SCANDINAVIAN ROAD SAFETY: IMPLICATIONS FOR AUSTRALIA?

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ABSTRACT: *In this paper an attempt is made to suggest reasons why the four Scandinavian countries (as well as many other developed countries) achieved dramatic reductions in road accidents and fatalities during the 1970s, while most Australian States, particularly New South Wales, achieved only modest reductions. It is suggested that the four most important factors are: there are much longer relative lengths of high quality road systems in Scandinavia; Australia has a much younger driving population and therefore a higher proportion of "high risk" young drivers; road safety publicity and public education in Scandinavia has been more organised and intense since the 1960s; a higher scale of economic activity in Australia has generated a greater demand for road travel by both commercial vehicles and private motorists.*

Where possible some simple statistical analyses are presented which support these suggestions. However, it is also suggested that conclusions drawn from these analyses are very tentative since no one factor should be viewed in isolation from all other factors influencing the road toll in the various countries. This is because the road toll must be viewed as resulting from a total road transport system which involves roads, vehicles and drivers all interacting with each other. A statistical analysis technique is suggested for coming to grips with this problem, although such an analysis is beyond the scope of this paper. Using this technique, international or interstate comparisons of the effectiveness of road safety policies can be much more conclusive.

SCANDINAVIAN ROAD SAFETY

INTRODUCTION

Since about 1970, the four Scandinavian countries - Denmark, Sweden, Finland, Norway - together have been extraordinarily successful in reducing serious road accidents by up to 50% of the peak levels which occurred in the early 1970's. While most other developed countries also substantially reduced their road accident levels in the same period, the four have been the most successful of all O.E.C.D. countries in this regard. As of 1981, they had road fatality rates which were among the lowest of all developed countries.

Australia, on the other hand, managed only a small reduction in road accidents in the same period. Australia's road accident rate is now one of the highest of all developed countries (see Table 1).

It would seem then that Australia could benefit from a comparative study of the factors involved in road accidents, to determine which factors are favourably influencing accident rates in Scandinavia but not in Australia. Of course such a comparative study is a very complex task since it involves a comparison over an extended period of time of all the factors which have a major impact on road accidents in developed countries. Up until the past few years, this task was impossible to do on any systematic and rigorous basis: all that could be done was to present the qualitative impressions and assertions of "experts" who were familiar with the road safety scenes in the countries (or perhaps States) being compared.

The possibility of quantitative comparative studies of road accidents has become possible in the past few years due to major developments in the three areas which enable a more scientific approach - theory, data and methodology.

1. Theory: Most of the major factors involved in influencing road crash rates have by now been identified. We can now draw up flow charts of these factors and how they interact to determine road accident rates. One such chart is Chart 1, which depicts the level of road accidents as being determined by eight broad factors - driver attitudes, quality of roads, policy activity, etc.

2. Data: Most of the factors which influence accident rates have now been measured over a fairly long period of time. Even where a factor has not been directly measured, it can be indirectly measured by an "indicator" or proxy variable. Most countries now have detailed time series data extending back many years, in some cases back to the late 1940's. Of special interest is the data series compiled by the International Road Federation in its publication titled, "World Road Statistics" (see I.R.F., 1983).

3. Methodology: Multivariate methods, which bring theory and data together in a systems modelling framework, are now readily available thanks to the development of large and fast computers, interactive software and refinements in statistical theory. One such set of multivariate methods is econometrics.

The application of econometric modelling to road fatality rates has been discussed by Thomson (1982) and demonstrated by Campbell and Filmer (1982), Thomson (1983a) and I.I.H.S. (1983). The practical use of such models in either predicting or evaluating the effectiveness of a particular road safety policy has been demonstrated by Thomson and Mavrolefterou (1984).

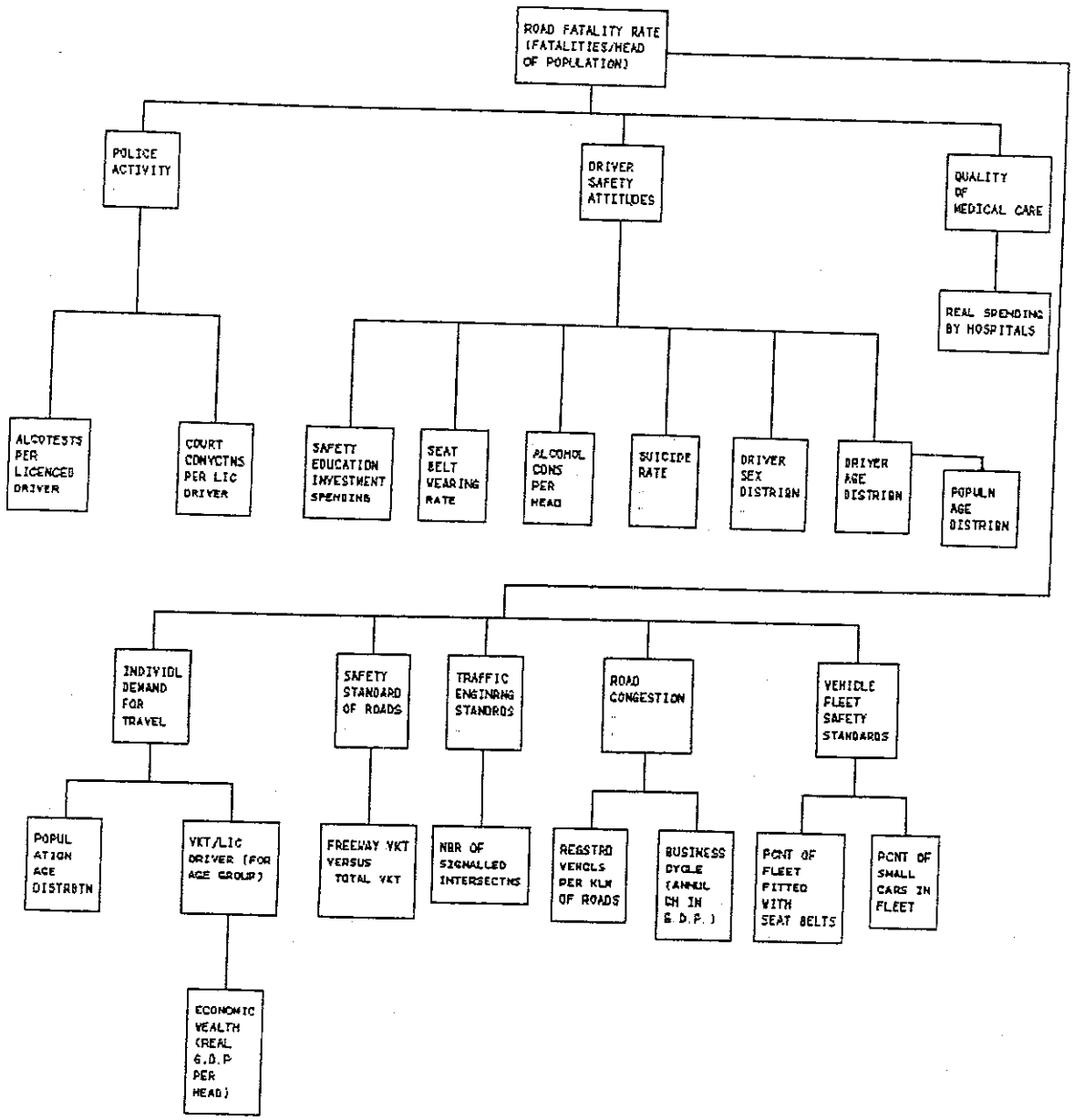
So it is now becoming possible to do comparative quantitative studies of road accident experiences in various countries, for example, the Australian States versus Scandinavian countries. This paper is a first step towards such a study. It will concentrate on the theoretical aspects, and will discuss which of the variables of Chart 1 are likely to account for the different road accident experiences of Australia and Scandinavia, and which are not. The discussion will draw on experiences, observations and data collected by the author while on a study tour of the Scandinavian countries in 1983. The tour was arranged by the Scandinavian Businessmen's Club of Sydney who felt that Australia could benefit from a better understanding of Scandinavian experience and practice in the road safety area. A full report on the findings of this tour is available - see Thomson (1983b).

