# Appraisal of Residential Water View Properties

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**Abstract**

This study explores the pricing impact of water view amenities on residential home sale prices. A new GIS spatial variable, *WATER VIEW AREA*, is designed to measure the area of water view available for each residential property. The study investigates whether water viewshed area acts as a proxy for the quality of different water views. The analysis employs a data set of 7,501 fair market real estate transactions in neighborhoods surrounding Lake Lanier, Georgia, with controls for a large set of neighborhood and spatial characteristics. The study finds that residential properties with lake access earn a price premium of 67% and that a 1% marginal increase in water view quality results in an increase in property prices of 0.42% for nonwaterfront properties and 3.85% for waterfront properties.

## Introduction

Research studies confirm that a water view amenity is associated with a pricing premium for residential properties. Although individual studies reveal disparate pricing effects owing to site-specific spatiotemporal variables, some generalizations can be inferred. First, studies support a hierarchy in the pricing of the view amenity, with premium-quality waterfront views obtaining the highest valuations.[1] Second, the pricing premium for the water view amenity decays with distance.[2] Third, researchers have employed alternative techniques to model the water view amenity, including binary variables, linear distance, and viewshed analysis. Although, each technique provides specific insights, they have proved more useful at estimating the value of different types of water views (e.g., ocean, lake, riverfront, pond, etc.) rather than the quality of a water view.[3] The absence of any standard modeling technique to measure the quality of waterfront views can make the valuation of even proximate residential properties sharing the same type of water view problematical if the views are of differing quality.

The focal point of this study is to evaluate the variability in water view quality by introducing a new geographic information systems (GIS) spatial variable, *WATER VIEW AREA*, which measures the area of water view available for each residential property. The study investigates whether the size of water view area acts as a proxy for the quality of the water view. It is hypothesized that a residential property with a higher-quality view, as measured by the size of its water view area, will command a price premium compared to lower-quality views. This spatial variable

1. Randy E. Dumm, G. Stacy Sirmans, and Greg T. Smersh, "Price Variation in Waterfront Properties over the Economic Cycle," *Journal of Real Estate Research* 38, no. 1 (2016): 1–25; David Wyman, Norman Hutchison, and Piyush Tiwari, "Testing the Waters: A Spatial Econometric Pricing Model of Different Waterfront Views," *Journal of Real Estate Research* 36, no. 3 (July–September 2014): 363–382.
2. Earl D. Benson, Julia L. Hansen, Arthur L. Schwartz Jr., and Greg T. Smersh, "Pricing Residential Amenities: The Value of a View," *Journal of Real Estate Finance and Economics* 16 (1998): 55–73; Steven C. Bourassa, Martin Hoesli, and Jian Sun, "What's in a View?" *Environment and Planning A* 36, no. 8 (2004): 1427–1450; and Notie H. Lansford Jr. and Lonnie L. Jones, "Recreational and Aesthetic Value of Water Using Hedonic Price Analysis," *Journal of Agricultural and Resource Economics* 20, no. 2 (December 1995): 341–355.
3. Oshadhi E. Samarasinghe and Basil M. H. Sharp, "The Value of a View: A Spatial Hedonic Analysis," *New Zealand Economic Papers* 42 (2008): 59–78.

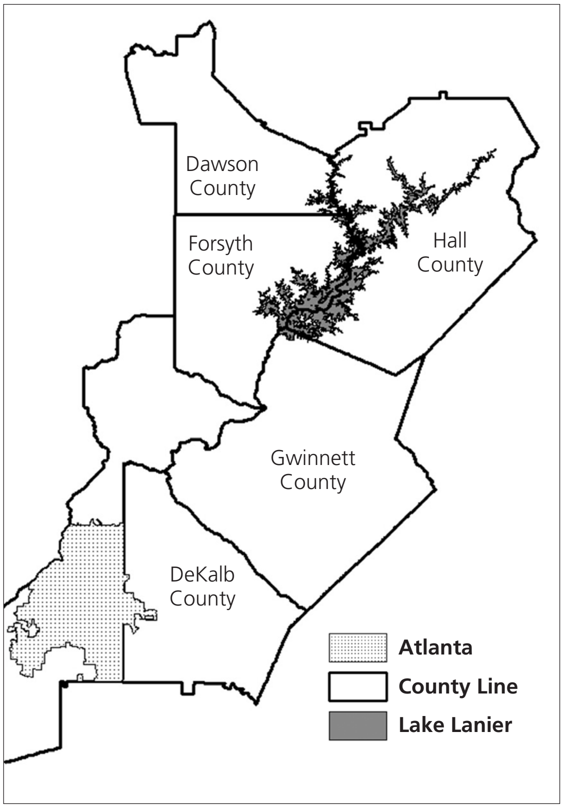
*WATER VIEW AREA* offers an improvement over existing techniques as (1) it quantifies the view using a continuous variable allowing one to identify a true marginal pricing effect, (2) it is not based on subjective measures to identify a premium view amenity, and (3) it is easily calculable using GIS software and therefore applicable for countywide valuations using larger databases.

