Long-distance trucking: why do truckies speed?

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Abstract:

There is growing community concern that trucks on long distance hauls are increasingly exceeding the speed limits and exposing all road users to high levels of risk. This paper reports the preliminary results of an in depth survey with a pilot sample of long distance truck drivers designed to investigate the underlying factors precipitating the current circumstances on the road. The study suggests that the economic reward conditions of the industry play an important role in explaining the causes of on-road behaviour.

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Introduction

In recent years the incidence of fatal crashes on the national highways involving semi-trailers has increased markedly (see Table 1). The crash in northern NSW in late 1989 between a semi-trailer and an interstate scheduled coach which claimed the lives of 20 people and injured 18 passengers, has highlighted the concern expressed about safety on the roads.

Table 1. N.S.W. Crash Statistics - 1986, 1987, 1988

	1986	1987	1988
Total number of people killed	1029	959	1037
No. killed in crashes involving articulated vehicles	96	75	151
No. of articulated vehicle occupants killed	31	19	30
Total fatal crashes	908	858	912
Fatal crashes involving articulated vehicles	77	67	128
Total single vehicle fatal crashes	315	318	292
Total single articulated vehicle crashes	18	9	20
Alcohol related fatal crashes	236	200	199
Fatal crashes in speed zone <60kph	461	426	475
Fatal crashes in speed zone 80 kph	85	74	78
Fatal crashes in speed zone100 kph	329	327	337
Fatal crashes in unknown speed zone	25	15	11
Total vehicle registrations ('000,000)	3034.1	3041.8	3081.2
Total articulated vehicle registrations ('000)	17.4	16.6	16.1
Total annual vehicle kms ('000,000)	47526.4	47550.8	48194.1
Total annual articulated vehicle kms ('000,000)	1379.8	1380.5	1399.2

Source: NSW Traffic Authority Annual Statistics

Reports which highlight the increase in fatal crashes involving truck drivers during 1988 do not represent the full picture. While it is a fact that the number of crashes did increase in 1988 compared with 1987, and the human tragedy of even one fatal crash cannot be ignored, when looked at over the longer term (Table 2), the decline in the number of crashes in 1987 appears as an aberation from the trend. This problem also seems to be confined to NSW as data presented in Staysafe 15 (1989) indicates that crash levels in the other states have remained fairly steady over the past 10 years.

The high profile currently given to truck drivers and truck safety has spawned many explanations, often anecdotes, about the reasons for the highly publicised crashes. The "evidence" may be suitable in illustrating case-specific behaviour, but is potentially dangerous in its representation of the behaviour patterns within the industry as a whole. Arguments used to "explain" a particular scenario of dangerous driving include fatigue, the competitive pressures to secure loads which result in depressed rates and fees, the tightness of freight forwarder imposed schedules (resulting from the requirements of the cargo owners), the "cowboy" mentality of drivers who see no risks in dangerous driving, the high levels of concentration required to handle large trucks over long distances, the state of the roads, and the poor physical and mechanical state of some trucks just prior to inspection. The May inquiry (May et al. 1984) highlighted many of the issues yet little appears to have happened in the industry to improve its reputation.

Table 2 Fatality Trends, Articulated Trucks - NSW

Year	Total road fatalities	Articulated trucks involved in fatal crashes
1980	1,303	135
1981	1,291	121
1982	1,253	119
1983	966	111
1984	1,037	124
1985	1,067	103
1986	1,029	77
1987	959	67
1988	1,037	128

Source: Staysafe 15, (1989)

This paper reports the results of an indepth pilot study of the relationship between the economic conditions faced by the long distance road haulage industry and the on-road behaviour of truck drivers, especially as it affects safety. A sample of truck drivers was interviewed in 1989 at a major loading/unloading truck stop in Sydney.

The paper is organised as follows. We begin with an outline of the study approach, followed by details of the survey method and basic descriptive statistics of the pilot sample. A number of hypotheses are investigated as a means of indentifying potentially important influences on the propensity to speed. We then present some preliminary results of an econometric analysis of the factors influencing the average speed of long distance truck drivers, followed by a conclusion which sets the scene for more detailed study.

The Study Approach

Objectives

The objective of this pilot study was to investigate the role of a number of facets of the industry which may bear on the on-road performance of truck drivers, operating as either owner drivers or employee drivers. The study concentrated on the collection of evidence on the economic pressures that exist in the trucking industry, the pressures which are placed on owner drivers and on employee drivers by freight forwarders and companies to maintain their livelihood. This information we hope will allow us to establish if there is any link between particular conditions within the industry and the driver's behaviour on the road which may result in lower than acceptable safety conditions in the road environment. We believe that speed, fatigue and non-adherence to service hours are strongly linked to the underlying economic conditions offered to drivers. Very little scientific inquiry (none in Australia to our knowledge) has investigated the behavioural links between on-road performance and economic reward. The dimensions of particular interest include:

1. The economic environment available to truck drivers (rates, fees, market competitiveness, access to contracts/once-off loads etc.) The distinction between owner-drivers and employee drivers is important.

