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PRE-DISASTER MULTI-HAZARD DAMAGE AND ECONOMIC LOSS ESTIMATION MODEL

ANNUAL PROJECT REPORT 2016-2017

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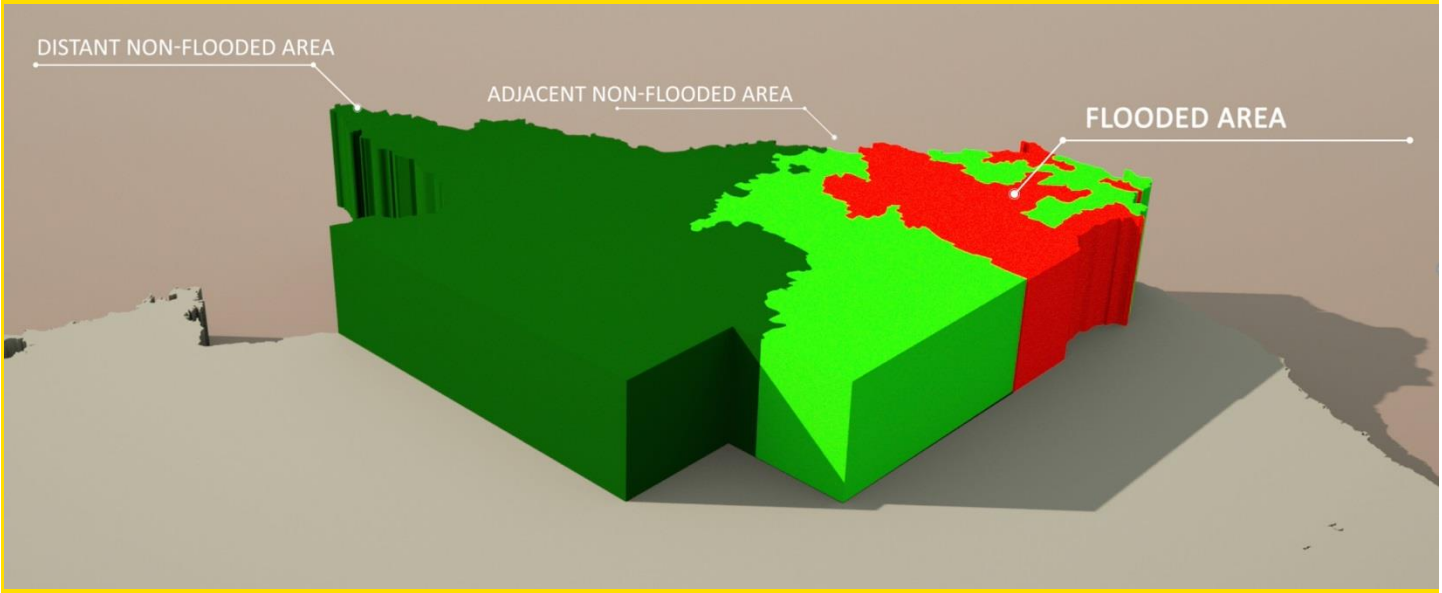

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Cover: Income comparison between flooded and unaffected individuals

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EXECUTIVE SUMMARY

This project investigates the economic impact of natural disasters on Australian economy, across sectors such as agriculture, forestry and fishing, mining, manufacturing, utilities, construction, retail trade, transport and health care. The economic impacts of natural disasters can often be overlooked in management planning as the effects are not always immediate. A substantial problem is the inability to estimate the full economic impact of natural hazards, considering all the affected sections of the economy. This effort should take into account not only the primary impacts of natural disasters but also secondary impact due to economic loss.

The main objective of the overall research program is to estimate the sector-disaggregated economic effects of the QLD Floods 2010-11, the Black Saturday Bushfires 2009, and Cyclone Oswald 2013 to support decision-making in the design of post-disaster recovery interventions. The evidence so generated will provide policy makers with indications through which they can alleviate the potential negative effects of natural disasters at the sectoral level.

In the first phase of the BNHCRC (2014-2017), the project placed the microscope on Queensland Floods 2010-2011 at the individual level, with a preceding 'introductory' analysis of the nation-level effects of floods and bushfires on state GSP, unemployment and inflation in Australia. The year 2016-17 has witnessed a major progress in terms of finalizing the case study on Queensland Floods 2010-11 as well as reporting the nation-level effects of floods and bushfires in a form that can be disseminated to a wider audience.

In the second phase of the BNHCRC (2017-2020), the project will additionally focus on Black Saturday Bushfires 2009 and Cyclone Oswald 2013 to present the impact of different types and scales of natural disasters on different sectors of the economy. This phase will see the investigation not only of individuals but also of business firms, to provide a full picture of the disaster impacts. It will also extend the Queensland Floods analysis to firms.

In both phases of the BNHCRC, the research program utilises the rich Australian Bureau of Statistics (ABS) Census data as the main workhorse of the analysis. The project also employs solid experimental research design comparing the outcomes on affected individuals and firms with those of unaffected ones.

Taken together, this project aims to assist the Australian Federal and State governments with identifying sector-specific economics effects of natural disasters both at individual and firm levels. It is expected that the findings of this project will act as a catalyst in designing post-disaster recovery interventions of the Federal and State policymakers that will not only be customised to directly support individuals but also assist firms to ensure their survival and keep their workforce employed. Moreover, investigation of the vulnerability dimensions is expected to enhance our understanding of the socio-economics of natural disasters and help formulate public policies in a way that will tangibly minimise the disaster risks.

