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## **The hedonistic cost of the Black Saturday bushfires**

Christopher L. Ambrey, Christopher M. Fleming, and Matthew Manning

Contributed presentation at the 60th AARES Annual Conference,  
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# The hedonistic cost of the Black Saturday bushfires

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# Overview

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The purpose of this study is to:

- Employ the experienced preference method to provide evidence on the link between the Black Saturday bushfires and wellbeing (life satisfaction).
- Estimate the hedonistic cost of the Black Saturday bushfires in terms of an 'income equivalent' or implicit willingness-to-pay.

In doing so, this study provides a distinct contribution to both the non-market valuation literature and the economics of happiness literature.

# Background

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- Australia shares broader global trends, experiencing record hot and dry conditions and longer fire seasons associated with anthropogenic climate change (Climate Council of Australia Limited, 2013).
- Australia suffered its worst bushfires on record following an unprecedented heatwave, the devastating Black Saturday bushfires (Karoly, 2009).
- This ravaged many parts of the State of Victoria and indirectly impacted many millions of people in the State, throughout the rest of Australia and beyond. In all, one hundred and seventy three people died, thousands of homes and other dwellings were destroyed and over 400,000 hectares were burnt (Country Fire Authority, 2012).



## Motivation

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- To quantify the social and economic costs of bushfires traditional revealed and stated preference non-market valuation techniques have tended to be employed.

However...

- There is a dearth of fire-specific studies and few studies that have been able to elicit more intangible values (Bennetton, Cashin, Jones, & Soligo, 1998).
- Paucity of research in other geographic contexts outside of the United States (Milne, Clayton, Dovers, & Cary, 2014).
- There is a need for *ex post* evaluation to capture the *total* changes to social welfare (Venn & Calkin, 2011).
- Psychosocial costs despite being well reported have not featured in conventional non-market valuation studies concerning bushfires (Gibbs et al., 2015).



## Method

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A micro-econometric life satisfaction function is estimated, which takes the form of an indirect utility function for a individual  $i$ , in location  $k$ , at time  $t$ :

$$U_{i,k,t} = \omega + \alpha_1 \ln y_{i,k,t} + \alpha_2 \ln f_{1i,k,t} + \sum_{j=1}^m \beta_j z_{ji,k,t} + \kappa_k u_i + \tau_t + \varepsilon_{i,k,t} \quad (1)$$

Implicit marginal willingness-to-pay (WTP) valuation:

$$WTP = \frac{\frac{\partial U_{i,k,t}}{\partial f_{1i,k,t}}}{\frac{\partial U_{i,k,t}}{\partial y_{i,k,t}}} = - \frac{\bar{y} \hat{\alpha}_2}{f_1 \hat{\alpha}_1} \quad (2)$$

# Data

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The life satisfaction and socio-economic data is obtained from the Household, Income and Labour Dynamics in Australia (HILDA) survey for the years 2001-2013.

- National probability sample of Australia, which takes the form of an indefinite life panel.

The Geographic Information Systems (GIS) data is obtained from the Victorian Bushfires Severity Map 2009 provided by the Victorian Government's Department of Environment, Land, Water and Planning.

- The bushfires extent variable takes the value 0 before the 7<sup>th</sup> of February 2009 and then the percentage an individual's CD which is fire effected thereafter.



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# Key base model results



Variable name	Coefficient (standard error)
ln(Bushfire extent)	-0.18 * (0.09)
ln(Household Income)	0.03 ** (0.01)
<i>Summary Statistics</i>	
Number of obs.	309,074
Pseudo R <sup>2</sup>	0.09

\* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level.

47 other covariates are included in the regression and reported in full in the paper.



## Valuation

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Using Equation 2 the implicit willingness-to-pay is estimated:

$$-1.00 \times \left( \frac{(73,624.54 \times -0.18)}{(8.80 \times 0.03)} \right) = \mathbf{\$50,198.55}$$

For a one-unit reduction in the percentage of an individual's CD that is bushfire effected, in terms of annual household income.

Not without uncertainty, 90% CI **\$5,577.62 to \$92,030.68.**

Crucially, this estimate depends on:

- The estimated effect of household income; and
- The estimated effect of the bushfire extent variable.

# Post-Black Saturday pathways



Variable name	Coefficient (standard error)
ln(No bushfire to bushfire)	-0.06 (0.16)
ln(Stay bushfire)	-0.29 ** (0.12)
ln(Bushfire to bushfire)	0.01 (0.35)
ln(Household Income)	0.04 ** (0.01)
<i>Summary Statistics</i>	
Number of obs.	255,199
Pseudo R <sup>2</sup>	0.09

\* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level.

# 'Time heals all wounds', or does it?



Variable name	Coefficient (standard error)	Variable name	Coefficient (standard error)
ln(No bushfire to bushfire)	0.07 (0.16)	ln(Stay bushfire) x 2012	-0.05 (0.14)
ln(Stay bushfire) x 2009	-0.25 * (0.16)	ln(Stay bushfire) x 2013	-0.05 (0.13)
ln(Stay bushfire) x 2010	-0.10 (0.10)	ln(Bushfire to bushfire)	0.23 (0.37)
ln(Stay bushfire) x 2011	-0.14 (0.13)	ln(Household Income)	0.04 ** (0.01)
<b>Summary Statistics</b>			
Number of obs.	255,199		
Pseudo R <sup>2</sup>	0.09		

\* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level.

# Discussion

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## Key findings:

- Estimates the hedonistic costs of the Black Saturday bushfires.
  - Finds an implicit willingness-to-pay of \$50,198.55 in terms of annual household income.
- The effect is strongest for those who stayed in the bushfire effected areas.
- The effect of the bushfires depends on an individual's social connectedness.
- The effect of the bushfires is most clearly evident in the year of the bushfires.
- Bushfire extent is positively linked with having seen a mental health professional.

# Conclusion

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## Public policy interventions:

- Australian Government provided comprehensive Recovery Assistance Package provided by the Australian Government which totaled more than \$465 million for reconstruction and recovery (Commonwealth of Australia, 2015).
- Without this government intervention the size of the estimates may have been larger.
- However, allowing homes to be built in bushfire-prone areas creates a moral hazard and land use planning needs to be improved to avoid this.
- Further, the Victorian Bushfires' Royal Commission urges policy makers to make living in bushfire-prone areas safer. While well-intended, this could also have perverse outcomes.

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# Questions?