2. The constraints imposed by the freight fowarders/cargo owners and the self-imposed schedules of drivers, especially owner drivers. These constraints include delays at loading/unloading terminals due to opening hours, service support etc.
3. The history of experience in the industry of drivers.
4. The profile of particular trips (origin-destination, road environment, distances and travel times between stops, activities at stops, number of stops etc.) and its relationship to items 1 to 3 above in order to identify any statistically significant associations between dimensions of speed (average for trip, maximum between stops, average excess over the speed limit etc.), economic conditions, constraints, experience, and the road environment.

Data collection approach

The survey design and data collection strategy were developed jointly by the Transport Research Centre, Macquarie University (TRC) and National Survey Research Pty Ltd (NSR). The primary source of data was from in-depth interactive face to face interviews with owner drivers and employee drivers. The data collection strategy involved three stages. A pre-pilot skirmish was conducted by the authors to check the selection of survey sites for the pilot and the content of the questionnaire. A pilot survey was carried out, with the main survey to be completed in 1991. The first two stages are vital for the development of the survey method and survey instrument to be used in the final survey. The current paper concentrates on the pilot survey.

Selection of the pilot survey site

Over a period of two days in September 1989, interviews were conducted with drivers at the Southern Cross Truck Terminal at Chipping Norton near Liverpool on the southern outskirts of Sydney. This truck stop is a depot for freight forwarders, where cargo is loaded or unloaded for long-distance trips throughout Australia. It provided an excellent site for interviewing as drivers spend long periods of time there waiting for their next load, giving plenty of time to conduct a 20 minute face to face interview.

Profile of the pilot survey sample

The pilot sample population included 46 drivers (41 face to face interviews and 5 mail back responses). Of this population 31 were employee drivers and 15 were owner drivers. Some summary statistics from the pilot survey are presented in this paper. Although care should be taken when drawing final conclusions from these statistics given the limited size of the sample, they give a reasonable indication of some of the trends in the data which will either be confirmed or refuted in the main study.

Our sample confirmed the high number of kilometres travelled by truck drivers every year. Nearly all drivers reported travelling annual distances in excess of 100,000 kms, with 65% of drivers travelling between 200,000 and 300,000 kms per year. These statistics were approximately the same for both employee and owner drivers.

The age distribution of drivers is shown in Figure 1. As could be expected, there are more employee drivers concentrated in the lowest age range; at this age it is unlikely that many drivers would have the access to the capital necessary to finance the purchase of their own truck. We encountered very few drivers in the older age brackets, but those

that were interviewed in these groups were predominantly owner drivers for whom driving was such a way of life that retirement seemed unthinkable.

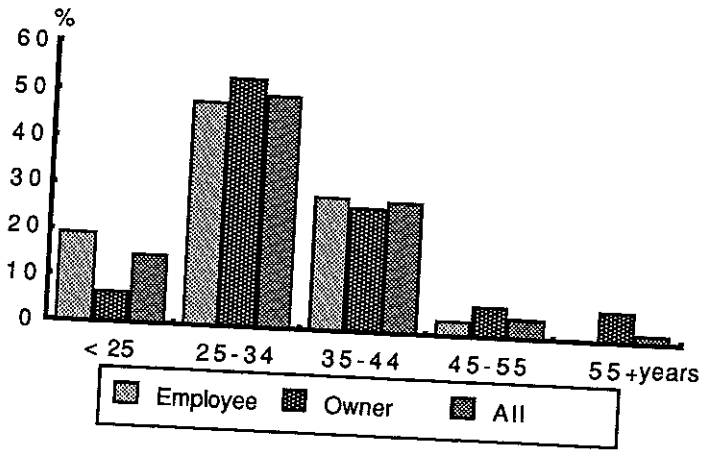

Figure 1. Age of drivers

The profile of years of driving experience for the pilot sample is shown in Figure 2. About one-third of drivers interviewed had over 15 years experience driving large freight trucks and over half the drivers interviewed had been driving large trucks for more than 10 years. These statistics indicate that there is a sizable stable long term population of drivers in the industry. It is often maintained by the media that truck drivers are only in the industry for quick rewards, often at the expense of road safety. While there is certain to be a shifting population element in the industry the predominance of this long term stable population should be emphasised.

