Understanding the Impact of Offshore Wind Energy Development on Beach Trip Demand to the Coast of North Carolina

Amanda Harker, University of Georgia, ajh98055@uga.edu
Craig Landry, University of Georgia, clandry@uga.edu
John Bergstrom, University of Georgia, jberg@uga.edu

Selected Poster prepared for presentation at the 2016 Agriculture and Applied Economics Association Annual Meeting, Boston, MA, July 31-August 2

Understanding The Impact of Offshore Wind Energy Development on Beach Trip Demand to the Coast of North Carolina

Amanda Harker[1]; Craig Landry, PhD[2]; John Bergstrom, PhD[3]
Department of Agricultural and Applied Economics, The University of Georgia

ABSTRACT

Since the OPEC oil embargo of the 1970's, U.S. energy policy has been increasingly concentrated on the advancement of domestic renewable energy resources. In order to reduce environmental impacts, promote energy security, and provide energy for an ever-growing population the U.S. has started to transition away from conventional fossil fuels and push forward towards the use of renewables. According to the Energy Information Administration (2015), the production and consumption of one renewable resource in particular, wind energy, has experienced a substantial increase over the past decade. Wind energy is often favored due to its inexhaustible nature, capacity to produce zero greenhouse gas emissions, positive impact on local job growth, and overall cost effectiveness. However, proponents of wind energy are frequently averse to the construction of turbines due to inadequate available land, possible decreases in property values generated by increased noise levels, impaired visual aesthetics, and the intermittence of the wind resource.

CONTACT

Amanda Harker
Department of Agriculture and Applied Economics
The University of Georgia
Email: ajh98055@uga.edu

INTRODUCTION

- Off shore wind turbines made their first appearance in Denmark in 1991.
- Fueled by the European Union's mission to reduce its environmental impact, their popularity among its countries expanded almost immediately.
- A standard wind farm can have as few as five wind turbines or as many as 150 depending on the capacity of its location.
- In the United States, the majority of wind farm development currently exists in the Great Plains region, with some development occurring in the western coastal states.
- Offshore placement of wind turbines can harness significant wind energy resources, offering expanded opportunities for clean and dependable renewable energy resources.
- The North Carolina coast is home to over three hundred miles of open beach accesses making it an ideal candidate to study the impacts of offshore wind expansion.

OBJECTIVE

The objective of our study is to estimate changes in economic welfare resulting from offshore wind farm expansion in coastal North Carolina. Specifically we estimate a fixed effects negative binomial model using a combination of both revealed and stated preference data.

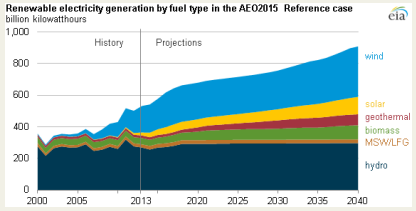


Figure 1. Renewable Electricity Generation by Source

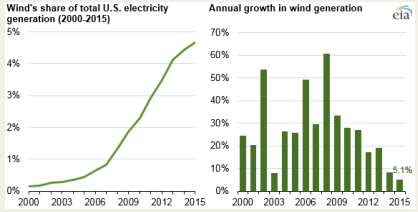
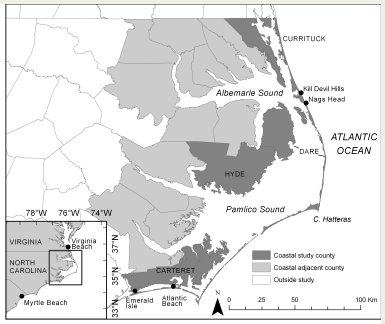


Figure 2. U.S. Wind Energy Generation Growth

EXPERIMENTAL DESIGN

Data were solicited through a telephone survey conducted by the East Carolina University Center for Survey and Research. Participants were asked questions regarding:

