	47	47
Hansen test	0.040	0.030	0.033	0.039	0.030	0.040
Arellano-Bond test AR(1)	0.000	0.000	0.000	0.000	0.000	0.000

Note: 1) Table 3-6 in An, Rhee, Park, and Kang (2012).

2) Newey-West (1987) standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Direct Effects and International Spillover Effects on Financial Markets: Event Study Approach[4]

The occurrence of unexpected large-scale external shocks can affect stock markets in a number of ways. As a rule, the worse the disaster, and the more unexpected it was, the higher are the market uncertainties, and investors therefore expect higher risk premiums. Furthermore, if a large-scale disaster occurs in a country that accounts for a large share of the global financial market, like the U.S. or Japan, there is a possibility of contagious effects on other countries' stock markets. The impacts of a large-scale external shock by industry could be as follows: 1) The external shock may negatively affect stock prices in the industry directly hit by the disaster. 2) Stock prices in the insurance industry may be negatively affected if the disaster is expected to cause heavy losses. 3) On the other hand, stock prices in industries related to restoration, like the construction industry, may be positively affected. The impact on stock prices for other industries, also, may differ according to the scale of damage, or the nature of the industry specific to the disaster area.

Based on this understanding, this chapter conducts empirical tests, using stock price indexes in different industries, to analyze the impact of large-scale external shocks on the stock market. The analysis uses composite stock price indexes for the global market, the U.S., Japan, China and Korea, and industrial indexes (based on the GICS code for 10 sectors and 24 industry groups for each market) issued by either MSCI or S&P/CITIC. The analyzing process involves the Event Study Analysis, as in most previous researches. Case examples will be limited to 9/11, Hurricane Katrina, the Great East Japan Earthquake, and the Sichuan Earthquake.

The findings show that in the case of 9/11, in which the disaster area was a global finance center, or the Great East Japan Earthquake, which directly hit nuclear power plants and automotive parts factories, earning rates in their own stock markets dropped sharply. On the contrary, since Hurricane Katrina and the Sichuan Earthquake occurred in areas that were of comparatively low industrial importance, the respective stock markets were not largely affected, suffering only a temporary, limited impact (Figures 1&2). The disaster area hit by Hurricane Katrina witnessed damage in the transport and tourist businesses, and the relevant industries were the only ones that experienced a decrease in earning rates. It can therefore be inferred that financial markets are affected not by the actual scale of physical damage, but by the type of industry directly hit by the disaster.

The impact of a disaster on other countries was also found to depend on trade relations in the relevant industry. When 9/11 occurred, concerns over a decline in Korea's exports led to a sharp drop in earning rates in the Korean stock market, but when it came to the Great East Japan Earthquake, despite geographical proximity, the Korean stock market was only slightly, temporarily affected. It can therefore be said that the impact on financial markets depends less on the type of disaster or the scale of damage, and more on the country's economic correlation with the disaster area. KIEP

[4] Summary of Chapter 4 in An, Rhee, Park, and Kang (2012)

Figure 1. Plots of Cumulative Abnormal Returns: Direct Effects

(Unit: %)

