DISASTERS AND ECONOMIC RESILIENCE: THE INCOME EFFECTS OF CYCLONE OSWALD 2013 ON SMALL BUSINESS OWNERS

A case study on the Burnett River Catchment Area

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END USER STATEMENT

Jane Carey & Laura Gannon, *Queensland Reconstruction Authority, QLD*

The Queensland Reconstruction Authority (QRA) welcomes this research which gives valuable insights into the economic impacts of flood events on communities in the Burnett River Catchment Area. Its particular focus on small business highlights the importance of building economic resilience to minimise the impact of disaster induced shocks on communities vulnerable to disasters.

This research complements QRA's Burnett Catchment Flood Resilience Strategy which takes a locally-led, catchment-based approach to building flood resilience. The Strategy also aims to strengthen the resilience of Individuals, communities, the economy and both the natural and built environments.

Engagement with residents of the Burnett Catchment undertaken through the development of the Burnett Catchment Flood Resilience Strategy highlighted anecdotal evidence that repeated storm and flood events have taken an emotional and financial toll on vulnerable people in the catchment. This research grounds this anecdotal evidence in economic analysis and confirms the importance of economic resilience as a key component underpinning community resilience.

Further, this research confirms the important role for government assistance in the form of disaster relief and recovery programs in supporting small business and the agricultural sector to support recovery and mitigate financial losses caused by disaster events.

Marcin PIUS*, Emergency Management Australia, ACT*

Emergency Management Australia (EMA), as the national emergency management coordinating body, including national recovery policy, may have an opportunity to use findings from these reports at various national recovery fora, encouraging the recovery community to consider the findings in the design of future recovery policy and programs. EMA is often involved in reviewing national recovery handbooks, development of guidelines and frameworks and could use the report findings to guide the content of the resources being developed. Finally, in respect of sharing the results of this research, EMA will include these reports in its knowledge management repositories making it available to recovery communities across all jurisdictions.

KEY TERMS USED IN THIS REPORT

TABLE 1 ACRONYMS USED IN THIS REPORT

Acronym	Explanation
ABS	Australian Bureau of Statistics
ACLD	Australian Census Longitudinal Dataset
ANZSIC	The Australian and New Zealand Standard Industrial Classification (ANZSIC) provides a basis for the standardised collection, analysis and dissemination of economic data on an industry basis for Australia and New Zealand
GDP	Gross Domestic Product
LGA	Local Government Area
NDRRA	Natural Disaster Relief and Recovery Arrangements
DRFA	Disaster Recovery Funding Arrangements
SA2	Under the Australian Statistical Geography Standard framework used by the Australian Bureau of Statistics, Statistical Areas Level 2 (SA2) are medium-sized general purpose areas built up from whole Statistical Areas Level 1. Their purpose is to represent a community that interacts together socially and economically.

TABLE 2 DEFINITIONS OF KEY TERMS

Term	Definition	Definition Source
Impact	The broadest term; includes both market-based (i.e. tangible) and non-market (i.e. intangible) effects. Individual impacts can be either negative or positive.	Stephenson, 2010
Difference in differences modelling	Difference-in-differences modelling is a quasi-experimental method that allows for evaluating the impact of a "treatment" on a group of interest. It is a natural experiment, in which one group has experienced the treatment, whereas another comparable group has not. The impact of the treatment is estimated by looking at the difference between the changes experienced by the two groups before and after the treatment.	Kennedy, 2003
Direct impact	Impacts that result from direct contact with the event	Stephenson, 2010
Disaster risk	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. Annotation: The definition of disaster risk reflects the concept of hazardous events and disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socioeconomic development, disaster risks can be assessed and mapped, in broad terms at least. It is important to consider the social and economic contexts in which disaster risks occur and that people do not necessarily share the same perceptions of risk and their underlying risk factors.	UNISDR, 2018
Economic resilience	At the macrolevel, static economic resilience refers to the ability or capacity of a system to maintain function (continue production) when shocked, while dynamic economic resilience is the ability and speed of a system to recover from a shock.	Xi et al., 2018
	At an individual level, this study considers an individual's income stream as effectively representing their economic resilience of to external shocks.	Author

Indirect impact	Impacts that arise as a consequence of the direct impacts of the event. For example, disruption to the flow of goods and services in and out of the affected area.	Stephenson, 2010
Natural disaster	Disasters caused by natural hazards. Natural hazards only lead to 'disaster' if they intersect with an exposed and vulnerable society (interrupting these systems) and when the consequences exceed people's capacity to cope.	Commonwealth of Australia, 2018a
Natural hazard	A natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation	UNISDR, 2018
Small Business	A small business is defined as a business employing less than 20 people. Categories of small businesses include: - non-employing businesses - sole proprietorships and partnerships without employees; - micro businesses - businesses employing less than 5 people, including non-employing businesses; - other small businesses - businesses employing 5 or more people, but less than 20 people.	ABS
	For the purposes of our study, we consider only small business owners who employ between 1 and 19 people.	Author
Tangible impact	Impacts on items that are normally bought or sold and that are therefore easy to assess in monetary terms	Stephenson, 2010
Intangible impact	Impacts on items that are not normally bought or sold. Social and environmental impacts are considered to be intangible	Stephenson, 2010
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and function through risk management.	UNISDR, 2018
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.	UNISDR, 2018

1. EXECUTIVE SUMMARY

"With five events in two years and the recently released Climate Commission Report that indicates our region can expect higher risk of heavy rainfall, there is a responsibility to at least identify the real cost to the community of flood events" – Mark Pitt, CEO, North Burnett Regional Council (2013)

Small businesses are regarded as the backbone of Australia's economy, forming up to 98% of Australian businesses and employing around 44% of Australia's private sector workforce (Australian Bureau of Statistics, 2018). In some sectors like agriculture and construction, small businesses represent over 70% of all businesses (Gilfillan, 2018).

Beyond employment, small businesses are integral to the social fabric of their communities, supporting local initiatives and providing important physical places for community members to socialise and engage with each other. This is especially true for regional areas with tight-knit communities.

Despite their economic importance, little empirical research has been done to understand the impact of natural disasters[1] on small businesses, and the efficacy of government assistance programs in promoting their recovery.

To that end, the *Disasters and Economic Resilience: The income effects of Cyclone Oswald 2013 on Small Business Owners – a case study on the Burnett River Catchment Area* report explores the impact of ex-Tropical Cyclone Oswald 2013 on the incomes of small business owners residing in the four Burnett River Catchment local government areas (LGAs) depicted in FIGURE 1.

FIGURE 1 IN-SCOPE BURNETT RIVER CATCHMENT AREA LGAS

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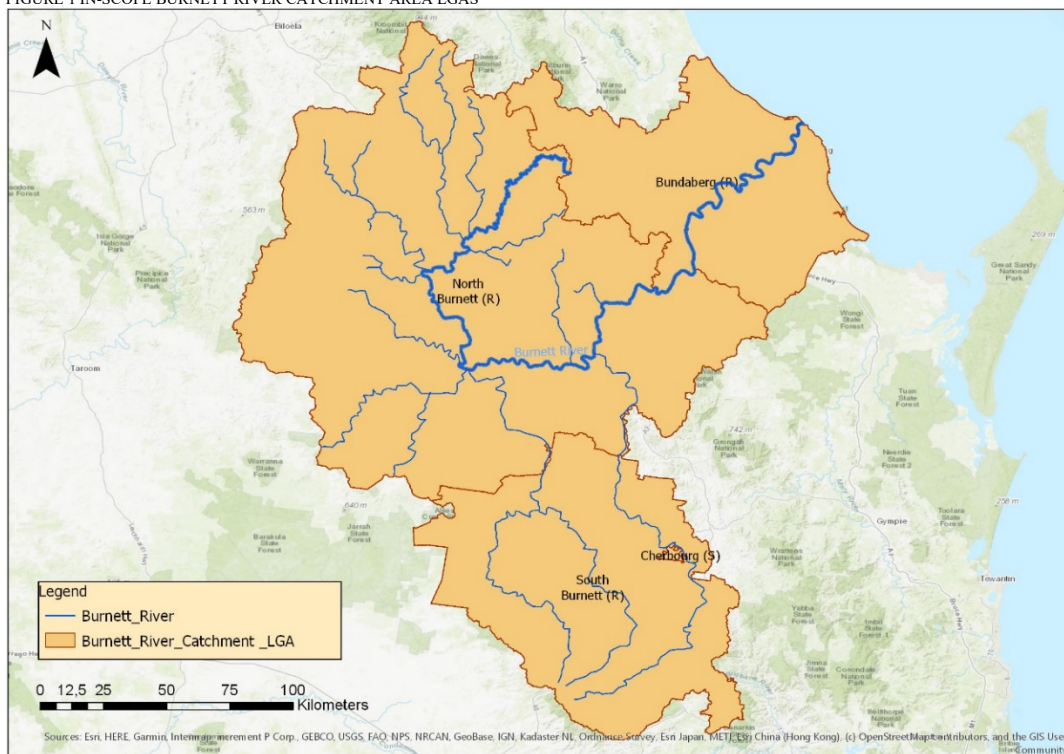
[1] Defined in this study as disasters arising from natural hazards. Please refer to Table 2 for full definition.

From 22 to 29 January 2013, Category 1 ex-tropical Cyclone Oswald moved across parts of Queensland and New South Wales, causing severe storms, flooding and tornadoes. The associated flooding and extreme weather events were declared a disaster in 53 Queensland LGAs, with the most devastating felt in the Bundaberg and North Burnett regions, damaging key infrastructure including sewerage systems and economically important assets including ports and road networks relied on by agricultural and manufacturing enterprises in the area. The record flooding in Bundaberg forced the evacuation of over 7,500 residents and damaged over 2,000 homes.

Thus, the flooding events associated with Cyclone Oswald that occurred in this region present a unique opportunity to causally investigate the impacts of a major disaster on small businesses in a regional community with an important agricultural base.

Isolating the effects of the floods from other shocks that hit the Burnett River catchment LGAs is challenging. The report pinpoints the income effects of Cyclone Oswald 2013 by using a difference-in-differences modelling approach. This approach compares the income changes of small business owners living in the Burnett River Catchment LGAs (treatment group) with those living in the comparable Richmond Valley LGAs in New South Wales (control group). Because of their comparability, it is the control group which provides us with the income path that would have occurred for the Burnett small business owners had the floods *not* happened, and thus enable us to compute any income deviations (losses or gains) arising from the associated flooding events.

The report utilises the Australian Census Longitudinal Dataset (ACLD)[2], which provides a unique opportunity to robustly examine the flood's impacts. Our results are net results, post any disaster relief and recovery efforts; are relative to our baseline year (2011); and are compared to our control group. As the Census date allow us to explore the effects up to three years post Cyclone Oswald, we define our 2011-2016 results as medium-term results.[3]

1.1 KEY INSIGHTS

1. Cyclone Oswald caused substantial income losses for small business owners in Bundaberg, North Burnett and South Burnett regional councils

As a result of Cyclone Oswald 2013, employing small business owners in the Burnett River catchment area LGAs suffered 45.3% income losses, or average income losses of $21,004.6 AUD. Based on small business numbers at the time, this equates to overall income losses of at least $78.2 million.

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[2] Available through the ABS DataLab.

[3] From a recovery perspective that temporal descriptors such as "short/medium/long term" have different meanings when compared to economic terminology. QRA's Queensland Recovery Plan 2017 defines "medium term" recovery as the "recovery and reconstruction phase" which is "the integrated execution of the deliberate, methodical recovery, and reconstruction to achieve an enhancement in outcomes for disaster affected individuals, communities, functions and infrastructure". "Long term" recovery occurs when the community realises its post-disaster "new normal" state when "all recovery and reconstruction responsibilities are managed as business as usual, namely when recovery efforts can be delivered without the support of additional resources". We would like to thank Jane Carey for clarifying these distinctions for us.

Given the heavy representation of agricultural small businesses in these areas, these losses reflect the sensitivity of the agricultural sector to disaster-induced economic shocks. They are also consistent with other economic estimations of Cyclone Oswald's impacts on the Burnett region, which put the agricultural losses at $265 million in Bundaberg and North Burnett alone (Queensland Government, 2018a).

2. **Small businesses in regional economies are vulnerable to the cascading effects of disasters owing to the composition of their workforces and economies**

It is already well known that disasters can have knock-on effects on supply chains, production and sales. For regional communities, such effects are more amplified, particularly in socioeconomically disadvantaged regional areas with less diversified or more disaster-sensitive economies, and whose workforces often live locally. For small business owners, this means they are often hit "twice" by disasters (Bannock, 2005), which is reflected in the experiences of small and medium enterprise owners in other major disasters like Cyclone Yasi (Kuruppu et al., 2013).

Consistent with these broader tends, our economic profiling reveals that most of the Burnett River region's employed residents (94%) work locally, with disaster-sensitive agricultural and construction businesses the predominant small business enterprises in these areas.

Compared to other areas in Australia, communities in the Burnett River catchment council areas[4] have been assessed as having low capacity to cope with and adapt to disasters arising from natural hazards (Parsons et al., 2019), which would have flow-on consequences on the ability of small businesses to return to "normal" levels of business activity when disasters strike.

