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## Ground travel mode choices of air arrivals at regional destinations: The significance of tourism attributes and destination contexts

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### ABSTRACT

The aim of this paper is to examine the air leisure arrivals' ground travel mode choice in the context of their decision to disperse beyond the gateway. A stated choice experiment was designed to examine the dispersal and travel mode choice of leisure visitors arriving on air transport at Cairns. Results show that for a hypothetical public bus alternative, attributes such as 'sightseeing opportunities' and 'driver quality' were significant for trips made to less known destinations located south of Cairns, compared to destinations north of Cairns. Findings suggest that while travel mode attributes and trip characteristics are significant determinants of the mode choice of air leisure arrivals, the extent of their significance varied markedly across destinations. Although the data examined in this paper were collected in Cairns, this research should be of relevance to many regions interested in understanding the relationship between destination transport and dispersal of air arrivals.

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### 1. Introduction

In the past decade, Australian domestic travel has changed significantly due to the proliferation of domestic air travel. Domestic overnight trips by air transport have increased from 15.4% of total trips, to 23.3%, an increase in 5.5 million trips between 1999 and 2008 (TRA, 2008). In the same period, overnight trips by private or rental vehicles decreased from 76.7% to 71.3%, a decrease of 5 million trips (TRA, 2008). The shift in modal share was partly due to the growing influence of Low Cost Carriers (LCCs) since 2001. One significant outcome of the stimulation in domestic air travel demand, led by the Low Cost Carriers, was the rapid growth of air arrivals contributing to tourist volume for regional destinations in Australia. This air travel growth has been particularly pronounced for trunk routes, i.e. between state capitals such as Sydney-Melbourne, Sydney-Brisbane, and for routes connecting state capitals to popular tourism destinations along the Eastern coast of Australia, e.g. routes from Sydney to Cairns, Melbourne to Coffs Harbour, etc. A major consequence of the proliferation of affordable air transport has been the rapid growth in air arrivals, shown in Fig. 1.

The rapid growth has led regional tourism destinations to become increasingly reliant on air transport. In particular, this has placed greater importance on ground travel modes at destinations to facilitate the dispersal of tourists to peripheral destinations beyond the gateways. In 2007, 52% of domestic tourism expenditures (or AUS\$22,764 million) was spent in regions beyond capital cities and the Gold Coast (TRA, 2008). Given the significance of tourists' spending to a region's economy, dispersal of the air arrivals to peripheral destinations is particularly relevant to regional destination managers, as well as policy makers who have regional economic development as a mandate. Without the dispersal of the air arrivals beyond gateways, peripheral regions may not fully capture the economic benefits which are to be gained from the increase in the air arrivals. The availability and quality of ground transport modes in destinations are important dispersal determinants to peripheral destinations because air leisure arrivals often do not have access to private vehicles. For peripheral destinations, ground travel modes other than private vehicle will be important; for example, rental vehicles, public transport and tour operators. The aim of this paper is to examine the ground travel mode choice of air leisure arrivals within the context of their decision to disperse beyond the gateway.

In order to illustrate the relationships between dispersal and travel mode choices, we adopted a case study approach. Specifically, a stated choice experiment was designed and applied. This approach has the advantage that it enables researchers to control transport attributes, whether or not the attributes are

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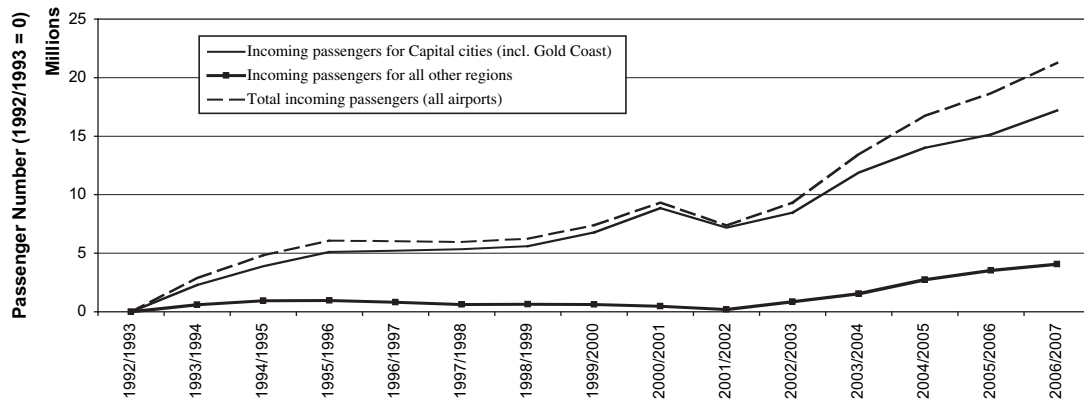


Fig. 1. Domestic Revenue Passenger Growth from 1992/1993 to 2006/2007. Source: compiled from Bureau of Infrastructure, Transport and Regional Economics, Aviation Australian Bureau of Statistics, 2007. Note: 1992/1993–2006/2007 (1992/1993 = 0): Capital cities (incl. Gold Coast) vs. All other.

actual or hypothetical, to examine their effects on demand. This provides an opportunity to empirically test the effects of travel mode variables identified in the tourism literature, by creating a number of 'what if' scenarios. This study uses the hypothetical scenarios in two ways.

First, this study includes a hypothetical tourism-oriented public bus as an alternative to rental vehicles and tour-shuttles in the choice experiment. This was done to explore the desirability of certain attributes of public transport— specifically 'en route stop-over' and 'driver knowledge and friendliness', in addition to more common variables such as price and time. Some of the most common mode choice attributes considered in the literature are travel cost and time, as well as a wide range of qualitative attributes, such as frequency and various surrogates for convenience, etc (see for example, Hensher and Prioni (2002) for a comprehensive list of qualitative attributes in urban public transport). While these variables have been examined in the context of tourists' transport mode choice (e.g. Kelly, Haider, & Williams, 2007), tourism researchers have asserted a number of other factors that may be of importance in tourists' mode choice context, and consequently of significant implications for public transport design for tourists. One notable study is Lumsdon (2006), which studied the issues surrounding the promotion of public transport for recreational uses in the UK. Based on stakeholder interviews, Lumsdon (2006) found that tourism attributes such as 'en route stopover opportunities' and 'driver knowledge about the destination and friendliness' are important considerations in the design of public transport service for leisure visitors. These attributes are examined in this paper.

