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IMPACTS OF SECOND HOME DEVELOPMENT ON HOUSING PRICES IN THE SOUTHERN APPALACHIAN HIGHLANDS

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This study estimates the value of socioeconomic, spatial and environmental attributes on housing prices of both urban and rural communities in the primary and second home areas of the Southern Appalachian Highlands, using the hedonic property price model. Distance and environmental attributes are valued more heavily in the rural communities of the second home area than in the urban communities of the primary home area. The effect of second homes on housing prices is mainly evident in the rural communities. Second home development impacts a home's value by US$2,378, or 4.2% of $56.245, the average value of a rural home.

I. Introduction

Residential development is a dominant driving force of land use change of the Southern Appalachian Highlands. Second homes are a significant component of the residential development of the region because the Great Smokey Mountains National Park attracts people for retirement and tourism. The population of many counties of the area (Macon County and Transylvania County, North Carolina) doubles during the summer through the addition of second-home owners. Madison County, North Carolina is called "the bedroom county of the city of Asheville" due to many second homes in Madison County are owned by Asheville residents. Many second homes are owned by residents outside of the Southern Appalachian region (Atlanta and Florida). During the last two decades, second home region of the area has shown consistent increases in house prices. Because of the increasing housing prices, the affordability of housing for local residents in the neighborhoods with second homes has become an increasing problem. For this reason, the relationship between house prices and their attributes, particularly regarding the presence of second homes in the area needs to be verified.

Each residential unit has a unique bundle of attributes: its accessibility to work, transportation, and amenities, as well as its structural characteristics, neighborhood, and environment. The relationship between the price of a home and its attributes has been examined since the development of the standard model of a monocentric city. The standard model examined the effect of accessibility to the Center of Business District (CBD) on housing prices (Alonso 1964; Muth 1969; Mills 1981). It has been extended in a number of ways to include consideration of accessibility to employment centers (e.g., McMillen and McDonald 1989) and environmental amenities (e.g., Polinsky and Shave11 1976; Brueckner et al. 1999; Wu 2001).

Most of the previous studies examining the effect of such attributes on housing prices implicitly assume that the effects of attributes on housing prices do not vary across local communities. This may not be a valid assumption under the circumstance where housing type and population density vary across local communities. For instance, the impact of accessibility to CBD on house price in a primary home community and a second home community would be different because residents of primary home community would value accessibility to CBD more than residents of second home community. Similarly, the impact of distance to the closest recreational park on house price would be different from a rural community to an urban community. In both cases, the implicit assumption of uniformity across local communities may mislead the estimation of those attributes on housing prices. If each local community has a different value of the same attribute, each local community would ideally need a separate indicator variable. The classification of each community accounting for heterogeneity across local communities in this study is based on housing type and population density.

The Southern Appalachian Highlands offers an excellent "laboratory" to examine the heterogeneity across local communities because the region is divided not only by population density of urban and rural communities but also by housing type of primary home and second home areas. We estimate separate hedonic house price models for each community of specification for primary home and second home areas and urban and rural communities of the Southern Appalachian Highlands.[1] The estimated values of the various attributes of housing prices in different communities can be important information for local government activities and services. Specifically, estimated impacts of second home development on housing price for different communities may help zoning boards, conservation commissions, and town councils determine the degree of responsibility of the housing affordability problem by second home development.

2. The hedonic house price model

House prices are difficult to evaluate because residential properties are composite goods that contain varying amounts of different attributes. The hedonic house price model uses observations on house prices to place a value on various attributes. The observed house price represents the value of the collection of the various attributes. The marginal value of any of

[1] A second home in this model is defined as a permanently located single-family house used seasonally for personal and private benefit. The occupants must have some other form of shelter which is considered their primary place of residence, and the second home must have been originally constructed for the purpose of leisure-time activities.

the attributes of a house can be estimated by observing how house price changes as various attributes change.

The hedonic model was first formalized in a theoretical model by Rosen (1974). Rosen's framework can be summarized as such: the price of a quality-differentiated good is a function of the attributes embodied in that good. The theoretical features of the hedonic house price model are very briefly discussed below, based on a summary of the theoretical aspects of the model provided by Freeman (1993).