The study area consists of residential home sales in neighborhoods bordering Lake Sidney Lanier (Lake Lanier) in northern Georgia. Lake Lanier is a 38,000-acre reservoir situated approximately forty-five minutes from downtown Atlanta. Initially, the US Army Corps of Engineers constructed Lake Lanier for flood control and hydroelectricity; however, as the Atlanta metropolitan area grew, the lake evolved to become a destination for both homeowners and recreational users. Exhibit 1 displays a map of Lake Lanier, and its location within the Atlanta metropolitan area. To evaluate the impact of water view amenities, 7,501 fair market value sales are examined in two of the counties, Dawson County and Forsyth County, that border 230 miles of Lake Lanier's shoreline.

The results confirm that the water view amenity earns a substantive pricing premium. The explicit modeling of the quality of view, as represented in the area of water view, reveals that a 1% marginal increase in the variable *WATER VIEW AREA* for waterfront properties earns a price premium of 5.25%. Thus, it is possible to quantify the price premium earned for a "big water view" and compare it to price premiums earned by residential properties with more limited waterfront views (e.g., situated in the side of a cove). Second, the impact of direct access to the lake is captured by modeling a *LAKE ACCESS* variable. The analysis of residential properties finds that *LAKE ACCESS* earns a price premium of 67% and that a 1% marginal increase in the variable *WATER VIEW AREA* for waterfront properties earns a price premium of 3.85%. The reduction of the *WATER VIEW AREA* coefficient with the inclusion of the *LAKE ACCESS* variable confirms the importance of direct waterfront access. It is also of note that the *WATER VIEW AREA* variable is related to, but distinct from, viewshed analysis. Viewshed analysis is used to identify the visibility of an area or object (e.g., water) within a GIS map cell from a location (e.g., residential property) within another cell. Viewshed analysis does not provide any quantitative statistics that summarize the area (or quality) of the water view from any given residential property.

The next section reviews the literature on water view amenities. This is followed by a discussion of the GIS and hedonic methodology that is used to model this environment. Next, the data from the study's empirical specifications are presented and discussed. Finally, the study results are summarized and their implications are examined.

**Exhibit 1** Map of Lake Lanier and Surrounding Areas




The above map shows the location of Lake Lanier relative to the Atlanta metropolitan area. Lake Lanier is shaded in dark gray at top right; Atlanta is indicated as the dotted region at bottom left; thick black lines represent county borders.

## Literature Review

Extensive academic research indicates that a waterfront view amenity earns a price premium, with a hierarchy of pricing premiums according to the quality of the view amenity.[4] Generally, pond views tend to earn the lowest price premium of waterfront properties. For example, Plattner and Campbell find that condominium units with a view of pond water earned a price premium of between 4% and 12%.[5] A study of waterfront properties in Tampa Bay, Florida, finds a hierarchy of price premiums associated with the quality of the waterfront view amenity. In that study, pond properties earn a modest 3.5% price premium, lakefronts earn an 11.3% premium, riverfronts a 47% premium, canals a 62% premium, and bay properties earn the highest price premium at 115%.[6] Similarly, a study of eight different view amenities in a lakefront golf course community in South Carolina finds different levels of price premiums for view, with premiums of 42% to 85% for golf course views, from 94% to 133% for lake views, and 124% to 287% for lakefront properties.[7] A study of residential property sales in Bellingham, Washington, by Benson et al. looks at eight different types of views: four types of ocean views, two types of lake views, mountain views, and no view.[8] This study confirms a hierarchy of view premiums, ranging from less than 10% for a mountain view to a premium of 126% for lakefront properties. The study also incorporates a distance interaction variable in the model and finds that a full ocean view property within 0.1 miles of the water earned a price premium of 68% compared to a premium of only 30% for properties two miles from the water. A subsequent study by Benson, Hansen, and Schwartz, employs the same eight view variables to classify almost 7,000 single-family homes in Bellingham, Washington.[9] They find that water view properties enjoy substantive price appreciation during the study (1984 to 1993). For example, the percentage premium for a lakefront home rose from roughly 85% in the mid-1980s to 125% in the early 1990s. They attribute this price appreciation to increased demand outstripping the limited supply of water view lots.

A number of studies find varying price premiums for distinctive waterfront amenities, including canals, wetlands, rivers, lakes, and ocean views.[10] The price premium for the water view amenity may be substantively higher for vacant lots compared to nonvacant lots where the age, size, and quality of housing structures can distort price premiums. For example, vacant lots with ocean views earn price premiums of 147% on Seabrook Island, South Carolina, and

4. Dumm, Sirmans, and Smersh, "Price Variation in Waterfront Properties"; Wyman, Hutchison, and Tiwari, "Testing the Waters"; Steven Schultz and Nick Schmitz, "Viewshed Analysis to Measure the Impact of Lake View on Urban Residential Properties," *The Appraisal Journal* 76, no. 3 (Summer 2008): 224–232; Samarasinghe and Sharp, "The Value of a View"; Bourassa, Hoesli, and Sun, "What's in a View?"; Michael Bond, Vicky Seiler, and Michael Seiler, "Residential Real Estate Prices: A Room with a View," *Journal of Real Estate Research* 23, no. 1/2 (2002): 129–138; Benson et al., "Pricing Residential Amenities"; and Robert H. Plattner and Thomas J. Campbell, "A Study of the Effect of Water View on Site Value," *The Appraisal Journal* 46, no. 1 (January 1978): 20–25.