In 2016-2017, the project has achieved several outcomes in terms of end-user engagement. The research team has organised three workshops with end-users: one with the Department of Environment, Land, Water and Planning (DELWP), and two with the Emergency Management Australia (EMA) of the Attorney-General's Department (AGD). The main objective of the latter two was to discuss the Natural Disaster Relief and Recovery Arrangements (NDRRA) in connection with the new evidence found on the 2010-11 Queensland Floods case study.

END USER STATEMENT (S)

Ed Pikusa, *Manager Policy and Reporting, Fire and Flood Management Unit, Regional Programs Branch, Department of Environment, Water and Natural Resources, SA*

This project has illustrated the potential to have utility in planning for relief and recovery programs, based on impacts to the broader economy.

The analysis being undertaken for this project is unique to the CRC, based on the fundamental population and economics data of Australia.

The demonstration of impacts from the larger Queensland flood events has generated further interest to conduct analysis of other events, which the project is continuing to pursue.

The project has shown readiness to realign itself to the needs of end users, and is continuing to proactively engage to ensure its outcomes are able to be used to assist planning.

The publication of the 2015 census data has the potential for extending the analysis further over the coming three years.

I encourage emergency management planning agencies not already engaged to participate in this project.

INTRODUCTION

In Australia, natural disasters are estimated to cost an average of AU$1.14 billion annually. Recent natural disaster events, such as the 2010-2011 Queensland (QLD) Floods, were estimated to have caused $6.7 billion in damage, with an overall cost of $14.1 billion (Deloitte Access Economics, 2016). The impact on the population was also substantial: the inundation of more than 28,000 homes, and power outage of 100,000 residences for several weeks. The QLD Floods are considered one of the most devastating floods in Australian history.

Preceding the QLD Floods, on Saturday, 7 February 2009, the state of Victoria experienced the worst bush-fire-weather condition ever recorded, which is famously called "The Black Saturday Bushfires". On a global scale, this was the world's worst fire event, which was equivalent to 400 Hiroshima style atom bombs going off. 173 people died; over 2,030 houses and 3,500 structures were destroyed with thousands more suffering damage. The total area destroyed was half a million square kilometres, which is almost the size of a small country (source: www.blacksaturdayfires.com).

Some natural disasters are not as extensive as the Black Saturday Bushfires, but still catastrophic to create havoc at the regional level. For instance, the tropical "Cyclone Oswald" in January 2013 passed over parts of Queensland and New South Wales. It resulted in widespread impacts including severe storms, flooding, and water spouts.

Australia suffers from numerous natural disaster events annually. Thus, understanding the economic impacts of natural hazards in Australia is central to implementing effective disaster risk reduction strategies and improving overall community resilience that mitigates the economic, social and environmental effects. Achieving this goal requires understanding not only the primary economic effects of the natural disasters but also the secondary effects that encompass many different sections of the economy. In order to bridge this gap, project team has conducted a case study on the 2010-2011 QLD Floods under the first phase of the BNHCRC with project titled "The Pre-Disaster Multi-Hazard Damage and Economic Loss Estimation Model", which involved comparisons between the flooded areas and unaffected areas of 19 economic sectors (as classified by the Australian National Accounts of the Australian Bureau of Statistics (ABS)). In particular, using the rich and extensive ABS Census Data of 2006 and 2011 (a nationally representative sample of 5% of the Australian population), which included more than 100,000 individuals residing in QLD, the project compared the economic conditions of individuals residing in flooded and non-flooded areas before and after the floods, revealing the sectoral decomposition of income and employment differences reflected in household well-being as a result of the floods.

The research project aims at understanding the true effect of natural disasters and provides evidence in support of devising effective relief and recovery interventions at the *individual* and *firm* levels in Australia.

PROJECT BACKGROUND

With the financial assistance and overall guidance of the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC), the Deakin Business School (DBS) at Deakin University has conducted this research project titled "Pre-Disaster Multi-Hazard Economic Loss Estimation Model."

WHAT IS THE PROBLEM?

Snapshot 1: Economic Sectors of Australia

- Agriculture, Forestry & Fishing
- Mining
- Manufacturing
- Electricity, Gas, Water & Waste Services
- Construction
- Wholesale Trade
- Retail Trade
- Accommodation & Food Services
- Transport, Postal & Warehousing
- Information Media & Telecommunications
- Financial & Insurance Services
- Rental, Hiring & Real Estate Services
- Professional, Scientific & Technical Services
- Administrative & Support Services
- Public Administration & Safety
- Education & Training
- Health Care & Social Assistance
- Arts & Recreation Services
- Other Services

As mentioned earlier, using data from the Australian Bureau of Statistics, in the first phase of this project, the team has compared income variation from 2006 to 2011 of the flood-affected individuals in Queensland with unaffected individuals to detect any differences in income by employment type as a result of the flood. Results indicate a range of outcomes – some sectors (see snapshot 1 for a full list of economic sectors of Australia) experienced no income difference as a result of the floods, while one sector was impacted negatively (Accommodation and Food Services), and two were impacted positively (Transport, Postal and warehouse, and Rental, Hiring and Real Estate Services). In addition, the following findings generated interest in connection with the national level impact assessment:

- On average, incomes of the affected individuals increased by around 4% following floods, compared to unaffected individuals;
- Employees in the accommodation and food services incurred around 20% income loss due to flood;
- Employees in the 'transport, postal and warehouse' and 'rental, hiring and real estate services' experienced 5.5% and 12.8% increase in incomes, respectively;
- The middle-income group experienced f slightly positive income effect by 1%, while low-income and high-income groups experienced no change;
- People who are affected by moderate levels of flood-water height (i.e., 1.17-2.60 metres) experienced an income rise of around 8 %;
- Self-employed individuals in incorporated businesses earned around 7 % more income following floods, but those in unincorporated business experienced no change. (The AGD mentioned that the then-DRA

scheme provided the support through employers, but subsequently the payments were made to employees);

- People aged below 25 experienced no income change, while those 25 and above experienced 4 % income rise;
- The spatial spillover effects are present but not strong. However, this is quite surprising, as individuals affected by blackouts more than 24 hours in the aftermath of floods were included in the NDRRA assistance.

