



What do natural features have to do with property values? A hedonic valuation study of Michigan Lakes

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How to Place Value on Natural Features: Hedonic Valuation

- One way to assign value to non-market goods
- Residential Property = Collection of Attributes
 - Improvement = ↑ value of property
- General Form of Hedonic Model:
 $P = f(S, N, E)$
- P = Property Sold Price
- S = Structural Characteristics
- N = Neighborhood Characteristics
- E = Environmental Characteristics

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- People will pay more for houses associated with certain natural features
- In other cases, proximity to natural features may actually decrease the value of the property
- So...what is the \$ value of these natural features?



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Research Questions

- 1) Which structural, neighborhood, and environmental characteristics significantly affect lakefront property values?
- 2) What is the \$ value of these significant environmental characteristics?



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Expectations (1)

- Structural characteristics
 - expect similar findings to previous studies (e.g. square footage, water frontage, AC have + effect)
- Neighborhood characteristics
 - **Negative Effects**: distance to city
 - **Positive Effects**: distance to boat launch
 - **Not Sure**: housing density
- Environmental characteristics
 - **Negative Effects**: percent of agriculture nearby
 - **Positive Effects**: lake water clarity, lake area, percent of forest cover and water nearby
 - **Not Sure**: proximity to conservation lands

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Expectations (2)

- We expect the \$ value could be substantial from previous studies....
- When WC ↑ by 1 m...
- ↑ Value of property \$1,200 to \$11,000 (1-13% of property's value)
- ↑ Value per foot frontage \$34 to \$81 (2-9% of property's value)
- ↑ Value of lake \$30,000 to \$93,000,000

Michael et al 1996, Boyle et al 1999, Gibbs et al 2002, Krysel et al 2003

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Expectations (3)

- Our results might be different than past studies' findings because of inherent differences between MI and ME
 - More MI lakes: 11,000 inland lakes > 5 acres
 - More MI impaired lakes
 - Fewer MI forested areas
 - Environmental attributes more valuable?
- Previous ME studies
 - Fewer lakes over smaller area
 - Other natural features rarely included

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Overview of Property Data

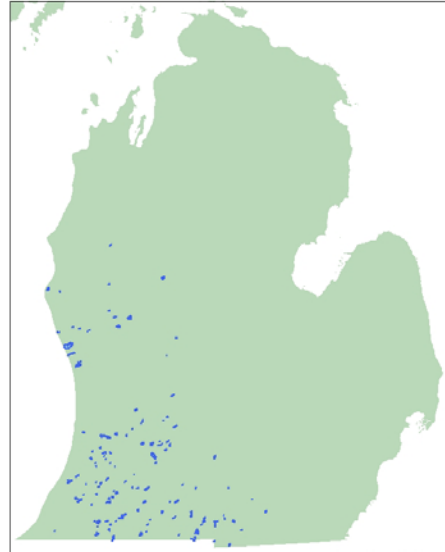
- N = 1360 lakefront properties, 20 counties, 136 lakes
- Single family, residential property sales records, 2001-2005
 - Converted to 2005 \$ using CPI

	Mean (\pm SE)	Minimum	Maximum
Sold Price	\$296,162 \pm 6,192	\$36,000	\$2,600,000
Square Footage (feet²)	1,568 \pm 21	320	9,000
Lake Frontage (feet)	92 \pm 3	10	1,735

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Overview of Lake Data

- N = 136 lakes
- Lake Area
 - Range: 18.1 – 4231.7 acres
- Maximum Lake Depth
 - Range: 3.7 – 33.5 meters



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Overview of Lake Data

- Summer Water Clarity Range: 0.3 – 6.5 m
- Lake-wide Housing Density Range: 0 - 50.7 structures/km shoreline
- 81 lakes with boat launches



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Predictor Variables in the Model...

