

**Valuing Proximity to Lake and Ski Recreation Amenities:  
Hedonic Prices for Vacation Rental Houses  
at Deep Creek Lake, Maryland**

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**Abstract.** This paper estimates hedonic price models for a sample of 610 vacation rental houses located in the vicinity of a lake and four-season ski-golf resort. Hedonic semi-logarithmic regression models are estimated for peak summer and peak winter rentals for 2008. The regression estimates for weekly rental prices are conditioned on explanatory variables for house size, house quality, and recreation features including lakefront proximity and ski-slope access. The estimates are used to obtain percentage effects and implicit monetary values, and provide evidence that access to recreation opportunities is reflected importantly in rental offers. Evaluated at the sample means, lakefront locations have a rental premium of about \$1100-1200 per week and the premium for ski-slope locations is \$500-600 per week. Although there is evidence of positive spatial correlation in the OLS residuals, estimation of spatial models does not result in substantial changes in most coefficient magnitudes or standard error estimates.

JEL Codes: Q26, Q51, R14, C21

Key Words: Recreation Demand; Environmental Valuation; Hedonic Prices; Spatial Models

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## Introduction

The development and sale of second homes in recreational subdivisions creates concerns that extend to the environment, local economics, and consumer protection (Stroud 1995). Private developers usually operate with multiple objectives, including provision of quality houses, recreation facilities, and opportunities for real estate investment. Government land planners and officials must determine if a proposed development blends with local objectives and is both economically sound and environmentally acceptable. Recreation subdivisions also increase the cost of running local governments in the form of record keeping, licensing, inspection, land-use planning, public safety, and zoning. Investments in public infrastructure may be necessary to keep up with increased demands on local streets and roads, water and sewer lines, and solid waste disposal facilities. Some recreation facilities, such as parks and beaches, may be provided publicly or there are increased demands on existing facilities. Reflecting past abuses on land sales to consumers, the Office of Interstate Land Sales and Registration (OILSR) was created in 1969 in the U.S. Department of Housing and Urban Development. The OILSR maintains a registry of large developers and requires land sellers to disclose certain information about the subdivision to buyers through a property report, which is presented to each purchaser prior to the signing of a sales contract or agreement. There were over 21,000 large developments registered with OILSR in 2009, many of which fall into the category of recreational subdivisions. Despite the size and importance of the market for recreational houses, there has been relatively little attention by economists to this aspect of land use. One important issue is consumers' revealed preference or willingness to pay for recreation facilities provided by private developers and local governments, an issue that can be examined using the hedonic price model. This paper applies the hedonic model to a sample of vacation rental houses located near Deep Creek Lake, a recreational development of about 2,500 houses located in rural western Maryland.

Empirical studies of residential housing have used the hedonic price model to examine the embodied value of numerous local public goods, with the ultimate purpose of demonstrating that markets can price heterogeneous products and that location and land use patterns matter importantly for housing asset values. Examples of hedonic pricing of neighborhood amenities include studies of proximity or access to viewsheds, open space, forests, lakes, rivers, wetlands, beach frontage, greenspaces, urban parks, golf courses, playgrounds, school quality, public safety, zoning restrictions, historic designations, shopping facilities, and transport facilities.<sup>1</sup> Such studies are potentially important for public policies that preserve open spaces, provide recreation facilities or improve the quality of local public goods. However, there are several criticisms of studies that rely on the hedonic price model (Freeman 2003; Haab and McConnell 2002; Palmquist 2005; Taylor 2003). First, it is common to argue that many homebuyers are

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<sup>1</sup> For recent surveys of the empirical literature on hedonic pricing models, see Boyle and Kiel (2001), Jackson (2001), and Sirmans et al. (2005), and for water-related attributes, Dalrymple (2006) and Kauko et al. (2003).

poorly informed about market conditions, especially with respect to neighborhood disamenities, which can lead to inefficient outcomes in housing markets (Hite 1998; Pope 2008). Second, residential properties are heterogeneous products that trade infrequently in localized markets, which can complicate the selection of a representative sample (Knight 2008). Third, market segmentation can lead to hedonic prices that vary importantly by location, making identification of coefficient magnitudes more difficult (Day et al. 2003). Fourth, some neighborhood characteristics may be provided in relatively fixed bundles (e.g., good schools and larger homes), making estimation of separate hedonic prices difficult to achieve. Fifth, the focus on asset values complicates the application of empirical results due to the uncertain time horizon and discount rate embodied in these values.

The present paper attempts to surmount these criticisms by using a sample of vacation rental houses. My sample includes over 600 vacation houses in the vicinity of a lake and ski-golf resort in rural western Maryland, where the houses in question are offered for rent through three real estate management agencies and by private owners. The vacation houses have several important features. First, photos and detailed information for each house are available to prospective renters in the form of printed catalogs and through web sites. Important housing characteristics and locational attributes are identified and described for each house, and terminology and maps are provided that facilitate recognition of recreation features (e.g., lakefront access, ski-in/ski-out access). Second, most houses are offered for rent throughout the year, and weekly rental prices vary by time of year (peak summer, peak winter, off-season). Infrequent rentals or vacancies during peak periods are not a general problem, and rental prices are set contractually, rather than negotiated. Third, the market in question is a compact geographic area, but the houses provide substantial variation in structural characteristics and locational features. Market segmentation is less likely under these circumstances, which facilitates estimation of unified models. Fourth, pricing differences among the three real estate agencies can be investigated, which is rarely possible for residential housing offered through multi-list services. Fifth, the use of weekly rental prices means that the hedonic model and coefficient magnitudes are closer to the classic economic model of market prices, in contrast to the asset pricing model employed for residential housing and commercial real estate.

Although the hedonic model has been applied to apartment rentals, hotel room rates, and the sale of undeveloped land near recreation facilities, only four earlier studies investigated rental prices for vacation houses in the United States; these are Benjamin et al. (2001), Smith and Palmquist (1994), Taylor and Smith (2000), and Wilman (1981, 1984). These studies are concerned with only two eastern coastal areas (Outer Banks of North Carolina, Cape Cod and Martha's Vineyard). The importance of additional studies in this area is further highlighted by the fact that there are over 4 million seasonal homes in the United States, many of which are located in scenic areas or near recreation facilities (Statistical Abstract 2009; Timothy 2003). The present paper is the first effort at applying the hedonic

model to rental houses near a four-season vacation resort and the first study to value ski-slope access in the US. The objective of the paper is to estimate the value of proximity to lake and ski recreation amenities, while controlling for other housing attributes that determine rental prices. The empirical results reveal that proximity to recreation amenities is reflected importantly in vacation rental offers. Although the revealed values apply to private housing, some of the recreation features in question are public and as a next best alternative, the recreation values provide an upper bound on the benefits of public facilities.

The remainder of the paper is organized as follows: Section 1 reviews four prior hedonic studies of vacation house rentals. This review identifies the important features of vacation properties that were valued in these studies and comments on the present study as an extension of prior work. Several unique features of vacation rentals are examined, which distinguish them importantly from properties sold in the market for residential housing. Section 2 describes the development of and recreation opportunities at Deep Creek Lake, Maryland. This section also identifies features of the vacation houses in the sample, and presents descriptive statistics for the sample. Section 3 presents empirical estimates by OLS for summer rentals. Fixed-effects dummy variables are included for pricing differences among three real estate management agencies. The focus in this section is the value associated with lakefront proximity. Comparisons also are made with earlier studies that value waterfront locations for residential housing. Section 4 repeats this empirical exercise for peak winter rentals, with a focus on the value associated with proximity to the ski slopes. As a sensitivity analysis, Section 5 examines spatial correlation in the OLS estimates and provides alternative estimates for spatial-lag and spatial-error models. Section 6 contains the conclusions.

