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POLICY BRIEF

AUGUST 2020

Disasters and economic resilience: the effects of the 2010-11 Queensland floods on individual income

A case study of the Brisbane River catchment area

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About this research

This research began in 2013 and was conducted as part of the *Optimising post-disaster recovery interventions in Australia* project. The project investigated how recent natural hazards have impacted and rippled through communities and the broader economy over time, through case studies of the 2009 Black Saturday bushfires, 2009 Toodyay bushfire, 2010-11 Queensland floods and 2013's Tropical Cyclone *Oswald*. The research findings will help policymakers better understand the socio-economics of natural hazards and formulate public policies in a way that better distributes budgets and resources towards vulnerable socio-economic groups and sectors of employment.

Background

Many major metropolitan cities around the globe are faced with a formidable threat of riverine flooding because they are situated on riverbanks. Examples of such cities include London, Paris, Berlin, Vienna, Budapest, Washington DC, Melbourne, Brisbane, Tokyo, Bangkok, Baghdad, Cairo, Delhi, Shanghai, Seoul, São Paulo and Buenos Aires. These complex urban systems have become increasingly exposed to urban flood risk that is accentuated by global warming, which is argued to have ushered in a new climatic regime of torrential rainfall with increased frequency and intensity (Kocornik-Mina et al., 2020; Boustan et al., 2020).

The 2010-11 Queensland floods struck both metropolitan and regional areas in Queensland, including the greater Brisbane region, and remain one of costliest flooding events in Australian history. The floods caused an estimated A\$6.7 billion in tangible damages, with an overall cost of A\$14.1 billion (Deloitte Access Economics, 2016).

Compared to direct damages reported in the immediate aftermath of disasters, currently little is known in Australian policymaking about the floods' influence on individuals' income, how different segments of the workforce coped with the catastrophe, and how government relief and recovery efforts assisted individuals' economic conditions to return to normal.

Aims and objectives

Disasters and economic resilience: the effects of the Queensland Floods 2010-11 on individual income.

A case study on the Brisbane River catchment area (Ulubasoglu and Beaini 2020) estimates the impact of the 2010-11 riverine flooding on individual income in four local government areas (LGAs) in the Brisbane River catchment area. The research focused on two key points: the effects of the floods on the income streams of individuals, and how the government's relief and recovery programs assisted individuals to return to their normal income trajectory. Demographic and sectoral characteristics of individuals are also considered in detail.

Focusing on individuals' income stream enables the ability to explore how disaster-induced economic shocks can be transmitted to the labour force via income-earning channels. It also offers a greater understanding of how the indirect costs of floods are borne by different segments of the working population.

In addition, by defining economic resilience to be an individual's ability to return to their pre-disaster income levels, this research helps policymakers better understand the socio-economics of disasters caused by natural hazards and formulate public policies in a sustainable way that better distributes budgets and resources towards vulnerable socio-economic groups and employing industries that are more sensitive to disasters.

The study is a comprehensive analysis of the ways that disasters can impact different sections of the labour force, and identifies key channels through which disasters can impact the working population. The report also provides a more holistic approach to thinking about disaster resilience and recovery.

Methodology

The study explores links between observed income effects and the 2010-11 Queensland floods by using difference-in-differences modelling. This approach compares income changes of individuals living in four LGAs in the Brisbane River catchment area (treatment group) with those living in comparable zones in Australia (control group). The research team identified the latter to be the Swan River catchment area (incorporating Perth), the Yarra River catchment area (incorporating Melbourne), the Parramatta River catchment area (incorporating Sydney), and the Torrens River catchment area (incorporating Adelaide). These control groups provide the income path that would have occurred for employed residents in the Brisbane River catchment area LGAs had the floods not occurred, and thus enables any income deviations (losses or gains) arising from the floods to be calculated. The research team investigated the regional effects on Somerset, Lockyer Valley and Ipswich separately.¹

¹ The comparison group for this regional analysis included regional LGAs in the outer Perth metropolitan area: Bassendean, East Fremantle, Kalamunda, Mosman Park, Peppermint Grove, Victoria Park, Vincent, Wandering, and York.

