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Trends in road crash fatality rates: International comparisons with Australia 1970-1990

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Abstract

Australia has seen a substantial and sustained reduction in road crash fatality rates between 1970 and 1990. This report compares this reduction with that seen in other countries.

Report CR 115 comprises a summary of this report and of CR 113, which is a detailed analysis of the trends in Australia.

Keywords

Fatality rate, international comparisons, crash fatality trends, statistics

Notes:

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Trends in road crash fatality rates:
International comparisons with Australia 1970-1990

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April 1993

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Trends in road crash fatality rates: International comparisons with Australia 1970-1990

SUMMARY

Australia has seen a substantial and sustained reduction in road crash fatality rates (expressed either as annual deaths per person or annual deaths per registered vehicle) between 1970 and 1990. This report compares this reduction with that seen elsewhere.

Overall, Australia's decrease in fatality rates (deaths per person) has been slightly better than that for other countries. Australia's decrease was better than most other countries for driver/passenger fatalities, but worse for pedestrian and bicyclist fatalities.

Data sources (Chapter 2)

Except for Australia and Canada, data on road fatalities were taken from the International Road Traffic and Accident Database (IRTAD). International comparisons are limited because IRTAD combines drivers and passengers, combines males and females, uses broad age groupings and is incomplete, particularly for the early 1970's. The Australian and Canadian data came directly from government sources.

Australian and Canadian trends (Chapter 3)

Australia and Canada have geographical and cultural similarities, and their level and pattern of vehicle ownership is similar. The rate of decrease in fatality rates per person was similar for drivers, but was greater in Canada for passengers, cyclists and pedestrians.

Total fatality rates (Chapter 4)

Of the 20 IRTAD countries with reasonably complete data, Australia has the fifth highest average road fatality rate per person between 1970 and 1990, after Portugal, France, Belgium and Austria. However, Australia's high rate of vehicle ownership results in its fatality rate per vehicle being the sixth lowest.

Australia's estimated average annual percentage decrease in the fatality rate per person was 3.2%, slightly better than the median decrease of 2.9%. Ten countries had an annual percentage decrease within 0.5 percentage points of that for Australia. Australia's low rate of increase in vehicle ownership means that the decrease in the fatality rate per vehicle is less than that for most countries.

Driver and passenger fatality rates (Chapter 5)

Drivers and passengers comprise 66% of Australian road deaths. This percentage ranges from 27% (for Portugal) to 72% (for Canada). For most countries, this percentage has increased between 1970 and 1990.

Only four countries - Netherlands, West Germany, Canada and Japan - had a greater average annual percentage decrease for driver/passenger fatalities than Australia. In 1970, Australia had the highest driver/passenger fatality rate of all countries for which there are data. By 1990, France, Spain, Belgium and Austria had higher fatality rates and the gap between Australia and most other countries had narrowed. Australia's relatively low rate of increase in vehicle registrations means that the average annual percentage decrease in the vehicle based rate is closer to the mean change for all countries than the population based rate.

Pedestrian fatality rates (Chapter 6)

In Australia, pedestrians account for about 19% of fatalities, lower than for most countries. For the Netherlands, this percentage fell from 19% in 1970 to 10% in 1990. Other countries also experienced a decrease, but to a lesser extent.

The average annual percentage decrease in fatality rate of pedestrians in Australia was greater than for any other mode of road user. However, it was less than the median decrease for all countries.

Motor cyclist fatality rates (Chapter 7)

Motor cycle usage differs considerably between countries, as does the percentage of fatalities. Australia has a low percentage of fatalities (about 11%). Australia also had a relatively small average annual percentage decrease of 2.0% in the population based fatality rate, although there has been a steeper decrease since 1986.

Bicyclist fatality rates (Chapter 8)

Only 3% of road fatalities in Australia are of bicyclists. For many other countries this percentage is much higher. The Netherlands has the highest proportion (20%). This is noteworthy because the Netherlands had the largest decreases overall for the other types of road user, but this did not occur for bicyclists.

Italy, which did not have high decreases for other modes, had the highest decrease in bicyclist fatality rates per person (5.5%). Germany, Austria, Japan and Canada all had decreases of over 4%. Most other European countries had decreases between 2% and 4%. Australia had one of the lowest decreases (1.2% annually), along with the United Kingdom and the United States.

Relationship between fatality rates and motorisation (Chapter 9)

More motorised countries tend to have fewer fatalities per registered vehicle than less motorised countries, even when the analysis is restricted to the richest nations. As countries become more motorised, their fatality rates decrease, and the more rapidly a country motorises, the greater is the decrease in the fatality rate. In addition, the decrease is greater for countries with the lower initial fatality rates. The Netherlands has achieved a particularly high decrease in its fatality rate between 1970 and 1990. Similar results obtain for driver/passenger and pedestrian fatality rates.

Related reports

A companion report (CR113) describes how the average annual percentage decrease in Australian road fatalities varies with road user type, State or Territory, gender, age group, time of week and month. Report CR115 summaries both reports.

1. Introduction

Australia has seen a substantial and sustained reduction in road crash fatality rates between 1970 and 1990 (Adena, Anderson and Montesin, 1993; Anderson, Adena and Montesin, 1993). For car drivers, car passengers, bicyclists and pedestrians, the change overall is well described by an average annual percentage decrease in the population fatality rate, although the change from year-to-year can be quite variable. For motor cyclists, an average annual percentage decrease characterises the pattern of change when the rate is expressed as a vehicle fatality rate rather than as a population fatality rate.

A companion report (Anderson, Adena and Montesin, 1993) describes the pattern for fatalities in Australia, and how the average annual percentage decrease varies by road user type, State or Territory, gender, age group, time of week and month. Adena, Anderson and Montesin (1993) summarises this material.

This report compares the changes seen in Australia between 1970 and 1990 with those that have occurred elsewhere. The data sources are summarised in Section 2. Section 3 compares these decreases for Australia and Canada, a country which is expected to have similar patterns to Australia. Sections 4 to 8 compare Australia with many other countries for total fatality rates (Section 4), drivers and passengers (Section 5), pedestrians (Section 6), motor cyclists (Section 7) and bicyclists (Section 8).

Fatality rates are related to the degree of motorisation in a country (Section 9). This is examined both for a single point in time and for changes over time.

2. Data sources

2.1 Australia

For each fatality in Australia between 1970 and 1990, the date and time of the crash, State or Territory where the crash occurred, and the gender, age and road user type of each person were sought from State and Territory authorities. These data, together with appropriate denominator data from the Australian Bureau of Statistics, have been used for the analyses reported in Adena, Anderson and Montesin (1993) and Anderson, Adena and Montesin (1993). These two reports contain the results of more detailed analyses than those reported here, and the set of data that was available at that level of detail is not precisely the same as that available for the present report. Therefore, estimates of average annual % decreases for Australia may differ slightly from those given in Adena, Anderson and Montesin (1993), and Anderson, Adena and Montesin (1993).

2.2 Canada

The Federal Office of Road Safety in Australia obtained the numbers of fatalities for each year between 1970 and 1990 for each road user type in Canada from its counterpart in Canada. The data for 1970 appeared to be inconsistent with those for later years, so the data for 1970 were not used for the analyses in this report. Denominator data (population and registered vehicles) were also obtained.

2.3 Other countries

The source of data for other countries was IRTAD, the International Road Traffic and Accident Database. It holds data for 25 countries. The database is nominally for the period 1970 to 1990, with some data also for 1965. However, many countries have missing or incomplete data.

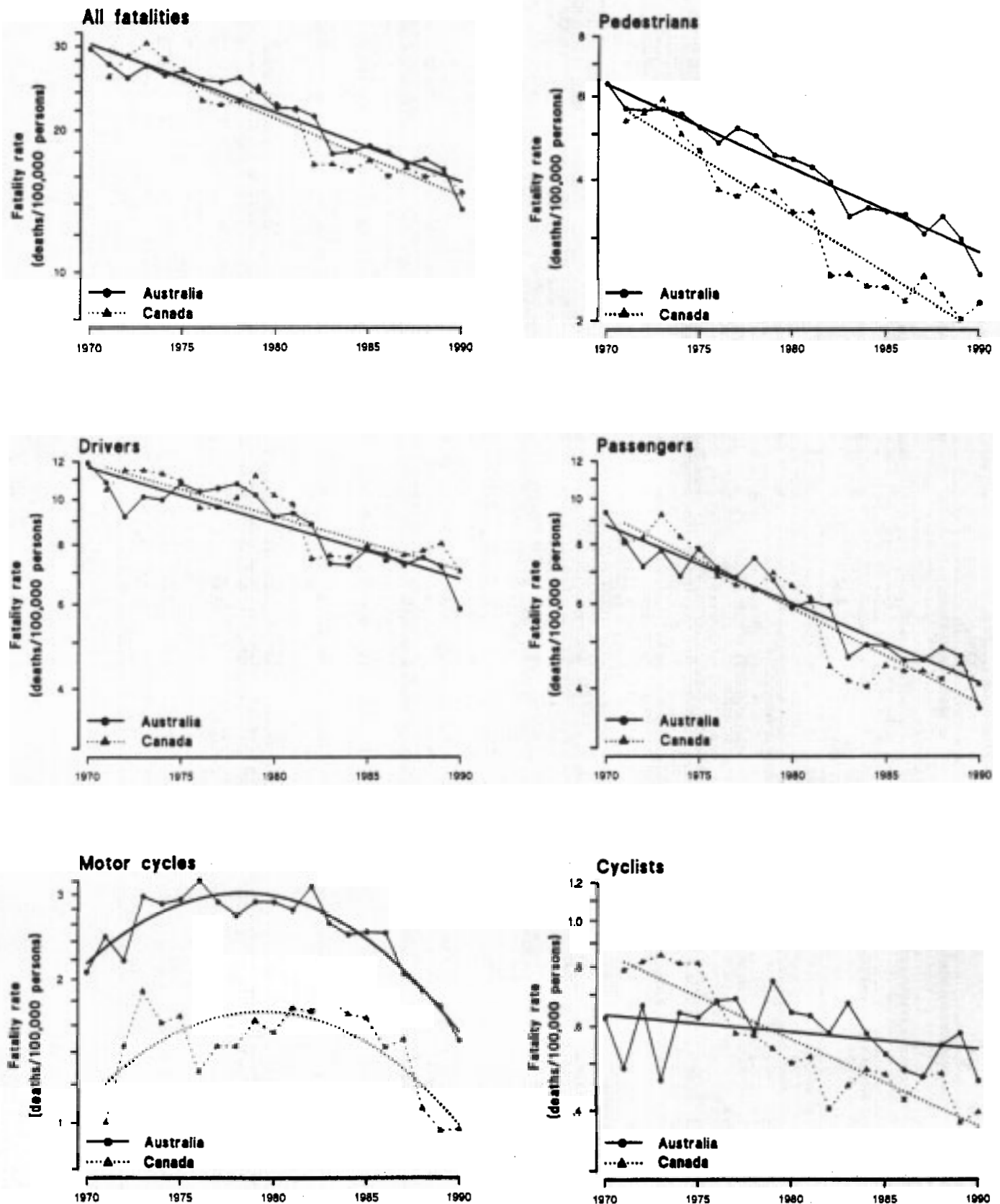
The IRTAD road user categories include car drivers and passengers (combined), pedestrians, motorcycle/scooter riders, moped/mofa riders, bicyclists and unknown. All data is for males and females combined. The IRTAD age groups are ages 0-5, 6-9, 10-14, 15-17, 18-20, 21-24, 25-64, 65 and older, and unknown. Except for West Germany, classification by age is available for only 1980 to 1990 and, for some countries, the individual years 1972 and/or 1975. IRTAD also includes denominator information such as the population by age group and year, and, for some countries, numbers of vehicles and total kilometres of travel each year.

International comparisons with Australia are hindered because IRTAD:

- combines drivers and passengers into one category,
- combines males and females,
- uses different age groupings, with ages 25 to 64 years lumped as a single group
- has incomplete data, particularly those classified by age group.

Although IRTAD contains data for Australia and Canada, these data have not been used in this report. Instead, data for these two countries have been taken from the sources described above in sections 2.1 and 2.2.

Figure 3.1 Population fatality rates of road users between 1970 and 1990 for Australia and Canada



3. Fatality rates in Australia and Canada

Of all countries, Canada is the most appropriate for comparison of trends in fatality rates with Australia. The two countries have geographical and cultural features in common, and have similar vehicle ownership rates (see Figure 4.2 in the next section). In 1990, the population of Canada was about 26.5 million compared with 16.1 million for Australia.

The average annual % decreases for Australia and Canada for each mode and all fatalities are shown in Table 3.1. The comparison between the two countries is similar for both population based and vehicle based rates because the levels of and trends in vehicle ownership have been similar (Figure 4.2).

Figure 3.1 shows the population based rates from 1970 to 1990. These are plotted with the rates on a logarithmic scale, so that constant annual percentage changes are represented by straight lines.

For both countries, the largest average annual % decrease was for pedestrians. However, it was much greater for Canada (5.7%) than for Australia (4.0%). In 1971, Canada and Australia had a similar pedestrian fatality rate, but by 1990 the estimated rate for Australia was about 50% greater. However, the difference between the actual rates was less because, in that year, Australia has a larger drop than would have been predicted and Canada had an increase compared with 1989.

The two countries had very similar fatality rates for both drivers and passengers throughout the period 1970 to 1990. In 1971, rates for the two countries were almost identical. However, compared with Canada, Australia has had a slightly greater average annual % decrease for the driver rate and a slightly lesser decrease for the passenger rate. In 1990, Australia had a lower fatality rate for both drivers and passengers because for this year there was a drop in fatalities which was greater than that predicted from the overall trend.

As observed in Australia, the pattern for motor cycle fatalities in Canada cannot be described adequately as a linear trend in the population fatality rate. The population fatality rate for both countries peaked in the early 1980's (with the exception of 1973 for Canada which appears to have been an abnormally high year). The overall decline in fatality rate was greater for Australia, so that the estimated rate for Australia was twice that for Canada in 1971 but only 1½ times as great in 1990.

The average annual % decrease in cyclist fatality rates was more than three times greater for Canada (4.2%) than for Australia (1.2%). This meant that the fatality rate for Canada has been less than that for Australia since the late 1970's, when previously it had been greater.

Overall, Canada had a greater decrease in the total fatality rate than Australia. This is largely due to the difference in the decrease in pedestrian fatality rates. However, the total fatality rates remained broadly similar throughout the twenty years.

Table 3.1 Average annual % change¹ in fatality rates for Australia (1970-90) and Canada (1971-90).

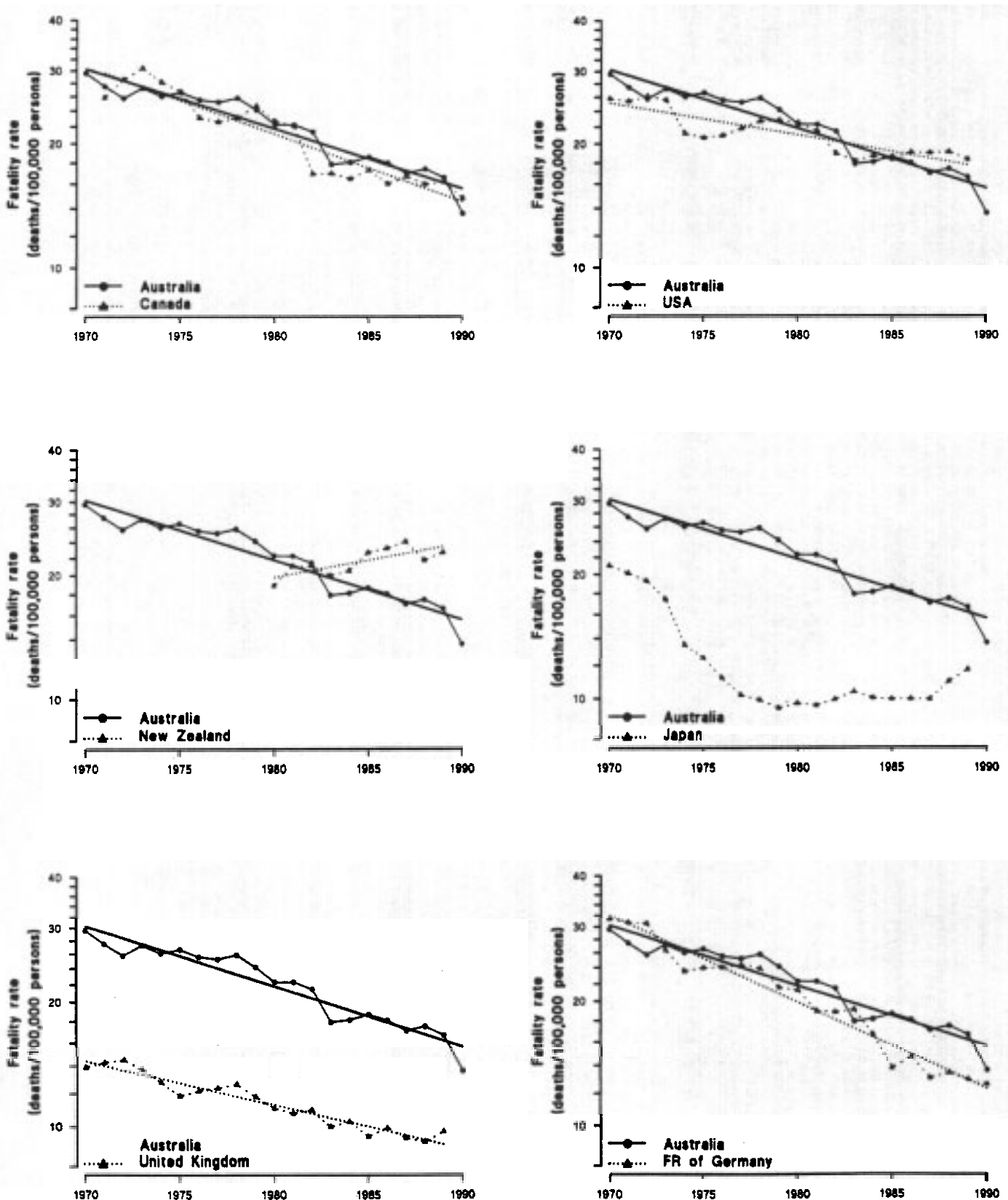
	Fatality rate per 10 ⁵ persons		Fatality rate per 10 ⁴ vehicles	
	Australia	Canada	Australia	Canada
All fatalities	-3.2	-3.7	-4.8	-5.6
Drivers	-2.7	-2.6	-4.9	-4.6
Passengers	-3.7	-4.5	-6.0	-6.5
Motor cyclists	(-2.0) ²	(-1.0) ²	-4.2	na ³
Cyclists	-1.2	-4.2	-3.4	-6.2
Pedestrians	-4.0	-5.7	-6.3	-7.7

¹ The estimates are not adjusted for any other factors (such as sex or age)

² The annual % decrease for motor cyclists was not constant between 1970 and 1990

³ Data on the number of motor cycles registered in Canada were not available

Figure 4.1 Population fatality rate of all road users between 1970 and 1990 for Australia and selected countries



4. Total fatalities

Fatality rates per 10⁵ people

Table 4.1 gives the average annual % change in overall road fatality rates for all countries for which data were available. The countries are in descending order of decrease in the population fatality rate.

Table 4.1 Estimated fatality rate in 1980 and annual % change in total road fatalities for the IRTAD countries, 1970-90.

Country	Years	Total road fatalities	Estimated fatality rate in 1980		Estimated annual % change in rate	
			per 10 ⁵ persons	per 10 ⁴ vehicles	per 10 ⁵ persons	per 10 ⁴ vehicles
Netherlands	1970-90	44392	14.4	4.4	-5.4	-8.6
Germany (W)	1970-90	267908	19.9	4.7	-4.6	-8.1
Finland	1970-90	15578	15.1	5.0	-3.9	-7.2
Japan	1970-89	281288	11.8	3.4	-3.7	-7.5
Canada	1971-90	101135	21.2	3.9	-3.7	-5.6
Austria	1970-90	43988	27.1	7.8	-3.5	-7.3
Switzerland	1970-90	25085	18.4	4.5	-3.4	-7.2
Denmark	1970-90	17080	15.7	4.4	-3.2	-4.7
Australia	1970-90	68170	21.8	4.3	-3.2	-5.5
Sweden	1970-90	20317	11.5	2.8	-3.0	-4.9
Italy	1970-90	188785	15.8	4.2	-2.9	-6.8
France	1970-90	289276	25.4	6.4	-2.8	-5.5
Belgium	1970-90	49346	23.6	6.5	-2.8	-5.4
Ireland	1970-89	10729	15.8	6.5	-2.7	-4.8
UK	1970-89	130078	11.3	3.4	-2.4	-4.6
USA	1970-89	958475	21.0	3.1	-1.8	-3.5
Germany (E)	1970-90	45818	12.9	4.9	-1.4	-5.2
Portugal	1970-89	55030	30.1	14.8	.0	-6.2
Spain	1971-90	133919	17.9	7.6	1.4	-3.6
Greece	1970-89	29751	15.6	12.0	2.6	-6.1
Median			16.8	4.6	-2.9	-5.5
<i>Countries with incomplete data</i>						
Luxembourg	1980-89	805	25.6		-3.5	
Norway	1985-89	2011	12.1		-3.2	
New Zealand	1980-89	7053	19.8		1.9	
Iceland	1985-89	128	7.4		4.8	
Turkey	1985-88	35429	12.0		5.7	

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Of the 20 IRTAD countries with reasonably complete data, Australia has the fifth highest road fatality rate per 10⁵ people for the 21 years from 1970 to 1990, after Portugal, France, Belgium and Austria.

The estimated average annual % decrease in fatality rate (unadjusted for age and sex) was 3.2%. This was the ninth greatest % decrease, and was slightly better than the median decrease of 2.9%. Ten countries had an annual % decrease within 0.5 percentage points of that for Australia (that is, between 2.7 and 3.7%). Figure 4.1 shows the annual fatality rates for each country compared with those for Australia.

Canada has experienced similar road fatality rates to Australia over the twenty year period 1971 to 1990. Its estimated average annual % decrease (3.7%) is slightly better than that for Australia (3.2%).

New Zealand has data from only 1980. Since then, the average annual % change has been an increase of 1.9%. By 1989, New Zealand had a fatality rate almost 50% greater than that for Australia.