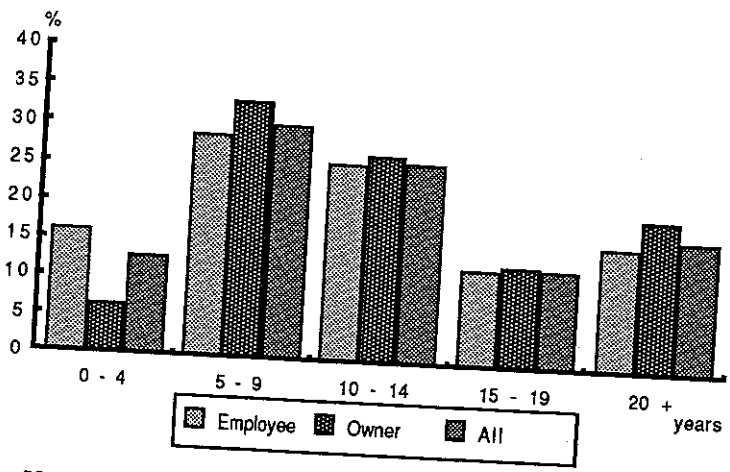

Figure 2. Years of driving experience

Information collected on specific trip profiles

The central feature of the survey instrument was the collection from each driver of the details of a specific trip which had been completed within the last one or two weeks. We used this approach to obtain the information necessary to assess the actual conditions faced by drivers on the road. For the selected trip the details collected included the exact origin and destination of the trip, the trip starting time and arrival at the destination, the driver's activities in the 8 hours before departure, how the truck was loaded, the cargo weight, type and value, and details of the stops on the trip (place of stop, distance travelled between stops, time between stops, time at the stop and the reason for the stop).

The information collected for each trip provided important data on speed which was used in the analysis of the pilot survey. Asking drivers to focus on a specific trip was also important in providing data which is specific to particular origin-destination pairs. This strategy provided valuable insights into the routine faced by the drivers in earning their living on the road and was vital in highlighting important issues and providing clarification of the hypotheses to be addressed in the main survey.

Findings from the pilot survey and the development of the hypotheses to be tested

A number of hypotheses for empirical investigation were established. These included:

1. The tightness of schedules forces many drivers to exceed the legal speed limit;
2. Carrier type or ownership of the freight has an influence on the propensity to speed;
3. Contexts of greater competition are associated with higher speeds;
4. Less experienced drivers are more likely to have tighter timetables;
5. Schedule tightness is strongly related to distance travelled and particular trip origin and destinations;
6. Schedule tightness is linked to the consignment type;
7. The road environment is the major factor influencing speed.

The information collected in the pilot survey confirms that our basic hypotheses appear to be worth investigating further, however, it is becoming evident that the factors underlying these hypotheses are perhaps not what were originally postulated.

The following conclusions are drawn from the data collected from drivers, especially that given in response to the questions relating to the specific trip for each driver, but also from the general comments and opinions expressed by the drivers.

Schedules and loading delays

Our original hypothesis was that there are economic pressures within the industry which cause truck drivers to have to meet tight schedules in order to maintain economic viablity either for themselves, if they are owner drivers, or for their company if they are employee drivers It was originally thought that companies and freight forwarders were solely responsible for setting tight schedules for their drivers and that these schedules were enforced by the use of financial or other penalties and incentives for drivers.

We have found little evidence to date of drivers being forced to meet unreasonably

tight schedules and being financially penalised if they do not meet them. Indications are emerging that schedules set on the long distance routes e.g. Perth to Melbourne/Sydney or Adelaide to Melbourne/Sydney appear to give the driver ample time to arrive within the driving hours regulations. However there is constant reference to the requirement that deliveries between Sydney/ Melbourne and Sydney /Brisbane have to be overnight. The reasonableness of the schedule for the driver on these trips depends to a large extent on the time by which they can get loaded and are able to leave on the trip.

The preliminary investigations suggest that the routine for these "shorter haul" trips is to get into the unloading depot as early as possible so as to reduce delays at the unloading site. This gives the driver more time to secure another load, load up and be back on the road so that the load can be in the other state next morning and the routine repeated. Even if the driver is an employee driver the company does not always have loads ready for the return trip.

Nearly all drivers have emphasised the need to get to the unloading site as early in the day as possible. As a result we questioned them further about the possible sources of delay at unloading depots and these include:

1. The site is not open when I arrive. Most unloading depots, particularly factory sites, do not open until 7 a.m. Consequently trucks arriving at 5 a.m. have to wait around for a couple of hours before they can unload. The major bottleneck appears to be factory hours for pick up/unloading, rather than freight forwarder hours. In some instances factories are only open to receive loads for a limited period, with drivers sometimes allocated to particular unloading times. If the driver misses the appointed unloading time he runs the risk of having to wait 24 hours before he can unload. This represents a significant loss of productive time.

2. Drivers stress the need to arrive early so as to be at the head of the queue, to get unloaded and then to secure a favourable position in the queue with a freight forwarder for the next load. Loads are generally allocated to drivers on a first come first served basis, not on the basis of price competition between drivers. Price competition is a more macro phenomenon, imposed on the (owner) drivers by the freight forwarders and indirectly by the shippers as a consequence of an oversupply of trucks and competition from other modes such as the railways. Loads are available at set rates and are offered to drivers who have registered on the list with the freight forwarder. Owner drivers have the option of not accepting loads and the load is then offered to the next driver on the list. The rate is not negotiable as it always seems that there is someone who will eventually take the load at the set rate. Common reasons for refusing to accept loads are that the rate is too low or that it will take a driver to a destination e.g. Perth or Brisbane, from which it is hard to get a back load, either at all, or at a reasonable rate.