Here, we note that Cyclone Oswald caused widespread damage in the region, with 2,000 houses damaged in Bundaberg alone. Apart from business disruptions, small business owners in these areas may have also suffered flood-related damages to personal property. This could delay business recovery where private household repairs are prioritised over reopening businesses and supporting broader economic recovery in the area, which anecdotally appears to be the case in Bundaberg (Insurance Business Australia, 2013).

3. **Government disaster relief and recovery programs play an important role in supporting regional economies recover from disasters**

While other market-based recovery means such as insurance payments are available, small business flood insurance uptake in Australia is rare, with significant rates of under-insurance or no insurance compared to residential insurance (Insurance Council of Australia, 2015). In this setting government disaster relief and recovery efforts typically step in to support small businesses for recovery.

Cyclone Oswald 2013 government relief and recovery assistance totalled over $1.53 billion, with approximately $12 million more directly assisting small businesses. As the income losses arising from Cyclone Oswald are net losses, this means that the significant post-disaster government relief and recovery efforts

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[4] At the corresponding SA2 areas.

could not fully mitigate the cyclone's impact on incomes of small business owners in the medium-term.

However, we consider that government prioritisation of economically critical rebuild efforts is likely to prevent income losses for small business owners from being far greater. For instance, the agricultural losses from Cyclone Oswald in North Burnett and Bundaberg were estimated at $265 million. Thus, prioritising funding and completion of dredging works at Port Bundaberg before the sugar cane harvesting season prevented further losses to the agricultural sector in North Burnett and Bundaberg, which is predominantly made of small businesses.

4. Small businesses must be part of actions to reduce disaster risks in Australia

The average annual total economic costs of natural disasters of Australia are forecast to reach $39 billion per year by 2050 (Deloitte Access Economics, 2017).[5] This figure does not take into account climate change, which will see coastal communities in the Wide Bay-Burnett region like Bundaberg increasingly subjected to flooding events and inundation from rising sea levels (Queensland Government, 2011), and thus further costly disasters like Cyclone Oswald.

Our small business income findings illustrate how costly such inundations can be on a small but important section of such coastal communities. Given the prevalence of small businesses across industry sectors, and importance for employment, it is critical that small businesses are encouraged to more proactively consider and manage the risks associated with the potential for more extreme weather events like Cyclone Oswald.

We note that this is already being actively encouraged by regulators of larger businesses including ASIC (ASIC, September 2018). With its emphasis on collective action to reducing disaster risks, the Australian National Disaster Risk Reduction Framework 2018 is a step in the right direction.

1.2   WHERE TO FROM HERE?

Disasters and Economic Resilience: The income effects of Cyclone Oswald 2013 on Small Business Owners – a case study on the Burnett River Catchment Area is one of four natural disaster case studies explored as part of the Optimising Post-Disaster Recovery Interventions in Australia research program, which were chosen to unpack the economic effects that disasters of different types and scales can have on metropolitan and regional communities:

• The Victorian Black Saturday Bushfires 2009

• The Western Australian Toodyay Bushfires 2009

• The Queensland Floods 2010-11

• Cyclone Oswald 2013 (this study).

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[5] This figure is in 2017 prices and does not consider the impact of climate change.

Disasters and Economic Resilience: The income effects of Cyclone Oswald 2013 on Small Business Owners – a case study on the Burnett River Catchment Area has quantified indirect impacts associated with a major disaster on small business owners residing in regional communities.

In doing so, it has provided policymakers with a valuable insight into the effects of severe disaster-induced economic shocks on small business enterprises, who constitute a large share of Australian businesses and are significant employers of the private sector workforce. This provides causal evidence to support a key insight in our Queensland Floods 2010-11 report, namely that business ownership and employment sectors are two channels through which disaster-induced shocks can affect individuals, vis-à-vis income.

The report has also helped demonstrate how such quantification exercises of indirect costs of disasters can be done, a current gap in disaster impact estimation, using national accounts records. Such an approach aids in better understanding economic vulnerabilities to disasters, as recommended by the National Disaster Risk Reduction Framework; and in informing evaluations of disaster recovery programs, as under the National Impact Assessment Framework.

More specifically, our research suggests that there may be a need to consider how to frame assistance under Australia's disaster relief and recovery arrangements, particularly where there are interlinkages between losses that create compounding and cascading economic effects on individuals. That is, where small business owners are unable to reopen their business due to the cost and priority in re-building or repairing their own disaster-damaged homes. For severe disasters, this may mean extending recovery assistance timeframes, particularly in less diversified and more disaster-sensitive regional economies.

Looking ahead, other case studies under the broader Optimising Post-Disaster Recovery Intervention Program will further consolidate our understanding of indirect costs of disasters arising from natural hazards, and provide significant input in a policy brief note on post-disaster recovery interventions in Australia. This note will be an input into the development of a guideline for optimising budget allocation across economic sectors in both pre-disaster mitigation as well as post-disaster recovery phases.

Extensions to this research are warranted to better understand the barriers that prevent small businesses from reducing their own exposure, and therefore risk, to the often high costs of such disasters. Here, the National Disaster Risk Reduction Framework's emphasis on collective action offers an important step in the right direction towards considering what can be done to reduce risks posed by disasters.

2. INTRODUCTION

The *Disasters and Economic Resilience: The income effects of Cyclone Oswald 2013 on Small Business Owners – a case study on the Burnett River Catchment Area* report measures the income changes for small business owners living within the boundaries of the Burnett catchment area LGAs:

- Bundaberg Regional Council, an amalgamation of the City of Bundaberg and shires of Burnett, Isis and Kolan since 2008

- Aboriginal Shire of Cherbourg

- North Burnett Regional Council, an amalgamation of the shires of Biggenden, Eidsvold, Gayndah, Monto, Mundubbera, and Perry since 2008

- South Burnett Regional Council, an amalgamation of the shires of Kingaroy, Nanango, Murgon and Wondai since 2008.[6]

The flooding events associated with Cyclone Oswald that occurred in this region present a unique opportunity to causally investigate the impacts of a major disaster on small businesses in a regional community.

In this report, we use difference-in-differences modelling[7] to estimate these income effects. The Australian Census Longitudinal Dataset[8] (ACLD) is our primary dataset. In examining the income effects, we consider whether and how the government's relief and recovery expenditures assisted these owners to resume their normal economic course to the extent that complementary publicly available government data are available.

As our research focuses on income effects for small business owners, such effects are microeconomic in nature; can be quantified (thus tangible) and are an indirect consequence of the disaster, thus fall within indirect market economic welfare effects (FIGURE 4). Such impacts are rarely assessed, despite evidence suggesting them to be of a greater magnitude than the more readily quantified direct costs (Ibarrarán et al., 2009).

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[6] The upper areas of the Burnett River Catchment also include small parts of Gympie and the Western Downs LGAs, which are not included in this analysis.

[7] See Table 2 for definition.

[8] Available through the Australian Bureau of Statistics (ABS) DataLab.

FIGURE 2 WHERE OUR PROJECT SITS WITHIN THE BROADER ECONOMIC IMPACTS ASSESSMENT OF NATURAL DISASTERS
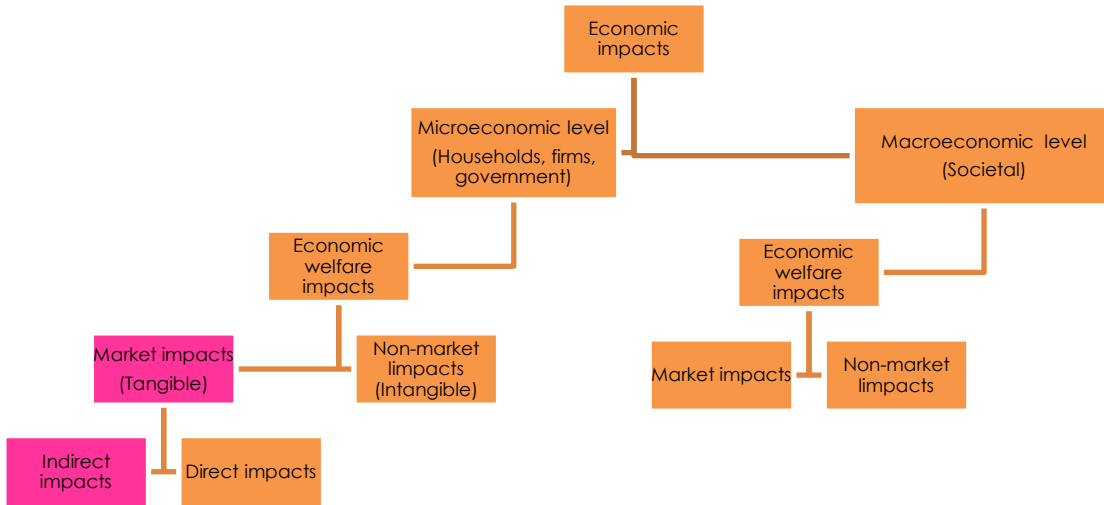
Out of scope are any other indirect effects[9] or other economic costs described in FIGURE 4. The project also does not assess the role insurance could have played in reducing or mitigating the effects of the floods. This is predominantly because of the dearth of insurance data at the LGA level, and is listed as a limitation of this study.

FIGURE 3 ECONOMIC COSTS OF NATURAL DISASTERS
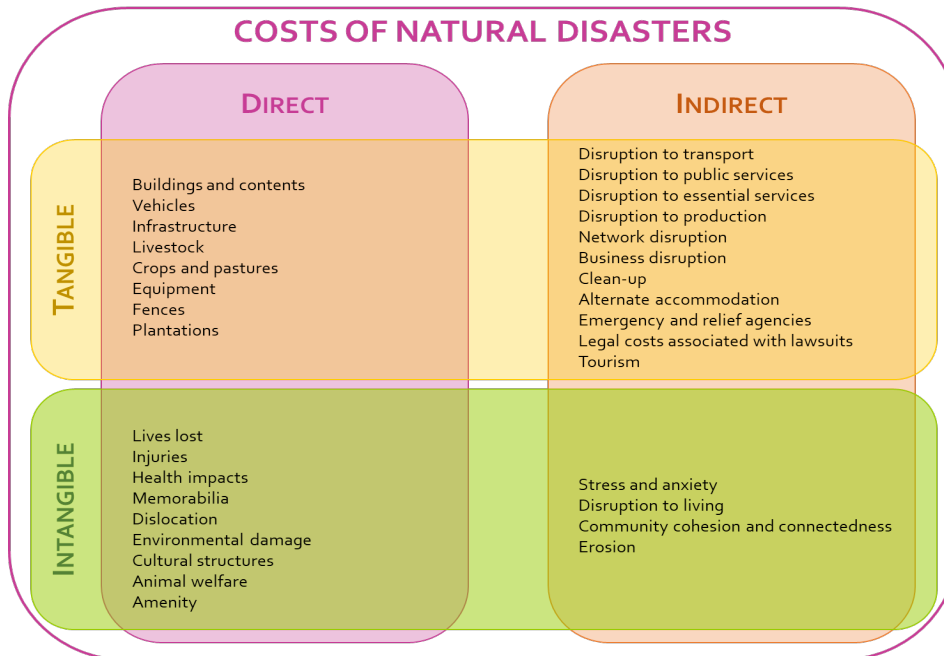
SOURCE: PENMAN ET AL. (2019)

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[9] See Table 2 for definitions of these terms.

The rest of the report Is organised as follows. We provide a brief review of relevant literature, then set the context by the Burnett River catchment area's economy, its susceptibility to flooding events, and the known impacts of Cyclone Oswald on the in-scope LGAs. We then outline the research approach we have taken to estimating the Cyclone-induced flooding impacts, highlighting the implications of key assumptions and limitations, before turning to reporting and discussing the implications of our results.

3. LITERATURE REVIEW

Like elsewhere in the world, small businesses are the backbone of Australia's economy. Small businesses form up to 98% of Australian businesses and employ around 44% of Australia's private sector workforce (FIGURE 4; Australian Bureau of Statistics, 2018). In disaster-sensitive sectors like agriculture and construction, small businesses represent over 70% of all businesses (Gilfillan, 2018).

FIGURE 4 AUSTRALIAN BUSINESSES, BY EMPLOYMENT SIZE (%)
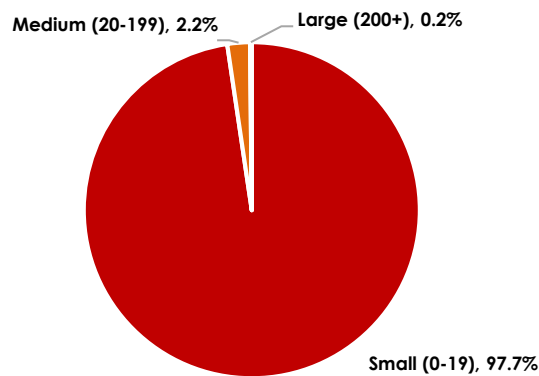
SOURCE: ABS CAT 8165.0 COUNTS OF AUSTRALIAN BUSINESSES, INCLUDING ENTRIES AND EXITS, JUN 2014 TO JUN 2018

Many small business owners are also residents of the areas they work in (Bannock, 2005), and so contribute at a personal level to the communities they are in. Importantly for more regional communities, more than 95% Australian broadacre and dairy farms (which represent 68% of all Australian farms) are family operated (Commonwealth of Australia, 2013). For these businesses, the relationship between household and business prosperity are intricately linked; what happens in an owner's household can impact the owner's business (Winter et al., 2004).