Figure 4.1 Population fatality rate of all road users between 1970 and 1990 for Australia and selected countries (continued)

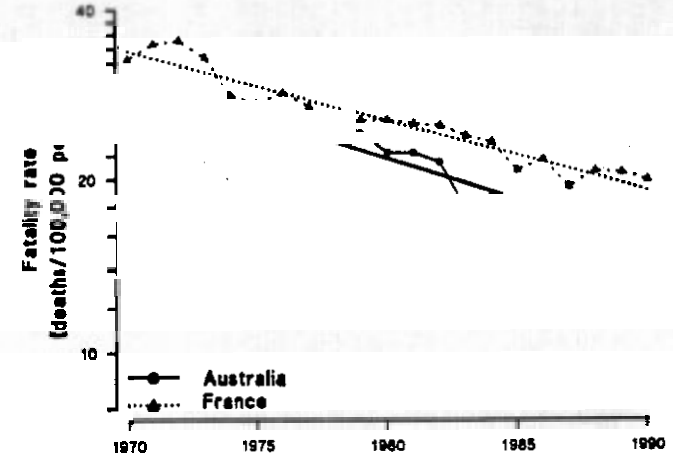
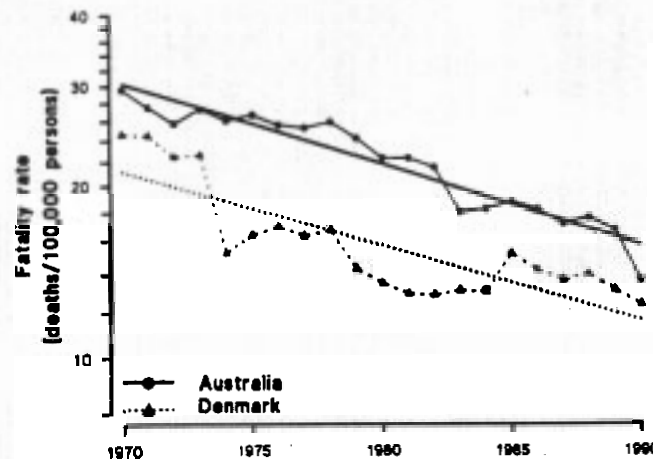
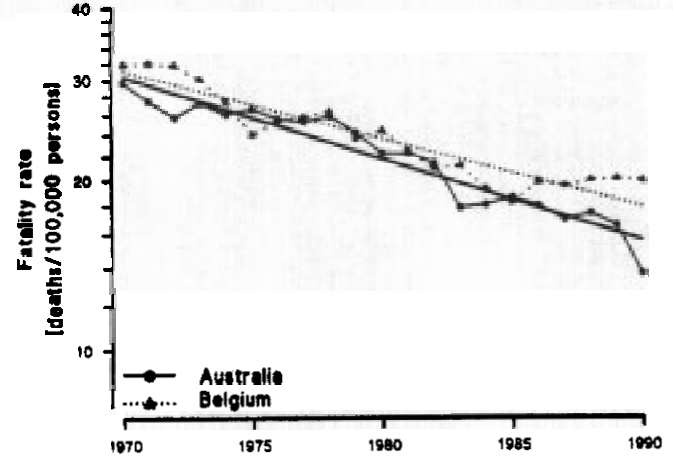
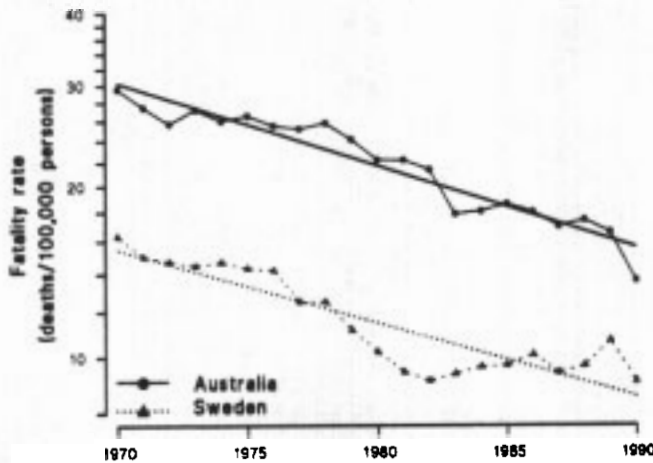
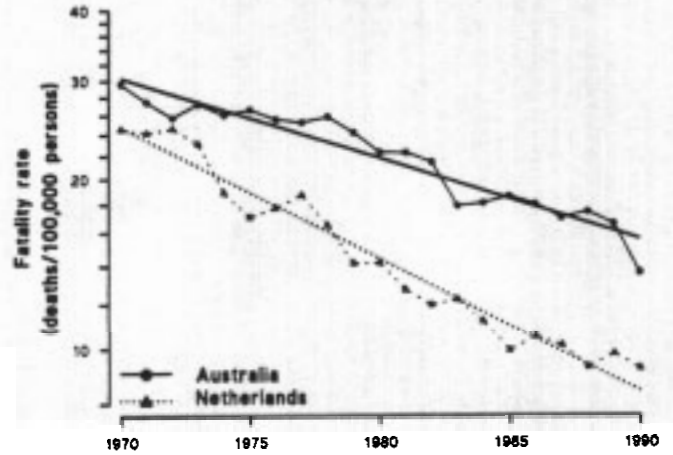
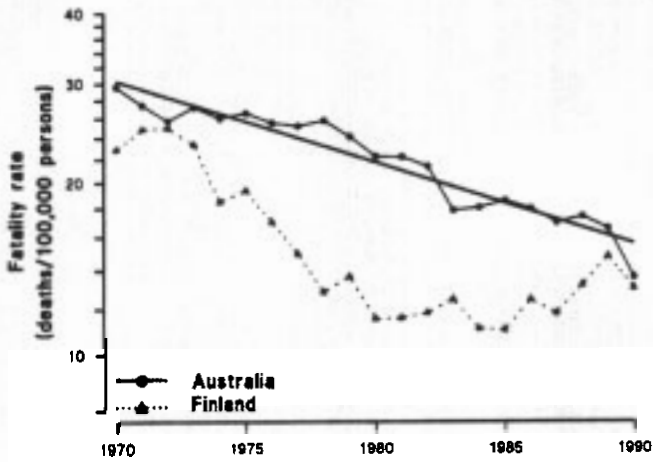
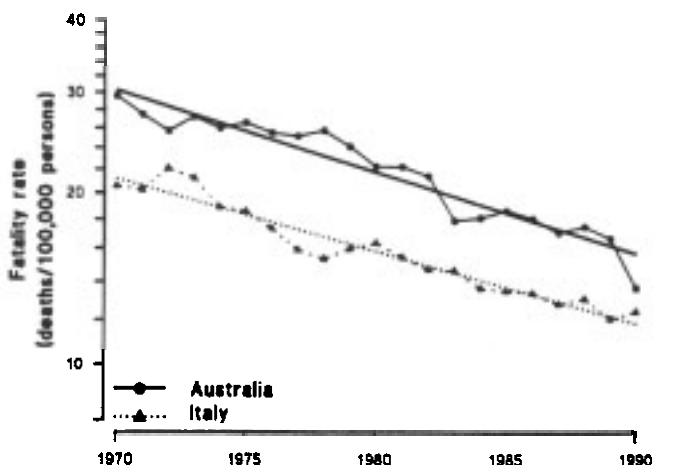
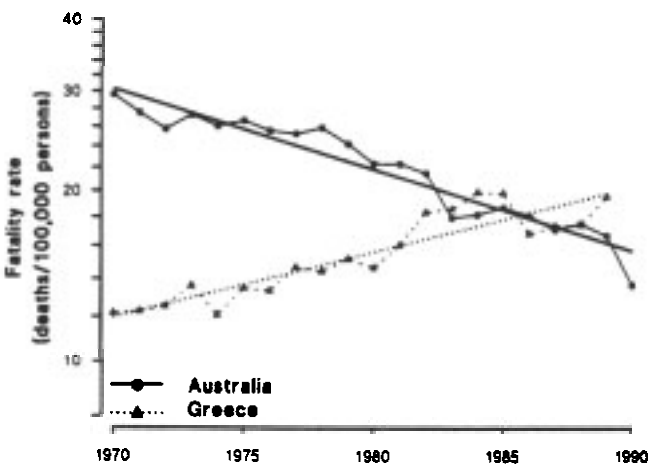
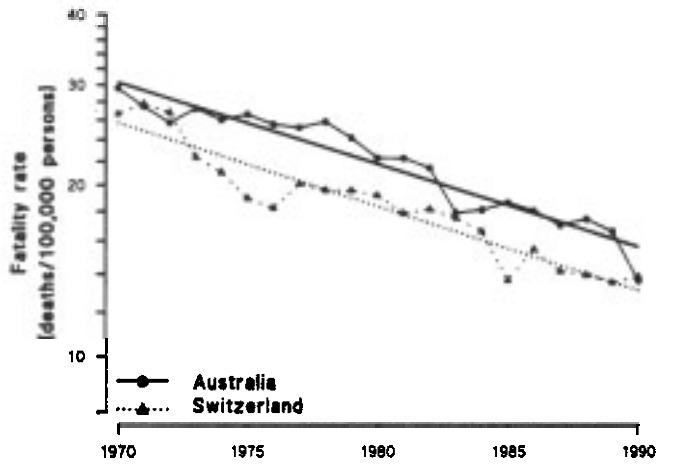
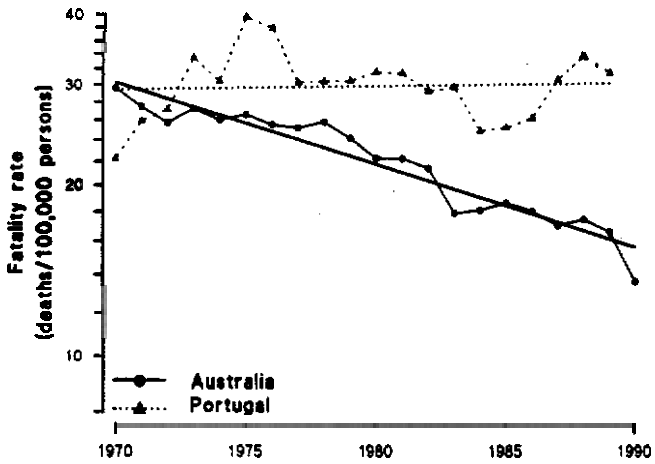
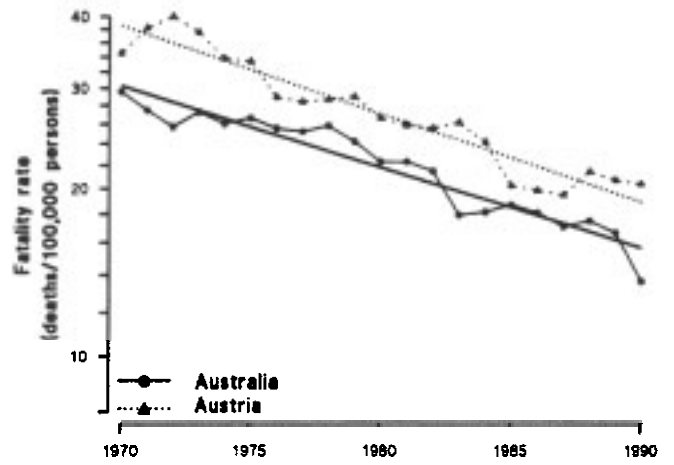
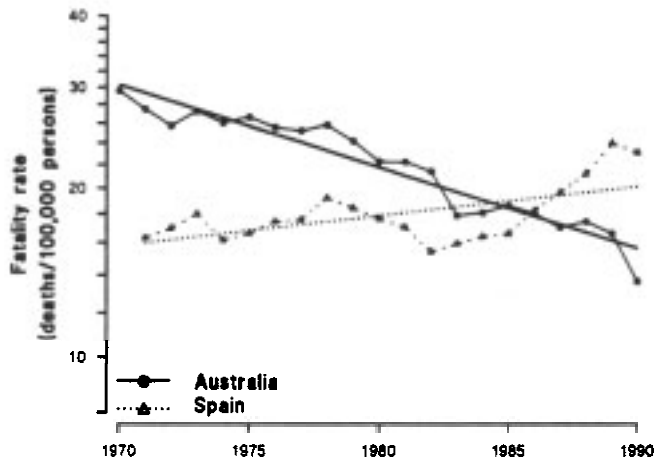


Figure 4.1 Population fatality rate of all road users between 1970 and 1990 for Australia and selected countries (continued)



The USA has had a lesser average annual % decrease (1.8%) than Australia. Since the mid 1980's, the USA has experienced greater fatality rates than Australia.

A number of countries have had a similar decrease in population fatality rates to Australia. For these countries, the fatality rate curve is parallel or almost parallel to that for Australia in the graphs in Figure 4.1¹. These countries include the United Kingdom, Finland, Sweden, Denmark, Italy and Switzerland, all of which have lower fatality rates than Australia. Their relative fatality rates range from about 50% (UK, Sweden) to 85% (Switzerland) of those in Australia. Austria, France and Belgium also have had a similar average annual % decrease to Australia, but their absolute fatality rates are higher than those in Australia.

West Germany and the Netherlands stand out as having markedly high average annual % decreases (4.6% and 5.4%, respectively). Both these countries had a similar population fatality rate to Australia in 1970, but the Netherlands, in particular, was much lower in 1990.

Portugal, Spain and Greece had lower population fatality rates than Australia in 1970, but had either no decrease (Portugal) or an increase in the average annual % change in fatality rates. By 1990, this has resulted in them having a higher fatality rate than Australia.

Japan has an unusual trend in the population fatality rate. It cannot be described satisfactorily with an estimated average annual % decrease. Between 1970 and 1977, the rate decreased rapidly, and Japan had the lowest rate at this time. From 1977 to 1987, the rate remained stable at around 10 deaths per 10⁵ people. It has since started to increase again, although it is still relatively low.

Fatality rates per 10⁴ vehicles

For fatality rates expressed per 10⁴ vehicles, Australia and Canada have comparatively low rates (sixth and fifth lowest, respectively). This is because these two countries, along with the USA, have the highest rates of vehicle ownership (Figure 4.2). However, vehicle ownership has not increased as quickly for these three countries as for most of the other IRTAD members (Figure 4.2). (Figure 4.2a shows vehicle ownership for only selected countries; countries within the band of 'other countries' in Figure 4.2a are shown in Figure 4.2b).

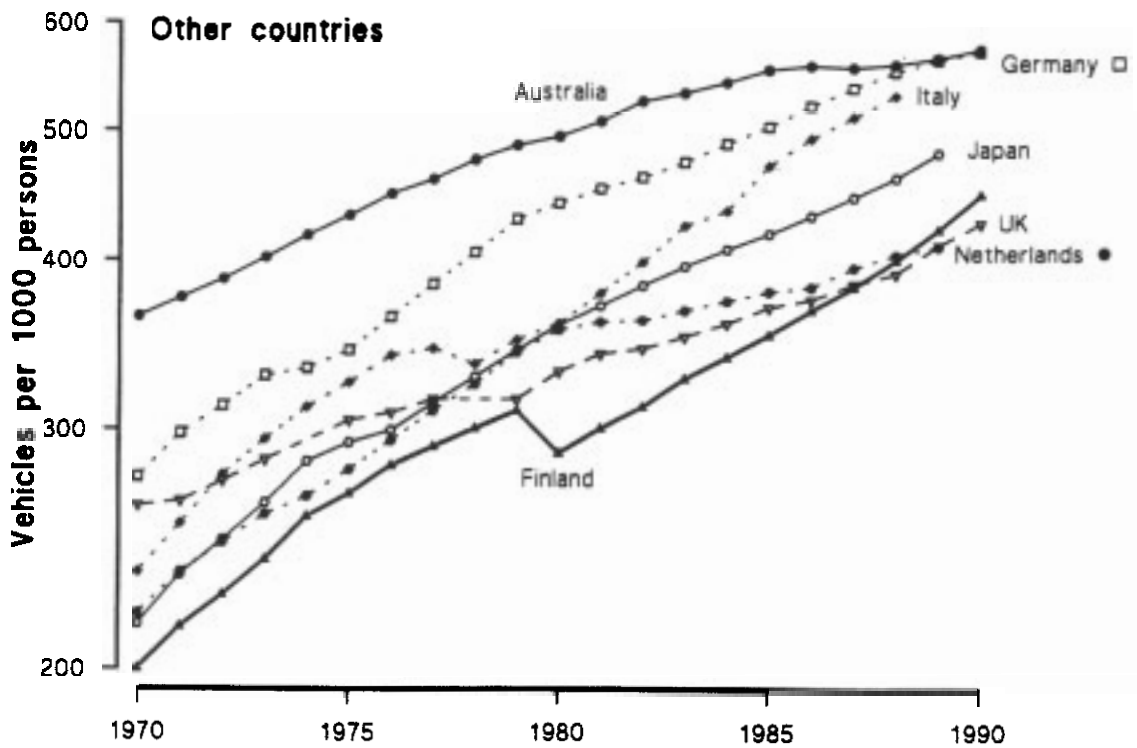
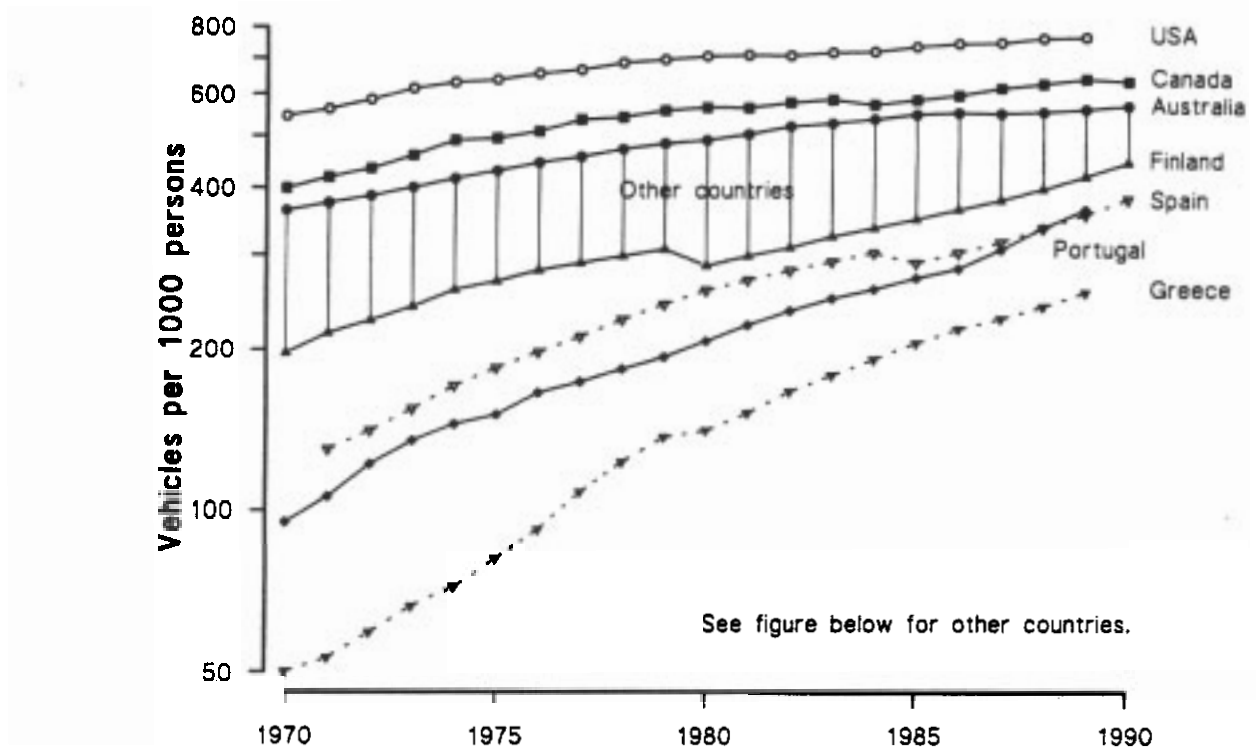
The average annual % decreases for the vehicle based rate for Australia and Canada are therefore not as large as those for the population based rate when compared with those for other countries (Table 4.1). Otherwise, the ordering of the countries with respect to average annual % decrease is generally similar for both the population based and vehicle based rates, except for Portugal, Greece and Spain. These three countries have had relatively large increases in the number of vehicles per head of population. This means that although they had decreases in the vehicle based fatality rate, they had no change or increases in the population based rate. Germany, Italy and Japan also had large increases in vehicle ownership, but maintained large annual % decreases as measured by both rates.

¹Figure 4.1 and the corresponding figures in other chapters consist of three pages, each containing six graphs. Each graph compares the population fatality rate of a single country with that of Australia between 1970 and 1990.

The first page shows the key comparisons in North America (top row: Canada and the USA), the Pacific (middle row: New Zealand and Japan) and Europe (bottom row: United Kingdom and West Germany). The first column shows the usual Commonwealth countries with which Australia is often compared; these also have similar legal and constitutional systems to Australia. The second column shows non-Commonwealth countries.

The second and third (facing) pages show graphs for comparisons of Australia with twelve European countries. Countries are grouped within each column, usually because they are neighbours and/or are geographically, economically or politically similar.

Figure 4.2 Rate of vehicle ownership between 1970 and 1990



5. Drivers and passengers

Fatalities as a percentage of all fatalities

Drivers and passengers are grouped together in IRTAD. In Australia, they form by far the largest group of fatalities (67% of Australian road deaths in 1990), and so the trends for this group largely reflect those for all fatalities. This is a higher proportion than all other countries except the USA (73%) and Canada (72%; Table 5.1). This proportion varies greatly, the lowest being Portugal with a mean for the period of 36%. For most countries, the proportion of fatalities which are drivers and passengers has increased between 1970 and 1990 (Table 5.1).

Table 5.1 Driver and passenger fatalities (occupants of enclosed vehicles, including passenger cars, trucks and buses) as a percentage of total fatalities, by country and year (1970-90). The countries are given in descending order of the mean percentage.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Mean
USA						73	74	73	74	73	72	72	71	72	72	72	73	75	76	77	76	73
Canada		72	69	68	70	70	71	72	71	74	74	72	70	69	70	72	73	71	75	77	75	72
Australia	70	67	64	64	63	67	65	65	68	66	64	65	64	63	63	65	65	66	67	68	67	66
Spain											63	64	64	63	65	64	64	68	67	66	65	65
New Zealand											65	64	66	64	59	63	66	66	66	68	65	65
France	54	55	56	56	53	55	56	57	57	58	58	62	63	63	65	66	67	66	66	67	64	60
Norway											58	53	59	58	57	60	59	63	67	64	60	60
Sweden	53	56	56	56	54	56	59	61	59	62	62	62	59	54	54	64	61	64	65	66	65	59
Belgium			53			48					54	57	56	58	59	58	62	61	64	63	57	57
Austria	46	50	49	52	47	51	52	50	56	56	57	57	58	57	56	54	58	61	61	60	64	54
Germany (W)	51	53	54	52	49	51	50	52	51	52	52	52	51	54	53	53	54	56	58	57	61	53
Italy	44	47	48	49	45	48	50	49	50	51	52	52	51	52	55	54	58	59	60	59	60	51
Greece	43	47	46	44	49	50	46	49	51	51	49	52	50	49	52	53	49	55	55	56	50	50
Netherlands	45	43	44	47	42	45	46	50	48	52	48	49	49	47	51	52	53	55	51	51	55	48
Denmark	44	42	45	47	40	43	45	44	47	51	49	45	46	47	51	57	57	56	58	54	48	48
Finland	43	44	41	45	42	41	48	50	46	48	44	44	50	49	48	48	55	54	60	55	60	48
Switzerland	44	42	43	43	43	46	43	45	46	50	51	47	45	48	50	49	47	47	49	52	54	46
UK			46						43	43	43	44	46	41	43	45	47	47	48	50	45	45
Ireland	39	41	39	42	40	46	47	46	46	47	48	43	51	47	45	45	47	46	46	51	45	45
Japan	35	36	37	35	36	38	39	38	38	36	37	38	37	37	37	36	36	35	36	39	37	37
Portugal	31	34	36												29	31	36	36	41	42	36	36

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁵ persons

Australia and Canada have had relatively larger average annual % decreases for drivers and passengers than most other countries (Table 5.2; Figure 5.1). Except for the USA, no country has had an average annual % decrease for drivers/passengers that is greater than that for all fatalities. The decreases for Australia and Canada are similar to their overall decreases. Only four countries - Netherlands, West Germany, Canada and Japan - had a larger average annual % decrease for driver/passenger fatalities than Australia.

In 1970, Australia had the highest driver/passenger fatality rate of all the countries for which there are data. By 1990, France, Spain, Belgium and Austria had higher fatality rates and the gap between Australia and most other countries had narrowed.

Table 5.2 Estimated fatality rate in 1980 and annual % change in driver and passenger fatalities for the IRTAD countries, 1970-90.

Country	Years	Total driver/passenger fatalities	Estimated fatality rate in 1980		Estimated annual % change in rate	
			per 10 ⁵ persons	per 10 ⁴ vehicles	persons	vehicles
Netherlands	1970-90	21250	7.0	2.1	-4.4	-7.6
Germany (W)	1970-90	140708	10.5	2.5	-4.1	-7.6
Japan	1970-89	103229	4.3	1.3	-3.6	-7.4
Canada	1971-90	72359	15.2	2.8	-3.4	-5.3
Australia	1970-90	38317	14.3	2.9	-3.1	-5.3
Switzerland	1970-90	11612	8.6	2.1	-2.5	-6.4
Austria	1970-90	23766	14.8	4.3	-2.3	-6.1
Sweden	1970-90	11983	6.8	1.7	-2.2	-4.1
Finland	1970-90	7404	7.3	2.4	-2.1	-5.5
USA	1970-89	738602	15.4	2.2	-2.0	-3.6
UK	1971-90 ¹	38599	5.0	1.5	-1.9	-4.1
Ireland	1970-89	4815	7.2	3.0	-1.8	-3.9
Denmark	1970-89	7861	7.6	2.2	-1.7	-3.1
Italy	1970-90	96916	8.2	2.2	-1.5	-5.5
France	1970-90	171887	15.2	3.8	-1.5	-4.1
Belgium	1972-89	22265	12.6	3.5	-1.0	-3.4
Portugal	1970-72, 84-89	7606	8.8	4.5	1.6	-5.0
Germany (E)	1970-90	12867	3.6	1.4	2.9	-1.0
Spain	1971-90	81182	10.2	4.3	3.7	-1.4
Greece	1970-89	14960	7.8	6.0	3.7	-5.1
Median			8.4	2.5	-1.9	-4.8

¹ Missing 1973-77

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁴ vehicles

Changes in vehicle based fatality rates show a similar pattern to that for population based fatality rates. Australia's relatively low rate of increase in vehicle registrations means that the average annual percentage decrease in the vehicle based rate is closer to the mean change for all countries than the population based rate (Table 5.2).

