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**Intercity Rail Services:
Evaluating Pricing Options**

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ABSTRACT: This is a renewed interest in intercity and long-distance rail services in many countries, with both new high-speed rail services and improvements to conventional rail under review. The current study reports on an investigation in 1990 of the demand for sleeper, motorail and dining services between Sydney, Northern N.S.W and Brisbane, a 12 to 14 hour trip, just after a decision by the NSW government to temporarily suspend sleeper and motorail services and introduce XPT seating service only, pending an inquiry into the demand for such loss-making services under alternative price and service levels. A matrix of direct and cross fare elasticities within the rail mode and between rail and competing modes are obtained for concession and non-concession travellers. The empirical evidence extends our knowledge of the sensitivity of the long distance passenger market to a range of rail fares, distinguishing between classes of fares and levels of service.

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I. Introduction

There is a renewed interest in intercity and long-distance rail services in many countries, with both new high-speed rail services and improvements to conventional rail under review (Hensher et al 1989, Hensher 1996, Wardman et al 1994, Toner et.al. 1995, Bhat 1995). For example, there are a number of initiatives in Australia such as the proposed Speedrail service between Sydney and Canberra on new track with design speeds up to 350 kph; and improvements in long-distance services on existing track such as the Sydney-Melbourne and Sydney-Brisbane services. The current study reports on an investigation in 1990 of the demand for sleeper, motorail and dining services between Sydney, Northern N.S.W. and Brisbane, a 12 to 14 hour trip, just after a decision by the NSW government to temporarily suspend sleeper and motorail services and introduce XPT seating service only, pending an inquiry into the demand for such loss-making services under alternative price and service levels. The aims are:

1. To identify the service attributes which have an influence on the demand for sleeper, motorail and dining services.
2. To quantify these service attributes and together with price to investigate the sensitivity of demand to varying price/service profiles. The major outputs are direct and cross price elasticities.
3. To analyse the market share implications of probable changes to government concession policy.

Long-distance passenger rail in Australia currently caters for a somewhat specialised passenger market (namely retired persons, low income families, students and rail employees). For example, over 50% of train users on the Sydney-Melbourne route are either retired, a student or unemployed.

Given the emphasis on the derivation of price and service elasticities as input into a determination of intra-rail and inter-modal market share in the presence of innovative new services designed to attract patronage back to rail, a stated choice experiment is appropriate. The choice experiment involves offering a traveller a number of alternative price/service attribute profiles and asking them to choose the most preferred. Each price/service profile is an alternative. Given the choice probabilities for each alternative, the relative importance of an attribute of service (e.g. the fare), and the level of the service attribute, we can calculate the matrix of direct and cross fare elasticities. Two decisions are modelled: (i) the choice between alternative rail services given choice of rail, and (ii) the choice between rail and other competing modes (car, plane and coach).

II. The Empirical Setting

The following surveys were undertaken :

1. A self-administered survey, handed out on the current XPT services to Northern N.S.W. and Brisbane, identified previous users of the sleeper, motorail and dining service as well passengers new to the rail service as a result of the introduction of the XPT. A sample of 200-400 travellers were administered on 3 successive days (on a day and an evening service). Switchers from the sleeper service, car, coach, plane and no-travel to the XPT were captured by an on-board XPT self-administered survey. Forms were handed out as trains departed Central station in Sydney and collected before arriving at Gosford (about 1 hour out of Sydney). The survey administrators alighted at Gosford and returned to Sydney by another train. Given that most passengers travel on long-distance travel in both directions by the same mode, there is little to be gained by surveying in both directions.

2. A self-administered survey on-board coaches departing Sydney for Brisbane. Survey administrators joined the coaches at Penrith (about 1 hour west of central Sydney) and travelled via Central and Parramatta to Hornsby (about 40 minutes north of central Sydney). A transfer coach from Hornsby was used to drive the survey administrators back to Penrith, the nearest location to their residences. With the downturn in tourism in the early 1990's, plus the after effects of the two fatal coach crashes with a loss of 40 lives, coach patronage was at an all-time low, with typical loadings of 20 passengers going north and coming south from/to Sydney. Approximately 100-200 completed surveys were sought, to pick up switchers from sleeper, motorail and previous rail seat only passengers, plus other modal users.

3. The remaining markets are car and plane travellers who switched from rail, car and plane travellers who never used rail, and ex-rail users who no longer travel. Given that the two travel markets above are the most important for the current study, priority was given to completing the XPT and coach surveys. The remaining markets were studied by telephone interview. A sample of households were randomly selected from the telephone directory for the Sydney Metropolitan Area. The key data required for modal choice modelling were highlighted in the telephone survey. The stated choice experiment was developed in a slightly different manner in order to accommodate a non-visual environment.

The survey form included a choice experiment and questions on the travellers rail-use profile for intra-state travel, attitudes to a number of qualitative dimensions of rail service provision, and some socioeconomic and demographic questions (occupation, income, age, size and composition of travelling party, sex, etc.).

III. Designing the Choice Experiment

The stated choice experiment required each respondent to consider five train alternatives - car, plane, ordinary coach and sleeper coach - a total of 9 alternatives - and to choose that one which offered the highest level of utility in respect of fare and frequency given the predefined and fixed description of each of the 5 train options. The train alternatives are luxury class private cabin (lcpc), first class private cabin (fcpc), economy class sleeper (ecs), first class seat (fcs) and economy class seat (ycs). Table 1 summarises the quality of service offered for each class of train travel - the sleeper or seating configuration and quality, bathroom facilities, and lounge and dining facilities. Additional options on the use of the motorail (for an additional fixed price of \$99) for each train alternative and the use of a seat alternative during the day or night are also included as non-design variables.