Despite their significance, little research has been done to understand how small businesses are impacted by, cope with and adapt to disasters.

In reviewing the existing literature on business survival, Marshall et al. (2015) noted that being an older (more experienced) businesses, or having past experience with adversity, including cash flow problems and disasters, appear to have increased business resilience and enabled these businesses to survive Hurricane Katrina. Importantly for our study, they also noted that business location mattered, with home-based businesses less likely to meet demise, compared to coastal counties.

From international experience, small businesses face greater short-term losses after a disaster than larger businesses (Chang and Falit-Baiamonte 2002). With many small business owners living locally, this means they are often hit "twice" by disasters (Bannock, 2005), as exemplified by this Australian example:

> "There was a large amount of anxiety in the community about external building companies. What happened after the cyclone was

that there was almost a convoy of building people coming into town to pick up building work on the recovery. The local builders, who were looking after their mates and cleaning the streets and dealing with local issues, were very emotionally concerned at a time when they had to look after their families and had to look after their neighbours, about not getting a portion of the work available or getting the less enticing components of work." (Kuruppu et al., 2013)

While the extent of damage is an important indicator on the ability to reopen a business, the true economic costs of disasters are often reflected in the income losses from business disruptions *post* disasters, which are underestimated by government and insurance companies (Corey and Deitch 2011; Downton and Pielke 2005)).

Disruptions that impacted the ability of generating revenue have been found to have a material impact on business continuity. In reviewing the literature, Sydnor et al. (2017) point to problems with employees getting to work, losses to customer base, difficulties in moving supplies, and disruptions to supply chains and essential infrastructure and services (water, electricity and communication services). Interestingly, they mention a Christchurch earthquake study by Brown et al. (2015) in which businesses indicated that damage to their local neighbourhood was more disruptive than damage to the building's contents.

This also appears to be the experiences of Australian businesses, as reflected by interviews by Kuruppu et al. (2013) with Australian SMEs,[10] many of whom experienced recent disasters:

"Cyclone Larry had quite a severe effect on our business. We had to look to the government for assistance to survive for the following six months because there were hardly any tourists coming to the area. We couldn't run any tours for six months or so because the islands were so badly devastated, people weren't coming into the area and to run a tourist operation just wasn't an option.[…] It devastated us, we had no business and still our business is probably just half of what it was prior to the cyclone"

"There were no phones for four days (after cyclone Yasi), no power for a month and cutoff roads and this meant that there was no communications."

The interviews also pointed to the flow-on effects on other communities, and the ongoing difficulties for regional business operators:

The conference centre [in Marysville] purchased all its meat from a butchery in another little village nearby and its eggs and fruit and vegetables from other towns. So, as well as the local businesses within the town that the fire occurred, these outlying villages and businesses were impacted greatly. One of them actually closed down and then another had to change the direction of their business.

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[10] Businesses with less than 200 employees.

"It's probably easier of course, to be better absorbed in an urban area. If the one pharmacy in a town closes, or the hospital's destroyed, there's a hospital a couple of blocks away. So I guess there's those sorts of geographic issues. In the urban environment there's a bigger critical mass, it isn't as reliant on the one or two small businesses to keep things ticking over. There are businesses that tend to step in and take over in an urban area That's not possible in a rural or regional area."

The additional (unproductive) workload in preparing for disasters that may not eventuate was also mentioned:

"In the whole ground floor of our building everything was removed to the second floor. So there was no furniture or there was nothing in the ground floor and then on the second and third floor - we have a three floor building everything was raised off the ground, because what happens in a cyclone is all the rooms get washed out with water. So there was a lot of work to relocate, protect everything that we had and then a huge amount of work to get back in-situ and to operate again."

What aids in small business recovery in Australia? From past government reviews, it is known that flood insurance among Australian small businesses is rare, with rates of coverage much lower than for residential insurance (Commonwealth of Australia, 2011). This means that in times of disaster, small businesses are primarily reliant on government disaster relief and recovery assistance to cope with and recover from disasters.

Here, again research by Kuruppu et al. (2013) is illuminating. The research points to several key vulnerabilities related to government processes that could constrain SMEs in coping with extreme events. These are:
• the short-term nature of government-led business recovery programmes
• the limited support available to SMEs who were indirectly impacted by extreme events
• limited support and recognition given to the psychological impacts on SMEs of extreme events
• the rigid and inflexible eligibility criteria for government recovery funds across certain jurisdictions
• the reactive nature of recovery processes which overlook the underlying business vulnerability associated with prevention and preparedness.

4. SMALL BUSINESSES IN THE BURNETT RIVER CATCHMENT LGAS

4.1 ECONOMIC PROFILE

The regional councils of Bundaberg, North Burnett and South Burnett, and Aboriginal Shire of Cherbourg are situated in the Wide Bay-Burnett region,[11] a region abundant with significant natural resources.

The agriculture, fisheries and forestry sector plays an important role in the Wide Bay-Burnett region. Around 33,000 square kilometres, or 68% of the region, is devoted to agricultural land uses, with the most common use (by area) being grazing modified pastures (36% of the region) (ABARES, 2018). The region's timber and forestry industry accounts for two-thirds of Queensland's softwood plantation resources (Wide Bay Burnett, n.d.). Between 2011 and 2016, the Wide Bay-Burnett agricultural sector contributed on average $1.2 billion annually to Queensland's economy, or 11% of the state's annual total gross value of agricultural production.[12] Other important employment sectors in the Wide Bay-Burnett region include retail trade and construction.

FIGURE 5 BROAD LAND USE IN THE WIDE BAY-BURNETT REGION
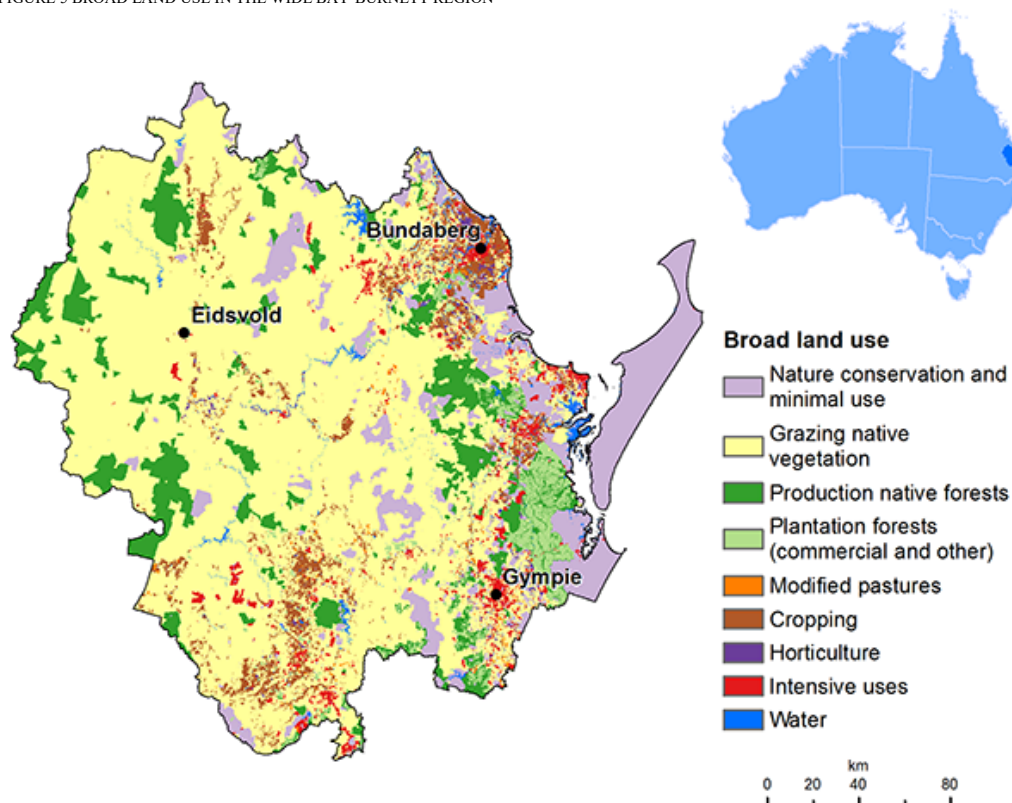
SOURCE: ABARES, 2018

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[11] The other LGAs in the Wide Bay-Burnett region are Gympie Regional Council and Fraser Coast Regional Council.
[12] Australian Bureau of Statistics, cat no. 7503.0 – Value of Agricultural Commodities Produced, Australia (2011-12 to 2015-16).

Within our Burnett River catchment LGAs, small businesses are the predominant businesses type, constituting around 97% of businesses in the Bundaberg, North Burnett and South Burnett council areas (Australian Bureau of Statistics, 2018). In 2013, the year of Cyclone Oswald, there were around 12,100 small businesses operating in these councils, or 88 small businesses for every 1000 residents.

Most small businesses (~67%, or ~8,200) in these council areas are non-employing, i.e. are run by sole traders or as business partnerships. Those that do employ are often microbusinesses employing between 1 and 4 employees (FIGURE 5).

FIGURE 6 SMALL BUSINESSES, BY EMPLOYMENT SIZE AND LGA
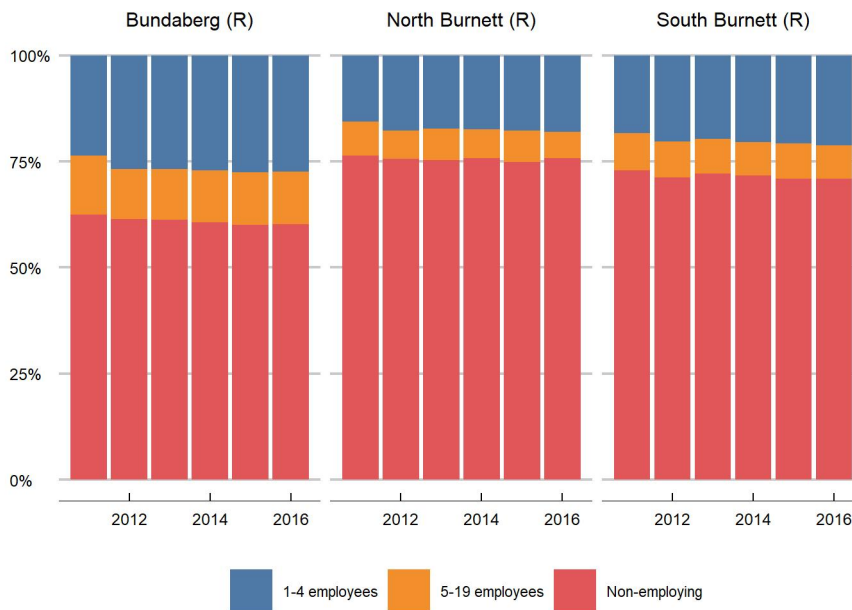
SOURCE: ABS CAT 81650: COUNTS OF AUSTRALIAN BUSINESSES, INCLUDING ENTRIES AND EXITS. NOTE: AGGREGATED BY SA2S THAT CORRESPOND WITH BURNETT RIVER CATCHMENT LGAS. CHERBOURG INCLUDED IN SOUTH BURNETT (R).

With 94% of employed residents working within the regional councils,[13] many residents of Bundaberg, North and South Burnett are either small business operators or working for a small business.

Unsurprisingly, these small businesses are heavily concentrated in the agriculture, forestry and fishing sector (FIGURE 6). This is especially true for North Burnett, where around 62% of small businesses are agricultural enterprises (FIGURE 6). Primary agricultural industries in this LGA include citrus, beef, fodder crops, small crops, pork, broad acre crops, timber and milk production (North Burnett Council, n.d.).

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[13] Based on analysis of 2011 Census data on employed persons, by LGA, place of residence and place of work. Data Source: Census of Population and Housing, 2011, TableBuilder

FIGURE 7 SMALL BUSINESSES, BY INDUSTRY SECTOR AND LGA (NUMBER, % OF TOTAL BUSINESSES)
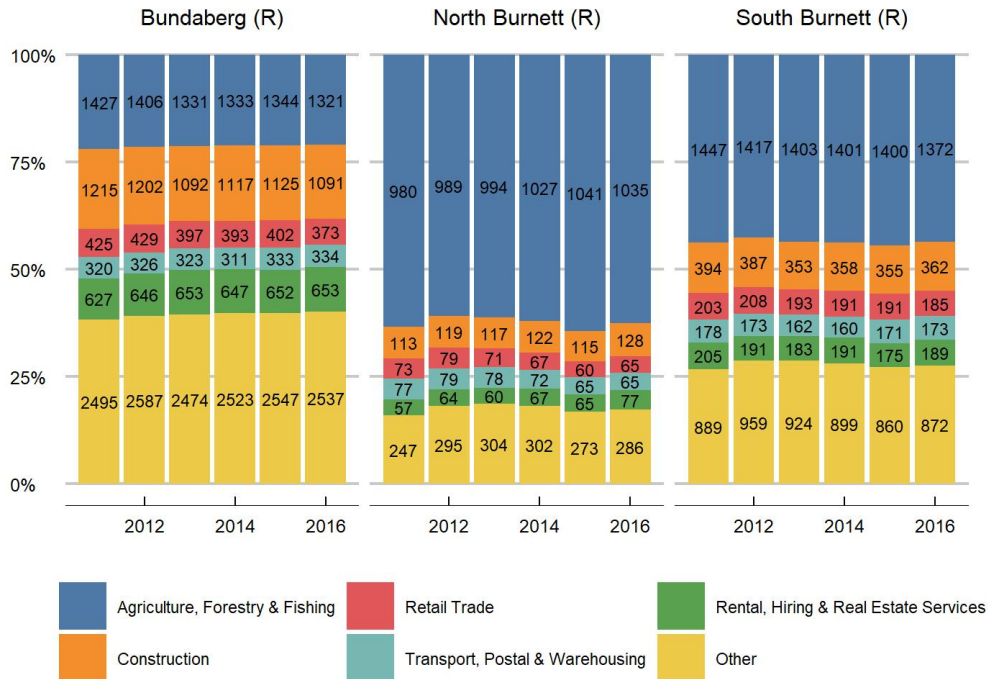
SOURCE: ABS CAT 81650: COUNTS OF AUSTRALIAN BUSINESSES, INCLUDING ENTRIES AND EXITS. NOTE: AGGREGATED BY SA2S THAT CORRESPOND WITH BURNETT RIVER CATCHMENT LGAS. CHERBOURG INCLUDED IN SOUTH BURNETT (R).