Figure 5.1 Population fatality rate of drivers and passengers between 1970 and 1990 for Australia and selected countries

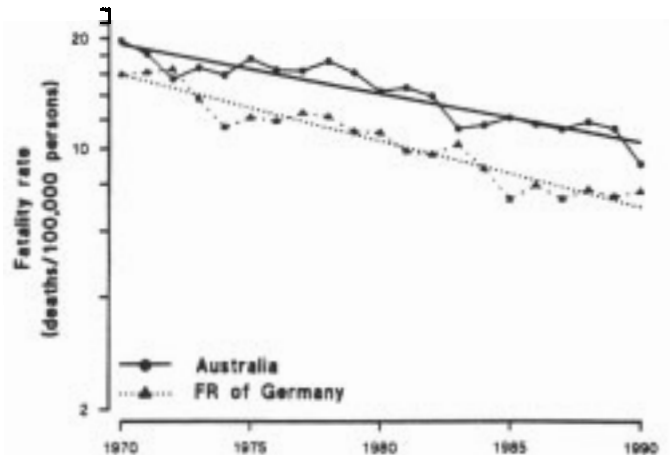
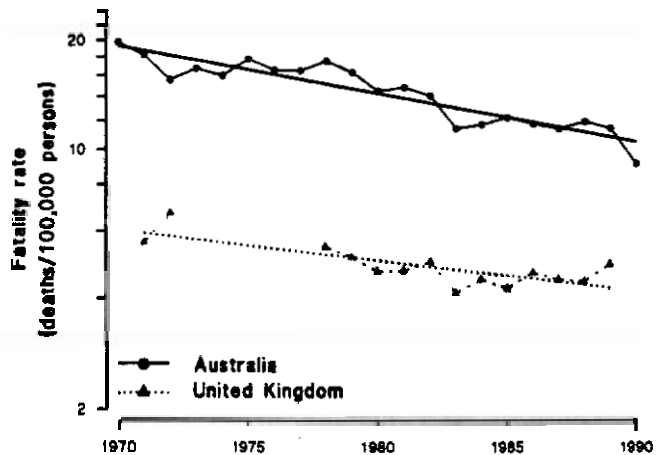
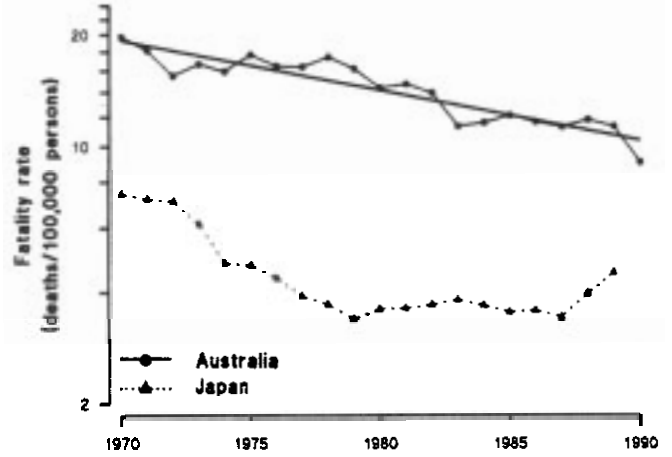
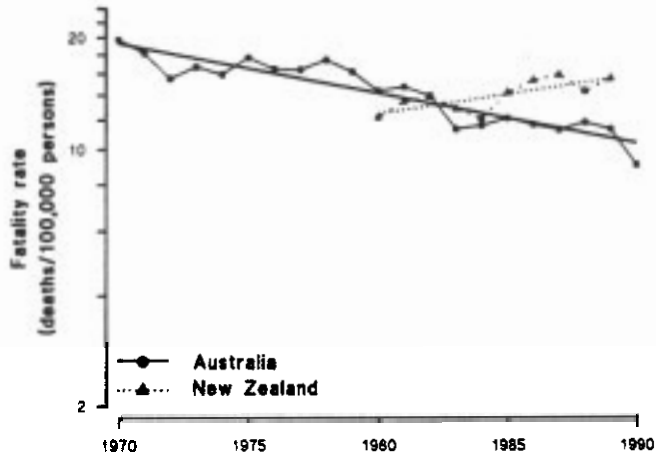
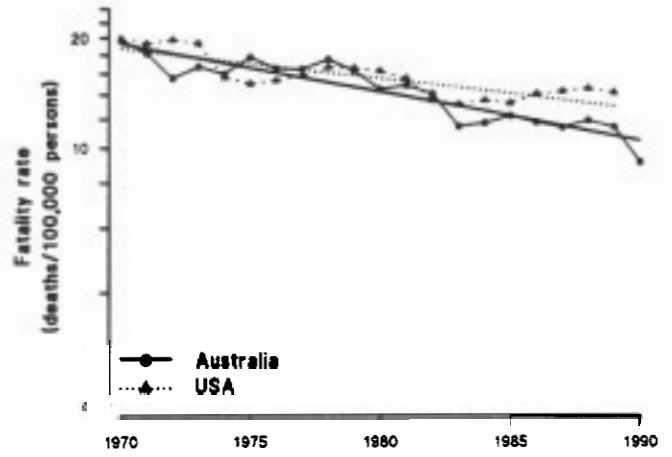
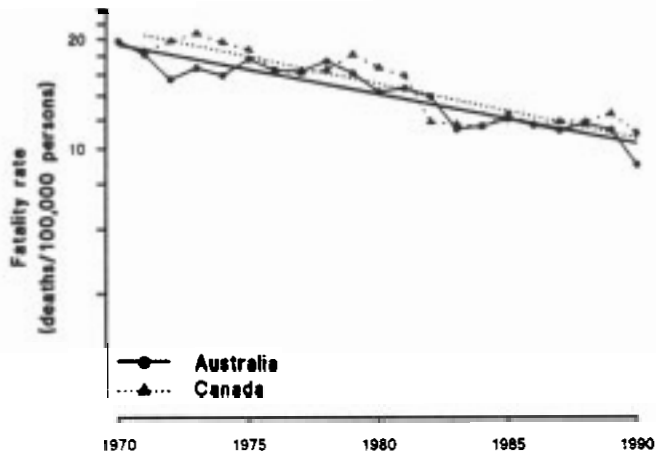


Figure 5.1 Population fatality rate of drivers and passengers between 1970 and 1990 for Australia and selected countries (continued)

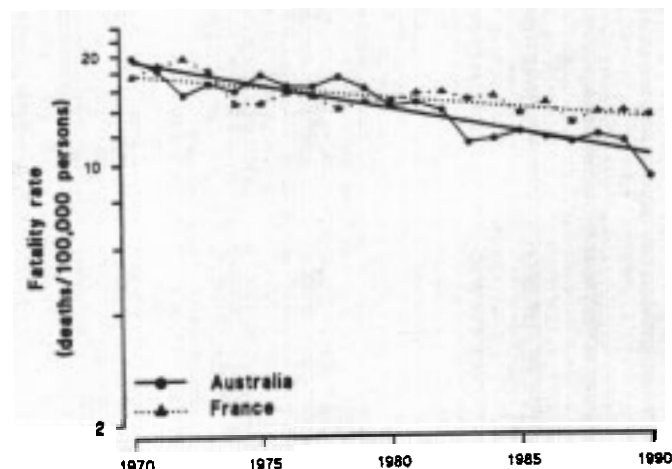
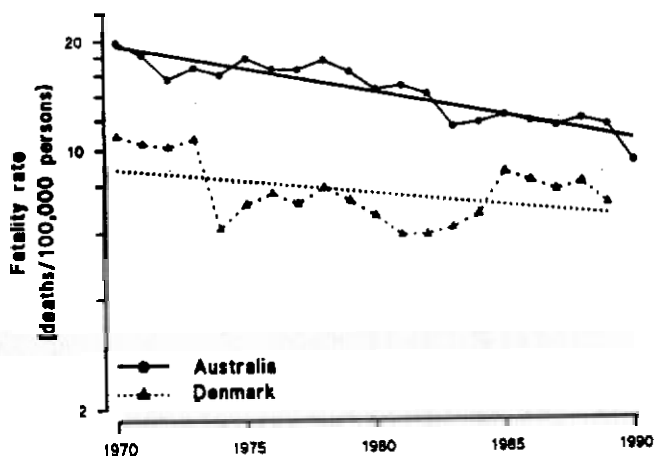
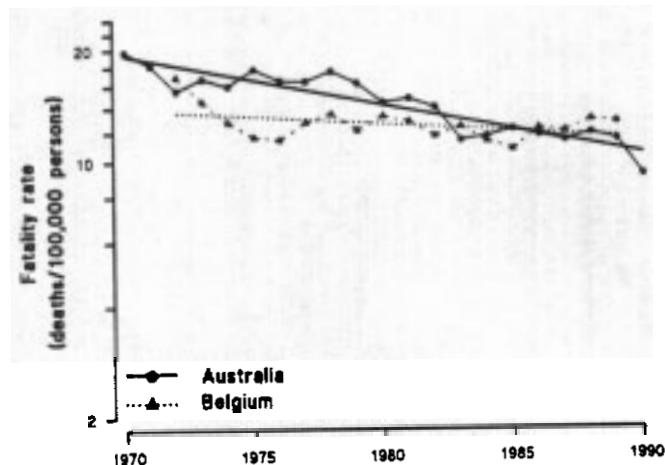
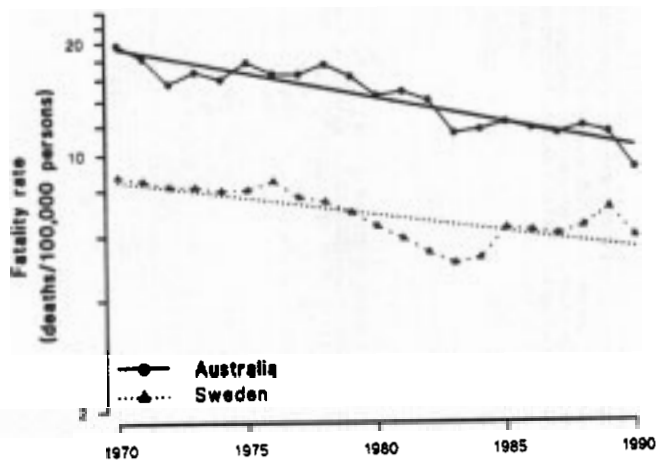
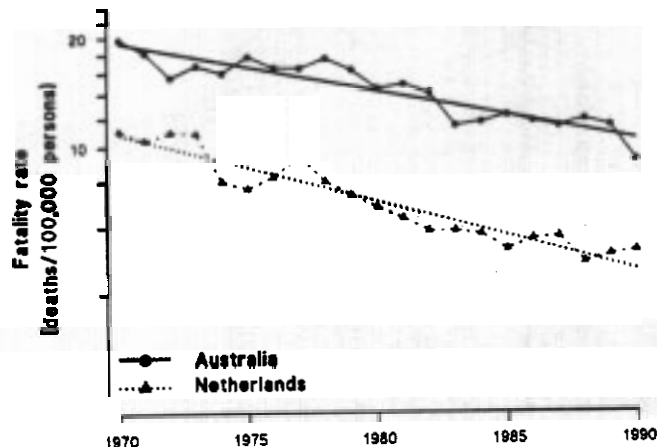
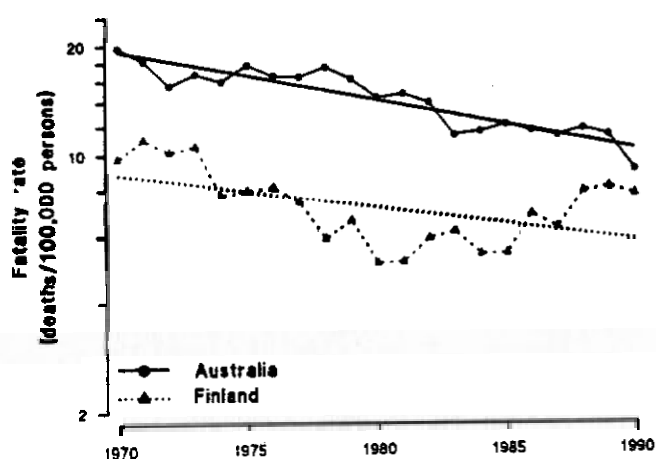
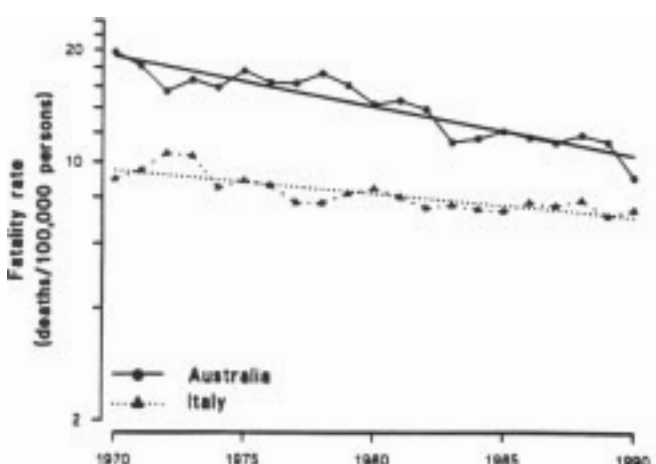
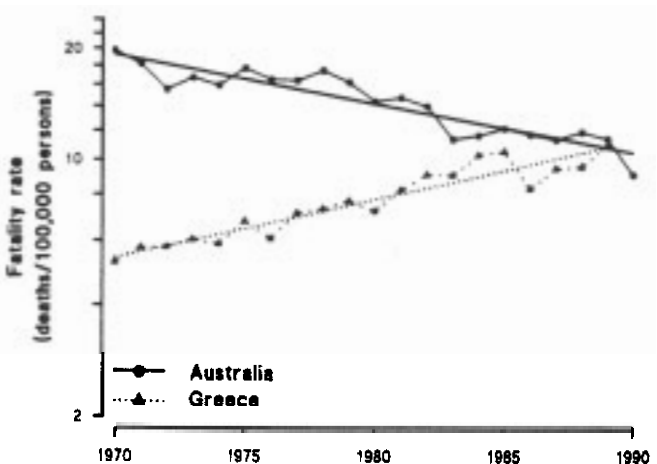
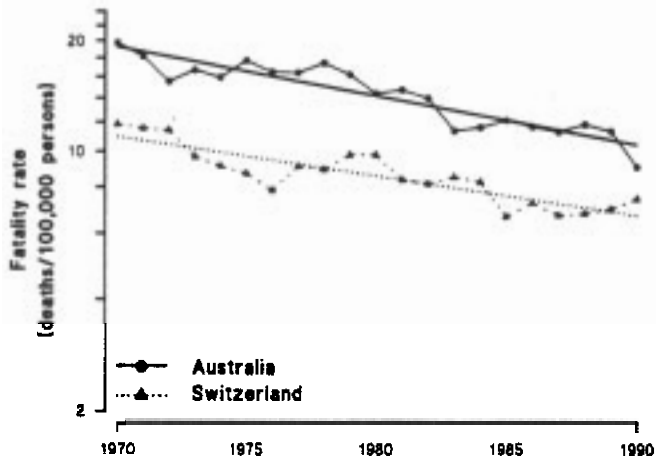
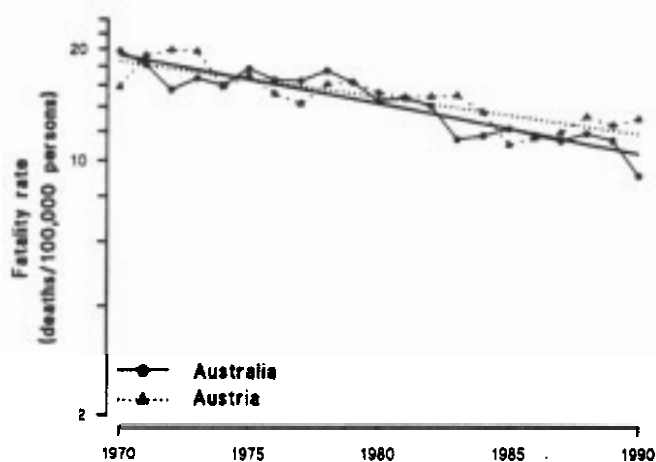
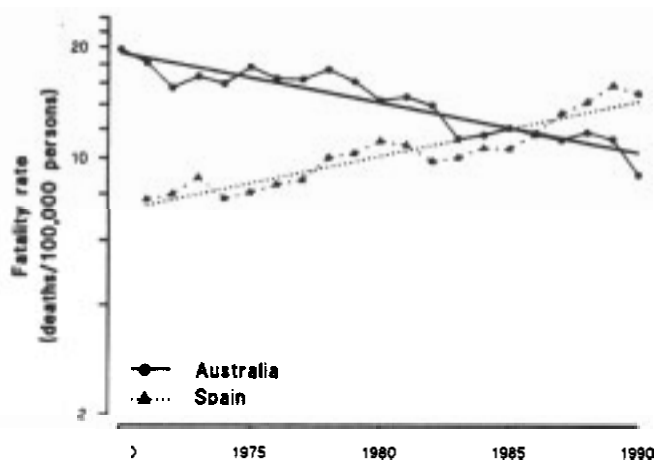


Figure 5.1 Population fatality rate of drivers and passengers between 1970 and 1990 for Australia and selected countries (continued)



Variation with age

The average annual % decrease in driver and passenger fatalities classified by the IRTAD age groups is given in Table 5.3 for those countries for which such data are available. Except for Australia and West Germany, data were available for only selected years in the range 1972, 1975 and 1980 to 1990. The overall estimate obtained is often different to that in Table 5.2 which summarises data for more years. For this reason, the emphasis here is not on the absolute value of the estimates for different age groups, but on the pattern of decreases between age groups (Figure 5.2).

For Australia, there was a fairly even decrease in fatality rates across the adult age groups (Figure 5.2; Anderson, Adena and Montesin, 1993); 15 to 20 year olds had a greater decrease, and 0 to 14 year olds had a lesser decrease. (These differences largely reflect variation with age for passengers.) Overall, the age related variation in the change in fatality rates was not statistically significant ($F_{5,114} = 2.1, p > 0.05$).

Other countries tended to have more age related variation, and this was statistically significant for several countries (Table 5.3; Figure 5.2). Most countries had a lesser average annual % decrease in the oldest age group (65 and older) than for other adults. The comparatively large decrease for teenagers in Australia was not apparent or less marked for most other countries, although most did show a lesser average annual % decrease for the 0 to 14 year olds than for 15 to 17 year olds.

Table 5.3 Estimated annual % change in population fatality rates (1970-90) of drivers and passengers, for six age groups.

Country	Years ¹	All ²	Age group (years)						F statistic ³
			0-14	15-17	18-20	21-24	25-64	65+	
Netherlands	1972-90	-4.1	-4.7	-6.6	-5.0	-2.2	-5.4	-3.5	4.8**
Germany (W)	1970-90	-3.9	-3.5	-4.6	-3.7	-5.1	-5.1	-3.2	5.2***
Australia	1970-90	-3.2	-2.4	-4.7	-3.8	-3.1	-3.3	-2.8	2.1
Switzerland	1975-89	-2.2	-6.0	-3.9	-1.8	-2.6	-2.6	-2.7	.4
Austria	1972-90	-2.5	-1.0	-2.6	-2.2	-3.6	-3.7	-.9	2.9*
Sweden	1975-90	-.4	-.8	-2.5	.4	1.0	-1.3	-.4	.5
USA	1980-89	-1.2	.4	.9	-.8	-1.3	-2.0	2.4	4.5**
Great Britain	1972-89 ⁴	-1.7	.8	-.1	-2.1	-2.6	-3.0	-.1	5.1***
Ireland	1975-89	-3.0	-5.3	-1.6	-1.2	-5.4	-4.0	.8	1.7
Denmark	1975-89	2.7	2.4	4.3	9.1	4.2	1.1	1.5	2.6*
Italy	1972-89 ⁵	-1.7	-4.3	-1.8	-1.1	-1.6	-2.7	-1.1	3.8**
Belgium	1975-89	.2	.4	-2.2	-.1	1.4	-.6	.9	1.3
Median		-2.1	-1.7	-2.3	-1.5	-2.4	-2.8	-.7	

¹ All countries have data for 1972, 1975 and 1980-90, except as indicated

² This estimate often differs from the estimate given in Table 5.2 for which the data are usually more complete; countries are ordered as in Table 5.2

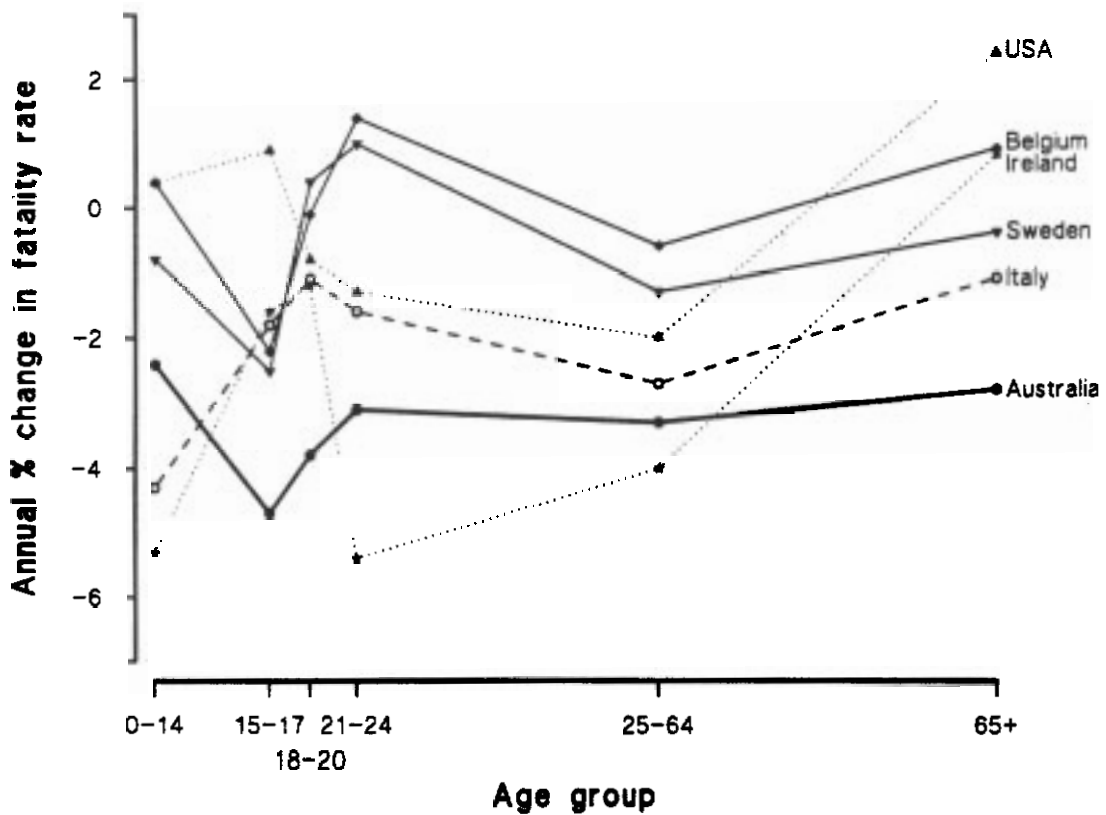
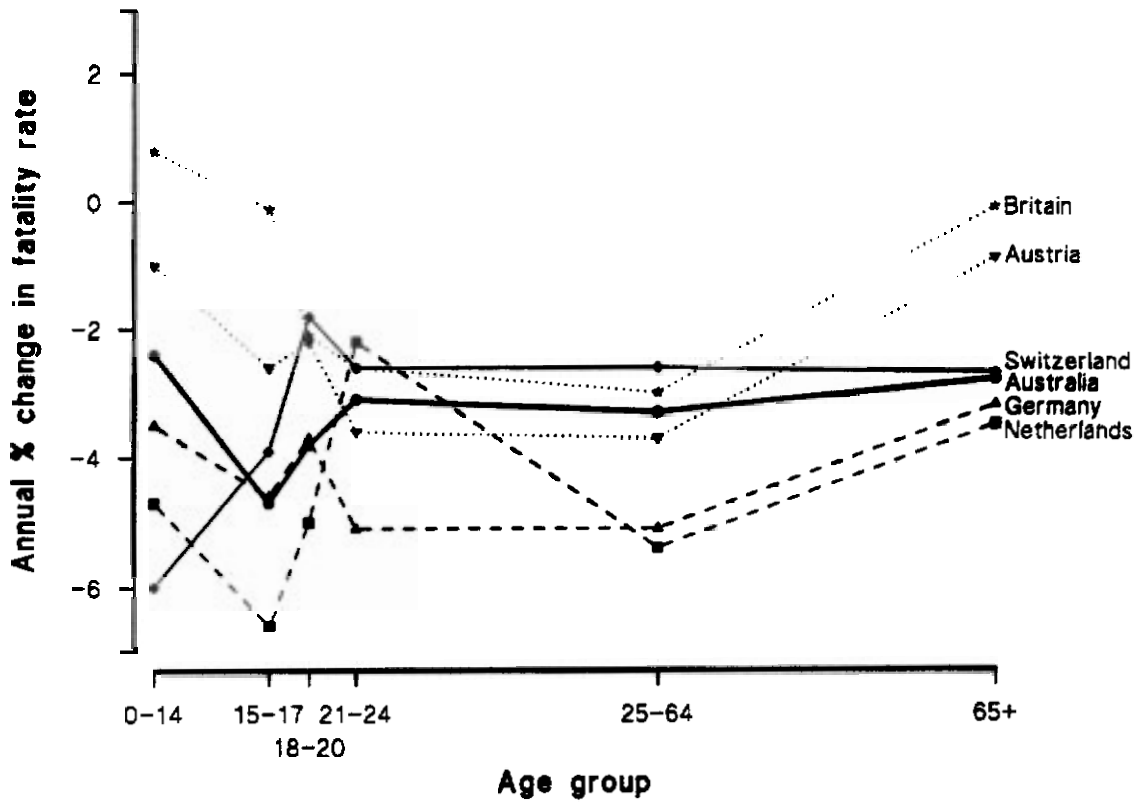
³ F statistics based on 5 and between 42 and 114 (median 54) degrees of freedom; test statistics give $p > 0.05$, except * ($0.01 < p < 0.05$), ** ($0.001 < p < 0.01$), *** ($p < 0.001$)

⁴ Great Britain is the United Kingdom excluding Northern Ireland

⁵ Missing 1985-86

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Figure 5.2 Average annual % change in population fatality rate of drivers and passengers between 1970 and 1990 for selected countries by age group



Note: Australia is repeated in both graphs

6. Pedestrians

Fatalities as a percentage of all fatalities

Pedestrians account for 19% of fatalities in Australia. This percentage is lower than for most countries (Table 6.1).