Table 1 Quality of Service Offered for Train Travel

Luxury class private cabins	Single or twin share sleepers These will have private bathroom facilities There is a lounge bar open all hours and an entertainment car.
	Restaurant service is available in the dining car serving a la carte meals.
First class private cabins	Single or twin share sleepers These are comfortable but not as luxuriously decorated as the luxury cabins
Economy class sleeper	Single or twin share sleepers There are no private bathrooms but showers and toilets are available at the end of the carriage.
First class seat	Comfortable reclining 45 degree seats. Showers and toilets are available at the end of the carriage.
Economy class seat	Comfortable reclining 30 degree seats. There are no shower facilities. Buffet/snack bar service only is available.

The fare and frequency for each train alternative were defined at three levels. The non-train modes had various configurations of design attributes: they all had three levels of price, but only sleeper coach had variation in frequency (2 levels), with a predefined fixed frequency level for plane and coach. The current fare levels together with the sleeper fares and possible cost-recovery fares were used as the basis for arriving at the adult one-way full fare. The selected levels are summarised in

Table 2. The fares refer to a one-way full adult fare. Children under the age of 16 years would pay 50% of the full adult fare. The service frequencies were fixed at the same three levels across all train alternatives. Each respondent was informed that the sleeper service would involve 15.5 to 16 hours and the sitting service would take 13.5 to 14 hours.

Table 2. Summary of fare and frequency levels for the choice experiment

Level	lcpc	fcpc	ecs	fes	ycs	car	plane	coach	sleeper coach
<i>Fare \$90:</i>									
High	275	220	160	105	80	60	300	70	140
Medium	250	195	135	80	55	50	240	50	100
Low	225	170	110	55	30	40	180	30	60
<i>Frequency</i>									
:									
High	2/day	2/day	2/day	2/day	2/day	-	25/day	8/day	4/day
Medium	1/day	1/day	1/day	1/day	1/day	-	25/day	8/day	-
Low	3/week	3/week	3/week	3/week	3/week	-	25/day	8/day	2/day

The final choice design administered to a sample of current XPT and coach travellers is summarised in Table 3. The actual choice experiment in the survey is given in Appendix A. Each respondent was asked to complete a total of 3 replications (i.e. three choice sets) if they are not entitled to a train concession. If they are entitled to a train concession they complete an additional replication in which the fares are reduced by 50% across the board. Three sets of choices sets were prepared for one-third of the survey forms:

Option Set 1: Choice Sets A, B, C plus concession = 50% of C.

Option Set 2: Choice Sets D, E, G plus concession = 50% of G

Option Set 3: Choice Sets F, H, I plus concession = 50% of I.

The current XPT and coach travellers considered each of three choice sets of 9 alternatives and chose one. In addition they were asked to indicate whether they would use the motorail if it were available for a one-way price of \$99 in the context of each train alternative. For the non-sleeper train alternatives a preference for day or night service was elicited.

The experimental design implemented by telephone for current car and plane travellers is a simplified version of the experiment administered to train and coach passengers. Using the fractional factorial design from the self-administered XPT and coach survey, we decomposed the experimental choice

set into pairs of rail alternatives, seeking the respondent to consider each pair in an hierarchical manner and to indicate the most preferred in the binary set. Since the 5 train alternatives are a ranked ordered set, in that the most expensive will always be the luxury class private cabin and the least expensive will always be the economy class sitting service, we offered 4 overlapping binary sets:

Train Binary Set	Trade-off Pair
1	LCPC vs FCS
2	FCS vs ECS
3	ECS vs FCS
4	FCS vs YCS

Table 3. The Choice Sets Implemented in the XPT and Coach On-Board Surveys

Each set of two numbers is the one-way full adult fare and the frequency of service

Choice set	lpc	fcpc	ecs	fcs	ycs	car	plane	coach	sleeper
A	275 2-D	220 2-D	160 2-D	55 3-W	30 1-D	40 -	300 25	50 8	80 4
B	225 2-D	170 2-D	135 1-D	105 1-D	55 3-W	60 -	240 25	30 8	60 2
C	275 2-D	170 3-W	110 3-W	105 3-W	80 3-W	50 -	180 25	70 8	100 4
D	225 3-W	170 2-D	110 1-D	105 1-D	80 2-D	50 -	180 25	50 8	80 2
E	225 2-D	220 2-D	110 2-D	105 1-D	55 1-D	40 -	300 25	50 8	80 4
G	250 3-W	220 1-D	135 1-D	80 2-D	55 3-W	40 -	240 25	30 8	60 2
F	250 3-W	220 2-D	110 2-D	105 3-W	80 1-D	60 -	240 25	30 8	60 4
H	225 3-W	170 3-W	135 1-D	105 3-W	55 2-D	50 -	240 25	30 8	60 4
I	225 2-D	195 1-D	110 3-W	105 2-D	55 3-W	60 -	240 25	70 8	100 2

One replication only will be administered over the phone. To ensure that we expose all the choice sets to the sample we rotated the choice sets. Each interviewer commenced with choice set A and progressed sequentially through to choice set I in a rotational manner. The four binary choice sets which map into a full 5-alternative train choice set are summarised in Table 4. The actual choice experiment in the survey is given in Appendix B.

Table 4. The Telephone Survey Experimental Design Specification

Binary Train Set	A	B	C	D	E	F	G	H	I
LCPC vs FCPC	275	225	275	225	225	250	250	225	225
FCPC vs ECS	220	170	170	170	220	220	220	170	195
ECS vs FCS	160	135	110	110	110	110	135	135	110
FCS vs YCS	55	105	105	105	105	105	80	105	105
	30	55	80	80	55	80	55	55	55

Each telephone respondent is asked within the context of a predetermined trip to consider each binary set and to indicate the preferred alternative. When all four binary choice set questions have been asked, the interviewer then elicited the most preferred train alternative. A final question required the respondent to indicate which means of transport they would choose to use for the predetermined trip where the choice set is the most preferred train alternative from the previous question, car, plane, and coach. Additional questions are individually asked to obtain use of the motorail and sitting services in the day or the night. This specification of the telephone survey enables us to derive data compatible with that obtained from the on-board surveys, enabling us to develop a modal choice model using all sources of survey data.

