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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Assessment of ripple effect and spatial heterogeneity of total losses in the capital of China after a great catastrophe shocks" *by* Zhengtao Zhang et al.

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Responses to the reviewer's comments on the manuscript "Assessment of ripple effect and spatial heterogeneity of total losses in the capital of China after a great catastrophe shocks" The authors would like to thank the reviewer for your efforts on this manuscript and providing us with insightful comments and suggestions to improve the quality of this manuscript. The following responses have been prepared to address reviewers' comments in a point-by-point fashion. And the sentences in red are the corresponding revised parts in our manuscript. We also attach a copy of the revised manuscript with the Track Changes in the below of the responses.

This paper addresses a very interesting topic: the economic evaluation of the ripple

effect and spatial heterogeneity after a catastrophe, with an application to earthquakes in the one of the most developed regions of China. The paper is well innovative and well written. It does a good job analyzing the ripple effect and spatial heterogeneity of total economic losses (especially indirect economic loss) by the established IRRE model. The results that the loss can be spatial extended into each street, and sectors' losses in each street can be further evaluated are both meaningful and useful. General Comments: i) Page 3, Line 3. Writing the names of the DEL and IEL in Figure 1 instead of acronyms would make it easier for the readers, especially in the introduction. Response: Thanks for your comments. We have already changed the full names of the direct economic loss and indirect economic loss instead of acronyms "DEL" and "IEL" in Figure 1. And we also delete the words below the Figure 1: ", DEL means direct economic loss, IEL means indirect economic loss". Please Check the Page 3, Line 7 in the revised manuscript.

ii) Page 6, Line16. You refer to Sichuan Province is a less developed region in China, (Page 2, Line18) refer to Beijing is a developed metropolises in China. . .What is the criterion to judge their economic development degreeïij§ Response: Thanks for your suggestion. We added a paragraph on the Page 7, Line 11 to illustrate the development level between Sichuan province and Beijing. Besides, we also compare per captia of BJ with the world standard to highlight its development: "The per capita GDP of SCP only ranks 24th of the 34 provinces and cities of China, while that of BJ ranks the second, and is almost more than double as the per capita of upper middle income country (5511 USD in 2008, from World Bank). The population density of SCP is 168/km2, which ranks 25th, and that of BJ is up to 1079/km2, which ranks 4th."

iii) Page10, Line10. The SDN model, "DELBJ/CAPBJ stands for direct economic loss/stock of fixed asset of BJ"; Page10, Line18. The IRRE model, "BINstr stands for business income of streets/(villages and towns),". Why do you use stock of fixed asset to spread direct economic loss, use business income to spread indirect economic loss? Response: Thanks for your comment. The reasons that the stock of fixed asset

is used to spread direct economic loss are: i) the direct economic loss belongs to the concept of "stock", the stock of fixed asset is in line with the nature of direct economic loss; ii) the destruction of sectors caused by earthquake disaster is mainly concentrated in destruction of stock of fixed asset, and the replacement costs of stock of fixed assets account for the most in the statistical components of direct economic loss; iii) the production capacity in the ARIO model is the key variable which is used to indicate the ability of increasing supply level to meet the post-disaster demand. The production capacity is set that it decreases x% when the stock of fixed asset decreases x% caused by the disaster. Therefore, using the sectors' stocks of fixed asset of streets/ (villages and towns) to spread direct economic loss not only accords with the statistical significance of direct economic loss, but also accords with the simulated mechanism of ARIO model. The reasons that the business income is used to spread indirect economic loss are: i) the indirect economic loss belongs to the concept of "flow", the business income is the flow data, so it's in line with the nature of indirect economic loss; ii) in the earthquake disaster aftermath, the enterprises will reduce production due to the limitation of production capacity, production bottleneck, and industrial linkage. All of the limitations can be reflected in the business income of the affected year. The business income of a sector will be greatly affected if that sector suffers large indirect economic loss; iii) Due to the fact of data limitations, only business income meets the data requirement to spread the indirect economic loss in all the available statistics of streets/(villages and towns). In fact, the most accurate method to assess the indirect economic loss of every street/(village and town) in Beijing is to simulate them one by one based on ARIO model and their direct economic losses. However, it's impossible in China, because there are no Input-Output Table of every street/(village and town) and the import and export data between different regions. Therefore, according to the existing data, using business income data to spread indirect economic loss accords with the theoretical and practical significance. We added a paragraph to describe the explanation. On Page 11, Line 11: "The stock of fixed asset is used in SDN model because that: i) the stock of fixed asset belongs to the concept of "stock", which is in line with the nature of direct

economic loss. And the replacement costs of stock of fixed assets account for the most in the statistical components of direct economic loss; ii) the core idea of the feedback of the production capacity of economic system in the ARIO model is that production capacities of sectors decreases x% when the stocks of fixed assets decreases x% caused by the disaster. Therefore, the using the sectors' stocks of fixed asset not only accords with the statistical significance of direct economic loss, but also the simulated mechanism of ARIO model." On Page 12, Line 4: "The business income is used in IRRE model because that: i) the business income is the flow data, which is in line with concept of "flow" of indirect economic loss; ii) in the earthquake disaster aftermath, the production reduction due to the limitation of production capacity, production bottleneck, and industrial linkage can be reflected in the business income of the affected year. The business income of a sector will be greatly affected if that sector suffers large indirect economic loss. Therefore, it's reasonable to use business income in the IRRE model."

iv) Page 10, Line16. What's the meaning of the parameters of spatial aggregation in Figure 4? You should illustrate them. Response: We are agree with your suggestion. We have already added the corresponding illustration below the Figure 4 due to the space limitation. Please check the Page 16, Line 7 in the revised manuscript: "the global Moran's I is an index to measure spatial correlation, which is more obvious when its value is closer to 1. The z-score and p-Value are used to judge confidence coefficient level, the results show that both of spatial aggregation of DEL and IEL exceed the 99% confidence interval."

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-354/nhess-2016-354-AC1-supplement.pdf

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