For the Netherlands, the percentage of fatalities that were of pedestrians fell from 19% in 1970 to 10% in 1990. Other countries have also experienced a decrease, but to a lesser extent.

Table 6.1 Pedestrian fatalities as a percentage of total fatalities, by country and year (1970-90). The countries are given in descending order of the mean percentage.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Mean
UK	39	38	40	38	39	37	36	35	36	34	33	32	31	35	33	35	34	33	35	32		35
Iceland	41	37	40	38	38	35	32	38	36	37	37	38	30	33	34	34	32	31	30	31		35
Japan	35	35	36	37	36	35	34	33	33	34	32	31	30	29	28	29	29	30	29	27		32
Germany (E)	32	33	29	29	29	26	28	28	31	31	31	31	32	30	30	30	30	31	31	30	21	30
Greece	37	34	35	36	32	32	35	31	33	31	31	29	28	27	25	24	28	24	26	23		30
Portugal	38	37	38												24	24	22	28	25	25		29
Finland	31	31	31	28	28	29	24	23	23	23	25	24	27	25	27	23	22	23	20	23	16	25
Germany (W)	32	30	28	28	30	27	27	25	26	24	24	22	22	21	22	21	23	21	21	21	18	24
Spain	29	29	30	29	29	29	29	27	27	23	23	23	23	23	21	21	22	18	18	17	17	24
Switzerland	31	30	29	30	29	25	28	28	28	25	21	23	23	21	20	21	19	23	21	16	18	24
Austria	32	28	29	27	30	26	24	24	23	24	23	19	19	21	20	21	19	17	18	19	17	23
Denmark	27	26	25	24	25	23	21	22	18	20	20	22	25	23	19	16	18	20	19	20		22
Norway												23	25	22	26	28	17	23	20	17	18	22
Italy	26	25	25	25	26	24	24	23	23	21	21	19	20	19	18	17	17	16	16	14	15	21
Belgium					24	25	24	23	22	22	21	21	19	19	18	18	18	17	17	15	14	20
Sweden	24	20	19	20	21	20	21	18	18	19	16	17	19	20	19	14	18	18	17	17	17	19
Australia	22	23	23	22	22	20	19	20	19	18	20	19	18	19	19	18	19	18	19	18	18	19
France	21	21	19	19	20	19	18	19	18	18	18	17	17	17	16	15	15	15	15	14	14	17
USA	17	17	17	17	17	17	16	16	15	16	16	16	17	16	16	16	15	15	15	14	15	16
Canada	21	19	19	18	17	17	16	17	15	15	15	15	15	15	14	14	14	15	14	12	15	16
Netherlands	19	18	18	16	17	17	17	15	16	13	15	16	15	16	13	13	14	12	15	13	10	15
New Zealand											16	16	13	16	18	17	15	14	11	11		15

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁵ persons

The average annual % decrease in fatality rate for Australian pedestrians was greater than for any other mode of road user. However, it was low compared with those for other countries (Table 6.2; Figure 6.1).

In 1970, Australia had a pedestrian fatality rate close to the median of the IRTAD countries. However, by 1990 it was higher than all except Spain, Portugal and Greece, the three countries that have had a large increase in vehicle ownership; and Austria which had the third largest decrease but from a very high rate in 1970. The USA and UK had smaller average annual % decreases (2.6% and 3.5% respectively) and had similar rates to Australia in 1990. The UK's decrease seems particularly low given that pedestrian fatalities are a markedly larger proportion of road deaths than for any other country, especially in the last few years. By contrast, the USA had one of the lowest proportions.

Table 6.2 Estimated fatality rate in 1980 and annual % change in pedestrian fatalities for the IRTAD countries, 1970-90.

Country	Years	Total pedestrian fatalities	Estimated fatality rate in 1980		Estimated annual % change in rate	
			per 10 ⁵ persons	per 10 ⁴ vehicles	persons	vehicles
Netherlands	1970-90	6951	2.2	.7	-7.3	-10.3
Germany (W)	1970-90	68101	4.8	1.1	-6.8	-10.2
Austria	1970-90	10421	6.1	1.7	-6.5	-10.3
Switzerland	1970-90	6244	4.4	1.1	-6.1	-9.9
Finland	1970-90	4016	3.8	1.2	-6.0	-9.2
Belgium	1972-89	8478	4.7	1.3	-5.9	-8.3
Italy	1970-90	40317	3.2	.9	-5.7	-9.4
Canada	1971-90	16297	3.4	.6	-5.7	-7.7
Japan	1970-89	91411	3.7	1.1	-5.4	-9.1
Denmark	1970-89	3633	3.3	.9	-5.2	-6.6
France	1970-90	50829	4.4	1.1	-4.7	-7.3
Sweden	1970-90	3839	2.1	.5	-4.2	-6.1
Australia	1970-90	11978	4.2	.8	-4.0	-6.3
Ireland	1970-89	3795	5.5	2.3	-4.0	-6.0
UK	1970-90	46209	3.9	1.2	-3.5	-5.5
USA	1970-89	153125	3.3	.5	-2.6	-4.3
Germany (E)	1970-90	13454	3.8	1.4	-1.9	-5.7
Spain	1971-90	31269	4.3	1.8	-1.9	-6.9
Portugal	1970-72, 84-89	6513	8.0	4.1	-1.4	-7.8
Greece	1970-89	8700	4.6	3.5	.4	-8.3
Median			4.0	1.1	-4.9	-7.5

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁴ vehicles

The ordering of countries by the decrease in vehicle based fatality rates is similar to that for population based rates (Table 6.2). For pedestrians, the vehicle based rate reflects the risk of being hit, rather than the amount of travel undertaken.

Figure 6.1 Population fatality rate of pedestrians between 1970 and 1990 for Australia and selected countries

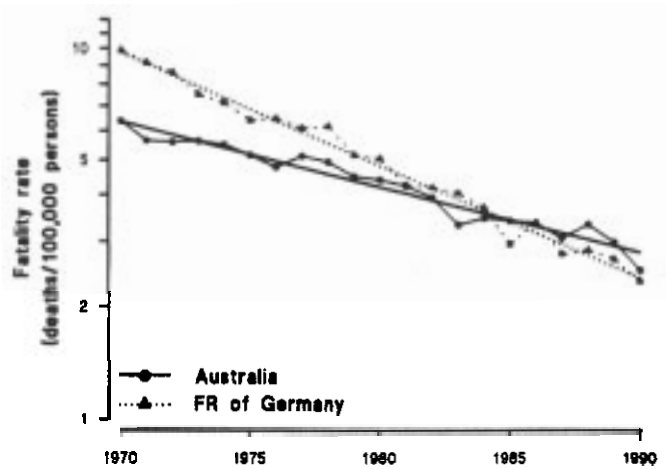
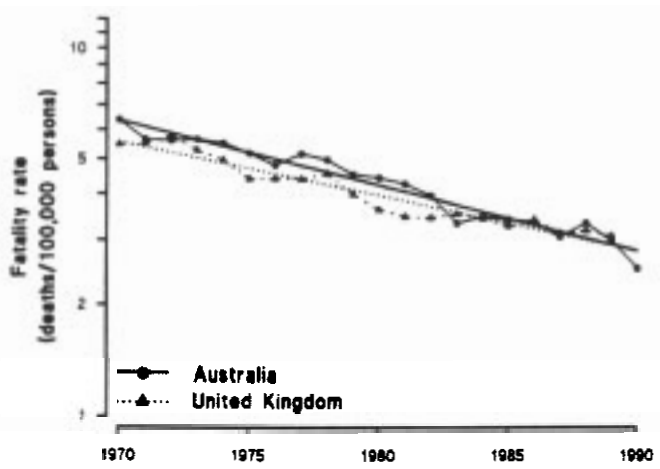
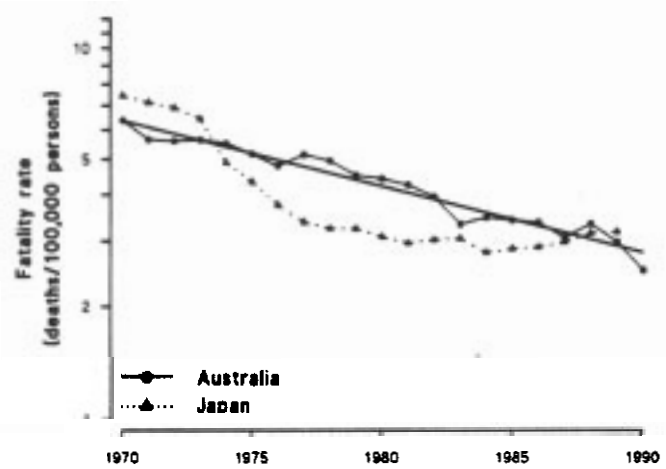
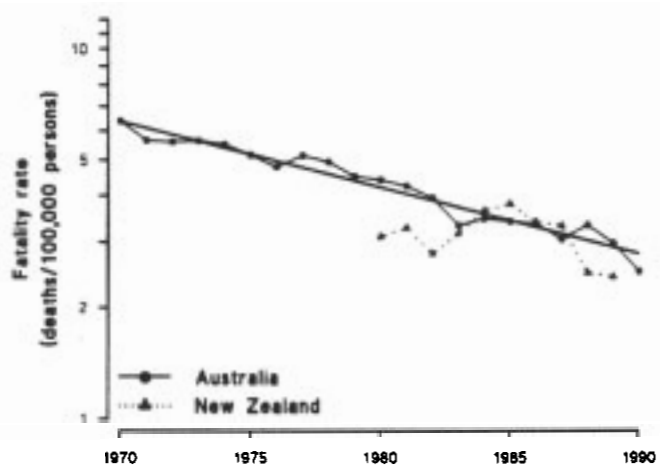
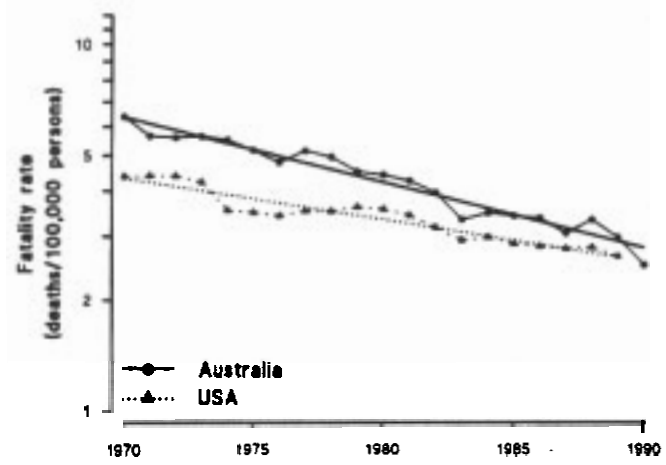
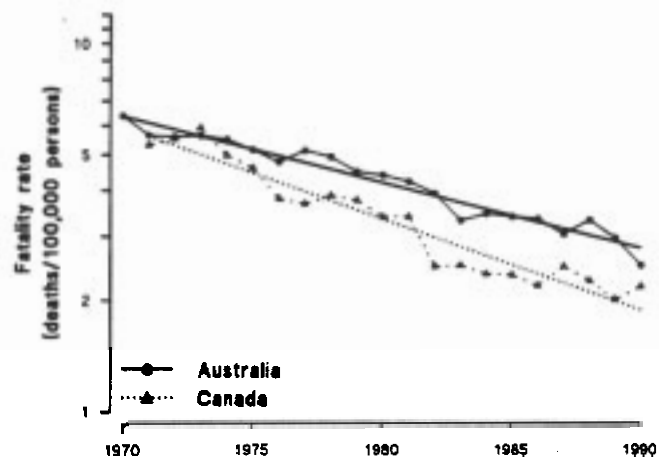


Figure 6.1 Population fatality rate of pedestrians between 1970 and 1990 for Australia and selected countries (continued)

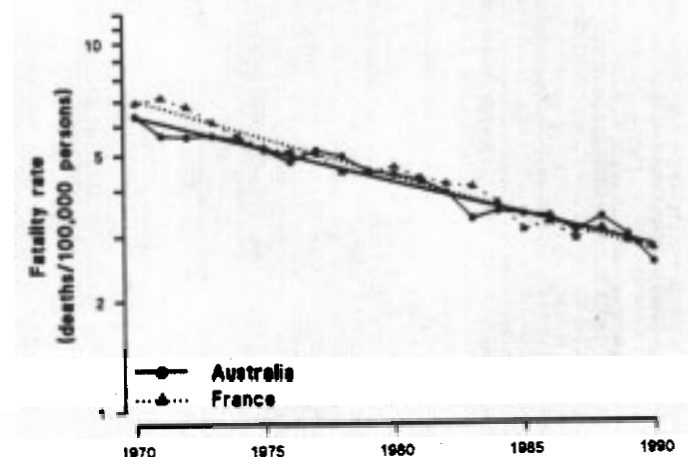
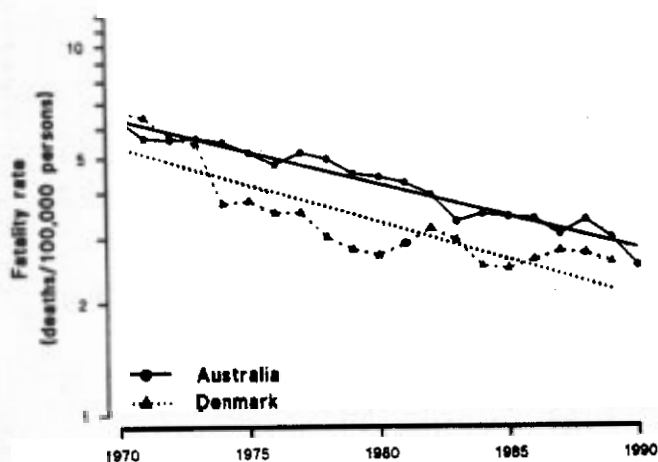
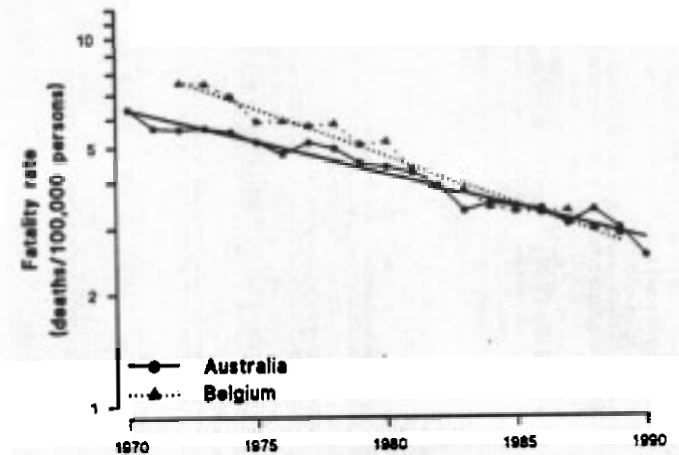
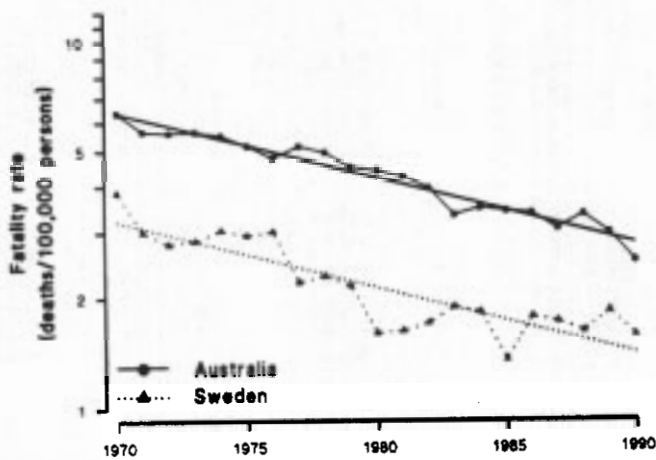
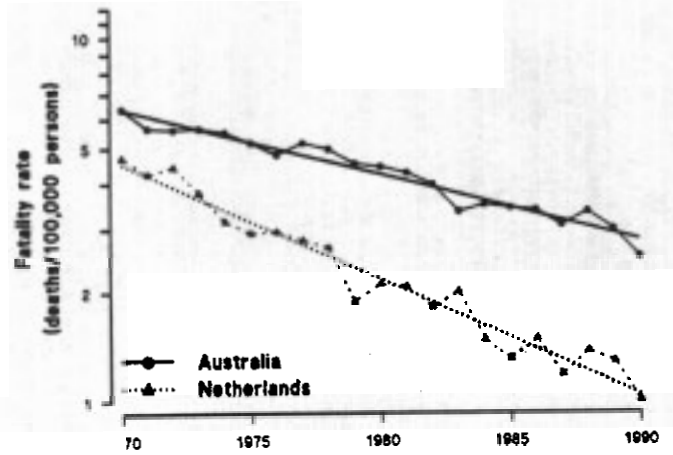
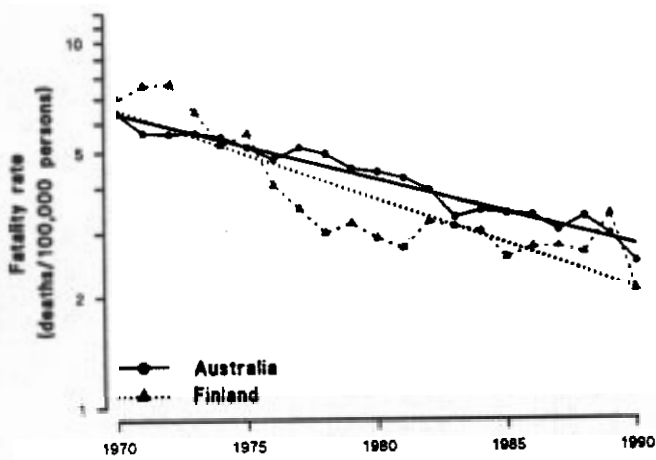
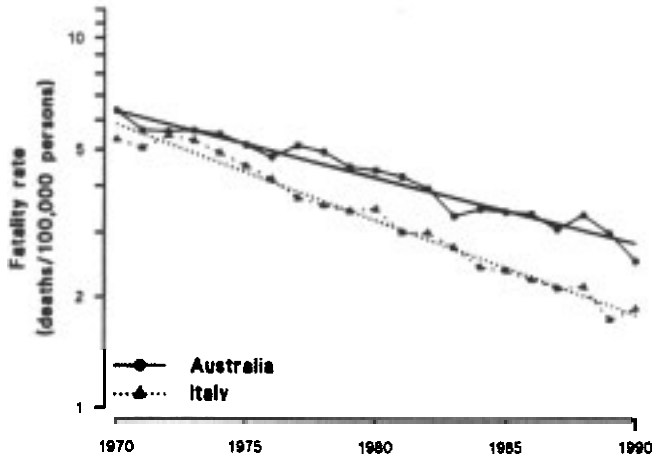
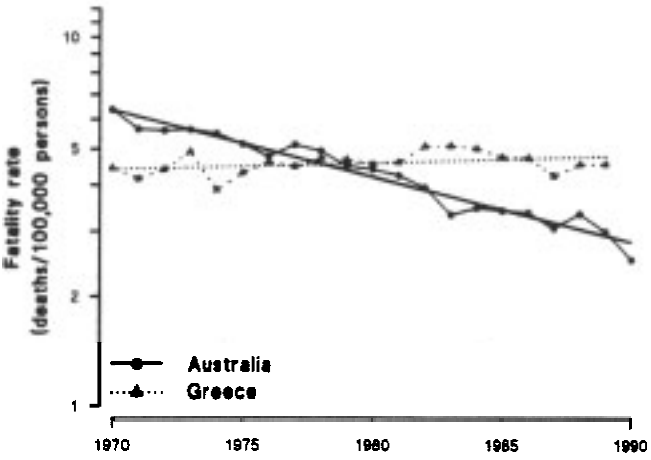
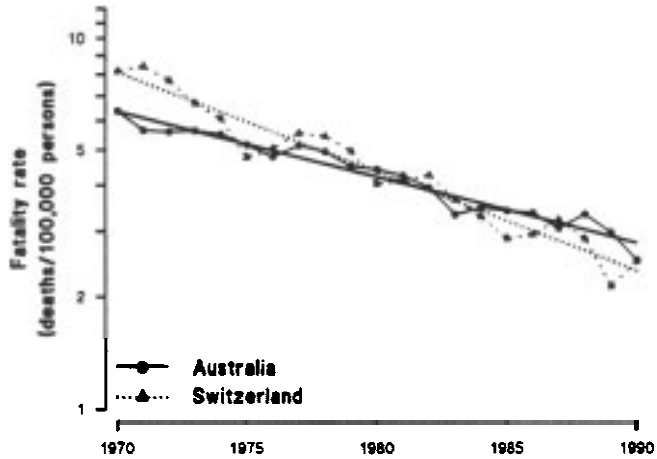
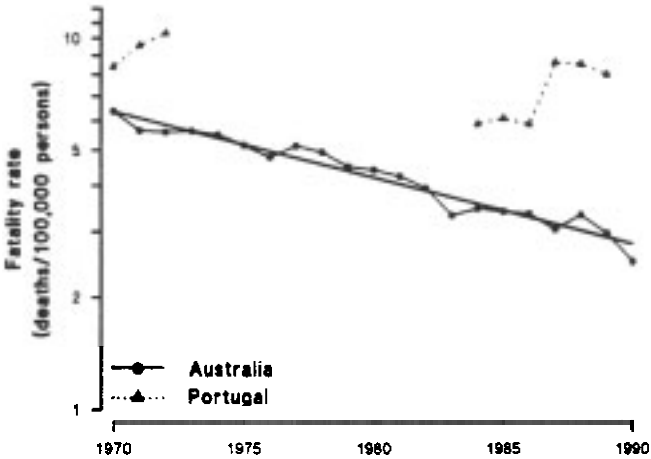
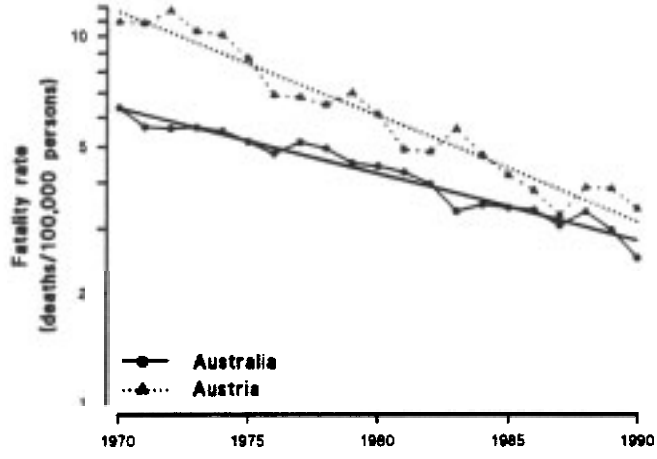
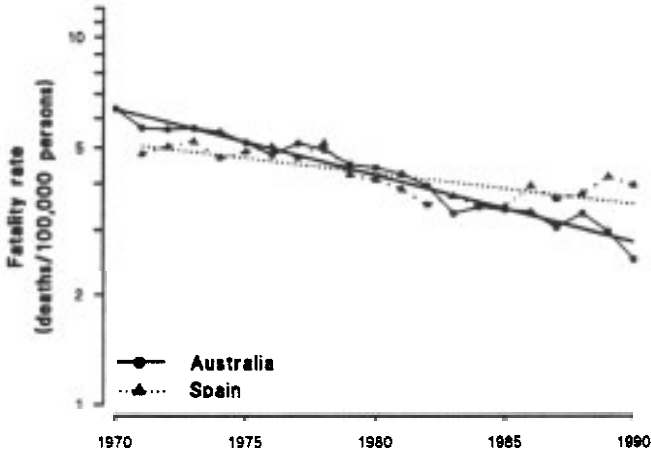


Figure 6.1 Population fatality rate of pedestrians between 1970 and 1990 for Australia and selected countries (continued)



Variation with age

The average annual % decrease in fatality rate varied more with age for Australia than for any other country except Sweden (Figure 6.2; Table 6.3). Sweden has such a small number of fatalities in some age groups that the variation with age, although large, was not statistically significant.