IV. The Modal and Train Choice Models

A nested logit model is estimated for 8 alternatives, in which the choice amongst the train options is conditional on the choice of train. Sleeper coach was eliminated from the choice set because of the very small number of observations choosing it.

To ensure that the estimated models are based on a representative sample of observations we have to weight each individual surveyed by the application of two weights. The first weight allows for the different number of replications in the design experiment. The telephone survey respondents from which the current car and plane travellers were sampled were asked to respond to one replication if they were a non-concession traveller and two replications if a concession traveller. The current XPT and Coach travellers were asked to complete three replications if a non-concession traveller and four replications if a concession traveller. Some respondents answered less than the three or four sought. The weights used to allow for these different replications are 1.0, 0.5, 0.33 and 0.25. For the XPT and Coach sub-samples combined, the mean weight for the train choice is 0.30, and for the mode choice it is 0.299, which says that on average each person completed 2 to 3 replications.

The second set of weights are the sample weights. Given the specialised interest in travellers entitled to a concession for travel on the train, we have developed separate weights for each of the concession and non-concession markets and combined them in such a way that the weights applied reproduce the best estimate of current modal shares in respect of passenger trips. The population shares in the corridor are plane (12%), car (80%), coach (4%) and train (4%). Identification of the modal shares for the concession and non-concession markets is difficult given the paucity of data on the population. The mix of concession/non-concession associated with current train users was obtained directly from the on-board XPT survey, plus some cross-checking with previous train-based surveys.

The set of weights applied to adjust sample proportions to reflect current population shares overall and within each class of concession/nonconcession status are summarised in Table 5. The final models weighted by the replication and sample weights are summarised in Table 6.

Table 5. Sample Weights for Concession and Non-Concession Travel Markets

Mode	Population Shares (%)		Sample Shares (%)		Sample Weights	
	Concess.	Non-Conc.	Concess.	Non-Conc.	Concess.	Non-Conc.
Car	8.0	72.0	3.35	13.8	2.462	5.220
Coach	0.8	3.2	7.2	12.2	0.111	0.262

Train	2.8	1.2	34.9	20.2	0.080	0.059
Plane	1.8	10.2	1.8	6.6	1.000	1.545

The two financial dimensions, price and income, represent the price one has to pay for a service and an ability to pay. The important role of privacy and comfort is highlighted in both the choice between train alternatives and the overall modal choice. In particular individuals who place importance on comfort have a higher probability of choosing the luxury or first class private cabin and avoiding travel by coach. Respondents placing importance on privacy tend to prefer the choice of a sleeper facility on the train.

Table 6 Nested Logit Models with Exogenous Weights (Estimation: Maximum-Likelihood)

(i) Upper Level: Modal Choice (1674 observations)

Variable	Acronym	Mode	Par. Est.	t-value
Car-Constant	ASCCAR	car	-1.6510	-5.03
Plane-constant	ASCAIR	plane	-1.7641	4.30
Coach-constant	ASCCCH	coach	-5.7516	-3.61
Price	PRICE	all	-0.0005	-1.42
Travel time	TIMAIR	plane	-0.8967	3.60
Comfort	COMFCCH	coach	-1.2506	-2.01
Pensioner	PENSA	train	0.8733	2.78
Current Car User	CARCURR	car	1.4941	5.15
Current Plane User	AIRCURR	plane	1.0101	3.61
Current Coach User	CCHCURR	coach	5.3129	3.28
Current Train User	TRNCURR	train	0.1934	0.39
Income	PINC	air	0.1214	2.18
Income	PINC	car	0.8733	2.78
Inclusive value	IVTN	train	0.4230	1.95
Log-likelihood at convergence			-632.79	
log-likelihood (slopes =0)			-974.47	
Pseudo-R-squared			0.35	

(ii) Lower level: Train Choice (1706 observations)

Variable	Acronym	Alt	Par. Est.	t-value
LPC-constant	ASCLPC	LPC	0.4497	1.45
FCPC-constant	ASCFCPC	FCPC	0.8847	3.30
ECS-constant	ASCECS	ECS	1.4272	8.70

FCS-constant	ASCFCFS	FCS	-0.4472	-2.38
Price/Income	PRICEP	all	-0.0280	-6.23
Visiting friends and relatives	VFRYCS	YCS	0.4851	1.52
Comfort	COMFA	LPC,FCPC	1.1813	6.10
Privacy	PRICSLP	Sleepers	0.2830	1.40
Other Income	INCOLPC	LPC	1.2564	2.29
Day-Night Seat	DYNGHT	FCS,YCS	1.4081	2.30
Log-likelihood at convergence			-988.96	
log-likelihood (slopes =0)			-1142.8	
Pseudo-R-squared			0.14	

The data set is rich in socioeconomic information. The only statistically significant socioeconomic influences on choice amongst the five train alternatives is (excluding personal income) the income from other household sources, which when present increases the probability of choosing to travel by luxury private cabin. Party size is interacted with price for the air mode suggesting that the larger the party size the less a person is able to afford the plane alternative

The use of the motorail service is independent of the train choice. Respondents either want to use it or not regardless of the choice of train alternative. The desire to travel in the day rather than at night by a seat service was a strong influence on the choice amongst train alternatives. Frequency of train services appears to have no statistical influence in the context of choosing amongst the alternative train services. We considered three frequencies: 2 per day (high), 1 per day, and 3 per week (low).