3. Other delays or hassles for drivers when they have reached their destination city are caused by the need to either make multiple drop offs of cargo and hence are subjected to compounding delays at each unloading site, or to have to deliver their cargo to a site which requires them to travel to the other side of the city through the city traffic, for example to make a delivery to North Sydney from Melbourne. In this case there is the added incentive to at least arrive very early at the outskirts of the city which allows them to drive across the city before the morning peak traffic. The concept of a super peripheral terminal has been suggested, located on the southern and northern outskirts of the major cities. The large long distance trucks would service these locations and smaller rigid vehicles being used for intra-urban distribution. This concept may not be greeted favourably by freight forwarders. Currently intra-urban drivers are paid on an hourly basis rather than a fee per

tonne, hence a greater role for intra-state drivers in the delivery process could be financially unattractive to the freight forwarder and the shippers of goods. However this cost has to be weighed against the benefits to society of improved safety on the road.

4. Other delays at the unloading site are caused by competition for unloading time from local (intra-urban) trucks. Since local truck drivers are paid on an hourly rate, they either have set times for loading and unloading, or are given preference for unloading/loading by the freight forwarders as the driver's waiting around time is expensive. By contrast long distance drivers, who are paid a rate per tonne or per trip, are made to wait around because their time, or the storage of the goods on their truck, is not an expense for the freight forwarder. It is however indirectly a cost which is eventually passed on as a social cost to the driving public. If by waiting around at the loading depot the long distance driver reduces the time in which he has to deliver the next load, particularly where there is pressure to make overnight runs on the eastern seabord routes, his need to speed becomes a social cost of decreased safety on the road.

This information suggests the need to look more closely in the main survey at:

1. the opening hours of freight forwarding depots and major factories;
2. the location of loading/unloading depots in the urban areas,
3. the incidence of multi drop off requirements, and
4. the alternative payment structures (fixed fee, percent of truck earnings, fixed salary).

The level of competition

We began the study with the hypothesis that competition between drivers for loads was forcing rates down. Although this hypothesis has been to date supported by our investigations, the mechanism of competition in the market works somewhat differently than the way we had expected. The starting premiss was that drivers/companies bid for loads with the load being given to the lowest price bidder. But it seems that the load rates are already set by the freight forwarders and loads are allocated to the first available driver who is willing to take the load. Drivers do not engage in open price competition by bidding against each other for loads. However, by following the ostensibly fair practice of "first in first served" they are competing against each other in terms of time on the road.

This, surprisingly, drivers do not see as competition for loads. When asked if there were too many drivers in the business, with the assumption that this oversupply is pushing down rates, they did not think that this was the case. They believe that it is the companies who are forcing the rates down, especially the larger companies who are willing to take loads at low rates, and sustain losses in the short term to try and force out the individual owner drivers who are not able to do this.

Many owners of small trucking companies feel under pressure from the large companies who are able to undercut their rates. It may be that in order to sustain these low rates the larger companies may set tighter schedules for their drivers backed up with financial penalties for non-compliance. We heard evidence that employee drivers receive greater effective (i.e. actually enforced) penalties for failing to meet schedules. Although owner drivers are subject to penalties for schedule non-adherence, they often do not pay the fines, and rarely receive a disadvantage as a consequence.

The main survey will explore the hypothesis that the level of competition in the industry and scheduling constraints have an influence on the speed at which the driver

travels on the road. Given the limited size of the pilot survey, it is not possible to draw conclusive evidence from that data to support or refute this hypothesis. However, in the course of our interviews we found that owner drivers generally argued that employee drivers, particularly of the large companies, have a tendency to drive more dangerously and exceed the speed limit more than owner drivers. This may reflect the tighter schedules under which they have to operate. From the specific trip data collected from drivers we calculated an average speed for that trip. The mean of these average speeds was found to be 83 kph for owner drivers and 85 kph for employee drivers. The proportion of drivers exceeding the speed limit of 100 kph was found to be 7.7% (1 driver) for owner drivers and 20% (6 drivers) for employee drivers. The distribution of average speeds over the specific trips sampled is given in Table 3. This evidence, although very preliminary, suggests a possible link between type of driver and speed on the road, which may be influenced by scheduling.

Table 3. Average speed over the specific trip

Speed kph	Employee Drivers No.	%	Owner Drivers No.	%	All Drivers No.	%
less than 80	11	(39.7)	6	(46.2)	17	(39.2)
80 - 89	7	(23.1)	3	(23.1)	10	(23.0)
90 - 99	6	(19.8)	3	(23.1)	9	(20.8)
100 - 109	4	(13.2)	1	(7.7)	5	(11.5)
over 110	2	(6.6)	0	-	2	(4.6)

The Bureau of Transport Economics (1979) in their study of the long distance road haulage industry, reports that the major problem in the industry is the financial plight of the owner driver which results partly from an oversupply of owner drivers. This however, they conclude is "essentially a short-term disequilibrium problem which should eventually correct itself". Our investigations in 1989 indicate firstly that there is possibly still an oversupply of drivers in the industry, suggesting that this is not a short-term disequilibrium problem, but a structural feature of the industry, and secondly that it is not necessarily only the owner driver segment of the industry which is responsible for this oversupply situation.

