Economic Loss and Recovery of Foreign Direct Investment under Natural Disaster: The case of Shanghai in the 2010s and 2050s

Topic: Input-Output Analyses and Input-Output Modelling of Disasters - I
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Since the frequency and severity of natural disasters (NDs) are expected to become greater in the future, substantial risks and deep uncertainties would be confronted by firms and industries, even the entire business and broader economic environment. Increasingly scholars from international business field have emphasized the significance of incorporating the risk induced by NDs into decision-making for effective business management and foreign direct investment (FDI) in particular. FDI is regarded as the driving force behind to support economic growth and development in developing and under-developed regions over the past decades. As the two popular entry mode choices for FDI to a host country, both "Joint-Venture" and "Wholly Owned firm" are facing several challenges from the host region, such as the changes in the institutional, political and economic environment. However, only a few studies try to consider NDs' impacts within the host area to FDI, largely because ND is viewed as an unpredictable and unmanageable event. This study is interdisciplinary by nature, takes a novel approach by bringing in climatological and engineering design, with industrial economics perspectives and zoom in the city of Shanghai, one of the megacities in the world with invaluable positions in politics and economic development in Far East. Using the case of Typhoon Winnie, which was the worst tropical cyclone typhoon in 1997 that impacted Shanghai and the surrounding coastal areas in China, the research question we are exploring is: to what extent might "Sino-foreign Joint Ventures" (SJVs) and "Wholly foreign Owned Firms" (WOFs) be affected by climate change?

We take both climate change and socioeconomic structure development into account in performing an integrated analysis to evaluate the economic impact and recovery of Typhoon Winnie on firm and industrial level in Shanghai with the outlook of the year 2013 and 2050. The research first started with the hydrodynamic model, Delft3D-Flow Flexible Model to estimate tide, wave, the typhoon-induced storm surge and inundation area in the city. Then we calculated the industrial direct economic loss (capital loss) based on the spatial information and damage-curves that build from this research. We further applied the Flood Footprint Model (FFM) to quantify the indirect/cascading economic impact at industrial and regional level. FFM follows the principle of the Input-Output (IO) analysis which in principle captures the transaction flows between producers and consumers in a given economy. Taking this IO model as the backbone of FFM, allows us to assess disaster-induced indirect economic evaluation throughout the entire supply chain activities by taking production bottleneck into account. Undertaking the FFM, we are able to explore how a natural disaster threat impacts on industry sectors and regions as well as how each sector makes bounce back and recover from the disruption of supply chain and production activities. Regarding the sample firms, we collected information about 4,035 overseas-funded (including Hongkong, Macao and Taiwan regions in China) manufacturing firms around Shanghai with the platform of the Third National Economic Census of China (2012-2015), including 1,281 SJVs and 2,754 WOFs, share nearly 55 percent of gross industrial output values and 88 percent of delivery values by industrial exports within Shanghai.

We estimated economic loss caused by Typhoon Winnie within Shanghai in 2013 and 2050 based on sample firms, and our results show that climate change brings higher economic losses of an extreme event to WOFs than SJVs. Moreover, we analysed the heterogeneity of climate risk faced by sample firms in Shanghai from both sectoral and geographical perspectives, and discussed whether WOFs or SJVs at indusial level are more vulnerable to climate change. Finally, we will

explore how the recovery of sample firms in the aftermaths of natural disasters. This research is the first study which estimate direct losses at the firm-level and consider the indirect losses and recovery costs for a known worst case of tropical cyclone compound flood event in China. We expect this paper will make contributions from below views. 1) Theoretical contribution to location advantage in the international business research field, since the natural disaster-induced direct and indirect economic risks have been considered with IO-based analysis. 2). The interdisciplinary approach is novel in understanding the complexity of climate change and its impact on international business, as this integrated modeling work successfully coupled the state-of-art hydrodynamic model and IO-based model, while this modeling framework can be applied to other coastal cities. 3) Since systematic biases and cost-benefit may be existed and overlooked within country-based analysis, this study only 'zooming in' to smaller geographical scales, such as Shanghai city and district.