5. Plattner and Campbell, "Effect of Water View on Site Value."

6. Dumm, Sirmans, and Smersh, "Price Variation in Waterfront Properties."

7. David Wyman and Stephen Sperry, "The Million Dollar View: A Study of Golf Course, Mountain and Lake Lots," *The Appraisal Journal* 78, no. 2 (Spring 2010): 159–168.

8. Benson et al., "Pricing Residential Amenities."

9. Earl D. Benson, Julia L. Hansen, and Arthur L. Schwartz, Jr., "Water Views and Residential Property Values," *The Appraisal Journal* 68, no. 3 (July 2000): 260–271.

10. Guy Garrod and Ken Williams, "An Economic Estimate of the Effect of a Waterside Location on Property Values," *Environmental and Resource Economics* 4, no. 2 (April 1994): 209–217; Cheryl R. Doss and Steven J. Taff, "The Influence of Wetland Type and Wetland Proximity on Residential Property Values," *Journal of Agricultural and Resource Economics* 21, no. 1 (1996): 120–129; Gayatri Acharya and Lynne Lewis Bennett, "Valuing Open Space and Land-Use Patterns in Urban Watersheds," *Journal of Real Estate Finance and Economics* 22, no. 2/3 (2001): 221–237; Bond, Seiler, and Seiler, "Residential Real Estate Prices"; Peter F. Colwell and Carolyn A. Dehring, "The Pricing of Lake Lots," *Journal of Real Estate Finance and Economics* 30, no. 3 (2005): 267–283; James R. Rhinehart and Jeffrey J. Pompe, "Estimating the Effect of a View on Undeveloped Property Values," *The Appraisal Journal* 67, no. 1 (1999): 57–61.

vacant waterfront lots on a bluff adjacent to the Lake Michigan shoreline earn a price premium of 200% compared to nonwaterfront lots with similar views.[11]

The wider application of GIS-based analyses to measure distance, scope of view or viewshed is only a recent phenomenon. A study of almost 5,000 single-family home sales in Auckland, New Zealand, controlled for a number of spatial variables including scope of view (wide, medium, or narrow) and distance from the coast.[12] It finds that price premiums increase with wider scopes of view and decrease with distance. A second study by the same authors examines residential sales transactions in Wellington, Auckland, and Christchurch, New Zealand (the three largest cities of that country). That study finds higher percentage price appreciation in Christchurch where fewer water view properties were for sale.[13] A third GIS-based study of 2,243 residential sales in Auckland confirms that properties with proximate, wider scenic views earn higher price premiums.[14]

A recent GIS trend is the increased use of viewshed analysis to determine the visibility of a given cell (such as water) from other neighboring cells (such as land). An analysis of two man-made reservoirs in Omaha, Nebraska, finds that multiple listing services (MLS) underestimate the number of properties with water views by 79%, while GIS frontage classifications overestimate water view properties by 42%.[15] The authors find, however, that viewshed analysis accurately identified (within 1%) the number of properties with water views. Given that the lakes were designed for flood control with limited recreational activities, the price premium for homes with a lake view is lower than in other recent studies, with premiums of roughly 8%.

In a study by Wyman, Hutchison, and Tiwari, GIS-based modeling techniques are employed to estimate the price of waterfront-adjacent properties in South Carolina.[16] They classify three types of lakefront properties and find a significant marginal price premium of 223% for point lots, 178% for deep water lots, and 117% for cove lots. The application of a spatial error model statistically improved goodness-of-fit indicators compared to OLS, indicating the importance of modeling for spatial autocorrelation. Spatial autocorrelation statistics are quantitative techniques that detect the extent of pricing interdependence of lots in a neighborhood, reflecting the tendency for the value of near neighbors on a map to be more related than distant phenomena.[17] Moreover, Wyman, Hutchison, and Tiwari find asymmetrical processes operating during the boom and bust periods of their study, with premium waterfront properties maintaining price premiums relative to lower quality, non-waterfront view properties.[18]

The above-mentioned studies reveal the increasing application of GIS-based technology to analyze real estate data. The next section specifies the GIS and hedonic methodology used to model the study area.

## Empirical Methods

A semilog functional form is used to construct a spatial hedonic model and estimate the marginal implicit prices of a vector of independent variables. The specification the hedonic model is shown in equation (1).

$$\ln(P_{ibjt}) = \alpha + W'_{ibj}\delta + X'_{ibj}\beta + NB_{bj} + C_j + Y_t + \varepsilon_{ibjt} \quad (1)$$

11. Rhinehart and Pompe, "Effect of a View on Undeveloped Property Values"; and Colwell and Dehring, "Pricing of Lake Lots."

12. Bourassa, Hoesli, and Sun, "What's in a View?"

13. Steven C. Bourassa, Martin Hoesli, and Jian Sun, "The Price of Aesthetic Externalities," *Journal of Real Estate Literature* 13, no. 2 (2005): 165–188.

14. Samarasinghe and Sharp, "The Value of a View: A Spatial Hedonic Analysis."

15. Schultz and Schmitz, "Viewshed Analysis to Measure the Impact of Lake Views."

16. Wyman, Hutchison, and Tiwari, "Testing the Waters."

17. Grant I. Thrall, "Common Geographic Errors of Real Estate Analysis," *Journal of Real Estate Literature* 6 (1998): 45.

