Spatial and Temporal Dimensions to the Value of Recreational Fishing

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8-14-2018

Introduction

- The United States has seen considerable increase in time allocated towards leisure in general (Aguiar & Hurst, 2007)
- Pergams and Zaradic (2008) evaluated various forms of nature recreation (e.g., fishing, camping, backpacking) related to park visitation in the United States, Japan, and Spain and find a decline the majority of the categories, and thus diagnosed **"a fundamental and pervasive shift away from nature-based recreation."**
- Marine recreational fishing alone produced $63.4 billion in spending and accounted for 61 million recreational trips in 2015 (NMFS 2015) as a whole (BEA 2018).

Motivation

- Many studies make generalizations about nature-oriented recreation trends from data collected for a specific region over a narrow time window
- Often, benefit transfer applications are pulled from multiple studies where different methods and assumptions are used
- My study takes advantage of the very large and detailed fishing intercept data compiled by the Marine Recreation Information Program division of NOAA to execute a travel cost model that is disaggregated across time and space
- This allows for more meaningful comparisons across seasons and regions

Research Questions

1. Create a data set of values over space and time
2. Evaluate Krutila's Conjecture
3. Assess the bias that is introduced via temporal or spatial limitations in environmental valuation literature

MRIP Data

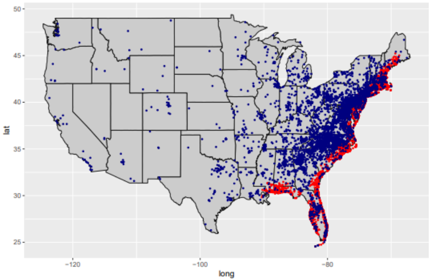
- Data obtained for two month segments (wave) from 2004-2016
- Weights are provided for each site
- From this data, I know the origin (zip code) and site choice
- I merge American Community Survey data via zip code

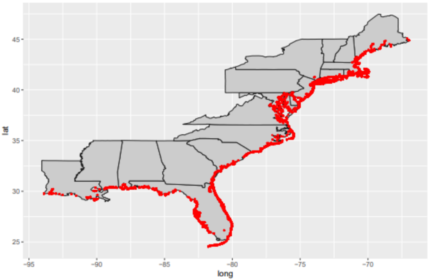
Wave-Month Correspondence

wave	**period represented**
1	January-February
2	March-April
3	May-June
4	July-August
5	September-October
6	November-December

MRIP Data

- 2,475 shoreline sites are identified in the choice set (shown below)
- Below is an example of all anglers intercepted in 2015 (red denotes travel distance of $<$100 miles)





Data

Summary Statistics for Anglers

Statistic	N	Mean	St. Dev.	Min	Max
catch	1,174,632	0.895	0.306	0	1
population	1,196,456	25,427	16,465.2	22	114,982
pop_density	1,196,456	48.332	63.880	0.009	3,911.405
median_age	1,196,456	40.299	6.469	7.900	79.500
avg_HH_size	1,196,452	2.558	0.304	1.090	4.920
avg_HH_inc	1,196,456	76,033.6	27,538.1	10,727.0	850,402.1
avg_commute_time	1,194,184	25.541	5.400	3	74
percent_white	1,196,456	77.469	18.706	0.000	100.000
HH_atleastone_child	1,196,456	0.317	0.083	0.000	0.944
percent_married	1,196,456	0.508	0.096	0.000	1.000
percent_HS_grad	1,196,456	0.302	0.082	0.000	1.000
percent_college_grad	1,196,456	0.174	0.077	0.000	0.651
employ_rate	1,196,444	91.070	3.684	15.254	100.000
mi_to_airport	1,196,456	20.1	14.9	0.1	131.1

Travel Cost

- Travel distances, tolls, and times are collected via PC*Miler
- Bureau of Transportation Statistics data is used for Fuel Efficiency, AAA data is used for per-mile wear and tear costs, and finally Energy Information Administration data is used for state level gas price data
- DB1B data is used for flight prices, SABRE data is used for flight times, and OAG data is used for layover times
- The opportunity cost of time is derived using the travel cost literature standard of $\frac{1}{3}$ of the wage rate (Cesario 1976)

Cost of Driving

- The driving cost was calculated as a function of the driving distance (d_{ij}), driving time (t_{ij}), the opportunity cost of time (p_i), hotel nights required (h_{ij}), cost of tolls (f_{ij}), and party size (n), as follows:

$$C_{ij}^{D} = \frac{p_d d_{ij} + p_h h_{ij} + f_{ij}}{n} + p_i t_{ij}$$

Cost of Flying

- The flying cost was estimated using an algorithm that found the four nearest airports to each origin and destination and determined the lowest cost option
- Each individual is assumed to have 1) driven to the matched airports 2) paid parking costs 3) acquired a rental car 4) paid a $50 baggage fee for airlines other than JetBlue and Southwest
- Opportunity cost is computed for total driving time, time spent in the airport, and flight time
- the 30th percentile for flight fares were used in effort to identify a typical non-business fare

Estimated Travel Cost

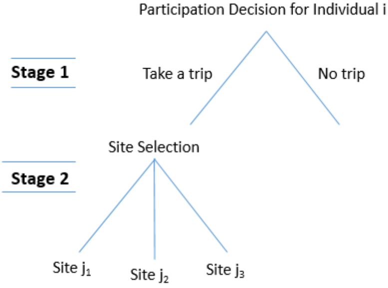
- The probability of flying is modeled as a function of distance using data from English et al. 2018 ▸ Probability Table

$$C_{ij} = (1 - p_{ij})C_{ij}^{D} + p_{ij}C_{ij}^{F}$$

where C_{ij}^{D} is the cost of driving from origin i to destination j and C_{ij}^{F} denotes the corresponding flying cost.

