A Hedonic Analysis of the Hedonic Affect of Eutrophication on Property Values in the Lake Champlain Basin

Ciara Low, Brown University ‘14 | Mentor: Asim Zia, University of Vermont

Introduction

- Eutrophication is an increasing problem in freshwater systems throughout the U.S.
- Cyanobacteria are an increasingly common consequence of excess nutrient inputs in Lake Champlain (VT, NY, Quebec) and have been identified as a serious health hazard and ecological threat
- Human health effects and ecological impacts are well documented, but research on the economic impacts of algal blooms is lacking

Objective

- To investigate the economic impact of eutrophication through a hedonic regression analysis of property transactions in lakeside towns between 1992 and 2013

Variables

- Sample: 33,422 property transaction records from lakeside towns, spanning 1992-2013. Prices were adjusted to 2010 real dollars and logarithmically transformed in half the models.
- Chlorophyll-a was used as the proxy variable for water quality (figure 1), with 15 u/L used as an indicator of eutrophication in the discrete models
- Hedonic Variables used: Distance from the lake, distance from the nearest high school, elementary/middle school, landfill. Dummy Variables: category (e.g. residential, commercial, farm), & town

Methodology

- Property transactions were geocoded using ArcGIS. Distances from the lake and dis/amenities were calculated using raster files and spatial analysis tools. Multiple linear regression models created in JMP.
- These results provide an economic argument for lake remediation and pollution prevention efforts, as well as a way to quantify the welfare benefits of policies that support clean water
- As the first economic valuation of water quality using hedonic regression modeling in Lake Champlain, this study can potentially provide a unique and important contribution to policy and decision-making in water quality management
- Next steps: the results listed here are preliminary and part of a more comprehensive hedonic regression evaluation being overseen by Dr. Asim Zia at the University of Vermont

Discussion/Future Work

- These results provide an economic argument for lake remediation and pollution prevention efforts, as well as a way to quantify the welfare benefits of policies that support clean water
- As the first economic valuation of water quality using hedonic regression modeling in Lake Champlain, this study can potentially provide a unique and important contribution to policy and decision-making in water quality management

Acknowledgements

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Marginal Implicit Prices

<table>
<thead>
<tr>
<th>Water Quality Attribute</th>
<th>Avg House Price</th>
<th>Chlorophyll-a (continuous)</th>
<th>Chlorophyll-a (discrete)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample mean</td>
<td>5.331</td>
<td>-0.006827</td>
<td>0.062068</td>
</tr>
<tr>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginal Implicit</td>
<td></td>
<td>$1580</td>
<td>$16,326</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Marginal implicit prices calculated from estimated water quality variable coefficients, using the sample average house price

Background

- Hedonic Regression is a form of revealed price elicitation used to extract a willingness to pay for a particular amenity or service
- Basic Hedonic Regression equation: $P_i = f(S_i, N_i, Q_i)$, where $P_i$ is the property price, $S_i$ is the property characteristics, $N_i$ is the neighbourhood characteristics, and $Q_i$ is the environmental characteristics
- In this study hedonic models are used to find the marginal implicit value of clean water

Figure 1: Average chlorophyll-a by LCBP monitoring station 1992-2013 (LCBP, 2013).

Figure 2: Model results for logarithmically transformed price and continuous chlorophyll-a variables

Figure 3: Marginal implicit prices calculated from estimated water quality variable coefficients, using the sample average house price

Regression Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Continuous Chl-a Model</th>
<th>S.E. (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
<td>0.0159896</td>
<td>0.000538***</td>
</tr>
<tr>
<td>Distance from Lake</td>
<td>-0.001364</td>
<td>0.000186***</td>
</tr>
<tr>
<td>Chlorophyll-a (continuous)</td>
<td>-0.006827</td>
<td>0.00132***</td>
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<tr>
<td>$R^2$</td>
<td>0.161602</td>
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<tr>
<td>Intercept</td>
<td>-24.54078</td>
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<tr>
<td>F-statistics</td>
<td>201.1176</td>
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<tr>
<td>n</td>
<td>33422</td>
<td></td>
</tr>
</tbody>
</table>

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Are they willing to pay for clean, clear water?

Surveys suggest yes, but is this reflected in their actual marketplace decisions?
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