18. Wyman, Hutchison, and Tiwari, "Testing the Waters."

In equation (1), $\ln(P_{ibjt})$ is equal to the natural log of the inflation-adjusted property sale price (in 2015 dollars) observed for home $i$ in neighborhood $b$ of county $j$ at time $t$, $W'_{ibj}$ is a matrix of water view amenity measures, $X'_{ibj}$ is a matrix of observed exogenous property and spatial characteristics, $NB_{bj}$ is a vector of neighborhood fixed effects, $C_j$ is a vector of county fixed effects, $Y_t$ is a vector of year fixed effects and $\varepsilon_{ibjt}$ is the error term. The neighborhood fixed effects vector represents a series of binary variables for the 196 tax-assessor-defined neighborhoods in the sample. The neighborhood fixed effects are included to capture unobservable neighborhood amenities, such as community pools and boat ramps, that are constant within a small geographic area and may be correlated with home sale price. Robust standard errors are used to account for any heteroscedasticity in the error terms.

The pricing impact of water views is predominantly measured through the use of a binary variable, which indicates if a property does or does not have a water view. The estimate on the binary variable identifies the average treatment effect; it identifies the average price for all properties with that characteristic (a water view) relative to the control group of properties without that characteristic (no water view). The use of a binary variable has four main drawbacks: (1) it cannot distinguish between views of differing quality, (2) the true marginal effect cannot be identified, (3) it may be difficult to construct for large data sets, and (4) the assignment of the binary variable may be based on the subjectivity of the researcher. For example, researchers have resorted to time-consuming site visits to differentiate between a good partial view and a poor partial view of water.[19]

Researchers have attempted to distinguish between views of different quality by dividing water views into categorical classifications. For example, Bourassa, Hoesli, and Sun estimate the price impact for three view qualities—narrow, medium, and wide—and Wyman and Sperry differentiate lakefront properties into cove, deep water, and point lots.[20] Results from these studies indicate the existence of a hierarchy of water views. Subdividing water views into different classifications relies on the use of binary variables and is subject to the same four drawbacks that occur with the use of a single binary variable.

This article offers a new GIS spatial variable designed to quantify the variability in water view quality. The new variable, *WATER VIEW AREA*, represents the quality of a view by measuring the area of water view available to each waterfront and nonwaterfront property. The new variable is created using the ArcGIS Viewshed tool to calculate the area of Lake Lanier that is visible from each parcel. This variable measures the quality of a view by assigning different values to views of different quality; higher values are associated with higher-quality views. The new variable is an improvement over previous attempts to measure the value of a view for three reasons. First, the view is quantified using a continuous variable, which allows us to identify a true marginal effect instead of an average effect. Second, the variable is not based on subjective measures of what is or what is not a quality view. Third, the variable is easily calculated using GIS software; thus, researchers are easily able to apply the methodology to other empirical studies, including ones employing larger data sets.

In equation (1), the matrix $W'_{ibj}$ contains three variables capturing water amenities. The first variable is *WATER VIEW AREA*, which is described in the above paragraph. The second variable, henceforth known as the *INTERACTION TERM*, is the interaction of the *WATER VIEW AREA* with an indicator variable for waterfront properties. The inclusion of the *INTERACTION TERM* results in the *WATER VIEW AREA* variable capturing the pricing impact of water view on nonwaterfront properties, while the linear combination of the *WATER VIEW AREA* and the *INTERACTION TERM* captures the pricing impact of water view on waterfront properties. In practice, both the *WATER VIEW AREA* and the *INTERACTION TERM* represent the natural logs of the respective view areas. The coefficients in the vector $\delta$

19. Benson, Hansen, and Schwartz Jr., "Water Views and Residential Property Values."

20. Bourassa, Hoesli, and Sun, "What's in a View?"; and Wyman and Sperry, "The Million Dollar View."

associated with *WATER VIEW AREA* ($\delta_1$) and the *INTERACTION TERM* ($\delta_2$) are of particular interest in this study as they capture the implicit marginal price of an increase in water view quality on home sale price. Positive values of $\delta_1$ and $\delta_2$ indicate that buyers are willing to pay more for higher-quality water views. The third variable, *LAKE ACCESS*, indicates if the property has access to Lake Lanier through the presence of a boat dock. The *LAKE ACCESS* variable is included since it is expected that buyers will pay a premium for direct lake access in addition to any price premium resulting from a water view.

Other control variables in equation (1) include housing and spatial characteristics. For housing characteristics, the square footage of the home, the number of bathrooms, the number of fireplaces, and age are included as control variables. The square of age is also included to allow for any nonlinear price impacts resulting from the age of the home. For spatial characteristics, variables are included for the lot size, slope, millage rate, distance to the closest city, and length of shoreline; a binary variable is included indicating if the property is located in Dawson County. Also included are the interaction of lot size with a binary variable indicating waterfront properties to disentangle pricing impacts of larger lots between waterfront and nonwaterfront properties. Finally, this study occurs during a period of boom and bust in the property market; thus, the study includes variables counting the number of nearby foreclosures to capture any pricing impact due to nearby vacated homes.