Assume that each individual's utility function depends on X, a composite commodity representing all goods other than housing and Q, a vector of housing characteristics: u(X,Q). It is assumed that there is a demand for characteristics to' be independent from the prices of other goods. The housing market is assumed to be in equilibrium if individuals optimize their residential choices based on the prices of alternative locations. With these assumptions, the price of any housing unit can be described as a function of the housing characteristics. The equation is referred to as the hedonic house price function:

$$P=P(Q). \tag{1}$$

Utility is maximized subject to budget constraint, M-P-X=0, where M is income and the price of X is normalized to $1. The first-order condition for the optimal level of j th housing characteristics; q_j, is written as:

$$\frac{\partial u / \partial q_j}{\partial u / \partial X} = \frac{\partial P}{\partial q_j}, \tag{2}$$

The equation implies that the marginal willingness to pay for the housing characteristics, q_j, is the marginal rate of substitution between the housing characteristics and a composite good. The partial derivative of the hedonic price function with respect to housing characteristics is the marginal willingness to pay for the housing characteristics. For example, the partial derivative of the hedonic price function with respect to distance to a lake represents the additional amount that the individual is willing to pay in order to locate closer to the lake, by one unit.

3. Procedures

The hedonic house price model for each community of specification is applied to the 1990 U.S. Census block level data of Southern Appalachian Highlands. Each block is specified as a community by housing type (primary home and second home area) and population density (urban and rural communities). We begin with an estimation of hedonic house price model for primary home and second home areas. The census blocks with and without presence of second home are assumed to represent second home area and primary home area, respectively. The estimation of this community specification captures heterogeneity of attributes on house price regarding housing type. The hedonic price function relates average house price to the socioeconomic, environmental, and other variables of the primary home and second home areas. We estimate the following hedonic house price models for both primary home and second home areas:

$$\ln P_i = \sum_j \beta_j q_{ji} + \varepsilon_i , \tag{3}$$

where In P_i is the natural log of the average house price of a block i, q_{ji} is j th characteristics, and ε_i are the observations of specific errors. Because the attributes on house price across primary home and second home areas are different, heteroscedasticity is likely to be present. Thus, we use the Seemingly Unrelated Regression technique (Greene 1997, p. 674) to estimate separate hedonic price function for primary home and second home areas.

We then re-classify primary home and second home area into four types of communities (urban-dominated, urban-moderate, rural-moderate and rural-dominated communities). The estimation of this community specification (e.g., urban-dominated community of primary home area and rural-dominated community of second home area) captures heterogeneity of attributes on house price regarding housing type and population density at the same time. We estimate hedonic house price models for the four types of communities of primary home and second home areas using the Seemingly Unrelated Regression technique for the possible existence of heteroskedasticity in the model.

This hedonic house price model for each community of specification can also be used to estimate the expected change in house price due to the presence of second homes for the overall area and the four types of communities of the Southern Appalachian Highlands. The expected change in house price due to the presence of second homes in the overall area is

$$E(P_{i1} \mid \nu = 1) - E(P_{i0'} \mid \nu = 0) = \sum_j (\beta_{i1} - \beta_{i0}) q_{ji1} , \tag{4}$$

where coefficients β_{i1} and β_{i0} indicate the willingness to pay for the characteristics of primary home area (v = 0) and second home area (v = 1), respectively. The right-hand side of equation (4) is the expected change in house price due to the presence of second home in the blocks under the assumption that $(\beta_{i1} - \beta_{i0})$ replicates the difference in willingness to pay for the characteristics of households in second home area and the primary home area. By the same token, the expected changes in house prices due to the presence of second home in the four types of communities are

$$E(P_{i1h} \mid \nu = 1) - E(P_{i0'h} \mid \nu = 0) = \sum_j (\beta_{i1h} - \beta_{i0h}) q_{ji1h} , \tag{5}$$

where coefficients β_{i1h} and β_{i0h} indicate the willingness to pay for the characteristics of blocks with and without presence of second home in h types of communities, respectively. The precision of the estimation of the expected changes in the house price due to the presence of second home is given with their standard errors. The standard errors (se.) are calculated as:

$$s.e[E(P_{i1h}|v=1)-E(P_{i0'h}|v=0)]=$$
$$\left[\mathrm{var}[E(P_{i1h}|v=1)]-2\,\mathrm{cov}[E(P_{i1h}|v=1),E(P_{i0'h}|v=0)]+\mathrm{var}[E(P_{i0'h}|v=0)]\right]^{1/2}. \quad (6)$$

The standard error of the equation (4) is also calculated in the same manner.