In the second section of this paper, road fatality patterns across time are presented in order to acquaint the reader with the Scandinavian achievement. Road fatality patterns are used for this purpose because they have been accurately counted in many countries over a long period of time, and because definitional problems are minimal.

In the third section is a discussion of road safety factors which are commonly assumed to have contributed significantly to the fall in the road toll in Scandinavia vis-a-vis Australia, but which on closer examination probably have not (for example the severe penalties prescribed by law for drink driving).

In the ensuing four sections are discussed four factors which do appear to have been effective in reducing the road toll in Scandinavia but not in Australia. In the fourth section, the effect of economic growth on road fatalities is discussed. The rate of economic growth in a country may strongly affect the volume and nature of commercial road traffic, as well as the nature and timing of private road travel, and both of these in turn affect the road toll. In the fifth section is discussed a factor which the Scandinavians themselves feel has contributed greatly to their road toll reduction and that is road safety publicity and public education. In the sixth section is discussed the fact that better progress with road construction in Scandinavia may well have strongly contributed to the accident decline there. In the seventh section, driving competence is discussed with regard to the fact that Scandinavia has on the whole an older, more experienced driving force than Australia since it has an older population.

Chart 1 - Some Factors Influencing Road Fatalities



ROAD FATALITY PATTERNS

In this section some statistics on road fatalities are presented in order to acquaint the reader with the post-war history of fatalities in Scandinavia and some other countries which are of interest. As mentioned previously, fatality patterns are used for this purpose because they have been accurately counted in many countries over a long period of time, and because definitional problems are minimal. The Scandinavian countries have road fatality rates which are amongst the lowest in the world. This is shown in the following table.

TABLE 1 - ROAD FATALITIES PER 100 MILLION VEHICLE KILOMETRES OF TRAVEL *
1981

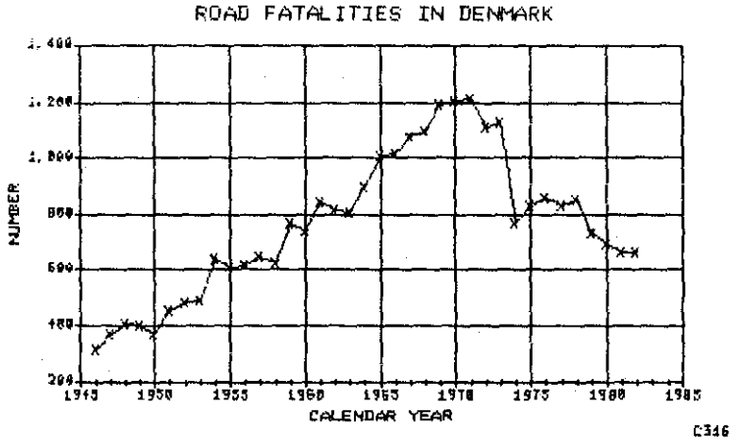
NORWAY	1.8	NETHERLANDS	3.2
GREAT BRITAIN	2.0	NEW ZEALAND	3.4
U.S.A.	2.1	WEST GERMANY	3.6
FINLAND	2.1	BELGIUM	4.1
JAPAN	2.2	AUSTRALIA	4.3
SWEDEN	2.3	FRANCE	4.4
DENMARK	2.6		

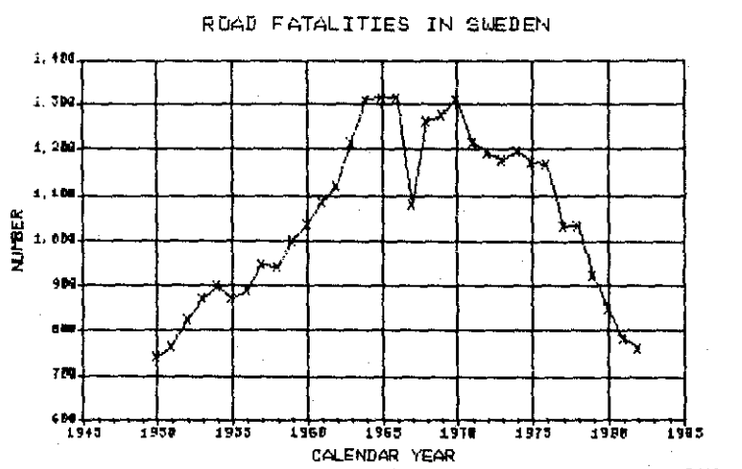
* Source of data: I.R.F., World Road Statistics

Not only are Scandinavian roads now among the safest in the world but, as mentioned previously, road fatality reductions since 1970 have been the most dramatic in the world. Chart 2 contains graphs of road fatalities from 1945 to 1982 in each of the Scandinavian countries. It will be seen that each graph has a similar pattern; road fatalities climbing steeply through the 1950's and 1960's before levelling off in the 1968 to 1973 period and then falling steeply through the mid-1970's to current levels which are roughly 40% to 50% below peak levels.

It can be noted at this point that this pattern, common to the Scandinavian countries, follows a pattern similar to that in most developed nations. Chart 3 contains graphs of road fatalities in the U.S.A., Great Britain, France, and West Germany; Chart 4 contains graphs for Japan, Belgium, and New Zealand. In Germany fatalities have fallen in the past ten years from about 19,000 to less than 12,000 - a fall of about 40%. In Britain the fall has been about 25%, in the U.S.A. 20%, in France 25%, and so on. Chart 5 contains road fatalities for four Australian States. In the past ten years, Victoria and South Australia have seen a 30% fall in fatalities; in New South Wales the fall has been less than 10%.

