GLOBALIZATION AND LOCALIZATION:

AN EMPIRICAL EXAMINATION[1]

YASUHIDE OKUYAMA

Graduate School of International Relations, International University of Japan, and Center for Urban Earthquake Engineering, Tokyo Institute of Technology

ABSTRACT

Albala-Bertrand (2007) claimed that economic impact of a disaster, which causes localized damages and losses on capital and activities, may not affect negatively the macro-economy in both short-term and longer-term. This appears to contradict with some empirical observations, such as the 1999 Chi-Chi Earthquake in Taiwan and other recent disasters. The propagation process of disaster impact in a global sense is examined in this paper using the empirical case of the 2004 Indian Ocean Earthquake and Tsunami. The results reveal that the potential propagation of economic impact in a global scale; however, the impact to the surrounding countries are relatively limited. Meanwhile, from the risk management perspective, the lack of localized countermeasures against disasters may lead to the spread of local risk over the global economy through international aids and donations.

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1. INTRODUCTION

The damages and losses brought by disasters, such as earthquakes, floods, hurricanes and cyclones, and so on, can have significant and intense impacts on a nation's economy. However, despite the importance of assessing the economic impacts of damages and losses in the aftermath of such events, estimating impacts is challenging. The consequences associated with the event will have many other aspects including damages on demand and supply sides, for example, since the event may affect a wide range of economic activities in different ways. The difficulties with impact analysis of disasters are, therefore, 1) disentangling the consequences stemming directly and indirectly from the event, 2) deriving possibly different assessments at each spatial level—cities, region, or nation—(Hewings and Mahidhara, 1996), and 3) evaluating the reaction of households which are poorly understood (West and Lenze, 1994). Data availability for the impact assessment is another issue. West and Lenze (1994) claim that sophisticated economic impact models requiring precise numerical input have to be reconciled with imperfect measurements of the damages. They proposed a systematic way to estimate the impacts from the available data; however, "impact assessment of unscheduled events is an inexact science" (Hewings and Mahidhara, 1996; p. 216).

Albala-Bertrand (2007) claimed that economic impact of a disaster, which causes localized damages and losses on capital and activities, may not affect negatively the macro-economy in both short-term and longer-term. This appears to contradict with some empirical observations, such as the 1999 Chi-Chi Earthquake in Taiwan, which caused a hike in price of computer memory chips in the US and other countries, and the 2005 Hurricane Katrina, which led to the increase in oil price domestically and internationally. These observations indicate that while the degree of damages and losses is much severer in the areas hit by such natural hazard, the indirect impacts of the event appear to spread over to many other areas and nations. In this regard, the propagation process of disaster impact in a global sense is examined in this paper using the empirical case of the 2004 Indian Ocean Earthquake and Tsunami.

In the following section, Albala-Bertrand’s Globalization and Localization: An Economic Approach (2007) is reviewed and critiqued. Section 3 defines and describes terminology associated with economic impact assessment of natural disaster. Analysis of empirical case study based on the 2004 Indian Ocean Earthquake and Tsunami is carried out and discussed. The final section concludes the paper with some remarks on future directions for this line of research.

2. REVIEW OF GLOBALIZATION AND LOCALIZATION

Albala-Bertrand has been actively studying about the economic consequences of natural disasters, especially in the developing country's context. In his studies, he often claims that economic impacts of natural disasters are rather minor in a macroeconomic sense, even with a catastrophic one. For example, he claimed that the indirect effects of disaster are "more a possibility than a reality" (Albala-Bertrand, 1993, p. 104). He also argued that in a long run negative impacts from damages made by a disaster and positive impacts from recovery and reconstruction may potentially cancel out and then the estimation of the total impacts often ends up deriving insignificant values (Albala-Bertrand, 1993). While his arguments were based on some empirical evidence of the past disasters (in 1960s and 70s for his 1993 publication), and whereas his conclusions have been agreed with many empirical studies of natural disaster, with the recent progress on globalization and increased interdependency between economies, economic impact of disasters should be re-examined with the augmented complexity of society.