The increase in the fatality rate for persons aged 18 to 24 years in Australia generally did not occur for other countries. Unlike other countries, Australia did not have an above average decrease for children aged 14 years and under. This pattern was particularly marked for those countries with the largest overall decreases (Netherlands, Germany, Austria and Italy). The comparatively low decrease for Australia is thus due mainly to the trends for children and young adults under 25 years old. For all countries, including Australia, the persons aged 25 to 64 years and those aged 65 years and over showed a similar decrease in fatality rate.

Table 6.3 Estimated annual % change in population fatality rates (1970-90) of pedestrians, for six age groups.

Country	Years ¹	All ²	Age group (years)						F statistic ³
			0-14	15-17	18-20	21-24	25-64	65+	
Netherlands	1972-90	-7.4	-10.0	-4.3	-1.4	-2.1	-5.5	-8.1	8.3**
Austria	1972-90	-6.9	-8.7	-10.0	-7.6	-6.3	-6.0	-7.0	2.2*
Germany (W)	1970-90	-6.8	-9.0	-9.0	-6.8	-6.3	-6.6	-6.5	15.5***
Italy	1972-89 ⁴	-6.1	-9.5	-10.2	-8.2	-6.3	-6.3	-5.5	15.8***
Ireland	1975-89	-5.3	-6.2	-6.9	-1.3	-2.4	-4.5	-6.2	.8
Belgium	1975-89	-5.3	-6.8	-3.7	-.1	-5.2	-4.8	-5.6	1.8
Switzerland	1975-89	-4.3	-6.8	-4.3	-1.6	-6.1	-3.5	-5.1	1.1
Australia	1970-90	-3.9	-4.1	-2.7	1.3	1.3	-5.1	-5.0	17.2***
Great Britain	1972-89 ⁵	-3.3	-3.8	-1.2	-.7	.1	-2.9	-4.4	5.2**
Sweden	1975-90	-3.2	-7.5	-.5	4.0	1.1	-4.7	-3.0	2.1
USA	1980-89	-2.8	-4.0	-4.8	-6.3	-4.1	-1.7	-2.9	7.1**
Denmark	1975-89	-1.5	-5.1	7.7	-1.1	7.7	-.9	-3.7	3.6*
Median		-4.8	-6.8	-4.3	-1.3	-3.2	-4.7	-5.3	

¹ All countries have data for 1972, 1975 and 1980-90, except as indicated

² This estimate often differs from the estimate given in Table 6.2 for which the data are usually more complete; countries are ordered as in Table 6.2

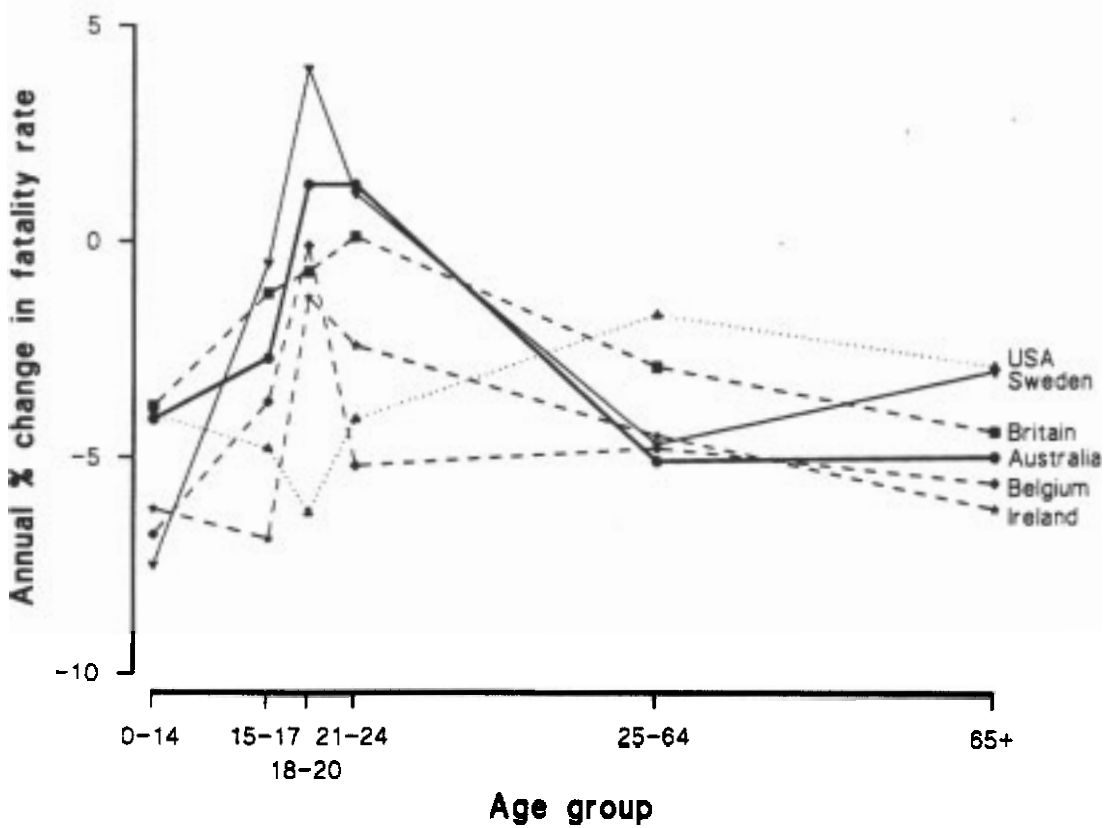
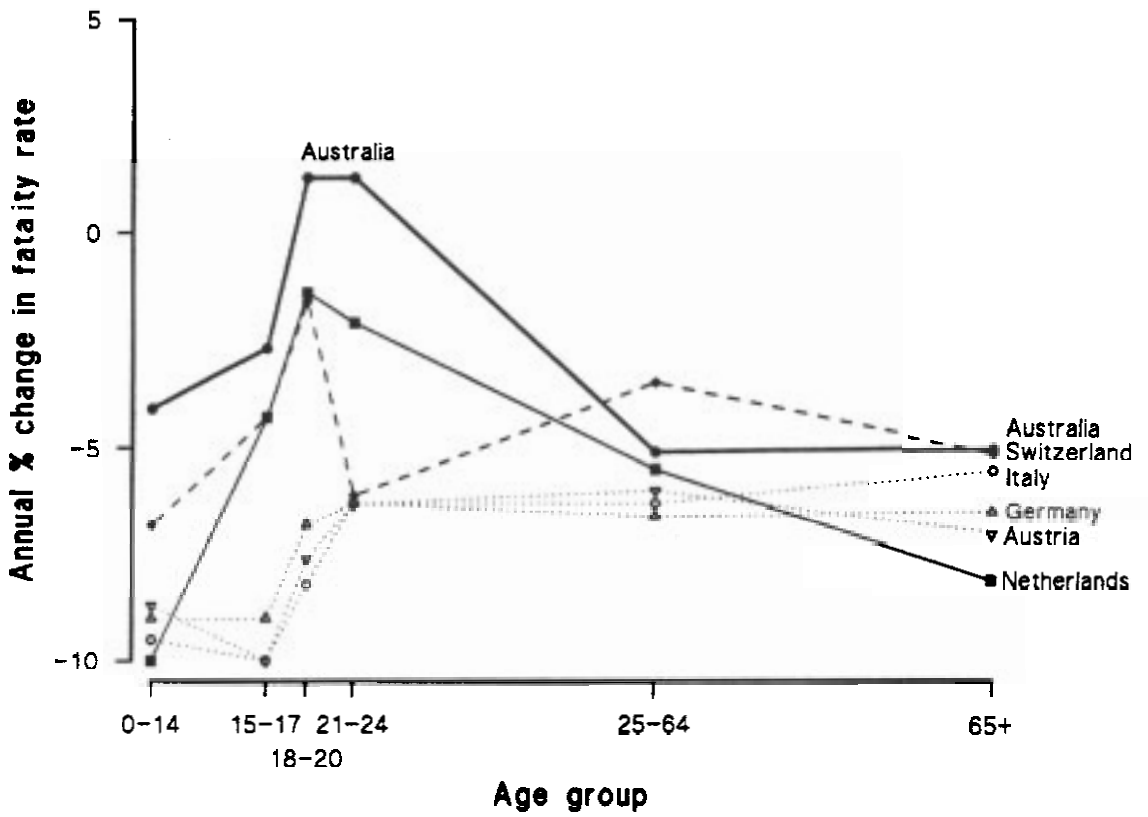
³ F statistics based on 5 and between 42 and 114 (median 54) degrees of freedom; test statistics give $p > 0.05$, except * ($0.01 < p < 0.05$), ** ($0.001 < p < 0.01$), *** ($p < 0.001$)

⁴ Missing 1985-86

⁵ Great Britain is the United Kingdom excluding Northern Ireland

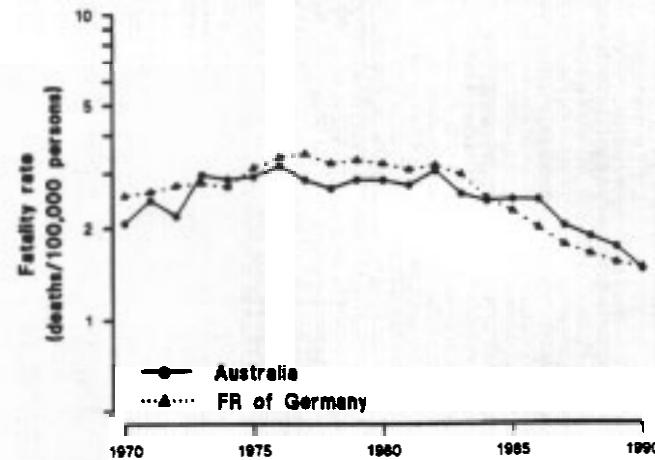
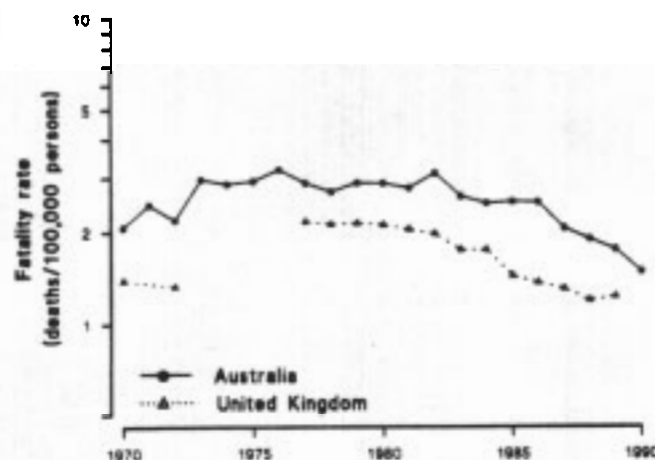
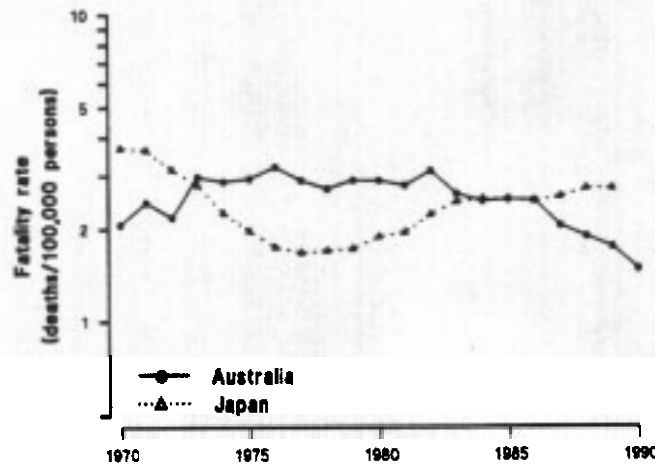
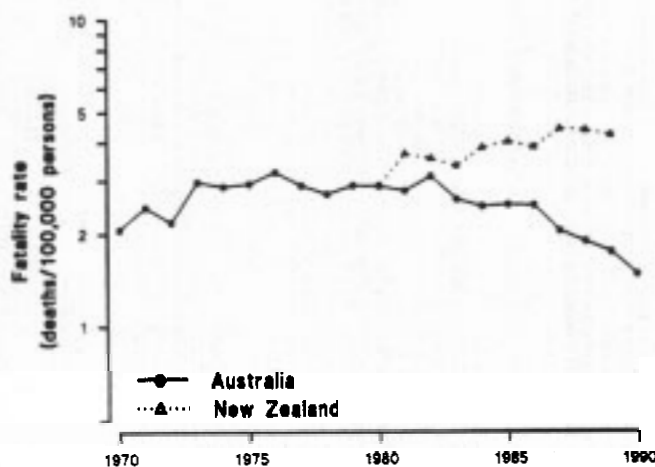
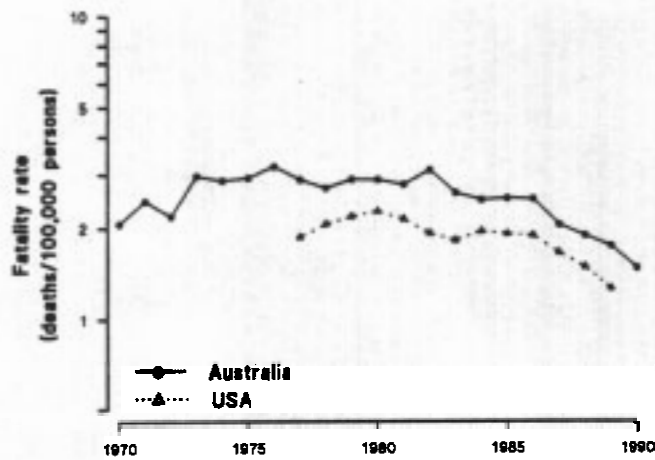
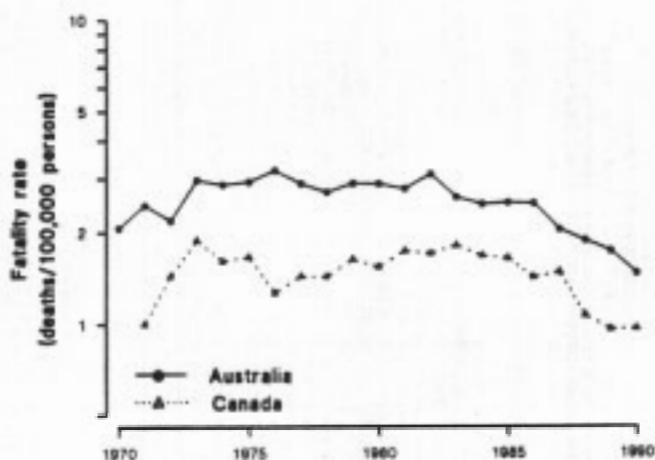
Sources: IRTAD for all countries except Australia and Canada (see section 2).

Figure 6.2 Average annual % change in population fatality rate of pedestrians between 1970 and 1990 for selected countries by age



Note: Australia is repeated in both graphs

Figure 7.1 Population fatality rate of motor cyclists between 1970 and 1990 for Australia and selected countries



7. Motor cyclists

Fatalities as a percentage of all fatalities

Motor cycle usage differs considerably between countries, as does the proportion of fatalities (Table 7.1). Australia has one of the lower proportions (a mean for the period of 11%). However, some of the countries with large decreases in fatality rates also have a low proportion, for example, Finland (12%).

Table 7.1 Motor cyclist fatalities as a percentage of total fatalities, by country and year (1970-90). The countries are given in descending order of the mean percentage.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Mean
Germany (E)	35	34	32	30	31	33	30	33	29	31	32	32	34	31	30	32	30	30	28	24	16	30
Portugal	23	23	17													26	27	24	30	28	27	25
Switzerland	18	21	24	22	22	22	22	21	20	19	22	24	25	25	24	24	27	24	23	25	22	23
Japan	18	18	16	16	17	16	16	16	17	18	19	20	22	24	25	25	25	26	25	23		20
Italy	19	18	18	17	19	19	18	20	18	20	20	21	21	22	21	21	19	17	17	20	19	19
France	20	20	20	21	22	21	21	20	20	19	19	16	16	16	15	15	14	15	15	15	16	18
Greece	19	18	17	18	17	16	18	18	14	16	17	18	21	23	21	21	21	20	18	20		18
New Zealand											15	17	17	17	19	18	17	18	20	19		18
Denmark	16	19	20	17	21	19	25	21	21	19	19	19	15	17	15	14	13	11	12	13		17
Netherlands	20	22	20	20	23	19	17	16	16	15	16	15	15	13	14	13	13	12	13	13	12	16
Austria	15	15	15	14	17	16	18	19	16	15	16	18	17	17	19	19	16	16	14	16	13	16
UK	10		9					17	17	18	19	19	18	18	17	15	14	14	13	13		15
Germany (W)	8	8	9	11	12	13	14	14	14	16	15	16	17	16	15	17	14	14	12	12	12	13
Belgium			12	12	14	15	17	15	13	12	15	13	14	12	13	13	11	12	11	13		13
Spain	13	10	11	10	11	11	10	11	10	10	12	11	11	11	11	12	12	12	14	15	16	12
Finland	13	13	13	14	15	15	15	12	17	12	12	14	8	9	9	11	9	8	9	8	8	12
Norway											13	13	10	11	10	15	11	12	10	12		12
Australia	6	8	8	10	10	10	11	11	10	11	12	12	13	14	12	12	13	11	10	10	10	11
Sweden	12	14	14	12	14	11	9	10	12	9	9	11	12	15	13	10	12	11	10	7	9	11
Ireland	10	9	13	10	11	10	11	8	9	7	9	11	11	11	13	12	13	15	11	10		11
USA								9	9	10	10	10	10	10	10	10	10	9	8	7	7	9
Canada		4	5	6	6	6	6	6	6	7	7	8	10	11	10	10	9	9	7	6	7	7

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Figure 7.1 Population fatality rate of motor cyclists between 1970 and 1990 for Australia and selected countries (continued)

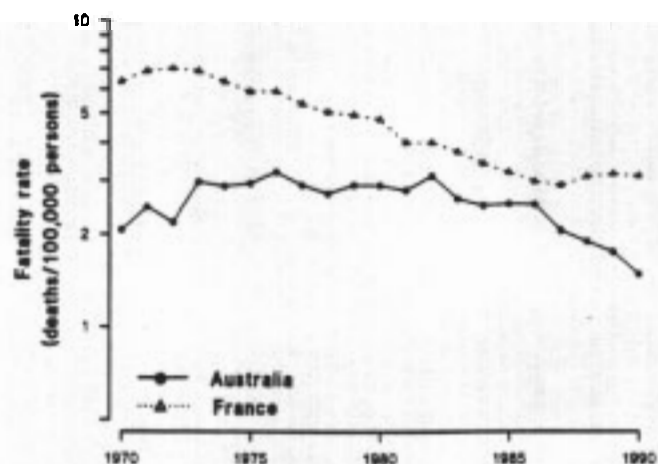
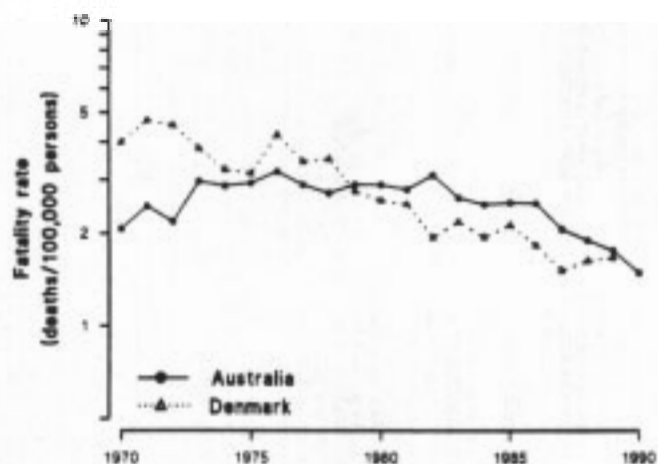
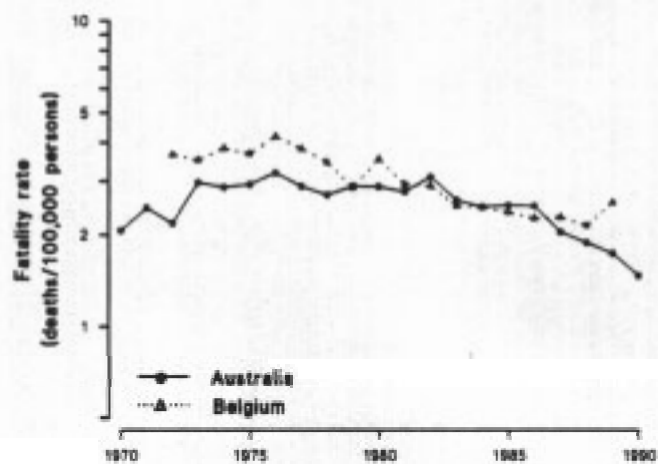
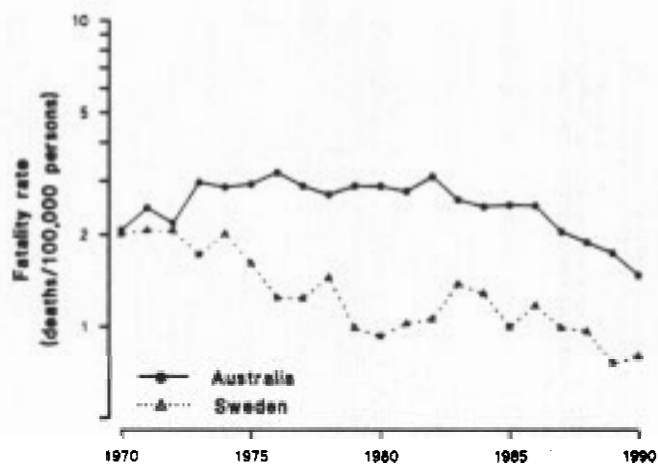
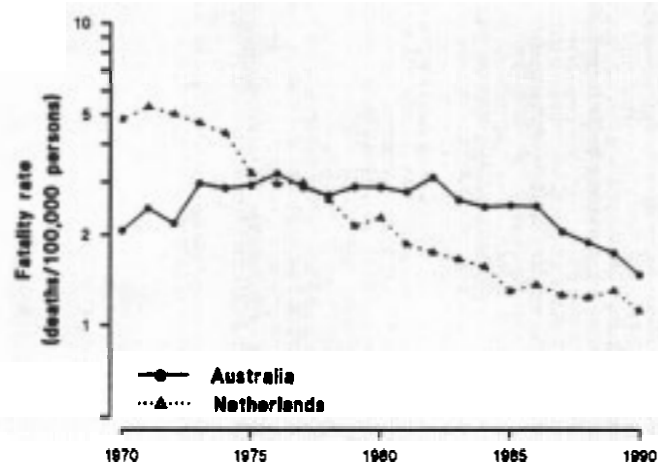
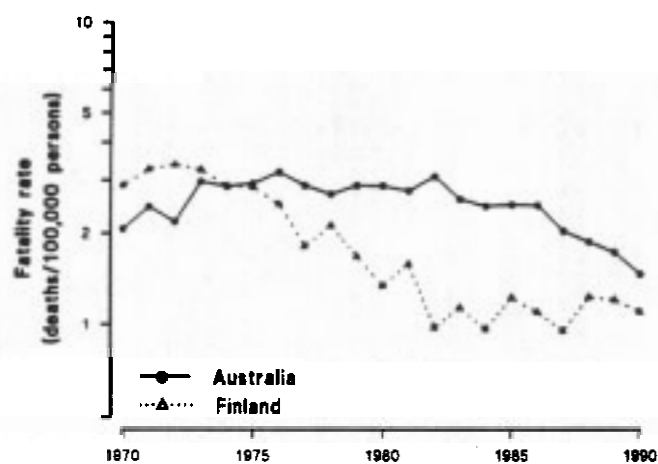
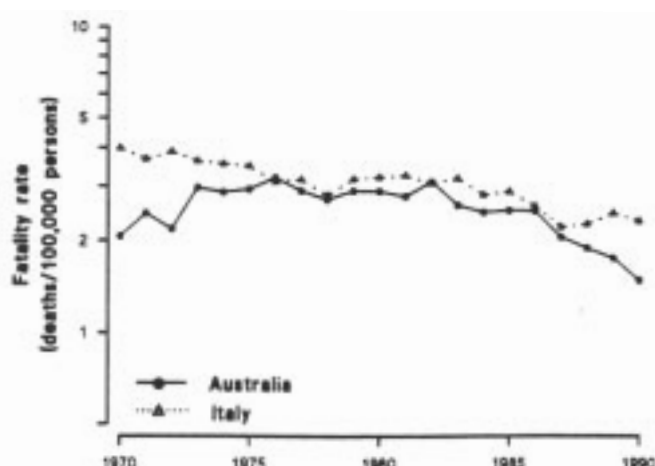
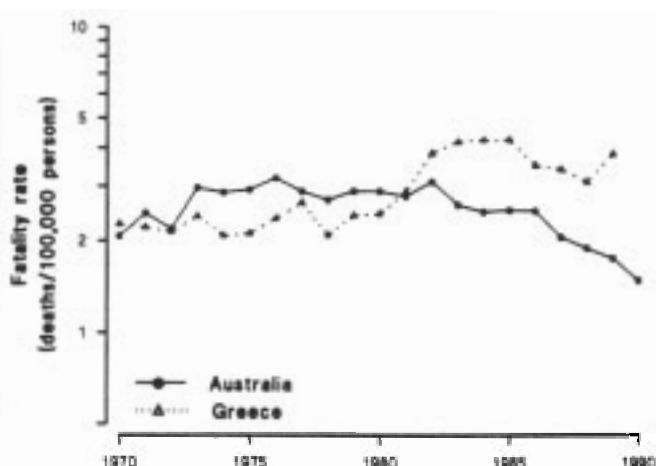
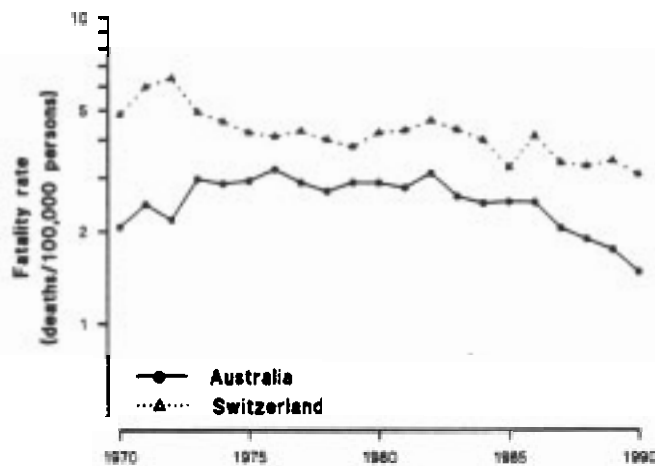
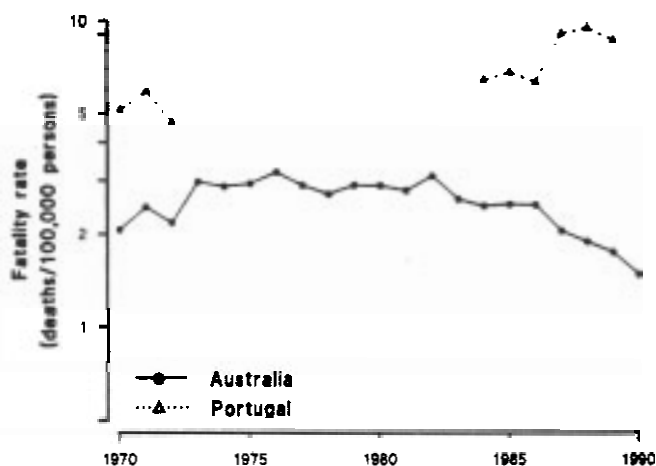
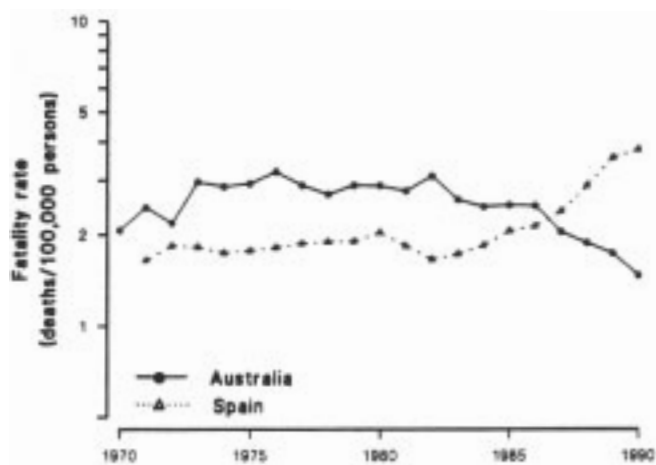