Second, we have examined and compared the mode choices of leisure tourists in different destination contexts. The Tropical Northern Queensland tourism region that our data collection was based for this study offers tourist experiences ranging from the Great Barrier Reef to rainforest, and cultural experiences ranging from mining towns in the hinterland to the city life of Cairns. Such destination characteristics, in addition to influences arising from the travellers' individual situations, are likely to interact with the travel mode choice decisions of tourists. Thus, this paper not only examines various attributes of transport modes (including tourism variables), it also examines how different tourist destinations affect the mode choice of tourists, and how the importance of each modal attribute varies.

## 2. The study region

The Cairns region was chosen for this illustrative case study. Cairns, and the Tropical North Queensland tourism region (TNQ)

which encompasses it, is the largest regional destination in Australia in terms of domestic air arrival volume (in excess of 1.5 million passenger arrivals in 2006/2007) (BITRE, 2007). Cairns is also the busiest gateway to the Great Barrier Reef (GBR). Moscardo, Saltzer, Norris, and McCoy (2004) demonstrated that the travel mode used to access a region is a significant determinant of tourists' travel patterns. Their study demonstrated that the trend towards greater use of long-distance roads in the region (between 1996 and 2001) was related to the greater use of the Whitsundays rather than Cairns as a point of access to the Great Barrier Reef (GBR).

Cairns has experienced rapid growth in interstate and international air arrivals since the early 1980s (Prideaux, 2000). Subsequent to the post-2000 emergence of LCCs, Cairns has been the recipient of a new wave of domestic air leisure arrivals. Peripheral destinations around Cairns do not have sufficient demand to warrant a direct LCC or similar type of service; rather, they must rely on the dispersal of air arrivals from Cairns. This region is a suitable study area for the research aim devised previously because (1) air transport is becoming an increasingly prominent mode of arrivals for tourists, and (2) the tourism region is sufficiently large that there is significant reliance on the quality of ground travel modes for the dispersal of air arrivals to peripheral destinations. Details of the peripheral destinations, along with the ground travel modes in TNQ, are outlined in the following sections. However, first we briefly introduce the logit model applied in this research.

## 3. The model

Discrete choice models are widely applied in the study of travel mode choices. This study applies the multinomial logit model (MNL). The MNL is of the following form:

$$p_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} \quad (1)$$

where:  $P_{ni}$  denotes the probability of an individual  $n$  choosing an alternative  $i$ ,  $V_{ni}$  represents the systematic (observed) components of the utility described by the attributes, and socio-economic and trip characteristics of alternative  $i$  for an individual  $n$ . Likewise,  $V_{nj}$  represents the observed variables for all alternatives in the choice set.

In the MNL model, it is the relative utility of one alternative to another that matters, rather than the value of an individual utility. The linearly additive utility functions,  $V_{ni}$ , are estimated from the data, and then transformed into probability estimates. The following utility function is estimated for each mode of transport:

$$V_{ni} = \alpha_i + \beta_i X_{ni} + \gamma_i T_{ni} + \phi_i Z_{ni} \quad (2)$$

where:  $V_{ni}$  is the level of utility for individual  $n$  choosing alternative  $i$ ,  $V_{ni}$  is a function of the levels of the attributes  $X_{ni}$  where  $\beta_i$  is a vector of coefficients to be estimated for each attribute of each alternative  $i$ ,  $T_{ni}$  is the trip characteristics where  $\gamma_i$  represents the vector of coefficients for each trip attribute, and  $Z_{ni}$  is the individual's characteristics with coefficients vector  $\phi_i$ . If there are  $m$  alternatives, there can only be  $m-1$  components of the vector  $\gamma_i$  and  $\phi_i$  that can be estimated. This is because one alternative must be used as a base value to which the relative utility for all other alternatives is determined. Thus,  $\alpha$ , which is an alternative specific constant for each alternative, can only be estimated for  $m-1$  of the alternatives.

One widely known limitation of the MNL is the independence of irrelevant alternative (IIA) property (e.g. Ben-Akiva & Lerman, 1985). Nested logit is a natural extension of this model, where there is partial relaxation of the assumption of constant and equal variances of the error terms. Both models were estimated for this paper. However, as it will be shown later, the MNL is sufficient to address the objective of this paper and highlight the key results in a meaningful way.

## 4. The dependent variable

### 4.1. Trip alternatives

Regional *dispersal* is defined as a trip that involves at least one night stay in the 'periphery'. The periphery is defined as a region outside the administrative boundary of Cairns city. Fig. 2 shows the Map of the region which was used in the actual survey to visually represent destinations north and south of Cairns. An alternative to dispersal is a trip that only involves overnight stays in the gateway, i.e. Cairns city. A day-trip option from Cairns to the periphery was added to the choice experiment as an alternative to an overnight trip. Excluding the day-trip alternative would be omitting a prominent option available for tourists in this region. Thus, the three trip alternatives may be viewed as 'gateway only', 'day-trip beyond the gateway' and 'at least one overnight stay beyond the gateway'.