In his recent publication (Albala-Bertrand, 2007), Albala-Bertrand analyzed the effect of globalization on disaster impacts from an economic perspective. His main conclusions are:

1. disaster impacts, such as casualties and economic losses, will be economically localized, and thus are unlikely to influence negatively the macro economy, such as national economy, even in a long run;
2. positive features of globalization, like access to larger markets and suppliers, etc., may lead to even more localization of disaster impacts, while negative features of globalization, which are fast efficiency and productivity improvements through privatization and deregulations and lead to thinner and

weaker social fabric against emergency situations, make localized disaster impact much more condensed into the local community than before; and

3. the synchronization of business cycle caused by globalization, especially with the US economy, may regulate the financial capability for disaster response of the world, especially when the leading economies are under recession.

These conclusions reflect his argument on disaster impacts above, while he acknowledges the uncertainty of disaster consequences, shown in 2 and 3, may increase due to globalization.

In a macroeconomic or an aggregated sense, his arguments appear plausible for having not so significant total impacts. However, the total impacts are the sum of negative and positive impacts. The positive impacts are based on the expenditure for recovery and reconstruction, and it can be much smaller if an economy has well equipped and prepared against natural hazard, let alone the opportunity cost of the expenditure for other use. In addition, economic structure can affect the extent and significance of disaster impacts, since the interdependency may act as a path for propagation of negative and positive impacts from disaster and the distribution and volume of negative and positive impacts may differ over space and time. In this line, Albala-Bertrand's claim, which urges for future studies to start classifying disaster impacts over localities, is imperative. This may contradict his claim of negligible total impact of disasters in an aggregate sense, but the disaggregation of disaster impacts, showing disequilibrium between negative and positive impacts over space and time, is necessary and essential on the way to display the nominal macroeconomic impacts.

3. ECONOMIC IMPACTS OF DISASTERS: CONCEPT AND DEFINITION

In order to discuss the economic impacts of disasters, we need to clarify the terminology first, since the use of similar words has created some confusion in many disaster literatures. According to Okuyama and Chang (2004), "*hazard* is the occurrence of the physical event *per se*, and *disaster* is its consequence" (p. 2). In this context, while the occurrence of hazards cannot be prevented, the extent and intensity of a disaster can be managed. Hence, the measuring the extent and intensity of economic consequences (disaster) caused by a hazard is necessary to evaluate and determine the countermeasures against hazards and is central to understand how the consequences of a hazard become a disaster.

In terms of disaster economic impacts, many comparable terms, such as damages, losses, impacts, direct losses and indirect losses, have been employed interchangeably without making any distinction or definition of them, and have led to further perplexity. Oftentimes, direct loss refers to the damages on stock, such as buildings, roads, houses, etc. and indirect loss implies the loss of flow due to business disruptions caused by stock damages. And then, in many disaster literatures, the total loss is calculated by adding these direct and indirect losses. However, in economics term, stock and flow are two different things and summing these up leads to potential double counting (Rose, 2004). Also, in the above way, the distinction between flow losses caused directly by the stock loss and flow losses caused via interindustry linkage (often referred as ripple effect) cannot be made, and this distinction is vital to illustrate the extent of disaster impact.

Consequently, the clear definition of disaster impact should be made. Okuyama and Sahin (2009) proposed the following terminology for disaster economic impacts: *damages* are by economics definition the damages on stocks, which include physical and human capitals; *losses* are business interruptions, such as production and/or consumption, caused by damages and can be considered as *first-order losses*; *higher-order effects*, which take into account the system-wide impact based on first-order losses through interindustry relationships; and *total impacts* are the total of flow impacts, adding losses (first-order losses) and higher-order effects. Rose (2004) further suggested that listing both damages and losses, but not adding them together, is appropriate for showing the different aspects of economic impact. In the following sections, these terms are used for the analysis.

What we are going to estimate in this paper is the economic intensity of a natural hazard on flow, while a comprehensive assessment of a natural disaster requires to include both negative impact of a natural hazard and positive effects of recovery and reconstruction activities. More concretely, the results shown in the following section are only the negative impact of a natural hazard over a year, without any restoration, recovery, or reconstruction. This looks a very unlikely scenario, but this serves as the worst-case scenario[2] (do-nothing-scenario) and also provides the extent to which recovery and reconstruction need to be done. In addition, those restoration, recovery, and reconstruction strategies will be decided based on the total impacts of a disaster and the distribution of them; thus, the estimation of negative impact only becomes a basis of decision making and is well worth doing.

