Road fatalities in Australia: A comparison of driver fatalities and motorcycle rider fatalities
Version 3

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Executive Summary

This report presents a comparison of motorbike rider fatalities and motor vehicle driver fatalities, for the five most populated states and for Australia as a whole, using the number of fatalities per 100 000 registered vehicles for the 20 year period 1989-2008. Figure 4 demonstrates the large increase in motorcycle use in recent times. Figures 5 and 6 show that roads are becoming safer for all vehicle operators: fatality rates are decreasing. This decrease was particularly prominent in the period 1989-2000. In the period 2001-2008 fatality rates have also decreased, albeit at a slower rate, in New South Wales, Victoria and South Australia. There has been little progress in Western Australia and Queensland during the 2001-2008 period; the fatality rate for motorcyclists in Queensland shows a modest increase. We also show that, when taking into account the distance travelled by each vehicle type, motorcycle riders have up to 27 times the risk of fatality in a traffic accident than vehicle drivers.

1 Introduction

This report presents a description of road fatalities of motorbike riders and drivers of other motor vehicles in Australia, using data collected in the period 1989-2008. In Section 2 the number of fatalities by age, state, accident and vehicle type are presented. These data are taken from the Australian Fatal Road Crash Database [1] provided by The Department of Infrastructure, Transport, Regional Development and Local Government. The database does not distinguish between truck drivers and the drivers of other passenger vehicles, so we compare motorcycle riders with drivers of all other motor vehicles. All fatalities are reported by calendar year, and do not include motorcycle pillion passengers or vehicle passengers, due our aim of comparing the fatalities of vehicle operators. It should be noted that motorcycle fatalities are often presented with the inclusion of pillion passengers; for example on the website of Victoria's Transport Accident Commission [2].

In Section 3 we assess the relative dangers of driving and riding. In order to do this, a measure of fatality rate is required. The Australian Bureau of Statistics (ABS) has data [3] recorded in the annual Australian Motor Vehicle Census (MVC), which includes, for each state, the number of registered vehicles by type of vehicle. Due to the availability and accuracy of this data, we calculate a fatality rate of the number of fatalities per 100 000 registered vehicles. This ignores kilometers travelled by each vehicle type; this issue will be discussed further in Section 3, where we adjust our risk comparison based on data obtained from the annual Survey of Motor Vehicle

Use (SMVU), also available from the ABS website [3]. Our approach also ignores fatalities on unregistered vehicles; this is difficult to account for due to data availability, and in any case is unlikely to have a large affect on the substantive conclusions of this report.

The definitions of the two vehicle types: motorcycle and other motor vehicles, and the definitions of all other variables used in the report, can be found in the relevant data sources.

2 Road Fatality Numbers

Figure 1 depicts road fatalities for vehicle operators plotted by year for each of the five most populated Australian states. The plot on the top shows fatalities for vehicle drivers and the plot on the bottom shows fatalities for motorbike riders. Driver fatalities have shown a slight decrease in the two largest states of New South Wales and Victoria, though they remain fairly constant for the other states. There is no obvious trend in motorcycle rider fatalities in any state, with the exception of Queensland, where fatalities have shown a large increase in the past ten years. These figures do not take into account the increasing use of both motorcycles and other motor vehicles; this is investigated in Section 3.

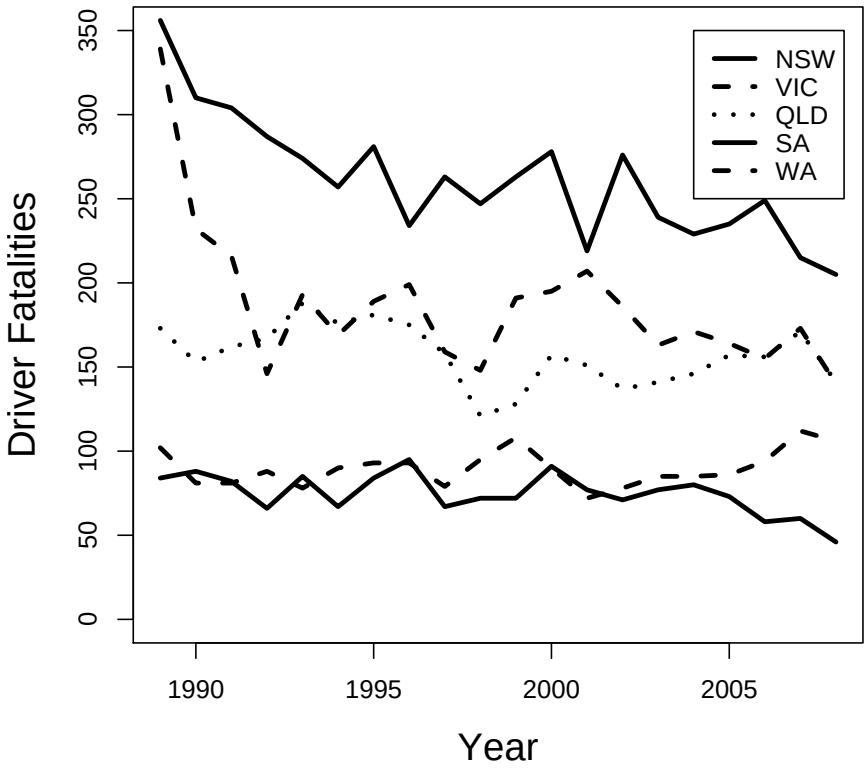
The Australian Fatal Road Crash Database gives data on the accident type; Figure 2 shows the proportion of Australian accidents resulting in vehicle operator fatality that were single vehicle accidents. Over time this proportion is fairly constant for both drivers and riders. Figure 2 shows that given an accident occurs with a vehicle operator fatality, the accident is less likely a single vehicle accident when the vehicle is a motorcycle. Using all data from 1989-2008, 51% of driver fatalities were single vehicle accidents, whereas 41% of motorcycle rider fatalities were single vehicle accidents.