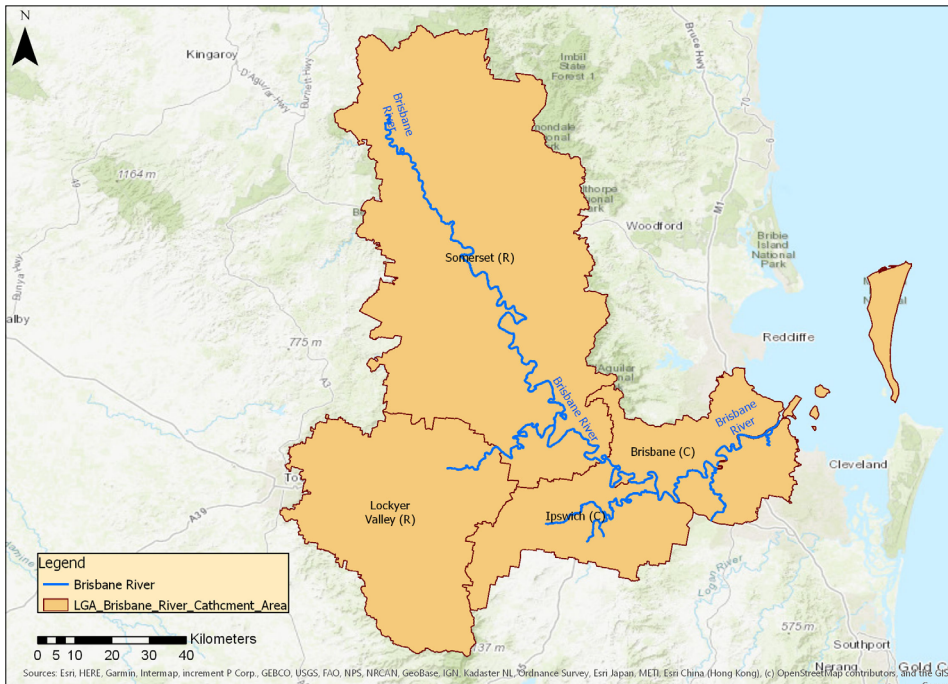


Figure 1: Brisbane River catchment area LGAs

The research team undertook an additional modelling step, called entropy balancing (EBalance)². This technique helps to identify individuals from the control group who most closely resemble individuals in the treatment group. Individuals were included in the control group not just based on whether they have similar incomes as of 2006, but also, for instance, that they have similar education, marital status, age, and residential mover/non-mover status, to individuals in the treatment group (Figure 2, below).

The study utilises data from the Australian Census Longitudinal Dataset of the Australian Bureau of Statistics (2018), which provides a unique opportunity to robustly examine the impacts of the flooding across a long timeframe (across 2006, 2011 and 2016) and across multiple dimensions (demographic and economic). All results reported are net of any post-disaster relief and recovery efforts; are relative to the baseline year (2006); and are compared to the control group. Short-term results are defined as changes over 2006–11, and medium-term results as changes over 2006–16.

2 Entropy balancing (EBalance) is a pre-processing procedure that allows researchers to create the most comparable treatment and control groups for the subsequent estimation of treatment effects. That is, it permits selecting individuals from the control group who most closely resemble the individuals in the treatment group, based on a range of characteristics, such similar education, marital status, age, and residential mover/non-mover status.

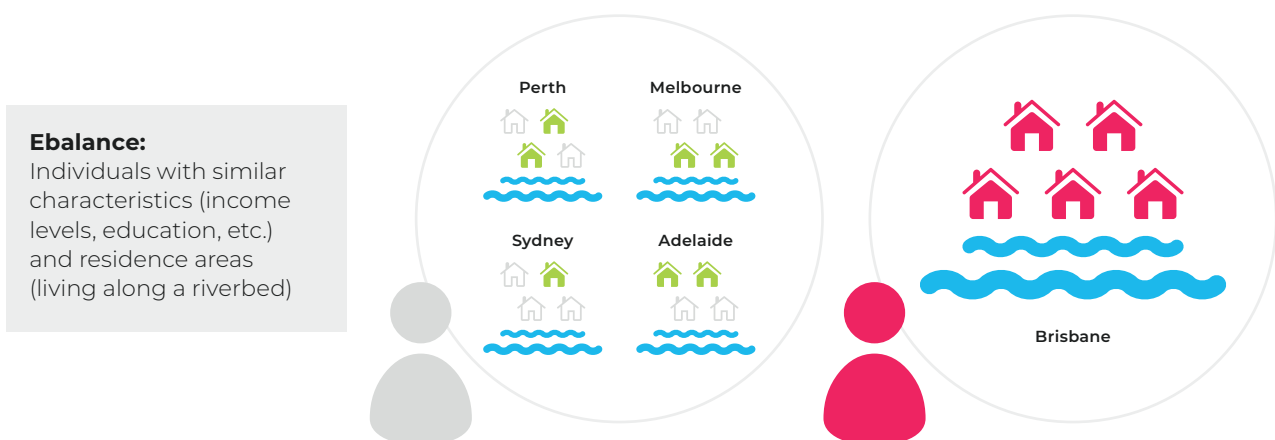


Figure 2: illustration of modelling with entropy balancing (EBalance)