Figure 7.1 Population fatality rate of motor cyclists between 1970 and 1990 for Australia and selected countries (continued)



Fatality rates per 10⁵ persons

Australia had a relatively small average annual % decrease of 2.2% in the population based fatality rate, although there has been a steeper decrease since 1986.

A number of countries, including Canada, USA, UK and Germany, had a similar pattern of change in the population based fatality rate for motor cyclists as Australia, with a peak in the early 1980's (Figure 7.1). Although such a pattern cannot be adequately described by an average annual % change, these have been calculated for the sake of comparison. Some countries do show an approximately linear decrease and these are the ones that had the largest change (Netherlands, Finland, Denmark, France, and Sweden).

Table 7.2 Estimated fatality rate in 1980 and annual % change in motor cyclist fatalities for the IRTAD countries, 1970-90.

Country	Years	Total motor cyclist fatalities	Estimated fatality rate in 1980		Estimated annual % change in rate	
			per 10 ⁵ persons	per 10 ⁴ vehicles	persons	vehicles
Netherlands	1970-90	7524	2.3	3.1	-8.4	-.8
Finland	1970-90	1869	1.7	3.6	-6.8	-3.2
Denmark	1970-89	2889	2.6	4.7	-5.7	1.5
France	1970-90	52579	4.5	4.7	-4.9	-1.8
Sweden	1970-90	2286	1.3	3.1	-4.5	.0
Belgium	1972-89	5399	3.1	5.6	-3.5	-2.5
Austria	1970-90	7043	4.4	5.4	-3.2	-3.5
Germany (E)	1970-90	13818	3.8	1.9	-3.1	-4.0
USA	1970-89	56904	2.0	8.6	-3.0	-1.2
Switzerland	1970-90	5652	4.2	3.4	-2.5	-3.2
Italy	1970-90	36063	3.0	3.7	-2.5	-4.8
Germany (W)	1970-90	34382	2.6	6.8	-2.4	-5.2
Australia	1970-90	6919	2.6	12.5	-2.2	-4.2
Ireland	1970-89	1141	1.7	18.8	-1.7	2.4
UK	1970-90 ¹	14248	1.7	7.9	-1.3	-.7
Canada	1971-90	7065	1.5	na	-1.0	na
Japan	1970-89	55471	2.4	2.3	-.8	-4.9
Portugal	1970-72, 84-89	5825	6.5	68	2.8	.1
Spain	1971-90	15707	2.0	1.7	3.7	11.7
Greece	1970-89	5581	2.9	28	3.8	-3.6
Median			2.6	5.1	-2.5	-2.5

¹ Missing 1971, 1973-76

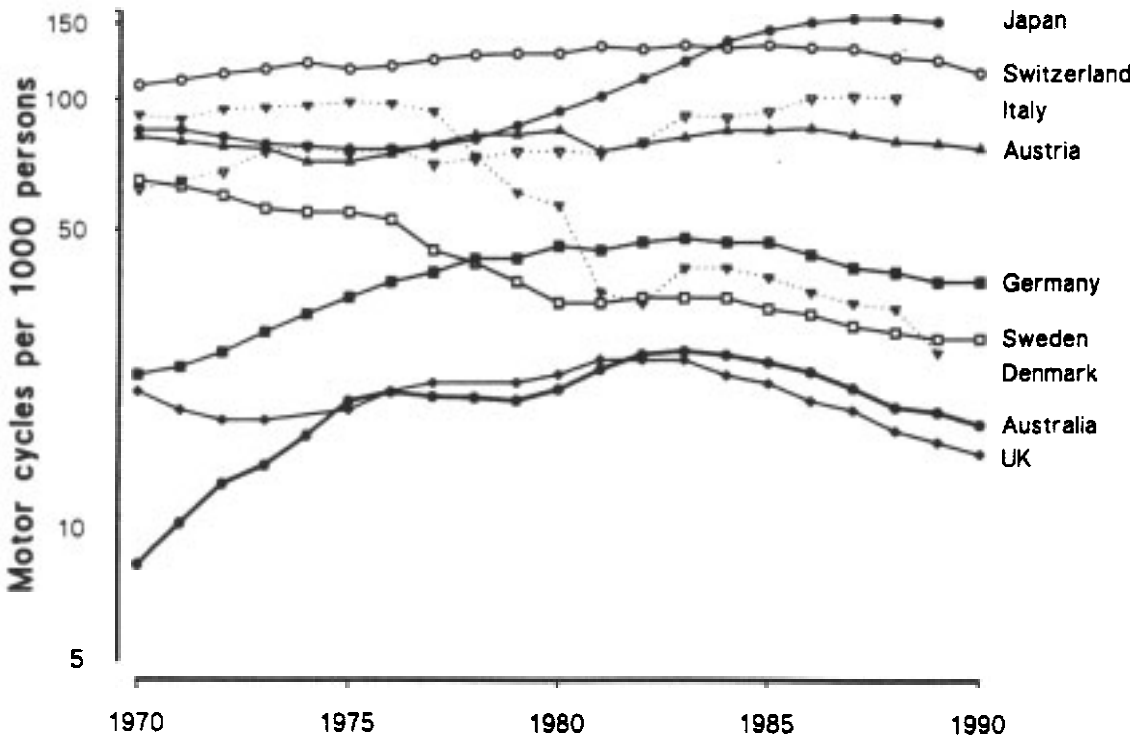
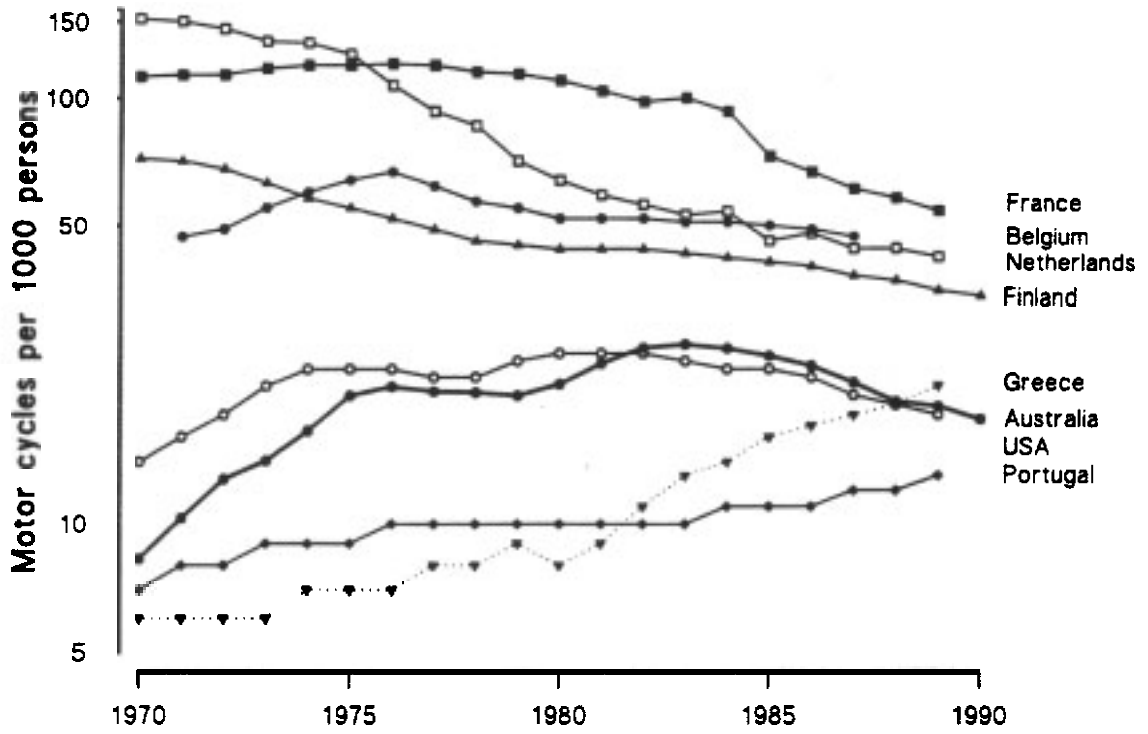
Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁴ motor cycles

The vehicle based fatality rate is the number of fatalities per 10⁴ motor cycles. The trends for these are quite different to that for the population based rate. Germany, Japan and Italy have the largest average annual % decrease for this rate. The differences between the two types of rate are due to varying patterns in motor cycle ownership from 1970 to 1990 (Figure 7.2a and 7.2b). Some countries such as Germany and the United States have a similar trend to Australia, with a sharp increase in the 1970's followed by a slower decrease in the 1980's. A number of others (such as Netherlands, Sweden and Finland) have had a decrease in ownership over the whole period, while Japan, Portugal and Greece have had steady increases.

Another complicating factor is the difference between countries in ownership of various types of motor cycle. Most European countries and Japan have large numbers of mopeds, which are usually defined as having an engine capacity of 50cc or less, often with a very low maximum speed. Australia does not have vehicles in this class.

Figure 7.2 Rate of motor cycle ownership between 1970 and 1990



Variation with age

The estimates for motor cycle fatalities by age group (Table 7.3) are not reliable because of the non-linearity of the trends for Australia and some other countries. Australia appears to have had a comparatively high decrease for the 15 to 24 year olds but a comparatively low decrease or an increase for the 25 to 64 year olds (Figure 7.3).

Table 7.3 Estimated annual % change in population fatality rates (1970-90) of motor cyclists, for six age groups.

Country	Years ¹	All ²	Age group (years)						F statistic ³
			0-14	15-17	18-20	21-24	25-64	65+	
Netherlands	1972-90	-8.0	-11.5	-6.7	-9.3	-6.1	-8.8	-12.0	3.8**
Germany (W)	1970-90	-2.4	-2.1	-4.5	-4.2	1.9	-2.9	-7.0	8.2***
Australia	1970-90	-2.5	2.3	-6.5	-5.2	-1.5	2.6	-3.7	2.9*
Austria	1972-90	-2.6	-6.5	-3.6	-2.3	-.3	-6.4	-6.6	7.6***
Switzerland	1975-89	-1.8	-6.1	-3.0	-3.3	-1.7	-1.6	-3.5	1.1
UK	1972-89 ⁴	-1.2	-1.7	-5.0	-3.6	.3	1.3	-3.3	4.7**
Italy	1972-89 ⁵	-3.0	-1.7	-.7	-3.2	-1.8	-5.6	-3.2	8.3***
USA	1980-89	-4.8	-9.7	-5.1	-3.0	-4.9	-3.5	-4.2	5.6***
Sweden	1975-90	-3.3	-3.2	-5.0	-3.2	3.7	-1.1	-11.7	4.2**
Belgium	1975-89	-3.8	-6.0	-6.1	-5.0	-.8	-2.2	-6.2	2.0
Denmark	1975-89	-2.5	-13.9	2.0	.9	3.2	-1.9	-6.7	2.0
Median		-2.6	-6.0	-5.0	-3.3	-.8	-2.2	-6.2	

¹ All countries have data for 1972, 1975 and 1980-90, except as indicated

² This estimate often differs from the estimate given in Table 7.3 for which the data are usually more complete; countries are ordered as in Table 7.3

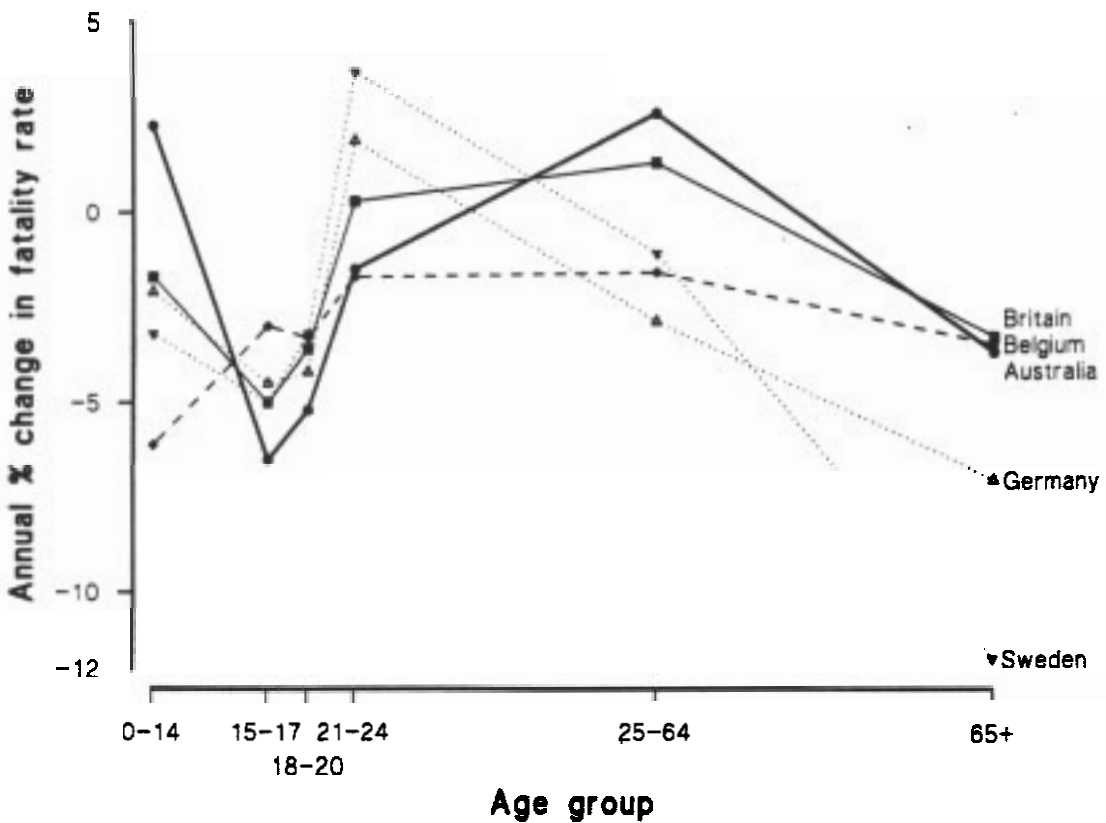
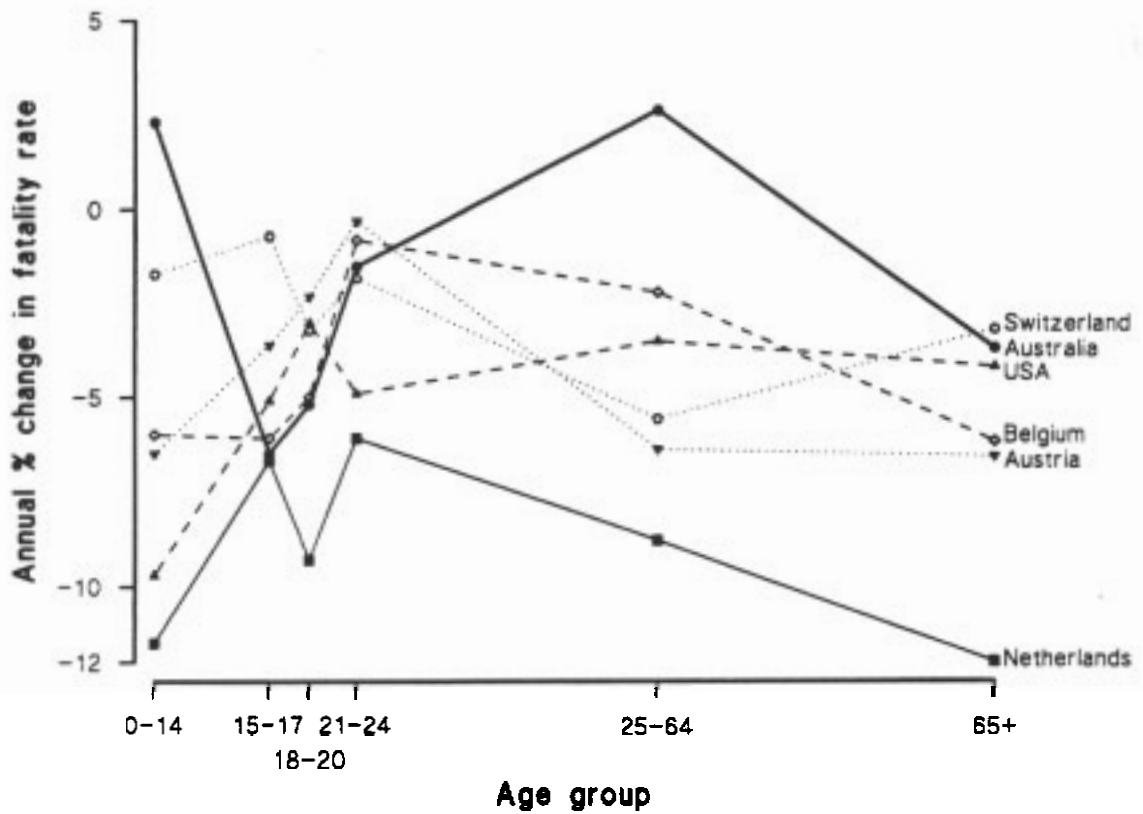
³ F statistics based on 5 and between 42 and 114 (median 54) degrees of freedom; test statistics give $p > 0.05$, except * ($0.01 < p < 0.05$), ** ($0.001 < p < 0.01$), *** ($p < 0.001$)

⁴ Great Britain is the United Kingdom excluding Northern Ireland

⁵ Missing 1985-86

Sources: IRTAD for all countries except Australia and Canada (see section 2)

Figure 7.3 Annual average % change in population fatality rate of motor cyclists between 1970 and 1990 for selected countries by age group



Note: Australia is repeated in both graphs

8. Bicyclists

Fatalities as a percentage of all fatalities

Only 3% of road fatalities in Australia are of bicyclists. For many other countries this percentage is much higher (Table 8.1). The Netherlands has the highest proportion (20%). This is noteworthy because the Netherlands has the largest decreases overall for the other types of road user, but this did not occur for bicyclists.

Table 8.1 Bicyclist fatalities as a percentage of total fatalities, by country and year (1970-90). The countries are given in descending order of the mean percentage.

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Mean
Netherlands	16	17	17	16	18	20	21	19	20	20	21	20	22	23	22	22	20	21	21	23	22	20
Finland	14	12	15	13	14	15	14	15	14	16	19	19	14	16	16	17	14	15	11	14	15	15
Denmark	13	12	9	12	14	14	10	14	14	11	12	13	15	14	15	13	11	12	11	14	13	13
Belgium			12	11	11	12	12	11	11	12	10	11	12	12	11	11	11	10	10	10	11	11
Sweden	11	10	12	12	12	13	11	12	11	10	13	10	11	12	14	11	10	7	8	10	9	11
Japan	12	11	11	12	11	12	12	12	13	12	12	11	10	10	10	10	10	10	10	11	11	11
Germany (W)	10	9	9	9	9	9	9	9	9	9	9	9	9	9	10	9	9	9	9	10	9	9
Germany (E)	11	9	12	11	11	10	9	9	9	8	10	9	10	9	9	10	9	8	10	9	6	9
Ireland	10	13	9	10	11	9	9	8	9	8	6	9	8	9	9	10	8	8	12	8	8	9
Italy	11	10	10	9	10	9	8	8	8	8	7	8	8	7	7	7	6	7	6	6	7	8
Norway											6	9	9	6	5	8	7	5	5	7	7	7
Portugal	8	7	9												6	6	6	5	4	4	6	6
Austria	8	7	7	6	7	7	7	7	6	5	4	6	7	5	5	6	7	6	6	5	7	6
Switzerland	7	7	5	5	6	7	7	6	6	5	6	6	6	6	7	7	8	6	7	8	6	6
UK	5	5	5	5	4	5	4	5	5	5	5	5	5	6	6	6	5	5	4	5	5	5
France	5	5	4	4	4	4	5	4	5	5	5	5	4	5	4	4	4	4	4	4	4	4
Canada		3	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3	3	2	3	3
Australia	2	2	3	2	3	2	3	3	2	3	3	3	3	4	3	3	3	3	3	3	3	3
New Zealand										4	3	4	3	5	3	3	3	2	3	3	3	3
Spain	3	3	3	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2
Greece	2	1	2	2	2	2	2	2	2	2	3	2	2	1	2	1	1	1	1	1	1	2
USA	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁵ persons

Italy, which did not have high decreases for other modes had the highest decrease in population bicyclist fatality rates (5.5%). Germany, Austria, Japan and Canada all had decreases of over 4%. Most other European countries had decreases between 2% and 4%. Australia had one of the lowest decreases along with the United Kingdom and the United States.