In South Burnett, agricultural enterprises account for 43% of small businesses. Peanuts, navy beans, cattle and pigs are among the region's notable agricultural produce (South Burnett Regional Council, 2019).

Underlying its status as the commercial enterprise capital of the Wide Bay-Burnett region, Bundaberg's small businesses are relatively more diversified than the other LGAs, with a greater share of small businesses engaged in construction activities. Agricultural enterprises in Bundaberg are significant producers of sugar cane, small crops, fruits and nuts. Bundaberg is also well known for manufacturing, including rum and brewed drinks. Its tourism is also reflected in the significant number of small businesses (around 650 across the period) operating in the rental, hiring and real estate services sector.

Gross regional product grew from $6.4 billion in 2011 to $6.75 billion in 2016 (2016-17 prices), largely underpinned by Bundaberg and South Burnett (FIGURE 7).

FIGURE 8 HEADLINE GROSS REGIONAL PRODUCT ($MILLIONS)
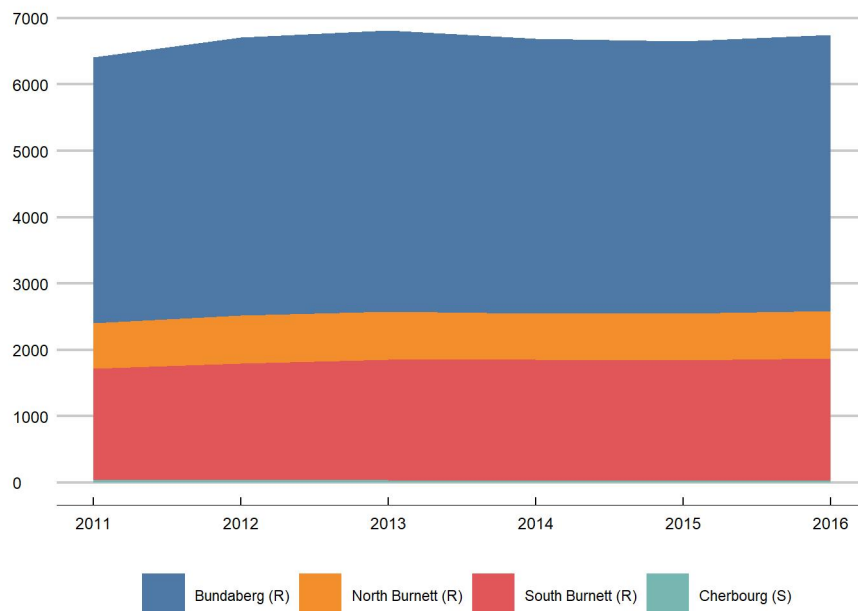
SOURCE: NATIONAL INSTITUTE OF ECONOMIC AND INDUSTRY RESEARCH, 2019. VIA ECONOMY.ID. NOTE: DATA ARE BASED ON A 2016-17 PRICE BASE FOR ALL YEARS.

Looking ahead, the Burnett River catchment LGAs population is expected to grow from 139,119 in 2016 to 168,802 in 2041, again bolstered by population growth in Bundaberg and South Burnett (Queensland Government, 2018b). Based on current trends, by 2041, 1 in 3 people will be aged 65 and older in Bundaberg, North and South Burnett Queensland Government, 2018b).

These trends have broader implications on unemployment and the age demographics of each LGA, which naturally will impact the workforce upon which small businesses rely for labour and revenue. Unemployment is already a challenge for some LGAs in the area, particularly Bundaberg and Cherbourg which were consistently been above the state average over our study period.

4.2 DISASTER PROFILE
4.2.1   Disaster susceptibility

Major flooding events along the Burnett River are relatively infrequent, but can cause significant damage to rural properties, commercial and residential areas when they happen (Bureau of Meteorology, 2019).

Major floods have been recorded at Bundaberg in 1875, 1890, 1893, 1928, 1942, 1954, 2010 and 2013 (Bureau of Meteorology, 2019). At 9.53 metres, the 2013 flooding events associated with Cyclone Oswald were the highest recorded flood levels since records began (FIGURE 8).

FIGURE 9 HIGHEST ANNUAL BURNETT RIVER FLOOD PEAKS, BUNDABERG
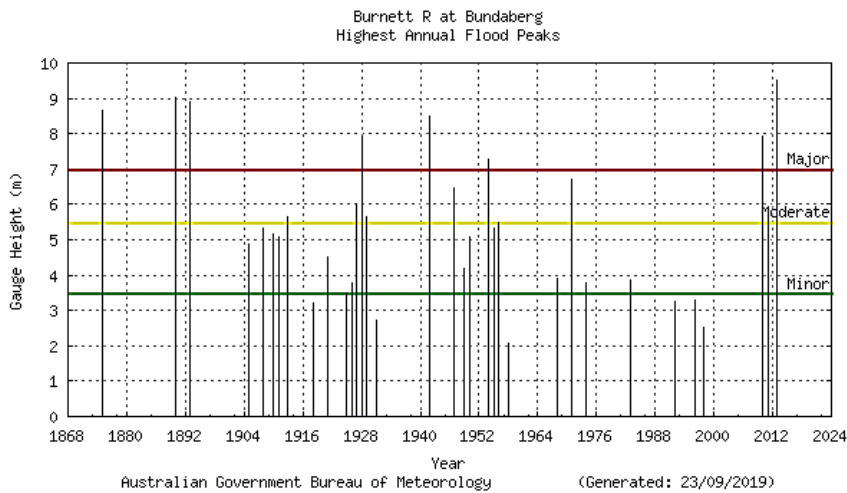
SOURCE: BOM 2019

In North Burnett, flood levels have exceeded 10 metres in over 15 events (Bureau of Meteorology, 2019). The 1942 floods remain the most extreme flooding event in Mundubbera (North Burnett), when the Burnett river peaked at 23.62 (Bureau of Meteorology, 2019; FIGURE 9).

FIGURE 10 HIGHEST ANNUAL BURNETT RIVER FLOOD PEAKS, NORTH BURNETT
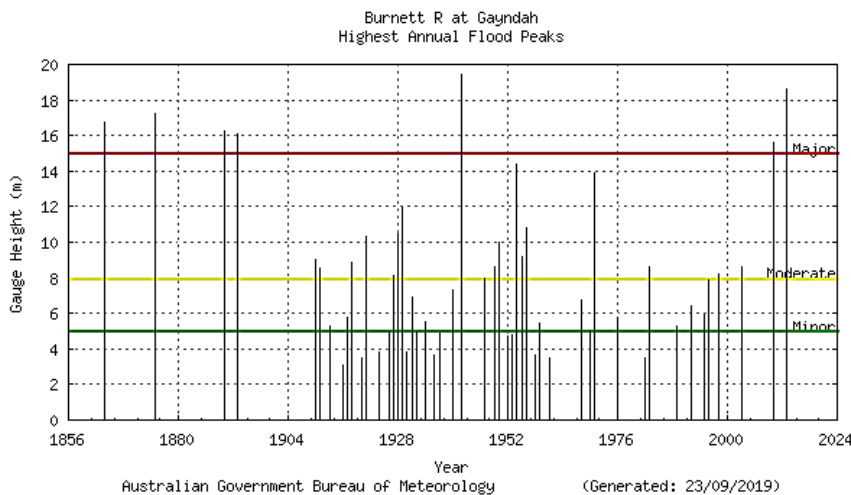
SOURCE: BOM 2019

A significant proportion of agricultural land and production is susceptible to flooding (FIGURE 10). Of the good quality agricultural land in the Burnett River catchment area, 38% is prone to flooding, with major implications on horticultural, cropping and livestock activities (Queensland Government, 2017b).

FIGURE 11 FLOODING RISKS TO PRIMARY PRODUCTION IN THE BURNETT RIVER CATCHMENT AREA
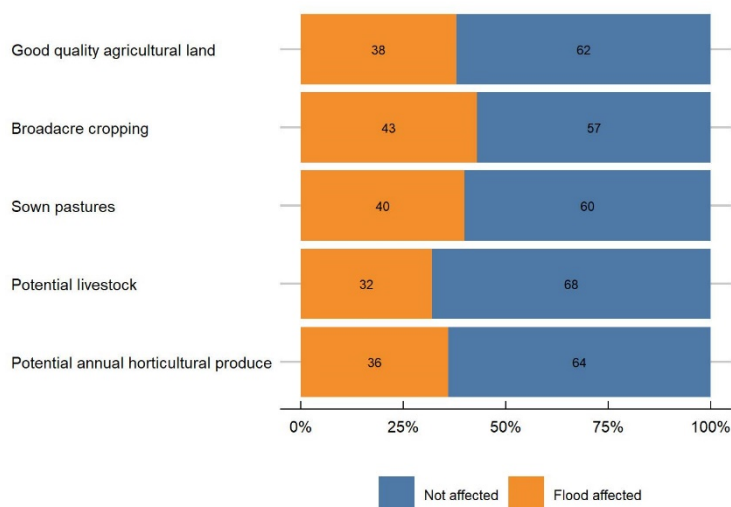
SOURCE: ADAPTED FROM: QUEENSLAND GOVERNMENT (2017B).

Climate projections for the Wide Bay-Burnett region include rainfall declines, increasing temperature and more extreme climate events. The region will increasingly be subject to flooding events and inundation from sea-level rise (Queensland Government, 2011), which will impact coastal industries and communities like Bundaberg, and have implications on agricultural production.

4.2.2 Disaster resilience

Not all Australian communities have the same capacity for disaster resilience (Parsons et al., 2019). Communities with lower capacity to deal with disasters will need more assistance so that they – and the local economies that support their social and economic wellbeing – can recover.

Here, the Australian Natural Disaster Resilience Index (ANDRI) is a national scale composite index that provides an evidence-based snapshot of the disaster resilience of SA2s across Australia. It defines resilience to disasters arising from natural hazards as: "the capacity of communities to prepare for, absorb and recover from natural hazard events and to learn, adapt and transform in ways that enhance these capacities in the face of future events." (Parsons et al., 2019).

ANDRI scores are available for SA2s corresponding with our in-scope Burnett River Catchment LGAs.[14] Compared to other Australian SA2s, all but one SA2 in Bundaberg (Branyan – Kensington) were ranked within the bottom quartile of SA2s and thus assessed as having low capacity for disaster resilience. Communities in areas assessed as having low disaster resilience "may be limited in their capacity to use available resources to cope with adverse events, and are limited in their capacity to adjust to change through learning, adaptation and transformation. Limitations to disaster resilience may be contributed by entrenched social and economic disadvantage, less access to or provision of resources and services, lower community cohesion and limited opportunities for adaptive learning and problem solving" (Parsons et al., 2019).

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[14] Approximate as SA2 and LGA boundaries do not completely overlap. All except one SA2 were assessed by the ANDRI project: SA2: 319021510 - North Burnett (Bundaberg LGA).

For small businesses operating in the Burnett River catchment LGAs, this has flow-on consequences on the speed by which they and their communities can socially and economically recover, and therefore is likely to play a role in their ongoing survival post disasters. Based on the experience of other regional communities, recovery can take up to 25 years to recover (Regional Australia Institute, 2013).

4.3 CYCLONE OSWALD 2013 FLOODING EVENTS

From 22 to 29 January 2013, Category 1 ex-tropical Cyclone Oswald moved across parts of Queensland and New South Wales, causing severe storms, flooding and tornadoes. The cyclone caused more than $2.5 billion dollars in damages across 57 LGAs in Queensland; from QRA records (December 2013) this includes:

- over 4,000 properties damaged, with more than 2,000 deemed uninhabitable

- more than 390,000 homes and businesses impacted by power interruptions

- approximately 750 businesses affected across the State

- more than 5,800 kms (17.5%) of state controlled roads closed

- 2,800 kms (39%) of the State rail network damaged or closed

- significant damage to crops and livestock, with sugar, citrus, pork and cotton production seriously impacted

- disruptions to operations at a number of coal mines, alumina refineries and ports.

