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Dimensions of Regional Processes in the Asia-Pacific Region

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Part 3. Risks & Challenges

Introduction

Asia and Pacific's growing importance to the rest of the world is widely acknowledged today. The dynamics of Asian economic development have tremendously impacted global trade relationships and regional cooperation. Thus, it is with great pleasure that we deliver another volume of Research Papers on Asia-Pacific economic issues.

This year we present 19 papers by various authors who examine the Asia-Pacific region from different perspectives. We decided to group them into 3 Chapters:

- Cooperation and trade
- Economy and policy
- Risks & challenges

Papers grouped in the First Chapter describe newly emerging regional trade architecture. You will find there a few analyses of general nature and regional scope (J. Dudziński, A. H. Jankowiak, E. Majchrowska) and some studies on specific trade agreements (A. Klimek writes about Shanghai Free Trade Zone, A. McCaleb and G. Heiduk try to find out what motivates China's cities to establish partner agreements with cities in Asia, B. Michalski analysing U.S.-Republic of Korea Free Trade Agreement, while M. Maciejewski and W. Zysk look for opportunities for Polish exports in the trade agreement between EU and Vietnam).

The Second Chapter is the most diverse one. It is devoted mostly to economic policy issues (including financial sector). S. Bobowski, L. Zyblikiewicz and K. Żukrowska look at the main threads in Asian regionalism. P. Pasierbiak and K. Łopacińska analyse the movements of Chinese capital. M. Dziembała and S. Mazurek deal with the subject of innovation supporting growth and development.

Articles in the Third Chapter are focused on extraordinary events influencing economies and development of the Asia-Pacific region. J. Pera prepared an assessment of risk of APEC countries, based on the country risk classification method and selected indexes of internal stability. A. Kukułka and B. Totleben analyse the impact of natural disasters on gross capital formation in Southeastern Asia. Finally, T. Serwach and M. Grabowski and S. Wyciślak deal with synchronization of business cycles and contagion of crises.

We sincerely hope that all the articles will be of great value to those who want to understand the role of Asia-Pacific economies in the global economy. Through various interests of authors, our volume provides a valuable insight into the problems of this region.

All the papers where submitted for the 8th international scientific conference "Dimensions of Regional Processes in the Asia- Pacific Region" which took place in

November 2015 at Wroclaw University of Economics, under the patronage of Polish Ministry of Foreign Affairs, Ministry of Science and Higher Education and the Ministry of Economy.

We appreciate your time and consideration, and we look forward to the submission of your own good work. We also appreciate the time and effort of our peer reviewers. Thank you!

Bogusława Drelich-Skulska, *Anna H. Jankowiak*, *Szymon Mazurek*

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NATURAL DISASTERS AND GROSS CAPITAL FORMATION IN SOUTHEASTERN ASIA[1]

KATASTROFY NATURALNE A AKUMULACJA KAPITAŁU FIZYCZNEGO W AZJI POŁUDNIOWO-WSCHODNIEJ

DOI: 10.15611/pn.2015.413.17
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Summary: The purpose of this paper is to examine the influence of the occurrence of natural disasters on the growth rate of physical capital accumulation in countries of Southeastern Asia with high catastrophic risk, i.e. Indonesia, Malaysia, Cambodia, Thailand, Vietnam and The Philippines. In the article, the consequences of natural disasters are presented, as well as the aspects of accumulation of physical capital within years 1990-2014. Presented data shows that the number of natural disasters, associated losses, as well as the level of physical capital all have increased over time in six considered countries. In order to check Granger causality, Wald test was performed for yearly data. It is shown, that in all countries but Thailand, the damages caused by natural disasters in the past have impact on the accumulation of physical capital. Such an outcome may be the result of the reconstruction process undertaken after disasters.

Keywords: natural disasters, physical capital accumulation, developing countries, Granger causality test.

Streszczenie: Celem artykułu jest zbadanie wpływu wystąpienia katastrofy naturalnej na zmianę tempa akumulacji kapitału fizycznego w krajach rozwijających się Azji Południowo-Wschodniej o podwyższonym ryzyku katastroficznym, tj. w Indonezji, Malezji, Kambodży, Tajlandii, Wietnamie i na Filipinach. Zaprezentowano skutki katastrof naturalnych oraz wybrane aspekty kształtowania się poziomu kapitału fizycznego w latach 1990-2014. Wykorzystując test Walda, dla sprawdzenia przyczynowości w sensie Grangera, wykazano, iż we wszystkich badanych krajach, poza Tajlandią, skutki wystąpienia katastrofy naturalnej wpływają na tempo akumulacji kapitału ludzkiego.