Table 8.2 Estimated fatality rate in 1980 and annual % change in bicyclist fatalities for the IRTAD countries, 1970-90.

Country	Years	Total bicyclist fatalities	Estimated fatality rate in 1980		Estimated annual % change in rate	
			per 10 ⁵ persons	per 10 ⁴ vehicles	persons	vehicles
Italy	1970-90	15490	1.3	.33	-5.5	-9.4
Germany (W)	1970-90	24717	1.8	.44	-4.6	-8.1
Austria	1970-90	2760	1.7	.48	-4.5	-8.3
Japan	1970-89	31176	1.3	.37	-4.4	-8.1
Canada	1971-90	2714	.6	.10	-4.2	-6.2
Sweden	1970-90	2209	1.2	.30	-4.0	-5.8
Netherlands	1970-90	8667	2.9	.88	-3.9	-7.0
Ireland	1970-89	978	1.4	.59	-3.7	-5.7
France	1970-90	12856	1.1	.28	-3.6	-6.2
Finland	1970-90	2289	2.2	.74	-3.5	-6.8
Belgium	1972-89	4564	2.6	.71	-3.5	-5.9
Germany (E)	1970-90	4291	1.2	.45	-2.9	-6.6
Denmark	1970-89	2063	2.0	.56	-2.8	-4.1
Switzerland	1970-90	1586	1.2	.29	-2.6	-6.4
Portugal	1970-72, 84-89	1323	1.6	.84	-1.9	-8.3
UK	1970-90	6490	.6	.17	-1.7	-4.0
USA	1970-89	18377	.4	.06	-1.3	-3.0
Australia	1970-90	1627	.6	.12	-1.2	-3.4
Spain	1971-90	2846	.4	.16	-.4	-5.4
Greece	1970-89	504	.3	.20	.1	-8.5
Median			1.2	.35	-3.5	-6.5

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Fatality rates per 10⁴ vehicles

The ordering of countries by the decrease in vehicle based fatality rates is similar to that for population based rates (Table 8.2). This is because vehicle fatality rates are not based on the number of bicycles, but on the number of vehicles of types which may hit a bicycle. Spain, Greece and Portugal have comparatively higher decreases in the vehicle fatality rates than the population fatality rates because they have had large increases in vehicle ownership from 1970 to 1990.

Figure 8.1 Population fatality rate of bicyclists between 1970 and 1990 for Australia and selected countries

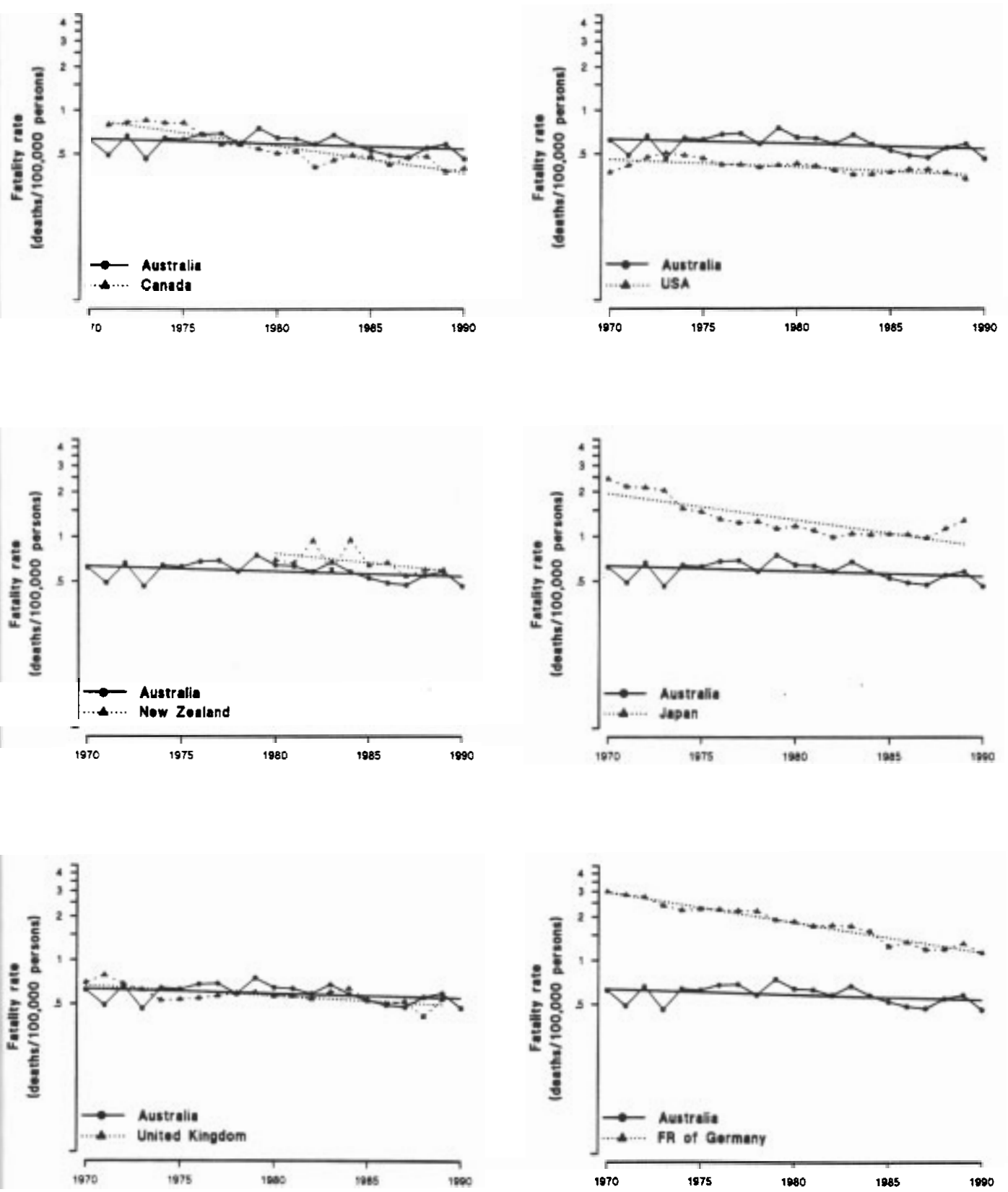


Figure 8.1 Population fatality rate of bicyclists between 1970 and 1990 for Australia and selected countries (continued)

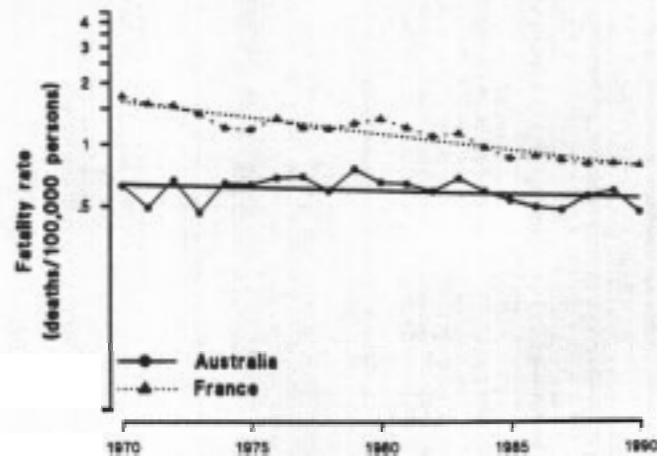
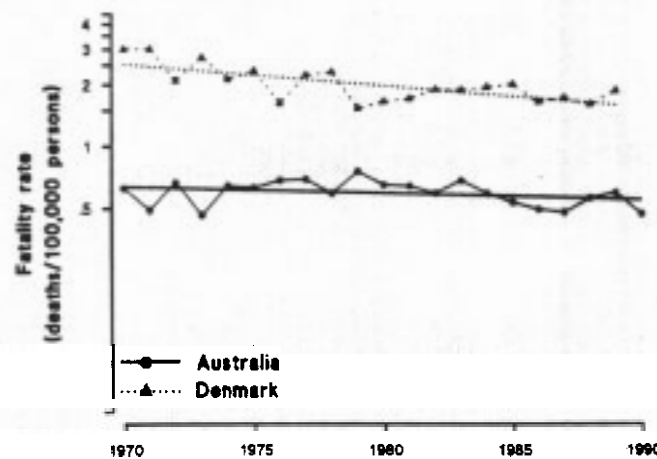
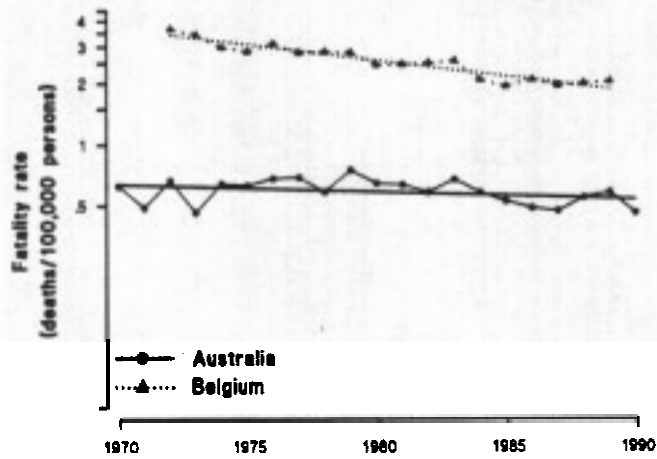
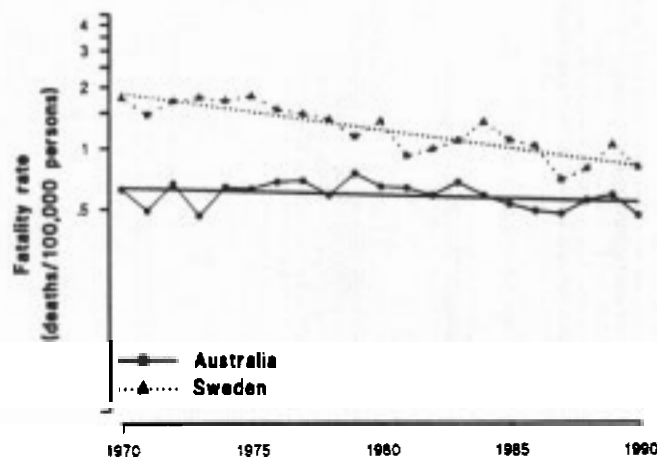
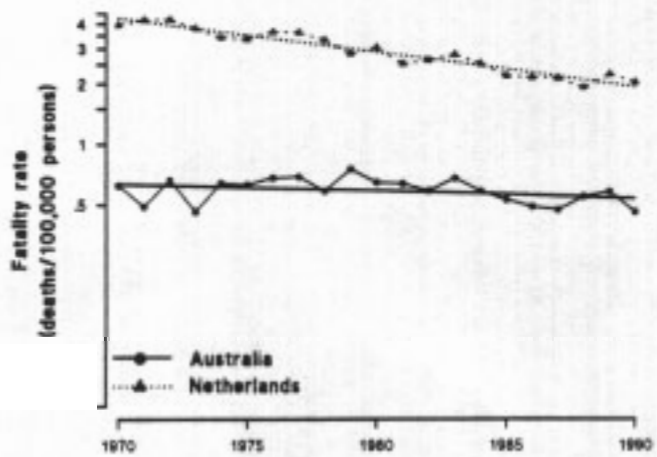
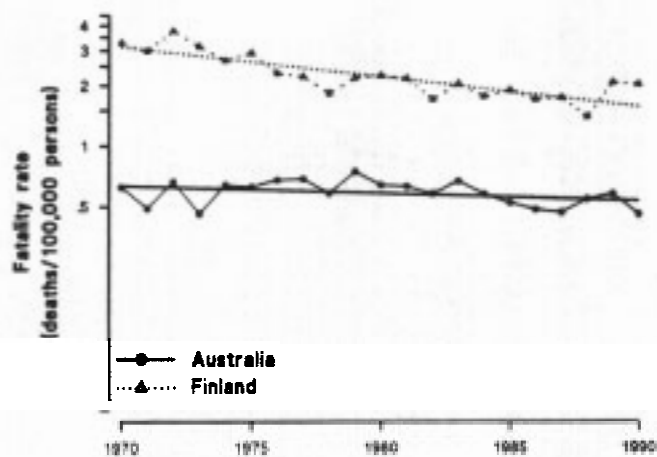
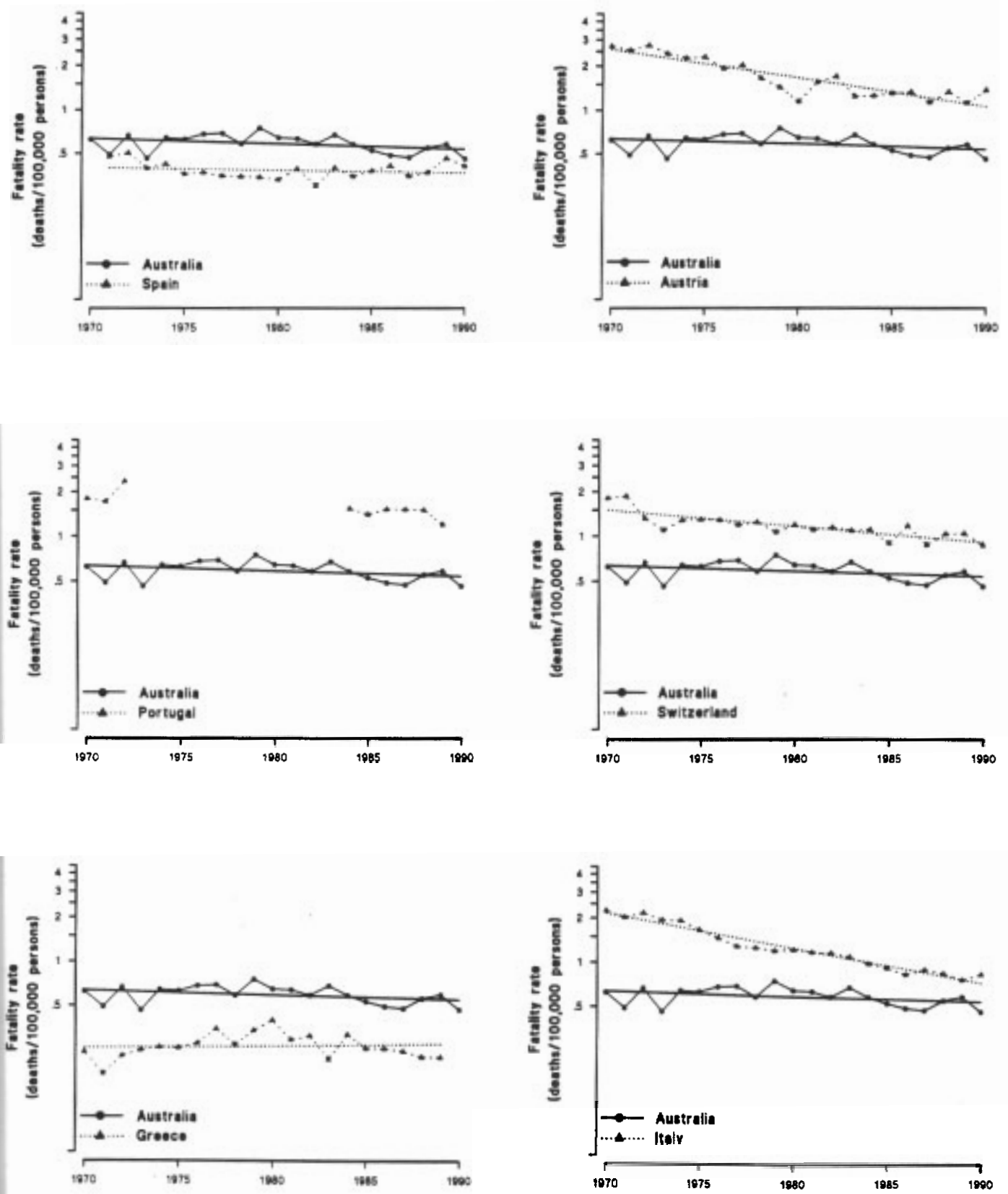


Figure 8.1 Population fatality rate of bicyclists between 1970 and 1990 for Australia and selected countries (continued)



Variation with age

Australia had a comparatively high decrease in rate for children aged 14 and under, and also for persons aged over 65 (Figure 8.2). There is considerable variation between countries for the young adult age groups (15 to 24 years). The change in fatality rate shows no clear average pattern across age groups.

Table 8.3 Estimated annual % change in population fatality rates (1970-90) of bicyclists, for six age groups.

Country	Years ¹	All ²	Age group (years)						F statistic ³
			0-14	15-17	18-20	21-24	25-64	65+	
Netherlands	1972-90	-4.0	-4.9	-.1	-.9	3.0	-3.5	-5.4	8.9***
Germany (W)	1970-90	-4.6	-5.4	-3.6	-1.6	-.1	-4.8	-4.2	5.2***
Australia	1970-90	-1.2	-2.1	.4	.6	1.0	1.3	-3.2	2.3
Ireland	1975-89	-1.9	1.1	2.4	9.3	-1.0	-5.8	-5.7	2.9*
Austria	1972-90	-4.5	-4.9	-2.1	-9.5	-.1	-4.4	-4.5	.9
Switzerland	1975-89	-1.9	-4.1	1.2	-6.0	.9	-.5	-1.8	.9
UK	1972-89 ⁴	-1.4	-1.9	-1.0	2.5	2.8	-.5	-3.7	2.4*
Italy	1972-89 ⁵	-6.0	-6.7	-7.8	-9.7	-6.2	-7.6	-5.1	2.8*
USA	1980-89	-1.3	-2.6	-1.5	-.2	.8	2.7	.5	5.9***
Sweden	1975-90	-5.1	-5.4	-3.9	-8.6	-7.7	-7.2	-3.9	.6
Belgium	1975-89	-2.8	-4.3	-6.3	.2	.8	-2.9	-1.8	1.7
Denmark	1975-89	-.1	-5.7	10.4	15.6	9.9	1.7	-4.0	8.3***
Median		-2.3	-4.6	-1.3	-.6	-.8	-3.2	-3.9	

¹ All countries have data for 1972, 1975 and 1980-90, except as indicated

² This estimate often differs from the estimate given in Table 8.3 for which the data are usually more complete; countries are ordered as in Table 8.3

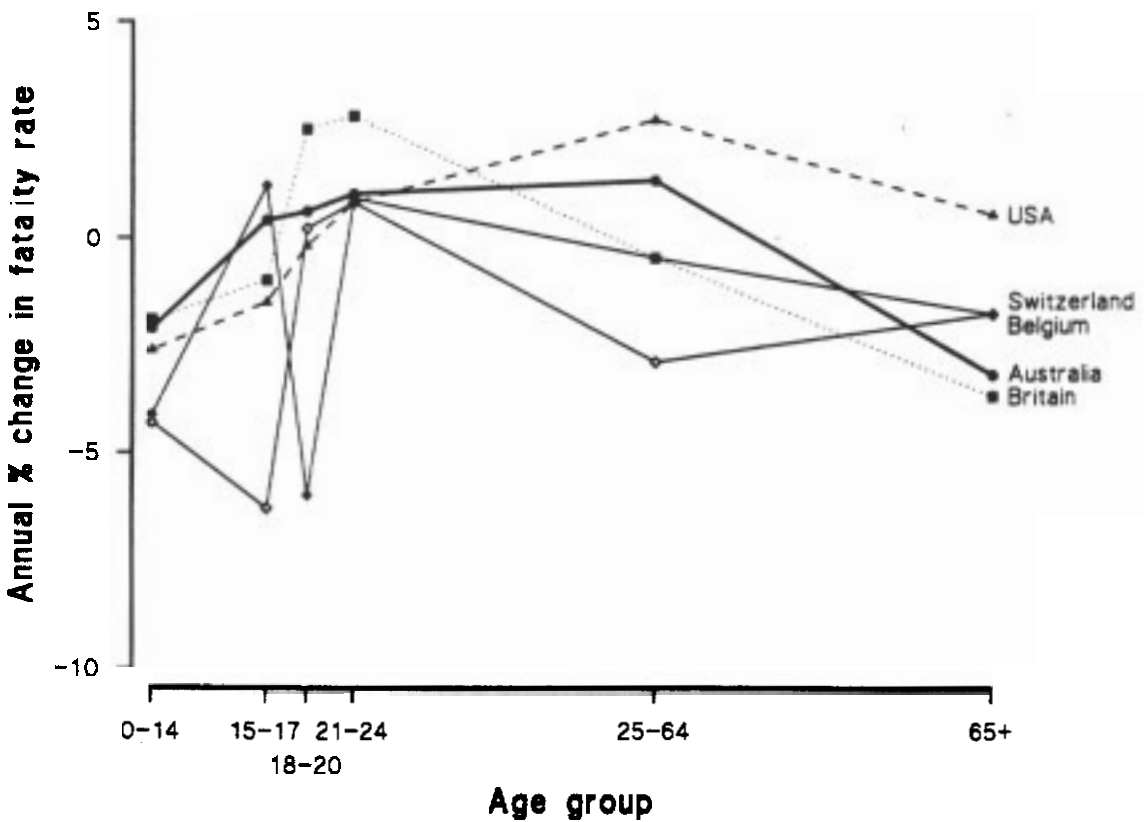
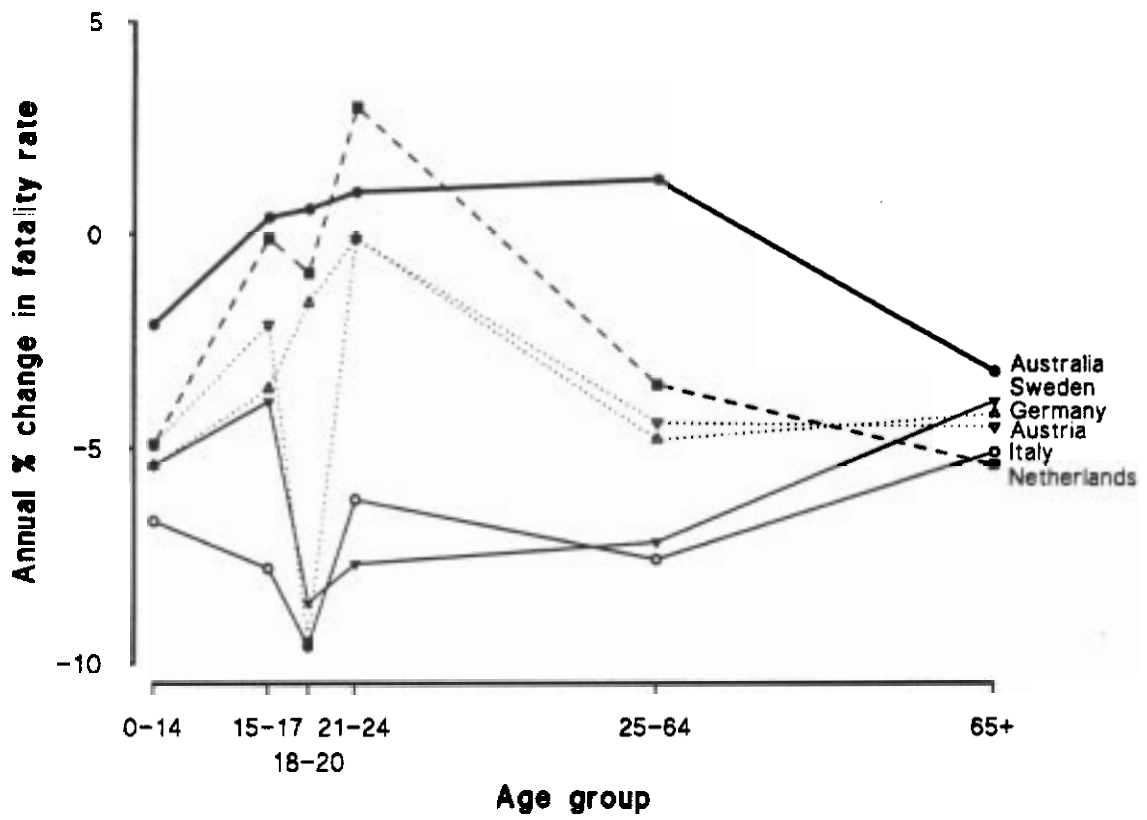
³ F statistics based on 5 and between 42 and 114 (median 54) degrees of freedom; test statistics give $p > 0.05$, except * ($0.01 < p < 0.05$), ** ($0.001 < p < 0.01$), *** ($p < 0.001$)

⁴ Missing 1985-86

⁵ Great Britain is the United Kingdom excluding Northern Ireland

Sources: IRTAD for all countries except Australia and Canada (see section 2).