Chart 2 - Road Fatalities in Scandinavian Countries





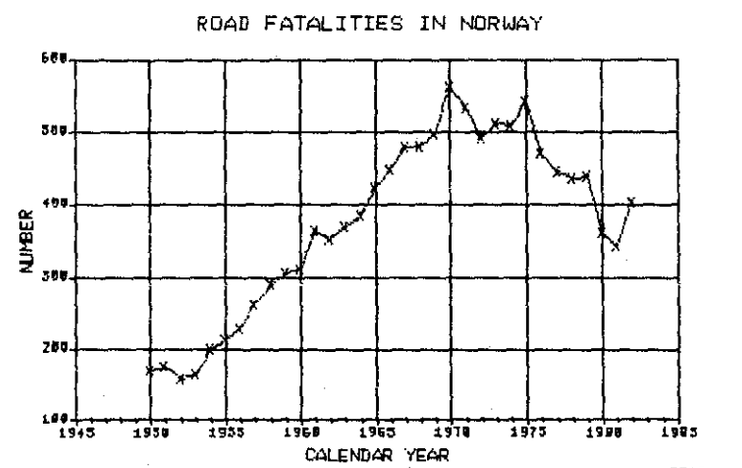
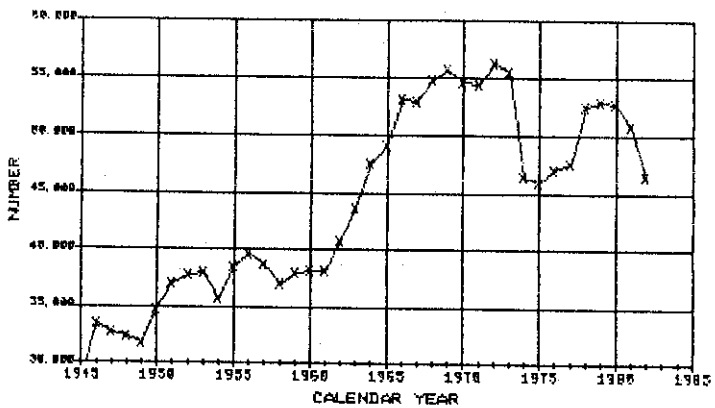
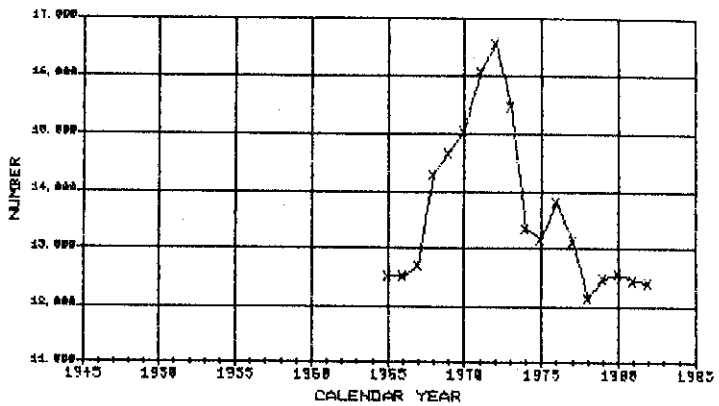


Chart 3 - Road Fatalities in Various Countries

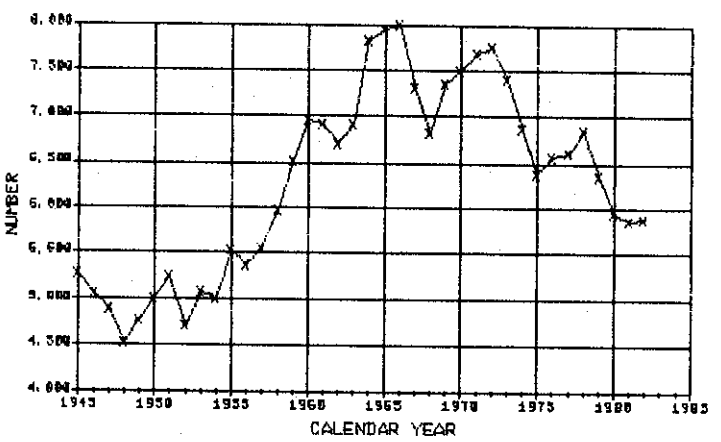
ROAD FATALITIES IN THE UNITED STATES



ROAD FATALITIES IN FRANCE



ROAD FATALITIES IN GREAT BRITAIN



ROAD FATALITIES IN WEST GERMANY

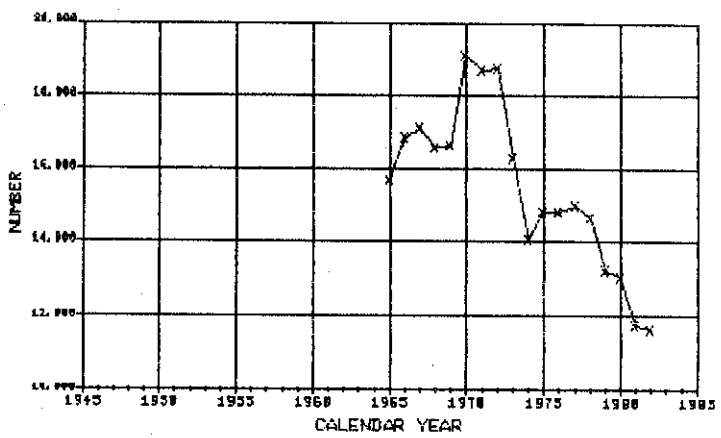
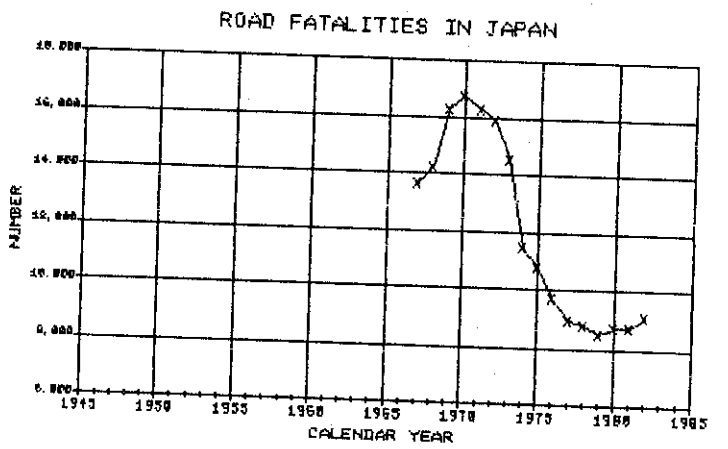
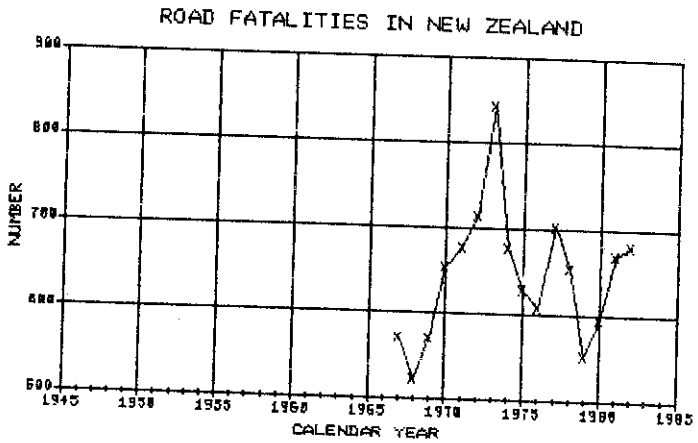


Chart 4 - Road Fatalities in Various Countries (continued)