Finally, Figure 3 depicts vehicle operator fatalities for each year of age of the vehicle operator. Again, the plot on the top refers to vehicle drivers and the plot on the bottom refers to motorbike riders. The fatality numbers are the total fatalities in the period 1989-2008. Fatalities of vehicle operators under 14 years of age (16 driver fatalities[1] and 19 rider fatalities) or over 92 years of age (25 driver fatalities and no rider fatalities) are not included in Figure 3.

The Figure shows that the distribution of fatalities across age is heavier-tailed for vehicle drivers, so relatively more fatalities occur in the older population (more than 45 years old) than for motorcycle riders. This reflects that fact that motorcycle riders tend to be of a younger age. The median average age for driver fatality is 35 years, whereas the median average age for rider fatality is six years younger, at 29 years. Although the median age for motorcycle riders is younger than for vehicle drivers, the modal age[2] for riders is 21 years old, which is 3 years older than the modal age of 18 years old for drivers. Consequently, for motorbike riders there is greater density in the distribution of fatalities in the 20-40 age group.

[1] Of the 16 driver fatalities under 14 years of age, eight were aged zero. This is presumably due to the fatalities of a driver and her unborn child, where both have been recorded as fatalities of the vehicle operator.

[2] The modal age is the year of age with the greatest numbers of fatalities.



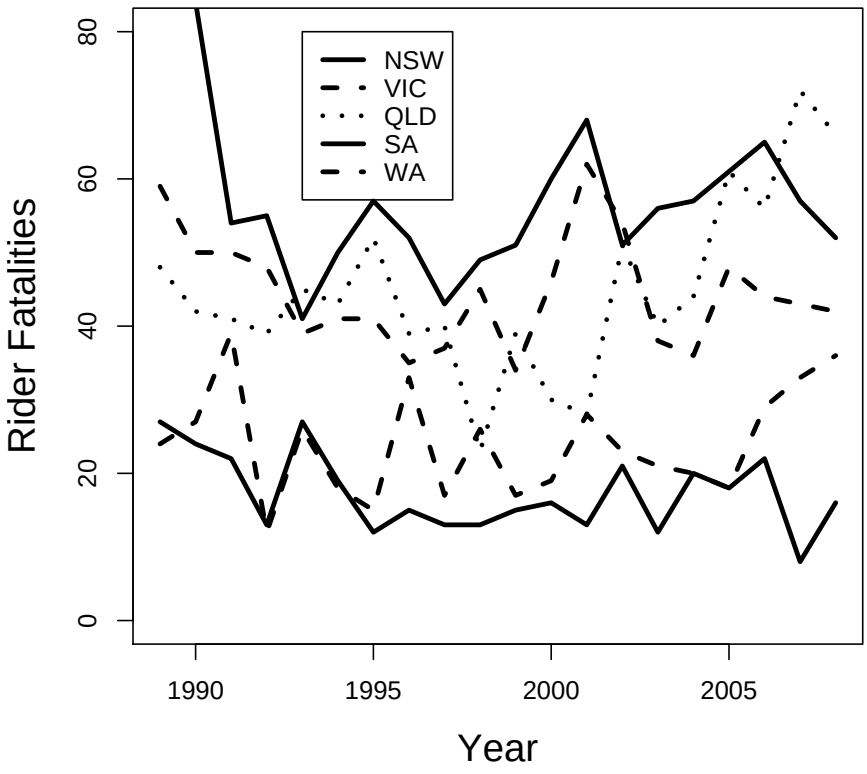


Figure 1: Road fatalities for vehicle drivers (top) and motorbike riders (bottom) plotted by year for each of the five most populated Australian states: NSW (solid line), VIC (dashed line), QLD (dotted line), SA (lower solid line) and WA (lower dashed line).