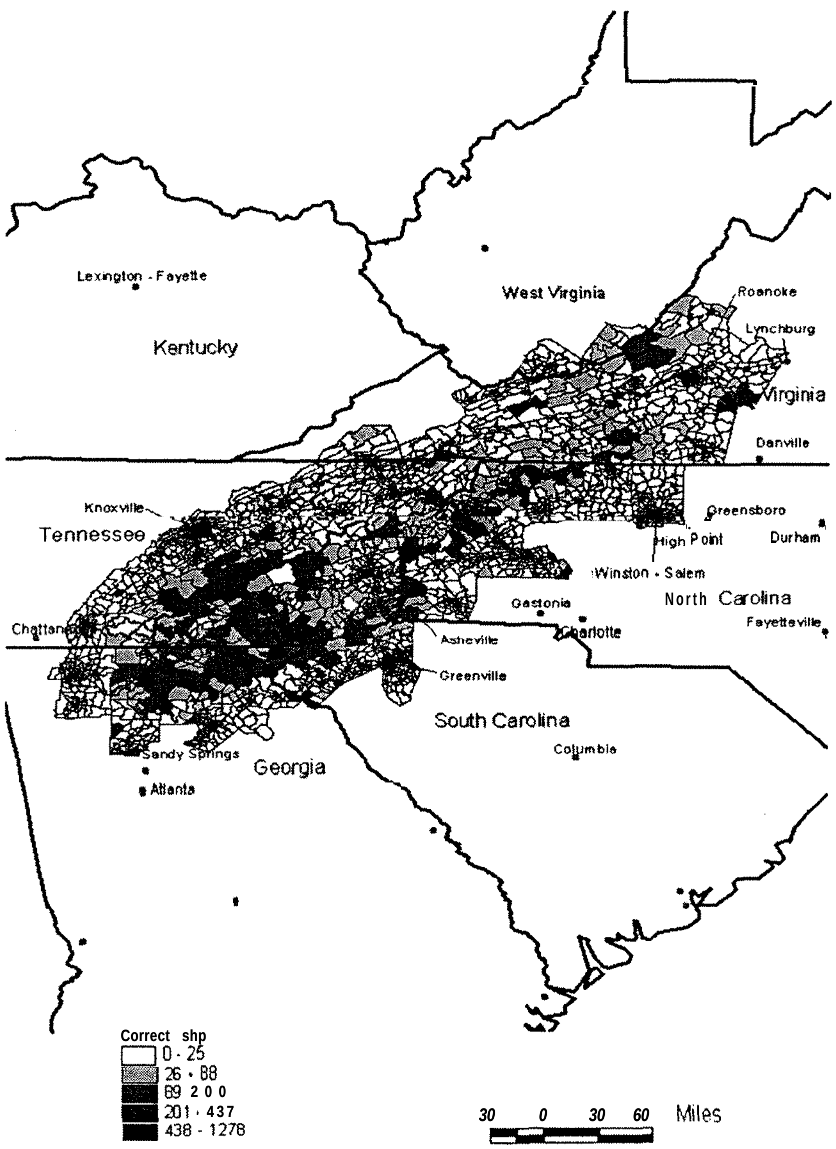
We test the hypotheses using the Chow test: all the regression coefficients are not different between primary home and second home areas and all the regression coefficients are not different across the four types of communities of the primary home and second home areas. The test checks if the disturbance variances from the regressions in the comparison are not different. If the hypotheses are rejected, heteroscedasticity exists in the estimation of the pooled data. The classical regression model then no longer applies if we estimate the model using the pooled data. Schmidt and Sickles (1977), Toyoda and Ohtani (1986) and Ohtani and Toyoda (1985) indicated that heteroscedasticity is quite likely to overestimate the significance levels of the t-test statistics of all coefficients. It is uncertain how extreme this effect is. It depends on the data and the extent to which the variance differs.