### 4.2. Travel mode alternatives

Several alternative modes of transport can be used by tourists to realise the trips mentioned above. Included are rental vehicles,

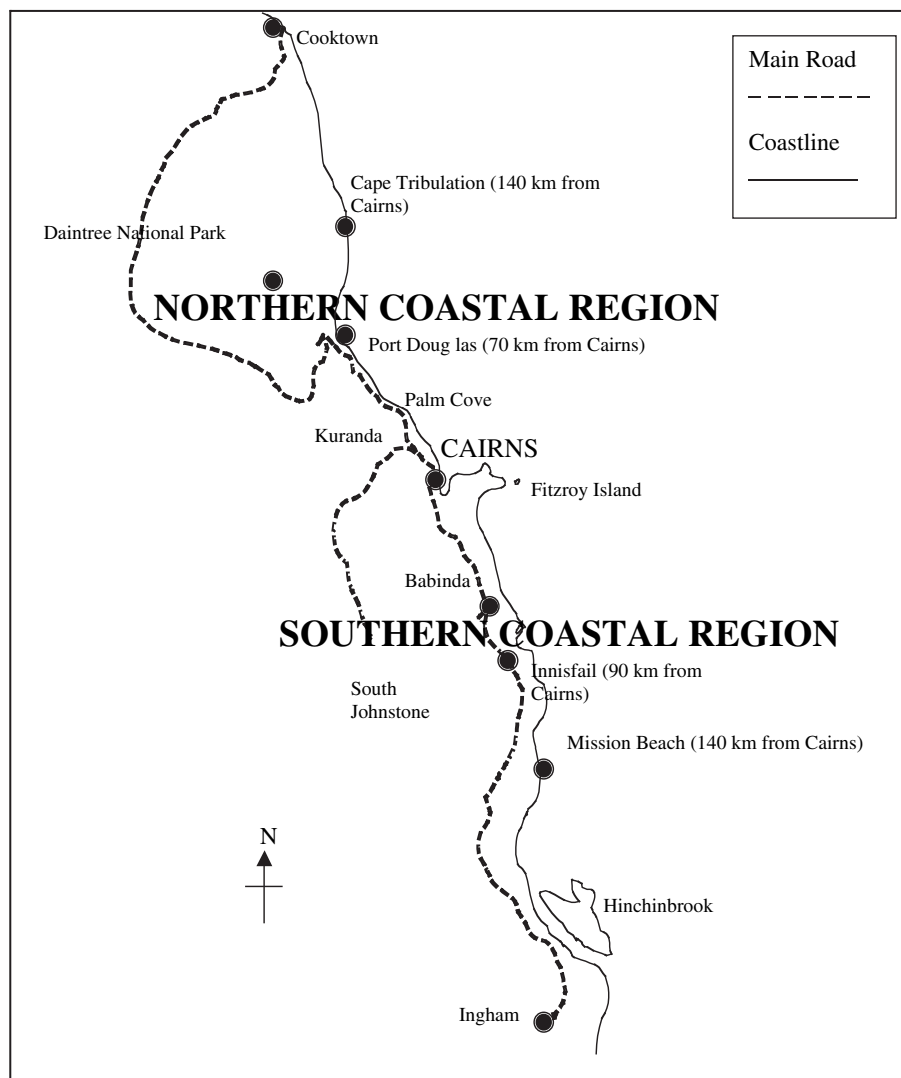


Fig. 2. Map of Cairns and its surrounding regions.

taxis, tour shuttles or four wheeled-drive operators, rail services, as well as non-motorised travel modes. Information available from internet travel sites for the region list the most popular forms of travel to be a self-drive by hiring a rental car or touring through a tour operator. Public transport (e.g. Sunbus) is currently available within town centres and suburbia, as well as on selected inter-regional routes. Other services such as Skyrail and boats also provide transport for tourists, although they are more limited to specific locations and tour activities, such as rainforest tours and tours of certain islands in the Great Barrier Reef.

Three salient travel mode alternatives were identified. They were rental cars, which provide a maximum 'degree of freedom', public bus, and small-group tours. 'Small-group tours' can be perceived as offering a level of flexibility and privacy that may be perceived between that of a car and public bus. For instance, small group tours offer a less 'public', and hence more personal experience than public transport, in addition to decreased responsibility in managing the transport than is involved in using a car.

We have introduced three trip types (an overnight trip, a day-trip and a Cairns-only trip) and three travel modes (rental car, public bus and a small group tour). For this research, we formed alternatives by combining trip types with travel modes. From these combinations, we chose six alternatives which seemed most relevant for the study region. Each of these alternatives can be specified as  $V_{ni}$  shown in Eq. (2). The alternatives are:

- An overnight trip beyond Cairns using a rental car (denoted RCD);
- A day-trip beyond Cairns using a rental car (denoted RCB);
- An overnight trip beyond Cairns via public bus (denoted PBD);
- A day-trip beyond Cairns via public bus (denoted PBB);
- A day-trip beyond Cairns with a small group tour operator (denoted Tour);
- A stay in Cairns only (denoted Gateway).

## 5. The explanatory variables

### 5.1. Attributes and attribute level labels

Two of the main attributes noted by Lumsdon (2006) were 'en route stopover opportunities' and 'driver knowledge about the destination and friendliness'. These are examined in this paper. A destination expenditure attribute was added as an aggregate measure of the expected spend per day. The attribute level labels used in the stated choice experiment are summarised in Table 1.

**Table 1**  
List of attribute level labels.

Attributes	Attribute level labels
<i>Rental car alternative</i>	
Daily rate (incl. fuel)	\$50, \$100, \$150
One-way 'in-vehicle' travel time	1 h, 2 h, 3 h
Car type	Economy, luxury, 4WD
<i>Public bus alternative</i>	
Price per person	Free, \$40, \$80
One-way 'in-vehicle' travel time	1 h, 2 h, 3 h
Driver attribute	Below expectation, average, above expectation
Sightseeing	Non, 1 or 2 stopovers, more than 2 stopovers
Frequency	Every 1 h, every 2 h, every 3 h
<i>Small group all-inclusive tour</i>	
Price per adult (child)	\$100(\$50), \$150(\$75), \$200(\$100)
One-way 'in-vehicle' travel time	1 h, 2 h, 3 h
<i>Destination expenditure (per night per person)</i>	
Northern destinations	\$120, \$170, \$220
Southern destinations	\$70, \$120, \$170

### 5.1.1. Price

For the rental car alternative, the attribute level labels were based on the daily and five-day rates of the major rental firms. Public bus fares were based on the current inter-regional bus fares (e.g. SunExpress). A 'free' ride attribute level label was added to the experiment to maximise the level of conditioning for this alternative. The ability to analyse the effect of a hypothetical alternative such as the 'free public bus' is one important advantage of the stated choice method. The labelling of price attribute for the tour alternative was based on day-tour information from brochures and websites. All websites were accessed in the first week of August, for prices in the period between 21st and 27th of August, which was the actual survey period in Cairns.