The most severe impacts centred on the Bundaberg and North Burnett, which were among 20 councils – along with South Burnett – to receive Category D assistance under the Natural Disaster Relief and Recovery Arrangements.

Flooding in Bundaberg exceeded the highest recorded flood level, peaking at 9.53 metres, while in North Burnett, the river peaked at Mundubbera at 23 metres, 4 metres higher than the Queensland Flood 2010-11 events and almost equal to the 1942 record level (23.62 metres)(North Burnett Regional Council, 2013).

The floods resulted in the evacuation of over 7,500 residents and patients at Bundaberg hospital. Homes and businesses were inundated in Mundubbera, Gayndah, Eidsvold and Monto Bundaberg/ North Burnett, with damage to 2,100 homes (Queensland Reconstruction Authority, February 2013). Widespread impacts were also reported to public infrastructure, including bridges, roads, sewerage and water lines.

In total, the cost to LGAs within our case study area from the Cyclone-related flooding and extreme weather events was $302.3 million, equating to 70% of all disaster-related damage costs from 2008 to 2014 (TABLE 3).

TABLE 3 ESTIMATES OF COST OF NATURAL DISASTER EVENTS FOR QUEENSLAND COUNCIL ASSETS ($MILLION)

Burnett River LGA	2012-13 disaster event	2008-09 to 2013-14
Bundaberg (R)	$120.10	$180.70
Cherbourg (S)	$0.70	$1.40
North Burnett (R)	$117.80	$136.70
South Burnett (R)	$63.70	$111.90
Total	**$302.30**	**$430.70**

SOURCE: LGAQ (2014)

In North Burnett, the floods required the reconstruction and repair of more than 500 rural roads and town streets, replacement of two bridges, reconstruction or replacement of three town water intakes and reconstruction and repairs to park infrastructure (Queensland Reconstruction Authority, April 2014). In South Burnett, $21.7 million was spent on the restoration of roads, which was achieved through an introduction of a road levy (South Burnett Regional Council, 2014).

The economic costs from both direct damages and business disruptions were also substantial. Agricultural and fisheries losses in Bundaberg and North Burnett alone reported as $265 million (Queensland Government, 2018a), with severe impacts recorded for important activities including sugar cane cropping, livestock, small crops and fishing.

Burnett River LGA	2012-13 disaster event	2008-09 to 2013-14

5. RESEARCH APPROACH

5.1 MODEL

Severe shocks like Cyclone Oswald can alter the income path for individuals residing or working in disaster-hit areas.

In this report, we use difference-in-differences modelling to causally examine whether the floods associated with Cyclone Oswald caused the incomes of small business owners living in the Burnett River Catchment area to deviate (positively or negatively) from their original path. The model is formally defined as:

$$Y_{ict} = cons + \alpha_i + L_i + \beta_1 Treat_{it} + \beta_2 PostDisaster_{ct} + \beta_3 Treat_{it} \times PostDisaster_{ct} + \varepsilon_{ict}$$

where:

Y_{ict}	= Income
α	= Individual fixed effect
L	= LGA fixed effect
β_3	= Coefficient of interest
i	= Individuals
c	= Cluster/LGA
t	= 2011, 2016
ε	= Disturbance Term.

This model calculates the effect of the "treatment" (disaster event) on the outcome (i.e. individual income) by comparing the differences in average changes over time between the treatment group (here, small business owners residing in the disaster hit area) and the control group (comparable small business owners in a comparable area). The latter is chosen to closely resemble the treatment group and provide the counterfactual income trajectory.

FIGURE 11 illustrates a hypothetical case of how the difference-in-differences calculates a negative disaster effect on income.

FIGURE 12 ILLUSTRATIVE DIFFERENCE-IN-DIFFERENCES MODEL SHOWING A HYPOTHETICAL NEGATIVE DISASTER EFFECT
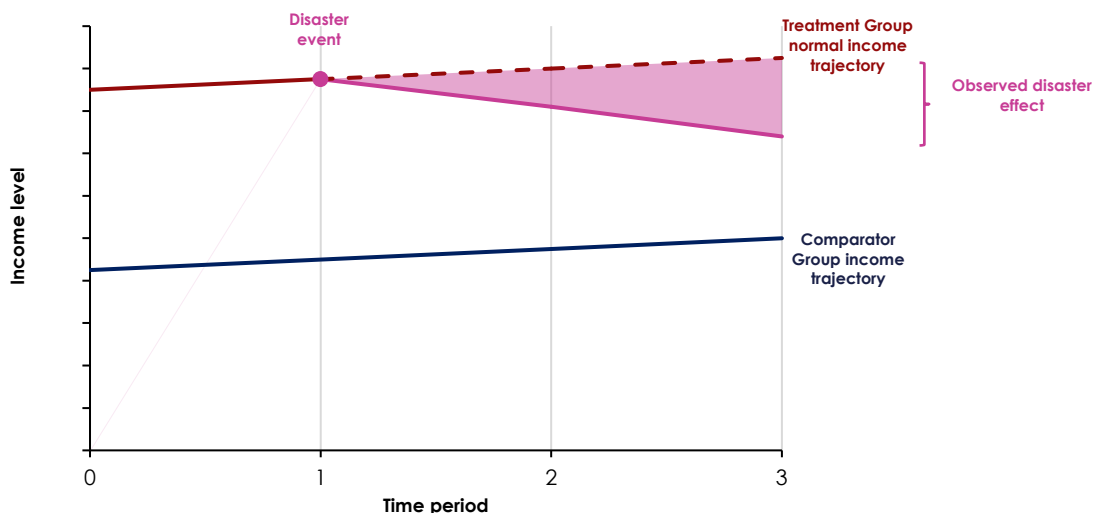
The pink solid line portrays the *observed* income trajectory in the treatment group and the dashed pink line represents the counterfactual income in the treatment

group, had the disaster not occurred at point 1. This counterfactual income trajectory is provided by the control group (the dark blue line). The vertical difference between the pink dashed and solid lines at point 2 reflect the disaster's income effect in the shorter term, while point 3 reflects the fully realised income effect of the disaster.

Worthy of mention is that we are not able to measure disaster relief and recovery assistance directly with data that would have enabled identifying its impact on individuals' income trajectory. Thus, the estimated income effect in our case is the *net* income effect of the disaster after the recovery and relief assistance has been provided.

5.2 DATASET

We utilise the rich, anonymised, individual-level Australian Census Longitudinal Dataset (ACLD) available through the ABS DataLab. This dataset includes a nationally representative 5% sample from each of the 2006, 2011 and 2016 Censuses, and links the individual records in the 2006, 2011 and 2016 Censuses. In other words, an individual can be tracked over time, including changes in their economic, demographic, and other characteristics.

While there are several limitations of this dataset (see section 3.5.2), compared to alternative sources, the ACLD has the largest sample size available for empirical research, and collects information on the location of individuals, allowing us to isolate and track individuals who likely lived into and out of the Burnett River catchment area at the time of the flooding.

5.3 SAMPLE CONSTRUCTION

5.3.1   Sample construction

We use the 2011 Census records to identify the appropriate small business owners whose income changes we will track over the course of our study period. We identify such small business owners by Census respondents who would have answered "Yes, 1 - 19 employees" to the question: "Does the person's business employ people?".

We use the linked 2011 and 2016 Census records for these small business owners to measure the individual income effects of Cyclone Oswald by observing the treatment and control groups before (August 2011) and after (August 2016) the Cyclone, which impacted the region in late January 2013.

The income variable is provided by the Census question: "What is the total of all wages/salaries, government benefits, pensions, allowances and other income the person usually receives?".

Because respondents tick a box that corresponds with an income range (e.g. $1-$7799), this provides interval-based annual income data.[15] We take the mid-point of the respective interval class as the actual income of individuals. To adjust for inflation, we then deflate this income measure using the Consumer Price Index of Brisbane between 2006, 2011 and 2016.

We exclude those who reported negative income as the ABS Census data report "-1" (i.e., minus 1) for these individuals' income. This information is practically unusable from the analysis perspective. This is a limitation of the ABS Census data. We note that these individuals constitute only a small portion of the sample, so we consider that their exclusion is unlikely to impact our results.

Other Census questions allow us to consider the plausibility of investigating social and economic dimensions. However, as small sample size issues impair causal investigation of these dimensions, we limit our analysis to small business owners.

5.3.2   Treatment group

The agreed treatment group is the flooded areas around the Burnett River at an LGA level. Our treatment group is formed by small business owners who were residing in one of these LGAs prior to the disaster year. In this case, it would be their usual address in the 2011 Census (see **FIGURE 1**).

5.3.3   Control (comparator) group

From discussions with our end-user, the Richmond river catchment area is an appropriate comparator group. The LGAs within this catchment we include in our comparator group are: Ballina, Kyogle and Richmond Valley (FIGURE 12).

FIGURE 13 CONTROL GROUP LGAS
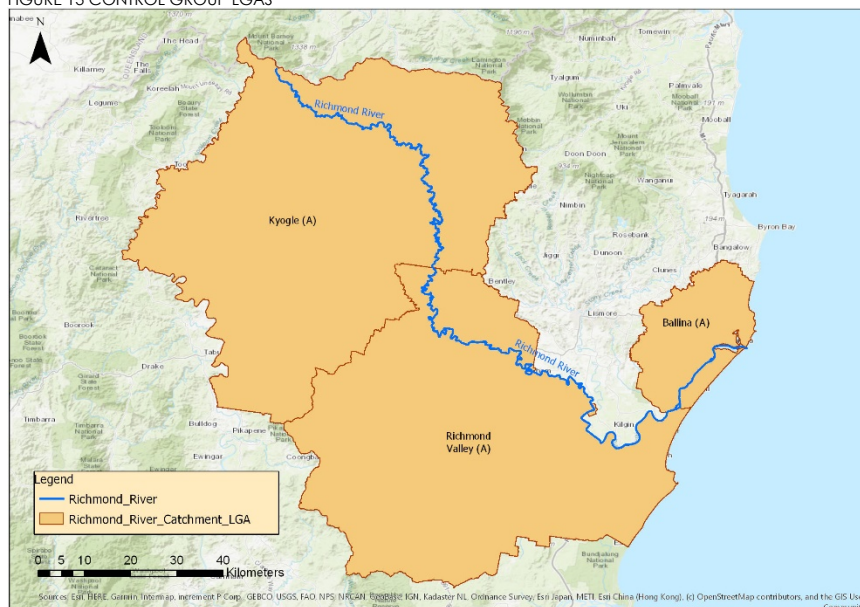
We use a technique called 'entropy balancing' to choose small business owners from this control group who most closely resemble small business owners in our

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[15] $0, $1-$7799, $7800-$12999, $13000-$20799, $20800-$31199, $31200-$41599, $41600-$51999, $52000-$67599, $67600-$83199, $83200-$103999, and $104000 or more.

treatment group on a range of characteristics, not just income. These include: education, marital status, age, and their mover/nonmover status (i.e. movements into/ out of residential address and therefore the treatment and comparator regions across 2006, 2011 and 2016).

5.3.4 Full sample descriptive statistics

In this study, "observation" refers to individuals who are small business owners at each Census year. TABLE 3 presents our sample descriptive statistics. As there are very few small businesses operating in the Cherbourg shire, our treatment group sample is likely to reflect small business operators in the other LGAs.

TABLE 4 SMALL BUSINESS OWNER STATISTICS

	Sample			Treatment group			Control group		
	Mean	Standard deviation	Observations	Mean	Standard deviation	Observations	Mean	Standard deviation	Observations
2006	$43,731.50	$27,569.15	419	$44,876.53	$27,290.14	196	$42,725.10	$27,834.36	223
2011	$43,314.47	$25,986.26	353	$41,640.76	$24,513.54	190	$45,265.42	$27,551.89	163
2016	$50,788.50	$32,907.96	207	$46,347.39	$30,648.99	104	$55,272.73	$34,613.82	103

The sample sizes are adequate for the purposes of our statistical analysis, albeit lower than comparable studies which use individual-level longitudinal datasets. This is because we are focusing on a sub-population (i.e. small business owners) in two regional economies. However, the sample sizes are greater than other randomised-controlled trials (RCT) in the economics literature which are used to infer causal impact of interventions or shocks on individuals.

5.4 CHECKS AND CONTROLS

We perform the necessary robustness checks and sensitivity analyses. We also check and control for many factors that, aside from the flooding, could have affected individual income in our treatment and control groups. These include:

- Eliminating any factors at both the LGA level and the individual level that do not vary with time, but could also lead to income differences between our treatment and control group[16]

- Eliminating factors at the individual level that *do* vary with time and could also create non-cyclone related income deviations between the groups

- Confirming that transitions (such as business ownership status) over our survey period do not materially affect our results

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[16] At the LGA level, this includes eliminating any differences in topography, climate and institutional structure. At the individual level, this includes netting out any characteristics, like risk-taking behaviour and psychological resilience, that could also influence their coping mechanism with economic shocks.

- Confirming that there is no measurement error introduced from using the mid-point of the income interval for each individual[17]

- Controlling for disaster-driven migration, which could also lead to bias in the reported impacts on individual income

- Controlling where possible for other shocks including disasters that hit the region during our survey period (e.g. Queensland Floods 2010-11).

