A TRAVEL COST MODEL OF LOCAL RESIDENT's BEACH RECREATION VALUES ON THE GOLD COAST

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Down to the shore we go to have some fun, embrace nature and relax. (Anon.)

Abstract: The beach is generally recognised as the most important recreation amenity in the region for Gold Coast residents, as well as tourists. However, there is very little data to support the role that this amenity plays in the life of over 500,000 (ABS 2011) Gold Coast residents. This paper reports the results of a survey that set out to collect data from Gold Coast residents regarding their beach use and the values they associate with the beach, and to develop estimates of the economic value of the beach to residents. A mail survey of 8,000 households resulted in 1,862 responses. Over 80 per cent of respondents indicated that the beach, parks and foreshore were important to them. On average, residents visited 10 beaches per month during summer and 6 per month during winter, taking a total of 35 million visits to local beaches and foreshores parks each year. We used the individual travel cost method and limited dependent variable regression techniques to estimate the value of, and explain, resident visits to beaches. Travel costs were found to be significant in explaining visits. Females, people on higher incomes, home owners and full time employees take fewer visits to beaches while larger households take more. We also found that visits to multiple sites were compliments rather than substitutes. The value of recreational benefits to Gold Coast residents was found to be between $365 million and $1.7 billion depending on whether fuel costs alone or full travel costs, including time, are used in the model. These estimates are invaluable to decision makers in resolving pressing policy issues such as adaptation options to climate change or budget allocations in maintaining beach services. Limitations and future areas for research are outlined in the paper.

Key words: Beaches, foreshores, benefits, travel cost method.

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Introduction

Beaches and foreshores provide an array of goods and services to coastal communities. For example, beaches on the Gold Coast in Australia are important tourist destinations and recreational places both for locals and day visitors. Annual visits for tourists and residents are in the order of 42 million for the Gold Coast. In many cases, beach visits are in excess of those of other outdoor recreation sites such as National Parks (Blackwell, 2007). In addition to their tourist and recreational benefit, beaches are also assets for some individuals who may use them rarely for recreation: those who want to live close to their beaches or retire near them; many of whom may be chasing a dream! Because beaches are important to residents and tourists alike, governments spend money to ensure their conservation.

Even though governments spend money to ensure their conservation, without estimates of the recreation value that beaches provide, governments will be misguided in the application of funds for this purpose. For example; *What are the best options in addressing the adverse impacts of climate change sea level rise; where should the funds be sourced, and how much should be spent?* This type of research is therefore invaluable for answering such questions and improving the allocation of limited public resources in what is a highly contested environment.

Given this background, this paper provides first time estimates of the recreational value of beaches on the Gold Coast. Previous studies have been conducted to estimate various measures of parts of the total economic value of Gold Coast's beaches, but none have been specifically undertaken to estimate the economic value of recreation using the travel cost method. Ours is the first in this regard.

For example, Smith and Piggot (1989) estimated the value of the Gold Coast's beaches in 1985 at $24m with a capitalised value of $160m using the discounted value of beach users' time on-site. These values were used to compare with expenditure on beaches and returns were shown to be substantial. Regardless, some people may argue against this type of methodology and instead we use the travel cost method, a trusted and well used method for estimating the economic benefits of outdoor recreation (e.g. Clawson and Knetsch 1966).

Another example is where the Queensland Government (1972) commissioned Maitra and Walker (1972) to assess the loss in tourism expenditure resulting from the severe erosion that occurred on the Gold Coast beaches at the end of the 1960's. In corollary, the benefits of maintaining tourism expenditures from 1972 to 1982 were estimated to be $227m in 1972 dollars. Despite these substantial values, the case did not receive support from the Commonwealth. Instead of benefits based on expenditure, surplus measures (e.g. recreational benefits) and environmental benefits may provide a more compelling case for public funding from the Commonwealth, should it be required in the future. Our paper provides such measures.

More recently, Raybould and Mules (1998) undertook a cost benefit analysis of the Gold Coast's proposed northern beach protection program and found the benefits exceeded costs by 60 to one with a net present value (NPV) of $475m at a discount rate of eight per cent. In their study they included tourism benefits from protection from erosion events. They also included estimates of the prevention of lost assets from fencing and vegetation to roads, parking and paths. Again, our estimates here differ, being surplus and not expenditure measures.