Such differential effects of the QLD Floods are puzzling, and thus, demand for an in-depth understanding on why some sectors exhibit no effects while others were somehow affected. One potential explanation to this puzzle is that the post-flood recovery interventions were heavily focused on some sectors, and consequently, the negative effect of such catastrophic incidence on those sectors was avoided.

An alternative explanation is that the impact of the natural disasters in Australia falls onto a different section of the economy, such as firms (e.g., small and medium-sized enterprises). The Chamber of Commerce and Industry Queensland (CCIQ) undertook a survey in the aftermath of floods, and indicated the following findings:

- One in five businesses in Queensland has had to close as a result of the floods due to either water inundation or electric power outage,
- The average number of days business were forced to close was eight (median of 4 days).
- The average number of days before their business returns to normal operations is 31 days (median of 10 days).
- The loss to property including plant and equipment, stock, buildings and motor vehicles to those businesses directly affected by the floods was on average $589,000 (median of $40,000).
- Business directly affected by the floods on average expect to lose in total $908,000 or approximately 11% of their annual turnover (median was $50,000 or 7% of annual turnover).
- Unsurprisingly 22% of all businesses within Queensland have indicated that the floods have had a major to critical impact on their businesses' viability with the very real threat of job losses.

All this evidence at both individual and firm levels has significant policy implications in post-disaster recovery arrangements. Defining the different groups of "needy individuals" is the crux of attaining efficiency in allocating the scarce mitigation and recovery resources. This project is targeted to shed light on who

the "needy individuals" and "needy firms and business enterprises" such that evidence-based formulation of relief- and recovery-related arrangements occur in Australia.

WHY IS THIS PROJECT IMPORTANT?

The economic impacts resulting from natural disasters are often overlooked in the economic planning process. This is because the immediate focus in the wake of natural hazards is typically placed on the emergency response systems, and it takes time to realise the economic effects of the disasters. In Australia, the disaster management arrangements across all stages (mitigation, preparedness, response and recovery) have proven to be very successful at saving lives. However, less attention and resources have been devoted to the economic impacts of natural disasters.

One of the problems identified in this setting is the lack of estimates of the full economic impact of natural hazards covering all the affected sectors of the economy. An ideal estimation should reflect both the primary and secondary effects of the natural disasters so that persistent losses throughout the economy emanating from various sectors are taken into account.

In this initiative, the effort should be given to take into account not only the primary effects of the natural disasters but also its all-important secondary effects due to the pervasive losses throughout the economy.

At least two major research gaps have been identified. First, a disaster risk assessment system needs to be developed to provide adequately quantifiable potential damages as a result of different types of disasters for regions of Australia. Second, a framework needs to be established to estimate the indirect economic losses. With the identification of the disaster-specific potential damage and losses, policymakers at different levels will be able to formulate disaster risk reduction-inclusive development policies to mainstream disaster resilience practices. Hence, estimating the impacts of previous natural disasters remains highly critical towards designing more informed national economic policies.

To move from reactive response to a proactive risk reduction culture, this research program will be a pioneering effort in mainstreaming disaster risk reduction (DRR) measures into the economic development process. The overall objective of the research project titled- 'A pre-disaster multi-hazard damage and economic loss estimation model for Australia' is to estimate the economic sector-specific losses of natural disasters so as to support decision makers in reducing disaster risks.

Australia is the primal beneficiary of this research on several accounts. First, at the national level, the research project investigates the economic impact of natural disasters on the growth of sectors in the Australian economy such as agriculture, forestry and fishing, mining, manufacturing, utilities, construction, retail trade, transport, healthcare, etc. At the state level, in addition to the national benefits, the research will conduct some case studies to understand detailed economic effects of natural disasters at the individual level. This will enable the identification of optimum economic policy options to recover or minimise such adverse effects on Australian communities.

OBJECTIVES OF THE PROJECT

The main objective of the overall research program is to estimate the sector-disaggregated economic effects of the QLD Floods 2010-11, the Black Saturday Bushfires 2009, and Cyclone Oswald 2013 to support the decision-making process in the design of post-disaster recovery interventions. The first phase of the research program (2014-2017) focused on QLD Floods 2010-11 at the individual level, with a preceding 'introductory' phase on the nation-level effects of floods and bushfires on states' GSP, unemployment and inflation. The second phase of the program (2017-2020) will place the microscope on the Black Saturday Bushfires and Cyclone Oswald both at the individual and firm levels. This phase will also see the extension of the QLD Floods 2010-11 analysis to firms. The year 2016-17 has seen a major progress with the finalisation of the case study on the economic impact of QLD Floods 2010-11 on individuals. The researchers also accomplished packaging the introductory study of the nationwide effects of floods and bushfires on states' GSP, unemployment and inflation in a disseminable form.