## **1. Survey of Prior Studies of Vacation Rental Accommodations**

The prior hedonic literature on vacation rental houses in the US is limited to four studies for eastern coastal areas.<sup>2</sup> A review of these studies is useful to identify important explanatory variables and any unique issues associated with vacation rental markets. Wilman (1981, 1984) studied monthly rental prices for a sample of tourist accommodations on Cape Cod and Martha's Vineyard for 1978. For the Cape Cod sample, accommodations were divided into four categories: (1) cottages and apartments; (2) rented vacation houses; (3) guesthouses and inns; and (4) hotels and motels. For Martha's Vineyard, two categories were used, rented vacation houses and other accommodations. The purpose of the study was to estimate a two-stage hedonic model that identified inverse compensated demand functions for coastal

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<sup>2</sup> Mollard et al. (2007) studied rentals of country cottages in southern France. However, there are no housing characteristics in the regressions and rental differences are explained by several environmental variables, the agricultural district, access to services, and an official heritage "label" applied to some cottages. Soguel et al. (2008) studied tourist apartment rentals at six alpine resorts in the Swiss Canton of Valais. Their empirical model included a variable for relative size of each local ski area (length of run per ski-lift), which takes on only six values at the resort level. Hence, this is not a study of proximity of the apartments to the nearest ski slope.

water quality and beach quality for each type of accommodation. For Cape Cod, there are 129 rental houses in the final sample that are distributed among fifteen towns. However, measuring water and beach quality is complex (e.g., attractiveness, cleanliness, width, surf conditions), and a factor analysis is used in this study to compress thirteen variables into five factors. Beach accessibility is measured by travel time to the most frequently used beach and whether or not the accommodation has an ocean view. Characteristics of rented vacation houses are represented by only two variables, number of rooms (size) and working telephone or not (quality). A number of other housing characteristics are either statistically insignificant or missing in too many cases (Wilman 1984, p.166). Only two beach quality variables are statistically significant (beach debris, time distance to commercial centers). For Martha's Vineyard, there are 49 rental houses that are distributed among six towns. Two accommodation variables (rooms, working telephone) and two beach-related factors (ocean view, beach visual attractiveness) are used in the final analysis. Overall, beach quality is a significant predictor of rental prices (Wilman 1984, p.119), but some of the results in the paper suggest that the sample is too heterogeneous. The present paper also estimates hedonic functions for access to lake and ski amenities, but incorporates a larger number of housing characteristics as explanatory variables and uses a more compact geographic area for the sample of vacation houses.

Smith and Palmquist (1994) studied weekly rental prices for cottage, duplex, and condominium accommodations along the Outer Banks in North Carolina for the period 1987 to 1990. The purpose of the study was estimation of people's willingness to pay for proximity to beaches depending on the timing of use (peak summer, pre-peak, post-peak), while also controlling for changes in the mix of site characteristics selected at different times (e.g., air conditioning). The sample of rentals was obtained from three management firms, but composition of the sample varied over time (Smith and Palmquist 1994, p. 123). Hence, separate regressions are estimated for each year, with sample sizes ranging from 213 observations in 1987 to 963 observations in 1989. Coastal amenities are measured by proximity to the ocean (oceanfront, oceanside, sound-front) and presence of an ocean view. The other explanatory variables capture characteristics of the accommodations (e.g., number of bedrooms, bathrooms, air conditioning) and identity of the management firm. Proximity to the oceanfront has the most consistent pattern of significant results for peak- versus pre-season rentals (Smith and Palmquist 1994, p. 123). However, this finding does not carryover to peak- versus post-season rentals. One potential limitation of this study is the pooling of several types of accommodations. The present paper also estimates hedonic functions for different rental seasons, but restricts the sample to vacation houses. Possible pricing differences for two rental seasons are considered: peak summer and peak winter periods.

Taylor and Smith (2000) expanded the Outer Banks sample to cover the period 1987 to 1992, with the objective of testing for pricing differences among four firms that managed beach rental

properties. Sample sizes varied from 132 observations for the smallest firm to 724 observations for the largest. Taylor and Smith argue that when markets are competitive, hedonic equations for weekly rents should not be significantly different across firms. Using data from the rental booklets, they estimate firm-specific hedonic-rent functions by year and season. Explanatory variables are divided into three categories: size of accommodation (e.g., number of bedrooms, bathrooms), quality of accommodation (air conditioning, dishwasher, etc.), and location (proximity to the shoreline). Taylor and Smith obtain statistically significant results for a number of explanatory variables, including proximity variables and a variable for single houses. Using an F-test for individual coefficients, they find significant differences across firms, especially for attributes that are not easily reproduced (e.g., ocean access). This test assumes linear marginal price functions, which may not hold. However, pricing strategies are relatively similar across seasons for each firm (Taylor and Smith 2000, p. 560). The present paper includes fixed-effects dummies to distinguish among rental offers by three real estate management agencies.

Benjamin et al. (2001) developed a model of the weekly rent differential for smoking and non-smoking vacation houses along the Outer Banks for the peak summer season of 1998. Using a sample of 208 properties obtained from a single large realtor, the authors estimate a hedonic model with fifteen explanatory variables including size of accommodation (e.g., number of bedrooms, bathrooms), quality of accommodation (age, swimming pool, air conditioning, non-smoking, etc.), and location (oceanfront, semi-oceanfront, oceanside). Tests for autocorrelation indicate virtually no spatial correlation in the data. The results indicate that renters are willing to pay as much as 60% more per week for an oceanfront unit (Benjamin et al. 2001, p. 124). The premium for non-smoking units is 11.6% per week, but the authors anticipate that this value will decline as more units are converted to non-smoking status (Benjamin et al. 2001, p. 125). In the present study, virtually all of the vacation properties fall into the non-smoking category, but I am able to investigate the effects of several other relatively new features of rental properties, including jetted tubs and internet access. My empirical results also reveal substantial premiums for location attributes, such as lakefront properties and private docks.

The present paper incorporates a number of methodological features that occur in past studies and which are relatively unique to vacation properties. First, the paper seeks to develop estimates of the value of proximity to lake-related amenities (lakefront, split-lakefront locations). A similar analysis is presented for proximity to ski amenities (slope-side, roadside locations). Several other locational variables are considered, including dock access (private, community) and swimming pool access (private, community). The estimates are conditioned by a number of explanatory variables for housing size (bedrooms, bathrooms, bed sizes, maximum occupants) and quality attributes (central air conditioning, jetted tubs, pool table, internet access). Following Smith and Palmquist (1994), selected results are reported for off-peak rental periods. Following Taylor and Smith (2000), differences among the rental agencies are

examined using fixed-effects dummies. In contrast to several earlier studies, the sample is restricted to larger vacation houses that accommodate at least six persons. A few smaller cottages, and all townhouses and condominiums are excluded from the sample. Last, there are important differences between residential housing markets and vacation rentals that are reflected in the sample of data and model specification. In analyses of vacation rental markets, emphasis is placed on those housing characteristics that are advertised in the rent offers, since rental can often occur on a “site unseen” basis. As revealed in the above studies, these advertised features do not include common residential characteristics such as square footage or age of the dwelling. It would be virtually costless for management agencies to provide this additional information if it were important to potential renters. In addition, the rental price is set by contract and is not commonly negotiated, at least during peak periods. Any differences between posted list prices and the actual weekly or weekend rental price are relatively unimportant.

## **2. Description of the Study Area and Sample**

Deep Creek Lake is located in Garrett County, the westernmost county in the state of Maryland. In 2000, Garrett County had a population of 30,000 (Maryland Department of Natural Resources 2001). Much of the county is rural farmland and forested areas, and there are over 70,000 acres of state forest lands in the county. Deep Creek Lake was created in 1925 as the result of a hydroelectric power dam that was constructed by the Pennsylvania Electric Company (Penelec). At this time about 8,000 acres of farmland were acquired for the project by Penelec, with about half of the acres actually inundated by the lake. Eventually, Penelec began divesting itself of some of the real estate surrounding the lake and over the years, the area developed into a recreation region. This development was aided in the late-1980s by the completion of an interstate highway (I-68) from the east, which increased the number of visitors from the Baltimore and Washington, DC population centers. In 1980, the state of Maryland agreed to take over management of recreation and access at Deep Creek Lake. In 2000, General Public Utility, Penelec’s holding company, negotiated the sale to the state of Maryland of the lake bottom, a buffer zone around the lake, and certain other land parcels owned by the power company. The sale price was \$17 million. The state immediately passed legislation creating a Deep Creek Lake Policy and Review Board (PRB). In 2001, the PRB and the Maryland Department of Natural Resources (MDNR) issued a management plan for the lake that regulates water quality, shoreline and buffer areas, adjacent land use, zoning, visitor access, commercial uses, recreation areas, and recreation activities (Maryland Department of Natural Resources 2001). Building of permanent structures within the buffer strip is prohibited and non-permanent structures (e.g., decks, paths, fire-pits, cutting of trees) require a permit from the MDNR. The lake is 12 miles in length and has a shoreline of about 65 miles covering 3,900 acres. The convoluted shoreline (Figure 1) is heavily wooded, and much of the lake is surrounded by low mountains and other

wooded areas. The lake is the center of popular water-based recreation activities, including power boating, fishing, lake kayaking, waterskiing, wakeboarding, tubing, jet skiing, windsurfing, and sailing. Most lake-based swimming occurs at a public beach at Deep Creek Lake State Park (Figure 1).