Key findings

In the four flood-hit Brisbane River catchment LGAs of Brisbane, Ipswich, Lockyer Valley and Somerset:

- There was no overall statistically significant change in the income trajectories of all employed residents as a group.
- This aggregate effect masks the marked differences between individuals with different demographic attributes, employment characteristics and locations.
- Low income individuals are hit hard because floods are associated with reduction in their incomes. By contrast, middle income and high income individuals observed some income gains following floods. This suggests that inequality increased in the flood zone.
- Part-time employees experienced income losses following the floods.
- Owning a business is another vulnerability characteristic. Regardless of their employment sector, business owners within the four LGAs suffered significant income losses in the short-term correlated with the 2010-11 Queensland floods. The losses were even higher for small businesses, and these losses tend to last into the medium-term.
- Socio-economic vulnerabilities are concentrated in particular sectors of the economy, primarily agriculture, construction, and accommodation and food services. However, the health sector employees experienced income gains

following the floods (presumably because of increased work hours of the employees).

- Female employees also experienced income gains, while male employees saw income losses. The health sector has a high concentration of female employment, whereas construction has a high rate of male employment.
- The income shock pathways of the 2010-11 Queensland floods mostly run from income changes in six industry sectors, some of which are top employers in the region, to demographic groups employed mostly by these sectors (see Figure 3, below).

The key vulnerable groups identified in this study, namely low income individuals, small business owners, part-time employees, and employees in the agriculture and accommodation and food services sectors, are similar to those identified in this project's other case studies (2009 Black Saturday bushfires, 2009 Toodyay bushfire and 2013's Tropical Cyclone *Oswald*).

Additional findings

Locational findings

- The heaviest income losses associated with the 2010-11 Queensland floods are observed for employed residents of the regional Brisbane River catchment area communities (Lockyer Valley, Ipswich and Somerset LGAs), with the

Figure 3: income shock pathways: sectors of employment where statistically significant income results were observed



least economic resilience to floods. Unlike their metropolitan Brisbane counterparts, where no statistically significant income effects were observed, employed residents of the regional Somerset and Lockyer Valley LGAs suffered average income losses of 27.3 per cent (or around \$9,780) in the first six months following the floods.

- According to the Australian Disaster Resilience Index (ADRI) constructed by Parsons et al (2020), the Brisbane LGA hosts the great majority of Statistical Area-2s (SA2s) in Queensland with the highest disaster resilience index rating, with Ipswich including SA2s with moderate resilience, and Somerset and Lockyer Valley hosting SA2s with the least capacity to cope and adapt to natural hazards.

Sectoral findings

- The acute individual-level losses in regional communities (Lockyer Valley, Ipswich and Somerset LGAs) highlight the scale of the floods' devastation in these areas, and the extent of their economic exposure to the disaster-sensitive industries that they host, such as agriculture (see Ulubasoglu et al. 2019).
- In the four LGAs the accommodation and food services sector saw short-term average annual income losses of 8.2 per cent (\$2,740). This employment sector is characterised by a high level of casualisation in the workforce and lower earnings potential than other sectors. Much like many regionally employed residents in the study areas, income losses of this scale are difficult for this sector's workforce to absorb, and disproportionately affect this group.

Demographic findings

- The 2010-11 Queensland floods were associated with short-term annual income losses among low income earners (-10.1 per cent, to the tune of \$3,100). This contrasts with gains experienced by middle income (8.5 per cent, \$3,780) and high income earners (5.1 per cent, \$3,380).
- While full-time employees did not experience any significant income change, part-time workers in the study areas suffered income losses of 5.2 per cent (\$1,820) in the short-term, and 6 per cent (around A\$2,440) in the medium-term (likely compounded by Tropical Cyclone *Oswald* in 2013).
- Many part-time workers were employed in the accommodation and food services sector. This employment sector is characterised by a high level of casualisation and lower earnings potential than other sectors. For full-time employees, salaried positions appear to offer an important buffer to shocks.
- While average annual short-term losses were highest for owners of unincorporated

businesses (-11.9 per cent, to the tune of \$5,030), these findings were not observed in the medium-term. In comparison, small business owners on average experienced losses in both the short-term (-6.1 per cent, \$3,130) and medium-term (-9.8 per cent, \$5,350). Likewise, incorporated business owners experienced income losses throughout the study period (-10.3 per cent, or \$6,030 over 2006-16).

