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The evolution of wilderness demand: investigating price, income, and other demographic effects with a quarter-century of data

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Motivations

- Climate Change
  - -Cross generational problem
- Forestry Management in general
- Pergams and Zaradic's suggestion that nature based recreation was becoming less important

Policy in the long run

- Many policy choices involve decisions that have ramifications across decades and centuries
- Even with stable preferences modern (Arrow et al) analysis suggests that declining discount rate structures may be preferred
- As suggested below evolving preferences will result in even more quickly declining discount rates for wildernesses

The role of evolving amenity demand in a present value context

- Simple Cross-Sectional: Present Value = Z*exp(-rt)
- Suppose Z grows through time exponentially : Z*exp(***d***t)
- Then: Present Value = Z*(exp(***d***t))*(exp(-rt))
- Or, Present Value = Z*exp((***d***-r)*t)

Much like risk adjustments growth acts to change the discount rate on long lived projects

This research effort

- Project is about measuring a ***d***
- Areas of interest are pristine wildernesses set aside for posterity
- Untouched wildernesses are always possible places for exploitation
- Wildernesses cannot be recovered if exploited, essentially development is irreversible

Basic Travel Cost Model

- Individual Linear Exponential Demand

  $\lambda = \exp(P_{ijt}, T_{ijt}, P_{ijt}*T_{ijt}, Y_{ijt}, P_{ijt}*T_{ijt}, Z_{ijt}, \beta)$

- where λ is the ith person's trips demanded of the jth site in year t, Pijt is the travel cost to the jth site by the ith person in year t, Tij is the year of travel to the jth site by the ith person in year t (*shifts the intercept through time*), Pijt * Tij an interaction term between time and travel cost (*shifts the demand slope through time*),), Yijt is the income of individual i in time t, Yijt * Tij an interaction term between time and income *(allowing income effects to shift through time*) , and the vector Z contains the characteristics of site j and β is a vector of parameters to be estimated

Welfare Measures

Seasonal Consumer Surplus $\lambda(t)/\beta_{travel\ cost}(t)$

Per trip Consumer Surplus $1/\beta_{travel\ cost}(t$

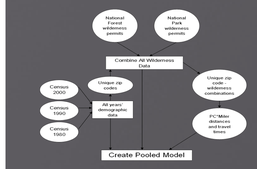
Data Briefly

Hiking permits collected between 1981 and 2004

Travel costs in $2014

Demographic data from census (annually interpolated)

Data study area and construction



Econometric Results

Variable	Negative binomial	Random Effects	Fixed Effects
constant	-9.496 *** (0.270)	-7.546 *** (0.190)	-4.925 *** (0.178)
year	0.049 *** (0.003)	0.045 *** (0.002)	0.048 *** (0.002)
travel cost	-0.009 *** (0.000)	-0.006 *** (0.000)	-0.006 *** (0.000)
travel cost*year	0.00008 *** (0.00000)	0.00003 *** (0.00000)	0.00003 *** (0.00000)
income	0.063 *** (0.002)	0.029 *** (0.001)	0.030 *** (0.001)
Income*year	-0.002 *** (0.000)	-0.001 *** (0.000)	-0.001 *** (0.000)
Ln(population)	0.779 *** (0.007)	0.385 *** (0.010)	0.191 *** (0.010)
age	-0.0132 *** (0.003)	.029 *** (0.002)	0.030 *** (0.003)
education	0.348 *** (0.012)	0.090 *** (0.010)	0.029 *** (0.010)
Household size	-0.820 *** (0.035)	-0.003 (0.013)	0.004 (0.008)
N	187,024	187,024	149,807
Log-likelihood	-100,060.96	-98,551.995	-87,745.666

Findings Briefly

24.94% increase in value 1981-2004

Annual change in welfare of 0.71% per year

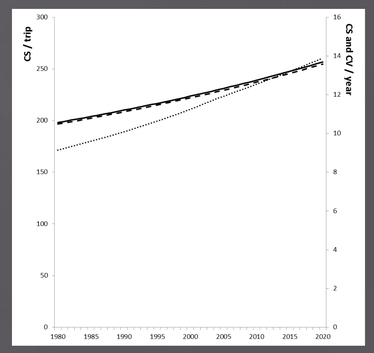
Present Value = Z*exp((***d***-r)*t)

- Present Value = Z*exp((***0.71-***r)*t)
- 4% becomes 3.29% - a non-trivial change

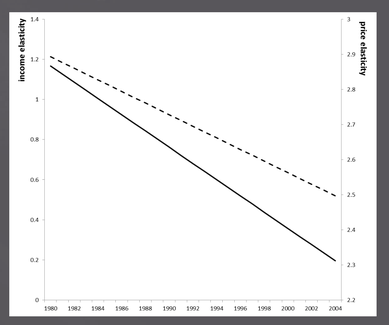
Much like risk adjustments growth acts to change the discount rate

Will result in more wilderness projects than a cross-sectional analysis would support

Changes in Welfare



Changes in Income Elasticities



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