4. Study area and data

The area of our study is in the Blue Ridge province of the Southern Appalachian Highlands; it includes all of the mountainous portions of western North Carolina, northern Georgia, southeastern South Carolina, eastern Tennessee, southwestern Virginia and southeastern West Virginia. Within this region, 3,687 blocks of the 1990 U.S. Census are used for the estimation of the hedonic house price model. About 70% of the blocks contain second homes. More second homes are located within the interior of the mountainous portions of the region where elevation is higher (Figure 1). Elevation has an important role in second home locations because many prospective second-home owners seek locations with better views.

Two principal data sources are used in this study: Applied Geographic Solutions, Thousands Oaks, California, which collects demographic, housing, crime risk and pollution data from the U.S. Census, the FBI and the EPA; and Geography Network, a web service which provides geographic data from the Environmental System Research Institute (ESRI), Redlands, California. Arcview computer software is employed to generate the database, using data from the two principal sources. Distance calculations are made using a raster system where all data are arranged in grid cells. Distances are measured as the Euclidean distance from the centroid of the census block to the nearest edge of a feature (e.g., city, road, open space, and lake). The sum of length for the stream index and road index, and the sum of area for the open space index are calculated using ArcScripts, downloaded from ESRI. The stream index is total distance of stream and river within a given area reflecting stream accessibility; the road index is total distance of all roads within a given area reflecting road accessibility; and open space index is ratio of open space reflecting open space accessibility of major open space of each block. The census blocks are areas bounded on all sides by visible features, such as streets, roads, streams, and railroad tracks, and by invisible boundaries, such as cities, towns, townships, and county limits, property lines, and short, imaginary extensions of streets and roads. The census blocks in remote areas may be large and irregular and contain many square miles (U.S. Census Bureau 1990).

Figure 1. Study area



Note: Shading represents the number of second homes in each block as indicated by the legends above

We construct an index to classify each block into urban-dominated, urban-moderate, rural-moderate and rural-dominated communities. The classification is based on information about housing type from the U.S. Census which is based on population density. The U.S. Census divides housing types into urban cores, urban non-cores, rural farms, and rural non-farms based on the population density of each block. Specifically, we calculate the ratio of housing types of urban cores and urban non-cores to all housing types for each block. A block is identified as an urban-dominant community if all the housing types of each block are urban core or urban non-core. 554 of the 3,687 blocks or 1% of the total study area are identified as urban-dominant communities. A block is identified as an urban-moderate community if the percent of urban core and urban non-core housings is greater than or equal to 50% and less than 100%. A total of 1,027 blocks or 6% of the total area are identified as urban-moderate communities. A block is identified as a rural-moderate community if the percent of rural farm and rural non-farm housings is greater than 0% or less than 50%. 495 blocks or 10% of total area are identified as rural-moderate communities. A block is identified as a rural-dominant community if all the housing types of the block are rural farm or rural non-farm. A total of 1,611 blocks or 83% of total area are identified as rural-dominant communities.

Second homes comprised 3.5% of the houses in the entire study area: 6.9% of the houses in rural-dominated communities and 0.4% of the houses in urban-dominated communities. The dependent variables, explanatory variables and the definitions associated with the variables are shown in Table 1. The mean values of variables of overall, rural-dominated, rural-moderate, urban-moderate, and urban-dominated communities in the primary and second home areas are given in Table 2.

5. Estimation results

The parameter estimates for the hedonic house price model in the primary and second home areas are presented in Table 3. The parameter estimates for the hedonic house price model of the four types of communities in the primary home area and in the second home area are presented in Table 4 and Table 5, respectively. Overall the models fit the data well. The system weighted R^2 for the all models range between 0.69 and 0.84. These numbers are relatively high for this size of data set.