Structural - Features of the House, Features of the Lot,
Taxes, Time of Sale

Neighborhood –

- Housing Density (Immediate and Lake-wide)
- Distance to Nearest City (Airport, Population >10,000)
- **Distance to Nearest Boat Launch**

Environmental –

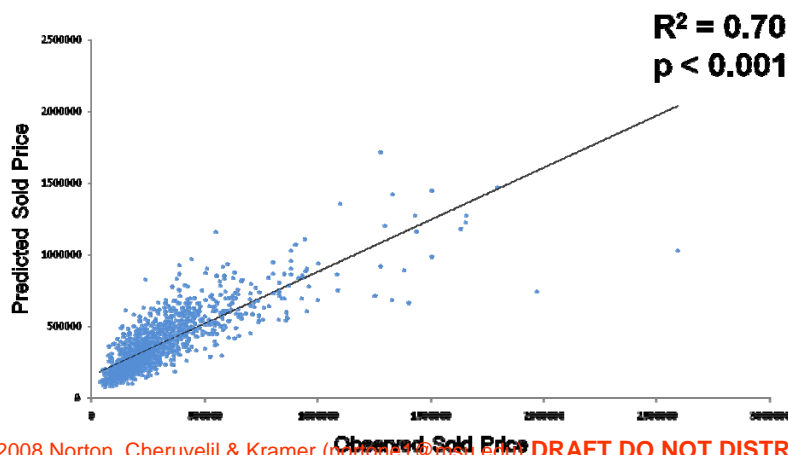
- Lake Water Clarity and Lake Area
- **Percent of Land Use within 1 km** (Ag, Forest, Grassland, Water, Wetlands, Other)
- **Percent of Conservation Lands within 1 km**
- **Distance to Nearest Conservation Lands**

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Results

- Best model with 19 non-highly correlated parameters
– Chosen using Mallows's C_p , AIC, R^2

Observed vs. Predicted Sold Prices



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Results: Significant Structural Variables...

Variable*	Effect (+ or -)
Square Footage	+
Stories	+
Sewer	+
Garage	+
Air Conditioning	+
Fireplace	+
Heat (Gas or Electric)	+
Feet of Water Frontage	+
Outside Features	+
Landscaping	+
Annual Property Tax	+
Year Sold	+

*All Significant at $p < 0.005$

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Results: Significant Neighborhood Variables...

Variable*	Effect	Standard Deviation (SD)	Average Change in Value with Increase of 1 SD
Lake-wide Housing Density	+	10.36	\$36,353
Immediate Housing Density	-	7.41	-\$13,533

*All Significant at $p < 0.005$

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Results: Significant Environmental Variables...

Variable*	Effect	Standard Deviation (SD)	Average Change in Value with Increase of 1 SD
Water Clarity	+	1.26	\$20,921
Lake Area	+	651.28	\$55,502
Percent Forest**	+	11.74	\$17,978
Percent Wetlands**	-	7.92	-\$15,665
Percent Water**	+	12.66	\$19,322

*All Significant at $p < 0.005$

** Calculated in a 1km buffer around each property

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Results: Water Clarity

With a 1 meter increase in lake water clarity...

- ↑ Value property by **\$17,323 (6%)**
 - **In the middle of the previously identified range**
- ↑ Value per foot frontage **\$237 (8%)**
 - **Higher end of that found previously**
- ↑ Value per lake **<\$1,000,000-\$37,100,000**
 - **Range is skewed higher than that found previously**

Michael et al. 1996, Boyle et al. 1999

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Results: Other Features...

- Distance to Boat Launch
 - Trend is ↑ property price with ↑ distance
- Percent Urban Lands in 1km Buffer
 - Trend is ↓ property price with ↑ percentage
- Both support findings that less developed properties are preferred, but neither are highly significant



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Conclusions

- Lakefront properties more valuable with...
 - Larger lakes
 - Clearer water
 - Greater % forested land and water nearby
 - Lower immediate housing density BUT higher lake-wide housing density
- These values of natural features are conservative estimates because they overlook:
 - Biological values
 - Recreational values

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Implications

- Property values translate into property taxes
- Results can inform policymakers and property owners... Value of water clarity is:
 - Incentive for policies to protect lakes (e.g., nutrient criteria)
 - Way for public to understand why protecting lakes is important

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Future Directions

- Multi-level model – relative amount of variation at the lake and property scales
- Value of water clarity versus cost of improving water clarity
- Properties further removed from the lake
 - What are the effects of lake and other landscape variables on property values

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