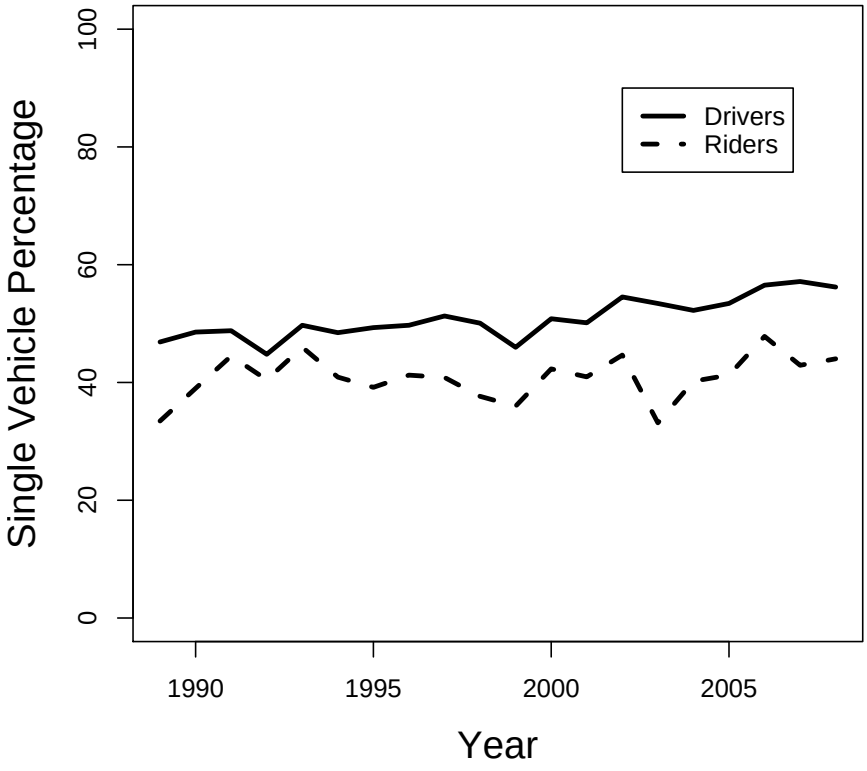


Figure 2: The proportion of Australian accidents resulting in vehicle operator fatality that were single vehicle accidents, for drivers (solid line) and motorcycle riders (dashed line), plotted against year.

