Assessing the economic losses of destructive events: an analytical framework combining production and consumption perspectives

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As global uncertainties persist, destructive events, whether natural or man-made, can cause disruptions to production and consumption, resulting in a significant impact on the overall economic system. This study proposes a comprehensive analytical framework to assess economic impacts of destructive events, utilizing the multi-regional input-output (MRIO) model and hypothesis extraction method. The advantage and contribution of our framework lies in its unique combination of production and household consumption perspectives. On the production side, our approach goes beyond traditional models by accounting for both upstream economic losses from production disruptions and downstream losses due to the interruption of intermediate product supply. This is achieved by integrating the concept of raw material inventory days on hand into the model. On the consumption side, our framework captures household spending loss due to the event by introducing the concept of non-rigid consumption, as well as long-term demand contraction generated by income loss, which is a novel approach in the field.

Employing the updated 2017 Chinese MRIO table, this framework was applied to conduct both retrospective and prospective analyses of destructive events. For retrospective analysis, we examined the economic impact of the COVID-19 outbreak in Shanghai in 2022. The estimated loss is about 153.8 billion yuan of gross domestic product (GDP) value in the second quarter of 2022 in Shanghai, with an error of only 3.6% compared to the actual data. This precise estimation underscores the reliability of our model in real-world scenarios.

The prospective analysis involved simulations to assess the potential impacts of similar events in various Chinese regions, enabling a comparative examination of economic characteristics across different areas. Furthermore, we explored the effectiveness of various disaster-mitigation policies through a series of what-if analyses, adjusting parameters and input variables within our model. This aspect of the research provided valuable insights into policy-making, highlighting how adjustments in strategies can effectively address challenges.

Overall, the results show that our analytical framework performs as a robust, accurate and flexible estimator for assessing the economic losses of destructive events under different scenarios. Additionally, it sheds light on the differentiated characteristics and roles of different regions in the economic system. This methodology is adaptable for analyzing global events like the Russia-Ukraine conflict and extreme weather impacts, providing valuable insights for risk management and policy-making.