Słowa kluczowe: katastrofy naturalne, akumulacja kapitału fizycznego, kraje rozwijające się, test przyczynowości Grangera.

[1] The research project is financed by National Science Center on the basis of the decision number DEC-2013/09/N/HS4/03659 and DEC-2013/08/T/HS4/00342.

1. Introduction

Six countries of Southeastern Asia (Cambodia, Indonesia, Malaysia, The Philippines, Thailand, Vietnam – SEA6) every year experienced devastation due to natural disasters. The number of natural disasters, as well as associated losses, both in human and economic terms, have increased over time. According to the Emergency Events Database (EM-DAT) collected by *the Centre for Research on the Epidemiology of Disasters* (CRED)[2] in years 1990-2014, 1022 natural events took place, causing death of about 255 thousand people, affecting almost 319 million and damages counted 109 billion USD.

Apart from the devastating effect of the natural disasters, it may be observed that upgrading of capital and new investment as a replacement of the destroyed one, takes place. Therefore, the question which may be asked is, if the damages caused by disasters also caused the increase in physical capital accumulation in developing countries of Southeastern Asia.

The rest of the paper consists of three main parts. In the first part there is a short review of the literature on the economic consequences of natural disasters. The second section is the analysis of the occurrence of natural disasters and their gross consequences followed by the study about capital formation in the region. In last part we present the methodology of our research, data description and the estimation results, followed by conclusions.

2. Literature review

As the effect of the increasing number of reported natural disasters and greater level of damages, more and more attention in the literature is paid to, inter alia, economic consequences of natural disasters. Moreover, due to globalization, trade and investment connections, not only the country where disaster took place is affected, but also its partners.

Albala-Bertrand [1993] in his research examines the immediate impact of natural disasters on GDP. By using "before-after" statistical analysis he shows the positive impact of natural disasters on the GDP level. However, this is questioned by Skidmore and Toya [2002]. The authors underline that it is the reconstruction of the damaged assets what causes the growth of GDP, therefore such pattern may be observed. Furthermore, they show the long-run positive correlation between the economic growth and the occurrence of natural disasters. This happens by increasing the accumulation of human capital and, therefore, the increase in productivity. Similar results are received by Noy [2009], i.e. natural disasters are positively correlated with economic growth, stronger in developing countries.

[2] The EM-DAT database contains data on the occurrence and effects of over 18 000 mass disasters in the world from 1900; www.emdat.be.

Loayza et al. [2012] point out that there is no reason to assume that natural disasters equally affect agriculture, industry or services. Also each type of disasters causes losses in different sectors of the economy. Drought, for example, may largely contribute to the losses in the agricultural sector, while earthquakes cause damage to the infrastructure, industry, through the destruction of companies, factories, roads, bridges. The authors show that the correlation between the variables describing the occurrence of natural disasters and economic growth is present in a case of developing countries. This is particularly visible in the industrial sector, in which the interdependence between the types of natural disasters and growth in this sector in all estimated equations can be observed. As the authors point out, the economic growth in developing countries is more sensitive to shock, which is the occurrence of a natural disaster.

Different type of research underlines that it is possible for the country to mitigate the negative consequences of the occurrence of natural disasters. It may be achieved by the higher the level of education, more developed financial system and more open economy, as showed by Skidmore and Toya [2002]. In addition, Noy [2009] observes that the number of deaths due to a disaster is negatively correlated with the ability to read and write, as well as the openness of the economy to international trade.

Noteworthy is also the fact described in the article of Hallegate and Dumas [2009]. In addition to the negative effects of natural disasters, such as the destruction of capital, including the destruction of factories, infrastructure, homes, modernization of the existing capital may be observed. An example is the replacement of old technology (destroyed completely or partially) by the new, more productive – in the case of firms, or in the case of households – building more secure houses using better materials and precautionary steps.

3. Natural disasters in Southeastern Asia

In six countries of the Southeastern Asia – Cambodia, Indonesia, Malaysia, The Philippines, Thailand and Vietnam (SEA6), each year several natural disasters take place. Among these countries, the highest number in 1990-2014 was reported in The Philippines (see: Table 1), as well as people affected. However, the highest number of deaths was in the case of Indonesia and damages – of Thailand.