The second recreation focal point is the Wisp Resort, a privately-operated ski and golf resort located in McHenry, Maryland at the northern tip of Deep Creek Lake (Figure 1). The resort is located within a three-hour drive from Baltimore and Washington, DC, two hours from Pittsburgh, and four hours from Philadelphia and Richmond. The ski area began operation in the mid-1950s as a local ski area, with the first major expansion occurring in the early 1970s when more trails were opened and snowmakers, lights, and chairlifts were added (Bell 2007). In 1981, Wisp Resort opened an 18-hole golf course and began billing itself as the only four-season resort in Maryland. In 1994, developers purchased 2,400 acres of land adjacent to Wisp. At this time, construction of vacation accommodations was focused on condominiums and townhouses. In 2001, DC Development LLC purchased Wisp for \$12 million and initiated a series of capital improvement projects that now total \$30 million, including expenditures on additional slopes and trails, larger chairlifts, and snowmaking equipment (Bell 2007). The ski area presently has 32 trails (10.5 miles, 132 acres) and a maximum vertical drop of 700 feet. There are seven chairlifts (2 quads, 5 triples), two ski carpets, and four surface tows. The lift capacity is 12,600 persons per hour. In 2007, an artificial whitewater kayaking and rafting course was opened on the mountain top, which employs the water reservoir used for snowmaking in the winter season. The resort also offers a variety of other seasonal recreation activities, including golf, tennis, mountain biking, rock climbing, horseback riding, fly-fishing, mountain coaster rides, paintball, snowboarding, snowtubing, and Nordic skiing. A wide variety of supporting commercial facilities and other recreation services have been constructed in the vicinity of the lake and resort (see the web sites in the Data Appendix). However, there are relatively few motels or hotels in the immediate vicinity of the lake and resort.

Beginning in the 1990s, construction of accommodations near the lake shifted from townhouses to vacation houses, with sizeable bedrooms, multiple decks, and other modern features. These structures tended to be much larger than earlier single-family homes and cottages (Maryland Department of Natural Resources 2001, p. 7). Further, the newer houses tend to be used throughout the year, rather than seasonally. As of 2007, there were about 2,500 homes in the Deep Creek Lake watershed (Bell 2008), but not all of these are rentals. Three real estate management agencies specialize in renting vacation properties, and these agencies' catalogs and web sites were the main source of data for this study (see the Data Appendix). The sample includes a variety of data on size and quality of accommodations, rental prices for three seasonal periods (summer peak, winter peak, late summer), and location features of the houses, including the latitude and longitude. The variables and data sources are described in the Data Appendix. The sample for the summer season has 610 observations. Rental Agency A is largest, with 312

vacation houses, followed by Agency B (157 properties) and Agency C (91 properties). There are 50 vacation-rental-by owner (VRBO) properties in the full sample, but information on the exact street address for these properties is missing. The winter sample has 577 observations.

Table 1 displays selected features of the rental houses for the full sample and for each management agency and the VRBO properties. The mean house in the full sample has 4.5 bedrooms, 4 bathrooms, and a maximum occupancy of 12 persons. There are 286 houses (47%) that have lakefront access and 64 houses (11%) that have ski-slope access. The summary indicates that Agency A's properties are somewhat larger (5 bedrooms, 13 occupants), and have higher rental prices on average. Each of the management agencies offers its properties for most of the year and the rental catalogs report a variety of list prices. There are weekly, weekend, and extra night prices for as many as seven seasonal periods: early Summer (mid-June to July); peak Summer (July to mid-August); late Summer (mid-August to Labor Day); Fall (Labor Day to mid-October); out of season (mid-October to mid-December); peak Winter (mid-December to mid-February); extended Winter (mid-February to mid-March); and Spring (mid-March to mid-June). However, rental prices do not necessarily vary across all time periods, e.g., the peak summer and late summer rates are sometimes the same. Some properties are not available on a year-round basis, and weekend (2-nights) rentals are not offered during the peak summer period. In order to facilitate the analysis, rental prices were obtained for peak summer (weekly only), late summer (weekly, weekend), and peak winter (weekly, weekend) periods for the year 2008. Table 1 reports relative price ratios for selected time periods. Winter rental rates are about 85% of the peak summer rate, while the late summer rate is about 90% of the peak summer rate. Weekend rates are about 50% of the weekly rate for both summer and winter. The empirical analysis concentrates on the peak weekly rates for summer and winter, but selected results are reported for the late summer period and weekend winter rentals. It is important to note that this paper is not a study of the effect of a view on rental values. Due to the convoluted heavily-wooded shoreline, lake views are often obscured or partially blocked for at least part of the year. All of the management agencies are careful to point this out in their rental catalogs.

The agency rental catalogs and web sites (and maps) are organized according to location categories for lake and ski access, and the catalogs define several location-related terms. Eleven location variables were created based on this information. These variables are summarized in Table 2, along with average rental prices for the properties in each category. For example, the median summer rent for lakefront properties is \$3095 per week compared to a median of \$1842 for lake-access properties. The difference is \$1253 per week. For winter rentals, houses nearest to the ski slope have a median rental of \$2308 per week compared to \$1750 for non-access houses, which is a difference of \$558 per week. On average, these differences correspond closely to the values derived from the hedonic regressions, and are indicative of substantial premiums associated with proximity to the lake and ski slope.

### 3. Empirical Results for Summer Rentals

This section estimates a semi-logarithmic hedonic price model for summer rentals for a sample of 610 houses. The estimated coefficients are used to obtain implicit prices for structural characteristics, quality attributes, and location features of the vacation houses. Following Kennedy (1981) and van Garderen and Shaw (2002), the coefficient estimates are transformed to obtain percentage effects and the percentages are evaluated at the sample means to obtain monetary values for 2008. In addition, selected results are reported for late-summer rentals and comparisons are made with several prior empirical studies of residential properties and waterfront proximity.

Let  $R_{im}$  represent the weekly rental price of the  $i$ -th property offered by the  $m$ -th rental agency ( $m$  = Agency A, B, C, or VRBO),  $X$  is a vector of continuous variables that describe the size of the property,  $Y$  is a vector of dummy variables for the quality of the property, and  $Z$  is a vector of dummy variables for location attributes. Omitting time subscripts, the semi-log hedonic regression model is written as

$$(1) \quad \log(R_{im}) = a + \sum_{j=1}^J b_j x_{ij} + \sum_{k=1}^K c_k y_{ik} + \sum_{l=1}^L d_l z_{il} + \delta_m + u_{im}$$

where  $a$  is the constant term,  $b$ ,  $c$ , and  $d$  are coefficients,  $\delta$  is an agency-specific intercept, and  $u$  is a stochastic error term assumed to be identically and independently distributed with a mean of zero and uniform variance. The agency intercepts capture unobserved fixed-effects. The regression model in this section is estimated by OLS with coefficient standard errors obtained using White's heteroskedastic-consistent estimator.

A variety of potential explanatory variables were collected for size, quality, and location of the properties for 2008 (see Table 2 and the Data Appendix). In order to reduce the number of variables to a potentially important set, collinearity among the variables was investigated using simple correlations and variance inflation factors (VIF). Some of the simple correlations are high among the size-related variables (e.g., occupants and bedrooms), and the lake and dockage variables. However, the VIF calculations in the Appendix suggest that these correlations are not troublesome in a multivariate context. The main data problem is the large number of quality variables and, in some cases, the category sample sizes are very small, e.g., only 11 properties have more than one hot tub. Hence, the models for the summer sample includes four size-related variables (maximum occupants, bedrooms, bathrooms, percent king-size beds); six quality-related variables (central air conditioning, jetted tubs, extra fireplaces, pool table, extra TV sets, internet access); and six location-related variables (lakefront, split-lakefront, private dock, dock slip, private pool, community pool).