- The floods were associated with short-term annual income losses among those under 25 years of age (-7.4 per cent, \$2,940).

Policy implications

General implications

- There is a need to look beyond aggregate impacts to understand socio-economic vulnerability to disasters.
- Many of the income losses are concentrated among groups already known to be disadvantaged (e.g. low income and part-time workers), or residing in areas that have much higher economic exposure to disasters and have been assessed as having lower resilience to disasters (i.e. the regional Somerset and Lockyer Valley LGAs).
- The 2010-11 Queensland floods caused material volatility in labour markets (Queensland Treasury, 2011), and this is reflected in the results.
- The acute individual-level losses for accommodation and food services highlight the extent of their exposure to the pause of economic activity in metropolitan areas, while for agriculture, it indicates the vulnerability of regional areas to economic shocks.
- Casualised workforce (i.e., part-time and casual employees) and small business owners exhibit weak economic resilience to disasters. The losses are disproportionate to the financial capacity of this workforce to absorb.
- Those in lower socio-economic brackets became poorer, while middle income and high income workers experienced income gains in the aftermath of the floods. This highlights not only the fact that those in the lower socio-economic brackets exhibit lower economic resilience to disasters, but also that disasters widen income inequality.
- Factors contributing to high disaster resilience typically include socio-economic characteristics such as employment, education and income; good access to or provision of resources and services; strong community cohesion and ample opportunities for adaptive learning and problem solving. By contrast, relatively lower economic diversity, higher unemployment rates, and lower educational attainment levels, are associated with lower disaster resilience and adaptive capacity.

- Looking at the impact on businesses, the findings also highlight that not only small businesses, but also other businesses that operate in the accommodation and food sector, farming businesses, those that employ part-time workers, as well as those with weaker supply chains (e.g., those in regional areas) and lower diversification of economic activities, are likely to be adversely affected by disasters.

General implications for relief and recovery programs

- It is critical to examine employment sectors and known social vulnerabilities concurrently within the social and economic context of the disaster-hit regions, so that results are interpreted correctly, and programs formulated and targeted accordingly.
- Data limitations prevented the research team from directly assessing whether the substantial government relief and recovery programs played a role in mitigating or reducing the effects of the 2010-11 Queensland floods at the LGA level. However, it is evident that government disaster relief and recovery programs have a role to play in supporting individual economic resilience to, and recovery from, disasters.
- The research suggests that these programs are necessary to reduce any potential income inequalities that may arise from or be widened by these disasters. It is noted that many of the programs under the Disaster Recovery Funding Arrangements 2018 are already directed at groups that this research suggests are likely to be susceptible to income shocks (e.g. low-income earners, primary producers, and small business owners).

Implications for sector relief and recovery programs

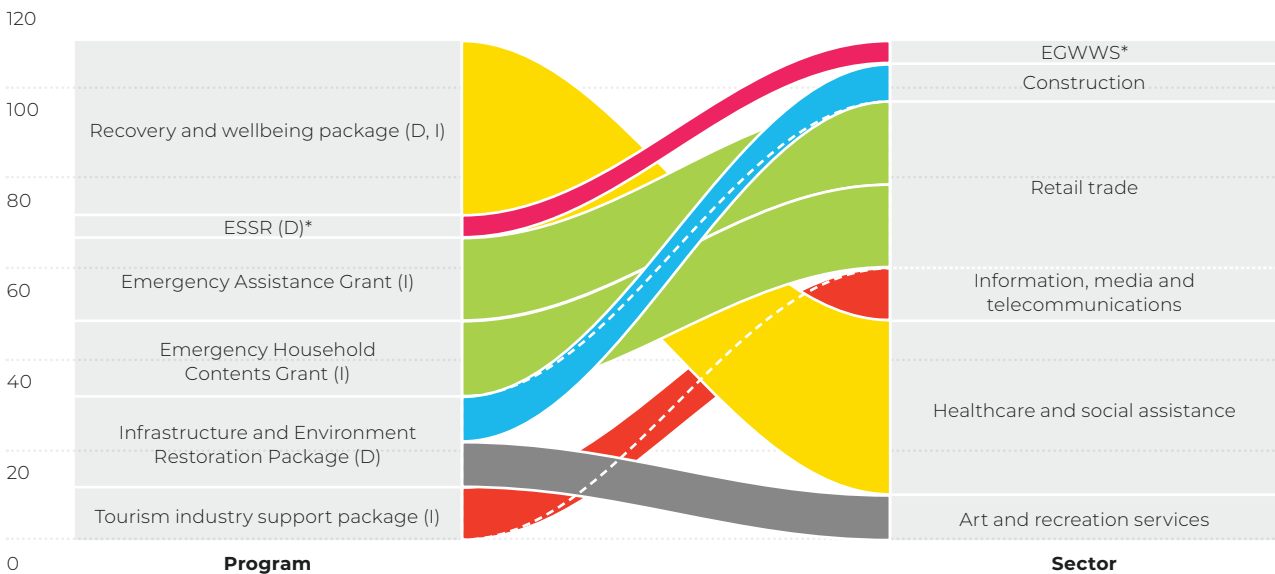
- Overlaying the sector results with government relief and recovery assistance following the 2010-11 Queensland floods up until early September 2011 (thus coinciding with this studies' short-term results) provides a good representation of the likely proportional expenditure per program (see Figure 4, page 6).
- From the available data, government community recovery programs are likely to have increased money flows into particular sectors than otherwise would have occurred. For instance, the Mental Health Disaster Recovery Package provided \$10 million to bolster mental health sector local organisations who were directly assisting disaster-affected communities. This sector was associated with short-term, income gains and disproportionately employs part-time female workers.
- For other sectors, such as the retail sector, the Emergency Assistance and Household Grants are