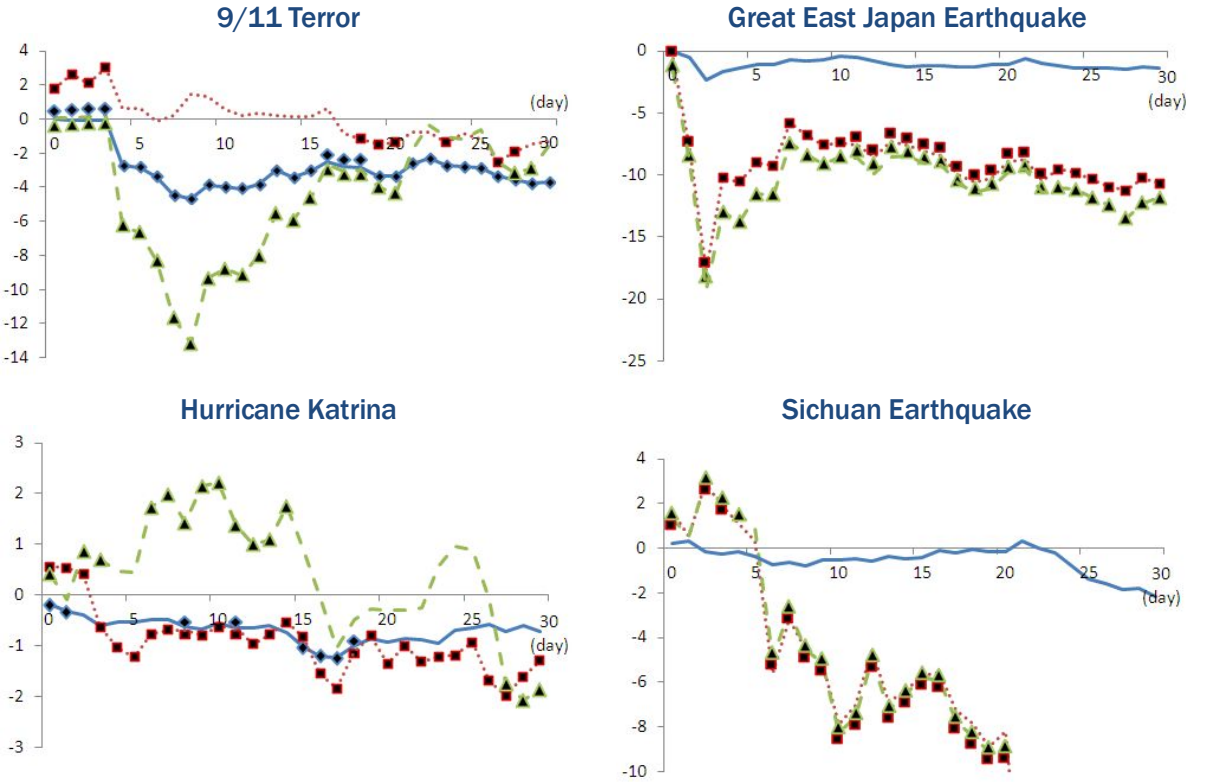
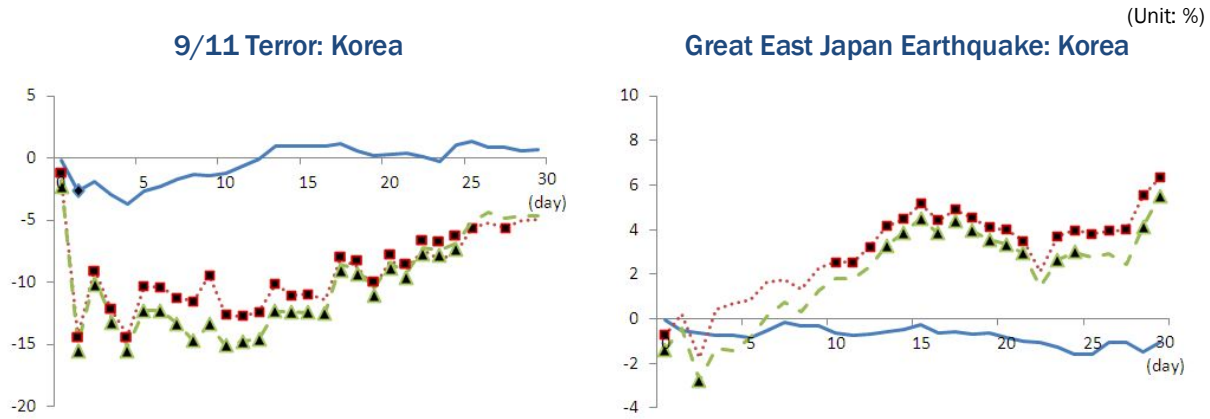


Figure 2. Plots of Cumulative Abnormal Returns: International Spillover Effects

(Unit: %)



Note: 1) The event days are from 0 to 30 business days. 0 event day indicates the day when a disaster occurs. The abnormal return of blue solid line is calculated using the market model as the normal return measure. The abnormal return of red dotted line is calculated using the industry market model, and the abnormal return of the green dotted line is calculated as the constant mean return model. The detailed explanation is described in An, Rhee, Park, and Kang (2012).

2) The bold markings denote statistical significance at 10 percent level or less.