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NON-MARKET VALUATION IN THE ECONOMIC ANALYSIS OF NATURAL HAZARDS

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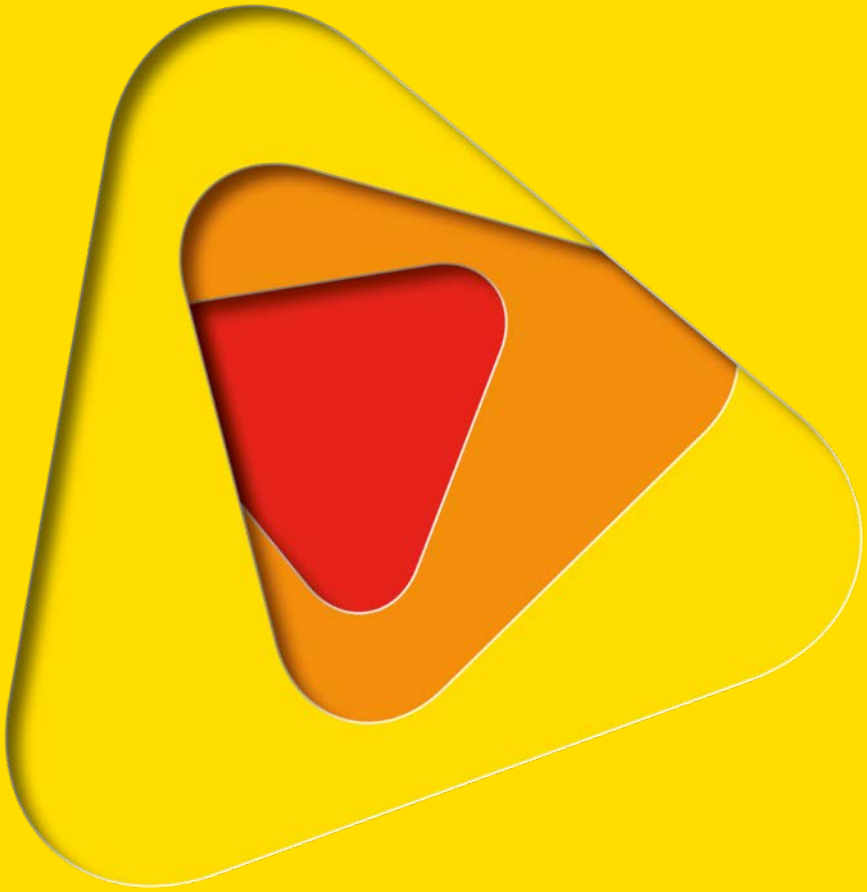

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ABSTRACT

To achieve value for money from investments in management of natural hazards (including mitigation, emergency response and clean up) economists advocate the use of tools like Benefit: Cost Analysis (BCA) to evaluate actions or policies (e.g. Milne et al. 2015). Many governments worldwide encourage the use of BCA for policy evaluation. For example, according to its Best Practice Regulation Handbook, 'The Australian Government is committed to the use of cost–benefit analysis to assess regulatory proposals to encourage better decision making' (Australian Government 2010, p. 61).

Some of the relevant benefits and costs related to natural hazard management are relatively difficult to quantify, particularly in financial-equivalent terms. There are a number of advantages from expressing non-financial impacts in financial-equivalent terms: to compare the benefits and costs of policy or management actions in order to evaluate whether they are worthwhile policies or actions; to rank alternative investments in terms of value for money; and to make rigorous business cases for investment.

Economists have developed a range of techniques to do so, known as 'non-market valuation', but they remain underutilized in the natural hazard sector. The first purpose of this presentation is to identify the methods available to quantify non-market values in financial-equivalent terms. Non-market valuation techniques use empirical evidence about human behaviour or statements in surveys to quantify preferences for the provision of a public good or service.

The technique applied to estimate the value of a non-market good depends on the type of value the non-market good provides to the community. 'Use' values cover non-consumptive uses such as recreation and amenity. 'Non-use' values cover those unconnected to a 'use value'. They include existence value (knowing a good, like a national park, exists), bequest value (maintaining a good for future generations) and option value (protecting a good for a future, undiscovered use option). Use and non-use value are conceptually distinct, but not mutually exclusive; they can both co-exist within the same individual or good (Carson and Hanemann 2005).

Different non-market valuation techniques are used to capture different value types. Significant research effort has been invested in developing and testing a range of techniques, which are broadly grouped into two main categories (Adamowicz 2004; Carson 2012). Techniques that draw conclusions based on actual behaviour (use values) are known as 'revealed preference' techniques, while those that rely on statements in surveys are called 'stated preference' techniques. A third technique, benefit transfer, is the use of research results from pre-existing primary studies at one or more sites or policy contexts (often called study sites) to predict welfare estimates or related information for other, typically unstudied, sites or policy contexts (often called policy sites) (Rolfe et al. 2015). Benefit transfer is advocated for use in policy making, particularly for non-market values, because it is usually cheaper, takes less time and is more straightforward than conducting primary studies.

We provide a simple framework showing how the non-market values for a natural hazard event could be derived and aggregated, which is relevant to all of the estimation methods described above.