The F-value for the test that all the regression coefficients are not different between primary home and second home areas is 3.44. It is greater than the critical value, 1.57. So, we would reject the hypothesis that all the regression coefficients are not different between primary home and second home areas at the 5% level. The F-values for the test that all the regression coefficients are not different between rural-dominated and rural-moderate, rural-moderate and urban-moderate, and urban-moderate and urban-dominated communities of primary home areas are 1.59, 1.79, and 2.14 respectively. The F-values for the same test of second home areas are 4.04, 4.49, and 2.75 respectively. All the F-values are greater than the critical value, 1.57. So, we would reject the hypothesis that all the regression coefficients are not different across the communities in the primary home and second home areas at the 5% level. Based on the tests, we conclude that area specifications by housing type (primary home and second home area) and population density (four types of communities) correctly address the heterogeneity across local communities.

Table 1. Definition of variables

Variable	Definition
Dependent Variables	
Housing value	Median value of owner-occupied houses in $1,000
Socioeconomic Variables	
Population density	Population within 1 km^2 of area
Income	Per capita income in $1,000
Crime rate	Number of reported crimes, from vehicle theft to murder
Education	Median school years
Stability	Ratio of occupancies with 5 years or more to total occupancies
Political view	Ratio of population with political outlook very conservative and somewhat conservative to total population
Distance Variables	
Travel time to work	Travel time to work per employee in minutes
Distance to any city	Distance from a center of each block to the nearest city, town or village in km
Distance to major city	Distance from a center of each block to the nearest city with more than 50,000 population in km
Distance to major road	Distance from a center of each block to the nearest primary highway with limited access, interstate highways and toll highways, in km
Distance to major open space	Distance from a center of each block to the nearest major open space including national park service land, national forest or other federal land, state or local park or forest in km
Distance to lake	Distance from a center of each block to the nearest major lake or reservoir in km
Environmental and Other Variables	
Air pollution level	NO_2 level
Elevation	Mean elevation of each block in km
Stream index	Total distance of stream and river of each block in km within 1 km* of area
Open space index	Ratio of total area of major open space to area of each block
Road index	Total distance of all roads in km within 1 km^2 of area
Second homes	Number of second homes

The coefficients of the socioeconomic variables with the exception of population density are consistent across the primary home and second home areas. Population density's coefficient is negative and statistically significant at the 1% level in the second home area, and it is negative and statistically significant at the 5% level in the rural-dominated communities of the second home area while it is not significant in the primary home area. These results show thatdecreasing population density in the second home areas, mainly of the rural-dominated communities, increases house value. A preference to be away from crowds is evident in the second home areas of rural-dominated communities. The marginal implicit price for a decrease in

Table 2. Mean values of variables in the primary home and second home areas

	Primary Home Area					Second Home Area				
	Overall	Rural-dmt	Rural-mdt	Urban-mdt	Urban-dmt	Overall	Rural-dmt	Rural-mdt	Urban-mdt	Urban-dmt
Dependent Variables										
Housing value ($ 1,000)	57.517	53.70	62.656	58.781	55.802	60.571	56.617	64.171	65.882	62.964
Socioeconomic Variables										
Population density (per km’)	0.56	0.10	0.16	0.73	0.94	0.29	0.05	0.13	0.58	0.92
Income ($1,000)	11.89	II .27	12.44	12.41	II.26	12.22	11.07	12.79	13.81	13.39
Crime rate	101.55	49.54	56.12	124.95	138.16	70.22	45.44	46.28	103.01	137.28
Education (year)	11.52	II.22	I 1.44	I 1.68	11.57	II.55	II.28	II.54	11.93	II.92
Stability (%)	0.57	0.63	0.59	0.56	0.53	0.59	0.64	0.59	0.54	0.50
Political view (%)	0.42	0.43	0.42	0.42	0.42	0.42	0.43	0.42	0.41	0.41
Distance Variables										
Travel time to work (min)	18.16	20.99	18.77	17.16	16.88	19.77	22.32	18.94	16.62	16.03
Distance to any city (km)	3.75	6.01	4.35	2.97	2.64	5.57	7.64	4.66	3.04	2.71
Distance to major city (km)	41.80	56.89	51.55	35.44	32.58	54.54	65.17	52.67	43.56	32.83
Distance to major road (km)	7.80	II.23	8.59	5.74	4.62	13.68	19.59	10.56	7.36	4.34
Distance to major open space (km)	16.68	16.41	16.80	17.53	15.48	16.61	17.17	16.71	16.22	14.87
Distance to lake (km)	6.65	7.23	6.89	6.61	6.06	6.77	7.42	5.73	6.33	6.01
Environmental and Other Variables										
Air pollution level	87.79	X6 29	87.28	X9 03	87 47	8X 75	88.52	89.31	88.76	89.12
Elevation (km)	0.37	0.39	0.37	0.36	0.37	0 4x	0.54	0.44	0.4 l	0.39
Stream index (km)	0.004	0.004	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Open space index (%)	0.002	0.0002	0.002	0.0008	0.004	0.005	0.008	0.001	0.002	0.001
Road index (km)	0.025	0.01 l	0.014	0.030	0.037	0.017	0.009	0.013	0.027	0.036
Second homes	0	0	0	0	0	25.13	41.59	13.85	6.58	3.86