While being a distinct effort on its own right, this project has also maintained a proper cohesion with the other aforementioned two projects of the 'Economics and Strategic Decisions' cluster.

In particular, the research program aims to achieve the following three objectives:

1. To estimate the sector-specific economic effects of QLD Floods and Cyclone Oswald on *firms*, and of the Black Saturday Bushfires on *individuals* and *firms*;
2. To develop a ranked list of the economic sectors that seek more attention for post-disaster resource allocation in minimising potential negative effects of natural disasters;
3. To inform budget allocation decisions across economic sectors in both pre-disaster mitigation as well as post-disaster recovery phases.

In its investigation, the research will place the microscope on how the following key variables change in the wake of disasters: i) at the individual level, income,

employment-type (full-time, part-time), status of employment, and the number of working hours, all investigated with respect to the social vulnerability status of individuals (i.e., gender, age, income-level), and ii) at the firm level, the volume of output, revenue, profit, and employment, again all examined with respect to the vulnerability status of firms, such as small vs large enterprises.

Taken together, this proposed project aims to assist the Australian Federal and State policymakers with identifying sector-specific economics effects of natural disasters at both individual and firm levels. It is expected that the findings of this project will act as a catalyst in designing post-disaster recovery interventions of the Federal and State governments that will not only be customised to directly support individuals but also be tailored in directly assisting firms to ensure their survival and keep their workforce employed. Moreover, investigation of the vulnerability dimensions is expected to enhance our understanding of the socio-economics of natural disasters and help formulate public policies in a way that will tangibly minimise the disaster risks.

SCOPE OF THE PROJECT

The scope of this project is twofold. On the one hand, it will investigate the economic impact of the QLD Floods 2010-11 and Cyclone Oswald on firms operating in the economy. On the other hand, it will estimate the economic impact of the Black Saturday Bushfires on individuals and firms located in Victoria. Both of these analyses will be followed by identifying the optimum economic policy options that inform the budget allocation decisions in both pre-disaster mitigation as well as post-disaster recovery phases. Given its nature, this project will focus only on Queensland and Victoria.

The specific sectors for which economic growth impact of natural disasters will be considered include 19 sectors as identified in the National Accounting System of Australia - agriculture, forestry and fishing; mining; manufacturing; food, beverage and tobacco products; electricity, gas, water and waste services; construction; wholesale trade; retail trade; accommodation and food services; transport, postal and warehousing; information media and telecommunications; financial and insurance services; rental, hiring and real estate services; professional, scientific and technical services; administrative and support services; public administration and safety; education and training; health care and social assistance; arts and recreation services; and other services.

RESEARCH APPROACH

PROPOSED ESTIMATION STRATEGY

To facilitate the investigation at the individual level, we will use Australian Census Longitudinal Dataset (ACLD), 2006 and 2011. This dataset brings together a nationally representative 5% sample from the 2006 Census with records from the 2011 Census. In fact, the availability of such data provides a unique opportunity to explore how Australian citizens are affected over time due to natural disasters. It is envisaged that the 2016 and successive Censuses will be added to this longitudinal dataset in the future. In the event of such data availability, the project team has a plan to estimate the long-run effect of natural disasters.

To facilitate the analysis at the firm level, we will use the Business Longitudinal Dataset (BLD) of the Australian Bureau of Statistics (ABS). The BLD comprises two independent samples (referred to as panels) drawn from the in-scope Australian business population. In our context, data labelled as "8168.0.55.001 - Microdata: Business Characteristics, Australia, 2009-10 to 2013-14" by the ABS fits well to facilitate our experimental research study. That is, we can use 2009-10 data as baseline and 2011-12 as end-line data to estimate the effects of natural disasters at the firm level.

With these data at disposal, the project will adopt one of the most robust methods of science, The Experimental Research Design, which has a long history of being used since pre-historic times (e.g., the Experiment of Archimedes for testing his theory of hydrostatics), as well as by modern applied physicists (e.g., the Large Hadron Collider of Conseil Européen pour la Recherche Nucléaire - CERN for testing the existence of Higgs boson or God particle). The Experimental Research Design has increasingly been adopted in the field of economics; many general-interest and field journals in economics attach great value to scholarly articles that utilise such methods. In our context, we treat natural disasters as a natural experiment in that a disaster event—the Queensland Floods 2010-11, Cyclone Oswald or the Black Saturday Bushfires 2009—is considered as a shock that treats a group of individuals within a population (i.e., the treatment group), while the rest of the population remains unaffected (i.e., the control group).

To understand our proposed method visually, consider Figure 1, where the red region indicates the flood affected area, the light-green region is the adjacent non-flooded area, and the dark-green region represents the distant non-flooded area in Queensland. We compare the economic differences between the group of flood-affected individuals (i.e., treatment group) and the group of individuals residing in non-affected areas (i.e., control group), by sector. The idea behind using two different non-affected areas is that the adjacent (light-green) area might also have experienced some effects due to economic spillovers after the floods. The distant non-flooded area enables checking whether there were such spillovers.