The empirical results for the summer sample are shown in the first three regressions in Table 3, which display results for the full sample of 610 observations and the three agencies. Examining the first regression, all of the explanatory variables have the expected positive sign and are statistically significant,

except the dummy for extra TV sets. Only the dummy for Agency A is significant in regression (1), so the two other agency dummies are deleted in regressions (2) and (3). The magnitude of the dummy variable coefficients is substantial for lakefront proximity, private pool, private dock, community pool, split-lakefront, and central air conditioning. It is interesting to note the consistency of magnitudes between some of the regressors: (1) an extra bedroom is valued more than an extra bathroom; (2) lakefront proximity is valued more than a split-lakefront location; (3) a private dock is valued more than a dock slip; and (4) a private pool is valued more than access to a community pool. The adjusted R-squares are quite high, with values of 0.910 and 0.917 for regressions (2) and (3), respectively. The regression standard error is only 2% of the mean of the dependent variable, indicating that the regressions perform well in a predictive sense. Finally, the coefficient magnitudes and standard errors are quite stable across the three regressions.

In order to further evaluate the results, percentage effects were calculated for fourteen variables, including three continuous variables (occupants, bedrooms, bathrooms) and eleven dummy variables: lakefront, split-lakefront, private dock, dock slip, private pool, community pool, central air conditioning, extra fireplace, pool table, internet access, and Agency A. The percentage effects were then evaluated at the mean rent in order to obtain implicit marginal dollar values for regressions (2) and (3). Table 4 displays the results of these calculations, including the standard errors for percentage effects. For the full sample, the largest percentage effect is lakefront proximity, 42.8% and 44.0% in columns (1) and (2), respectively. This yields lakefront premiums of \$1128 and \$1181 per week. A private dock is valued between \$429 and \$498 per week. Focusing on the agency results in column (2), a marginal increase in the number of occupants is worth \$50 per week; an additional bedroom, \$171; and an additional bathroom, \$169. For the housing quality variables, a private pool is worth \$907 per week; central air conditioning, \$381; an extra fireplace, \$144; a pool table, \$240; and internet access, \$172. The other locational attributes also have substantial values: a split-lakefront is worth \$324 per week; a dock slip, \$270; and access to a community pool, \$411. In order to examine pricing over the summer season, additional regressions were estimated for the late summer period and the percentage effects and marginal values are reported in Table 4 for lakefront access only (full results available upon request). The value of this amenity is worth \$121 to \$126 less during the late summer rental season. An examination of the combined value of lakefront and private dock access indicates that late summer value is uniformly about 90% of the peak summer value. Overall, the regressions yield percentage and implicit marginal values that are quite stable and reasonable.

As a further test, the lakefront premium in the present study can be compared to values obtained from prior studies of residential property values. Geoghegan et al. (1997) found a waterfront premium of 37% (author's calculation) for the Washington, DC area for 1990. Rush and Bruggink (2000) found a

premium for oceanfront properties of \$175,800 (\$225,400 in 2008\$) at Long Beach Island, New Jersey, which is 49% of the mean price. Benjamin et al. (2001) reported an oceanfront premium of 60% for vacation rental houses on the Outer Banks. Bond et al. (2002) found a lakefront premium for Lake Erie of \$256,500 (\$256,500 in 2008\$), which is 49% of the mean price. Hence, the lakefront premium of 43-44% derived for Deep Creek Lake is within the range of earlier studies.<sup>3</sup>

#### 4. Empirical Results for Winter Rentals

This section estimates a semi-logarithmic hedonic price model for winter rentals for a sample of 577 houses, including 64 slope-access (ski-in/ski-out) houses and 33 ski-road access houses (Marsh Hill Road location). The OLS estimates are used to obtain percentage and monetary values for structural characteristics, quality attributes, and location attributes. In addition, selected results are reported for weekend winter rentals. The estimation procedures used in this section parallel those used for peak summer rentals, except that some variables are omitted from consideration (air conditioning, dock access, split-lakefront) and a dummy variable is included for saunas. The variable for lakefront proximity was included as an explanatory variable to reflect any fixed-effects associated with these properties.

In Table 3, regressions (4)–(6) display the empirical results for peak winter rentals for 2007-08. In regression (4), all coefficients for the explanatory variables are significantly positive, except for the dummy for jetted tubs. None of the agency fixed-effects dummies are significant, and these variables are omitted in regressions (5) and (6). The three largest coefficients are private pool, ski-slope access, and lakefront proximity. The adjusted R-squares are 0.887 and 0.893 for regressions (5) and (6), respectively. The regression standard error is about 2% of the mean of the dependent variable, indicating that the regressions perform well in a predictive sense. The coefficient magnitudes and standard errors are quite stable across the three regressions.

Table 4 displays the results for percentage effects and marginal dollar values for peak winter rentals. Using the last two columns, the percentage premium for ski-slope proximity is between 27% and 28%; ski-road access, 7%; lakefront proximity, 21%; and private pool access, 33-34%. The implicit marginal dollar values in column (4) are: ski-slope access, \$606 per week; ski-road access, \$150; lakefront proximity, \$474; and private pool access, \$720. Only selected results also are reported for weekend winter rentals, but it is more interesting in this case to examine the percentage effects compared to weekly rentals. For ski-slope access, the weekend premium is about 31-32%, which exceeds the weekly premium of 27-28%. Dollar-wise, the weekend premium is \$334 to \$346 or about 55-56% of the weekly

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<sup>3</sup> I also examined the prices for January 2009 for undeveloped lakefront lots and lake-access lots offered for sale by an agency. The mean price for 19 lakefront lots was \$375,000 per quarter-acre, while the mean price for 21 lake-access lots was \$100,000 per quarter-acre, implying a lakefront premium of \$275,000.

values. In Table 1, weekend rates are about 50% of the weekly rate. Because weekend skiers are likely to want to maximize their time spent on the slopes, the ski-access premium gets reflected in the relatively higher weekend rates for slope-side properties. Overall, the value of proximity to the ski-slopes is substantial for both weekly and weekend winter rentals. Examining the other variables for the winter sample, a marginal increase in the number of occupants is worth \$41 per week; an additional bedroom, \$223; and an additional bathroom, \$158. For the housing quality variables, a community pool is worth \$178 per week; a sauna, \$136; an extra fireplace, \$135; a pool table, \$207; and internet access, \$143. Reflecting lower average weekly rates in the winter, most of these values are lower than their comparable summer values, except for an additional bedroom. In general, the summer/winter differences are revealing of a market where housing characteristics are priced differently at different times during the year. This replicates findings reported in Smith and Palmquist (1994) and Taylor and Smith (2000).

### **5. Sensitivity Analysis: Spatial Regression Estimates**

As a sensitivity analysis, this section estimates hedonic price models for peak summer and peak winter rentals that correct for spatial autocorrelation. Three questions are addressed. First, are spatial effects present in the data for weekly rentals? Test results are reported for Moran's I and Geary's C statistics. Second, if evidence of spatial effects is uncovered, which spatial model is best? Maximum likelihood estimates are provided for the spatial-lag model and the spatial-error model for both time periods. Third, given a preferred model, how do the spatially-corrected estimates compare to the OLS values reported in Tables 3 and 4? Comparisons are presented for the percentage effect for each variable in the regressions for the agency sample. VRBO properties are omitted in this section due to missing data on the exact addresses of these properties. The sample sizes are 560 and 527 observations for summer and winter, respectively.

The use of spatial econometrics for hedonic real estate models began twenty years ago with the publication of papers by Can (1990, 1992) and Dubin (1988, 1992). Surveys of the literature are available in Anselin (2003), Dubin (1998), Dubin et al. (1999), and LeSage and Pace (2009).<sup>4</sup> Spatial correlation can arise for at least two reasons. First, there may be spatial-lag or autoregressive effects in the dependent variable. For example, neighborhood spillovers may occur due to the tendency for houses in subdivisions to share common features. In the spatial-lag model, the indirect effects of these features are incorporated through spatially-weighted averages of "nearby" housing prices or rents. Spatially-lagged dependent variables result in positively-biased OLS estimates (LeSage and Pace 2009, p. 156). Second, the

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<sup>4</sup> In some traditional applied areas for hedonic studies, there are several papers that examine the effects of spatial correlation on property values or apartment rentals, including air pollution (Anselin and Le Gallo 2006; Beron et al. 2004; Ho and Hite 2008; Kim et al. 2003; Neill et al. 2007); open space (Cho et al. 2009; Irwin 2002; Jauregui et al. 2005); and transportation noise (Cohen and Coughlin 2008; Day et al. 2004; Salvi 2008; Theebe 2004).

stochastic errors can be autocorrelated due to omitted variables that are correlated over geographic space (e.g., lot dimensions, age of dwelling, better views). In the most likely scenario of positive spatial correlation, OLS estimates are inefficient and the estimated standard errors are biased downward (LeSage and Pace 2009, p. 157).