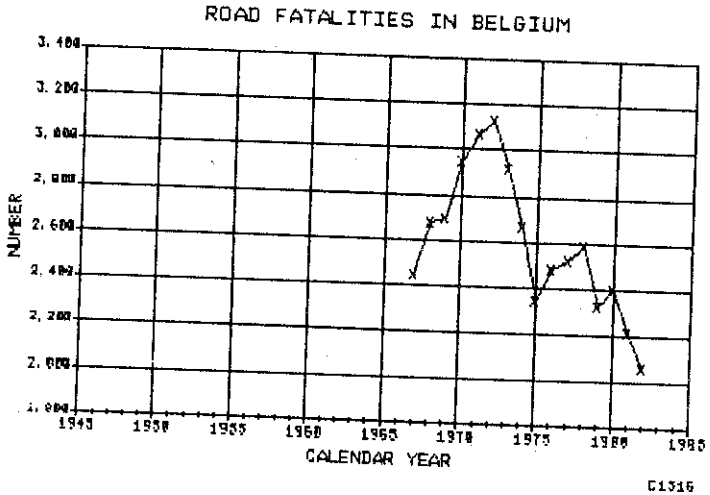
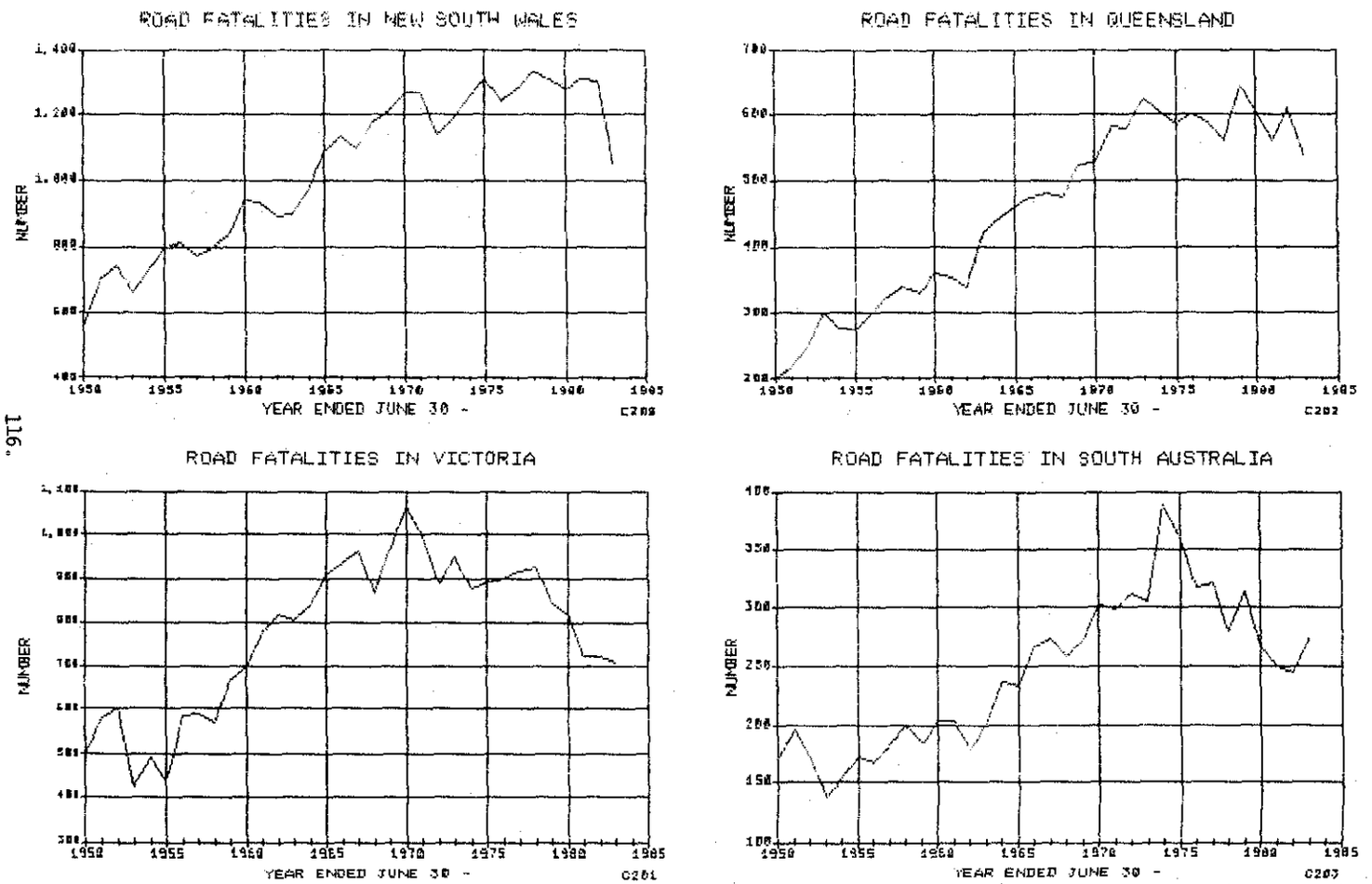


Chart 5 - Road Fatalities in Four Australian States



Thus the fall in Scandinavia's road fatalities in the past 15 years is in part a world-wide phenomenon and it appears that some common causes should be searched for. In the fourth section, it will be argued that this phenomenon is associated with the general pattern of economic growth in most developed countries over the same period, and that this may have had a greater effect in the Scandinavian countries than in Australia.

There are many other interesting features of these graphs on which one could comment. To mention a few:

1. the effect in 1974 of the first "oil crisis" in Denmark, Finland, France, Japan, U.S.A. and New Zealand;

2. the introduction in 1967 in Great Britain of the British Road Safety Act amid great controversy over the introduction of P.C.A. (Prescribed Concentration of Alcohol) laws in the Act;

3. the effect in Sweden in 1967 of the change from left hand to right hand driving;

4. the introduction of fines for non-usage of seat belts in Norway in 1980, in Sweden in 1977;

5. the impact of the very rapid growth in motorisation and demand for road travel in almost all countries between roughly 1955 and 1970.

Almost all of the up and down movements in road fatalities seem to have been associated with economic and social events which took place. In addition, the introduction of road safety policies also had significant effects on the road toll in all countries. A comparative statistical analysis using econometric techniques would yield a much better understanding of the forces which determine road accident levels in various countries, and would give a valuable clue as to future trends. Such an analysis could also be of great use to developing countries in understanding and controlling the social and economic costs of their road systems.

COMMON FACTORS IN ROAD ACCIDENT EXPERIENCE

In this section is a very brief review of road safety factors which, while important to road safety in most countries, do not appear to explain the differences between Australia and Scandinavia in road crash experience.

The overall impression the author received while visiting the Scandinavian authorities in mid-1983 was that there are few significant differences between the Scandinavian countries and the Australian States in most of the factors shown on Chart 1. Vehicle safety design standards, traffic engineering standards, quality of after-accident medical care, have all progressed at a similar rate there as here.

Further, changes in road congestion (as measured by registered vehicles per kilometre of roadway) and travel demand (as measured by kilometres of travel per licensed driver) are unlikely to have had a significant contribution to the relative performance in road accident reduction between Scandinavia and Australia over the past ten years. While road congestion and individual travel demand are currently somewhat lower in Scandinavia than in Australia, these factors were also lower in the early 1970's. In other words, the relativities have not changed between Scandinavia and Australia for these two variables over the past ten years.

Nor does it seem that police activity is higher. Such indicators as breath tests and court convictions per licensed driver are about the same or a little higher in Australia than Scandinavia. Seat belt wearing rates and motor cycle crash helmet wearing rates are also, if anything, higher in Australia than in Scandinavia.

Many writers on road safety have seized upon the fact that the Scandinavian countries have much stiffer penalties prescribed under the law for drink-drive offences - penalties such as automatic gaol sentences for offenders caught over the 0.05 maximum P.C.A. limit. However, these laws were probably more vigorously applied in the 1950's and 1960's, with the 1970's seeing a much more selective application of these laws. In Norway, for example, which has had the harshest laws, about 88% of gaoled drink drivers convicted in 1982 were above the high level of 0.12 B.A.C. Most of the rest were between 0.08 and 0.12.

Ross (1982), in a study of drink-drive laws in many countries, concluded (p60) "....the 1936 law in Norway and the 1941 law in Sweden achieved little marginal deterrence". However, he points out that a "scientifically convincing demonstration .... is extremely difficult because of many plausible rival explanations". Such a demonstration, statistically testing the rival explanations, can only be done using econometric techniques as described in the first section. But prima facie it would appear that this would lead to no more positive results than the partial analysis done by Ross.