A very important influence on mode choice is previous experience with a mode. All other things being equal the current modal use increases the probability of continuing with the current mode. This is an important variable to include in a model based on stated choices since it recognises the role of inertia and other dimensions of prior experience which are not picked up by the other explanatory variables.

The sensitivity to fares on public modes and car costs is clearly important in determining the share of the market attainable by train. A number of direct- and cross- fare elasticities have been calculated which indicate the relationship between the probability of choosing a particular train and modal alternative and the level of fare. The results at the mean of the respective sub-samples are summarised in Table 7. Separate results have been obtained for pensioners and non-pensioners. The elasticities associated with the train choice are derived from the price variable divided by personal income. We have evaluated the elasticities at the actual incomes of each traveller. The prices used

are the medium level in the design.

Table 7 Direct and Cross Fare Elasticities

Direct Elasticities: Train Choice

	LCPC	FCPC	ECS	FCS	YCS
Pensioner	-2.2	-1.5	-1.0	-.62	-.50
Non-Pensioner	-1.9	-1.0	-.80	-.54	-.47

Direct Elasticities: Mode Choice

	Car	Plane	Coach	Train
Pensioner	-.006	-.244	-.014	-.015
Non-Pensioner	-.003	-.151	-.081	-.331

Cross-Elasticities: Mode Choice

Pensioner	.010	.005	.002	.003
Non-Pensioner	.008	.004	.002	.001

The elasticities are intuitively plausible and lie within an acceptable range. All results are relatively inelastic except for the upper end of the sleeper train market within the train choice set. For example, a 10 percent increase in the fare for luxury private cabin will, *ceteris paribus*, lead to a 22% reduction in the probability of a pensioner travelling by luxury private cabin, given they choose to use the train. Thus with a base market share of .058 of the entire market for full fare or 2.9% of the pensioner train type share within the train market (.058/1.98), the probability of a pensioner selecting the train, given train is chosen, decreases from .029 to .0226. Pensioners are generally more sensitive to fares than are non-pensioners which is expected given their ability to pay. However in the context of mode choice there is evidence of some modal captivity which makes pensioners somewhat more resilient to price on the train and coach. It appears that the price variable in the upper level of the mode choice model is picking up the availability of modes, which explains in part

why the direct elasticities are relatively low.

The mean elasticity estimates for the train alternatives which come close to current and recent train options are extremely plausible in the range of -0.47 to -1.0 . Current practice has tended to adopt estimates within this range. For example, the mean estimate of -0.62 says that a 1 per cent increase in fares for a first class seat will, all other things being equal, lead to a 0.62% reduction in the probability of a pensioner choosing the first class seat option out of the full set of offered train alternatives, assuming the individual will travel by train. The elasticity estimates from the mode choice models reflect the current dominance of car use.

There is greater sensitivity to price in the upper end of the train service market, as expected. Previous evidence has been unable to identify the extent of such fare sensitivity across the entire range of train options. The direct elasticities from the modal choice model are somewhat lower than the train choice estimates as expected because of the greater benefits between options. In particular there is a relatively high sensitivity to plane use because of fares and relatively low sensitivity to fares associated with train, coach and car travel. Other important factors such as safety, comfort and privacy also influence overall modal and train choices.

Although the direct and cross-elasticities can be applied to a wide range of fares within the range evaluated in the experimental designs, we have calculated a number of important modal shares across all modes and within the alternative train services as a guide to assist in identifying the likely implications of the two extreme fare regimes: full fare for all (using the medium level of the choice experiment) and concessions for all who are eligible (using what individuals are currently entitled to). We have been able to desegregate the modal shares by three categories of traveller: pensioner, other-concession traveller and non-concession travellers.

A. Modal Shares

To identify the predicted modal shares under various regimes of train fares, the combined mode and train choice models are applied in the context of reasonable fare levels. To do this we have to ensure that the models are able to reproduce our best estimates of modal shares in three market segments: pensioners, other concession travellers and non-concession travellers. The interpretation of concession herein is in respect of eligibility for a concession on the NSW rail system.

The base mode shares are summarised in Table 8. These refer to the situation in place in 1990.

Table 8 Base Mode Shares

Person Status	Car	Plane	Coach	Train	Total
All	80	12	4	4	100
Pensioner	4.5	0.74	0.19	1.98	7.41
Other Concession	3.5	1.06	0.61	0.82	5.99
Non-Concession	72	10.2	3.2	1.2	86.6

To evaluate the implications of alternative train options, we establish a number of reasonable fare scenarios. The starting point is a scenario in which there are no concession fares at all. In calculating the net effect of this severe pricing regime we recognise that the full set of train facilities available as described in the stated choice experiment provide a much improved service than the current service. The 4 percent train share above is based on surveys and counts undertaken since the elimination of the sleeper services, and thus we might expect some return to rail with the reintroduction of sleepers with no concession fares at all plus some new patronage as a result of a more appealing service. The full fare scenario summarised in Table 9 yields a market share for train of 4.73%, a statistically sizeable increase (nearly 20% predicted increase in rail patronage).