The present paper estimates by maximum likelihood (ML) the spatial-lag and spatial-error models using weights matrices based on distance bands. Tests were first conducted for spatial correlation using the OLS residuals from regressions (3) and (6) in Table 3 for peak summer and peak winter rentals, respectively. Table 5 displays the results for the global Moran's I statistic, Geary's C statistic, and z-scores for two distance bands (400m, 600m). In all cases there is evidence of positive spatial correlation. Using the 400m bands, Figure 2 displays Anselin's Moran scatterplots for the local z-scores. Greater dispersion is evident in the scatterplot for the winter rentals. While the diagrams demonstrate positive autocorrelation, many of the values are clustered around zero and it may be that a few outliers in the upper right and lower left quadrants are responsible for the results in Table 5 (the OLS residuals are close to normally distributed, except for a few outliers). This inference is supported by the ML regression results reported below.

Using the weights based on 400m bands, Table 6 shows the ML estimates for peak summer and winter rentals for the agency sample. In columns (3) and (6), numerical comparisons with the OLS estimates are reported by using the percentage effects and standard errors for each explanatory variable. The first thing to observe is that there are some minor changes in the significance of the explanatory variables. In column (3) of Table 3, the OLS insignificant variables are percent king-size beds and the dummy for extra TV sets. In columns (1) and (2) of Table 6, the ML insignificant variables also are percent king-size beds and the dummy for extra TV sets. In column (6) of Table 3, the OLS insignificant variables are percent king-size beds and the dummy for jetted tubs. In columns (4) and (5) of Table 6, the ML insignificant variables are these two variables and the dummy for ski-road access. The second observation is that the autoregressive parameters ( $\rho$ ) in Table 6 are insignificant for the spatial-lag model, while the autocorrelation parameters ( $\lambda$ ) are statistically significant in columns (2) and (5) for the spatial-error model. The log-likelihood values also are greater for these latter regressions. The results suggest that locational variables contained in the OLS model specification are sufficient to account for any spatial correlation in the dependent variables, but omitted variable bias might be present. Hence, the preferred model for both summer and winter rentals is the spatial-error model.

In Table 6, columns (3) and (6) present numerical comparisons for percentage effects and standard errors for the OLS estimates versus the spatial-error estimates. For the most part, the differences are minor. For example, in column (3), the lakefront premiums are 44.0 and 44.2% for OLS and ML, respectively, and the dollar values for lakefront proximity are \$1181 and \$1188. The standard errors are

not changed in any substantial manner. The spatial regressions for winter rentals display somewhat greater changes in coefficient magnitudes. In column (6), the ski-slope premiums are 27.5 and 22.6% for OLS and ML, respectively, and the implicit dollar values for ski-slope proximity are \$606 and \$498. With the exception of the two ski-access variables, modeling of spatial correlation does not have a large impact on the coefficient estimates or standard errors. This result repeats the outcome in several prior papers that estimate spatial models, including Benjamin et al. (2001), Kim et al. (2003), Mollard et al. (2007), Salvi (2008), and Mueller and Loomis (2008).

## **6. Conclusions**

This paper estimates hedonic price models for a sample of 610 vacation rental houses located in the vicinity of a lake and four-season ski-golf resort. Hedonic semi-log regression models are estimated for peak summer and peak winter weekly rentals for 2008. Selected results are reported for late summer and winter weekend rentals. The regression estimates for rental prices are conditioned on explanatory variables for house size, house quality, and recreation features including lakefront proximity and ski-slope access. The estimates are used to obtain percentage effects and monetary values evaluated at the sample means. The estimates provide evidence that access to recreation opportunities is reflected importantly in vacation rental prices. Lakefront locations have a rental premium of about \$1100-1200 per week (+43 to 44%) and the premium for ski-slope locations is \$500-600 per week (+23 to 27%). In addition to housing characteristics, implicit values also are reported for split-lakefronts, ski-road access, dockage access, private swimming pools, and access to community swimming pools. The paper also reports maximum likelihood estimates that correct for spatial correlation. The preferred model is the spatial-error model. Although there is evidence of positive spatial correlation in the OLS residuals, estimation by maximum likelihood does not have a substantial effect on most coefficient magnitudes or standard error estimates, suggesting that omitted variable bias in the OLS estimates is unimportant.

The economic costs and benefits of recreational subdivisions and second homes is an issue that can generate substantial controversy at the local level. Relatively few economic studies have examined this market or employed the rental market to generate recreation values. The present paper adds to the small literature on economic benefits of vacation houses. Additional research on benefits and costs for this issue is clearly desirable, and would be an aid to private developers, public officials, and consumers. One important feature of the resort site used in the present paper is the careful environmental oversight and land stewardship exercised by the state of Maryland. It is likely that this oversight is embodied generally in the property values and rental values at Deep Creek Lake.

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## Data Appendix

**Data Sources:** Data were obtained from rental catalogs and associated web sites of three management agencies: Coldwell Banker Deep Creek Realty, *2008 Vacation Rental Guide* ([www.deepcreekrealty.com](http://www.deepcreekrealty.com)); Long & Foster Real Estate, *2008 Rental Guide* ([www.deepcreekresort.com](http://www.deepcreekresort.com)); and Railey Mtn. Lake Vacations, *2008 Rental Vacation Guide* ([www.rentals.deepcreek.com](http://www.rentals.deepcreek.com)). Rent-by-owner data for fifty houses were obtained in December 2008 from *VRBO Vacation Rentals* (<http://www.vrbo.com>). Due to missing data, two smaller management agencies with about 25 properties each were omitted from the study. **Sample Restrictions:** Rentals were restricted to detached houses that accommodate at least 6 persons. No condominiums or townhouses were included, but several duplexes are included. One super-luxury house was excluded from all samples. **Dependent Variables:** Weekly and weekend rental prices were collected for the peak winter, late summer, and peak summer (weekly only) rental periods. Rental prices include linen fees, but exclude taxes and optional charges (e.g., dock slip rentals). For Railey Vacations, rental prices for fifteen of its “classic houses” were adjusted upward for a bed linen and bath towel fee (\$17 per bedroom multiplied by the number of bedrooms). Some of the VRBO properties also reflect separate linen fees reported on the web site. **Independent Variables:** (1) Occupants – maximum number of persons allowed; (2) Bedrooms – number of bedrooms; (3) Bathrooms – number of bathrooms, including half-baths; (4) King-size beds – percent of bedrooms with a king-size bed; (5) Lakefront dummy – see Table 2; (6) Split-lakefront dummy – see Table 2; (7) Lake-access dummy – see Table 2; (8) Lake-area dummy – see Table 2; (9) Ski slope-access dummy – see Table 2; (10) Ski-road access dummy – see Table 2; (11) Private and public golf dummies – see Table 2; (12) Private dock dummy -- house has a private dock; (13) Dock slip dummy – house has free access to a community dock slip; (14) Private pool dummy – house has a private swimming pool; (15) Community pool dummy – house is located in an area with access to an indoor community pool; (16) Central AC dummy – house has central air conditioning; (17) Sauna dummy – house has a sauna; (18) Jetted tub dummy – house has one or more jetted tubs or Jacuzzi; (19) Extra fireplace dummy – house has more than one fireplace or wood stove; (20) Pool table dummy – house has a pool table and game room; (21) Extra TVs dummy – house has four or more television sets; and (22) Internet access dummy – house has access to internet (can be wireless, high-speed or other). Several other variables were insignificant in preliminary regressions and have been deleted from the final models (extra grills, extra hot tubs, extra VCRs, extra DVDs, two kitchens, private golf, maximum cars, lake-area and lake-access locations). **Spatial Weights:** Latitude and longitude values were obtained using the address of the house and the web site for iTouchMap.com. Latitude and longitude were not available for *VRBO* houses due to missing addresses. For the spatial regressions, standard formulas were used to translate latitude-longitude coordinates to Cartesian coordinates in meters. Four possible distance bands were examined for spatial weights, and the final weights are based on 400 meter bands (spatial estimates with 600 meter bands were very similar).