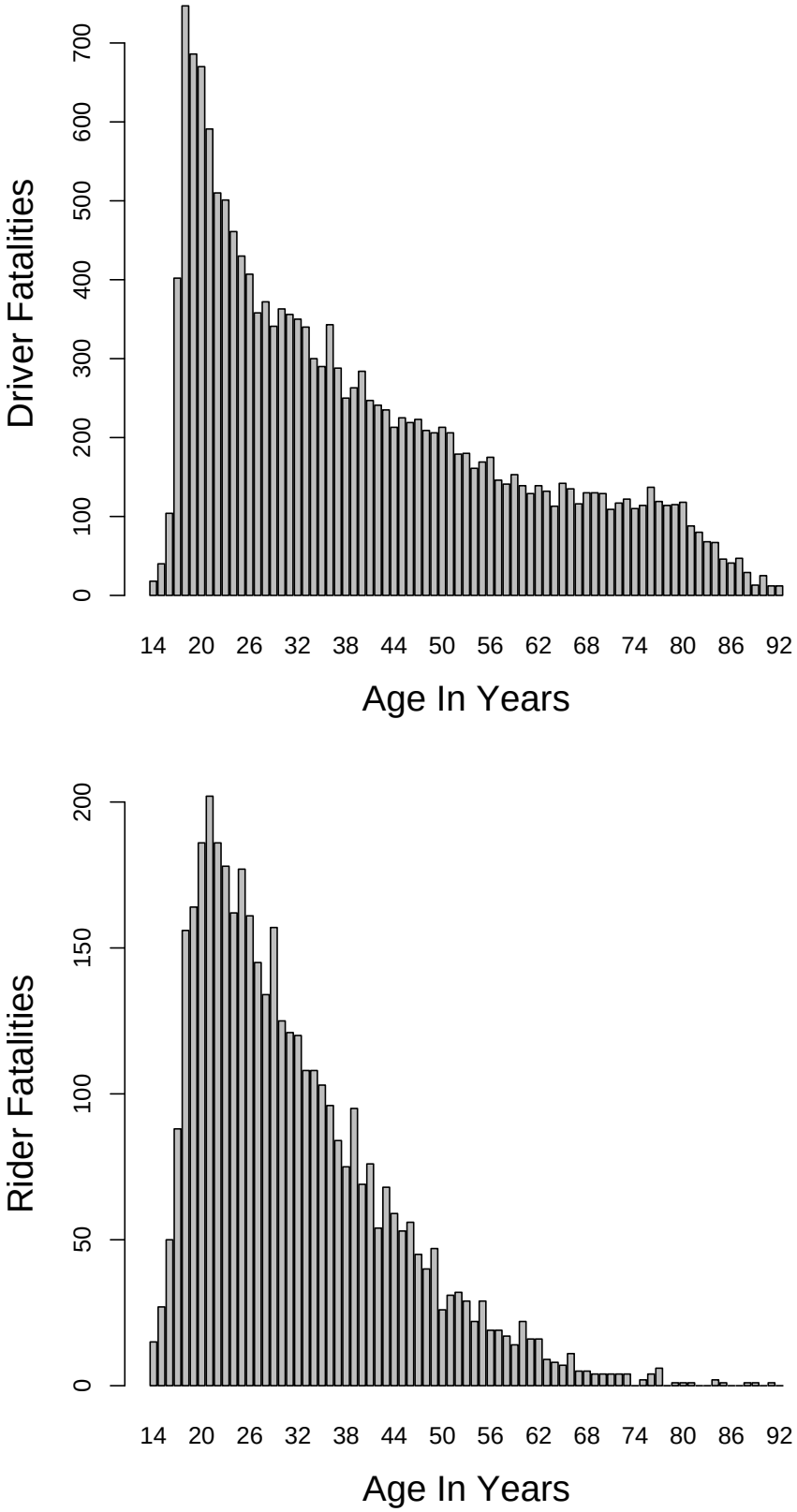


Figure 3: Bar charts of Australian road vehicle operator fatalities over the 20 year period 1989-2008 for vehicle drivers (top) and motorbike riders (bottom) by year of age. Vehicle operators under 14 years or over 92 years have been excluded.

3 Road Fatality Rates

Selected data obtained from the Australian Motor Vehicle Census (MVC) is available from the ABS website [3], which includes the number of vehicle registrations by state and by vehicle type. The census is now performed annually, but this was not the case in the past: in the years 2000, 1994, 1992, 1989, 1990, 1989, 1987 and 1986, no census was carried out. In addition the census dates were at different months within the year: since 2001 it has been taken in March, from 1996-1999 in October, in May 1995, June 1993, and in September for 1991, 1988 and 1985.

For simplicity, we ignore the fact that data were recorded at different months in the year, and simply take the number of registrations at the time as an approximation of the average number registrations within that year. For missing years, we linearly interpolate using the closest non-missing values. The MVC has noted that registration numbers for the Northern Territory in 1988 are unreliable, and hence we treat then as missing and use the earlier 1985 MVC for interpolation. Additionally, the NSW motorcycle registrations given in the 1985 MVC are unusually large: although the MVC did not list this as unreliable, we decided to treat this as missing and use the previous 1982 MVC for interpolation. We do not use the 1982 MVC data otherwise, since this MVC did not include Government owned vehicles. We note that the pdf files distributed by ABS do not explicitly contain registration numbers for the category 'motor vehicles other than motorcycles' from the 2002 MVC onward, and they must be determined by calculation.

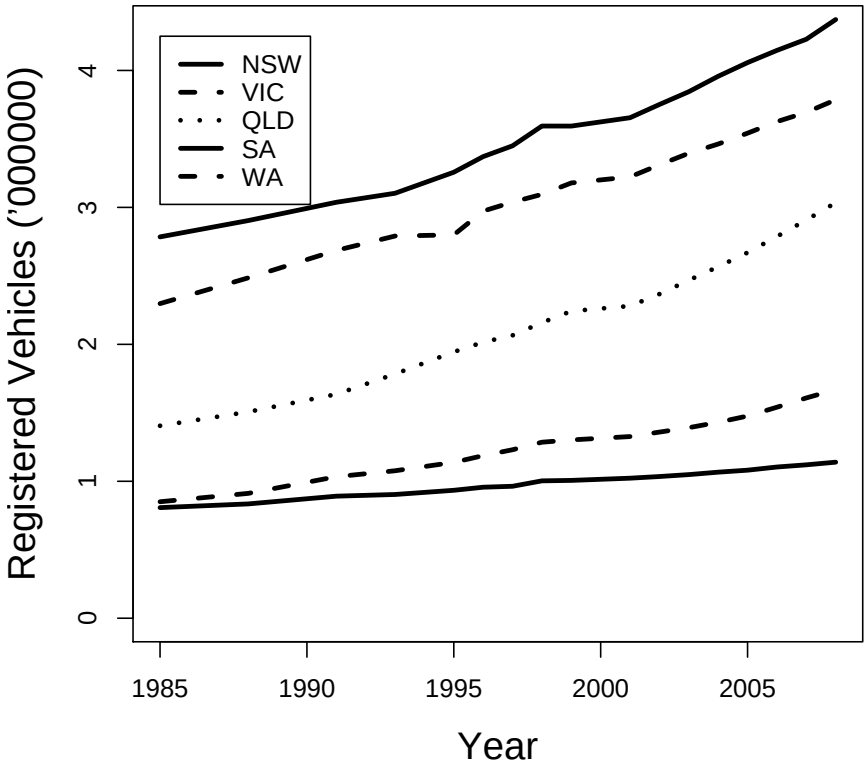
Figure 4 shows the number of vehicle registrations over time for motorcycles and all vehicles other than motorcycles, for each of the five most populated Australian states. We see that for all of the states the number of registered motor vehicles has been increasing at a regular rate. For motorcycles however, the increase in the last ten years is approaching exponential growth, particularly in Queensland, where registrations have roughly doubled since 2000. The period 1985-1990 appears to show a decline in motorcycle use, although the data in this period is taken from only the older MVCs of 1985 and 1988, and hence is less reliable.