Due to their importance, we further discuss the last in further detail two below.

5.4.1   Controlling for migration

It is well-known that some individuals who are severely hit by the disaster might make the decision to migrate out of the disaster hit-area. It can also be that some individuals may move to the disaster zone for work in disaster-related economic activities.

To ensure that our results are not driven by migration into and out of the treatment and control LGAs, we construct indicators of an individual's location (i.e. LGA) in 2006, 2011 and 2016, and include the indicators in modelling to net out any possible effect of migration on income estimates. This is our benchmark model, and so our reported benchmark estimates are where we control for the migration indicators.

We check the robustness of these results by ignoring the migration issue altogether in another modelling estimation. We find our benchmark income estimate to be robust, as the income estimate has the same negative sign in both cases (though with a somewhat larger estimate in our benchmark model),

5.4.2   Controlling for other shocks that hit the region

As with migration, another concern is other shocks that occurred in the treatment and control groups in between the Census periods which could also contribute to observed income deviations between the two groups.

Here, our construction of comparator group and use of entropy balancing would help in controlling for such general shocks. For instance, using a control group which has similar exposure to the agricultural industry would assist in addressing the influences of natural and widespread shocks (e.g. the Millennium drought). For universal shocks like the Global Financial Crisis, our entropy balancing method matches similar individuals from the control group to those who faced the flooding in the treatment group, and so our control group would have a similar GFC exposure to treatment groups.

Aside from these more generalised shocks, we need to be mindful of whether disaster shocks in either the treatment group or the control group bias our observed income effects.

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[17] We do this because the ACLD provides income for individuals in intervals. This could introduce measurement error (i.e. under-estimating or over-estimating the income effects). While this is a limitation of the ACLD income data, there is no plausible reason to expect that the treatment group incomes lie, on average, say, above the midpoints and the control group incomes lie, on average, say, below the midpoints (or vice versa) such that our income estimates are estimated with a bias due to this measurement error.

We know that disasters arising from natural hazards are a regular event in the Australian context, with Queensland being the most disaster-impacted state (Queensland Government, 2017b). Thus, it is more extreme events that would likely have a material effect on incomes, and cause income deviations between our treatment and control group. Here, we can rely on assistance classifications under the Australian disaster relief and recovery arrangements[18] to isolate more severe disasters requiring special assistance (i.e. Category D, which requires prime minister approval) from more "regular" events (Categories A to C).

To that end, the Burnett river catchment LGAs experienced 10 declared natural disaster events (FIGURE 17) between 2011 and 2016. Of these, two exceptional events required Category D assistance: the Queensland Floods 2010-11 and Cyclone Oswald 2013.

FIGURE 14 DISASTERS THAT OCCURED IN THE BURNETT RIVER CATCHMENT CASE STUDY LGA OVER STUDY PERIOD (2006-2016)
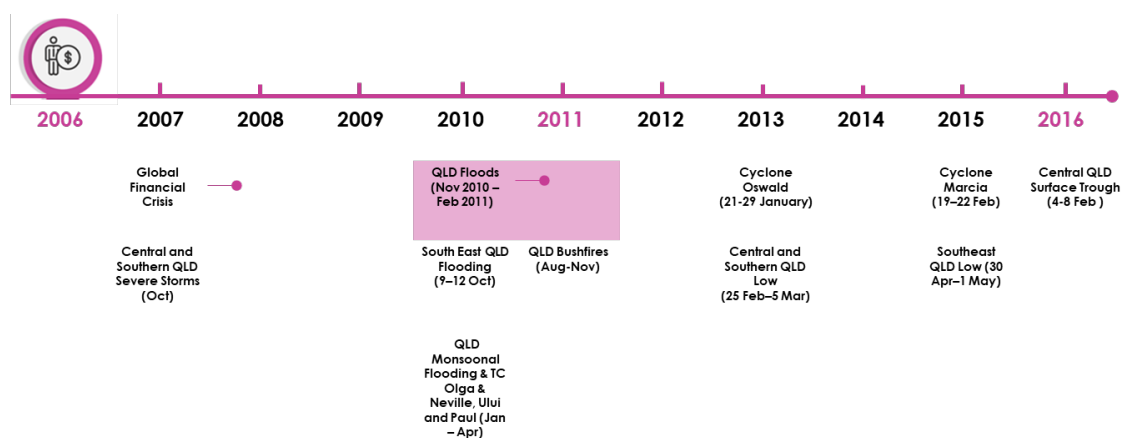
We have already confirmed that there are no statistically significant results in the 2006-11 period (TABLE 5), which means that the treatment and control groups did not differ in their income levels in 2011 compared to 2006, so that the Queensland Floods 2010-11 short-term effects are not exerting any statistically detectable influence on our results over this period.

We are confident that our 2011-16 are primarily attributable to Cyclone Oswald flooding events, rather than any medium-term effects of the Queensland floods.

As shown by the Bureau of Meteorology graphs reported earlier (FIGURE 8 and FIGURE 9), the flood levels experienced during Cyclone Oswald were on par with the highest flooding levels ever recorded in these regions. While the effects of the Queensland Floods were distributed across the entire state, Bundaberg and North Burnett bore the brunt of flooding effects of Cyclone Oswald (Queensland Reconstruction Authority, February 2013). The magnitude of the cyclone's effect is reflected in the extensive damage costs to the Burnett River catchment LGAs (Table 3), which formed around 70% of natural disaster related costs for these councils over the entire period between 2008 and 2014.

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[18] For events prior to 1 November 2018, i.e. our study period, this would be covered under the i.e. the Natural Disaster Relief and Recovery Arrangements, or NDRRA. New events are covered by the Disaster Recovery Funding Arrangements (DRFA).

With respect to our control group, there is no recorded event that required Category D assistance.[19] While the area experienced some adverse impacts from weather events coinciding with the Cyclone Oswald, looking at the subgroup parallel trends graph (Figure 19), the average income of small business owners in the Richmond Valley catchment area does not decline during 2011-2016 – to the contrary, it goes up slightly. Thus such disaster shocks to the control group are unlikely to bias our treatment effects over this period.

5.5 ASSUMPTIONS AND LIMITATIONS

5.5.1   Assumptions

5.5.1.1   Assumption 1: Parallel trends assumption

Our results are sensitive to the selection of control group, and so a key difference-in-differences model assumption we need to meet is that treatment and control group incomes were growing in parallel before the flooding events associated with Cyclone Oswald (see FIGURE 11).

Put simply, if we know that the control and treatment groups were growing at similar trends prior to the disaster, and we have properly accounted for other potential reasons for variations in income, including socioeconomic characteristics and topography, this gives more confidence that the Cyclone Oswald alone was responsible for any deviations of the treatment group from its expected trajectory post disaster. For the ABS five-year interval dataset, this means examining income patterns between 2006 and 2011.

As our focus is on a subsample of a regional population, it is more meaningful to explore whether incomes across the broader treatment and control group regional economies show parallel trends. This is because it is at the general equilibrium level that wages are determined for small business owners in these areas. We use the ACLD to compare the average income for the treatment and control group workforces across our study period. FIGURE 14 shows that the parallel trends assumption (between 2006 and 2011) is met for the two regional economies.

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[19] Please see appendix 10.

FIGURE 15 TESTING PARALLEL TRENDS ASSUMPTION FOR GENERAL INCOMES IN BURNETT AND RICHMOND VALLEY STUDY AREAS
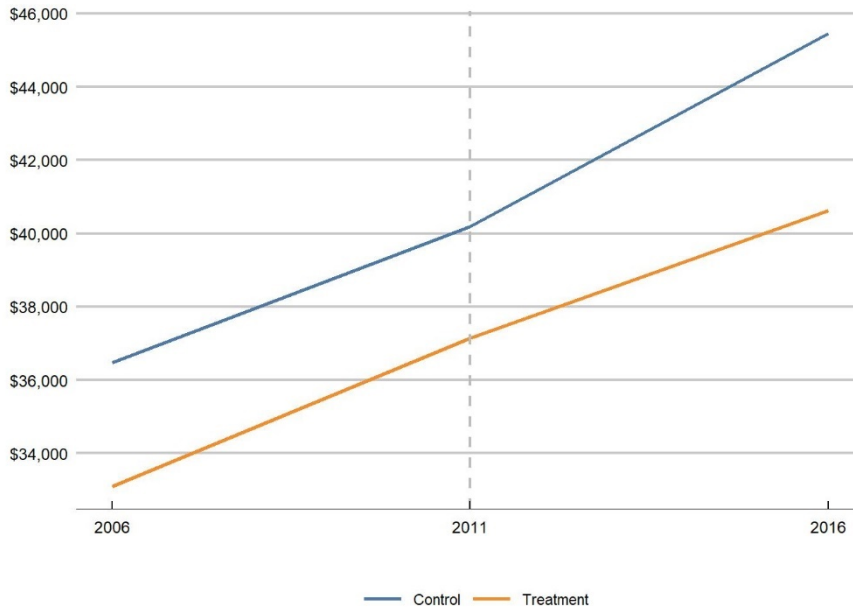
What about the parallel trends for small business owners in the treatment and control groups? FIGURE 16 shows the logarithm of small business owner incomes across our study period. The plots represent the net of individuals' differences such as gender, age. Netting out the latter is important for a sub-population of individuals such as small business owners, where heterogeneity in individuals' characteristics may be high.[20] Taking the logarithm of income provides a better distribution for what is normally a skewed variable like income.

FIGURE 16 TESTING PARALLEL TRENDS ASSUMPTION FOR SMALL BUSINESS OWNER INCOMES IN BURNETT AND RICHMOND VALLEY STUDY AREAS

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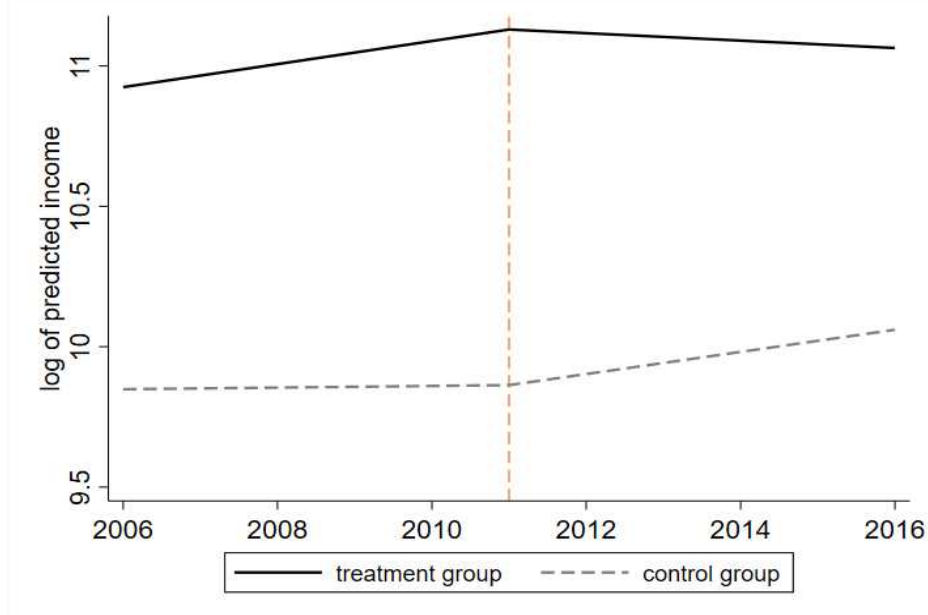
[20] i.e. individual fixed effects, which would have a much greater bearing on variations we observe in income for small samples (i.e. our small business owner sub-sample) than larger ones (i.e. our regional sample).

Upon first glance, FIGURE 15 may not appear to show parallel trends between the treatment and control groups across 2006 and 2011 but relatively successfully shows the income changes over time for a sub-population.

The surest way to check for, and satisfy, the parallel trends for this sub-group is the regression approach where we strictly control for potential differences between individuals (TABLE 5).

TABLE 5 BURNETT RIVER CATCHMENT LGAS: SMALL BUSINESS OWNER INCOME CHANGES AS A RESULT OF CYCLONE OSWALD 2013 (RELATIVE TO 2011 AND CONTROL GROUP)

	Small business owners
post $\times$ **D**	
2006-11	-0.0921
	(0.0979)
2011-16	-0.4532***
	(0.1219)
Observations	963
R-squared	0.276

post ×D is the difference-in-differences estimate. Standard errors in parenthesis. For statistically significant results, significance levels are denoted by: *p <0.10, ** p <0.05, *** p <0.01. Findings are based on use of ACLD Microdata.

Here, we find that the income deviations observed in Figure 19 between 2006 and 2011 are statistically insignificant (TABLE 3). As such, we are satisfied that the parallel trends assumption holds.

5.5.1.2   Assumption 2: Government intervention mechanisms played a role in mitigating the flood's effects on individual income

We assume that our results include the Cyclone's effect plus disaster relief and recovery effect.[21] This assumption is critical for us to examine the role that government relief and recovery programs played in supporting small businesses in the Burnett River Catchment area.