**Appendix Table:** Descriptive Statistics

Variable	Mean (s.d.)	Median	Min.	Max.	Non-zero (no.)	Smpl N	VIF
Summer week (\$)	2637 (1484)	2155	595	8852	610	610	---
Winter week (\$)	2178 (1297)	1828	572	8548	577	577	---
Late summer (\$)	2420 (1411)	1977	555	8548	610	610	---
Occupants (max no.)	12.2 (4.1)	12	6	28	610	610	5.95
Bedrooms (no.)	4.5 (1.4)	4.0	2.0	9.0	610	610	6.33
Bathrooms (no.)	3.7 (1.5)	3.5	1.0	9.5	610	610	4.98
King-size beds (pct.)	26.8 (25.1)	25.0	0.0	100.0	415	610	1.48
Lakefront	0.47 (0.50)	0.0	0.0	1.0	286	610	2.62
Split-lakefront	0.04 (0.19)	0.0	0.0	1.0	24	610	1.32
Ski-slope access	0.11 (0.31)	0.0	0.0	1.0	64	577	1.16
Ski-road access	0.06 (0.23)	0.0	0.0	1.0	33	577	1.05
Private dock	0.33 (0.47)	0.0	0.0	1.0	201	610	3.56
Dock slip	0.38 (0.48)	0.0	0.0	1.0	229	610	1.93
Private pool	0.05 (0.22)	0.0	0.0	1.0	32	610	1.31
Public pool	0.04 (0.21)	0.0	0.0	1.0	27	610	1.07
Central AC	0.69 (0.46)	1.0	0.0	1.0	419	610	1.66
Sauna	0.06 (0.24)	0.0	0.0	1.0	35	577	1.26
Jetted tub	0.48 (0.50)	0.0	0.0	1.0	292	610	1.38
Extra fireplace (>1)	0.47 (0.50)	0.0	0.0	1.0	285	610	1.46
Pool table (>0)	0.55 (0.50)	1.0	0.0	1.0	336	610	1.59
Extra TVs (>4)	0.50 (0.50)	1.0	0.0	1.0	306	610	1.72
Internet access	0.63 (0.48)	1.0	0.0	1.0	382	610	1.19

Notes: Non-zero (no.) is a count of the number of non-zero values for each variable. Smpl N is the maximum sample size for each variable in the summer sample. VIF is the variance inflation factor computed from regressing each explanatory variable on a set of fifteen other independent variables; mean VIF is 2.26. VIF values that exceed 8-10 are indicative of severe multicollinearity.

**Table 1.** Means, Standard Deviations, and Counts for Selected Variables

Variable	Total Sample	Agency A	Agency B	Agency C	VRBO
Summer rent (\$)	2637 (1484)	3177 (1649)	2291 (1095)	1672 (821)	2108 (896)
Late summer (\$)	2420 (1411)	2948 (1579)	2058 (1002)	1485 (703)	1967 (886)
Winter rent (\$)	2178 (1297)	2518 (1513)	1992 (877)	1402 (645)	1884 (972)
Winter wkend (\$)	1081 (618)	1214 (719)	998 (463)	800 (335)	956 (487)
Occupants (no.)	12.2 (4.1)	13.2 (4.5)	11.7 (3.6)	9.9 (2.8)	11.3 (2.7)
Bedrooms (no.)	4.5 (1.4)	4.8 (1.4)	4.3 (1.2)	3.8 (0.9)	4.2 (1.1)
Bathrooms (no.)	3.7 (1.5)	4.0 (1.6)	3.6 (1.3)	2.8 (1.0)	3.5 (1.1)
Lakefront (no.)	286	174	70	25	17
Split-lakefirt (no.)	24	7	6	11	0
Slope-side (no.)	64	28	31	1	4
Road-side (no.)	33	27	5	1	0
Winter-summer rent ratio	0.84 (0.19)	0.79 (0.17)	0.90 (0.22)	0.86 (0.12)	0.88 (0.18)
Late summer-summer rent ratio	0.91 (0.05)	0.92 (0.04)	0.90 (0.03)	0.89 (0.05)	0.93 (0.08)
Winter weekend rent ratio	0.50 (0.06)	0.48 (0.04)	0.50 (0.05)	0.58 (0.05)	0.51 (0.07)
Late summer weekend rent ratio	0.50 (0.06)	0.48 (0.05)	0.48 (0.05)	0.57 (0.05)	0.49 (0.06)
Summer sample N	610	312	157	91	50
Winter sample N	577	301	149	77	50

Notes: Means are computed for the summer sample for the three size variables and number of lakefront and split-lakefront properties; standard deviations in parentheses. Slope-side and road-side counts are for the winter sample. The late summer and winter weekend ratios are ratios of the weekend rental price (2 nights) to the weekly rental price (7 nights). The weekly ratio samples sizes are 571 observations for winter and 610 observations for late summer. Similar procedures were followed for each agency's means and the weekend ratios. See the Table 2 and the Data Appendix for additional information on the variable definitions and data sources.

**Table 2.** Description of Location Variables

Variable	Description
Lakefront	The property borders the buffer zone around the lake. Lakefront means that the renter has access to the water for swimming and can go directly to the water without crossing a road. Most lakefront homes have access to a private dock or a dock slip at a community dock or marina. Lakefront does not necessarily mean that the property has a view of the lake because much of the shoreline is wooded. There are 286 lakefront houses in the sample. Mean (s.d.) weekly summer rent, \$3408 (1587); median, \$3095. Mean (s.d.) weekly late summer rent, \$3129 (1528), median, \$2793.
Split-Lakefront	The property borders on the buffer zone, but there is a road between the house and the water. The property owner owns the land on both sides of the road bordering the buffer zone. Split-lakefront houses do not necessarily have a view of the lake. There are 24 split-lakefront houses. Mean (s.d.) weekly summer rent, \$1903 (569); median, \$2060.
Lake Access	The property has a deeded access place to reach the water for swimming and in some cases, boat docks, but the property owner does not own the access area. The renter may be able to walk to the water. The property may or may not have a view of the lake. There are 212 lake access houses. Mean (s.d.) weekly summer rent, \$2059 (1040); median, \$1842. Not included in final model.
Lake Area	This term refers to all other properties in the surrounding Deep Creek Lake area. The property may or may not have a view of the lake. There are 88 lake area houses. Mean (s.d.) weekly summer rent, \$1722 (835); median, \$1571. Not included in final model.
Ski-Slope Access	Ski-in/ski-out properties are located near the Wisp Resort and are within walking distance of the ski slopes (550 yards or less). There are 64 ski-slope access houses. Mean (s.d.) weekly winter rent, \$2684 (1320); median, \$2308. Mean (s.d.) weekend winter rent, \$1401 (672); median \$1195. The weekly mean (s.d.) value for 480 non-access properties is \$2071 (1250); median, \$1750.
Ski-Road Access	The property is located on Marsh Hill Road that leads directly to the ski slopes, but are not within walking distance of a ski lift. There are 33 ski-road access houses. Mean (s.d.) weekly winter rent, \$2749 (1560); median, \$2195.
Private Dock	House has access to a private dock. There are 201 houses with access to a private dock. Mean (s.d.) weekly summer rent, \$3061 (1548); median, \$2750. Mean weekly late summer rent, \$2812 (1499); median, \$2492.
Dock Slip	House has access to a dock slip at a community dock or marina. There are 229 houses with access to a dock slip. Mean (s.d.) weekly summer rent, \$2896 (1563); median, \$2322.
Private Pool	There are 32 houses with private swimming pools, and most are indoor pools. Mean (s.d.) weekly summer rent, \$6022 (1925); median, \$5695. Mean (s.d.) weekly late summer rent, \$5724 (1863); median, \$5206.
Community Pool	There are 27 houses with access to a community swimming pool. Mean (s.d.) weekly summer rent, \$2628 (1115); median, \$2322.
Public Golf	Due to the compact size of the Deep Creek Lake area, all rental houses in the sample were considered to be within a 10-15 minute drive of the public golf course at Wisp Resort. Consequently, a separate dummy variable was not created for public golfing access.
Private Golf	Waterfront Greens is a gated housing subdivision adjacent to Deep Creek Lake. It has a private par-3 golf course and clubhouse. There are only 28 rental houses in the sample with access to a private golf course. Mean (s.d.) weekly summer rent, \$3720 (1777); median, \$3847. Not included in final model.

Notes: See Table 1 and the Data Appendix for additional information on the variables. The information in this table is based in part on descriptions in the rental catalogs of the three real estate management agencies.