Loading rates

One of the starting hypotheses for this study was that the economic pressure in the industry, evidenced by declining real freight rates, was influencing the on-road behaviour of some drivers to the detriment of the safety of the road environment. Statistics from the Bureau of Transport and Communications Economics (1988) indicate that there has been a 33% decline in real freight rates between Sydney and Melbourne in the period 1978 to 1988. This reflects the increased capacity on this route in terms of increased truck capacity and also shorter travelling time.

Despite the decline in rates, the evidence from the pilot survey suggests that there is greater competition for the Melbourne - Sydney route, as the overnight rates on these high volume routes are higher relative to other intercapital routes. This may reflect the greater competition for this route, but may also be a result of the fact that it is now technologically possible to make the Sydney - Melbourne run in 10 to 12 hours, i.e.

overnight. Freight forwarders and cargo agents are thus demanding tighter schedules for deliveries between these capitals.

The imbalance between forward and backloading rates is an important issue. Backloading from centres such as Perth, Brisbane and Adelaide are reported by drivers to be very bad, with loads hard to obtain and the rates offered are very low, often not covering more than the truck expenses of the trip. The situation in Perth was quoted by one owner driver as being so bad that he preferred to travel unloaded from Perth to Adelaide, where he was able to pick up a load to Sydney, rather than take a load out of Perth at rates which would not cover the cost of his trip. Other drivers also supported this evidence claiming that in some cases if rates only cover the cost of the trip in terms of fuel and truck expenses, the driver is worse off by taking those loads because he also has to expend time and effort in loading and unloading for which there is no return.

These rate structures are related to the imbalance in the flows of freight in Australia as a result of the concentration of manufacturing and the flow of imports through the South Eastern Capitals. If the road freight industry is to operate efficiently, and safely, some consideration has to be given to allowances for the cost of the backload to the driver in the forward load rate structure. Many owner drivers work with deals which ensure that they are paid at the full or agreed reduced rate per tonne for the trip for a minimum of 22 tonnes, regardless of whether they have a load. But as the BTE (1979) points out the setting of minimum freight rates for owner drivers is fraught with difficulties, for if the legislated minimum rates did not reflect the freight imbalance between capital cities, the shippers of freight from the smaller capitals would be penalised. The main survey will collect more detailed data on the fee structure under which drivers operate so as to explore more fully the links between the economic pressures on the driver and their behaviour on the road.

Economic return to drivers

Linklater (1977, 1978) in her work on the attitudes and behaviour of truck drivers, states that although truck drivers were found to be generally of lower educational level than the general driving public, they reported higher income levels. It would not appear that this income differential has been sustained into the late 1980's. We have found little evidence to date that owner drivers receive more than an average wage. All report declining income levels and tightening financial conditions which have worked against drivers so that they have had to work longer hours to receive an ever eroding level of income. In our sample 60% of owner drivers had a gross income in 1988-89 of less than $26,000. When this is considered within the context of a working week of at least 100 to 120 hours, it represents a very low hourly rate.

Drivers were asked for their annual gross income received from their truck driving activity but **after** truck related expenses (Figure 3). Owner drivers were found to have much lower income levels than employee drivers. The median income for employee drivers falls within the range of $32,000 to $40,000, while that of owner drivers falls within the range of $22,000 to $26,000. Due to union awards, no employee driver earned less than $18,000, while 2 owner drivers claimed to have cleared less than $12,000 after their expenses, from their truck activity, and 2 others earned between $12,000 and $15,000.

Drivers were also asked about the income earned by other members of their household from activities other than truck driving. For most drivers, who had other members in their household, the income earned by the other members was less than $12,000. However a greater percentage of other members of owner driver households

were earning some income. Only 20% of other members of owner driver households were not earning any income compared with 45% for employee drivers. This reflects the need by other members of owner driver households to supplement the low, and often irregular, income of the owner driver. However for both categories of drivers income earned by other members of their household was quite low thus improving little the income status of the truck driver's household. These figures emphasise the financial pressures placed on drivers as the main income supporters of their households.

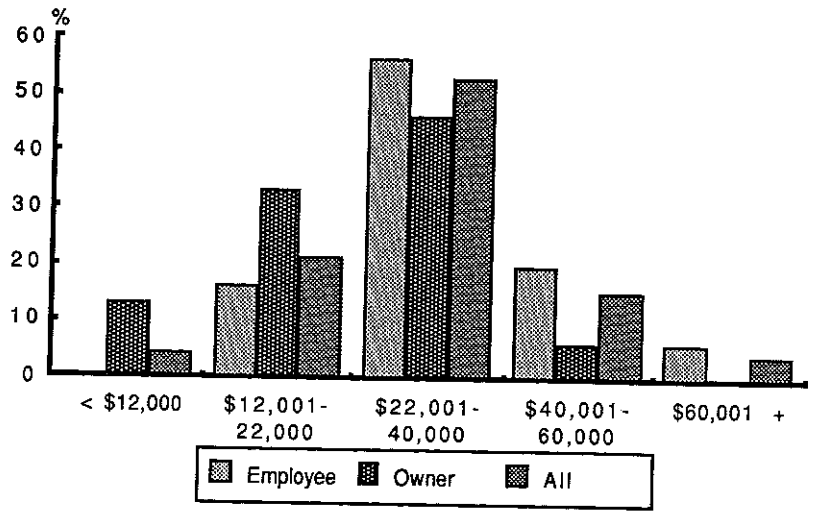

Figure 3. Gross income of drivers from truck driving after truck expenses 1988-89

As well as considering the income received by drivers in the context of a very long working week, it is also important, in the case of owner drivers, to look at their income in relation to the level of expenses and capital commitments required to maintain their business operations. The income obtained from owner drivers was net of truck related expenses.