THE EFFECT OF ECONOMIC ACTIVITY

Economic Growth And Road Fatalities

The history of most developed societies from the end of World War II to about 1970 was characterised by strong economic growth with low unemployment, rapidly rising per capita incomes, a consumer durables boom, etc. In particular, rapidly rising incomes led to what appeared to be an almost insatiable demand for mobility and travel, especially using the automobile. Haight[1] has argued that this process inevitably led to rapidly rising road fatalities in the period to about 1970.

During the late 1960's however, rising inflation started to emerge as a major problem, and as various countries turned to restrictive policies to contain this inflation, the post-war boom ran out of steam in the 1968 to 1973 period. It also happens that during this period the growth of road fatalities also slowed down as described in the second section. Again, it is reasonable to assume that the slowdown in the world economy had indirectly much to do with the levelling out of the number of fatalities in most countries in this period.

This slowdown was greatly accentuated in late 1973 when the "oil-crisis" hit. A severe recession ensued in the period 1974 to 1976 and it was also in this period that road fatalities in most countries, especially the Scandinavian countries, fell dramatically. From 1976 a weak recovery took place in most countries based on a recovery in the United States economy. In most countries however, this gave only a short respite until the world sank into another severe recession in the 1981-83 period.

Thus, changing fortunes of the world economy over the post-war period has an uncanny similarity to the fatality patterns mentioned in the second section. Evidently the fact that the patterns of the fatality history since World War II are similar in all four Scandinavian countries and that these patterns are similar to most other countries in the same period is no coincidence. The common pattern was shaped by the path the world economy has followed since World War II.

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1 Haight (1983) p.2

Economic Cycles and Road Fatalities

The assertion that the pattern of economic growth in a country is related to the pattern of its road fatalities can be subjected to statistical tests. If the assertion is correct, then we would expect a significant correlation between the annual rate of change in real gross domestic product (R.G.D.P.) of a country and its annual rate of change of road fatalities.

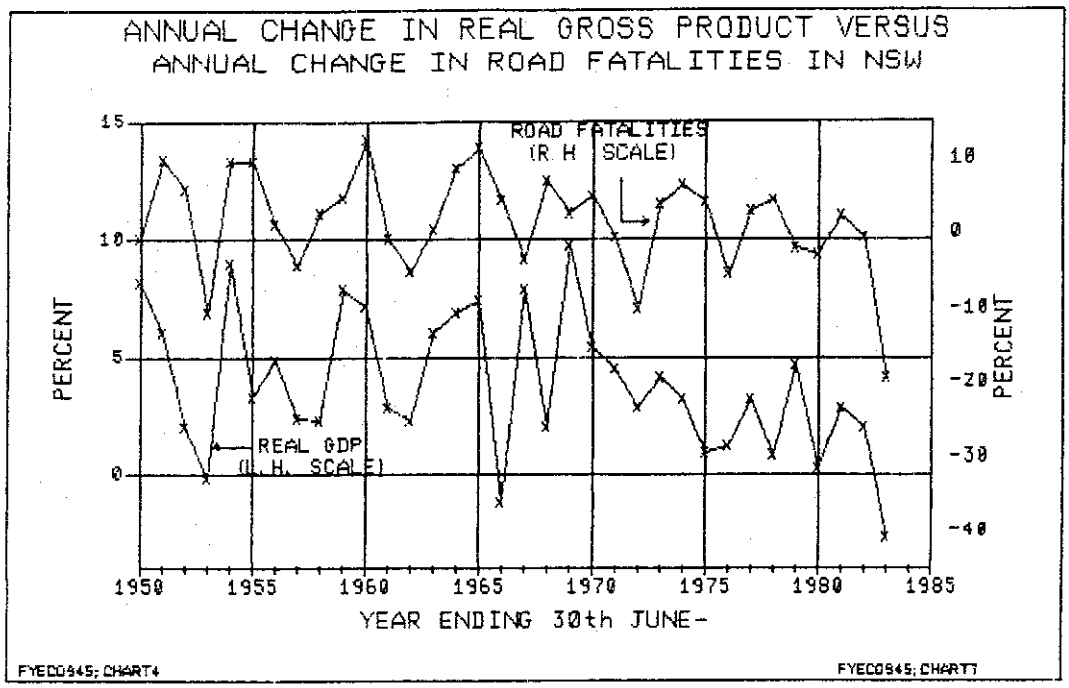
Chart 6 shows these two variables plotted for both New South Wales and Denmark as illustrations. The correlation is fairly evident. However, we can formalise this for the above two countries and several others. The correlation coefficients for these two variables for several countries and six Australian States are presented in Table 2 together with the results of the so-called "T-test" of the significance of each coefficient (see Johnson, 1972, p36). Note that these coefficients must be between 0 and 1 - a coefficient of 0 indicates no correlation, while a coefficient of 1 indicates a perfect correlation. While a coefficient can fall between 0 and -1 this would be logically unacceptable and the assertion disproved; however, none were negative.

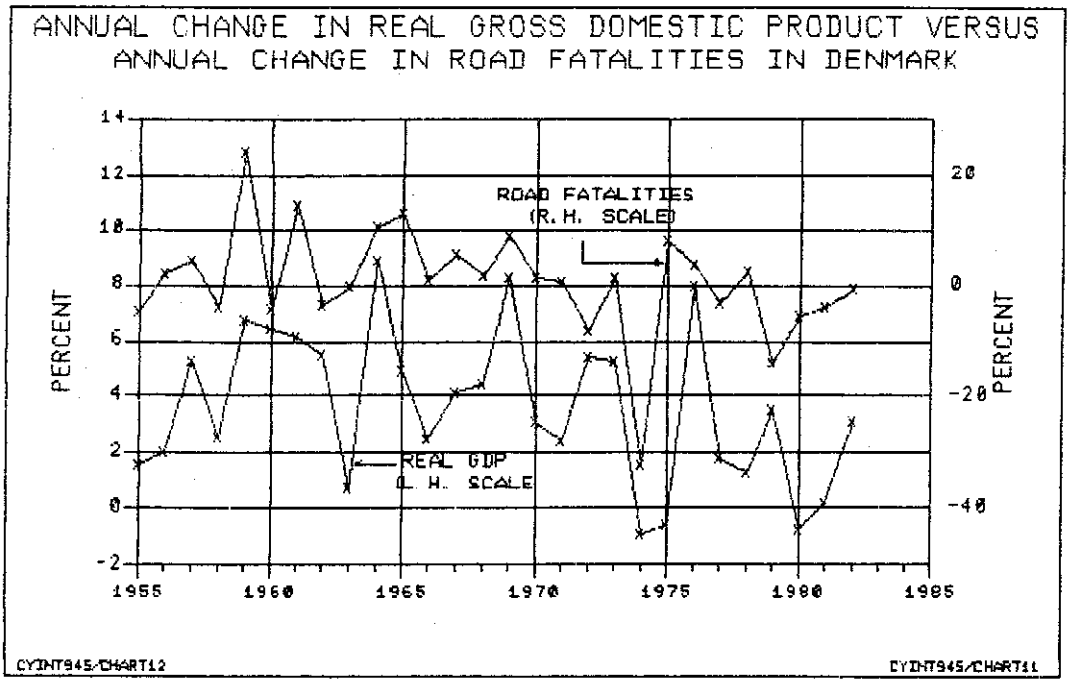
TABLE 2 - CORRELATION BETWEEN R.G.D.P. AND ROAD FATALITIES 1955-1981

Country	Correlation Coefficient	T Value		Significance Level
U.S.A.	0.77 (32)	6.61		99%
Canada	0.68 (27)	4.64		99%
Denmark	0.51 (27)	2.96		99%
Sweden	0.50 (27)	2.89		99%
Belgium	0.43 (27)	2.38		95%
Australia	0.40 (32)	2.39		95%
U.K.	0.33 (31)	1.88		95%
Finland	0.30 (32)	1.72		95%
Switzerland	0.34 (27)	1.58		90%
Norway	0.04 (27)	0.20	under	90%
N.S.W.	0.37 (32)	2.18		95%
South Australia	0.31 (32)	1.79		90%
Victoria	0.28 (32)	1.60		90%
Tasmania	0.18 (32)	1.00		90%
Western Australia	0.15 (32)	0.83		90%
Queensland	0.13 (32)	0.72	under	90%