Table 9 Modal Shares Under a No-Concession Regime

Person Status	Car	Plane	Coach	Train	Total
All	79.80	11.9	3.57	4.73	100
Pensioner	64.70	7.40	1.90	26.0	100
Other Concession	60.15	15.1	7.20	17.55	100
Non-Concession	82.80	11.58	3.20	2.42	100

Table 10 Within Train Class Shares Under a No-Concession Regime (4.73% of total market)

Person Status	LPC	FCPC	ECS	FCS	YCS	Total
All	0.157	0.450	0.567	0.706	2.85	4.73
Pensioner	0.058	0.190	0.236	0.296	1.20	1.98
Other Concession	0.014	0.042	0.084	0.180	0.76	1.08
Non-Concession	0.085	0.218	0.247	0.230	0.89	1.67

The results in Table 10 are interpreted as follows: 0.058 of the total train share (or 4.73 per cent of

the entire trip market) is pensioners using a luxury private cabin. This represents 0.058/1.98 or 2.92% of the pensioner travellers by train. Approximately 65% of predicted train ridership under a no-concession regime are current concession holders, which compares with the current 70%. There has been nearly a 17% reduction in current concession holder travel but this is more than compensated by the gains from non-concession travellers. From Tables 9 and 10 we can identify the incidence of demand for each type of train service if all 5 services were available. Overall the 4.73% market share comprises 0.157 for LPC, 0.450 for FCPC, 0.567 for ECS, 0.706 for FCS and 2.85 for YCS. Thus 75% of all predicted train use is by seating with the balance of 25% requiring a sleeper. Within the sleeper segment, we have almost equal preference for first class and economy sleeper, with a small niche market for luxury private cabin (the latter representing 3.3% of the train segment market).

If a concession were maintained under the new set of train services, with all travellers who are entitled to a concession pay the full sleeper supplement but receive a concession on the seat fare component based on current concession entitlement, the train market share will increase to 5.4% (Table 11). This is a relatively small increase (14%) because the majority of the population of travellers are not entitled to a concession (i.e. 86% of the population who in the past have travelled between Sydney and the North Coast and on to Brisbane).

Table 11 Modal Shares Under a Concession Regime

Person Status	Car	Plane	Coach	Train	Total
All	79.55	11.65	3.4	5.40	100
Pensioner	61.1	6.70	1.9	30.3	100
Other Concession	58.35	14.15	7.0	20.5	100
Non-Concession	82.8	11.58	3.2	2.42	100

Table 12. Within Train Class Shares Under a Concession Regime (5.4% of Total Market)

Person Status	LPC	FCPC	ECS	FCS	YCS	Total
All	0.17	0.64	0.628	1.012	2.95	5.4
Pensioner	0.069	0.37	0.289	0.322	1.2	2.25
Other Concession	0.016	0.052	0.092	0.460	0.86	1.48
Non-Concession	0.085	0.218	0.247	0.23	0.89	1.67

This concession fare regime almost reinstates the percentage of all train users on concession back to

the current 70%. This is because the improved services attract more non-concession travellers but also attract some additional concession people who were removed when sleepers were eliminated. Sometimes a percentage decreases in an apparent counter-intuitive way, yet this is correct. For example, with the move from full fare to concession we note that the non-concession people have an increase in the modal share to car. This occurs because their percent of the train mode share decreases (due to the higher number of concession travellers as a percentage of all train users), and hence the car modal share for non-concession travellers as a whole will be higher to reflect the reduced train split. The results can be best appreciated by summarising them in one table (Table 13).

Table 13 Modal Share Implications of Two Extreme Fare Regimes for Train Travel
(Each row sums to 100)

Person Status	Car	Plane	Coach	Train	LPC	FCPC	ECS	FCS	YCS
Pensioner:									
Base	60.9	9.99	2.57	26.8					
Full Fare	64.7	7.4	1.9	26.0	.058	.19	.236	.296	1.2
C-Fare	61.1	6.7	1.9	30.3	.069	.37	.289	.322	1.2
Other Concession:									
Base	58.4	17.7	10.18	13.69					
Full Fare	60.15	15.1	7.2	17.55	.014	.042	.084	.180	.760
C-Fare	58.35	14.15	7.0	20.5	.016	.052	.092	.460	.860
Non-Concession:									
Base	83.1	11.8	3.7	1.4					
Full Fare	82.8	11.58	3.2	2.42	.085	.218	.247	.230	0.89

Table 13 can be used to obtain an estimate of total travellers by type of train service when faced with (i) full fare regime of LCPC=\$250, FCPC=\$195, ECS=\$135, FCS=\$80, and YCS=\$55; and (ii) concession holders travelling at current entitlement which varies depending on concession status.

For example, a \$10 seat plus full sleeper supplement. The predictions in Table 13 highlight the extent of a preference to move up the scale of train services available when a concession is available, but importantly that the amount of train use does not fall below current levels when everyone has to pay the full fare for the much-improved train service. The judgement facing the State Rail Authority of NSW is the trade-off between level of service, fare and market share. Clearly the set of options evaluated if all are provided will lead to an increase in total demand for train travel. If the aim is to dampen demand then the predictions suggest that the offering of only economy class sleeper with both types of seating may achieve this at the full fare and concession fares. The introduction of luxury and first class private cabins will divert some trips from car and plane, even at the full fare.

The results in Table 13 represent the upper and lower predictions of train patronage by train type assuming that all train facilities are provided. The upper end of the train service set is attracting current car users, and may be lost if only economy class sleepers were provided (given the definition of such a sleeper). What we have identified is a strategy which will not only accommodate the 6% latent demand of ex-sleeper users who in the survey claim no alternative means of travel, but which will attract new customers.

V. Conclusion

This empirical inquiry has extended our knowledge of the sensitivity of the long distance passenger market to a range of rail fares, distinguishing between classes of fare and levels of service. Previous studies concentrate on a simple weighted average fare without consideration of the potential for switching between classes of travel with the train market. Establishing a matrix of switching elasticities which are sensitive to the class of rail fare will enable rail planners to predict more accurately the impact of differentiated fares on patronage and revenue.

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APPENDIX A

CURRENT RAIL AND COACH TRAVELLERS

We would like you to consider the following rail and non-rail services. We have given you 8 travel options with different levels of service, costs, travel time and frequency of service. We would like you to look at each service and consider which of the 8 ways of travelling appeal to you most assuming you are travelling on your current trip and with your current travellers.