population density by one person per km^2, evaluated at the mean house value in the second home area ($60,572), yields an estimated increase of $3,857 in house values.[2]

Increasing income, decreasing crime rate, and increasing median school year all consistently increase house value regardless of the housing type of the area. These results are expected given that people with greater income and higher education level, and better safety of the neighborhood reside in houses of higher value. The fairly close marginal implicit prices between the primary home area and the second home area reflect consistent values of these variables (income, crime rate, and median school years) in the area. Decreasing stability increases house price across the communities of both the primary home and second home areas.

[2] The marginal implicit price for population density is ∂ price/a population density, which is equal to the mean of house price times coefficient of population density,

Table 3. Parameter estimates for hedonic model in the primary home and second home areas

	Primary Home Area	Second Home Area
Socioeconomic Variables		
Population density	0.028687	-0.06367”’
	(0.028208)	(0.020014)
Income	0.041306”’	0.034991***
	(0.002514)	(0.001213)
Crime rate	-0.00036”’	-0.00046”’
	(0.000095)	(0.000066)
Education	0.146970”’	0.145049”
	(0.012757)	(0.007286)
Stability	-0.40804”’	-0.46816”’
	(0.058218)	(0.034070)
Political view	0.146412	0.104618’
	(0.103437)	(0.059682)
Distance Variables		
Travel time to work	0.002146	-0.00237”’
	(0.001604)	(0.000916)
Distance to any city	0.000706	0.001165
	(0.002743)	(0.001114)
Distance to major city	-0.00015	-0.00064”’
	(0.000280)	(0.000135)
Distance to major road	-0.00201”	0.001102”’
	(0.000894)	(0.000293)
Distance to major open space	-0.00055	-0.00125”
	(0.000610)	(0.000340)
Distance to lake	0.000245	-0.00107”
	(0.001228)	(0.000555)
Environmental and Other Variables		
Air pollution level	0.001805”’	0.003612”’
	(0.000763)	(0.000367)
Elevation	-0.13646”’	0.104643”’
	(0.057847)	(0.018184)
Stream index	1.022719	4.000925”
	(1.372358)	(1.944866)
Open space index	-0.32014	-0.08869
	(0.221465)	(0.072884)
Road index	-5.67674”’	-2.37361***
	(1.043751)	(0.689965)
Number of Observation	788	2,551
System weighted R^2	0.78	0.73

Note: Standard errors are in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4. Parameter estimates for hedonic model in the primary home area of various urban and rural communities