The wording of the Census question is unlikely to prompt Census respondents to report government assistance received or insurance pay-outs as part of their annual income (see section 5.1.2). Rather, we know from the economics literature that when large and unexpected natural shocks hit the economic system, a negative wealth and income effect may appear. If the intervention mechanisms are strong enough (such as insurance markets and government programs), the negative income is smoothed and potential losses are mitigated. In this case, the income effect is likely to be transient.

However, when the economy cannot resume its activities effectively and if the intervention mechanisms are not effective enough, the income trajectory remains lower than the pre-disasters levels, so that the effect is permanent.

So for instance, by speedily rebuilding roads, repairing critical assets, and reconnecting essential services, government recovery programs minimise disruptions to businesses and therefore reduce or fully mitigate any economic losses. Thus, well-designed interventions provide the supportive environment to

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[21] This includes post-disaster income and recovery assistance by the government, disaster insurance, reconstruction efforts and infrastructure investments.

enable the continuation of the income trajectory, which would be reflected in the results reported.

While we cannot directly test this due to data limitations, we are satisfied based on available evidence that the government post-disaster relief and recovery assistance are the primary intervention mechanism over the course of our study period, and so are the primary driver of the relief and recovery effect that are detectable within the scope of our analysis. We explain this below.

Overall, Cyclone Oswald related damages totalled over $2.5 billion (Queensland Treasury, 2013), and significant government money was expended on relief and recovery efforts. For the Burnett Catchment LGAs, all except Cherbourg Shire were granted Category D assistance, exceptional assistance that can be provided under the-then NDRRA arrangement. The LGAs were also able to attract a significant portion of funding under the Queensland Government Betterment program introduced after the Cyclone. For instance, Bundaberg received $15 million in funding for 18 Betterment projects to restore flood-damaged infrastructure (Crisafulli, 2014).

Importantly, relief and recovery programs more generally provided over $83 million in direct assistance (clean-up and recovery, loans, grants and subsidies) to small businesses and primary producers (TABLE 6). Many of the recovery programs also sought to prioritise the restoration of critical infrastructure and assets used by primary producers and businesses in the region, thus minimising the longevity of disruptions to income generating activities for small business owners. For instance, the Bundaberg Port dredging works were timed to ensure that the port would be operational before the sugar cane harvesting season (Queensland Reconstruction Authority, December 2013). This work therefore would limit further losses to small business owners who produce sugar cane or are dependent on sugar cane as an input in their production.

TABLE 6 SUMMARY OF RELEVANT CYCLONE OSWALD 2013 RELIEF AND RECOVERY PROGRAM ASSISTANCE

Package	Total value ($m)	Objective	Burnett River Catchment LGAs mentioned:
Community recovery package	$5	Funding for community development officers in the hardest hit communities of Bundaberg and North Burnett, support for mental health services and a flexible fund that assists communities to implement engagement and development activities	Bundaberg, North Burnett
Rural Financial Counselling Services	$1.5	Provision of financial planning advice for rural businesses and primary producers to assist in the recovery of local economies following the disaster.	
Clean Up and recovery program	$10	Program to assist primary producers to clear debris and restore fencing in the worst affected areas; to maintain workers while income generating activities are reduced and to clear debris from watercourse that poses a hazard to downstream infrastructure and activities.	
Industry Recovery officers	$1.5	Placement of 18 full-time Industry Recovery Officers to assist business and primary producers recover from flooding by acting as the primary point of contact for farmers and small businesses to access government assistance programs and services.	Bundaberg, North Burnett.
NDRRA Concessional loans and grants to primary producers and small businesses	$83.14	Category B loan approvals: $3.6 million to 39 primary producers; and $0.41 million to 6 small businesses. Category C grant approvals: $10.39 million to 851 small businesses, $53 million to 4,032 primary producers. Category D loan-grant approvals: $11.82 million to 41 primary producers; $2.27 million to 4 businesses; and $1.66 million to 4 small businesses.	
Enhanced concessional	-	Loans of up to $650,000 (with a grant component of up to $50,000) are available to applicants that have suffered extreme damage such that the existing concessional loan and recovery grants	

		under NDRRA category B and C are insufficient to support recovery.	
Environmental Recovery program	$10	Program to fund existing programs to conduct flood specific clean up and soil conservation work following the 2013 flooding. As at 30 November 2013, year to date spend for on-farm productivity and environmental recovery contracts has been $5.7 million and $2.9 million respectively, including: • advice and assistance on soil conservation to 154 properties • 2.5km of streambank has been stabilised through engineering works and debris removed from 52.3ha in the Bundaberg and Burnett area including 8 stranded boats and 10 pontoons in the Burnett River • 2.2km of stream bank was stabilised in the Lockyer Fassifern area through engineering works and 1874kg of debris removed from 11.2ha of riparian areas in the Darling Downs	Bundaberg, Burnett area
Other measures	$4.9	Fund dredging works to restore Bundaberg Port to its pre-2013 flood clearance depths. Completed in December 2013	Bundaberg
Millbank Waste Water Treatment Plant project	$2.4*	The plant was not operational for three months after the 2013 event. The estimated cost of the Betterment project for the Millbank Waste Water Treatment Plant is $2.4 million, of which approximately $635,000 will be funded through the Betterment Fund. The balance will be funded as a combination of both Category B NDRRA eligible works and by Council contribution.	Bundaberg

SOURCE: QUEENSLAND RECONSTRUCTION AUTHORITY (DECEMBER 2013)

Thus, the scale and type of assistance provide us with sufficient confidence to assume that the government relief and recovery efforts were large enough to exert statistically detectable influences on our results.

What about the role of insurance? Unfortunately, there is a dearth of information, and so we list this as a limitation. We know from Insurance Council of Australia (February 2013) that there were 53,711 claims made in Queensland, with insurance losses estimated at $553 million. While 57 LGAs were affected by Cyclone Oswald, there is no LGA breakdown of these figures, or businesses versus household insurance losses which would allow us to assess the role that insurance played in supporting small business owners in the Burnett River catchment LGAs.

From a previous government flood insurance inquiry that flood insurance for small businesses is rare (Commonwealth of Australia, 2011). Quoted in this inquiry is a 2008 Insurance Council of Australia survey, which found significant small business under-insurance and non-insurance, with at least 26% of small to medium businesses not having any form of insurance in 2008, compared to 4% of owner occupiers who do not hold home insurance. Thus, any insurance payments to small business owners in the Burnett River catchment area are likely to be for repair and reconstruction of private homes, rather than business premises.

5.5.2 Limitations

As with any study, multiple limitations constrain the applicability of our findings.

As acknowledged in the 2018 National Disaster Risk Reduction Framework, "disaster risk data and information is not always available to those who need it and it does not adequately integrate climate science" (Commonwealth of Australia, 2018, p. 12).

Related to this, information useful to:

• constructing measures such as disaster severity (including infrastructure and insurance data),

• estimating effects of government assistance on income, and

• estimating the effects of insurance pay-outs on income.

is not readily available and/or requires significant consultation lead time before being made available. This has limited the scope of the project. These data limitations are general in nature and would affect other similar studies.

The five-year interval period of the ACLD dataset is another major limitation. Coupled with the lack of LGA-level data discussed above, this makes it difficult to completely isolate the effects of Cyclone Oswald from other shocks.

Even if we could completely address these limitations, our choice of measure (income) add further limitations in how our results can be interpreted. Here, other financial dimensions are also likely to influence a small business owner's financial capacity to economically cope and recover from the disasters. This includes access to credit cards, business loans, and ability to draw loans on existing assets.

Additionally, the results reported are average point estimates, which do not give the complete distribution of effects of the floods. This means there will always be certain business owners who are more (less) severely impacted than what we report.

6. RESULTS AND CONCLUSIONS

6.1 RESULTS

Overall, compared to our control group, employing small business owners in the Burnett River catchment area LGAs suffered 45.3% income losses compared to what they would have earnt had the flooding events not happened (TABLE 5).

This equates to average income losses of $21,004.6 AUD. Based on the number of small business numbers at the time of Cyclone Oswald (3,722 employing small businesses in 2013), this equates to income losses of at least $78.2 million for employing small business owners as a whole.[22]

While these figures appear to be large, they are plausible considering the widescale devastation to important infrastructure (including ports and water treatment facilities), and that agricultural losses alone in North Burnett and Bundaberg were estimated at $265 million, which would have had knock-on effects on other sectors in the region. They are also consistent with the low capacity for disaster resilience of the Burnett River catchment area, as assessed by the ANDRI project (see section 4.2.2).

Given the time-period, these losses were sustained into the medium term, despite the significant government relief and recovery efforts directed at the Burnett Catchment area LGAs, particularly Bundaberg and North Burnett. This underscores the severity of the flooding events associated with Cyclone Oswald in the region, and the heightened exposure of the predominantly agricultural Wide Bay-Burnett region to disasters.

6.2 CONCLUSIONS

Our research has demonstrated the devastating economic effects that extreme weather events can have on employing small businesses in regional communities.

As a direct result of ex-Tropical Cyclone Oswald 2013, we estimate that small business owners residing in the Bundaberg, North and South Burnett regional councils lost on average $21,000 in income in the medium term (up until 2016).

This finding supports a key insight from our Queensland Floods 2010-11 report (Ulubasoglu and Beaini, 2020), in which we identified three possible channels through which disaster-induced economic shocks can be transmitted to individuals, vis-à-vis income. These are: owning a business, working in sectors whose economic activity is susceptible to disaster shocks (both positive and negative), and working part-time. Whereas that report's findings are based on correlational observations, here we provide causal evidence supporting the business ownership channel, and – owing to the high proportion of agricultural enterprises in the Burnett region – the employment sector channel.

Considering the number of employing small businesses at the time of the flooding events, this equates to at least $78.2 million in income losses in total. These income

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[22] Assuming one owner per small business.

losses are compared to what small business owners could have earnt had Cyclone Oswald not happened, and are the net effect of the disaster after government relief and recovery efforts. Given the heavy representation of agricultural small businesses in these areas, they are also consistent with other economic estimations of losses, which put the agricultural losses in Bundaberg and North Burnett alone at $265 million (Queensland Government, 2018a).

As we have focused on *employing* small businesses (i.e. those who have 1-19 employees), these income losses are likely to have broader economic impacts on the workforce, particularly where small business owners are forced to reduce their employees' shifts or are unable to retain their workforce due to the severity of the flooding's effects on business activity, as happened in other disasters like the Queensland Floods 2010-11.

Our research findings also illustrate the difficulty in fully mitigating economic losses in regional communities in Australia, particularly where economic activity is concentrated in – and centred around – disaster sensitive industries like agriculture or tourism. For the Wide Bay-Burnett region, these difficulties will only be exacerbated by the projected population growth and climate change, which is expected to increase extreme weather events and the risk of further inundations in communities like Bundaberg.

Given the scope of our research, all of this has important implications on the scope and sustainability of Australia's disaster relief and recovery arrangements.

Here, small businesses account for 97.4% of Queensland's businesses and employ 44% of Queensland's private sector workforce (Queensland Government, 2017a). Small businesses also rarely take out flood insurance, with insurance rates much lower than residential insurance (Commonwealth of Australia, 2011). This makes small businesses particularly reliant on government relief and recovery efforts in the aftermath of disasters.

In examining Australian disaster relief and recovery arrangements, we note that small businesses (and primary producers) are already covered by these arrangements, with the Category B and C assistance under the Disaster Recovery Funding Arrangements (DRFA) providing loans and subsidies, and assistance with clean-up costs. For Cyclone Oswald, it is apparent that many programs funded under Category D assistance were prioritised and appropriately targeted towards minimising disruptions to core income generating activities in the region, e.g. the dredging works at Port Bundaberg.

However, given the workforce composition of the region, there may also be other factors that might exacerbate the financial ability of these small business owners to cope with the floods, or capacity to take on additional loans, even at attractive rates as envisaged by these arrangements. Here, we note that 94% of employed residents of our Burnett River catchment LGAs work locally, and account for 95% of the total workforce across all these region councils. With the scale of devastation in these areas, it is likely that small business owners were hit "twice". Indeed, past disasters suggest that it is likely that at least some of these small business owners had to also contend with flood damages to their own private properties, particularly if uninsured. Thus, assistance may need to be framed in a way that recognises the overlap and interrelationships between the seemingly different groups covered by these arrangements.

7. KEY MILESTONES

TABLE 7 CYCLONE OSWALD CASE STUDY AND RELEVANT RESEARCH PROGRAM MILESTONES

Year	Milestone	Milestone date	Status
2019-20	Submit the final report on the Cyclone Oswald 2010-11 Case Study, including economic profiling	31 January 2020	Completed
2019-20	Submit Policy briefing for the Cyclone Oswald 2013 Case Study	31 March 2020	Upcoming
2019-20	A national seminar to sensitise the policymakers on the economic and social effects of disasters	30 May 2020	Upcoming
2019-20	Submit guidance note on the methodology of estimating economic and social impacts of natural disasters	30 June 2020	Upcoming
2019-20	Submit a research brief to facilitate the adoption of research findings at agency level	30 June 2020	Upcoming

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8. UTILISATION OUTPUTS

ACHIEVEMENTS

End User Engagement

Opportunities

Queensland Reconstruction Authority, QLD

Findings of this research can inform local governments' future resilience planning across the Burnett Catchment. QRA will share this study with the Wide Bay Burnett Regional Organisation of Councils' (WBBROC) Resilience Coordination Committee.