4. EMPIRICAL EXAMINATION: 2004 INDIAN OCEAN EARTHQUAKE AND TSUNAMI

In this section, how economic impacts of a local disaster can (or cannot) spread over internationally is examined, employing the 2004 Indian Ocean Earthquake and Tsunami as the case study. While this event was a multi-country incident, involving at least five countries (India, Indonesia, Maldives, Sri Lanka, and Thailand), the damaged areas in each country were relatively limited geographically. Thus, using Albala-Bertrand's term, this was a localized event for each country. The economic impacts of this event are evaluated using the 2000 Asian International Input-Output table for analyzing whether or not any sizable economic impacts were propagated over other countries, *i.e.* globally.

4.1. 2004 Indian Ocean Earthquake and Tsunami

The December 2004 Indian Ocean disaster was caused by an earthquake, and the earthquake generated a tsunami, carrying many million tons of water in a series of very large waves that traversed the Indian Ocean in a matter of hours. These waves hit beaches, flooding low-lying lands coastal areas. The destruction was widespread: the most seriously affected areas were Banda Aceh, Indonesia, as well as in tourism resorts in Thailand, Sri Lanka, and the Maldives. Many small and medium sized rural villages located along the beachside in the five countries were also wiped out (ADPC, 2005).

According to the preliminary assessment of damages and losses (ibid.), total of 281,900 persons died as a result of the earthquake and tsunami; 189,500 persons were

[2] There would potentially be some worse scenario than this, if the recovery and reconstruction activities were misguided to create further negative influence.

injured, physically and psychologically, and required immediate or medium term treatment; and, 1.2 million persons became homeless and even a year after the tsunami many were still housed in temporary camps, a sizable fraction of which still requires shelter, food and health services. The total economic effects of this event were estimated as US$ 5.6 billion of damages and 4.3 billion of losses over five countries—Indonesia, India, Sri Lanka, Maldives, and Thailand. In this paper, the total impacts of this event are estimated and analyzed for Indonesia and Thailand using the 2000 Asian International IO table, since other three countries (India, Maldives, and Sri Lanka) was not included in the IO table.

Indonesia

The total damage and loss in Indonesia were estimated as US$ 2,664 million and 1,136 million, respectively (ibid.). The housing sector had the largest damage with 1,398 million (52% of total damage). The transport sector had the second largest damage, 409 million. The productive sector, especially agriculture and industry (manufacturing) sectors, also had some sizable damages. On the other hand, the losses were concentrated on these productive sectors, 550 million for agriculture and 280 million for industry, and together, they had about 73% of total loss.

Thailand

The total damages and losses in Thailand were estimated to US$ 509 million and 1,690 million, respectively. The damages were concentrated on tourism with 376 million (74% of the total damage), resulted from the washed out resorts and hotels on the beaches. Other noticeable damages were on agriculture. The losses were also mostly on tourism with 1,470 million (87% of the total loss), and agriculture and industry had some losses around 100 million each.

4.2. Methodology

There is a wide range of methodologies used to estimate the higher-order effects thus the total impacts of disasters (further detailed discussion of methodologies for impact estimation can be found at Rose (2004), Okuyama (2007), and Greenberg *et al.* (2007)). Input-Output (IO) model has been the most widely used methodology for disaster impact estimate for the recent decades (for example, Cochrane, 1997; Gordon and Richardson, 1996; Rose *et al*. 1997; Okuyama *et al*., 1999; and, Hallegatte, 2008). The popularity of IO models for disaster related research is based mainly on the ability to reflect the economic interdependencies within an economy in detail for deriving higher-order effects, and partly on its simplicity. On the other hand, this simplicity of the IO model creates a set of weaknesses, including its linearity, its rigid structure with respect to input and import substitutions, a lack of explicit resource constraints, and a lack of responses to price changes (Rose, 2004).