The registration figures allow us to calculate our fatality rates: the number of fatalities of drivers per 100 000 registered motor vehicles (excluding motorcycles), and the number of fatalities of riders per 100 000 registered motorcycles. Fatality rates for each of the five major states and for Australia as a whole are given in Figure 5 for drivers and Figure 6 for riders. The fatality rates for the smaller states show a great deal of variability due to the small fatality numbers and are consequently of little interest.

Figures 5 and 6 show the roads are becoming safer for all vehicle operators: fatality rates are decreasing. This decrease was particularly prominent in the period 1990-2000, though we still see decreasing fatality rates in recent times, albeit at a slower rate, in New South Wales, Victoria and South Australia. There has been little progress in Western Australia and Queensland during the 2001-2008 period; the fatality rate for motorcyclists in Queensland shows a modest increase. The additional variation over time apparent in the the rider plots is to be expected, since there are less riders than drivers, and less data produces more volatility. In 2008 in Australia, there were 4.65 driver fatalities for every 100 000 registered motor vehicles (excluding motorcycles), and there were 41.23 motorcycle rider fatalities for every 100 000 registered motorcycles.

We now examine risks of riding a motorbike compared with driving another motor vehicle. In order to assess this, we construct a relative risk measure by taking the fatality rate estimates for riders and dividing by the fatality rate estimates for drivers. This can be done for each state, but here we only present the results for all of Australia. The relative risk values are an assessment of how many times more likely a rider is to die in a road accident than a driver.

Figure 7 shows these relative risk values plotted over time. For every year in the period 1989-2008, the relative risk lies somewhere between 7.1 and 9.4. The are various methods that could be used to obtain a single estimate of the relative risk. For example, one could fit a time series



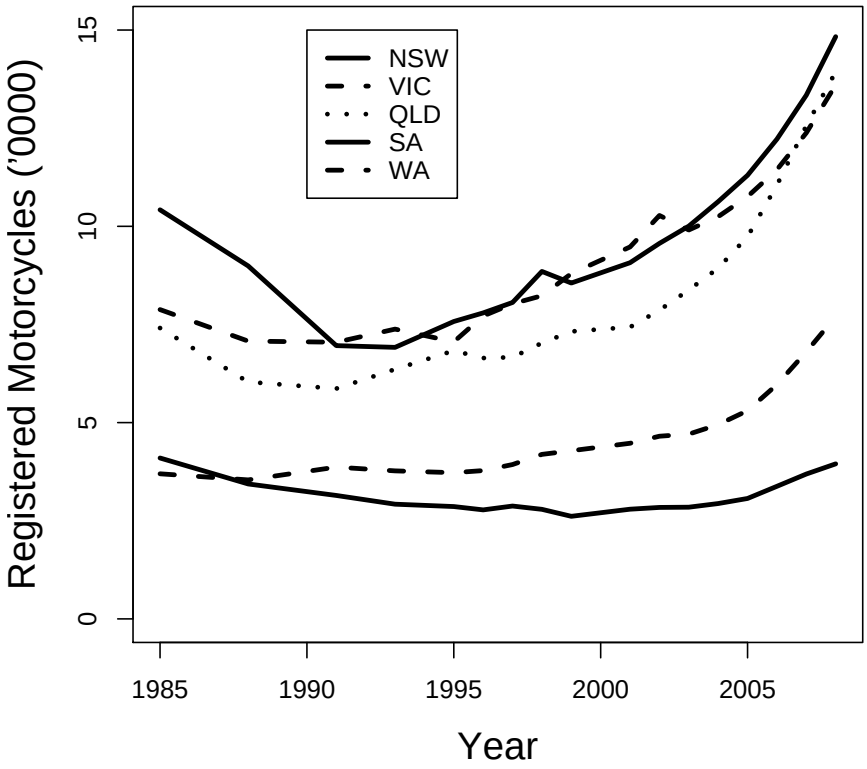
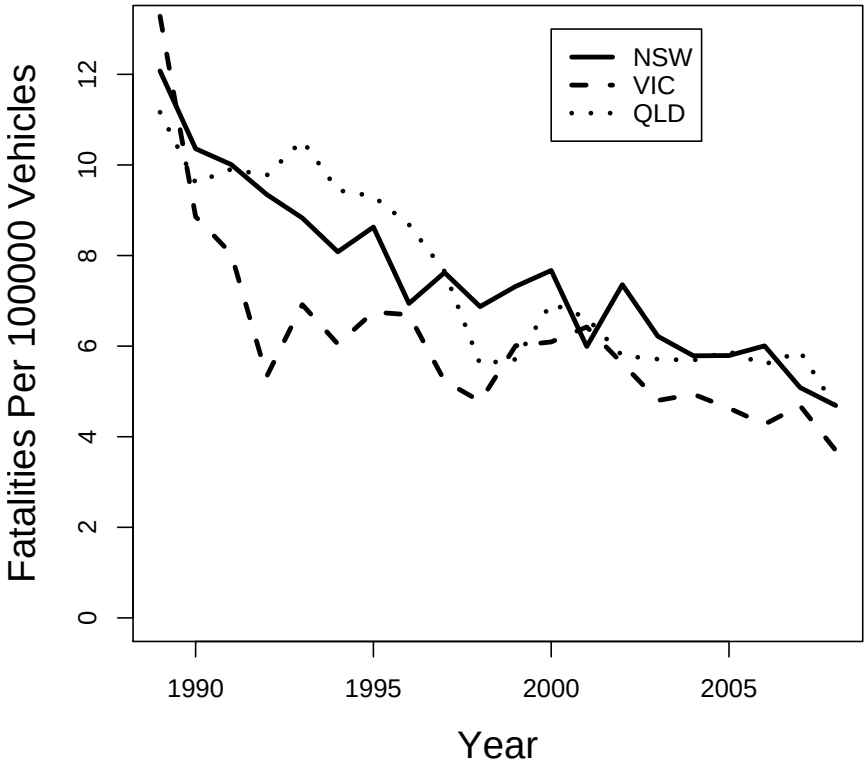