They were asked separately for estimates of their financial expenses. Total costs for the majority of owner drivers (77%) were between $100,000 and $200,000 for the financial year 1988-89. Fuel, repayments on their vehicle, maintenance, and tyres were the major expenses. Repayments on the vehicle were revealed to be the second major expense item, after fuel, accounting for up to 43% of total costs for one driver, with a mean percentage for the sample of 27% of total costs. The distribution of costs for owner drivers, as shown in Figure 4, highlights the level of repayments as a percentage of the driver's total costs. Repayments on the vehicle represent a severe financial burden for the owner driver amounting to a mean, for our sample of 29% of earnings. It is a plausible hypothesis that the obligation to meet these repayment commitments influences the drivers behaviour on the road, and although there was some support for this in the pilot data, this relationship will be explored more fully in the main survey.

The pilot survey revealed that employee drivers are paid by a variety of arrangements. The most common methods of payment for employee drivers were by fixed salary (22.6%), as a percentage of earnings of the truck (19.4%) and a fixed payment for the trip (25.8%).

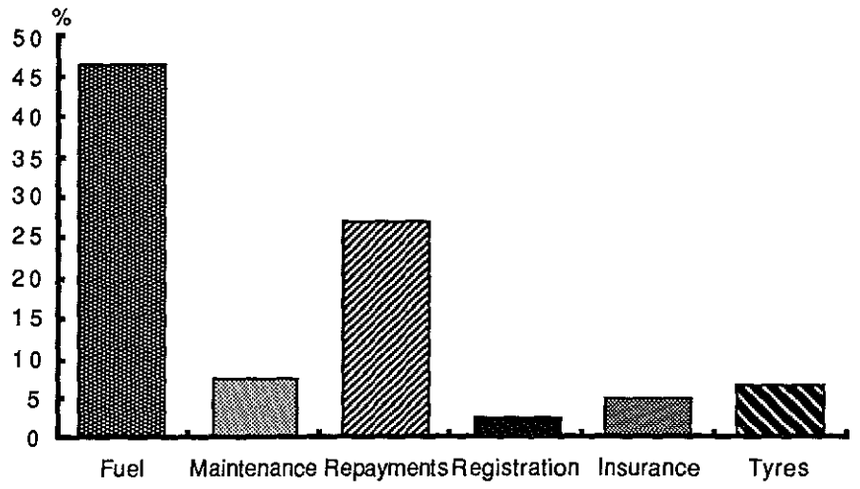

Figure 4 Percentage distribution of costs for owner drivers 1988-89

Driver fatigue

Driver fatigue is a commonly reported cause of crashes involving long distance trucks. Given the number of annual kilometres travelled by long distance truck drivers it is to be expected that drivers, at least at some times, experience fatigue on the road. We focus not just on the incidence of fatigue and the implications for road safety, but on the reasons for driver fatigue. We began this study with the hypothesis that the economic conditions in the industry forced drivers to spend long hours on the road. The pilot data supports this hypothesis but has also revealed other factors contributing to driver fatigue such as long hours waiting around to get a load, the physical demands of having to load and/or unload the truck and the lack of opportunity within the routine of securing loads and making deliveries, to obtain lengthy periods of sleep.

In relation to the specific trip selected by each driver, drivers were asked about their activities in the eight hours prior to departure on that trip. This information highlighted the extremely demanding and stressful workload of the driver even when off the road.

In our sample 57% of drivers had less than 1 hour of sleep in the eight hours before starting out on the trip and for owner drivers 80% had less than 2 hours sleep. Loading the truck was the main activity in which drivers were occupied in the eight hours prior to the trip. In our sample 63% of drivers spent more than 1 hour loading the truck with the median loading time being 2 to 3 hours for owner drivers compared with 1 to 2 hours for employee drivers. Other activites in which drivers were involved in the eight hours prior to departure include maintenance on the truck, entertainment, and just waiting around for a load. Other activites mentioned by drivers were personal business and in some cases being on the road delivering a previous load. The mean percentage distribution of the time spent in activities undertaken in the eight hours prior to leaving on the trip are shown in Figure 5. The graph highlights the more demanding routine of the owner driver who spent more hours loading and carrying out maintenance on the truck, and less hours sleeping than the employee driver in the 8 hours prior to departing on the trip.

Figure 5. Percentage distribution of the time spent in activities prior to departure

The physical involvement of the driver in the unloading and loading of the truck must also be stressed as a significant source of fatigue before setting out on the trip. In our sample 80% of owner drivers were actually involved in loading the truck either on their own, or helped by someone else. At the other end of the trip 60% of owner drivers were involved in unloading the truck. These figures were slightly lower for employee drivers but still 60% of employee drivers were involved in loading and unloading.