Please choose the most preferred.

Please indicate, if the motorail (you could put your car on the train) were available for \$99 one-way would you use it on these train trips? Please indicate if you would prefer a day or night service on the train seat services?

CHILD UNDER 16 YEARS IS HALF THE ADULT FARE. THE TRAVEL TIMES FOR THE TRAIN SERVICES ARE 15 1/2 TO 16 HOURS FOR THE SLEEPER SERVICES AND 13 1/2 TO 14 HOURS FOR THE SITTING SERVICES.

CHOICE SET 1.

	Cost per Adult ONE-WAY	Frequency	RANK	Motorail Circle Yes/No	Service Circle Day/Night
TRAIN Luxury private cabins (sleeper)	\$275	2 per day		Yes/No	
TRAIN First class private cabins (sleeper)	\$220	2 per day		Yes/No	
TRAIN Economy class sleeper	\$160	2 per day		Yes/No	
TRAIN First class seat	\$55	3 per week		Yes/No	Day/Night
TRAIN Economy class seat	\$30	1 per day		Yes/No	Day/Night
CAR	\$40				
PLANE	\$300	25 per day			
COACH	\$50	8 per day			
SLEEPER COACH	\$80	4 per day			

Here is another set of 8 travel options with different combinations of level of service, cost and service frequencies. Would you please consider this set of services in the same way you did for the first set and choose one.

CHOICE SET 2.

	Cost per Adult ONE-WAY	Frequency	RANK	Motorail Circle Yes/No	Service Circle Day/Night
TRAIN Luxury private cabins (sleeper)	\$225	2 per day		Yes/No	
TRAIN First class private cabins (sleeper)	\$170	2 per day		Yes/No	
TRAIN Economy class sleeper	\$135	1 per day		Yes/No	
TRAIN First class seat	\$105	1 per day		Yes/No	Day/Night
TRAIN Economy class seat	\$55	3 per week		Yes/No	Day/Night
CAR	\$60				

PLANE	\$240	25 per day
COACH	\$30	8 per day
SLEEPER COACH	\$60	2 per day

CURRENT CAR AND PLANE TRAVELLERS

We would like to tell you about some possible changes to the train services. I am going to read out to you some pairs of train services telling you the fares for each type of service. Please tell me which one you would prefer to use if you were to travel by train.

EVEN IF THE RESPONDENT IS UNLIKELY TO TRAVEL BY TRAIN THEIR OPINION ABOUT THE TYPE OF TRAIN SERVICES PROVIDED IS STILL IMPORTANT.

INTERVIEWER INSTRUCTION

Circle the letter for the fare column, from the fare showcard, which you are using for this interview

A B C D E F G H I

and write in the fares next to the options as you read them out

If you were to travel to Brisbane or the far North Coast of NSW by train which of these levels of service would you prefer?

A luxury private class cabin, with private bathroom facilities which costs \$_____ (single or twin share sleepers)

OR

A first class private cabin also with private bathroom facilities, which costs \$_____ (single or twin share sleepers)

Which of this pair of levels of service would you prefer?

A first class private cabin with private bathroom facilities, which costs \$_____ (single or twin share sleepers)

OR

An economy class sleeper with shared shower and toilets, which costs \$_____ (single or twin share sleepers)

And which of this pair of levels of service would you prefer?

An economy class sleeper with shared bathroom facilities, which costs \$_____

OR

A first class seat, also with shower facilities available, which costs \$_____

And lastly, which of this pair would you prefer?

A first class seat with shower facilities available, which costs \$_____

OR

An economy class seat, no shower facilities are available, which costs \$_____

APPENDIX B

XPT PASSENGER SURVEY

- A. A total sample of 309 passengers was obtained on 3 XPT trips (2 Sydney - Brisbane night trains, and 1 Sydney - Murwillumbah day train).

Table 1. Sample profile

Age		
	14 to 24 years	31%
	25 to 34 years	17%
	35 to 44 years	17%
	45 to 60 years	14%
	over 60 years	20%
Sex		
	Male	39%
	Female	62%
Visiting from overseas		3%
Occupation		
	Student	26%
	Home duties	19%
	Professional	13%
	Retired	18%
Concession entitlement		
	% of total sample	60%
Concession travellers		
	Pensioners	48%
	Students	44%
Pensioner concession travellers		
	over 60 years	57%
Aged travellers (over 60 years)		
	Concession	87%
Income		
	less than \$9,000	52%
	less than \$15,000	69%
	les than \$22,000	75%
Other household income		52% No other income

Passengers sampled on the XPT trips are concentrated at either end of the age spectrum with 31% being less than 24 years of age and 20% being over 60 years of age. Consequently they are predominantly in the lower income brackets with 75% of the sample having an income of less than \$22,000 pa. 60% of the sample is entitled to concession travel on the train, of which 48% are on some form of pensioner entitlement and 44% are students. Not all pensioner concession travellers are elderly, only 57% of this group is over 60 years of age. Of those over 60 years of age for the sample as a whole 87% are entitled to concession travel.

B. Pensioner concession and aged (over 60 years) travellers

Given the predominance of aged and pensioner travellers in the sample and the assumption that they have particular travel needs, the following points are made about their profile and opinions towards travel. Not all pensioners are elderly, but nearly all elderly are entitled to concession travel. Consequently the pensioner group in general is of a slightly lower income level than the over 60 years group. For the over 60 group comfort and privacy appear to be the overriding choice factors, while for the pensioner group these factors are important for part of the sample, but for others the main influencing factor is income.

1. Table 2. Profile of sample of aged and pensioner travellers

	Pensioner concession	Over 60 years
Sex		
Female	72%	54%
Male	28%	46%
Drivers licence (yes)	72%	75%
Income		
less than \$9,000	63%	62%
less than \$15,000	87%	79%
Other household income	90% No	87% No

The higher percentage of females in the pensioner group reflect the group of single/supporting mothers who make up the bulk of the younger pensioner group.