Figure 4: Number of vehicle registrations for vehicles other than motorcycles (top; in millions) and for motorcycles (bottom; in tens of thousands) plotted against time for each of the states NSW (solid line), VIC (dotted line), QLD (dashed line), SA (lower solid line) and WA (lower dashed line).



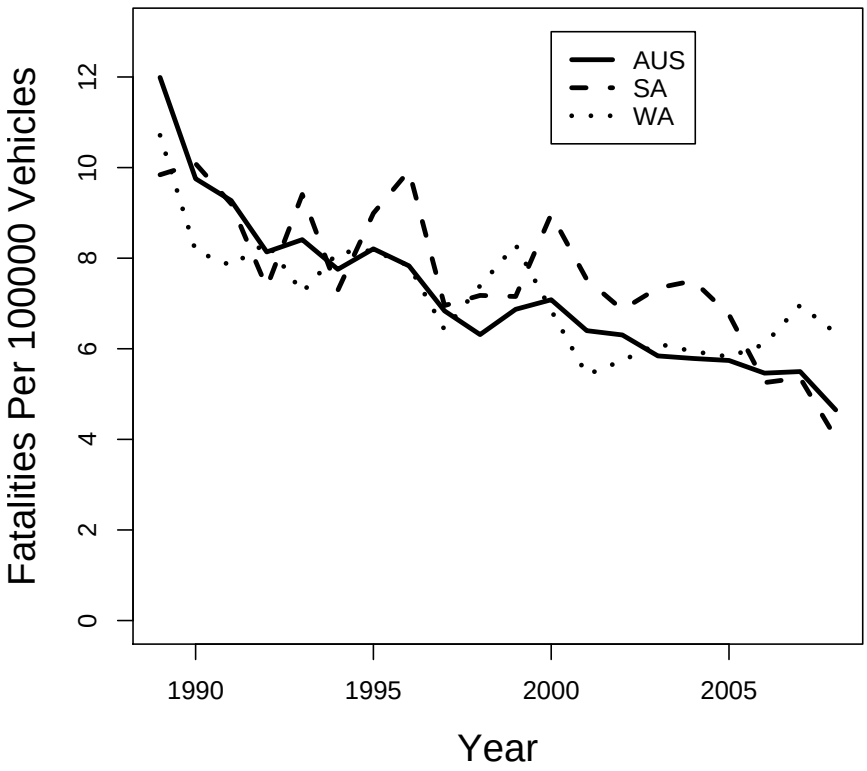
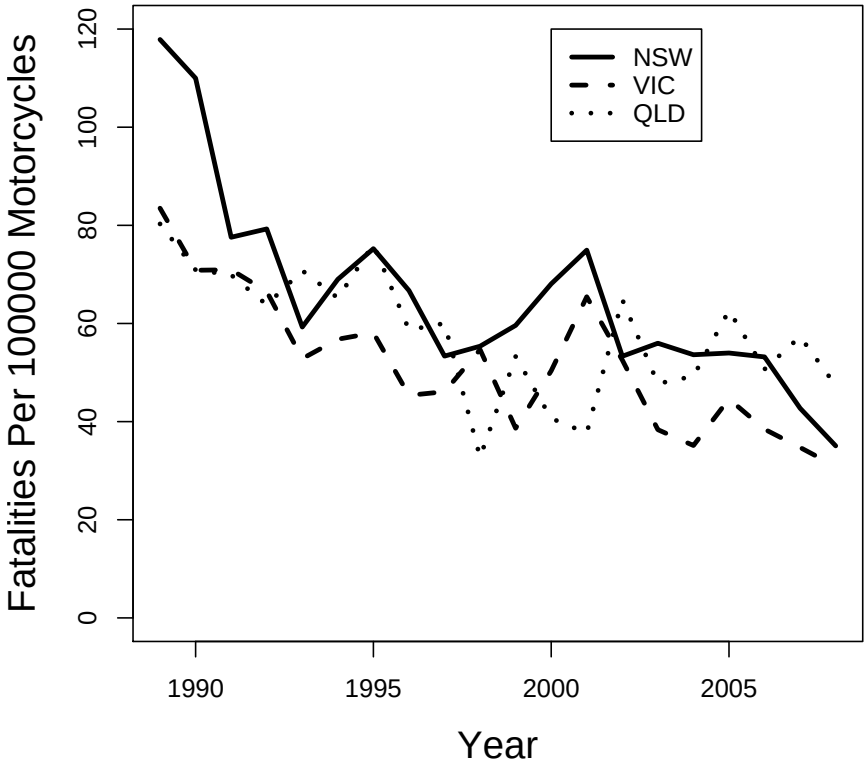