Table 1. Natural disasters in SEA6 in 1990-2014

	Cambodia	Indonesia	Malaysia	The Philippines	Thailand	Vietnam
Natural disasters	34	298	59	360	112	159
Total affected (million)	20.4	20.4	3.1	155	81.9	45.6
Total deaths	2473	189 481	1227	37 589	11 714	12 479
Total damages (bn USD)	1.56	27.50	2.14	21.00	46.20	10.50
Max no of disasters	3	19	6	36	8	11
Max no of affected (million)	5.03	3.94	2.43	25.7	15.5	7.18
Max no of deaths	506	166 604	333	7750	8389	3692

Source: Own study, based on CRED [2015].

In the region, many very severe disasters took place. Among them, one should mention Indian Ocean Tsunami from December 26th 2004, which affected more than 10 countries from Asia and Africa. Another one was flood in Thailand (5.08.2011) with damages of 40bn USD. This event belongs to the top natural disasters in terms of economic losses. A well-known disaster happened also in The Philippines on November 8th 2013. In the country's history this was the most serious disaster with damages of about 10bn USD, over 16 m people affected and more than 7000 deaths.

In comparison to the rest of the World, on average 11% of disasters took place in 6 considered countries (Fig. 1). While the damages were a small fraction of the overall losses, the number of people affected varied across the years, reaching almost 40% in 2013 (Fig. 2).

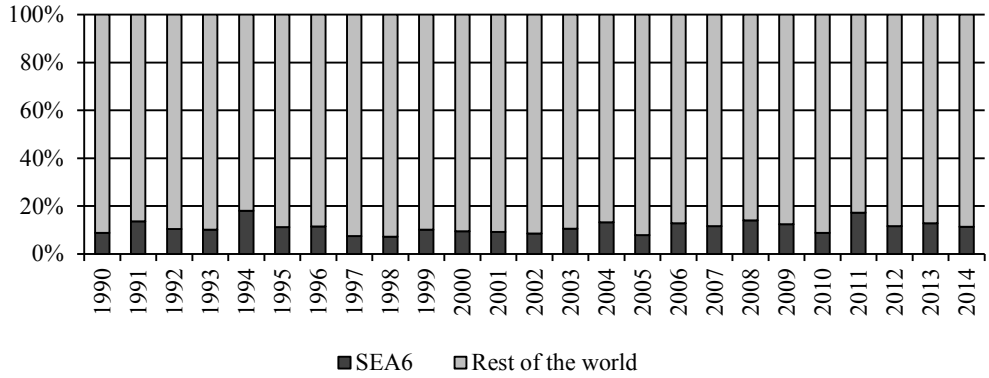

Fig 1. The number of natural disasters in SEA6 and in the rest of the World

Source: Own study, based on CRED [2015].

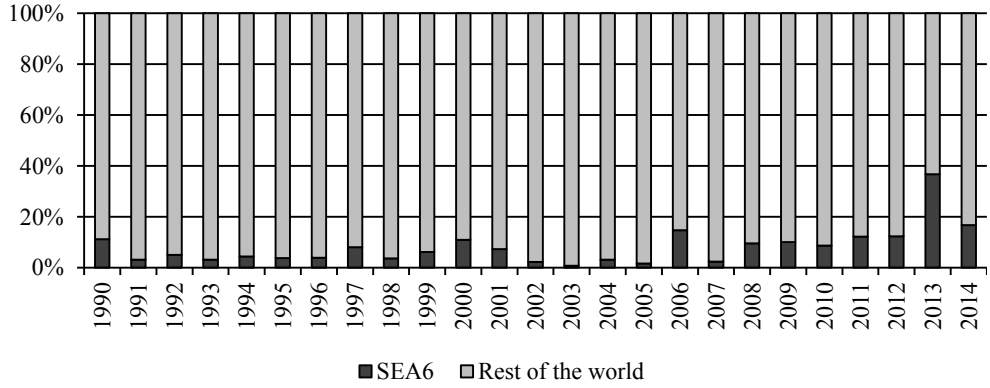

Fig 2. People affected by disasters in SEA6 and in the rest of the World

Source: Own study, based on CRED [2015].