The first identifiable travel cost study of beach recreation in Australia was conducted by Kinhill Stearns and Riedel and Byrne (1983) but their study used the zonal approach which lacks the ability to test the statistical reliability of the model. With the advent of computers in the last century, the individual travel cost model is able to provide this test and this is the model we use.

Blackwell (2007) estimated the economic value of recreation at Mooloolaba beach on the Sunshine Coast, Queensland, using the individual travel cost method and limited dependent regression techniques. Using the preferred truncated negative binomial functional form, he estimated the recreation benefits per annum in 1999-2000 dollars to be $862 million for his overall sample of residents and visitors, $152 million for residents, and $205 million for visitors. He found his results to be comparable with the range of values provided for beach recreation in the international literature and greater than those provided by national parks or forests.

Other examples across Australia include studies that value recreation and protection of upland property to inform policy and funding options for beach replenishment work and conservation. For example, Anning, Dominey-Howes, and Withycombe, (2009) used the travel cost method, among others, to value climate change impacts on Sydney beaches to inform coastal management decisions. Anning *et al.* (2011), as presented at this conference, estimated consumer surplus values per person-visit for residents and tourists of Collaroy-Narrabeen and Manly Ocean beaches. They obtained 2008 dollar values of between about $2 and $30 and $7 and $20 respectively, depending on the costs included in the model.

AECOM (2010) assumed a 40% increase factor on the gross value added to businesses to account for the non-traded value from beach replenishment works at Sydney's beaches. They did not include benefits obtained using methods such as ours – non-market valuation – and their measures are based on values provided to the market.

Burgan prepared a range of economic values for beaches near Adelaide in South Australia, a main component of which relies on the values determined by Kinhill Stearns and Riedel and Byrne (1983).

PWC (2003) transferred values from Read Sturgess (1999) which was a travel cost study of the economic value of Victoria's Parks, including piers, coastal parks and terrestrial parks but not beaches *per se*. For this reason we question the validity of the use of these studies, especially given that values per trip and visitor numbers for beaches differ from national parks (Blackwell 2007).

Pitt (1992) also undertook a travel cost study of the value of coastal land using a travel cost study. Again, this study uses the zonal travel cost method and suffers from the inability to be statistically tested.

Lastly, Hundloe, MacDonald and Blamey (1990) undertook a study of recreational trips to Fraser Island. The Island offers an array of recreational and tourism opportunities, being Australia's largest sand island, part of which includes beach visits. These visits however, differ considerably to those to urban beach environments, such as those on the Gold Coast. The authors also used a zonal travel cost model, dissimilar to our individual travel cost study.

In this paper we provide a range of estimates of the benefits provided to society from beach recreation measured through consumer surplus – the maximum amount people are willing to pay (WTP) for these services less the price paid for these services. Beach access for recreation is free on the Gold Coast and therefore WTP measures consumer surplus.

The remainder of the paper is set out with materials and methods, results, discussion, including limitations and areas for future research, and conclusion sections.

Materials and Methods

We used the individual travel cost method to analyse the data collected by Raybould and Lazarow (2009) for Gold Coast beaches as depicted in the results section below. Raybould and Lazarow (2009) used a mail survey of 8,000 Gold Coast households, resulting in 1,862 responses. The methods used to collect the dataset are outlined by Raybould and Lazarow (2009). A number of practical adjustments were made to the Raybould and Lazarow (2009) dataset and some limitations to our approach remain:

- Australian Bureau of Statistics (2011), National Regional Profile data for individual wage and salary income from 2008 were married with the postcode provided by respondents using the AusPost (2011) postcode locator. Wage and salary income does provide some indication of the general capacity to pay of the individual based on the locality in which they live. These wage and salary estimates were also used in estimating the value of respondent’s time from the Gold Coast sample.
- No adjustment has been made of travel costs in the Gold Coast data to account for the value of a beach visit *per se*, separate from the whole trip experience of respondents (Bateman, 1993).
- No inclusion of time spent onsite to calculate the cost of being onsite, because a question of this nature was not included in the survey instrument.
- The requirement to assume that party size was one where it was not stated by respondent.
- The requirement to delete a number of observations for non-users, to allow for truncated regression and endogenous stratification correction techniques to be used (Shaw 1988), and missing data across a number of explanatory variables.