Figure 5: Number of driver fatalities per 100 000 registered motor vehicles excluding motorcycles, plotted against time for each state and for Australia. Top: NSW (solid line), VIC (dotted line), QLD (dashed line). Bottom: Australia (solid line), SA (dashed line) and WA (dotted line).



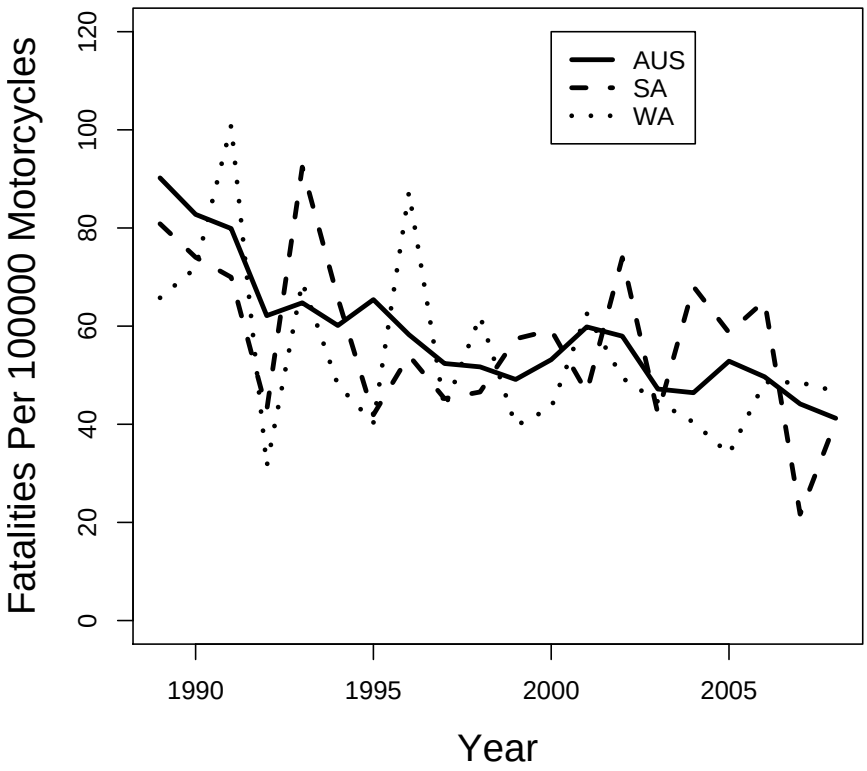


Figure 6: Number of rider fatalities per 100 000 registered motorcycles, plotted against time for each state and for Australia. Top: NSW (solid line), VIC (dotted line), QLD (dashed line). Bottom: Australia (solid line), SA (dashed line) and WA (dotted line).

model and predict the 2009 value. We take a simpler approach by estimating the risk based on all fatality data in a previous time period. Using the previous 5, 10 and 20 years of data yields relative risk values of 8.58, 8.36 and 8.09 respectively. Rounding upwards, riding is nine times riskier than driving, based on fatalities per registered vehicles.