**Table 3.** OLS Regression Results: Weekly Peak Summer and Peak Winter Rentals

Variable	(1) Summer: Full Sample	(2) Summer: Full Sample	(3) Summer: Agencies	(4) Winter: Full Sample	(5) Winter: Full Sample	(6) Winter: Agencies
Constant	6.4208 (0.036)*	6.4171 (0.026)*	6.4161 (0.027)*	6.2913 (0.036)*	6.2904 (0.026)*	6.2888 (0.028)*
Occupants (no.)	0.0178 (0.004)*	0.0178 (0.004)*	0.0188 (0.004)*	0.0190 (0.004)*	0.0185 (0.004)*	0.0185 (0.004)*
Bedrooms (no.)	0.0717 (0.012)*	0.0720 (0.012)*	0.0638 (0.012)*	0.1014 (0.013)*	0.1034 (0.013)*	0.1009 (0.013)*
Bathrooms (no.)	0.0626 (0.009)*	0.0618 (0.009)*	0.0628 (0.009)*	0.0718 (0.009)*	0.0697 (0.009)*	0.0718 (0.009)*
King-size beds (pct.)	0.0006 (0.0003)*	0.0006 (0.0003)*	0.0005 (0.0003)	0.0007 (0.0003)*	0.0008 (0.0004)*	0.0007 (0.0004)
Lakefront	0.3535 (0.019)*	0.3562 (0.019)*	0.3648 (0.020)*	0.1784 (0.016)*	0.1871 (0.016)*	0.1947 (0.017)*
Split-lakefront	0.1220 (0.042)*	0.1182 (0.041)*	0.1149 (0.042)*	---	---	---
Private dock	0.1523 (0.026)*	0.1512 (0.026)*	0.1705 (0.027)*	---	---	---
Dock slip	0.0860 (0.017)*	0.0867 (0.017)*	0.0961 (0.018)*	---	---	---
Ski-slope access	---	---	---	0.2364 (0.028)*	0.2500 (0.027)*	0.2430 (0.028)*
Ski-road access	---	---	---	0.0656 (0.021)*	0.0714 (0.022)*	0.0659 (0.022)*
Private pool	0.3087 (0.036)*	0.3058 (0.037)*	0.2920 (0.039)*	0.2965 (0.038)*	0.2960 (0.038)*	0.2832 (0.041)*
Community pool	0.1327 (0.0252)*	0.1330 (0.025)*	0.1427 (0.027)*	0.0681 (0.027)*	0.0748 (0.027)*	0.0778 (0.027)*
Central AC	0.1140 (0.018)*	0.1160 (0.018)*	0.1327 (0.017)*	---	---	---
Jetted tub	0.0402 (0.014)*	0.0476 (0.013)*	0.0391 (0.013)*	0.0130 (0.016)	0.0261 (0.015)	0.0243 (0.016)
Sauna	---	---	---	0.0712 (0.027)*	0.0741 (0.026)*	0.0604 (0.028)*
Extra fireplace	0.0455 (0.013)*	0.0499 (0.013)*	0.0524 (0.013)*	0.0460 (0.017)*	0.0524 (0.016)*	0.0598 (0.017)*
Pool table	0.0838 (0.015)*	0.0808 (0.014)*	0.0856 (0.015)*	0.0888 (0.017)*	0.0863 (0.017)*	0.0898 (0.018)*
Extra TVs	0.0170 (0.015)	0.0199 (0.015)	0.0195 (0.015)	0.0299 (0.018)*	0.0357 (0.018)*	0.0378 (0.019)*
Internet access	0.0689 (0.018)*	0.0641 (0.017)*	0.0624 (0.019)*	0.0565 (0.020)*	0.0598 (0.016)*	0.0630 (0.017)*
Agency A houses	0.0945 (0.027)*	0.0944 (0.016)*	0.0948 (0.018)*	0.0253 (0.028)	---	---
Agency B houses	0.0166 (0.029)	---	---	0.0293 (0.030)	---	---
Agency C houses	-0.0282 (0.036)	---	---	-0.0437 (0.037)	---	---
Adjusted R-sq	0.911	0.910	0.917	0.888	0.887	0.893
Sample N	610	610	560	577	577	527
Mean rent (\$)	2637	2637	2684	2178	2178	2206

Notes: Dependent variable is log of weekly rent for 2008; White's heteroskedastic-consistent standard errors in parentheses. Asterisks indicate statistically significant coefficient at the 95% confidence level. Agency samples exclude the VRBO properties.

**Table 4.** Percentage Effects and Implicit Marginal Dollar Values

Variable	(1) Summer: Full Sample	(2) Summer: Agencies	(3) Winter: Full Sample	(4) Winter Agencies
Occupants (no.)	1.78 (0.4) \$47	1.88 (0.4) \$50	1.85 (0.4) \$40	1.85 (0.4) \$41
Bedrooms (no.)	7.20 (1.2) \$190	6.38 (1.2) \$171	10.34 (1.3) \$225	10.09 (1.3) \$223
Bathrooms (no.)	6.18 (0.9) \$163	6.28 (0.9) \$169	6.97 (0.9) \$152	7.18 (0.9) \$158
Lakefront	42.77 (2.8) \$1128	44.00 (2.8) \$1181	20.56 (1.9) \$448	21.48 (2.0) \$474
Lakefront – late summer rentals	41.61 (2.8) \$1007	42.85 (2.8) \$1055	---	---
Split-lakefront	12.45 (4.6) \$328	12.08 (4.7) \$324	---	---
Ski-slope access	---	---	28.36 (3.5) \$618	27.46 (3.5) \$606
Ski-slope access – winter weekend rentals	---	---	31.96 (4.4) \$346	30.62 (4.4) \$334
Ski-road access	---	---	7.37 (2.3) \$161	6.79 (2.3) \$150
Private dock	16.28 (3.1) \$429	18.54 (3.1) \$498	---	---
Dock slip	9.04 (1.8) \$238	10.07 (2.0) \$270	---	---
Private pool	35.69 (5.0) \$941	33.80 (5.2) \$907	34.35 (5.1) \$748	32.62 (5.4) \$720
Community pool	14.18 (2.9) \$374	15.30 (3.1) \$411	7.73 (2.9) \$168	8.05 (3.0) \$178
Sauna	---	---	7.66 (2.8) \$167	6.18 (3.0) \$136
Central AC	12.28 (2.1) \$324	14.18 (2.0) \$381	---	---
Extra fireplace	5.11 (1.4) \$135	5.37 (1.4) \$144	5.36 (1.7) \$117	6.15 (1.8) \$135
Pool table	8.41 (1.6) \$222	8.93 (1.6) \$240	9.00 (1.9) \$196	9.38 (1.9) \$207
Internet access	6.60 (1.8) \$174	6.42 (2.0) \$172	6.15 (1.7) \$134	6.49 (1.8) \$143
Agency A houses	9.88 (1.7) \$261	9.93 (1.9) \$266	---	---
Sample N	610	560	577	527
Ave. summer rent (\$)	2637	2684	2178	2206
Late summer rent (\$)	2420	2461	1081	1092

Notes: For each variable, percentage values and standard errors (in parentheses) in the first row and marginal dollar values in the second row. Dollar values are calculated at 2008 sample means (in last two table rows). Values for late summer rentals and weekend winter rentals are from separate unreported regressions. Calculations of percentage effects and standard errors for the dummy variables in a semi-log model follow Kennedy (1981) and van Garderen and Shah (2002). Full results for the late summer and winter weekend regressions are available upon request from the author.

**Table 5.** Global Spatial Autocorrelation Statistics for OLS Residuals

Distance Band	Summer: Moran's I	Summer: Geary's C	Winter: Moran's I	Winter: Geary's C
0 – 400m	0.049 (3.608)	0.931 (-3.358)	0.058 (4.142)	0.924 (-3.931)
0 – 600m	0.040 (3.250)	0.939 (-3.238)	0.054 (4.246)	0.930 (-3.919)