2. Travelling party

For both these samples the majority of respondents were travelling alone or with only 1 other family member. 35% of pensioners were travelling alone, 43% of the over 60s, and 61% of pensioners were travelling with one member of their family, 54% for the over 60s.

3. Table 3. Class of fare

	Pensioner concession	Over 60 years
First class	66%	86%
Economy class	34%	14%

A higher proportion of the elderly were travelling on a first class fare than for the pensioner group, reflecting their slightly higher income level and also the importance placed by them on comfort due to their age.

4. Table 4. Fare type

	Pensioner concession	Over 60 years
Pensioner free voucher	69%	65%
Pensioner half price	26%	16%
Adult full fare	-	8%
Caper fare	-	5%

COACH PASSENGER SURVEY

Sample

A sample of 101 coach passengers responded on 4 coaches travelling from Sydney to Brisbane over a period of 4 days.

Table 1. Sample profile

Age		
	14 to 24 years	56%
	25 to 34 years	43%
	35 to 60 years	19%
	over 60 years	3%
Sex		
	Male	48%
	Female	52%
Visiting from overseas		10%
Occupation		
	Student	38%
	Tradesperson	14%
	Home duties	12%
	Professional	9%
	Sales	6%
	Clerical	5%
Concession entitlement on the train		
	Total of sample	55%
	Students % of total sample	34%
	Pensioner % of total sample	7%

Income		
	less than \$9,000	50%
	less than \$15,000	62%
	less than \$22,000	71%
	less than \$32,00	91%
Other household income		36% No other income

Compared with the sample of XPT train travellers coach travellers were predominantly much younger. Over 50% of the sample was less than 24 years of age and only 3% of the sample was over 60 years. Because of the predominance of students and respondents engaged primarily in home duties or lower income occupations, the income profile of coach travellers is similar to that of the train travellers in that it is concentrated in the lower income groups. It would seem that the elderly prefer to travel by train, rather than by coach because it is more comfortable and considered safer. In addition if they are travelling on a concession fare on the train it is less expensive than coach travel.

TELEPHONE SURVEY: COMPARISON OF EX-SLEEPER TRAVELLERS WITH TRAVELLERS ON OTHER MODES

1. Sample size

A sample of 319 respondents who had travelled to the North Coast in recent years was interviewed on the telephone. This sample was made up of 100 ex sleeper travellers who were found with the assistance of telephone numbers provided from the State Rail Authority booking lists, and 219 travellers by other modes (53% car, 26% plane, 20% coach), who were found by random telephone dialling in the Sydney metropolitan area.

This discussion compares the profile and opinions of the ex sleeper travellers with those who travelled by other modes, mainly car and plane, who were interviewed on the telephone. Throughout "other modes" includes only those interviewed in the telephone survey.

2. Table 1. Profile of the two sample populations:

		Ex sleepers	Other modes
Sex	Female	69%	64%
	Male	31%	36%
Age	16 to 45 years	23%	65%

	45 to 55 years	14%	15%
	55 to 59 years	14%	7%
	over 60 years	49%	13%
Income			
	less than \$9,000	34%	27%
	less than \$15,000	50%	40%
	less than \$32,000	74%	49%

The ex sleeper sample is predominantly in the older age brackets and concentrated in the low income groups. 49% of that sample is over 60 years of age compared with 13% for the other modes and 50% of the ex sleeper sample earns less than \$15,000 pa.

3. Access to other modes for the ex sleeper sample

Of the ex sleeper sample 72% had a drivers licence, compared with 91% for the other modes. However according to the screening question for the interview 72% had not recently travelled to the north coast by car as the driver, and 69% had not travelled by car as a passenger. Also 69% indicated that they had not travelled by plane and 79% had not travelled by coach.

4. Travelling party

Of the ex sleeper sample 28% were travelling alone (24% for other modes) and 49% with one other person. Other mode travellers were travelling in larger groups 28% with 3 or 4 other persons reflecting family travel.

5. Train fare

Of the ex sleeper sample 45% were travelling on the full adult fare, 37% on a pensioner fare and 5% on an employee pass. For other modes only 8% were entitled to a pensioner concession if travelling on the train and 7% entitled to a student concession.

6. Table 2. Train preferences

Within the range of price options given the levels of train service in the choice design, the following choice preferences were indicated by the two samples.

	Ex sleeper	Other modes
Luxury sleeper cabin OR	24%	17%
First class sleeper	76%	83%
First class sleeper OR	65%	42%
Economy class sleeper	35%	58%
Economy class sleeper OR	87%	71%
First class seat	13%	29%

First class seat OR	82%	56%
Economy class seat	18%	43%

In each case the ex sleeper sample prefers the more expensive level of service whereas the other mode sample indicates a preference for the less expensive sleeper option where there is a choice between two levels of sleeper service. Although the ex sleeper sample is generally of a lower income level than the other mode sample, because they are also in the older age group the more expensive train service is also the more comfortable option.

7. Table 3. Most preferred train option

	Ex sleeper	Other mode
Luxury class sleeper	13%	13%
First class sleeper	54%	27%
Economy class sleeper	26%	38%
First class seat	4%	7%
Economy class seat	3%	14%

By far the majority of the ex sleeper sample preferred a sleeper service of some type on the train. The most preferred level of service being the first class sleeper with the private bathroom facilities considered an advantage over the economy class sleeper for this older age group. The majority of other mode travellers also preferred a sleeper service but a greater percentage were happy with the economy class service.