Sources of data: Overseas G.D.P: United Nations. Australian National Accounts with a State breakup consistent with estimates supplied by W. D. Scott Co. Road Fatalities: I.R.F. World Road Statistics and Australian Commonwealth Yearbooks.

Chart 6 - Relationship Between Economic Growth and Road Fatalities in New South Wales and Denmark





It should be mentioned at this point that the above test is fairly severe. The test can confirm the assertion but not reject it. this is because the effect of other variables can confound the relationship between fatalities and economic growth. The assertion can only be positively rejected in a full modelling context, in which the effect of all other relevant variables has been included.

As can be seen, the correlation coefficients are remarkably high in most cases, despite the fact that many variables other than real G.D.P. influence road fatalities! For the Scandinavian countries, an important exception is Norway, where there appears to be little correlation. Norway, however is not a highly motorised nation as are the United States, New South Wales, Sweden and Denmark. Norway is essentially a seafaring nation, most of its commercial transport task being done by sea. For this reason yearly ups and downs in the economy appear not to have a dominant effect on the road toll. However the above statistical test is only for a year to year relationship, and it is still likely that longer term economic trends have affected the Norwegian road toll. To test this would require that a different type of statistical test be used (e.g., a full econometric modelling approach).

We can conclude that the above statistical test confirms that there is a significant influence of a country's economic activity on its road toll, the strength of the influence appearing to depend on the degree of motorisation of the country.

Economic Effect in Australia versus Scandinavia

Having suggested above that the longer term economic trends in developed countries seem to coincide with longer term trends in road fatalities, and then having shown that annual economic growth changes are associated with annual changes in road fatalities, it remains to be shown that Scandinavia was probably more affected by world economic events than Australia in the critical post-1973 period when road accidents and fatalities dropped sharply in Scandinavia.

It would involve a complex economic argument to present a comprehensively argued case. Space permits only what is perhaps the most significant economic influence to be discussed, i.e., the size and timing of petrol and diesel price rises in Australia versus Scandinavia in the wake of the first "oil-crises" of December 1973. In that month the price of O.P.E.C. oil quadrupled. Since the Scandinavian countries produced little oil of their own at the time (North Sea oil came on stream two years later), the price of oil products in Scandinavia was immediately permitted to rise in line with O.P.E.C. oil prices. Australia, being about 70% self sufficient in oil at the time and about 90% self sufficient in oil for transport fuels, was not much affected. Only in late-1978 did Australia opt for full import parity pricing of oil products. Thus the high rise in petrol and diesel fuel prices which took place in Scandinavia in early 1974, took place in Australia only in early 1979.

SCANDINAVIAN ROAD SAFETY

The reaction of the road transport sector and private motorists to such large fuel price rises ranged from great concern in Sweden and Norway to a sense of crisis in oil-dependent Denmark and Finland which were especially hard-hit. Immediately a series of measures were enacted in these two countries to conserve fuel and find alternative energy forms. One of these measures was to lower speed limits on all major roads to 80 km/h in early 1974. This was accompanied by an extensive media campaign to encourage motorists to conserve fuel and avoid unnecessary trips by car. It was also accompanied by intensive police surveillance of the lower speed limits. Because of both this surveillance plus a sense of national crisis, compliance by motorists in 1974 and 1975 with the lower speed limits was very good.

Besides altering their driving habits to conserve fuel, another reaction by motorists was to switch to alternative forms of transport for many types of trips. In Denmark there was a strong move back to the bicycle - a traditional form of transport in a country well suited to bike riding. There was also a big switch to public transport.

The end result was an immediate large drop in road accidents and fatalities in 1974 in Denmark (fatalities dropped 32%) and Finland (fatalities dropped 20%). It can be argued that the imposition of speed limits, increased police surveillance, and the media campaign contributed to the drop in road fatalities. But the underlying force which motivated the application of these policies was the effect of apparently dire economic circumstances.

In Sweden and Norway, with adequate supplies of hydro power to supply total energy needs, there was a lesser sense of emergency. Much higher fuel prices and reduced economic circumstances as a result of the 1973 - 1975 world recession, took longer to act. But in the years after 1973 it is reasonable to believe that this factor had a depressing effect on the road toll.

In Australia, with adequate supplies of oil, and abundant supplies of most other energy forms to supply total energy needs there was much less concern until 1979 when world parity pricing of oil was imposed and road fuel prices increased dramatically.

The point of this section has been to suggest that the great improvement in the road toll that took place in Scandinavia vis-a-vis Australia was partly due to the more severe impact of economic circumstances there. It was suggested that one way in which this happened was through the differing impact of fuel prices on the road transport sector and private motoring. Of course, this accounts for only a part of the different road accident experience between Scandinavia and Australia. But it seems likely that these economic effects were quite significant.

ROAD SAFETY EDUCATION

It would be very difficult indeed to statistically verify that road safety publicity and public education activity affects the road toll. However, it seems to be a reasonable argument that such is the case, since in all four Scandinavian countries, active organisations have existed for the purpose of shaping public attitudes to road safety since the late 1960's (late 1950's for Norway). These organisations became increasingly active in the 1970's in encouraging more careful, responsible public attitudes to road safety. This was done by regular mass media campaigns on television, radio and newspapers, and by active involvement in promoting road safety in schools, community groups, etc. This process could have been partially responsible for the declining road fatalities pattern in the 1970's.

In Australia, such organisations have either never existed in a particular State or have been short-lived or ineffective. Thus it could be said that the road toll in the Australian States has been influenced much less than in Scandinavia by mass media publicity to improve public attitudes to road safety.

Little or no data, in the form of periodic public attitude surveys, exist to test this proposition. However, it could be tested in an econometric modelling context by including in the modelling process a variable such as real (i.e., inflation adjusted) spending by public authorities on road safety education. In this paper it can only be pointed out that the proposition that large scale public road safety media coverage over a long period of time can have a significant impact on the road toll (a belief strongly held by all Scandinavian governments), seems to have some validity.

QUALITY OF ROADS

Another reason why road crashes and fatalities have dropped in Scandinavia during the 1970's more than in Australia may be that high quality roads systems have developed there faster than here. This does not mean that road engineering and design standards are higher there, but rather, that the Scandinavian countries appear to have devoted more resources to building high quality road systems than has Australia.