Input-output (IO) framework was developed by Wassily Leontief in the late 1920s and early 1930s. The structure of IO mimics the double-entry style of bookkeeping scheme. For the production side, the output is determined as the sum of intermediate demand and final demand as follows:

$$x_i = \sum_j x_{ij} + f_i \tag{1}$$

where x_i is the output of sector *i*, x_{ij} is intermediate demand from sectors *j* to *i*, and f_i is the final demand for sector *i*. Direct input coefficient, a_{ij}, is calculated by $a_{ij} = x_{ij} / x_j$, and equation (1) can be transformed as follows:

$$x_i = \sum_j a_{ij} x_j + f_i \tag{2}$$

In the matrix notation, (2) becomes:

$$\mathbf{x} = \mathbf{Ax} + \mathbf{f} \tag{3}$$

Solving this relationship for **x** yields:

$$\mathbf{x} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \mathbf{f} \tag{4}$$

$\left(\mathbf{I} - \mathbf{A}\right)^{-1}$ is the Leontief inverse matrix. For the impact analysis, the impact of changes in final demand can produce the changes in output in the following manner:

$$\Delta\mathbf{x} = \left(\mathbf{I} - \mathbf{A}\right)^{-1} \Delta\mathbf{f} \tag{5}$$

Miyazawa's (1976) extended input-output analysis intends to analyze the structure of income distribution by endogenizing consumption demands in the standard Leontief model. In some sense, Miyazawa's system is considered the most parsimonious in terms of the way it extends the familiar input-output formulation. Miyazawa considered the following system:

$$\left(\frac{\mathbf{x}}{\mathbf{y}}\right)=\left(\begin{array}{c|c}\mathbf{A} & \mathbf{C}\\ \hline \mathbf{V} & \mathbf{0}\end{array}\right)\left(\frac{\mathbf{x}}{\mathbf{y}}\right)+\left(\frac{\mathbf{f}}{\mathbf{g}}\right) \tag{6}$$

where **x** is a vector of output, **y** is a vector of total income for some *r*-fold division of income groups, **A** is a block matrix of direct input coefficients, **V** is a matrix of value-added ratios for *r*-fold income groups, **C** is a corresponding matrix of consumption coefficients, *f* is a vector of final demands except households consumption, and *g* is a vector of exogenous income for *r*-fold income groups. Solving this system yields:

$$\left(\frac{\mathbf{x}}{\mathbf{y}}\right)=\left(\begin{array}{c|c}\mathbf{B}(\mathbf{I}+\mathbf{CKVB}) & \mathbf{BCK}\\ \hline \mathbf{KVB} & \mathbf{K}\end{array}\right)\left(\frac{\mathbf{f}}{\mathbf{g}}\right) \tag{7}$$

where:

$\mathbf{B}=(\mathbf{I}-\mathbf{A})^{-1}$ is the Leontief inverse matrix;
BC is a matrix of production induced by endogenous consumption;
VB is a matrix of endogenous income earned from production;
L=VBC is a matrix of expenditures from endogenous income; and
$\mathbf{K}=(\mathbf{I}-\mathbf{L})^{-1}$ is a matrix of the Miyazawa interrelational income multipliers.

In this paper, the IO model used is transformed to the Miyazawa's extended IO framework for the analysis of impact on income generation.

Model used in this paper is the 2000 Asian International Input-Output Table, published by the Institute of Developing Economies (IDE), the Japan External Trade Organization (JETRO). This table includes nine countries and one region (Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Taiwan, Korea, Japan, and the United States) with seven industrial sectors (agriculture, mining, manufacturing, utility, construction, trade and transport, and services). This is the only officially available data source for this type of international input-output table, while the data year, 2000, is a bit earlier than the year when the event occurred, the end of 2004, implying some of the trade relationships may have changed between these years, especially with China.

The sectors in the original model are aggregated as much as possible to fit with the data of damages and losses in order to maintain the feature of the input data. The IO model is a demand driven model so that the input to model should be the form of changes in final demand, and then changes in output will be derived. Therefore, losses (decreased output level) is converted to final demand change in each sector, using

Miller and Blair's (1985) method—dividing the changes in output (output loss) by the diagonal term of the Leontief inverse matrix for IO model. Then, the derived changes in final demand model are multiplied with Leontief inverse matrix to calculate impact by sector. Because of extension to the Miyazawa framework, the model can yield both the output impact (higher-order effects) and the impact on income generation (income impact) as the results.

At the end of the estimation, the impact multiplier is calculated by dividing the total output impact (not including income impact) by total converted losses (sum of total output decease and total income decrease). While this is different from the standard output multiplier in IO literature, where the changes in output are divided by the changes in final demand and usually income losses are converted to the changes in final demand, this impact multiplier aims to connect the calculated impact with the original loss data in the respective assessment report, and not to double-count between the impacts on output, which already take into account the income decrease and on income.

