BRINGING HAZARD AND ECONOMIC MODELLERS TOGETHER

Abbas Rajabifard[1], Mehmet Ulubasoglu[2], Mohsen Kalantari[1], Prasad Bhattacharya[2], Yiqun Chen[1], Habib Rahman[2], Katie Potts[1]

[1] Department of Infrastructure Engineering, The University of Melbourne, VIC
[2] School of Accounting, Economics and Finance, Deakin University, VIC

A PAPER ON THE USE OF A SPATIAL PLATFORM FOR DAMAGE AND LOSS VISUALIZATION TO BRING TOGETHER HAZARD AND ECONOMIC MODELLERS

1. INTRODUCTION

Rapid economic growth along with complex urban planning and development processes tend to accelerate economic vulnerabilities which makes disaster risk reduction (DRR) interventions more important than ever. In this connotation, knowing the potential damage and losses due to natural disasters is indispensable to design pre-disaster mitigation and post-disaster recovery activities. In practice, civil engineers and hazard modellers assess the potential damage of physical assets using a spatial platform. Economists are inclined to estimate losses in economic flows due to natural disasters mainly at state or national level using econometric methodologies. Such divergence in approaches make the DRR field very challenging for economic applications when the expectation is to provide a spatially enabled decision support tool that can visualise not only damage of physical assets but also map overall economic effects of natural disasters. This paper bridges the gap between hazard and economic modellers by devising a spatial platform that can provide inputs to an economic model as well as display the outputs of it on maps. Precisely, this paper contributes to providing a method that unleashes opportunity for hazard and economic scientists to work together to enable better prediction about potential effects of natural disasters.

2. DATA AND MEASUREMENT

Given its multi-disciplinary scope, a wide range of datasets are used in this paper. First, annual data on sector-specific Gross State Product (GSP) for the period 1990-2013 is taken from the Australian Bureau of Statistics (ABS, 2014). Second, for disaggregating these sector-wise GSP to a smaller geographic level, the total number of employment in each sector at a finer spatial unit—Destination zones (DZNs) — taken from the Places of Work database (POWP, 2011) is used. This historical series of natural disaster events are sourced from the Australian Emergency Management Knowledge Hub (AEM, 2014) that provides data on the location of incidence and its intensity in terms of human mortality and casualties. Finally, to identify the exogenous sources of natural disasters, we collected time-series gridded data on various climatic features such as monthly rainfall, temperature, and wind speed from the Bureau of Meteorology, Australia (BOM, 2015).

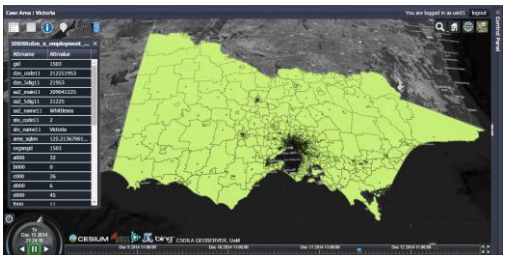

Figure 1: Delineating destination zones in Places-of-Work (POWP) data 2011

3. SPATIAL PLATFORM

This research sets the Intelligent Disaster Decision Support System (IDDSS) platform as an standard to facilitate the decision making process in Disaster Risk Reduction (DRR) field by utilising a combination of disaster modelling, spatial data analysis, visualisation and optimisation technologies. In particular, in this research the IDDSS performs a spatial analysis, which disaggregates GSP at DZN level. After this disaggregation process, the IDDSS is used to visualise the overall sectoral effects of natural disasters at local level.

4. METHODS

To track the localized effect of bushfires, floods and earthquakes on sector-specific GSP, we follow a four step process:

- defining the geographic zone (i.e., destination zone in our context) that would be used as a cross-sectional unit in both spatial and economic analyses
- disaggregating sector-specific GSP at DZN level
- categorizing sector-specific GSP into 4 broader groups—i.e., production, infrastructure, social, and cross-cutting
- estimating disaster losses by 19 economic sectors as well as 4 broader groups.

5. TENTATIVE RESULTS AND CONCLUSIONS

It is evident that bushfires have significant effects on infrastructure and social sectors, but this effect disappears in production and cross-cutting sectors. Similarly, it is likely that earthquakes do not affect significantly, possibly because Victoria does not experience any strong earthquake during 1950-2013. However, floods can primarily hit production and infrastructure and passively affect social and cross-cutting sectors. One of the main contributions of this research is that the empirical strategy is connected with a spatial platform that can be used to display the sectoral effects of natural disasters on map at the DZN level once they are estimated, which is of utmost importance for formulating effective policies. Such visualisation of potential findings can act as a decision support tool for both the federal and state governments to prioritize budget allocation across different development sectors.

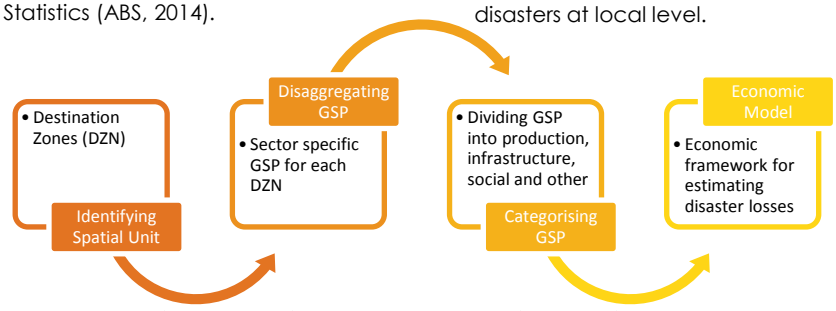

Figure 2: Spatially enabled economic modelling process

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