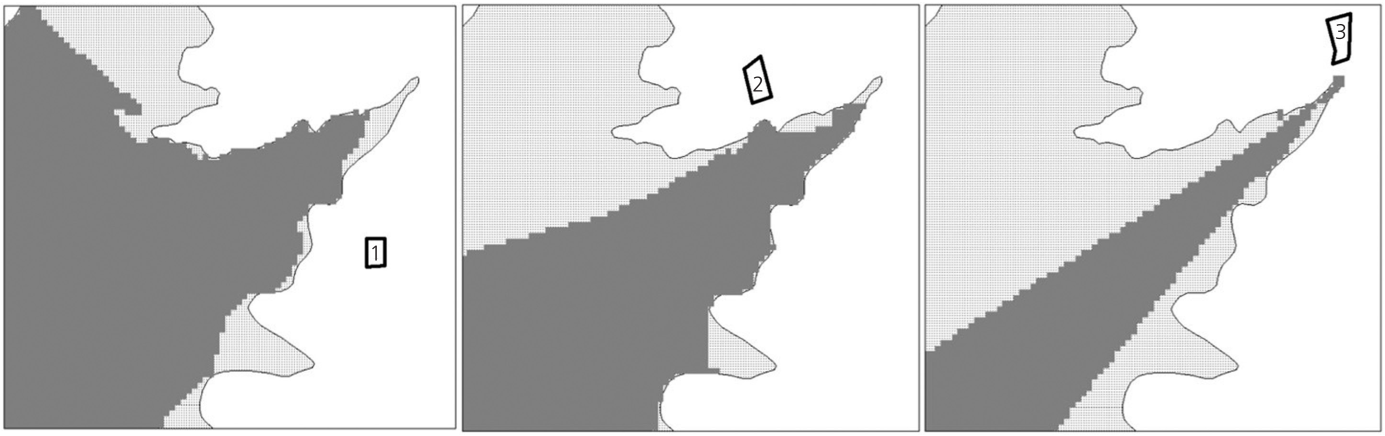
## Data

Home sales data and corresponding characteristic data was collected for two counties bordering Lake Lanier—Dawson County and Forsyth County. The sales data includes sale date, sale reason and nominal sale price, while home characteristics data includes square feet, number of bathrooms, number of fireplaces, etc. Parcel-level GIS data was collected to allow each home sale to be assigned a unique location in space. Next, the sample was constrained to neighborhoods in the Lake Lanier region, and the data was scrubbed to eliminate properties with incomplete data. The resulting data set consists of 7,501 fair market sales of single-family properties sold between 2000 and 2015.

The *WATER VIEW AREA* is calculated using ArcGIS viewshed analysis. The viewshed analysis tool identifies which points in space are visible from an observer point taking into consideration elevation changes. The analysis returns a value of 1 if the point is visible from the observer point and a value of 0 otherwise. By aggregating up the visible points of Lake Lanier from an observer point, it is possible to create a measure of the water view amenity. Since the viewshed analysis results are sensitive to the location of the observer point, care needs to be taken when choosing its location. Ideally, viewshed analysis would be calculated and averaged over all points from which a potential homeowner could observe the water (e.g., a deck, bedroom window, or dock). Because the exact locations of a parcel's built structures are unknown, the parcel centroid is used as the observer point under the assumption that the view from the parcel centroid is representative of all views from the parcel. For lakefront properties, an additional viewshed analysis is conducted using the "viewpoint" as the observer point. A parcel's viewpoint is the point in space on Lake Lanier that is closest to the parcel's boundary, and it captures a representative view from the waterfront portion of the parcel. Then, the viewshed results for the parcel centroid and viewpoint are combined using the maximum value of the two viewsheds to create the *WATER VIEW AREA* variable for waterfront properties.

Exhibit 2 illustrates the *WATER VIEW AREA* measure for three lakefront parcels (parcels 1, 2, and 3) in one of the neighborhoods around Lake Lanier. Parcel 1 has the largest water view area due to its location on a relatively straight portion of shoreline that offers unobstructed views of Lake Lanier. Parcel 3 has the smallest water view area due to its location in a cove, which constrains the visible area. Parcel 2 has views between those offered by parcels 1 and 3 since its view is obstructed by land but not as much as parcel 3. The study is based on the hypothesis that the size of the water view area acts as a proxy for the quality of the water view and that

**Exhibit 2** Water View Area




**Panel A: Parcel 1** **Panel B: Parcel 2** **Panel C: Parcel 3**

The above figure shows the view measure for three residential lakefront parcels (Parcels 1, 2, and 3) on Lake Lanier. Dark gray areas indicate visible portions of the lake from each parcel. Light gray areas indicate Lake Lanier.

properties with higher-quality water view areas sell at a price premium relative to properties with lower quality views. The study hypothesis is that parcel 1 will sell for a higher price premium than parcel 2, parcel 2 will command a premium relative to parcel 3, and parcel 3 will have a higher sale price than interior parcels that have no water view.

The empirical models include a set of spatial control variables to control for other price impacts that vary across space. First, the methodology discussed by Daneshvary and Clauretie is followed, which includes three variables counting the number of nearby foreclosures that occur within the past six months.[21] The three variables divide nearby foreclosures into three groups based on distance: 0 to 0.10 miles (*PROXIMATE*); 0.10 to 0.25 miles (*MODERATE*); and 0.25 to 0.50 miles (*FAR*). Second, the *SLOPE* variable is calculated using ArcGIS functionality. The *SLOPE* variable captures the average percent change in elevation across the parcel and is intended to capture the relative steepness of the parcel. The *DISTANCE TO CLOSEST CITY* variable measures the distance from each parcel's centroid to the centroid of the nearest city; this variable acts as a proxy to indicate accessibility of the respective range of services available in nearby cities.