It is widely reported in the media, and also confirmed by research (Linklater 1977, Abkowitz et. al. (1989)) that long distance truck drivers take stimulants to overcome fatigue. By asking drivers how they maintained their concentration level while driving for long periods, and including in the options taking "stay awake" pills for some or all trips, we attempted to ascertain the incidence of the use of stimulants by drivers.

Drivers were not hesitant in admitting to the use of stimulant drugs. Of the drivers interviewed 22% took "stay awake" pills on every trip, this percentage being the same for both owner and employee drivers. Another 35% took pills on some trips, however there was a difference here between owner drivers and employee drivers with 47% of owner drivers taking pills on some trips compared with 29% of employee drivers. Thus in total a higher percentage of owner drivers (67%) said they took pills at least on some trips compared with employee drivers (52%). These figures are somewhat higher than those found by Linklater (1978) in a 1976 survey of truck drivers, which stated that 40% of drivers took stimulant drugs.

Analysis of the pilot data

The interactive indepth interviews have been essential to develop the survey instrument and to consolidate the set of hypotheses for investigation. Some of the ideas which have evolved out of this pilot inquiry will be more fully investigated in the main survey. Given the complex nature of the interrelationships between the propensity to speed, the

economic pressures in the industry, lifestyle attributes and backgrounds of truck drivers, a multivariate statistical analysis is required if we are to separate out the influences on on-road performance. Although we recognise that there are a number of important endogenous variables linked to on-road performance, especially availability of work, rates of pay, mean speed, and speed variance, a simple one-equation approach will be adopted in this pilot study because of the small sample size. The dependent variable for this single equation is the average trip speed.

Our particular interest is in any systematic relationship between a number of alternative specifications of speed and variables defining the economic conditions facing the driving sector of the long distance trucking industry. Since speed as an influence on exposure to risk on the road is a complex phenomenon, we begin by preparing a number of alternative definitions:

1. average speed for the entire trip,
2. average speed for each leg of a trip
3. the number of legs with an average speed in excess of a particular level. We will consider average thresholds of 80kph, 90kph and 100kph.
4. the differences between the time required to complete a trip if travelling at the speed limit all the time, and if travelling at the average achieved speed.

In the analysis of the pilot data we have restricted our investigation to the first definition. The first definition of speed is regressed against the following possible influences on speed differences for a typical trip:

1. employment status (owner driver, employee driver for small business, employee driver for large business),
2. driver experience (years driving large trucks),
3. socio-economic characteristics of the driver (age, income from truck activity, other household income, financial dependencies),
4. particular route (Sydney-Melbourne, Melbourne-Sydney, Brisbane-Sydney etc, experience on this route in last month),
5. stops enroute (number, activity, stop time as percentage of total time)
6. total annual kilometres all up
7. activities by duration in previous 8 hours
8. age of truck and trailer
9. alternative reward rules
10. time of day trip began
11. hours travelled in darkness
12. concentration aids
13. financial obligation on the truck

We were unable to satisfactorily investigate many of the dimensions because of the lack of variablity in the data, due primarily to the size of the sample. Despite the small sample of 43 long distance trips, the data per se is extremely accurate and can provide an illustration of the way in which an econometric model can assist in seeking out the sources of influence on the propensity to speed. The empirical findings are intuitively plausible and serve to highlight the types of influences on the average speed of long distance truck drivers. Separate analyses have been undertaken for each of the two main driver segments - employee drivers and owner drivers - as well as an analysis of the pooled data. The preliminary models are summarised in Table 4.

In our search for suitable preliminary models of average trip speed, we set up a number of hypotheses and undertook an exploratory data analysis using a partial correlation matrix. This highlighted which variables are likely to have an influence on average speed and which variables are correlated to such an extent that multicollinearity would distort the role of the variable (in the presence of the two highly correlated

variables) in its contribution to explaining the variation in average trip speed across the sample.

Five variables were found to have a statistically significant influence on the average trip speed for the total sample, explaining 50.2% of the variance in the mean trip speed. The most interesting influences are associated with "stay awake" pills and the conditions of pay. We have established that drivers who do not use any pills at all to stay awake (i.e. maintaining concentration is not a problem) travel at an average speed which is less than drivers who depend on such pills sometimes or always. All other things being equal, the mean speed is 20 kph lower for drug non-dependent drivers. This is a significant difference. Likewise, drivers paid on the basis of a percentage of trip earnings tend, on average, to travel at an average speed which is 15 kph above the average of drivers paid other ways, predominantly by a fixed fee.

Table 4. Preliminary Results of Factors Influencing the Average Speed of Long Distance Truck Drivers.