  This resulted in the final sample size being reduced to 1324.

Table 1: Regression variables used for Gold Coast data

Variable name	*Description*	*Measurement for subsequent component*
Dependent		
VISITSPY	Respondent's annual quantity of day visits to the site	Whole, positive number
Explanatory		
COMVIS	Respondents annual quantity of day visits to next favourite beach site	Whole, positive number
TTSCMIN	Per person fuel costs of travel to the site including return (distance * $/km/party size * 2 (return trip)[a)]	$, AUD per person per trip
TTSCTIM	Per person money expenditure of travel (distance * $/km/party size * 2 (return trip)[b] **)** + travel time cost (travel time * 0.4 of individual's wage rate)	$, AUD per person per trip
PARTSIZE	Size of respondent's car party	Whole, positive number
FEM	Whether respondents was female or not	1 = yes 0 = no
AGE	Age of respondent	Midpoint of ranges in years
INC	Individual salary and wage income from Statistical Local Area of respondent via their post code	$, AUD 2007-08
HHSIZE	Total number of people in respondent's household	Whole, positive number
OWNER	Whether respondent owns their home or not	1 = yes 0 = no
EMPDUM	Whether respondent is a full time employee or not	1 = yes 0 = no

Notes and Sources: a. Fuel costs based on medium sized car, 2.4L at $0.1449/km from RACQ (2008); **b.** Running costs based on Ordinary Cars, up to 1600cc, $0.58/km (smallest amount) as allowed by the Australian Taxation Office 2007/08 financial year (RACQ, 2008; confirmed ATO, 2008, p. 46).

Table 1 provides a description and any necessary calculations of the variables used in the regression analysis of the data. These explanatory variables were chosen based on their expected relationship with explaining visits taken by beach users on an annual basis (VISITSPY).

Results

In order to obtain reliable estimates of the benefits of beach recreation using the travel cost method, it is necessary to first obtain a statistically significant and correctly signed relationship between travel costs and number of visits undertaken by respondents. Further, a sound model for explaining visits is also necessary to control for factors other than travel cost.

Table 3 Regression results of survey data from Gold Coast residents, TCMIN and TCTIM

	TCMIN			*TCTIM*		
Variable	*Ordinary Least Squares (OLS)*	*Truncated Poisson (TP)*	*Truncated Negative Binomial (TNB)*	*OLS*	*TP*	*TNB*
Constant	71.56	4.96*	5.53*	57.54	4.76*	5.45*
	(1.18)	(57.86)	(10.60)	(0.94)	(55.09)	(10.47)
COMVIS	0.9777*	0.0029*	0.0070*	0.9759*	0.0029*	0.0070*
	(32.39)	(210.6)	(23.99)	(32.41)	(212.4)	(23.97)
TCMIN or	-8.34*	-0.1434*	-0.0958*	-1.74*	-0.0303*	-0.0204*
TCTIM	(-5.20)	(-55.17)	(-9.77)	(-5.78)	(-62.4)	(-12.88)
PARTSIZE	-14.64*	-0.2381*	-0.1990*	-13.63*	-0.2195*	-0.1892*
	(-6.63)	(-73.58)	(-10.22)	(-6.33)	(-69.0)	(-9.81)
FEM	-5.53	-0.1647*	-0.0846**	-5.57	-0.1669*	-0.0835**
	(-1.17)	(-26.79)	(-2.15)	(-1.18)	(-27.14)	(-2.13)
AGE	1.18	0.0261*	0.017	1.19	0.0266*	0.0166
	(1.11)	(18.05)	(1.58)	(1.12)	(18.37)	(1.54)
AGESQ	-0.01	-0.0003	-0.0002	-0.01	-0.0003*	-0.0002
	(-1.21)	(-18.81)	(-1.82)	(-1.19)	(-18.80)	(-1.74)
INC	-0.00009	-0.00001*	-0.00003*	0.0003	-0.000006*	-0.00003**
	(-0.06)	(-5.88)	(-2.75)	(0.24)	(-2.91)	(-2.48)
HHSIZE	2.75	0.0549*	0.0347**	2.64	0.0525*	0.0339**
	(1.38)	(21.03)	(2.30)	(1.33)	(20.16)	(2.23)
OWNER	-10.00	-0.1717*	-0.1315**	-10.43	-0.1787*	-0.1036**
	(-1.44)	(-19.87)	(-2.08)	(-1.50)	(-20.65)	(-2.04)
EMPDUM	-2.58	-0.0864*	-0.1011**	-2.85	-0.0919*	-0.1036**
	(-0.50)	(-12.44)	(-1.99)	(-0.55)	(-13.24)	(-2.04)
α	-	-	0.5821*	-	-	0.5766*
			(24.86)			(24.95)
Chi squared	-	43243*	67969*	-	44186*	67040*
Log Likelihood	-7680.7	-40921	-6936.4	-7677.5	-40450	-6929.6
Adj. R^2	0.4901	-	-	0.4925	-	-
F	128.2*	-	-	129.4*	-	-
N	1324	1324	1324	1324	1324	1324