It should be pointed out that all six countries are developing and as Skidmore and Toya [2002] observed, in countries with lower GDP per capita there are more deaths than in countries with higher value of this index. Moreover, the size of the country, i.e. its population and land area, as well as GDP level, can have an influence on the magnitude of direct damages.

4. Data and methodology

Physical capital is defined by World Bank as outlay in addition to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, etc.); plant, machinery, and equipment purchases; and the construction of roads, railways, and alike, including schools, offices, hospitals, private residential dwellings, as well as commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and the work in progress [World Bank 2015].

Damages caused by natural disasters are extracted from the EM-DAT database. Estimated damages are defined by CRED as the amount of damage to property, crops and livestock in given US dollars. For each disaster, the registered number corresponds to the damage value at the moment of the event.

In all examined years, it is Indonesia, where the highest level of physical capital was observed (over 120bn USD in 2014). The lowest was reported in Cambodia (less than 3bn USD) (see: Fig. 3).

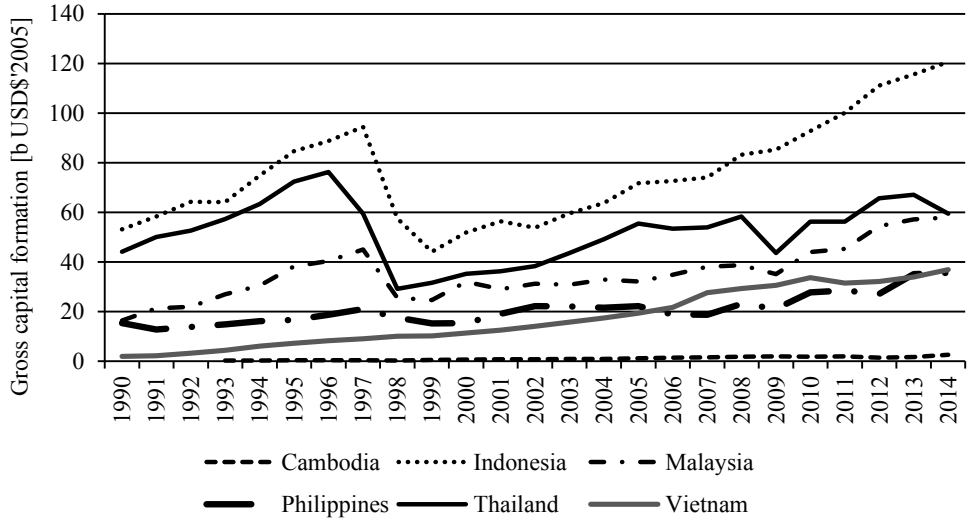

Fig 3. Gross Capital Formation in SEA6 per country

Source: Own study, based on World Bank [2015].

As depicted by Fig. 3., the level of physical capital in SEA6 countries has a tendency to increase. The only period of high decrease is caused probably by the Asian financial crisis in 1997-1998. In terms of the growth rate, the highest value is observed for Cambodia and Vietnam (on average yearly more than 10%) and the lowest for Thailand (see: Table 2). Even though these two countries are characterized by high average growth rate, the level at the end of the examined period is still the lowest one – for Cambodia and third lowest – for Vietnam. This is due to the low initial value.

All the considered countries experienced natural disasters and the highest average level of damages (yearly), as well as the maximum value of damages is the case of Thailand (1.78bn USD). Such a number is mainly caused by the aforementioned flood of 2011.

Table 2. Descriptive statistics

	Gross Capital Formation (billion USD)					Natural disasters (billion USD)	
	Initial level (1990)	Min	Max	Final level (2014)	Average annual growth	Average annual damages	Maximum damages
Cambodia	$0.31_{(1993)}$	$0.31_{(1993)}$	$2.69_{(2014)}$	2.69	10.9%	0.06	$0.52_{(2011)}$
Indonesia	53.24	$44.19_{(1999)}$	$120.65_{(2014)}$	120.65	3.5%	1.06	$8.09_{(1997)}$
Malaysia	16.42	$16.42_{(1990)}$	$57.89_{(2014)}$	57.89	5.4%	0.08	$0.97_{(2007)}$
The Philippines	15.46	$12.79_{(1991)}$	$35.58_{(2014)}$	35.58	3.5%	0.81	$12.42_{(2013)}$
Thailand	44.21	$29.22_{(1998)}$	$76.21_{(1996)}$	59.5	1.2%	1.78	$40.32_{(2011)}$
Vietnam	2.05	$2.05_{(1990)}$	$36.98_{(2014)}$	36.98	12.8%	0.41	$1.55_{(2013)}$

Source: Own study, based on CRED [2015].