### 5.1.2. In-vehicle travelling time (one-way) and frequency

The attribute level labels for the travel time attribute were based on distance and imputed travel time from Cairns to main destinations in the North and South. This information was available from 'google map'. The attribute labels for frequency were based on the current frequency of regional bus services.

### 5.1.3. Rental vehicle type

Rental vehicle type was included as an attribute. This was considered important because consumers often associate quality with price in their choice (Hensher, Rose, & Greene, 2005). Not including information on the quality of the rental vehicle explicitly may induce tourists to choose a high price alternative because it is associated with higher quality. This carries a risk of measuring the combined effects of price and quality, not only price.

### 5.1.4. 'Tourism variables' for public transport

As mentioned previously, two tourism attributes have been added to the public transport alternative: 'one or two stopovers in special places' and 'driver knowledge and friendliness'.

### 5.1.5. 'Comfort' factors

Anable and Gatersleben (2005) have shown that 'freedom' and 'control' are the affective qualities of cars that travellers emphasise over public transport. In addition, the 'flexibility' and 'convenience' of a car are important variables that explain the popularity of this mode in all travel purposes (e.g. Anable & Gatersleben, 2005). Each of these factors could not be included as part of the experimental design for pragmatic reasons (to contain the size of the experimental design). However, the survey asked the respondents to rate the 'comfort' of travel modes on a Likert scale. This is an imperfect remedy, but it does capture some aspects of the qualitative attributes that may not be so easy to explicate in the experimental design without increasing the size. Similar methods have been used, for instance, by Koppelman and Sethi (2005) in inter-regional mode choice experiment.

### 5.1.6. Expenditure at the destination

More information is provided on this attribute in the next section (5.2 Destination contexts). Here we note that destinations in the South are much more affordable than those in the North. Different levels of expenditure per night per person were specified to reflect this difference.

## 5.2. Destination contexts

A specific aim of this research is to examine how the travel mode choice and trip type for air arrivals' depended on the destination to which they were travelling. Two destination contexts are included in this experiment to account for the effect of differences in destination characteristics. The Tropical North Queensland tourism

region (TNQ) is characterised by its diverse range of attractions. This creates a major challenge for identifying a parsimonious set of destination contexts, as well as for delineating an appropriate 'destination' boundary. This is necessary for the size of the experimental design to remain feasible to apply in practice.

It is commonly cited in traveller information brochures that TNQ offers experiences ranging from the City (Cairns) and beaches, to rainforests and tablelands, and the GBR. The reduction in the number of destination contexts for this study was achieved by considering references to the current pattern of travel. Tourism accommodation establishments, bed-spaces and room number statistics released by the Australian Bureau of Statistics (ABS, 2007) were consulted to identify the key destinations of overnight stays. This identified that most (over 90%) of accommodation establishments were in the Coastal regions (including Cairns with 67%).

Two contrasting geographic regions – the North and South – were delineated from the coastal regions. Local Government Area (LGA) profiles published by Tourism Research Australia (TRA, 2007) were used to achieve this. Douglas was used as the representative LGA in the North, and Johnstone was used as the representative LGA in the South. The LGA profiles show that the Johnstone LGA (south of Cairns) and the Douglas LGA (north of Cairns) are similar in that:

- leisure (holiday or VFR) accounts for a high proportion of travellers to those regions (87% and 91% respectively);
- 'beach' is the main activity that overnight tourists engage in these destinations (53% and 61% respectively);
- a multi-destination travel itinerary is likely to constitute a high proportion of the visitations, probably involving overnight stay(s) in Cairns (44% and 41% of Johnstone and Douglas overnight visitors also stayed overnight elsewhere in their trip, compared to 30% of visitors to Cairns and 11% national average).

These are the strong similarities observed. Key differences are:

- the average spend differs significantly, with per night expenditure of \$92 in Johnstone against \$223 in Douglas, indicating that Johnstone is a more affordable alternative;
- Johnstone has a much higher share of 'caravan parks' as accommodation than Douglas (according to ABS, Johnstone shares 2% of 'hotels, motels and apartments' bed spaces, but 13% of the region's caravan parks. Equivalent figures for Douglas are 20% and 12% respectively);
- the length of stay in Douglas is longer (5.2 nights) than Johnstone (3.8 nights) - the South is relatively less popular in both volume of traffic and in number of nights;
- only 24% of Johnstone visitors are of interstate origin opposed to Douglas' 65%. This reflects the fact that many of the air arrivals (from Sydney, Melbourne), of interstate origin, are less familiar with the South, and that visitation to this region is of a lower priority than the North for these visitors.

Thus, the North and the South were sufficiently different in characteristics to affect the mode choices of the air arrivals. Table 2 summarises the attributes and alternatives included in the choice experiment. As explained in the following section, the 20-attribute experimental design was created for each of the North and South destination context, bringing the total number of attributes to 40.

## 6. Experimental design and data collection

A key issue in the development of an experimental design for choice modelling is whether or not the design should be capable of testing the validity of the independently and identically distributed (IID) error terms. The ability to perform such a test provides a basis for extending the analysis towards more sophisticated models, if the assumption is violated (Louviere, Hensher, & Swait, 2000). Given the choice dimensions of this study, it was appropriate for the experimental design to be non-IID, so that non-IID models could be estimated from the data collected (e.g. nested logit). A sufficient condition for a non-IID design is that all attributes are orthogonal with one another, both within and between alternatives (Louviere et al., 2000). Thus for this study, a design that could accommodate at least 20 orthogonal attribute columns was required (the number of attributes shown in Table 2).

A fractional factorial of  $3^{20}$  was selected. This fractional factorial allows up to 20 orthogonal columns, each with three levels. In the 54 treatment combinations (choice sets), this is an orthogonal main-effects-only plan. Thus, the effects of two-way and higher order interactions are not protected from confounding with the main effects. For instance, the effect of the price of an attribute is independently estimated from the effects of all other attributes. However, there is no guarantee that this effect will be independent from the interaction effect of, say, price and time.