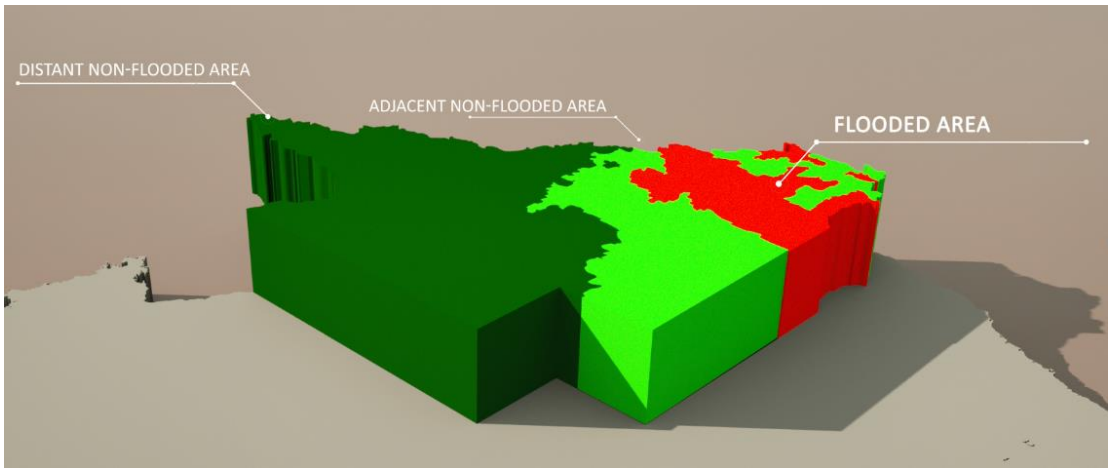

Figure 1: Income Comparison between Flooded and Unaffected Individuals

Because our natural experimental design provides data for two different time periods, we can observe the treatment and control groups before and after the disaster event. This strategy assures us pinning down the causal income effects of the QLD Floods 2010-11 for individuals.

The same methodology will be employed for firm-level analysis of QLD Floods and the Cyclone Oswald, and individual- and firm-level impacts of the Black Saturday Bushfires.

KEY MILESTONES

POTENTIAL OUTCOMES

This proposed research project is designed in a way that will quantify the sector-specific economics effects of the Queensland Floods 2010-11, Cyclone Oswald and the Black Saturday Bushfires 2009. The main economic variables we will focus on are income and employment for individuals, and output, profit, revenue and employment for firms. As indicated, an important focus will be placed on vulnerable groups within individuals and firms. Such quantification of the sector-wise impact of natural disasters enable the policymakers in figuring out the disaster-disadvantaged sections of the economy that require post-disaster recovery assistance to larger extents than others. That is, it facilitates the prioritisation of sectors in terms of allocating scarce resources in the aftermath of natural disasters.

In particular, the research program aims at obtaining the following outcomes:

1. Identification of the economic sectors that are adversely affected by natural disasters
2. Identification of the economic sectors that are 'beneficiaries' of natural disasters
3. Identification of the economic sectors that are unlikely to be affected by natural disasters
4. Development of a ranked list of the economic sectors that seek more attention for post-disaster resource allocation in minimising potential negative effects of natural disasters
5. Development of a guideline for optimising budget allocation across economic sectors in both pre-disaster mitigation as well as post-disaster recovery phases

Note that the first three outcomes above are derived from the first research objective and the last two outcomes are attached with the second and third research objectives identified earlier (see Objectives of the Project section).

WHAT THE PROJECT HAS BEEN UP TO

As of now, the research project has accomplished several milestones in the last financial year 2016-2017 that are described below.

DEVELOPING THE ESTIMATION METHOD

Every economy has two distinct parts: a) market for goods and services, where households purchase goods and services from firms in exchange for money; and b) market for factors of production (such as labour or capital), where firms purchase factors of production from households in exchange for money. This has been graphically presented in Figure 2. Using this simple economic concept, one can estimate the total income generated within the economy by adding up all households' incomes and firms' profits. In our context, the research team exploits individual level economic information as retrieved from the Australian Census Longitudinal Dataset, 2006 and 2011 to estimate the changes in individuals' incomes of the flood affected victims as compared with the affected cohort by economic sector. For example, as shown in Map 2, we are basically comparing income variation from 2006 to 2011 of the flood affected individuals with the unaffected.

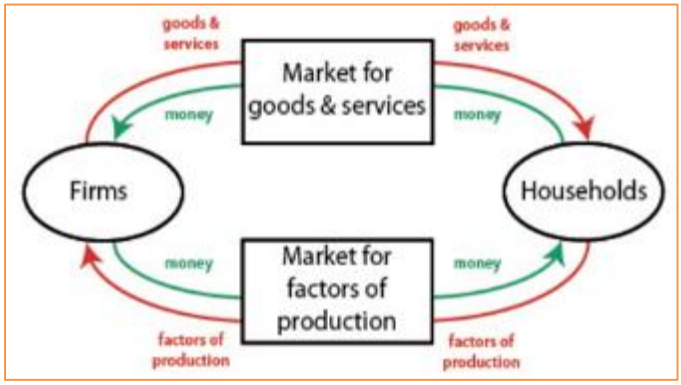

Figure 2: Circular Flow Diagram of the Economy

The team has developed a unique natural experimental method of estimating the effects of natural disasters by using the Australian Census Data. This is the most advanced method frequently used in Applied Microeconomic studies. We believe that using such a method in disaster-related research opens a new window of opportunity to understand the causal effects of natural disasters on various economic, social, and crosscutting factors.

ACCESSING THE AUSTRALIAN CENSUS LONGITUDINAL DATASET (ACDL), 2006 AND 2011

The project uses the Australian Longitudinal Census Data (ACLD), 2006-2011 as the main work horse. However, accessing this data is a very tedious process that is in place to ensure the confidentiality of the people's personal information.