Figure 8.2 Average annual % change in population fatality rate of bicyclists between 1970 and 1990 for selected countries by age group



Note: Australia is repeated in both graphs

Figure 9.1 Relationship between the estimated total fatality rate (deaths/10000 vehicles) in 1990 and the estimated number of vehicles per 1000 persons in 1990.

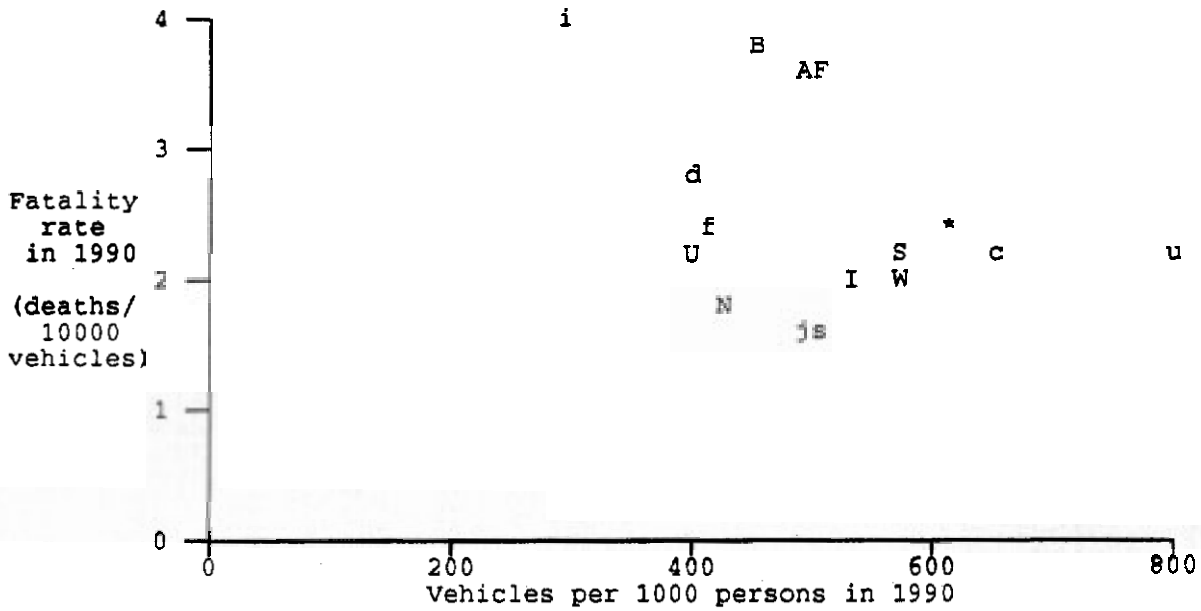
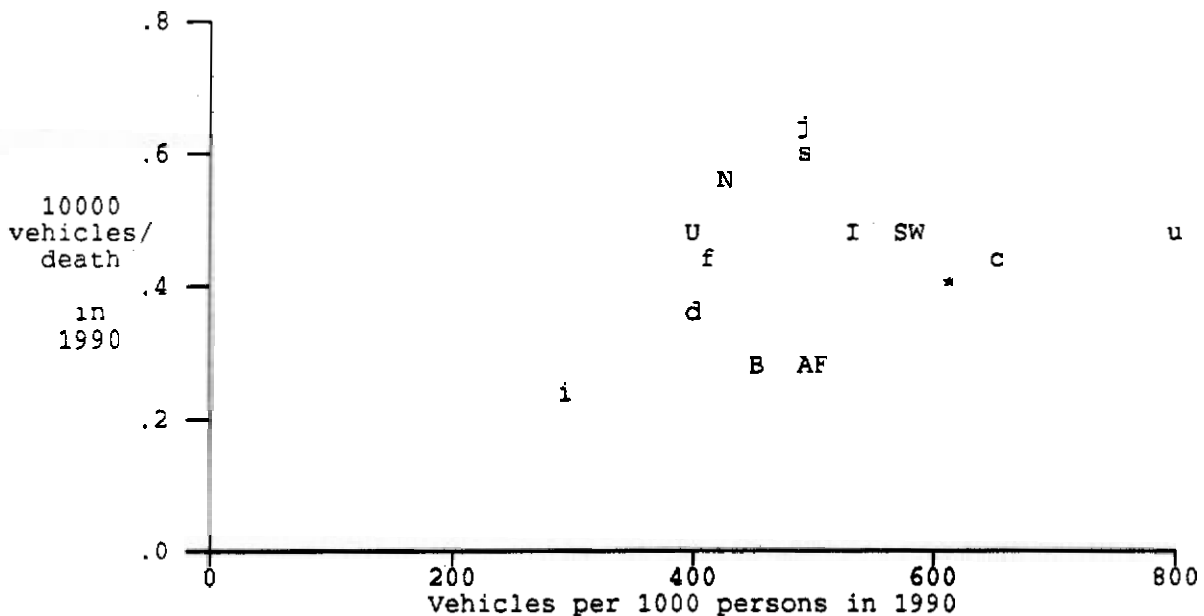


Figure 9.2 Relationship between the reciprocal of the estimated total fatality rate (10000 vehicles/deaths) in 1990 and the estimated number of vehicles per 1000 persons in 1990.



The countries are:

- | | | |
|------------------|---------------|----------------|
| • Australia | B Belgium | S Switzerland |
| A Austria | d Denmark | F France |
| c Canada | I Italy | i Ireland |
| f Finland | N Netherlands | s Sweden |
| j Japan | u USA | W West Germany |
| U United Kingdom | | |

9. Fatality rates and motorisation

More motorised countries tend to have fewer fatalities per registered vehicle than less motorised countries. Evans (1991, p3) shows this relationship for a wide range of countries, from the poorest to the richest. Although it is plausible that this relationship would not hold for comparisons between the richest nations, this is apparently not so (Figure 9.1). Figure 9.1 shows the total fatality rate (fatalities per 10,000 registered vehicles) in 1990 plotted against the number of registered vehicles per 1000 persons in 1990. The curvilinear relationship in this figure can be linearised by taking the reciprocal of the fatality rate, that is, the number of registered vehicles per fatality (Figure 9.2).

The data in Evans and in Figures 9.1 and 9.2 are cross-sectional, that is, are for only a single point in time. However, the relationship can be thought of as longitudinal: as countries become more motorised, their fatality rates should decrease. This can be tested for the richest nations using the data from the earlier chapters in this report.

The data used here are for those countries with data for all or most of the period 1970 to 1990, and for which the data on registered vehicles in IRTAD seem reliable. Inevitably, this means that the analysis here is of the richest nations represented in IRTAD.

Figures 9.3 and 9.4 plot the annual percentage change in the total fatality rate between 1970 and 1990 against the fatality rate in 1970 and the percentage change in the number of vehicles registered per person between 1970 and 1990. A multiple regression model confirms that those countries with the greatest percentage increase in the number of registered vehicles over this period also had the greatest decrease in the fatality rate over the same period ($t_{14} = 5.7, p < 0.001$; after adjusting for the reciprocal of the initial fatality rate, $t_{13} = 4.1, p < 0.001$). This can be interpreted as countries with the largest wealth increase over this period also tending to have the greatest decrease in road fatality rates. This contradicts the hypothesis that road safety improvements (measured as percentage changes in fatality rates) may be more difficult to achieve as a country becomes more developed: the opposite appears to occur.

After taking account of this relationship, there is a small additional negative relationship of the annual percentage decrease in the fatality rate with the reciprocal of the initial fatality rate, although this is not statistically significant ($t_{13} = 1.7, p > 0.05$). This result contradicts the hypothesis that countries with the greatest fatality rates might achieve the greatest percentage improvements in their fatality rate. (The reciprocal transform was used for the initial fatality rate because it appears to have a stronger relationship with the change in the fatality rate than the untransformed variate has.)

Given its change in the number of vehicles per person, the Netherlands has an annual decrease in its fatality rate of 2.2 percentage points more than expected ($t_{13} = 7.3, p < 0.001$). This suggests that it would be worth examining how and why the Netherlands has achieved this impressive road safety improvement.

Another possibility is that richer countries might be more able to achieve road safety improvements than poorer countries. The number of vehicles per 1000 persons in 1970 is a measure of initial wealth. After controlling for the change in motorisation, it appears that the change in the fatality rate depends only weakly on initial wealth ($t_{13} = 0.9, p > 0.05$). Although not statistically significant, this regression model suggests that poorer, rather than richer, countries have better improvements in their fatality rates.

Figure 9.3 Relationship between the estimated annual change in the total fatality rate (% of the rate per vehicle) between 1970 and 1990 and the estimated fatality rate (deaths/10000 vehicles) in 1970.

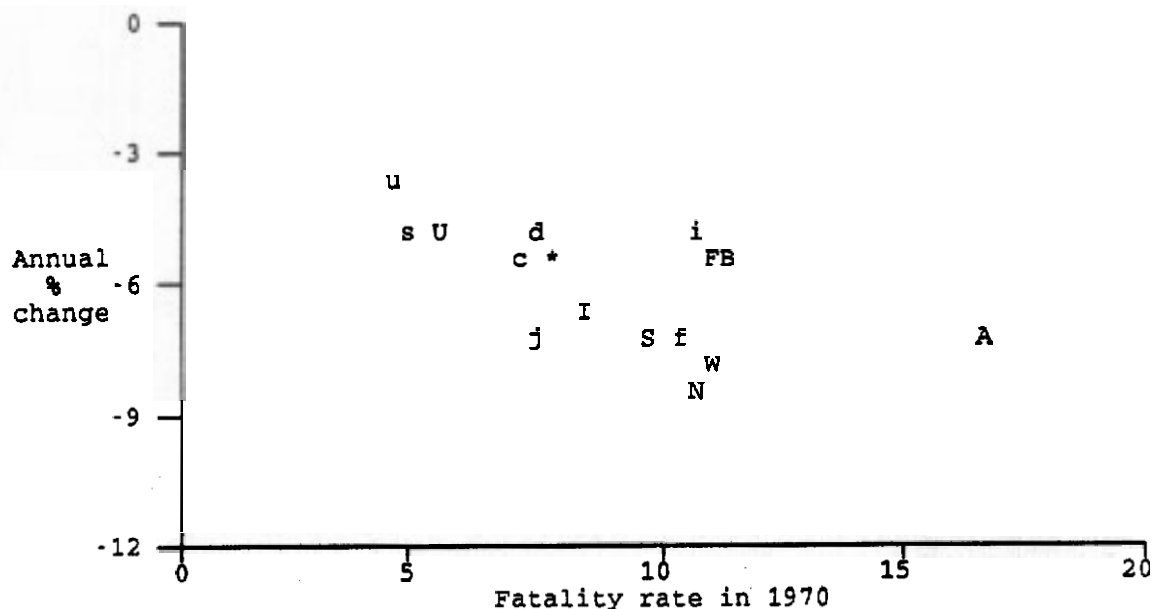
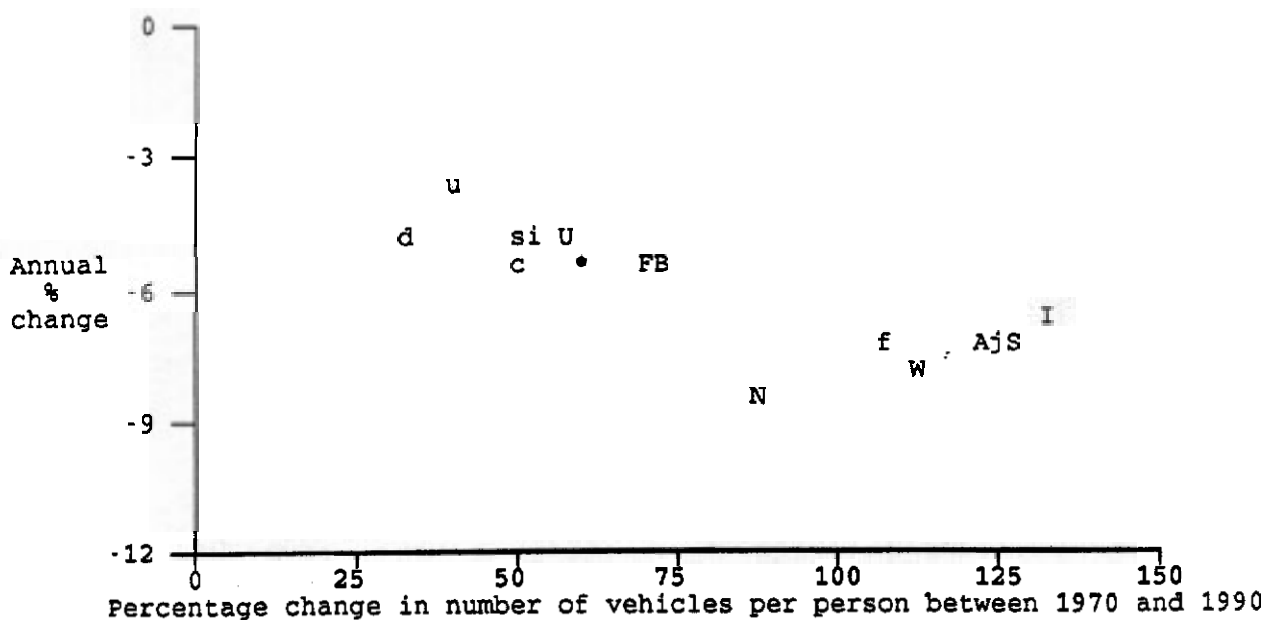


Figure 9.4 Relationship between the estimated annual change in the total fatality rate (% of the rate per vehicle) between 1970 and 1990 and the estimated percentage change in the number of vehicles per 1000 persons between 1970 and 1990.



The countries are:

- | | | |
|------------------|---------------|----------------|
| • Australia | B Belgium | S Switzerland |
| A Austria | d Denmark | F France |
| c Canada | I Italy | i Ireland |
| f Finland | N Netherlands | s Sweden |
| j Japan | u USA | W West Germany |
| U United Kingdom | | |

Similar results obtain for driver/passenger fatality rates (Figures 9.5 and 9.6), and for pedestrian fatality rates (Figures 9.7 and 9.8):

Fitted model for average annual % decrease in the fatality rate between 1970 and 1990	Road user group					
	Total		Drivers/passengers		Pedestrians	
	Estimate	t	Estimate	t	Estimate	t
<i>Model 1</i>						
Intercept	3.2	-	2.4	-	4.0	-
% change in vehicles/person 1970 to 1990	.036	5.7***	.034	4.5***	.048	6.2***
<i>Model 2</i>						
Intercept	4.8	-	2.7	-	5.4	-
% change in vehicles/person 1970 to 1990	.029	4.1***	.033	4.1***	.041	4.3***
1/initial fatality rate (1970)	-8.5	1.7	-1.0	.3	-1.5	1.4
<i>Model 3</i>						
Intercept	4.2	-	2.4	-	5.4	-
% change in vehicles/person 1970 to 1990	.030	6.2***	.033	4.9***	.039	5.0***
1/initial fatality rate (1970)	-5.9	1.7	-0.1	.0	-1.6	1.8
Netherlands	2.2	4.0***	2.4	2.6*	2.3	2.6*

t-tests are not statistically significant, except * (0.01 < p < 0.05) and *** (p < 0.001)
(For this analysis, fatality rates were expressed on a per vehicle basis)

Reexamination of Figures 9.4, 9.6 and 9.8 shows that fitting regression models to the data as a whole is not the only possible approach. For example, it appears that the countries consist of two subsets, those which more than doubled their level of motorisation between 1970 and 1990 and those with a lesser increase. The Netherlands, with an increase of 88%, could be regarded as belonging to either subset.

Within each subset, the relationship between the annual percentage change in the fatality rate and the change in the level of motorisation is much less marked than for the data set taken as a whole. Indeed, for the countries with most change in motorisation, the relationship may even be negative. This is consistent with the hypothesis that countries with extremely rapid increases in motorisation may be unable to keep up with the required infrastructure improvements, and so road safety may suffer.

Figure 9.5 Relationship between the estimated annual change in the fatality rate of drivers and passengers (% of the rate per vehicle) between 1970 and 1990 and their estimated fatality rate (deaths/10000 vehicles) in 1970.

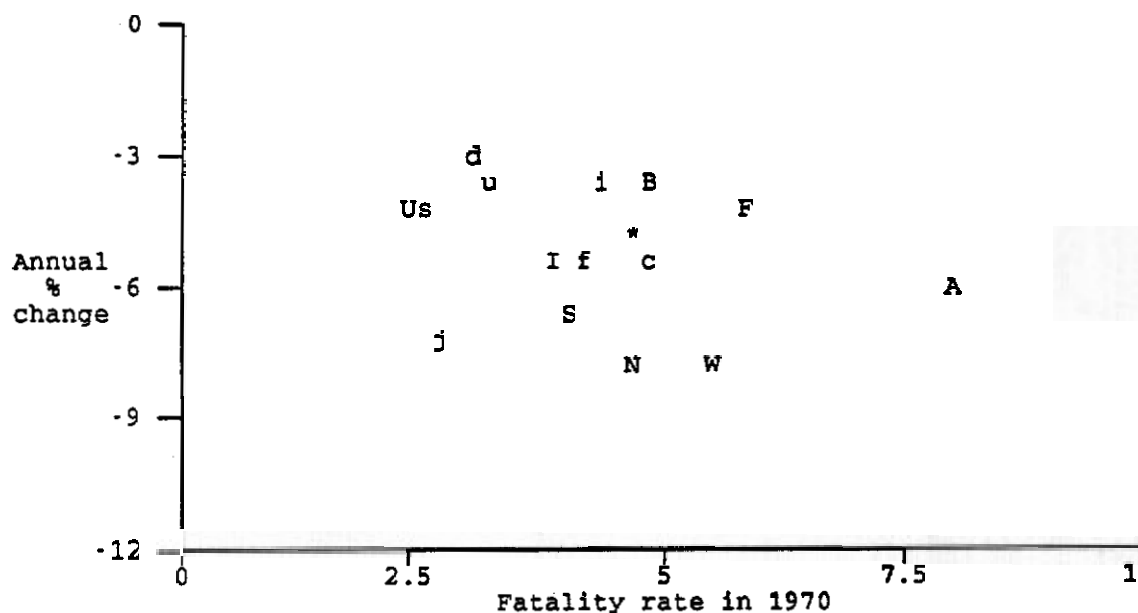
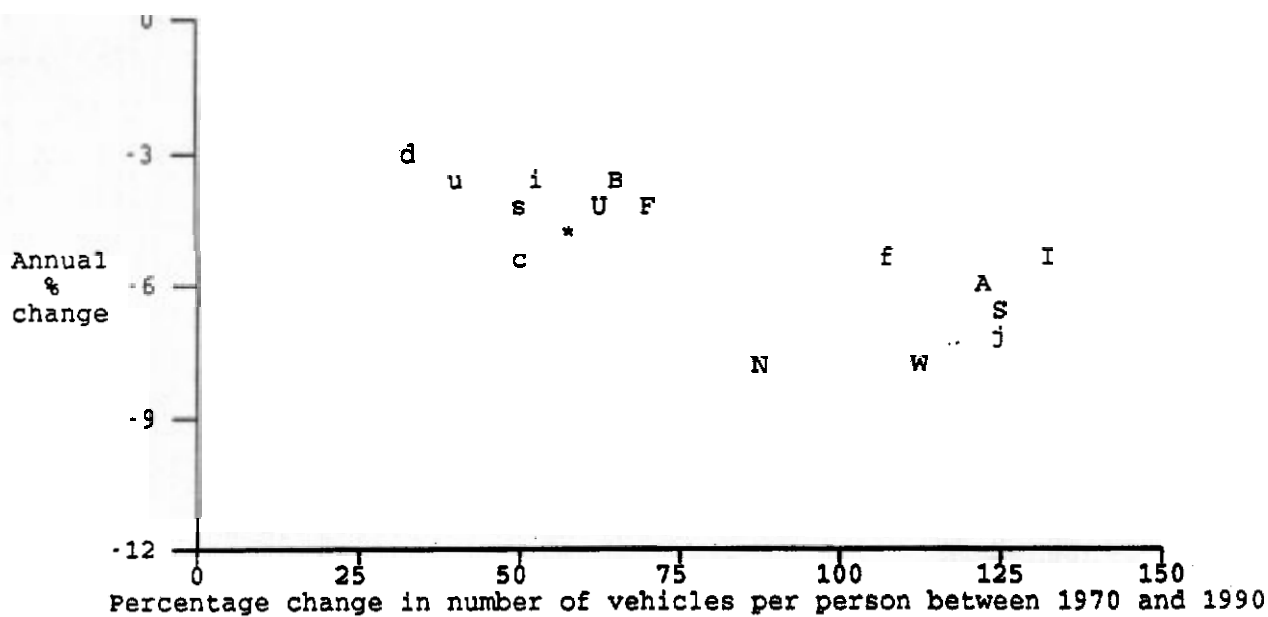


Figure 9.6 Relationship between the estimated annual change in the fatality rate of drivers and passengers (% of the rate per vehicle) between 1970 and 1990 and the estimated percentage change in the number of vehicles per 1000 persons between 1970 and 1990.



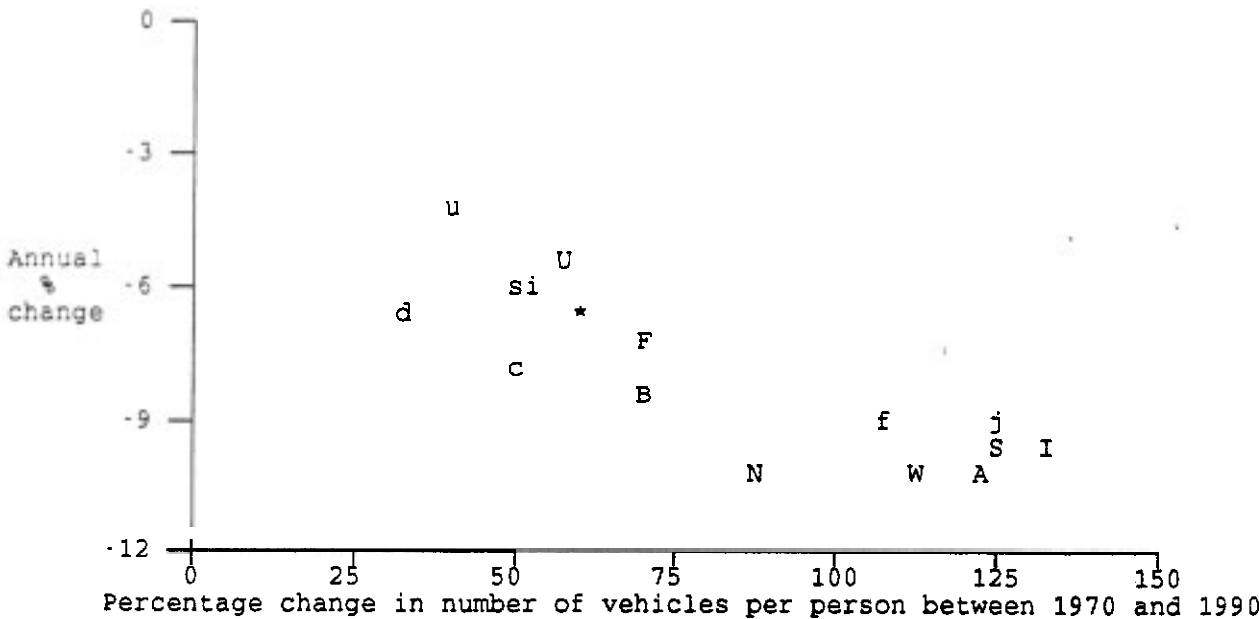
The countries are:

- | | | |
|------------------|---------------|----------------|
| • Australia | B Belgium | S Switzerland |
| A Austria | d Denmark | F France |
| c Canada | I Italy | i Ireland |
| f Finland | N Netherlands | s Sweden |
| j Japan | u USA | W West Germany |
| U United Kingdom | | |

Figure 9.7 Relationship between the estimated annual change in the fatality rate of pedestrians (% of the rate per vehicle) between 1970 and 1990 and their estimated fatality rate (deaths/10000 vehicles) in 1970.



Figure 9.8 Relationship between the estimated annual change in the fatality rate of pedestrians (% of the rate per vehicle) between 1970 and 1990 and the estimated percentage change in the number of vehicles per 1000 persons between 1970 and 1990.



- The countries are:
- Australia
 - A Austria
 - c Canada
 - f Finland
 - j Japan
 - U United Kingdom
 - B Belgium
 - d Denmark
 - I Italy
 - N Netherlands
 - u USA
 - S Switzerland
 - F France
 - i Ireland
 - s Sweden
 - W West Germany

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