This design was replicated to produce choice scenarios in the context of trips to the Northern regions and another complete set of scenarios in the context of trips to the Southern region. Thus, there are 104 treatment combinations in total (after removing the treatment combinations without any designed trade-offs), and this was blocked into 26 versions to produce four choice scenarios for each respondent. All available alternatives are present in the choice scenarios, and each respondent received two scenarios from each of the North and South destination contexts.

The survey was conducted at the Cairns domestic airport terminal in the period between the 22nd and 27th of August in 2008. The peak period for tourism in Cairns is between April and October, as the other months are part of the wet season. There was a continuous flow of visitors throughout the day, departing to Sydney, Melbourne, Brisbane, Perth and Adelaide. All visitors who regarded themselves as residents of these cities were eligible for an interview provided:

**Table 2**  
Summary of the alternatives and attributes.

Attributes	Alternatives						Number of attributes
	RCD	PBD	RCB	PBB	TOUR	Gateway	
Attributes [Destination expenditure]	Generic across RCD and PBD			Generic across RCB, PBB and TOUR			2
Attributes [Price]	Alternative specific attribute (ASA)						5
Attributes [Travel time]	ASA						5
Attributes [Car type]	ASA						2
Attributes [Sightseeing stopovers]	-			ASA			2
Attributes [Driver characteristics]	-			ASA			2
Attributes [Frequency]	-			ASA			2
Total number of attributes							20



- the purpose of their trip was 'visiting friends and relatives' or for a holiday (or both), and
- they had taken one of Jetstar, Qantas or Virgin Blue flights.

The collection method was 'simple random', in that interviewers approached the travellers in the departure lounge area who took seating on every second row, for instance. The turnover of travellers was high. The final 2 day of data collection focussed on obtaining a more representative sample across demographic groups (age and gender), which represented a stratified random sampling technique. The data collection exercise aimed for eight replications of the entire design, or 208 respondents. After discarding unreliable responses, 196 surveys were judged usable, providing at least seven replications with a total of 784 choice observations. The face-to-face survey helped to assure reliable and informed responses.

While the primary component of the survey was the hypothetical choice scenarios, other trip information was gathered. While most of the questions on the travellers' trip details and personal information were not found intrusive, a question on 'income' was ignored by more than 20% of the respondents. Consequently, this variable was dropped from the models. Included in the results reported in the following section (7. Results) are trip characteristics information on the length of stay and whether or not the respondent has visited Cairns before. This information pertains to the  $\gamma_i$  term in Eq. (2), which was dummy coded.

## 7. Results

### 7.1. Descriptive statistics

The sample collected was slightly skewed towards male (59%). The age group 26–35 represented 31% of the sample. This was partly a consequence of the greater willingness of this age group to participate in the survey. As a benchmark, the National Visitor Survey statistics on Cairns show that the share of the 25–44 age group and the 45–64 age group should be approximately the same (TRA, 2008). The 18–25, 36–45 and 46–55 groups were approximately equally represented with shares between 16 and 20% of the total sample. The 56–65 group accounted for 11%, and the over 65 group represented 4% of the total sample.

All respondents departed Cairns via air transport; however, a small percentage of sampled individuals arrived on modes other than air. These respondents were subsequently removed from the analysis. The following trip characteristics are highlighted:

- 'Rental cars' were used as a main mode of ground transport at the destination for nearly half of the visitors sampled (43%). This was followed by walking (20%), private vehicle (11%), tour company (7%) and public bus (5%). The cases of private vehicles apply to friends' and relatives' vehicles.
- Half of the sample stated 'hotels, motels and apartments' as their main accommodation (51%). This type of accommodation, together with 'resorts', accounted for 80% of all samples' accommodation. 10% indicated friends' and relatives' property.
- 80% of the sample stated 'eating out' as their main form of travel activity, followed by 'walk or drive around' (75%) and 'visiting the rainforest' (56%). This pattern is consistent with the LGA profiles mentioned in 5.2 Destination contexts. Only 47% of the sample stated 'Great Barrier Reef' as one of their travel activity, indicating the diverse range of activities tourists seek from the Cairns and the TNQ region. It would seem from the data that tourists prefer to do things themselves rather than rely on services provided by local tour operators. The high proportion of respondents listing 'walk or drive around' (75%) and 'go to the beach' (58%) compared to the relatively low

incidences of 'day-trips with a tour company' (31%) suggests this.

- Couples represented 46% of the total, while those travelling alone represented 30% and those in groups of three represented 14%. The goal was to obtain one survey per travel group. However, on several occasions 'couples' participated in the survey separately. This was most likely a contributing factor in the inflated sampling of couples. Nonetheless, their stated choice data remains valid in the context of this study.
- For the length of stay, the sample median was 4.5 nights, while the average was 5.4 nights. This is consistent with the 4.8 average nights found in the published sources (e.g. TRA, 2008). For 92% of the sample, the entire trip duration was for less than 11 nights. Finally, 59% of the sample was comprised of repeat travellers, with 41% being first time visitors to Cairns.

The study sample does have limitations. For instance, market segments such as campervans and backpacker segments were not explicitly considered in this study. Furthermore, due to resource constraints, the survey could be carried out over a limited period. While the survey period has been carefully selected (e.g. avoiding special events, etc.), the authors acknowledge that the short survey period imposes some limitations on the findings. In general, the samples collected are more representative of the behaviour of tourists during peak-holiday season than off-peak. While we are unable to assert that the data are statistically representative of the entire visitor population of Cairns, the data collected are demonstrated to be consistent when compared with the best available secondary data of the region.