We noted in Section 1 that our analysis does not take into account the distances travelled by registered vehicles. This information is available by state and vehicle type through the Survey of Motor Vehicle Use (SMVU). The SMVU data is currently available on the ABS website [3] for the years 1998-2007. We have reproduced the analysis of this section using a fatality rate of fatalities per billion kilometers travelled by registered vehicles. We do not show the results here because such analysis is largely uninformative due to the sampling variation in the estimates for distances travelled, particularly for motorcycles, which appear to be undersampled in the SMVU. The sampling variation means that when estimated distance travelled is used as a denominator, the variability in the resulting fatality rate estimates swamps any potential features of interest.

The relative risk values given above also do not account for kilometers travelled by each vehicle type. Accounting for kilometers travelled increases the relative risk value since motorcycles typically travel less kilometers within a given time period than other motor vehicles. The 2007 SMVU gives two estimates[3] for average use by vehicle type: including or excluding registered vehicles that did not travel at all during the 12 month[4] reference period. For all registered vehicles (i.e. including vehicles that were not ridden or driven) motorcycles averaged 3 700 kms and other motor vehicles averaged 14 900 kms. For used registered vehicles (i.e. excluding vehicles that were not ridden or driven) motorcycles averaged 5 000 kms and other motor vehicles averaged 15 600 kms. This yields relative use figures of 4.03 and 3.12 respectively. The value 4.03 should not be used: the distributions of distances travelled for both motorcycles and other motor vehicles have spikes at zero corresponding to unused vehicles, and to summarize such distributions using a mean average is not appropriate. One should therefore use the value 3.12, which is lower as a consequence of there being relatively more unused motorcycles. Taking the worst case scenario for the motorcyclist, we can estimate the relative risk, accounting for kilometers travelled, as $8.58 \times 3.12 = 26.77$. So accounting for kilometers travelled increases the relative risk from 8.58 to 26.77. This adjustment for distance travelled should be used with caution however, given the sampling variability of the SMVU data.

We conclude by emphasizing that the roads are becoming safer for both motorbike riders and motor vehicle drivers. Motorcycle riders have 9 times the risk of death in a traffic accident than vehicle drivers based on fatality rates using number of registered vehicles, but this figure increases to 27 times the risk when taking into account the distance travelled by each vehicle type.

Bibliography

[1] http://www.infrastructure.gov.au/roads/safety/index.aspx

[2] http://www.tacsafety.com.au/jsp/homepage/home.jsp

[3] http://www.abs.gov.au/

[3] Estimates for the category 'motor vehicles other than motorcycles' are not given directly and must be derived.
[4] 1st November 2006 to 31st October 2007.

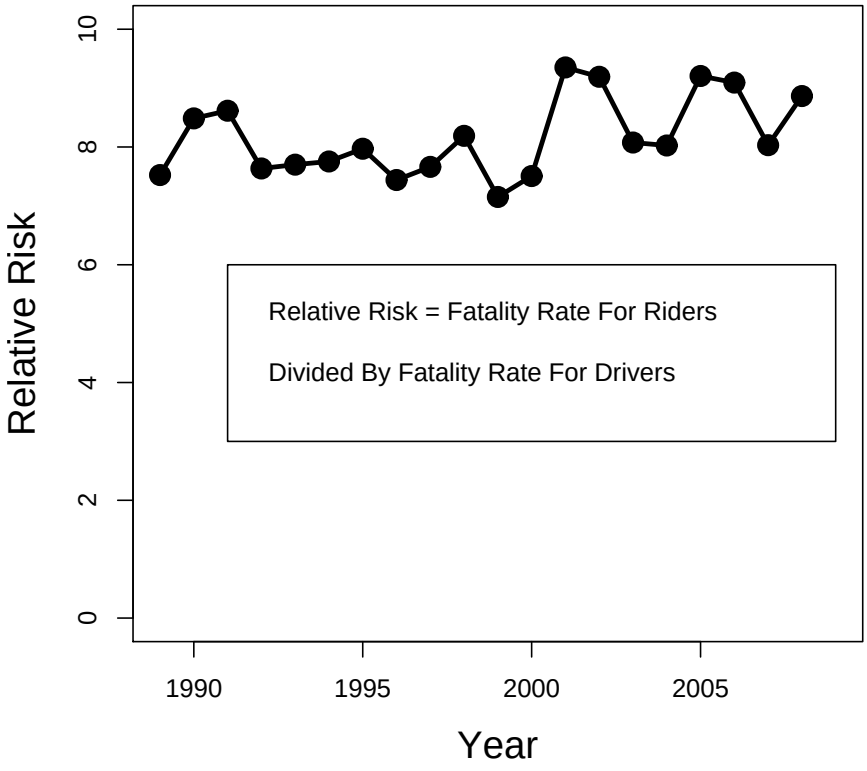


Figure 7: The relative risk of road accident fatality in Australia for motorcycle riders verses other motor vehicle drivers, measured using number of fatalities per registered vehicles.