After a long chase, our project team has developed a solid rapport with the ABS, who agreed to share the dataset provided that one of our team members had to work in their office. Hence, an office space has been allocated in the ABS

data lab (ABSDL), Melbourne office for us to work there sporadically by using a statistical software package 'STATA'. As of now, the research team has visited ABS office **nine times** to work on the confidential dataset.

COLLABORATION WITH THE DEPARTMENT OF ENVIRONMENT, LAND, WATER AND PLANNING, VICTORIA

An agency level Meeting with the **Department of Environment, Land, Water and Planning** (DELWP), State Government of Victoria was held at 2.00-4.00 pm on 28 March 2017 in Level 15, 8 Nicholson Street, East Melbourne, Victoria. The main objective of this meeting was to discuss the Black Saturday Bushfires 2009 in terms of identifying how the decision-making process can benefit from understanding the causal impact of the Black Saturday Bushfires 2009. Here are the key discussion points that the DELWP and the research team have made in this meeting.

- The DELWP recommended that estimating the economic impact of the Black Saturday Bushfires would be more beneficial if it segregates the analysis by different geographic areas in terms of its economic significance.
- In addition to economic impacts, the impact of bushfires on individuals' "mental health" is not clear. The DELWP suggested that the Deakin University shed some light on this matter.
- Bushfires affect local communities more severely than the aggregate economy. The DELWP suggested that the research team focus on identifying significant livelihood issues that created jeopardy on individuals' standard of living at the local level.
- Since the agricultural sector is likely to be the most affected ensuing bushfires, DELWP requested that the research team check whether individuals related to agriculture suffer differently than others in terms of their both physical and mental health.

The **meeting minutes** are provided in **Appendix 1**.

COLLABORATION WITH THE ATTORNEY-GENERAL'S DEPARTMENT

As the project is aimed at supporting the nation-level relief and recovery interventions in Australia, the Emergency Management Australia (EMA) operated under the **Attorney-General's Department** (AGD) has turned out to be a key end user. The research team has had two meetings with AGD during 2016-2017.

The first meeting with the AGD was held on 13 Oct 2016 at 3-5 National Circuit, Barton, ACT 2600. The main objective of the meeting was to make the initial contact and touch base on the parties' approach to evaluate the potential effects of natural disasters at both *nation* and *state* levels.

Picture 1: A Meeting with the AGD, 13 Oct 2016;

The second meeting with the AGD was held at 1.00-3.30 pm on 13 Jul 2017, Thursday, at 3-5 National Circuit, Barton, ACT 2600. The main objective of the meeting was to discuss the Natural Disaster Relief and Recovery Arrangements (NDRRA) in connection with the new evidence found on the economic effects of the 2010-11 Queensland Floods, which was produced by Deakin University in conjunction with the BNHCRC funding. In particular, parties sought to identify how the decision-making process in Australia in relation to funding large scale natural disasters can benefit from detailed research evidence with a view to optimise the disaster-related expenditures at the federal and state levels. All participants in this meeting came up with the following consensus:

Picture 2: A Meeting with AGD, 13 Jul 2017;

- Given that the estimated positive effect of floods may be associated with relief and recovery interventions, it is recommended that the research team incorporate recovery-related data in their models for verification.
- The AGD are currently developing a Monitoring and Evaluation Matrix to understand the effectiveness of existing disaster interventions. The AGD requested the research team to share comments on this document.
- Recently the AGD have been working on the Sendai Framework and on documenting the impact of disasters on the livelihood of Australian communities. The AGD will share the template of the Sendai Framework, and the research team will feed the AGD with information related to the nexus between livelihood and natural disasters.

This project is expected to come up with a 'policy brief note' on post-disaster recovery interventions in Australia for sensitising relevant policymakers.

In the meeting with the AGD, it is agreed that one of the key objectives of this project should be rationalizing the Natural Disaster Relief and Recovery Arrangements (NDRRA), Disaster Recovery Payment (DRP), and Disaster Recovery Allowance (DRA) through generating evidence in support of the selection criteria to provide disaster-related assistance to the victims. The research team endeavours to:

- inform recovery and relief funding arrangements so that better decisions can be made for minimising negative effects of disasters
- identify those who are in need of disaster assistance highlighting on vulnerable economic sectors, vulnerable firms, and needy individuals
- provide evidence to strengthen the upcoming "National Impact Assessment Model"
- understand the complementarity between NDRRA and other supporting programs (e.g., Newstart allowance and exceptional circumstances income relief payments)
- observe how firms are affected in the wake of disasters
- identify the commonalities and distinctions between large-scale disasters (e.g., the 2010 Queensland floods) and small-scale disasters (Cyclone Oswald)

The minutes of the meeting will be shared along with the next quarterly report.

PARTICIPATION IN THE BNHCRC MEETINGS

The research team participated in the **Research Advisory Forum (RAF)** held in **Perth on 5-6 Apr 2017**. The project team presented the key findings of the Queensland Floods 2010-11 case study. A team member also participated in the end-user meeting on the second day.

The team also participated in the **Research Showcase** held in Adelaide on 5-6 Jul 2017.

Overall, the project has generated extensive interest on how the Queensland Floods (2010-11) affected individuals' income stream. In the second phase of the project, the research team will investigate how business firms have been affected by the Queensland Floods.

OTHER ACTIVITIES

In January-March, the team worked on a number of key deliverables. The **utilisation matrix** has been developed, and the estimation results on the economic effects of the 2010-2011 Queensland floods on sectoral economic development in Australia have been prepared.