Fig. 3 shows that the option to 'hire a rental car and take an overnight trip' (41.5%) is the most popular choice, followed by 'staying in Cairns' (25.6%). There appears to be a small market for public transport with a choice share of 13.3% for both overnight and day-trips. The surprising result was regarding 'small-group tours', where little choice preference was indicated. It is possible this reflects the potential cannibalisation of this market by the introduction of tourist oriented public transport alternatives. In aggregate, the distributional patterns are similar in North and South trip contexts, across choice alternatives. However, Public Bus and day-trips are more popular for travel to the South. The authors assert that the tourists' lack of familiarity with the southern destinations compared to the northern destinations is a contributing factor to this. As shown later by the model results, the significance of 'sightseeing' and 'driver's knowledge' attributes for public bus to the South is evidence that supports this view.

### 7.2. Model results

Various model specifications were applied to the collected data. Table 3 below shows the model performance indicators.

The most relevant results for this paper's research aims are highlighted in Tables 4 and 5 below. Some variables were omitted from model specification if they were judged to unnecessarily detract from the key results of this paper. The consequences of omitting these variables from the model are minimised by the fact that multi-collinearity is only a minor issue with stated choice data. Variables shown in Tables 4 and 5 are the full list of variables used in model estimation.

'Cairns only and GBR' trip was taken as the base alternative. The coefficients in Tables 4 and 5 represent the marginal effect of a variable on an alternative's level of utility (see Eq. (2)). For example, the coefficient value of  $-0.74$  on the 'PBD \$80' variable in Table 4 shows that the utility from choosing 'overnight trip beyond Cairns on public bus' decreases by 0.74 units of utility ('utils')

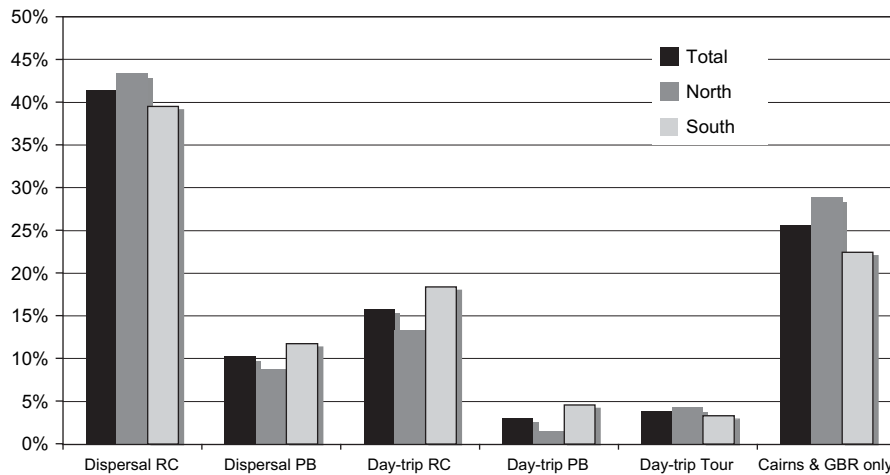


Fig. 3. Sample choice shares.

relative to the base case (which is the ‘stay in Cairns’ option) when the public bus fare to the Northern destinations is \$80.

All designed attributes were effects-coded. For example, from Table 4 the coefficient for the ‘free’ option for PBD should be 0.7, which is obtained by the formula  $\{-PBD\$80 - PBD\$40\}$  or  $\{-(-0.74)-(0.04)\}$ . The actual trip characteristics, which were also collected from the survey, are dummy coded. The base case is shown in brackets; for example, ‘Repeat visit’ (first-time) means that first-time visitors are the base (coded ‘zero’). All coefficients are alternative specific with the exception of ‘Destination expenditure’ coefficients, which are generic within trip structures; for instance, overnight trip alternatives such as RCD and PBD share generic parameters.

Before commencing our discussion of the results, we provide some information about the IIA tests and nested logit models applied. The Hausman-McFadden test was applied in the following way. For models ‘North’ and ‘South’, the two most prominent alternatives (in terms of sample choice shares) were removed from the unrestricted models. Thus, four tests were conducted in total: a restricted model without the ‘rental car overnight alternative’ (one for north and one for south) and a restricted model without the ‘public bus overnight alternative’ (one for north and one for south). The tests revealed that when the rental car ‘overnight’ alternative was removed from the North and the South model, there was insufficient evidence to reject the IIA assumption (Hausman and McFadden statistics of  $-18.4$  and  $-12.53$  respectively). As for the public bus alternative, the North model violated the IIA assumption at the level of 1% significance, whereas the South model did not. Given the small choice shares of public bus alternatives in the sample, it was appropriate that further tests are applied.

The second IIA test applied was the inclusive value (IV) test. Table 6 shows the inclusive value parameters (IV parameters) of the models nested in travel mode, as well as the models nested in trip structure. The nested logit models were specified as per the models that generated the results in Tables 4 and 5. That is, the variables shown in Tables 4 and 5 were the full list of variables specified to

estimate the nested models. The IV parameter estimation results are either statistically insignificant, from 0 or 1, or they exceed the value of 1. The latter case violates the utility maximisation assumption, whereas values of 0 or 1 indicate that the specified nest is not significant statistically (Hensher et al., 2005). In particular, given the incidences of the statistically equivalent value of 1 in

Table 4  
Model output: North.

Trip to the Northern region	
Variables	Coefficient p-value
<b>Constants</b>	
RCD	-0.95**
PBD	-1.83***
RCB	-3.44***
PBB	-2.94***
Tour	-2.17***
<b>Price</b>	
PBD \$80	-0.74**
PBD \$40	0.04
Tour \$200	-0.97**
Tour \$150	0.06
<b>Destination Expenditure</b>	
Overnight trip in the North \$220	-0.45***
Overnight trip in the North \$170	0.19
<b>Driver knowledge and friendliness</b>	
Above expectation (PBD)	0.15
As expected (PBD)	0.11
<b>Sightseeing (number of stopovers)</b>	
More than two stopovers (PBD)	-0.09
One or two stopovers (PBD)	0.08
<b>Repeat visit (base: first time)</b>	
RCD repeat	-0.450**
<b>Comfort</b>	
RCD comfort	0.18***
RCB comfort	0.33***
<b>Length of stay (base: 1–3 nights)</b>	
RCD 4–6 nights	0.19
RCD 7–10 nights	-0.08
RCD 11 or over	0.26
PBD 4–6 nights	0.45**
PBD 7–10 nights	0.02
PBD 11 or over#	-

Asterisk [\*] asymptotic t-test significance at 10%, [\*\*] 5%, [\*\*\*] 1%. [#] indicates empty sample in the cell. The base case is shown in brackets; for instance,  $-0.45$  on ‘RCD repeat’ variable shows that repeat visitors yield negative utility (by 0.45 utility) by choosing ‘overnight trip beyond Cairns on a rental vehicle’. See 4.2 Travel Mode for abbreviations.