By high quality roads is meant roadway with such features as divided carriageways (with a wide median strip or a concrete barrier separating opposing flows of traffic), vehicle over-passes (where cross-flows of traffic are separated), pedestrian over-passes or under-passes (where pedestrians can cross a busy road in complete safety), etc. The only type of roads that have all these features are classified as "motorways" in Scandinavia or "freeways" in Australia, although many other roads have some of these features.

Because motorways are designed to minimise potential conflict situations, they have a proven road accident reduction record as the following table of data from Britain shows.

TABLE 3 - CRASH RATES BY ROAD CLASS

Injury Crashes per Billion Kilometres of Travel on Different Classes of Roadway Great Britain, 1978*

Roads in Non Built-up Areas	5.1
Roads in Built-up Areas	14.6
Motorways	1.6

Thus if over a period of time a country has a greater growth of its motorway network than another country, it can be expected that the decline in road accidents and fatalities will be greater in that country. In Table 4 the four Scandinavian countries are compared with the two largest States of Australia as well as other countries in respect of (i) the average annual change in the motorway network between an average of 1970 to 1972 and an average of 1980 to 1982; (ii) the same annual change for road fatalities.

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* Source of Data: Basic Road Statistics, British Road Federation

TABLE 4 - MOTORWAYS AND ROAD FATALITIES

Average annual change between 1970-72 average and 1980-82 average*

Country	Klms of Motorway	Road Fatalities
Sweden	48	-44
Denmark	30	-51
Finland	9	-56
Norway	3	-16
Victoria	24	-21
New South Wales	11	-2
France	377	-342
West Germany	307	-68
Japan	172	-747
Great Britain	129	-176
Netherlands	104	-137
Belgium	53	-82
Switzerland	49	-50
Austria	41	-78
New Zealand	2	-4

There appears to be a relationship in the above table between growth of the motorway network in a country and negative growth in road fatalities. This relationship was tested statistically by calculating a correlation coefficient for the two variables; this was -0.77. A T-test for the significance of the coefficient indicates that we can be 99% certain that the growth of motorways through the 1970's has favourably affected road fatalities.

The relationship between additions to motorway networks and road fatality declines can be shown more clearly by charting the data in Table 4. Thus Chart 7 shows that there is a reasonably linear relationship betrween the variables for all countries except Japan and Germany. In Japan, fatalities have dropped far more than can be accounted for by consideration of motorways alone, in Germany, less.

The above statistical test is open to the criticism that the correlation between the two variables might be a chance one in that the effect of other factors is not allowed for. As mentioned previously, this can be tested only in a full multivariate modelling context, in which all major factors on fatalities are represented.

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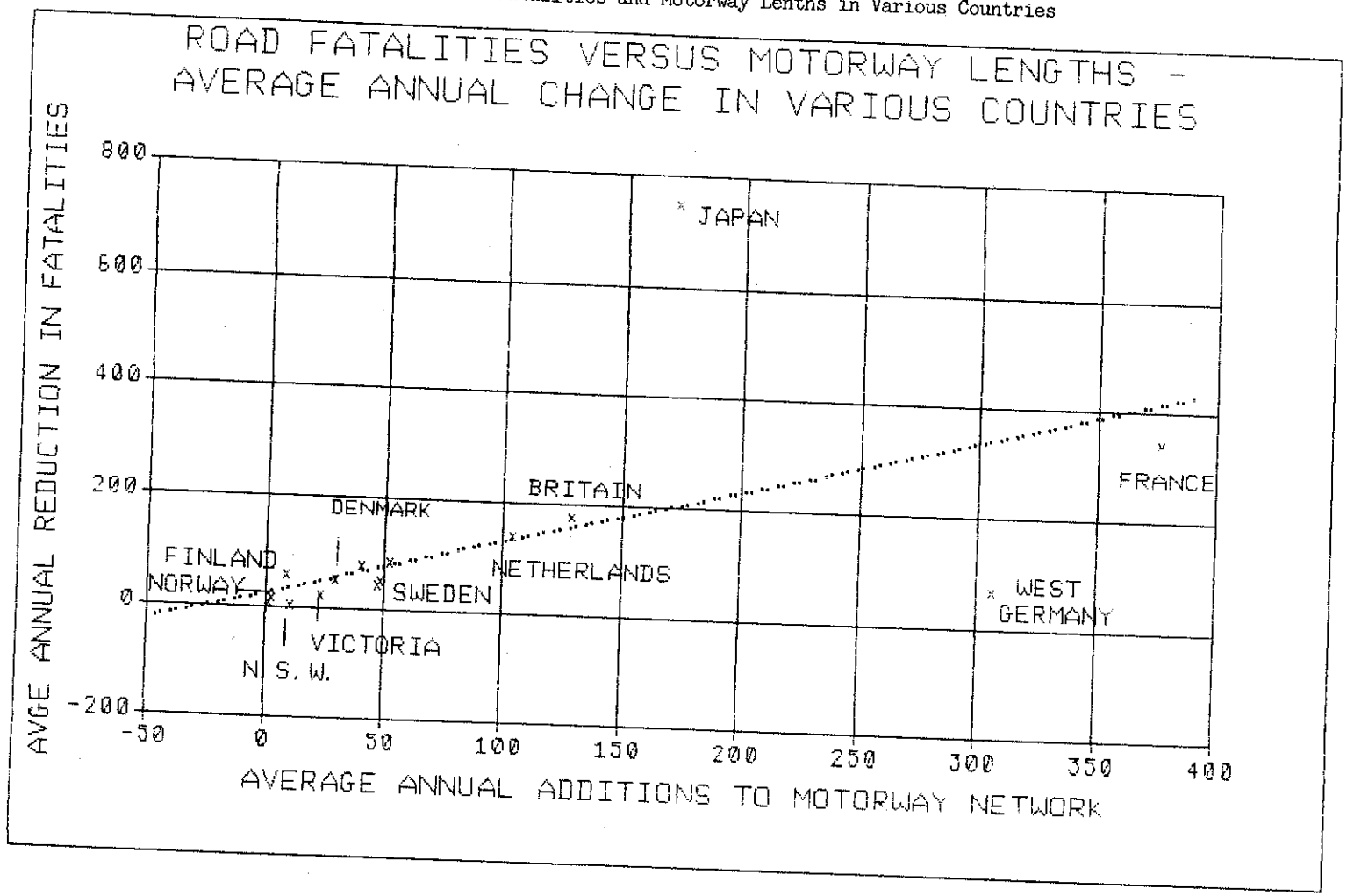
* Source of data: I.R.F. World Road Statistics, N.S.W. Traffic Authority, Australian Bureau of Statistics.

Chart 7 - Relationship Between Road Fatalities and Motorway Lenths in Various Countries



THE EFFECTS OF THE POPULATION AGE DISTRIBUTION

It is well known that younger drivers, especially males, in the 17 to 25 year old age group, tend to have a high traffic accident risk. This is shown in the following table for New South Wales.

TABLE 5 - FATAL ACCIDENT INVOLVEMENT OF DRIVERS
Fatal Accidents per 100 Million Klms Travelled
By Age Group and Sex of Drivers
New South Wales, 1979*

	17-19 Yrs	20-24 Yrs	25-29 Yrs	30-39 Yrs	40-49 Yrs	50-59 Yrs
Males	40	14	8	5	5	4
Females	14	6	3	2	2	2

Although the above data is not immediately available for the Scandinavian countries, it can be safely assumed that the picture is similar.

If a country has a higher concentration of young drivers in its driving population, it follows that its road accident rate will be higher than another country with a lower concentration. Such a difference in concentration existed in the 1970's between Australia, with a young population due to post-war immigration, and Scandinavia, with a degree of post-war emigration (many to Australia).