- Concerns over climate change and wind farm expansion
- Previous recreational site visits
- Future estimated recreational site visits given the policy change
- Socio-demographic characteristics



METHODS

Travel Cost Method for Incomplete Demand System with Quasi-Panel Data:

We assume $BeachTrips_i = f\ (TC_i, M_i, Z_i)$

Where
- $TC_i = Travel\ cost\ to\ site\ for\ individual\ i$
- $M_i = Annual\ money\ income$
- $Z_i = Sociodemographic\ characteristics\ of\ individual\ i$

$$\Pr(y_{ij} = y|u_{ij}) = \frac{\Gamma(y + r_{ij})}{\Gamma(y+1)\Gamma(r_{ij})} p_{ij}^{r_{ij}}(1-p_{ij})^{y}$$

Via maximum likelihood estimation we estimate

$$E[Trips_{ij}|x, u_j] = \exp(x_{ij}\beta + z_{ij}u_j)$$

Where
- X_{ij} is a $(1\times p)$ row vector of fixed effects
- z_{ij} is a $((1\times q)$ vector of random effects

We calculate total Marshallian surplus from recreational demand as

$$Total\ MS_i = \int_{TC_i^0}^{TC_i^1} \exp(x_{ij}\beta + z_{ij}u_j)\, dTC$$

We estimate changes in Marshallian surplus as:

$$\Delta MS = \int_{TC_0}^{TC_1} \exp(x_{ij}\beta + z_{ij}u_j)\,|q_1 - \int_{TC_0}^{TC_0^1} \exp(x_{ij}\beta + z_{ij}u_j)\,|q_0$$

Where
- q_0 is quality of the beach under current conditions.
- q_1 is quality of the beach under the proposed policy change (offshore wind farm expansion).

PRELIMINARY RESULTS#

Random Parameters Neg Bin Regression

ptr	-0.0009***	(0.0002)
inc	0.0053***	(0.0013)
ln(age)	-0.1816	(0.1134)
hschool	0.7471*	(0.4323)
some_coll	0.9230**	(0.4277)
college	0.9981**	(0.4285)
future	-0.2257***	(0.0492)
future_wind	-0.2714***	(0.0494)
Constant	1.3709**	(0.5591)
ln(alpha)	-16.7952	(161.3057)
var(sp)	0.2481***	(0.0431)
var(_cons)	1.1607***	(0.1100)
cov(sp, _cons)	0.0334	(0.0506)
Observations	909	

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01
# - subject to change

DISCUSSION

Random Parameters specification of Negative Binomial regression permits:

- Flexible expression of conditional variance of trip counts
- Correlation among counts from individual households
- Preference heterogeneity through introduction of normally distributed random parameters for model constant, SP indicator for stated preference scenarios (future demand, future demand under wind farm scenario), including a covariance.

Results indicate inelastic demand and suggest that beach visits are a normal good, with greater education households taking more trips.

SP count variance > RP count variance

Household expect to take less trips in the future, and the introduction of widespread wind farm development decreases trips further. Estimates of Economic Value forthcoming.

REFERENCES

1. Cameron, A. C., & Trivedi, P. K. (2001). Essentials of Count Data Regression. In B. H. Baltagi (Ed.) , *A companion to theoretical econometrics* (pp. 331-348). Companions to Contemporary Economics.
2. Landry, C. E., Allen, T., Cherry, T., & Whitehead, J. C. (2012). Wind turbines and coastal recreation demand. *Resource And Energy Economics*, *34*(1), 93-111. doi:10.1016/j.reseneeco.2011.10.001
3. Whitehead, J. C., Pattanayak, S. K., Van Houtven, G. L., & Gelso, B. R. (2008). Combining revealed and stated preference data to estimate the nonmarket value of ecological services: An assessment of the state of science. *Journal Of Economic Surveys*, *22*(5), 872-908. doi:10.1111/j.1467-6419.2008.00552.x