Table 3  
Model summary.

	North	South
Adjusted pseudo R <sup>2</sup>	0.26	0.22
Log likelihood (model)	-517.88	-548.89
Constant only LL	-549.18	-595.59
No coefficient LL	-702.37	-702.37

**Table 5**  
Model output: South.

Trip to the Southern region	
Variables	Coefficient
<b>Constants</b>	
RCD	−0.84
PBD	−1.64***
RCB	−1.61**
PBB	−2.13***
Tour	−2.22***
<b>Price</b>	
PBD \$80	−0.39*
PBD \$40	−0.28
PBB \$80	−1.26**
PBB \$40	−0.20
<b>Destination Expenditure</b>	
Overnight trip in the South \$170	−0.25*
Overnight trip in the South \$120	−0.22
Day-trip in the South \$170	−0.54***
Day-trip in the South \$120	−0.08
<b>Driver knowledge and friendliness</b>	
Above expectation (PBD)	0.51**
As expected (PBD)	−0.43
<b>Sightseeing (number of stopovers)</b>	
More than two stopovers	−0.59**
One or two stopovers	0.53**
<b>Repeat visit (base: first time)</b>	
RCD repeat	−0.47**
RCB repeat	−0.90***
<b>Comfort</b>	
RCD comfort	0.16*
RCB comfort	0.15
<b>Length of stay (base: 1–3 nights)</b>	
RCD 4–6 nights	0.34**
RCD 7–10 nights	0.04
RCD 11 or over	0.38**
PBD 4–6 nights	0.64***
PBD 7–10 nights	0.18**
PBD 11 or over	0.25

Asterisk [\*] asymptotic *t*-test significance at 10%, [\*\*] 5%, [\*\*\*] 1%. The base case is shown in brackets; for instance, −0.47 on 'RCD repeat' variable shows that repeat visitors yield negative utility (by 0.47 utility) by choosing 'overnight trip beyond Cairns on a rental vehicle'. See 4.2 Travel Mode for abbreviations.

these models (IVRC and IVPB in the travel mode nest, and IV day-trip in trip structure nest), there is evidence that the nested model collapses to a simple multinomial logit model. This simplifies our modelling task to a multinomial logit.

In the following discussion we concentrate mostly on the overnight trips of tourists and the significant travel mode attributes associated with the overnight trips. Overnight trips typically result in greater expenditures at peripheral destinations due to the extra expenditures that staying overnight entails. Thus overnight trips may be of the most interest to the peripheral destinations. The overnight trips were also the most popular form of choices in the results, as shown by Fig. 3, and consequently were subject to much less of the problems associated with low choice samples.

## 8. Discussion

### 8.1. Dispersal and rental cars: attributes

Tourists were largely unresponsive to price and travel time attributes of rental cars. This result is unexpected because price and time are significant variables in the transportation literature. Given the low relative costs of rental vehicle hire compared to destination expenditures, such results may be expected. Thus, the price of travel mode is not significant but the price of destination is

**Table 6**  
Inclusive value (IV) parameters.

	North	South
<b>Travel mode nest</b>		
IV RC	1.1 **	0.17
IV PB	11.6	1.2 ***
Gateway	1	1
<b>Trip structure nest</b>		
IV overnight	7.5	2.6 **
IV day-trip	1.6 **	1 ***
Gateway	1	1

Asterisk [\*] indicates statistically equal to one at 10%, 5% [\*\*], 1% [\*\*\*] level of significance.

significant (destination expenditure variables). Furthermore, the rental vehicle rate was indicated in the survey as 'per day' cost, whereas the destination expenditure was indicated as 'per person per day'. Perhaps the 'per day' specification resulted in a decreased regard for transport costs, as they could be pooled over a group.

The travel time inelasticity indicates that in the travel time range examined in this paper (one to three hours), an increase in the travelling time is not negatively related to utility. The insignificance of travel time attributes provides evidence supporting the fact that for the air leisure arrivals, travelling time at the destination can be viewed as an integral component of tourists' experience, rather than a 'necessary evil', as may be the case with long-distance air travel or congested journey-to-work trips.

The perceived comfort of the rental vehicle is a strong source of utility (the coefficient indicates a change in one unit in the Likert scale between one and ten). It can be concluded that perceived comfort is one of the most important reasons why car is the most popular form of travel in the model. This supports the Anable and Gatersleben (2005) study that demonstrated the importance of affective factors (such as freedom and control) – the effects of which the variable 'comfort' partly aimed to capture. This finding supports Eaton and Holding (1996) who argued that the popularity of the car cannot be replaced by other modes when it is compared against the same attributes. Rather, they argued, other modes must capitalise on what the private vehicle cannot offer.

### 8.2. Dispersal and rental cars: trip characteristics

Repeat visitors to the region are less likely to choose RCD and RCB, as is indicated by the negative sign. This is the case for both destination contexts. Thus, lowering the price is less likely to entice repeat travellers to choose this option, than it is for first time visitors (or those not familiar with the destination). This result suggests that first time visitors are more likely to use rental cars for dispersal, while repeat visitors are less likely to do so, possibly because their greater destination familiarity enables them to exploit other alternatives. Li, Cheng, Kim, and Petrick (2008) noted that first time visitors are more extensive in their destination exploration, while repeat visitors are more intensive in their use of time across a smaller range of destinations. It has been suggested that "the more familiar the tourist is with the location, the more knowledge one has of different kinds of local activities and attractions to fill an entire trip schedule" (Hwang, Gretzel, & Fesenmaier, 2006, p. 1060), which renders repeat visitors more specific in the activities pursued, but also less likely to explore, diminishing the need for a travel mode that provides this capacity for the visitor.