Findings of this research will assist to support ongoing implementation of the Burnett Catchment Flood Resilience Strategy and its corresponding action plan.

This work can help to inform the forthcoming preparation of the new Wide Bay Burnett Regional Plan.

Impacts

Tracking

9. WHERE TO FROM HERE

The *Disasters and Economic Resilience: The Income Effects of Cyclone Oswald 2013 on Small Business Owners – A Case Study on the Burnett River Catchment Area* report has quantified indirect impacts associated with a major disaster on small business owners residing in regional communities.

In doing so, the research has provided policymakers with a valuable insight into the effects of severe disaster-induced economic shocks on small business enterprises, who constitute a large share of Australian businesses and are significant employers of the private sector workforce. It has also helped demonstrate how such quantification exercises of intangible costs of disasters can be done, a current gap in disaster impact estimation, using national accounts records. Here, we note that a future deliverable of our research program is to provide guidance material that can assist policymakers in replicating our modelling approach.

Considering our broader BNHCRC research program, the project has provided causal evidence to support our findings in our Queensland Floods 2010-11 case study, which revealed income streams within industries and sections of the workforce that are more susceptible to disaster-induced disruptions to economic activity. By examining flooding effects on a regional community, this report provides complementary evidence to our Victorian Black Saturday Bushfire 2009 case study on how economic impacts can persist among different sections of the community. Altogether, this information can help policymakers plan for and better target economic recovery programs so that long-term recovery is not only achieved more quickly, but also spread more evenly across the community.

More specifically, our research suggests that there may be a need to consider how to frame assistance under Australia's disaster relief and recovery arrangements, where there are interlinkages between losses that create compounding and cascading economic effects on individuals, and beyond. That is, where small business owners are unable to reopen their business due to the cost and priority in re-building or repairing their own disaster-damaged homes. For severe disasters that attract Category D assistance, this may mean extending recovery assistance timeframes, particularly in less diversified and more disaster-sensitive regional economies.

While beyond the scope of our research, it is worthwhile examining what barriers exist to small businesses reducing their own exposure, and therefore risk, to the often high costs of such disasters. This includes issues around the small business take-up of private insurance, which could alleviate pressure on public expenditure. Here, the National Disaster Risk Reduction Framework's emphasis on collective action offers an important step in the right direction towards considering what can be done to reduce risks posed by disasters.

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10. PUBLICATIONS LIST

4.1   PEER REVIEWED JOURNAL ARTICLES

1   Ulubasoglu M, Rahman MH, Önder Y, Chen Y, Rajabifard A, *Floods, bushfires and sectoral economic output in Australia, 1978-2014,* 2019: 1-23, Economic Record, Chichester, Eng., C1.

2   Rahman MH. *Earthquakes don't kill, built environment does: Evidence from cross-country data*, Economic Modelling 201*8*; 70: 458–468.

3   Rahman MH, Anbarci N, Bhattacharya P, Ulubasoglu M, *Can Extreme Rainfall Trigger Democratic Change? The Role of Flood-Induced Corruption*, Public Choice, March 2017;171:331–358.

4   Rahman MH, Anbarci N, Bhattacharya P, Ulubasoglu M, *The Shocking Origins of Political Transitions? Evidence from Earthquakes*, Southern Economic Journal, January 2017;83: 796–823.

4.2   PAPERS

4.2.1   Refereed Conference papers

1   Rahman, M.H., M. Ulubasoglu, P. Bhattacharya, K. Potts, Y. Chen, M. Kalantari and A. Rajabifard (2015). "Natural Disasters and Economic Development: Evidence from Australia", Australian Conference of Economists, 7-10 July 2015, Brisbane.

4.2.2   Non-Refereed Conference Papers

2   Ulubasoglu, M. *Disasters and economic resilience: income effects of the Black Saturday bushfires on disaster-hit individuals*. AFAC18 (Bushfire and Natural Hazards CRC, 2018).Google Scholar BibTeX XML

3   Ulubasoglu M, Önder YK, Rahman MH, *Evaporative Heating: The Negative Income Effects of the Black Saturday Bushfires in Disaster-Hit Areas*, The 2018 Annual Conference of the Australasian Fire and Emergency Service Authorities Council, 5-8 September 2018, Perth.

4   Ulubasoglu M, Rahman MH, *Unpacking the Sectoral Income Effects of Natural Disasters: Evidence from the 2010-11 Queensland Floods*, The 2017 Annual Conference of the Australasian Fire and Emergency Service Authorities Council, , 3-5 September 2017, Sydney.

5   Rahman MH, Chen Y, Potts K, Bhattachary P, Rajabifard A, Ulubasoglu M, Kalantari M, *Bringing hazard and economic modellers together: A spatial platform for damage and losses visualisation*, 2015, Research proceedings from the Bushfire and Natural Hazards CRC and AFAC conference, Report No. 2015.084, Adelaide.

6   Rajabifard A, Ulubasoglu M, Potts K, Rahman MH, Kalantari M, Bhattacharya P. "*A pre-disaster multi-hazard damage and economic loss estimation model for Australia*", The 2014 Annual Conference of the Australasian Fire and Emergency Service Authorities Council, 2-5 Sep 2014 Wellington.

4.2.3 Working papers

In the coming year, we will also be progressing several working papers. These papers, while strictly outside the scope of our project, nevertheless have greatly benefited from and been informed by our BNHCRC research program methodology and learnings, underscoring the positive externalities that CRCs such as the BNHCRC effect on the quality and relevance of Australian research:

- Önder, Rahman, Ulubasoglu: *The Spillover Effects of Black Saturday Bushfires: A Network Approach*

- Önder, Rahman, Ulubasoglu: *Droughts and Crop Yield in Australia*

- Rahman, Anbarci, Ulubasoglu: *"Storm Autocracies": Islands as Natural Experiments*

- Rahman, Guven, Ulubasoglu: *Floods and Agricultural Productivity: Natural Field Experimental Evidence from Micro Plot-Level Data on Sri Lanka*.

4.2.4 Other

1 Ulubasoglu M, Beaini F. 2019. *Black Saturday bushfires: counting the cost*, Australian Journal of Emergency Management, 2019:5–6.

2 Beaini F, Ulubasoglu M. 2019. *Demographic profiling:* Toodyay Bushfire 2009 case study, Bushfire and Natural Hazards CRC, 2019.

3 Beaini F, Ulubasoglu M. 2018. *Demographic profiling: Victorian bushfires 2009 case study*, Bushfire and Natural Hazards CRC, 2018, https://www.bnhcrc.com.au/node/5214.

4 Beaini F, Ulubasoglu M. 2018. *Demographic profiling: Queensland Floods 2010-11 case study*, Bushfire and Natural Hazards CRC, 2018.

5 Ulubasoglu M, Beaini F. 2020. *Disasters and Economic Resilience: The effects of the Queensland Floods 2010-11 on individual income. A Case Study on the Brisbane River Catchment Area.* February 2020. Bushfire and Natural Hazards CRC.

6 Ulubasoglu M. 2020. *Disasters and Economic Resilience: The income effects of Cyclone Oswald on Small business owners. A Case Study on the Burnett River Catchment Area.* January 2020. Bushfire and Natural Hazards CRC.

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11. TEAM MEMBERS

Professor Mehmet Ulubasoglu – Project lead

Professor Mehmet Ulubasoglu is the Head of the Department of Economics and the Director of the Centre for Energy, the Environment and Natural Disasters at Deakin University. Professor Ulubasoglu is one of Australia's foremost experts on the economic impacts of natural disasters, with many years' experience working on these questions with governments in Australia, through his work with the Bushfire and Natural Hazards Cooperative Research Centre, and in South-East Asia with the Asia Disaster Preparedness Centre.

His current BNHCRC research project *Optimising Post-disaster Recovery Interventions in Australia* fills a major gap by estimating economic impacts of several Australian natural disasters on economic sectors and vulnerable groups.

He has published extensively in leading international journals, including the Review of Economics and Statistics, Journal of Development Economics, American Journal of Agricultural Economics, European Economic Review, and American Journal of Political Science.

Ms Farah Beaini – Research fellow

Farah Beaini is a Research Fellow in the Department of Economics at Deakin University, and the Industry Program and Research Coordinator at the Deakin Business School's Centre for Energy, the Environment and Natural Disasters.

Farah brings a wealth of stakeholder engagement and project management experience from her previous state and Commonwealth government roles in digital transformation, service delivery, administrative law and economic research. As part of the BNHCRC project, Farah oversees the stakeholder management and end-user engagement.

Other

In addition to the core research team, there are a number of casual members who contribute valuably to the project by working on the ArcGIS, statistical programming, and performing regressions as part of the Australian Bureau of Statistics visits.

12. APPENDICES

12.1 BURNETT RIVER CATCHMENT AREA DISASTER INFORMATION

To the author's best knowledge, the below table sets out all disaster events in where NDRRA assistance was activated, and thus were severe enough to potentially create a shock to the income trajectory *of* Burnett River Catchment area small business owners. The Queensland Reconstruction Authority (QRA) was formed in the aftermath of the Queensland Floods (2010-11). Events predating the QRA's formation were obtained from the Disaster Queensland Disaster Relief Activations archive page.

TABLE 8 DECLARED NATURAL DISASTER EVENTS IN THE BURNETT RIVER CACHMENT LGAS THROUGHOUT STUDY PERIOD (2006-16)

Date	Disaster event	NDRRA Category activated	NDRRA assistance activated for LGA?				Source
			Bundaberg	Cherbourg	North Burnett	South Burnett	
22 Aug 2007	South East and North Coast Queensland East Coast Low	A,B	Yes	Yes	Yes	Yes	**Disaster Queensland**
7-12 Oct 2007	Central & Southern Queensland Severe Storms	A	Yes	No	Yes	No	**Disaster Queensland**
28-30 Oct 2007	Central & Southern Queensland Severe Storms	A,B	No	No	Yes	Yes	**Disaster Queensland**
Jan - Apr 2010	Qld Monsoonal Flooding & TC Olga & Neville, Ului and Paul, January to April 2010	A	Yes	No	Yes	Yes	**Disaster Queensland**
9-10 Oct 2010	South East Queensland Flooding	A	No	No	No	Yes	**Queensland Reconstruction Authority**
Nov 2010 - Feb 2011	Queensland Flooding and Tropical Cyclones Tasha and Anthony	A,B,C,D	Yes	Yes	Yes	Yes	**Queensland Reconstruction Authority**
Aug - Nov 2011	Queensland Bushfires	A	Yes	No	Yes	Yes	**Queensland Reconstruction Authority**
25 Feb - 5 Mar 2013	Central and Southern Queensland Low	A	Yes	No	Yes	Yes	**Queensland Reconstruction Authority**
21-29 Jan 2013	Tropical Cyclone Oswald and Associated Rainfall and Flooding	A,B,C,D(a)	Yes	Yes	Yes	Yes	**Queensland Reconstruction Authority**
19 - 22 Feb 2015	Severe Tropical Cyclone Marcia and South East Queensland trough	A,B,C(b)	Yes	No	Yes	No	**Queensland Reconstruction Authority**
4 - 8 Feb 2016	Central Queensland Surface Trough	A	No	No	Yes	No	**Queensland Reconstruction Authority**

NOTE: (A) ALL APART FROM CHERBOURG (ONLY A AND B ACTIVATED). (B) FOR BUNDABERG, ONLY CAT A ACTIVATED.

12.2 RICHMOND VALLEY CATCHMENT AREA DISASTER INFORMATION

To the author's best knowledge, the below table sets out all disaster events where NDRRA assistance was activated, and thus were severe enough to potentially create a shock to the income trajectory of Richmond Valley Catchment area small business owners. Events are sourced from the Australian Government Disaster Assist page.

TABLE 9 DECLARED NATURAL DISASTER EVENTS IN THE RICHMOND VALLEY CACHMENT LGAS THROUGHOUT STUDY PERIOD (2006-16)

Date	Disaster event	NDRRA Category activated	NDRRA assistance activated for LGA?			Source
			Ballina (A)	Kyogle (A)	Richmond Valley (A)	
1 Oct -15 Oct 2010	New South Wales—Northern Rivers floods	A,B	Yes	Yes	Yes	**Disaster Assist**
26 Dec 2010 - Jan 2011	New South Wales floods	A,B,C	Yes	Yes	Yes	**Disaster Assist**
27 Jan 2012	Northern New South Wales heavy rainfall and flooding: 27 January 2012	A,B	Yes	Yes	Yes	**Disaster Assist**
17 Nov 2012	Richmond Valley storm: 17 November 2012	A,B	Yes	Yes	Yes	**Disaster Assist**
26 Jan 2013	North Coast storms and floods	A,B,C	Yes	Yes	Yes	**Disaster Assist**
Feb 2013	East coast severe weather and floods	A,B,C(a)	Yes	No	Yes	**Disaster Assist**
30 Apr 2015	North Coast floods: 30 April 2015	A,B	Yes	Yes	Yes	**Disaster Assist**
Jun 2016	East Coast Storms and Floods	A,B,C (b)	Yes	No	No	**Disaster Assist**

NOTE: (A) CATEGORY C FOR ALL APART FROM KYOGLE (ONLY A AND B ACTIVATED).(B) CATEGORY C ONLY FOR BALLINA.

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