Exhibit 3 presents summary statistics for the sample of 7,501 home sales. The average home has a sale price of $322,000, contains 2,230 square feet, has 2.5 bathrooms, and is fourteen years old. Approximately 35% of the sample homes are lakefront homes. The average *WATER VIEW AREA* is 185 indicating that the average home views 185,000 square feet of Lake Lanier. The *WATER VIEW AREA* variable has a large variance and range, which indicates there is significant variability in the level of water views available. Congruent with national trends, the number of home sales peaked in the years 2004 to 2006 dropping by over 50% in 2009 from its peak annual sales count.

21. Nasser Daneshvary and Terrence M. Clauretie, "Toxic Neighbors: Foreclosures and Short-Sales Spillover Effects from the Current Housing Market Crash," *Economic Inquiry* 50, no. 1 (January 2012): 217–231.

**Exhibit 3** Summary Statistics

| Variable | Mean | Std. Dev. | Min. | Max. | Units |
|---|---|---|---|---|---|
| **Panel A: Housing Characteristics** | | | | | |
| Inflation-Adjusted Sale Price | 321.88 | 242.77 | 11.01 | 2,267.12 | Thousands of 2015 dollars |
| Square Feet | 2.23 | 1.21 | 0.31 | 14.63 | Thousands of square feet |
| Baths | 2.49 | 0.93 | 0.50 | 7.50 | Count |
| Fireplaces | 0.97 | 0.49 | 0.00 | 4.00 | Count |
| Age | 13.81 | 13.02 | 0.00 | 101.00 | Years |
| Age Squared | 360.30 | 586.10 | 0.00 | 10,201.00 | Years |
| Lot Size | 24.88 | 22.81 | 1.19 | 622.02 | Thousands of square feet |
| Lot Size for Waterfront Properties[a] | 28.94 | 26.82 | 4.49 | 622.02 | Thousands of square feet |
| Slope | 14.48 | 6.17 | 1.22 | 44.78 | Percent change in elevation |
| **Panel B: View Characteristics** | | | | | |
| Water View Area | 185.48 | 461.21 | 0.00 | 4,136.13 | 100,000's of square feet |
| Water View Area for Waterfront Properties[a] | 167.60 | 360.11 | 0.00 | 2,962.46 | 100,000's of square feet |
| Shoreline | 131.75 | 90.15 | 7.00 | 1,266.40 | Feet |
| Waterfront[a] | 0.35 | | 0 | 1 | 2,660 Sales |
| Lake Access | 0.29 | | 0 | 1 | 2,158 Sales |
| **Panel C: Location Characteristics** | | | | | |
| Proximate Foreclosure Count | 0.17 | 0.55 | 0.00 | 5.00 | Count |
| Moderate Foreclosure Count | 0.53 | 1.14 | 0.00 | 13.00 | Count |
| Far Foreclosure Count | 1.21 | 1.99 | 0.00 | 17.00 | Count |
| Distance to Closest City | 5.81 | 2.73 | 0.86 | 9.90 | Miles |
| Millage Rate | 23.57 | 1.95 | 19.11 | 27.80 | Mills |
| Dawson County | 0.20 | | 0 | 1 | 1,472 Sales |
| **Panel D: Sales by Year** | | | | | |
| 2000 | 0.08 | | 0 | 1 | 631 Sales |
| 2001 | 0.08 | | 0 | 1 | 572 Sales |
| 2002 | 0.08 | | 0 | 1 | 589 Sales |
| 2003 | 0.09 | | 0 | 1 | 649 Sales |
| 2004 | 0.10 | | 0 | 1 | 739 Sales |
| 2005 | 0.11 | | 0 | 1 | 786 Sales |
| 2006 | 0.09 | | 0 | 1 | 684 Sales |
| 2007 | 0.06 | | 0 | 1 | 462 Sales |
| 2008 | 0.03 | | 0 | 1 | 251 Sales |
| 2009 | 0.02 | | 0 | 1 | 172 Sales |
| 2010 | 0.03 | | 0 | 1 | 216 Sales |
| 2011 | 0.03 | | 0 | 1 | 207 Sales |
| 2012 | 0.04 | | 0 | 1 | 269 Sales |
| 2013 | 0.05 | | 0 | 1 | 402 Sales |
| 2014 | 0.06 | | 0 | 1 | 437 Sales |
| 2015 | 0.06 | | 0 | 1 | 435 Sales |

The sample contains 7,501 sales.

[a] Calculated over 2,660 lakefront properties.

## Results

To test the study hypothesis that higher-quality views lead to higher price premiums, four separate hedonic models are constructed. The base hedonic model, Model 1, includes all control variables except those for the water amenities. Model 2 restricts the sample to the group of 2,660 properties located on the water. Model 3 includes both the *WATER VIEW AREA* and the *INTERACTION TERM* variables, thereby separating out the pricing impact of view quality on waterfront and nonwaterfront properties. Finally, Model 4 includes a dummy variable—*LAKE ACCESS*—to indicate properties that have direct access to the lake. The introduction of the *LAKE ACCESS* variable allows us to test if the water view variables are capturing the impact of water views in addition to lake access. The results for all the specifications are presented in Exhibit 4.