	Dependent variable = average trip speed (kph)		
	Total sample (43 obs.)	Employee drivers (30 obs.)	Owner drivers (13 obs.)
Constant	80.3055 (26.17)	79.4638 (19.23)	60.8935 (16.25)
Driver takes "stay awake" pills on every trip (1,0)		-	15.3778 (3.09)
Driver takes "stay awake "pills sometimes (1,0)		9.5302 (1.89)	-
Staying awake/ maintaining concentration is not a problem (1,0)	- 20.1949 (- 4.07)	-17.3326 (- 2.97)	
Driver is paid a % of truck earnings	15.4640 (2.92)	13.6864 (2.02)	
Truck is Federally registered (1,0)	11.1230 (2.95)	13.2012 (3.03)	-
Truck is registered in NSW (1,0)	-15.2842 (-1.79)	-	-
Age of chassis/ cabin (yrs)	-	-0.9552 (-1.45)	
Time spent doing nothing, just waiting for a load in prior 8 hours (mins)	-	-	0.2029 (3.74)
Total trip kms of travel (kms)	-	-	0.007962 (5.08)
Average time at destination is before 10 a.m. (1,0)	-	-	10.1298 (2.78)
Overall fit (R^2)	0.502	0.624	0.865

The State of registration of the truck was also found to have a significant influence on average speed. Trucks registered in NSW tend to be associated with drivers whose average speed is 15 kph less than that of drivers with trucks registered elsewhere, and Federally registered trucks travel at speeds averaging 11 kph higher than the average for other trucks. However, the reasoning underlying this observed pattern of on-road performance is unclear. We believe that there are some behavioural characteristics of the drivers and/or State-specific penalties associated with the driving licence (assuming for example that the majority of drivers of NSW registered trucks have a NSW driving licence) which are highly correlated with truck registration and which have an influence on average trip speed.

The segmentation of the data into employee drivers and owner drivers suggests a different set of influences on the average trip speed for each driver segment. The influences of "stay awake" pills is quite different. Owner drivers tend to be more reliant on such pills which contributes to mean speeds 15 kph above the mean speed for owner drivers not reliant on such pills. We were able to find a statistically significant influence of non-dependence on pills on mean trip speed for employee drivers (reducing average speed by 17 kph), although those employee drivers who sometimes take these pills, average 9.5 kph above the mean of all other drivers (predominantly drivers who never take pills).

The owner driver model has identified three other influences on average trip speed. Since all these three effects have positive coefficient estimates, they exert an upward influence on average trip speed. Owner drivers who arrived at the final destination prior to 10 a.m. tend to have mean trip speeds which are 10 kph above the mean speed of drivers arriving after 10 a.m. We investigated a number of arrival time thresholds and found that 10 a.m. was the only statistically significant threshold. The temporal composition of the trip is a very important issue since it suggests that the pressure placed on the drivers varies significantly between trips undertaken primarily during daylight hours and those undertaken primarily during the night. This may be linked to scheduling constraints (e.g. the opening hours of factories), the nature of commodities being carried (e.g. express parcels overnight), and the simple fact of less traffic and maybe less police surveillance at night. The potential source(s) of influence will be investigated in detail in the main study.

Another important finding is that owner drivers who spend large amounts of time in the eight hours prior to departure simply waiting around for a load tend, once on the road, to have higher speeds. For example, a driver who spends one unproductive hour waiting for a load tends on average to travel at 12 kph above the average of drivers who have no load-waiting time. This preliminary evidence suggests that unproductive time encourages drivers to speed (but not necessarily to exceed the speed limit) and that this association is linked to the need to spend less time travelling so as to cushion the effect of unproductive time spent in securing loads, and be in the line to get subsequent loads.

We have also established a statistically significant relationship between average trip speed and total kilometres of the trip. Owner drivers on the longer trips have a tendency, all other things being equal, to travel at higher mean speeds than drivers on shorter trips. This effect however needs careful interpretation because it may be due to the fact that there is more opportunity on the longer routes e.g. Perth - Sydney to travel at higher speeds than on the shorter routes. Due to the limited sample size of the pilot survey it was not possible to explore fully the statistical relationships on an individual route basis. The size of the sample in the main survey will be large enough to allow stratification of the data on a route basis so that route specific effects can be identified.

Finally, the employee driver model has identified a mildly significant influence of the age of the chassis/cabin. All other things being equal, there is a tendency to travel at a slower average speed as the rig ages. Each additional year reduces the mean speed by approximately 1 kph. In the main study we will cross-tabulate this effect by the

background characteristics of the driver (especially age) in order to ensure that what we are identifying is a vehicle-specific constraint rather than any possibility that older vehicles are driven by older persons.

Conclusions

The conclusions drawn from the analysis of the pilot survey must be considered in the light of the limited sample size of that survey. The pilot survey has been successful in clarifying a number of important issues in the trucking industry which are worthy of further investigation. It has confirmed our initial hypothesis that the underlying economic conditions in the industry are a significant contributor to the on-road behaviour of drivers. These conditions, which manifest themselves in declining freight rates, tightening schedules and increasing competition confront drivers daily as they try to forge a living on the road. If the problem of safety on our roads is to be addressed, and solved satisfactorily, it is important to look beyond the symptoms of speeding, infringement of driving time regulations, and driver fatigue and consider the underlying causes which result in this behaviour. The data collected in the pilot survey has provided a start in analysing the relationship between these symptoms and possible causes which we believe will add to the understanding of the structure and the operation of the trucking industry in Australia and form the basis for recommendations for changes which will contribute to improving safety on the roads.

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