In order to determine the impact of damages caused by natural disasters on the growth rate of physical capital (GFC), Granger causality test is performed. Granger causality for each considered country is based on the estimation of the following equation, given by Sargent [1976] and Granger [1969][3]:

$$Y_t = \sum_{j=1}^{m} \alpha_j X_{t-j} + \sum_{j=1}^{m} \beta_j X_{t-j} + \varepsilon_t,$$

where: Y_t – growth rate of investments in fixed assets plus net changes in the level of inventories (GFC), X_t – economic losses due to natural disasters, ε_t – error term.

[3] Estimation was performed in STATA12.

5. Empirical results

The empirical results of the Granger causality test are presented in Tab.2. In all cases but Thailand, the performed test confirmed that economic losses due to natural disasters in past years Granger cause the growth of physical capital. For three countries the null hypothesis, i.e. the total damages do not cause GFC growth, may be rejected at 1% significance level (Cambodia, Indonesia and Vietnam), for one at 5% (The Philippines) and one at 10% (Malaysia).

Table 3. Empirical results of the Wald test

Equation	Cause	Effect	Country	chi^2 (p-value)	Granger's causality
(1)	Total damage	GFC growth	Cambodia	15.21 (0.002)	YES*
(2)			Indonesia	20.688 (0.000)	YES*
(3)			Malaysia	7.7635 (0.051)	YES***
(4)			The Philippines	10.305 (0.016)	YES**
(5)			Thailand	1.502 (0.682)	NO
(6)			Vietnam	21.327 (0.000)	YES*

Source: Own study.

Note: *, **, *** – level of significance at 1%, 5%, 10%.

All of the five countries almost every year have been hit by natural disasters and have suffered losses. These include damages to infrastructure, buildings, livestock, equipment which all must be replaced or reconstructed. Therefore, reconstruction process may affect the level of physical capital in a particular country.

6. Conclusions

Natural disasters are phenomena which nowadays happen with higher and higher frequency. It is also visible in Southeastern Asia, where in the six developing countries studied, the reported number of disasters, as well as the damages caused by them, are growing over time. Damages with respect to material losses, such as: buildings, infrastructure and equipment have to be replaced or reconstructed. Therefore, after disasters, thanks to, inter alia, the received financial aid, reconstruction process is taking place.

In our paper we showed that in five developing countries of the Southeastern Asia, damages caused by natural disasters Granger cause the growth rate of physical capital increase. Natural disasters, apart from negative effects i.e. destruction, human suffering, can cause positive long term effects due to reconstruction process which includes new investments, inflow of new technologies to a country, better infrastructure and equipment. Moreover, it may lead to improvement of physical capital, increase in productivity and, at the end of the day, they contribute even to higher economic growth.

References

Albala-Bertrand J.M., 1993, *Political economy of large natural disasters*, Clarendon Press, Oxford.

CRED, 2015, *Emergency Events Database (EM-DAT)*, Centre for Research on the Epidemiology of Disasters, http://www.emdat.be/advanced_search/index.html (14.07.2015).

Granger C., 1969, *Investigating casual relations by econometric models and cross-spectral methods,* Econometrica, Vol. 37, No. 3, pp. 424-438.

Hallegate S., Dumas P., 2009, *Can natural disasters have positive consequences? Investigating the role of embodied technical change*, Ecological Economics, No. 68, pp. 777-786.

Loayza N., Olaberria E., Gigolini J., Christiaenses L., 2012, *Natural disasters and growth: going beyond the averages*, World Development, Vol. 40, No. 7, pp. 1317-1336.

Noy I., 2009, *The Macroeconomic consequences of disasters,* Journal of Development Economics, No. 88, pp. 221-231.

Sargent T.J., 1976, *A classical macroeconomic model for the United States,* Journal of Political Economy, No. 84, pp. 207-238.

Skidmore M., Toya H., 2002, *Do natural disasters promote long – run growth?,* Economic Inquiry, Vol. 40, No. 4, pp. 664-687.

World Bank, 2015, *World Development Indicators*, http://data.worldbank.org/wdi (21.07.2015).