The activities the January-March quarter focused on finalising the results of **the Queensland Flood Case Study** and preparing the report on the 2010/2011 Queensland Floods. Descriptive statistics were prepared. The team also spent much time working in the ABS office gathering data.

As of the submission of this report, the research team has finished estimating the benchmark models and is now in the process of fine-tuning Case Study on the Sectoral Economic Impact of the Queensland Floods 2010-11. We expect that the report will be ready for submission by 31 July 2017, as per the contract agreement.

In March 2017, the research team completed a research paper on the **national macroeconomic impacts of natural disasters** in Australia for the period 1978 to 2014. The key outcomes analysed are sectoral economic output, inflation and its subcomponents, and unemployment (with an additional light on gender differences). The paper is titled "The Heterogeneous Impact of Natural Disasters in an Advanced Economy: Evidence from Australia."

In March 2017, the research team submitted an extended abstract to the AFAC17 meetings for a paper titled "*Unpacking the Sectoral Income Effects of Natural Disasters: Evidence from the 2010-11 Queensland Floods.*" The submission has been successful, and the research will be presented at AFAC 17 in Sydney in September 2017.

To engage with the wider audience and to obtain some technical feedback about the method of estimating income effects of natural disasters, Professor Ulubasoglu was invited by the Department of Economics, Deakin University to give a seminar on the topic- "*Gone with the Water? The Causal Evidence on the Economic Effects of Queensland Floods 2010-11"* in June 2017. This is one of the mainstream Economics seminars at Deakin, where many prominent economists regularly come and give talks. The seminar turned out to be very effective in communicating the study to an academic audience and attracted some constructive suggestions for fine-tuning the case study.

In August 2016, Dr. Rahman was invited for a keynote speech on "*Econometric Model for estimating loss and damage in agriculture sector due to climate change induced floods"* in the Consultative Forum of Econometric Modelling in Disaster Studies, 13-14 September, 2016, Colombo, Sri Lanka. This event is organised by the Department of Meteorology, Government of Sri Lanka.

Further, the research team contributed a Hazard Note that jointly presented the cluster projects in Economics and Decision Making with a piece on "Pre-Disaster Multi-Hazard Damage and Economic Loss Estimation Model" (published in Issue 25, December 2016). Recently, the research team has committed to preparing another Hazard Note highlighting on how this project helps formulate relief and recovery interventions of the Attorney-General's Department.

Picture 3: A Seminar at Deakin on Disaster Impact Assessment, 27 Jun 2017;

Finally, the Project Leader gave a three-minute video interview in October 2016 through the BNHCRC Media to inform the wider audience about the significance of the project.
[website: http://www.bnhcrc.com.au/resources/presentation-audio-video/3177]

WHERE TO FROM HERE

This project is now well-positioned to proceed to its second phase for the next three years, 2017/18, 2018/19 and 2019/20. The project has taken the AGD and DELWP on board as the key end-users. In the next one year, the research team will be working with the end users to develop an explicit utilisation path for relevant stakeholders. Subsequently, the research team will organise a nation-level workshop to conduct the Key Informant Interviews (KII) with primary policy-making agencies. This will set the ground for this project to finalise the **Proof of Concept** for utilisation.

Table 1: Key Milestones for the Period 2017-18

# of Milestones	Milestones	Deadline
1.1.1	Poster for BNHCRC Conference	31-Jul-17
1.1.2	An explicit utilisation path for relevant stakeholders is finalised	30-Sep-17
1.2.1	Preparation of background information for conducting the Key Informant Interviews (KII) with primary policy-making agencies	31-Dec-17
1.3.1	A Report on the Key Informant Interviews (KII) with primary policy-making agencies for developing a Proof of Concept for utilisation	31-Mar-18
1.4.1	The Proof of Concept for utilisation to be documented	30-Jun-18

PUBLICATIONS LIST

As mentioned in the Self-Assessment Matrix (SAM), the project produced two working papers, which were presented in various forums such as the AFAC Conference, and Deakin University's Departmental Seminars.

PEER REVIEWED CONFERENCE PAPERS:

- Presented a paper on "*Climate Variability, Natural Disasters and Sectoral Economic Growth: Evidence from Australia*" at AFAC September 2016, Brisbane.
- Had a paper accepted on "*Unpacking the Sectoral Income Effects of Natural Disasters: Evidence from the 2010-11 Queensland Floods*" for presentation in the upcoming AFAC to be held in Sydney in September 2017.

The following two papers are in progress, and the research team is planning to submit them to the *Journal of Environmental Economics and Management* (JEEM) in July 2017 and *American Economic Journal: Economic Policy* in September 2017, respectively:

- The Heterogeneous Impacts of Natural Disasters in an Advanced Economy: Evidence from Australia
- Gone with the Water? The Causal Evidence on the Economic Effects of Queensland Floods 2010-11

In addition, the following outputs have been submitted to BNHCRC.

- Identification of the economic sectors that were affected by the Queensland floods [Sep 2016]
- Preparation of a ranked list of the economic sectors that seek more attention for policy intervention to minimise potential negative effects of natural disasters, e.g., Queensland flood 2010-11 [Dec 2016]
- Preparation of the report on the Queensland flood 2010-11 [Dec 2016]
- Preparation of the Research Paper on the Economic and Social Effects of Queensland Floods 2010-11 at Individual Level [Jun 2017]

TEAM MEMBERS

The project team consists of many stakeholders from a range of organisations. These stakeholders are categorized into the two groups: researchers, and end users.