Notes: t-value or equivalent in brackets. Significance level:* = 1%, ** = 5%.

Table 3 presents the results of the travel cost models from the survey data of residents. TCMIN is the travel cost model in which only fuel costs are considered, while TCTIM is the model where total costs of running a vehicle allowable by the Taxation office plus travel time costs are included. These models were chosen from a possible array to provide lower and upper bound values of consumer surpluses and because time in modern life is a scarce commodity.

The results of three functional forms, ordinary least squares (OLS), truncated Poisson (TP), and truncated negative binomial (TNB) are presented in the table. In the case of overdispersion, the TNB functional form is preferred (refer to Blackwell, 2007). The dispersion co-efficient in the TP model, α, is both positive and significant. The TNB model has the added advantage of dealing with truncation and sample selection bias[2] (Shaw, 1988).

The results in Table 3 provide the following insights:

- The TNB regressions for residents have the highest log likelihood and as expected are therefore the preferred models.
- The most important coefficients in these regressions for gaining consumer surplus measures are those for travel costs. In all models, the travel cost coefficients have a negative sign which is to be expected, and are significant at least at the one per cent level. The negative sign is expected because as the costs of travel to the site increase, one is expected to take fewer trips per annum, *ceteris paribus* (given a fixed level of income).
- The more visits a person takes to their favourite beach, the more likely they are to take visits to a complimentary beach. This positive relationship is significant across all models and functional forms.
- The larger a respondent's travel party size the less likely is she or he to take a beach visit. Coordinating larger group sizes can be difficult. This result is significant across all models and functional forms.
- Females take fewer visits to beaches. People on higher incomes take fewer visits. Larger households take more visits. Owners of homes and full time employees take fewer visits. These results are significant in the TP and TNB functional forms.

Benefits of beach recreation

Table 4 outlines the estimated benefits (consumer surplus) per person-visit using the travel cost-coefficients for TCMIN and TCTIM from Table 4.

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[2] The Gold Coast data were collected via mail-out to residents which, therefore, include both users and non-users of beaches. For practical reasons, non-users were excluded from the Gold Coast sample data of Raybould and Lazarow (2009). Areas for further research include to: (1) compare the results obtained in this paper with those where the observations include non-users, that is, people who don't visit the Gold Coast beaches; and (2) to investigate whether mixed mode data collection strategies elicit significantly different users, patterns and user preferences.

Table 4: Consumer surplus for beach recreation for Gold Coast residents, per person-visit, $2008

Variable	OLS	TP	TNB
TCMIN	4.28	6.97	10.44
TCTIM	20.35	33.00	49.02

Notes: All consumer surplus measures were estimated from statistically significant variables.

These per person-visit benefits presented in Table 4 can then be aggregated across user populations in order to estimate the total value of beach recreation at the Gold Coast for residents. Table 5 outlines these total benefits by multiplying the per person-visit estimates in Table 4 by annual beach visitation estimates for residents. The person-visits for residents had already been separately calculated for the Gold Coast in Raybould and Lazarow (2009). These were adjusted for non-users (13%) to gain 35,000,000 person-visits for residents. We also found that on average, residents visited 10 beaches per month during summer and 6 per month during winter. Over 80 per cent of respondents indicated that the beach, parks and foreshore were important to them.