Model 1 reveals that the majority of structural housing coefficients are of the expected sign and magnitude. The estimated coefficients for *SQUARE FEET*, *BATHS*, *SLOPE*, and *FIREPLACES* are all positive, indicating that an increase in any of those home attributes is associated with higher sale prices. The millage rates and count of distressed sales all have negative coefficients as expected, indicating that a higher millage rate or proximity to higher levels of foreclosures decreases sale price.

Model 1 yields three additional results worth discussing. First, the *AGE* coefficient is positive and the *SQUARE OF AGE* coefficient is negative, and these results are the opposite of typical hedonic studies. A likely explanation is that the lakefront parcels were developed earlier than nonlakefront parcels. Second, the *SHORELINE* coefficient is positive, indicating that parcels with a longer shoreline sold for a price premium. The estimated coefficients indicate that a 1% increase in the shoreline is associated with an 11.9% increase in home sale price, which translates into a $38,300 price increase for the average home. Third, the *DISTANCE TO CLOSEST CITY* coefficient is positive, indicating that 1% decrease in accessibility to city services is associated with a 3.15% increase in home sale price, which translates into a $10,300 price increase for the average home.

Model 2 restricts the sample to only waterfront properties and adds the *WATER VIEW AREA* variable. The coefficient is positive and indicates that a larger water view area is associated with a higher sale price. The estimated coefficients indicate that a 1% increase in the view is associated with a 5.25% increase in home sale price, which translates into a $16,900 price increase for the average home.

In Model 3, the *WATER VIEW AREA* coefficient is positive and indicates that a 1% increase in the view is associated with a 0.34% increase in home sale price for nonwaterfront homes. The linear combination of the *WATER VIEW AREA* and the *INTERACTION TERM* coefficients indicates that a 1% increase in the water view is associated with a 5.4% increase in home sale price for waterfront homes. For the average home, the coefficient from Model 3 indicates that a 1% increase in the view leads to a $1,100 increase in sale price for nonwaterfront homes and a $17,400 increase for waterfront homes.

The linear combination of the *WATER VIEW AREA* and *INTERACTION TERM* coefficients in Model 4 is approximately 34% smaller than the corresponding linear combination of coefficients from Model 3. The magnitude of the linear combination indicates that a 1% increase in view quality results in a 3.85% increase ($12,400) in home sale price. This result is due to the inclusion of the *LAKE ACCESS* variable in Model 4, which means that the *WATER VIEW AREA* and the *INTERACTION TERM* coefficients are identifying the impact of a water view instead of the impact of the water view and lake access. Finally, the *LAKE ACCESS* estimate is positive and indicates that people are willing to pay a 67% increase in sale price (approximately $217,000) for a lakefront property.

Estimates for other control variables in Model 4 are generally consistent with the other models with one exception worth mentioning. Larger lots sell at a price premium compared to smaller lots, and the magnitude of the premium is approximately 10.2% ($32,800) for a 1% increase in lot size; however, the lot size premium for waterfront parcels is 3.9% ($12,500). One possible reason for this is that premium waterfront properties are located on points or have been divided by the developer into smaller lot sizes compared to inferior waterfront lots located in coves and nonwaterfront properties.

**Exhibit 4** Regression Results

| **Variables** | **Model 1** **Base Model** | **Model 2** **Waterfront Only** | **Model 3** **Interaction Term** | **Model 4** **Lake Access** |
|---|---|---|---|---|
| **Water View Area** | | | **0.00344*** (0.00112)** | **0.00419*** (0.00110)** |
| **Interaction Term** | | **0.0525*** (0.00585)** | **0.0506*** (0.00505)** | **0.0343*** (0.00478)** |
| **Lake Access** | | | | **0.515*** (0.0236)** |
| Square Feet | 0.141*** (0.00772) | 0.126*** (0.00916) | 0.135*** (0.00760) | 0.120*** (0.00723) |
| Baths | 0.0985*** (0.00862) | 0.0988*** (0.0114) | 0.0959*** (0.00858) | 0.0802*** (0.00829) |
| Fireplaces | 0.0869*** (0.0125) | 0.0638*** (0.0171) | 0.0775*** (0.0123) | 0.0641*** (0.0119) |
| Age | 0.0112*** (0.00172) | 0.00572** (0.00231) | 0.0100*** (0.00170) | 0.00604*** (0.00163) |
| Age Squared | -0.000190*** (3.51e-05) | -0.000122*** (4.35e-05) | -0.000184*** (3.42e-05) | -0.000158*** (3.30e-05) |
| Lot Size | 0.0292** (0.0136) | | 0.0731*** (0.0139) | 0.102*** (0.0133) |
| Lot Size x Waterfront | 0.00638 (0.00850) | -0.00744 (0.0194) | -0.0644*** (0.0115) | -0.0639*** (0.0107) |
| Slope | -0.000539 (0.000935) | -0.00136 (0.00135) | -0.000394 (0.000927) | -0.00124 (0.000894) |
| Shoreline | 0.119*** (0.0180) | 0.122*** (0.0172) | 0.110*** (0.0181) | 0.0958*** (0.0165) |
| Proximate Foreclosure Group | -0.00216 (0.00689) | 0.0181 (0.0191) | -0.00360 (0.00687) | -0.00328 (0.00647) |
| Moderate Foreclosure Group | -0.0196*** (0.00413) | -0.0334*** (0.0103) | -0.0192*** (0.00412) | -0.0195*** (0.00397) |
| Far Foreclosure Group | -0.00654*** (0.00252) | 0.00287 (0.00571) | -0.00598** (0.00250) | -0.00662*** (0.00235) |
| Millage Rate | -0.0268* (0.0138) | -0.0160 (0.0191) | -0.0273** (0.0136) | -0.0305** (0.0129) |
| Distance to Closest City | 0.0315*** (0.0119) | 0.00356 (0.0197) | 0.0199* (0.0118) | 0.00923 (0.0109) |
| Dawson County | -0.917*** (0.128) | 0.208 (0.161) | -0.580*** (0.133) | -0.702*** (0.115) |