8. Concession fares

The concession fares did not change the preferred train option for many travellers. Only 11% of the ex sleeper sample who travelled by concession indicated that they would change their choice, generally moving up to the next level of service. In the other mode sample 6% of concession travellers said that they would change their preference but the change was only within the sleeper services; no one changed from a seat to a sleeper.

9. Table 4. Preferred mode of travel on next trip.

mode	Ex sleeper	Other mode	% of sample for current trip - other
Car	4%	33%	52%
Plane	6%	18%	26%
Coach	0%	1%	20%
Train	90%	48%	0%

90% of ex sleeper travellers would prefer to travel by train on their next trip and as the

previous table indicated this was on a sleeper service. 48% of travellers by other modes indicated that they would prefer to travel by train on their next trip. The figures for the mode percentages of the sample of other mode travellers for their current trip are also given in the table. A comparison of these with their preferred mode for their next trip indicates a significant possible switch to train, particularly from car and coach.

10. Table 5. Factors important in deciding on mode of travel on long trips

Each respondent could mention more than one factor. The table shows the number of times each factor was mentioned both as an unprompted and prompted response.

	Ex sleeper		Other mode	
	Unprompt.	Prompt.	Unprompt	Prompt
Frequency of service	2	16	4	50
Travel time	15	21	81	34
Comfort	49	33	78	86
Privacy	11	36	19	42
Children	2	5	7	10
Medical/privacy	1	8	1	3
Medical/unable to sit	5	14	1	8
Cost	16	6	59	21

The factors mentioned most often by the sleeper travellers were comfort and privacy, again reflecting the age of the respondents. Medical conditions were mentioned but cost and travel time were also important. The other most important factor mentioned by both samples was safety. 18 respondents in the sleeper sample mentioned safety and 35 in the other mode sample, this was an unprompted response.

11. Type of berth required.

Of the ex sleeper sample 95% preferred a 1 or 2 berth cabin reflecting the fact that they generally travelled alone or at most with one other person. In the other mode sample there was a greater spread in the preferences for berth size reflecting more larger family groups travelling.

12. Seat service.

Both samples preferred a day time service if travelling by train. 67% for the sleeper sample and 56% for the other modes.

13. Food service.

A reasonably priced restaurant was the most preferred option for both samples - 64% for the

sleeper sample and 40% for the other modes.

14. Motorail service

The ex sleeper sample indicated a greater interest in the motorail than did the other mode sample. 58% of ex sleeper travellers said that they would, or possibly would take their car on the motorail if it were available, compared with 47% of other mode travellers.

15. Ex sleeper travellers problems with bookings

22% of ex sleeper travellers indicated that they had had problems when last booking a sleeper service. The most common problem cited was that it was booked out or that it was necessary to book a long time in advance to travel on the chosen date. The other main problem mentioned was difficulty in getting through on the telephone to the booking office and inefficiency and rudeness of staff when that was finally achieved.

16. Table 6. Expected mode of travel for next trip - ex sleepers

Car	37%
Plane	22%
Coach	4%
Train seat	28%
Not able to travel	6%

Ex sleeper travellers were asked how they would travel on their next trip if the sleeper service was not available. The majority were able to switch to other modes, but generally this choice was not made uncomplainingly, particularly expressing concern at the difficulty of driving that distance if going by car and the discomfort of having to sit up for that length of time if travelling by train. Only 6% indicated that they were unable to make the trip again and this was due to an inability to sit due to old age or a medical condition.

17. Concession fare on the plane - ex sleepers

If the concession fare on the plane was the same as that for the sleeper on the train 65% of respondents indicated that they would still travel by train. This generally reflects a dislike of flying by the elderly and the unimportance of travel time.

18. Concession fare on the sleeper coach - ex sleepers

If the concession fare on the sleeper coach was half that on the sleeper train 93% of respondents indicated that they would still travel by train. Although respondents were not familiar with the concept of a sleeper coach this was explained to them by interviewers. Even so, the majority of respondent preferred to travel by train due mainly to a dislike of coach travel in general.

19. General comments.

Both samples expressed similar general comments about the train services. 87% of ex sleeper users would like to see the sleeper service reintroduced and 57% of other mode travellers would like to see the sleeper service reintroduced, the main reason given by these respondents was that they felt that it was necessary for elderly travellers.

The main difference in the comments was that a significant number of other mode travellers commented that the train service should be cheaper. This was not mentioned by as many ex sleeper travellers, possibly reflecting the high number of these respondents that travel by concession on the train.

Although some ex sleeper travellers commented that they just generally enjoyed train travel and had found the old sleeper service enjoyable, the majority of comments about the train services were in the negative.

The main comments made were:

- a. The travel time should be shorter - there should be faster service either by increased speed, or less stops at small stations and less delays due to shunting on the line etc.
- b. The dining/food services should be improved. Many respondents expressed the desire for the return of the dining car, complaining that it is difficult to carry food from the snack bar back to the seat, especially for the elderly, on a rocking train. In general it was felt that the quality of the food should be improved.
- c. The motorail service should be reintroduced. Many respondents enjoyed the convenience of using the motorail thus saving the long car trip, but having the car available for travel at the destination.
- d. It was generally felt that the trains should be updated and the facilities improved. There were many complaints about uncomfortable seats, poor maintenance, and outdated facilities.
- e. There were also a significant number of comments about the poor quality of service from the staff, complaining that they were either not available for service or were rude and unfriendly.
- f. A number of negative comments were also made about the current XPT service in particular. The comments related both to the timetabling of the service and to the quality of the onboard service. Many respondents felt that the service to Brisbane should be a day service. There were also many complaints about poor linking of train services with the coach feeder services and inconvenient drop off times and locations for the coach services. The onboard service was generally considered not to be unsatisfactory with poor quality food and a low level of service from staff. The train itself was also thought to be noisy and rocky.