The second purpose of this presentation is to identify the non-market values that might be affected by natural hazards. They include values related to human health, the environment, and social issues. The values of these things to society could be improved or, in some cases, diminished by the implementation of mitigation actions. We discuss the non-market valuation literature available for each value type. There are thousands of non-market valuation studies. However, for some value types there are no non-market valuation studies available.

The third purpose of this presentation is to provide guidance on the existing literature that estimates non-market values relevant to natural hazards. Despite a large body of literature, our review reveals gaps in the availability of WTP estimates for the value types we identify as being relevant to natural disasters. Amenity and safety values from floods, earthquake and bushfires have the most comprehensive information available. The majority of studies employ the hedonic price method (revealed preference) to infer the value of amenity and safety from variations in property prices. Morbidity and recreation also have a handful of studies that are relevant to the bushfire mitigation context.

For the other value types, there are few estimates specific to a natural disaster context. Meta-analysis functions are available for water quality, life, ecosystem degradation and threatened species. For stored carbon there are multiple estimates of the market value of stored carbon, and a handful that estimate the non-market aspect of the social cost from lost soil carbon. For animal welfare, cultural heritage, invasive species, social disruption and injury, stress or anxiety, pain and grief, there are few studies available.

The challenge for analysts and policy makers is to use the values information within a decision framework for prioritising mitigation actions. New studies could be conducted, if budgets and time permit, to provide accurate estimates for the specific policy question. New studies are required for those value types where no or few existing WTP data is available.

Benefit transfer is advocated as a suitable approach for value types for which estimates are well documented within the literature. However there are some potential issues with applying benefit transfer to a natural disaster context. The first is whether the influence of disaster context (cause, severity) significantly affects the WTP estimate. Jones-Lee and Spackmann (2013) provide some insight into the likely difference in value estimates for fatalities within the UK transport sector:

> *"…the prevailing view [previous studies] appears to be that the prevention of a statistical fatality in a large-scale multiple fatality accident does not warrant a higher value than is applied in the small-scale single fatality case";*

The second issue with the transfer accuracy of a WTP estimate is the target population to be considered. Natural disasters often impact large geographical areas. For example, the 2010/2011 Queensland floods affected more than 78 per cent of the state and over 2.5 million people, killed 33 people, inundated 29,000 homes and businesses and cost in excess of $5 billion (Queensland Flood Commission of Inquiry, 2012). In this case the socio-demographic profile of the target population is variable, meaning that a single fixed unit could not be transferred to all sites. For example, age and health status have been reported to affect the VSL estimate (Krupnic et al. 2002). This is likely to be important when evaluating mitigation strategies for natural disasters. In an analysis of fatalities in Victoria's Black Saturday fires, O'Neill and Handmer (2012) found

> *"…fatality dataset highlighted how many of the fatalities (44%) were particularly vulnerable due to age (either 70 or over, or under 12) and/or had a chronic and/or acute disability. Note that these vulnerabilities were sometimes compounded—2% of fatalities had both a chronic and an acute disability; and a further 9% had a chronic disability and were 70 or over."*

The third issue is the potential influence of the context for a non-market value. For example, there is evidence emerging that the cause of death matters in people's valuation of reducing risk of death (e.g. Viscusi 2009). If one were to transfer a VSL derived from traffic accidents surveys, this may not reflect the VSL from a bushfire or drowning incident.

In conclusion, there is scope to use existing WTP studies, through benefit transfer, for some of the values affected by natural disasters. For some types of impacts, existing evidence is likely to be sufficient to support benefit transfer, while for others, additional studies are needed to fill information gaps.

REFERENCES

Adamowicz, W, Louviere, J, Williams, M (1994) Combining revealed and stated preference methods for valuing environmental amenities. Journal of Environmental Economics and Management 26, 271–292

Australian Government (2010). Best Practice Regulation Handbook. Australian Government, Canberra

Carson, RT, Hanemann, WM (2005) Contingent valuation. In: Handbook of Environmental Economics, Volume 2. Edited by K.-G. Mäler and J.R. Vincent

Carson, RT (Ed) (2012) 'Contingent valuation: a comprehensive bibliography and history.' Edward Elgar

Jones-Lee, M, Spackman, M (2013) The development of road and rail transport safety valuation in the United Kingdom. Research in Transportation Economics 43,23-40

Krupnic, A, Alberini, A, Cropper, M, Simon, N, O'Brien, B, Goeree, R, Heintzelman, M (2002) Age, health and the willingness to pay for mortality risk reductions: a contingent valuation survey of Ontario residents. The Journal of Risk and Uncertainty 24(2), 161–186

Milne, M, Clayton, H, Dovers, S, Cary, GJ (2015) Evaluating benefits and costs of wildland fires: critical review and future applications. Environmental Hazards 13(2), 114-132

O'Neill, SJ, Handmer, J (2012) Responding to bushfire risk: the need for transformative adaptation. Environ. Res. Lett 7, 1-7

Rolfe, J, Johnston, RJ, Rosenberger, RS, Brouwer, R (2015) Introduction: Benefit transfer of environmental and resource values. In 'Benefit transfer of environmental and resource values'. (Eds Johnston, RJ, Rolfe, J, Rosenberger, RS, Brouwer, R). pp 3-17. (Springer: Dordrecht)

Viscusi, WK (2009) Valuing risks of death from terrorism and natural disasters. Journal of Risk and Uncertainty 38, 191-213