Methodology

- I estimate a repeated discrete choice model of participation and site choice
- I use a two-stage nested logit framework to decompose the participation decision into two nests



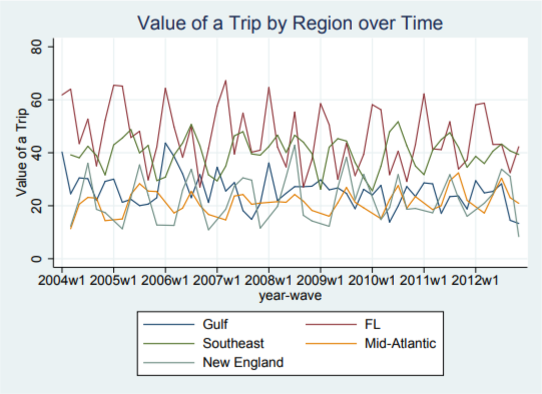
Empirical Implementation

$$V_{ij} = \begin{cases} \delta \times Z_{it}, & \text{no trip} \\ ASC_{jt} + \beta \times C_{ijt}, & \text{trip to site j} \end{cases}$$

Z_{it}: vector of demographics
ASC_{jt}: Alternative Specific Constants
C_{ij}: Round trip travel cost from origin i to destination j

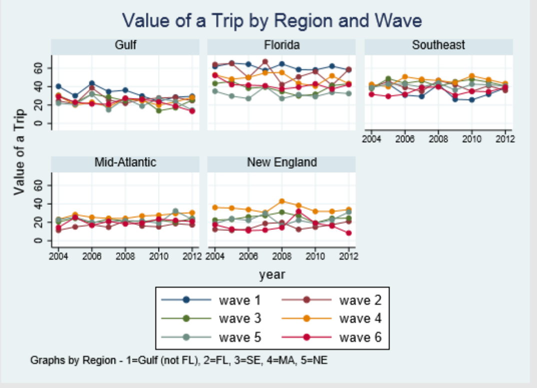
- The coefficient of interest is β, and $\frac{1}{\beta}$ estimates the value of a trip (VOT)

Results



Value of a Trip by Region over Time
Value of a Trip
0
20
40
60
80
2004w1
2005w1
2006w1
2007w1
2008w1
2009w1
2010w1
2011w1
2012w1
year-wave
Gulf
FL
Southeast
Mid-Atlantic
New England

Results



Value of a Trip by Region and Wave
Gulf
Florida
Southeast
Mid-Atlantic
New England
Value of a Trip
0
20
40
60
2004
2006
2008
2010
2012
year
wave 1
wave 2
wave 3
wave 4
wave 5
wave 6
Graphs by Region - 1=Gulf (not FL), 2=FL, 3=SE, 4=MA, 5=NE

Results

Value of a Trip by Year and Region ($2012 Dollars)

Year	Gulf	Florida	Southeast	Mid-Atlantic	New England	Overall Average
2004	29	52	38	18	21	**32**
2005	23	49	42	24	21	**32**
2006	32	45	40	20	21	**32**
2007	24	50	40	20	24	**32**
2008	27	44	43	21	25	**32**
2009	25	42	37	21	26	**30**
2010	23	43	40	22	21	**30**
2011	23	45	40	25	22	**31**
2012	23	46	40	23	23	**31**
Overall Average	**25**	**46**	**40**	**22**	**23**	**31**

Results

Dose-Response Regression of Value of Trip on Distance Share

	(1) vot
dis100	-0.474^{***} (-5.39)
dis200	0.0522 (0.24)
dis500	1.040^{***} (7.63)
average_HH_inc	-0.000133 (-1.07)
N	251

Conclusion

- Using my consistent methodology and assumptions, I find strong seasonal effects
- I find the distribution of distance traveled to be an important indicator of value
- Often, due to computational constraints or scope of study, researchers will force a distance threshold, which could introduce a lot of bias in the WTP measurements.
- My research serves as a platform for benefits transfer analysis and experimentation

Future Work

- Future work will focus on the role of income in fishing recreation trends
- I would appreciate suggestions for how to econometrically test for recession/other macroeconomic effects
- Evaluate data for Krutila's Conjecture

Thank you!

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Probability of Flying

One-way driving distance	*HH Inc $\leq$ \$70k, Family Size $\leq$ 2*	*HH Inc $>$ \$70k, Family Size $\leq$ 2*	*HH Inc $\leq$ \$70k, Family Size $>$ 2*	*HH Inc $>$ \$70k, Family size $>$ 2*
$\leq$ *250 Miles*	0	0	0	0
$>$ *250 Miles &* $\leq$ *500 Miles*	0	0.03	0	0
$>$ *500 Miles &* $\leq$ *1000 Miles*	0.168	0.338	0.056	0.201
$>$ *1000 Miles &* $\leq$ *1500 Miles*	0.736	0.788	0.443	0.784
$>$ *1500 Miles*	0.842	0.88	0.842	0.88

HH Inc = household income; Family Size = total number of adults and children in the household.