4.3. Analysis

The economic impacts of the 2004 Indian Ocean Earthquake and Tsunami for Indonesia and Thailand, and other Asian countries are calculated and evaluated in this subsection. Table 1 shows the input data, damages and losses, and the results, output impact and income impact in Indonesia. The derived total impacts are US$ 2,386 million (0.93% of 2004 GDP) for output and 1,219 million for income. The most significant output impact falls on manufacturing with 814 million (with 280 million of output decrease as loss), followed by agriculture with 672 million. The sectors with large impact tend to be accompanied with large losses, while the other sectors with small or no losses, such as mining, utilities, and construction, have limited higher-order effects. This may lead to the relatively small impact multiplier of 2.10.

The derived impact for Thailand on output and income are US$ 3,205 million (1.99% of 2004 GDP) and 1,240 million, respectively, as seen in Table 2. The total impacts fall mostly on services (including tourism industry) with 1,535 million (48% of the total output impact). Meanwhile, manufacturing has a sizable impact of 872 million (27% of the total output impact), indicating that the Thailand's domestic industries are highly interwoven and interdependent so that the total impacts spread across the sectors. However, the calculated impact multiplier is 1.90, a relatively low value. This implies that while the tourism industry is one of the major industries in Thailand, the losses are concentrated on one industry (tourism) and thus the total impacts are somehow limited and not widely spread to the entire economy.

As seen above, the impacts of the event appear not so large within the two countries (0.93% of GDP in Indonesia and 1.99% of GDP in Thailand). With increased economic interdependency between countries through international trades, this simultaneous damages and losses in multiple neighboring countries may bring the higher-order effects to other surrounding countries, or globally. As described in the previous section, the model used for this particular event (2000 Asian International IO table) includes the above two countries and six other Asian countries and one region, and the United States so that the impacts to those countries can be estimated.

Table 3 indicates the impacts for these countries. Except those directly affected countries, Indonesia and Thailand, Japan receives the largest total impacts (thus the largest higher-order effects, since there are no first-order losses in Japan) in this system, with US$ 428 million. The United States has the second largest total impacts of 306 million. China follows these two countries and has 156 million of the total impacts. Among the sectors, manufacturing has the most significant impact in total (2,307 million) and for each country in this system. This also is an evidence of increasing interdependence among manufacturing firms through international trades. Comparing to the total impacts in Indonesia and Thailand and to their own GDPs, these impacts in the other countries can be considered as negligible. At the same time, for the system as a whole, the aggregated total impacts become 6,761 million with the impact multiplier of 2.39, and these numbers are noticeably larger than the above two countries'. For the multi-country disaster case such as this Indian Ocean Earthquake and Tsunami, this type of international analysis is useful to capture the comprehensive picture of the impacts.

So, does this mean that this type of localized but multi-country disaster can have any global economic impact? The answer would be probably 'NO', since the higher-order effects to other surrounding countries are very small in value. As described in the previous section, the derived economic impacts do not include the positive impacts from recovery and reconstruction activities in the respective countries. If included, the economic impacts to other surrounding countries may become much smaller than the values in Table 3. In the meantime, some parts of recovery and reconstruction activities were done with the cooperation of international organizations and international aids from those surrounding and other countries. If these aids cancel out the higher-order effects in Table 3 by preventing the spread-out of higher-order effects and those countries had no impact from such additional expenditure, the positive feature of globalization worked as Albala-Bertland argued. But it may not be so simple under the current difficult situation for the global economy caused by the global financial crisis. In addition, how the negative feature of globalization, which may weaken the local economies, needs to be investigated through how the damaged localities have been recovered and reconstructed.

Table 1. Economic Impacts of 2004 Indian Ocean Earthquake and Tsunami: within Indonesia (2007 US million dollars)

Indonesia Sector		Data		Converted			Calculated	
		Damages	Losses	Sectors in model	Output decrease	Demand decrease	Output impact	Income impact
Infrastructure	Housing	1,398	39	Agriculture	550	410	672	
	Transport	409	148	Mining	0	0	69	
	Electricity	68	0	Manufacturing	280	158	814	
	Water and Sanitation	27	3	Utilities	3	3	30	
	Urban and Municipal	132	89	Construction	0	0	20	
	Water Resource			Trade and Transport	148	113	370	
Social	Health and Nutrition	111	9	Services	116	80	412	
	Education	166	18	HH Income decrease	39			1,219
Production	Agriculture	186	550					
	Industry	167	280					
	Service							
	Tourism							
Total		2,664	1,136		1,136		2,386	1,219