Table 5: Total consumer surplus ($2008 millions) per annum for resident beach recreation.

	Variable	Gold Coast [a]	
Functional form		TP	TNB
Consumer Surplus	TCMIN	244	365
	TCTIM	1,155	1,716

Notes and sources: OLS estimates have been removed. a. Resident person-visits (2007) calculated from Raybould and Lazarow (2009, pp. 21) with adjustment for 13% of non-users.

Discussion

The estimates in Table 5 are significant. For example, the upper estimate of the value of beach recreation to residents on the Gold Coast is $1.7 billion (AUD), comparable to eleven per cent of gross regional product. This value includes the cost of time spent in travel in addition to car running costs and uses the preferred truncated negative binomial functional form for explaining visits to the beach. Where only fuel costs are included in travel, the lower estimate is 365 million dollars (AUD), about one fifth of that estimated using the opportunity costs of travel time and the full costs of running a car.[3] Where the truncated Poisson estimates are used, the benefits are less but these are troubled by bias from overdispersion as discussed previously.

[3] This benefit is comparable to about two and a half per cent of regional product.

Limitations and areas for future research

The benefits presented here include only passive use recreation. These are only part of the total economic benefits delivered to society from the services that beaches and their management provide. There are also other indirect use-related benefits, such as protection of property and access areas for marine related tourism (e.g. boating, fishing, paragliding, flyovers etc.) and option value (having the option to use a beach, while not currently visiting, may provide value to tourists and residents). Beaches and their management also provide benefits to non-users through their existence (knowing a beach exists rather without any intended use), bequest (providing a beach for future generations to enjoy), and vicarious value (seeing healthy beaches in various media, film, art etc.). Beaches and their management also provide a key ingredient to the social and ecological fabric of regions, the benefits of which can be categorised as above into use and non-use components. *Overall, the actual benefits to society from beaches and their management are likely to be greater than what has been presented here*. Thus, an area for future research is to estimate the magnitude of non-use values associated with beaches in Australia which are expected to be significant compared to those from passive use recreation (Blackwell, 2007).

The recreational value here may also not include the full extent of benefits provided by the services delivered by service providers. For example, we have not included any values for the benefits that safe bathing facilities services provide beyond recreation. While estimates of the benefits for safe bathing facilities in Australia exist (e.g. Allen Consulting Group, 2005[4]; Blackwell and Tisdell, 2010), these need to be separated and aggregated for the beaches to provide a refined measure of the full extent of benefits provided by beaches and their management. Similar arguments can be made for other services such as beach cleaning.

Further, there is a requirement to better understand the interaction between service categories provided on beaches and how these affect their own category benefits and those benefits of other categories. For example, while beach cleaning may improve some recreation values, the associated removal of wrack and other items reduces the non-use values associated with ecological components of the beach. Similarly, beach

[4] Surf Lifesaving Australia is due to release an updated version of this report.

replenishment may improve property protection and values; however, it can be detrimental to the quality and extent of certain types of beach recreation[5][6].

Lastly, we believe the inclusion of travel time, in estimating consumer surplus for the Gold and Sunshine coast councils is also in need of further analysis. While we are certain time plays an important role in human decision making, including visits to beaches, we need to be aware of its large impact when included in benefit estimates.

Conclusion

Beaches and foreshores provide significant benefits to the residents of the Gold Coast. The estimates provided in this paper ensure (1) decision makers have the necessary information to resolve a number of pressing public policy issues and, by doing so, (2) should enable authorities to improve the allocation of limited public resources in a contested environment. These estimates are, for example, required to inform the choice of coastal adaptation options in the face of climate change and in allocating budgets for beach protection works by various levels of government. These estimates also open the door for a number of further endeavours for research such as: 'What are the non-use values of beaches on the Gold Coast and how do these compare to the passive recreational use values presented in this paper?'

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[5] The reader is referred to the Gold Coast City Council Shoreline Management Plan (Lazarow *et al.* 2008) for more information on both of these examples.

[6] In addition, a better educated and connected community may 'tread more lightly' on its beaches, making the asset last longer and able to better withstand climate change impacts. Community education and connection helps grow an attachment to place that can often diminish when natural resources are diminished or lost.

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