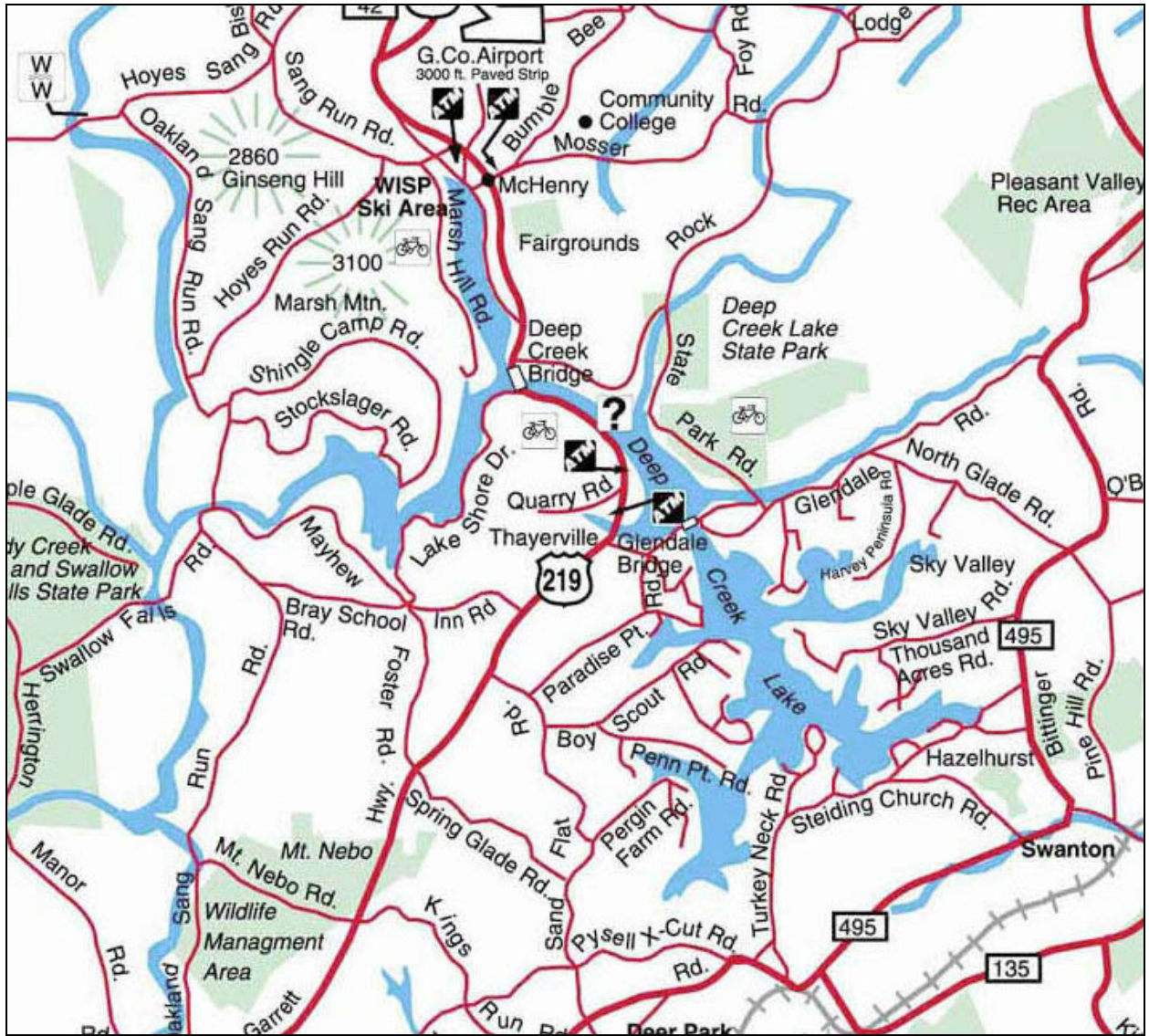
Notes: Tests using residuals from regression (3) and (6) in Table 3, with standard normal z-scores in parentheses. For Moran's I, z-score values greater than 1.64 are indicative of positive spatial correlation at the 95% level, one-tailed test. Geary's C is a measure of local spatial correlation and is inversely related to Moran's I. Distance bands are cumulative and based on Cartesian coordinates. Statistics calculated using Stata/IC 10.

**Table 6.** Spatial Correlation Regressions for Weekly Rentals

Variable	(1) Spatial lag: Summer	(2) Spatial error: Summer	(3) Pct. effect: ols, spatial error	(4) Spatial lag: Winter	(5) Spatial error: Winter	(6) Pct. effect: ols, spatial error
Constant	6.1127 (0.356)*	6.4166 (0.029)*	---	5.8189 (0.366)*	6.2917 (0.031)*	---
Occupants (no.)	0.0186 (0.004)*	0.0176 (0.004)*	1.88 (0.4), 1.86 (0.4)	0.0181 (0.004)*	0.0174 (0.004)*	1.85 (0.04), 1.74 (0.04)
Bedrooms (no.)	0.0634 (0.012)*	0.0670 (0.012)*	6.38 (1.2), 6.34 (1.2)	0.0998 (0.013)*	0.1021 (0.013)*	10.09 (1.3), 10.21 (1.3)
Bathrooms (no.)	0.0633 (0.009)*	0.0643 (0.009)*	6.28 (0.9), 6.33 (0.9)	0.0727 (0.009)*	0.0749 (0.009)*	7.18 (0.9), 7.49 (0.9)
King-size beds (pct.)	0.0005 (0.0003)	0.0005 (0.0003)	0.05 (0.03), 0.05 (0.03)	0.0007 (0.0004)	0.0007 (0.0004)	0.07 (0.04), 0.07 (0.04)
Lakefront	0.3608 (0.020)*	0.3658 (0.020)*	44.00 (2.8), 44.14 (2.8)	0.1933 (0.016)*	0.1940 (0.017)*	21.48 (2.0), 21.39 (2.1)
Split- lakefront	0.1148 (0.041)*	0.1143 (0.043)*	12.08 (4.7), 12.00 (4.8)	---	---	---
Private dock	0.1733 (0.026)*	0.1615 (0.028)*	18.54 (3.1), 17.49 (3.2)	---	---	---
Dock slip	0.0969 (0.017)*	0.0897 (0.018)*	10.07 (2.0), 9.37 (2.0)	---	---	---
Ski-slope access	---	---	---	0.2293 (0.028)*	0.2040 (0.035)*	27.46 (3.5), 22.55 (4.2)
Ski-road access	---	---	---	0.0577 (0.022)*	0.0374 (0.029)	6.79 (2.3), 3.77 (3.0)
Private pool	0.2917 (0.038)*	0.2920 (0.038)*	33.80 (5.2), 33.81 (5.0)	0.2819 (0.040)*	0.2788 (0.039)*	32.62 (5.4), 32.06 (5.2)
Community pool	0.1459 (0.027)*	0.1303 (0.033)*	15.30 (3.1), 13.85 (3.8)	0.0842 (0.028)*	0.0535 (0.035)*	8.05 (3.0), 5.44 (3.7)
Central AC	0.1336 (0.017)*	0.1375 (0.017)*	14.18 (2.0), 14.72 (1.9)	---	---	---
Jetted tub	0.0383 (0.013)*	0.0380 (0.013)*	3.98 (1.4), 3.86 (1.3)	0.0231 (0.015)	0.0228 (0.015)	2.44 (1.6), 2.30 (1.5)
Sauna	---	---	---	0.0594 (0.028)*	0.0527 (0.028)*	6.18 (3.0), 5.37 (2.9)
Extra fireplace	0.0515 (0.013)*	0.0478 (0.013)*	5.37 (1.4), 4.88 (1.4)	0.0580 (0.016)*	0.0565 (0.016)*	6.15 (1.8), 5.80 (1.7)
Pool table	0.0845 (0.015)*	0.0851 (0.015)*	8.93 (1.6), 8.87 (1.6)	0.0883 (0.017)*	0.0926 (0.017)*	9.38 (1.9), 9.68 (1.9)
Extra TVs	0.0197 (0.015)	0.0242 (0.015)	1.96 (1.5), 2.43 (1.5)	0.0365 (0.018)*	0.0457 (0.018)*	3.83 (1.9), 4.66 (1.9)
Internet access	0.0614 (0.018)*	0.0574 (0.018)*	6.42 (2.0), 5.89 (2.0)	0.0631 (0.016)*	0.0546 (0.016)*	6.49 (1.8), 5.60 (1.7)
Agency A houses	0.0961 (0.017)*	0.0978 (0.017)*	9.93 (1.9), 10.26 (1.9)	---	---	---
Rho & lambda values	0.0396 (0.047)	0.3974 (0.105)*	---	0.0633 (0.050)	0.4371 (0.125)*	---
Log-likelihood	290.41	295.71	---	227.45	233.54	---
Sample N	560	560	560	527	527	527
Ave. rent (\$)	2684	2684	2684	2206	2206	2206

Notes: Spatial models estimated by maximum likelihood using Stata/IC 10. Dependent variables are the logs of 2008 weekly rental prices. Huber-White robust standard errors in parentheses; asterisks indicate statistically significant coefficient at the 95% confidence level. Rho values reported for spatial-lag models and lambda values reported for spatial-error model. OLS comparisons in columns (3) and (6) are with the spatial-error models (standard error in parentheses)

Figure 1. Deep Creek Lake, Maryland



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**Figure 2.** Moran Scatterplots for OLS residuals