Unfortunately data do not exist, or are very difficult to compile, on the annual age and sex distribution of the driving force in each Scandinavian country or in Australian States until the mid-1970's. Thus we cannot trace, for the period from World War II to the mid-1970's, the changes in the age/sex distribution in order to correlate this with road fatalities. However, if we assume that the age distribution of the driving population is the same as that of general population of driving age, we can use the latter as a "proxy" variable.

Thus in Chart 8 is shown the annual percentage of the population in the 20 to 24 age group for both New South Wales and Denmark (the population of 18 and 19 year olds is not available back to 1950). It can be seen that the concentration of 20 to 24 year old males rose through the 1950's and early 1960's in the aftermath of the post-war "baby boom" which occurred in most developed countries. In the mid-1960's when these people started to reach driving age, the demand for driving licences increased quite rapidly. Further, a greater proportion of this population bracket were obtaining driving licences than ever before. This was both because these people were able to afford to buy a car since they were earning much higher incomes, and because a much higher social status was attached to owning and driving a car than ever before.

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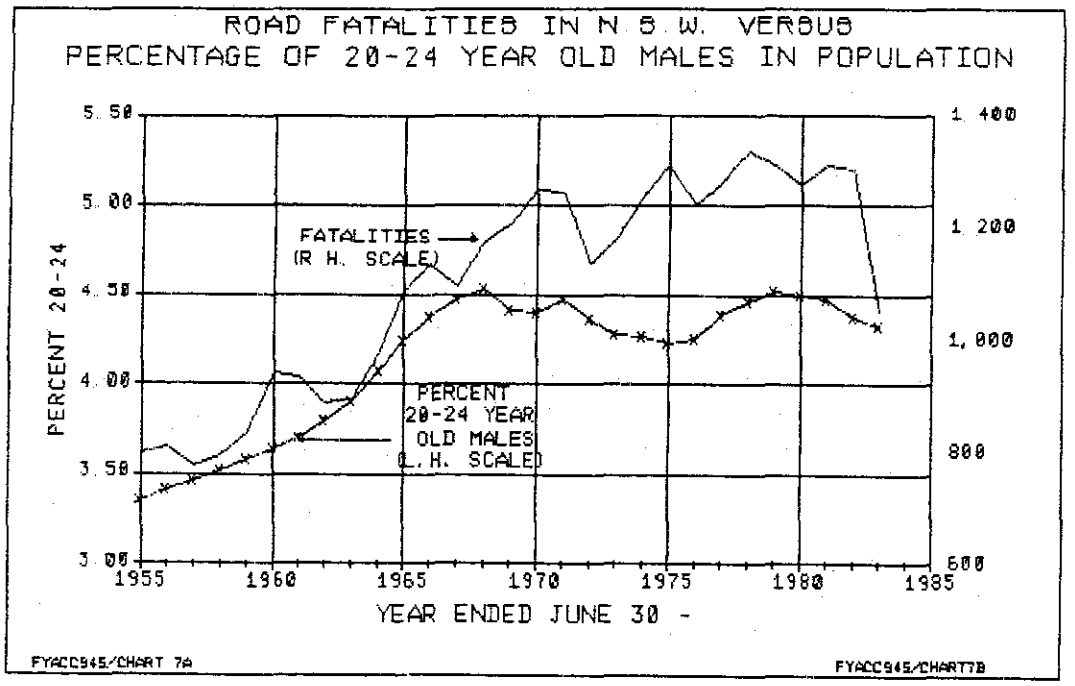
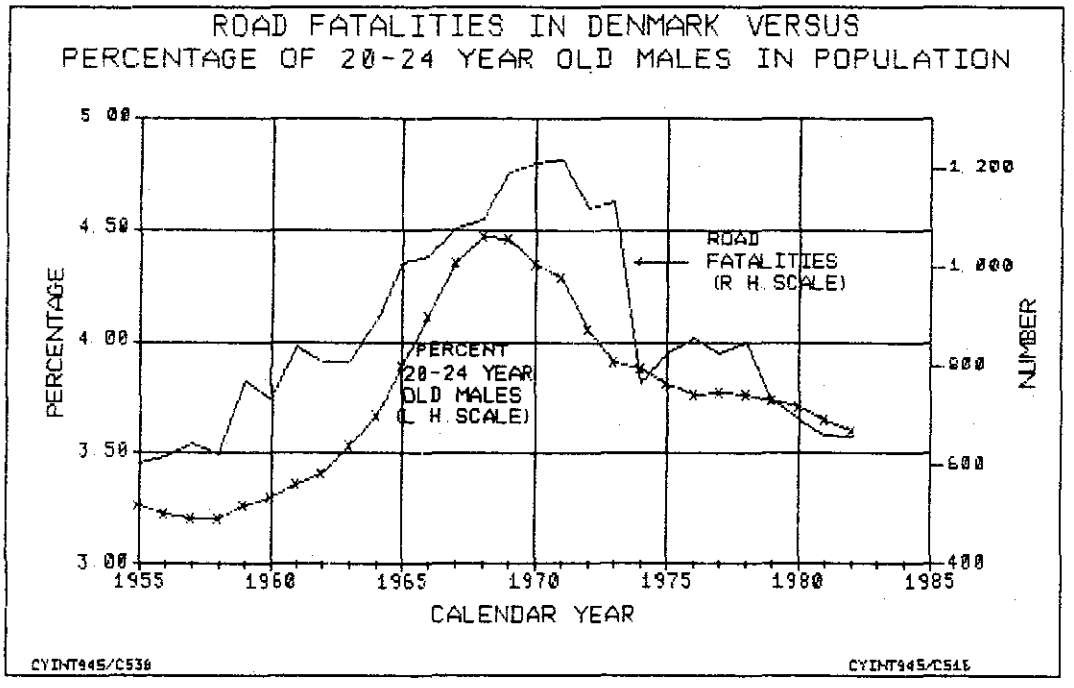
* Source: Traffic Authority of N.S.W. and A.B.S.

Chart 8 - Relationship Between Road Fatalities and Percentage of 20-24 year old males in New South Wales and Denmark





However, due to the different patterns of post-war immigration, Denmark saw a decline in the 1970's in this age group relative to New South Wales. There was a great population influx into Australia (particularly New South Wales) of young families, whereas in the Scandinavian countries there was little immigration. This probably had the effect of raising the average driver age in Scandinavia and lowering it in Australia. The net effect of this widening gap in average driver age meant a widening gap in road accidents given the implications of Table 5.

CONCLUSION

This paper has attempted to show that four factors were probably responsible for the large drop in road fatalities which occurred in all four Scandinavian countries in the 1970's. These were: Scandinavia has had a lower level of economic growth through the 1970's, especially after the 1973 "oil crisis"; Australia has a much younger driving population and so a higher percentage of "high risk" young drivers; road safety publicity and public education in Scandinavia has been better organised and intense since the 1960's; high quality road systems are relatively more widespread in Scandinavia. However, it has also been stressed that, to achieve reliable conclusions, each of these factors cannot be assessed in isolation from all the other factors which have a significant impact on the road toll. Such an assessment needs to be done with multivariate statistical techniques such as econometric methods. With respect to comparative international road accident analysis such assessments have rarely if ever been done for various reasons. However such assessments could yield rich rewards in our attempts to better understand the factors affecting the road toll and thus our attempts to assess the effectiveness of road safety policies.

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