The estimated utility functions differ for the two destination contexts in two ways. First, the attribute coefficients, such as 'destination expenditure' have less influence on a trip to the South than to the North. Second, the length of stay exerts a significant influence on the choice of RCD<sup>S</sup> but not for RCD<sup>N</sup> (superscript



denoting 'North' or 'South'). This is an interesting finding given that the length of stay is usually positively related to greater dispersal and multi-destination travel ("when time is short, space is conserved" – Fennell, 1996, p. 814). A trip to the South becomes more likely only when there is sufficient time, reflecting the fact that South is less popular and known to the tourists, ranking it as a lower priority to many of the travellers. Importantly, length of stay is mostly pre-determined prior to arrival. This result shows the relative ineffectiveness of destination control variables, e.g. price, on dispersal to the South.

### 8.3. Dispersal and public transport: attributes

Results show significant differences in the factors that determine PBD<sup>N</sup> compared to PBD<sup>S</sup>. A key finding is that a choice of PBD<sup>N</sup> or PBD<sup>S</sup> is associated with a different responsiveness to different public transport attributes. The PBD<sup>S</sup> alternative is determined by the qualitative attributes of public bus, as well as price, whereas only price matters for the choice of PBD<sup>N</sup>. A high level of 'driver knowledge and friendliness' and '1 or 2 stopovers for sightseeing' are qualitative features of public bus design that may contribute to a decision to utilize a public bus service, but only for trips to the South region.

Market share simulation based on Table 5 results shows that the PBD<sup>S</sup> alternative will gain 5.4% market share if the bus service included one or two stopovers for sightseeing. Compared to that, more than two stopovers will result in a 5% loss. This suggests that tourists travelling to Southern destinations prefer to have some opportunities for sightseeing en route, but not more than two. Based on the market share simulation of the model in Table 5 we found that when the public bus has 'above expectation levels of driver knowledge and friendliness', 'one or two stopovers for sightseeing' and costs \$80, the PBD<sup>S</sup> alternative's market share will change very little (–0.16%) compared to the sample choice shares. This indicates that the public bus provider can charge up to \$80 per person without losing much market share to other alternatives, as long as the service is of high quality.

The differences in the utility functions of alternatives between destination contexts can be attributed to two factors. First is the relatively unknown status of the South as a destination compared with the North. Qualitative attributes of the public transport services are important for tourists with little familiarity and knowledge of the destination. The second factor refers to market segments. Lumsdon (2006) described two market segments for public bus services: 'sightseeing' and 'activity seekers'. The study argued that the latter group is much less concerned with the 'transport as tourism' aspect of the trips. This group will use the bus purely as a vehicle to get from origin to destination in pursuit of their sought activities. The significant utility gained from the qualitative attributes indicates that sightseeing tourists may be the primary source of demand for travel to the South. In turn, the South may generate demand of sightseeing tourists because it is an unfamiliar destination.

### 8.4. Dispersal and public transport: trip characteristics

Similar to the RCD<sup>N</sup> and RCD<sup>S</sup> alternatives, the PBD<sup>S</sup> and PBD<sup>N</sup> alternatives also differ, in that trip characteristics exert significant influence on the choice of travel to the South region. Travel decisions among trips to the South depend on the length of stay. It was shown previously that this is not the case for the North. This reflects the fact that the Northern region is a prime attractor of tourists to Cairns and the TNQ. For many of the well-known regions, the effect of length of stay may not be important. It is possible that this is because well-known regions are often the main destination for the

trip. However, for a relatively unknown periphery, the length of stay is an important determinant. This is not surprising, because the Southern destinations are less known, and will be lower on the priority list of tourists. It is only once the utility from visiting the primary destinations has been fulfilled that less known destinations are likely to be considered. One implication is that the trend of short and frequent breaks will not contribute to dispersal into the peripheral destinations. This has important ramifications for the dispersal of LCC-induced tourists, as LCCs have been associated with the stimulation of short and frequent breaks (e.g. Mason, 2005).

## 9. Conclusion

The aims of this paper were to examine leisure tourists' travel mode choice for dispersal, and the significance of destination contexts in moderating these choices. The use of stated choice data, and the application of choice modelling is particularly useful for delineating these issues, due to its ability to provide the *ceteris paribus* effects of attributes (even for hypothetical attributes) and trip characteristics on choice. For those choosing rental cars, perceived 'comfort' is the primary source of utility for using this mode for dispersal. Thus, the quantitative attributes such as price and time are relatively ineffective in contrast to the subjective and more qualitative elements.

As expected, there was a strong relationship between cars and dispersal. This relationship was evident in both destination contexts. Destination context (whether a trip is to the South or North of Cairns), however, changed the relationship between dispersal and public transport markedly. The clear difference was that travel to the Northern region was related to functional elements such as the price of the public bus alternative, whereas travel to the South emphasised qualitative attributes such as adequate 'stopovers for sightseeing' and 'driver knowledge and friendliness'. It was argued that the difference came about because tourists were generally less familiar with the Southern destinations. Another significant finding was the importance of length of stay in influencing dispersal to Southern destinations. Length of stay was a constraint that tended to reduce the propensity of air arrivals in Cairns to disperse to Southern destinations. Hence, ground transport is less effective in promoting dispersal of the air arrivals to the South, as length of stay is in many instances pre-determined before arrival.

This paper has shown that the dispersal of air leisure arrivals can be facilitated and stimulated by public transport. However, it was highlighted that the design of tourism public transport should be responsive to the destinations to which the bus is to be deployed. Although the data examined in this paper was collected in the Tropical Northern part of Australia, this research should be of relevance to many regions interested in understanding the relationship between destination transport and the dispersal of air leisure arrivals from gateways to surrounding destinations in the periphery, as many regions have experienced vast growth in the air leisure arrivals in recent years due to the advent of low-cost carriers.

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