likely to have resulted in a spike in demand for household goods once businesses were re-opened. It is noted that the retail sector was associated with income gains in the medium-term (2006-16) which may be also correlated with economic activity associated with Tropical Cyclone *Oswald* in 2013.

- The accredited safety inspectors and repairer services needed to access the Essential Services Reconnection grants is likely to have supported economic activity in the electricity, gas, water and waste services sector. The income results for this sector showed no significant change; it is noted that this sector predominantly employs high-income earners.
- While the Tourism Industry Support Package aimed to promote recovery in tourism-oriented sectors, it funded an advertising campaign and so is more likely to generate activity in the information, media and telecommunications sector. This sector predominantly employed middle-aged workers, high-income earners and full-time workers, and showed no statistically significant income changes.
- The approach used for this research aids in better understanding the vulnerabilities to disasters, as recommended by the National Disaster Risk Reduction Framework, and in informing evaluations of disaster recovery programs using the National Impact Assessment Framework. Figure 5 (see page 6) shows the disaster recovery packages that could most readily link to specific sectors of the economy.
- Within these package groups, a significant proportion of joint Commonwealth–state government recovery expenditure under the National Disaster Risk Reduction Framework was for grants and loans to primary producers (at least \$100 million).
- Metropolitan Brisbane had a small number of agricultural sector employees, so the income results for the overall agricultural sector was statistically not significant. However, for the regional analysis on Somerset and Lockyer Valley LGAs, where employment in the agricultural sector is much higher, the annual income losses for employed residents in this region were 27.3 per cent in the short-term.
- The recovery programs included packages to support the repair and reconstruction of Queensland sporting and recreational facilities. Such packages would assist the arts and recreation sector. The income results for this sector, which predominantly employs low income, part-time workers, showed no significant change.
- The extension of wage assistance programs, like the Cyclone *Yasi* program, to include part-time employees is likely to help individuals working in disaster-sensitive industries to better cope with disasters when they strike.

Figure 4: government disaster recovery packages that stimulate economic activity in industry sectors

\$ million



Note: D = direct, I = indirect; ESSR = essential services safety and reconnection; EGWWS = electricity, gas, water and waste services. Based on data from the Queensland Reconstruction Authority (2011).

- In ascertaining the appropriate level of assistance, the results indicate the importance of considering socio-economic vulnerabilities and disadvantages. For instance, estimated average annual individual income losses range between around \$1,820 (part-time workers) and \$5,030 (unincorporated business owners) within Brisbane, compared to \$9,800 for employed residents of the regional and more hard-hit Brisbane River catchment area councils.
- Surveys of households in Brisbane and Ipswich show that the floods resulted in disruptions to work and significant expenses that were not adequately covered by insurance, thus putting further stress on household budgets at a time of deep financial and psychological distress. Such income disruptions exacerbate mental health conditions (Gibbs et al., 2016), and so need to be considered when formulating community recovery programs.

Figure 5: government disaster recovery packages that assist in reconstruction and repair activities in industry sector

\$ million



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