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**Exhibit 4** Regression Results (*continued*)

| Variables | Model 1 Base Model | Model 2 Waterfront Only | Model 3 Interaction Term | Model 4 Lake Access |
|---|---|---|---|---|
| 2000 | -0.141 | -0.151 | -0.157* | -0.216** |
| | (0.0946) | (0.131) | (0.0934) | (0.0886) |
| 2001 | -0.0873 | -0.157 | -0.106 | -0.163** |
| | (0.0827) | (0.120) | (0.0818) | (0.0776) |
| 2002 | -0.0451 | -0.161* | -0.0630 | -0.119* |
| | (0.0728) | (0.0921) | (0.0719) | (0.0682) |
| 2003 | 0.0350 | -0.0458 | 0.0217 | -0.0261 |
| | (0.0486) | (0.0646) | (0.0480) | (0.0453) |
| 2004 | 0.0730 | 0.0260 | 0.0596 | 0.0128 |
| | (0.0511) | (0.0703) | (0.0505) | (0.0476) |
| 2005 | 0.0970 | 0.0899 | 0.0841 | 0.0393 |
| | (0.0637) | (0.0872) | (0.0629) | (0.0593) |
| 2006 | 0.111 | 0.166* | 0.103 | 0.0549 |
| | (0.0681) | (0.0966) | (0.0673) | (0.0637) |
| 2007 | 0.125* | 0.230** | 0.118* | 0.0783 |
| | (0.0722) | (0.106) | (0.0713) | (0.0676) |
| 2008 | 0.127** | 0.203** | 0.122** | 0.101** |
| | (0.0550) | (0.0809) | (0.0542) | (0.0509) |
| 2009 | -0.0184 | 0.0289 | -0.0303 | -0.0569 |
| | (0.0551) | (0.0850) | (0.0545) | (0.0509) |
| 2010 | -0.0648 | -0.0679 | -0.0763 | -0.106** |
| | (0.0477) | (0.0693) | (0.0469) | (0.0443) |
| 2011 | -0.146*** | -0.105** | -0.150*** | -0.179*** |
| | (0.0308) | (0.0452) | (0.0304) | (0.0281) |
| 2012 | -0.213*** | -0.128*** | -0.215*** | -0.228*** |
| | (0.0308) | (0.0436) | (0.0301) | (0.0278) |
| 2013 | -0.103*** | -0.0836** | -0.103*** | -0.120*** |
| | (0.0257) | (0.0387) | (0.0254) | (0.0237) |
| 2014 | -0.0870*** | -0.0905** | -0.0936*** | -0.103*** |
| | (0.0246) | (0.0382) | (0.0244) | (0.0222) |
| Constant | 12.26*** | 11.10*** | 11.78*** | 11.66*** |
| | (0.435) | (0.628) | (0.430) | (0.407) |
| Observations | 7,501 | 2,660 | 7,501 | 7,501 |
| *R*-squared | 0.694 | 0.600 | 0.700 | 0.723 |
| Adjusted *R*-squared | 0.685 | 0.569 | 0.691 | 0.715 |

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; All specifications include neighborhood fixed effects.
A table of full results is available from the authors upon request.

## Conclusion

Prior studies have revealed the importance of measuring the view amenity in the valuation of residential properties. However, an unresolved issue in view amenity studies is how to objectively measure the quality of differing water views for residential properties. Research indicates that even neighboring properties may have water views of dissimilar quality. As a proxy for the quality of the view, this study offers a new GIS spatial statistic—*WATER VIEW AREA*—that measures the area of water view available from each property. The modeling applied in this study confirms that properties with higher-quality views (measured in terms of water view area) sell at a price premium relative to properties with lower-quality views. In essence, the proposed spatial variable provides a method to quantify the quality of "big water" views (or the lack thereof) in residential property markets.

Keep in mind that the explicit pricing coefficients of the current study are site specific. Whereas previous waterfront property classifications of water view properties may have employed an element of subjectivity and were time intensive to construct, this study offers a replicable GIS-based analytical tool that may assist residential appraisers in estimating the marginal pricing effect of higher-quality water views.

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### Additional Reading

Suggested by the Authors

Brown Jr., Gardner M., and Henry O. Pollakowski. "Economic Valuation of Shoreline." *Review of Economics and Statistics* 59, no. 3 (August 1977): 272–278.

### Additional Resources

Suggested by the Y. T. and Louise Lee Lum Library

**Appraisal Institute**

**Lum Library External Information Sources [Login required]**

Information Files—Views influence on residential property values