RESEARCHERS

The researchers in this project hail from three different organisations – the University of Melbourne, Deakin University, and Asian Disaster Preparedness Centre (ADPC).

- Professor Mehmet Ulubasoglu, Deakin University [Lead Researcher]
- Dr. Md Habibur Rahman, Deakin University [Research Fellow]

END USERS

This project currently has a total of 7 end users from across industries. The end users extend their support to the research team in delivering the assigned outcomes of the project.

- Emergency Management Australia, Attorney General's Department
- Department of Environment, Land, Water & Planning, Victoria
- Department of Environment, Water and Natural Resources, South Australia
- Queensland Reconstruction Authority
- Department of Treasury and Finance Victoria
- Queensland Treasury

REFERENCES

1 Bureau of Transport Economics (2001) Economic costs of natural disasters in Australia, Report 103, Bureau of Transport Economics, Commonwealth of Australia, Canberra

2 Deloitte Access Economics (2016) The economic cost of the social Impact of natural disasters, Australian Business Roundtable for Disaster Resilience and Safer Communities, Canberra.

3 The Chamber of Commerce and Industry Queensland- CCIQ (2011), Impact of the Queensland Floods on Business, CCIQ Survey.

APPENDIX 1

MEETING MINUTES:

A Meeting with the Department of Environment, Land, Water and Planning, Victoria: The Black Saturday Bushfires 2009

Venue: **8 Nicholson St, East Melbourne;** ***Date:*** **Tuesday, 28 Mar 2017**

PREAMBLE

An agency level Meeting with the Department of Environment, Land, Water and Planning (DELWP), State Government of Victoria was held at 2.00-4.00 pm on 28 March 2017 in Level 15, 8 Nicholson Street, East Melbourne, Victoria. The main objective of this meeting is to discuss the Black Saturday Bushfires 2009 in terms of identifying how the decision-making process can be benefitted from understanding the causal impact of the Black Saturday Bushfires 2009.

AGENDA

At the commencement of the meeting, all parties agreed on the following agenda items for facilitating the discussion:

- A presentation on the proposed scope of the Black Saturday Bushfires Case study by Prof. Mehmet Ulubasoglu, Deakin University
- An interactive discussion on the existing policies/financing strategies at state level in addressing bushfire events

DISCUSSION AND DECISION POINTS

- Ms. Laura invited Prof. Mehmet, and he made a presentation on "The Black Saturday Bushfires 2009: Utilising longitudinal census data to inform public policy".
- It is identified that estimating the economic impact of the Black Saturday Bushfires would be more beneficial if it segregates the analysis by different geographic areas in terms of its economic significance.

Action Point: The Deakin University team will single out the impact of Bushfires in the Great Ocean Road region, and provide a dedicated ranked list of economic sectors that had adversely affected by the Bushfires.

- In addition to economic impacts, the impact of bushfires on individuals' "mental health" is not clear. The Deakin University could shed some lights on this matter.

  Action Point: The Deakin University team will attempt to address this issue using The Household, Income and Labour Dynamics in Australia (HILDA) Survey data.

- Generally Bushfires affect local communities more severely than the aggregate economy. It is suggested that the research team should focus on identifying significant livelihood issues that created jeopardy on individuals' standard of living at the local level.

  Action Point: The Deakin University team will look into it using spatial information of affected cohorts, and try to understand whether there is any permanent changes that force local communities to downgrade their standard of living.

- Economic sectors are inter-connected and changes in one sector could cascade changes in others, and any large-scale bushfire event is likely to affect almost all sectors of the economy.

  Action Point: The Deakin University team will ensure that the estimated effect of the Black Saturday Bushfires would be *causal* and it will not be contaminated with inter-sectoral impacts of the event.

- It is suggested that the DELWP would provide their post-bushfire intervention data so that the research team can estimate the true effect of such interventions.

  Action Point: The DELWP agreed to provide such post black Saturday bushfires recovery data for further analyses.

- Since Agriculture Sector is likely to be affected the most ensuring bushfires, it would be interested to check whether individuals' related to agriculture suffers differently than others in terms of their both physical and mental health.

- The Black Saturday Bushfires was a series of many bush fires; so the research team is requested to conduct their impact study by singling out key bushfire events during the catastrophic period.
- Population Density should be taken into account to estimate the impact of bushfires on sectoral performance of the economy.
- With regard to bushfires, DELWP is generally initiating mitigation activities such as reduction of fuel for lessening bushfire severities, prescribed burning for better land use planning and housing regulations and prepositioning of resources for better preparedness. Therefore, the spatially-enabled ranked list of economic sectors in terms of their vulnerability to bushfires would help DELWP policy-makers to make their decisions more effectively.

ADJOURNMENT

Ms. Laura thanked all participants and concluded this meeting.

APPENDIX 2

Melbourne campus at Burwood
221 Burwood Highway, Victoria 3125 Australia

20 June 2017

Dear Ms Beekharry

I write to confirm the commitment of DEAKIN UNIVERSITY to providing a safe workplace for its staff, students and contractors. We confirm that activities carried out by

- staff and contractors towards fulfilment of Bushfire and Natural Hazards CRC Project Agreements and
- students funded in full or in part by Bushfire and Natural Hazards CRC scholarships,

will be conducted under the DEAKIN UNIVERSITY Occupational Health and Safety Policies and Guidelines. A copy of those policies may be found at www.deakin.edu.au.

Yours truly,

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