Table 2. Economic Impacts of 2004 Indian Ocean Earthquake and Tsunami: within Thailand (2007 US million dollars)

Thailand Sector		Data		Converted			Calculated	
		Damages	Losses	Sectors in model	Output decrease	Demand decrease	Output impact	Income impact
Infrastructure	Housing	22	0	Agriculture	102	89	228	
	Transport	7	9	Mining	0	0	33	
	Electricity	4	10	Manufacturing	93	58	872	
	Water and Sanitation	1	3	Utilities	13	10	132	
	Urban and Municipal	15		Construction	0	0	3	
	Water Resource			Trade and Transport	9	7	401	
Social	Health and Nutrition	9	3	Services	1,473	946	1,535	
	Education			HH Income decrease	0			1,240
Production	Agriculture	75	102					
	Industry		93					
	Service							
	Tourism	376	1,470					
Total		509	1,690		1,690		3,205	1,240

Table 3. Spatial Distribution of Total Impact in 2004 Indian Ocean Earthquake and Tsunami (2007 US million dollars)

	Sectors in model	*Indonesia*	*Thailand*	Malaysia	Philippines	Singapore	China	Taiwan	Korea	Japan	USA	Total
Output Impact	Agriculture	*672*	*228*	2	1	0	19	2	3	8	13	948
	Mining	*69*	*33*	5	0	0	7	0	0	1	4	118
	Manufacturing	*814*	*872*	36	7	33	96	42	59	230	120	2,307
	Utilities	*30*	*132*	1	1	1	6	1	2	11	7	192
	Construction	*20*	*3*	0	0	0	1	1	0	4	2	30
	Trade and Transport	*370*	*401*	5	2	7	14	9	7	64	47	926
	Services	*412*	*1,535*	9	2	9	14	15	19	110	114	2,239
	Total	*2,386*	*3,205*	58	14	50	156	69	90	428	306	6,761
Income Impact		*1,219*	*1,240*	22	5	12	39	24	26	154	143	2,885

5. SUMMARY AND CONCLUSIONS

In this paper, the total impacts of 2004 Indian Ocean Earthquake and Tsunami were estimated using the 2000 Asian International Input-Output table. The results show that the higher-order effects and total impacts of disasters are significant and complex domestically. The spread of higher-order effects to other surrounding countries do exist, while the value per se is relatively small comparing to the localized higher-order effects and to their respective size of the economy. However, this does not mean there is no global or international ripple effect of the disaster impact; rather, if proper development and domestic policy and appropriate recovery and reconstruction strategies were not practiced, these higher-order effects would spread over globally.

Some researchers claim that the short-term impact of disasters are negligible since the positive impact of relief, recovery, and reconstruction activities starts immediately after the occurrence of hazards and the counteraction measures that a society inherently has against such a calamity would respond to reduce the higher-order effects (Albala-Bertrand, 1993 and 2007). This may be true, if the negative impact of higher-order effects and the positive impact of relief and reconstruction are added up to show the total impact; in many empirical disaster studies, the total impacts are indeed sometimes negligible, offsetting negative and positive impacts, or even positive in some cases. However, these results do not lead to the conclusion that disasters have no impact on the economy. A thorough investigation of disaster impacts requires a detailed and disaggregated analysis, which separates negative and positive impacts, and not merely adding them up, in order to assess how negative and positive impacts interact each other and affect various segments of society differently. Negative impacts of higher-order effects surely exist as seen in this paper, and their proper recognition and estimation can enable policy makers to contemplate how ex-ante loss reduction measures can be formed effectively and efficiently.

The data for damages and losses used as input for estimation in this paper are based mostly on the ECLAC methodology (UN ECLAC, 2003). While the accuracy of these data is the key for the precision of the estimated results and in this regard the data collection methodology needs to be streamlined further (Greenberg, et al., 2007), this ECLAC methodology can standardize the assessment of damages and losses of a disaster, and this standardization not only enables inter-disaster comparison but also encourages the discussion of mitigation, preparedness against disasters, and vulnerability analysis of economies based on the common framework. An important next step would be to make the estimation methodology of higher-order effects a part of a standardized methodology – such as the ECLAC methodology – evaluating a more accurate measure of disaster impacts.

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