	Rural-Dominated	Rural-Moderate	Urban-Moderate	Urban-Dominated
Socioeconomic Variables				
Population density	-0.15020 (0.299062)	0.056541 (0.222790)	0.08 1196 (0.05 1229)	-0.00666 (0.043957)
Income	0.0499 17”’ (0.006623)	0.0568 10*** (0.007436)	0.038015”’ (0.003645)	0.033212*** (0.005423)
Crime rate	-0.00086”’ (0.000363)	0.000327 (0.000387)	-0.00055”’ (0.000142)	0.000126 (0.000202)
Education	0.168359” (0.035069)	0.097062”’ (0.035443)	0.1495 14”’ (0.019288)	0.173927”’ (0.027748)
Stability	-0.42293”’ (0.136873)	-0.5 1973”’ (0.155712)	-0.25033”’ (0.092000)	-0.29625” (0.130538)
Political view	0.033836 (0.205891)	-0.16546 (0.257023)	0.000078’ (0.001467)	-0.09327 (0.256521)
Distance Variables				
Travel time to work	0.002136 (0.002784)	0.002013 (0.003739)	0.0029 13 (0.003 153)	0.0 10520”’ (0.004067)
Distance to any city	0.007855” (0.003986)	-0.01315’ (0.008277)	0.003703 (0.006405)	-0.005 19 (0.009172)
Distance to major city	-0.00054 (0.000557)	-0.00059 (0.000617)	0.000185 (0.000492)	-0.00013 (0.000667)
Distance to major road	-0.002 13 (0.001368)	-0.00143 (0.001925)	-0.00 147 (0.001 X39)	0.002771 (0.002568)
Distance to major open space	-0.00283”’ (0.001154)	-0.003 14”’ (0.001301)	0.000999 (0.00 1064)	0.001613 (0.001529)
Distance to lake	-0.0006 1 (0.002419)	0.000914 (0.002671)	0.0003 15 (0.002007)	-0.00535 (0.003351)
Environmental and Other Variables				
Air pollution level	0.004373” (0.001258)	0.001085 (0.00 1593)	0.000078 (0.001467)	-0.00277 (0.002279)
Elevation	-0.14322 (0.095957)	-0.05 190 (0.127347)	-0.18724 (0.118751)	0.022400 (0.153190)
Stream index	-4.79458 (9.2097 10)	-2.00503 (9.295 195)	1.975642 (1.555823)	-0.20878 (5.991908)
Open space index	1.001019 (7.699758)	0.442867 (1.044584)	-1.64335 (1.014843)	-0.523 15** (0.259995)
Road index	0.122960 (5.417786)	-7.9665 1 (5.355234)	-6.433 15”’ (1.711269)	-6.47925”’ (1.869047)
Number of Observations	198	135	286	169
System weighted R^2	0.76	0.81	0.79	0.84

Note: Standard errors are in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Table 5. Parameter estimates for hedonic model in the second home area of various urban and rural communities

	Rural-Dominated	Rural-Moderate	Urban-Moderate	Urban-Dominated
Socioeconomic Variables				
Population density	-0.29676" (0.137244)	-0.05538 (0.092379)	0.011186 (0.038488)	**0.001085** (0.037424)
Income	0.041530"' (0.001959)	0.032444'" (0.003374)	0.031003"' (0.002145)	0.033484"' (0.003706)
Crime rate	-0.00035" (0.000130)	0.000473' (0.000245)	-0.00022' (0.000116)	-0.0004 1*** (0.000177)
Education	0.143301" (0.011396)	0.164349"' (0.020390)	0.146136"' (0.013 102)	0.159344"' (0.023692)
Stability	-0.46353" (0.048392)	-0.44927"' (0.074793)	-0.53320'" (0.072140)	-0.26173" (0.113552)
Political view	0.148752' (0.077136)	-0.04530 (0.131153)	0.016699 (0.131699)	-0.07750 (0.228905)
Distance Variables				
Travel time to work	-0.00328"' (0.001066)	0.010273"' (0.002412)	0.004019 (0.002578)	-0.00622 (0.005215)
Distance to any City	0.004150"' (0.001233)	0.000502 (0.003607)	-0.01053" (0.004597)	0.000741 (0.009636)
Distance to major city	-0.00074"' (0.000177)	-0.00019 (0.000302)	-0.01053" (0.004597)	-0.00106' (0.000575)
Distance to major road	0.001127"' (0.000333)	-0.00020 (0.000771)	-0.00068 (0.0003 10)	0.005352"' (0.002266)
Distance to major open space	-0.00187"' (0.00044 1)	-0.00061 (0.000752)	-0.00068 (0.000310)	0.001001 (0.001543)
Distance to lake	-0.00137" (0.000661)	0.000721 (0.001310)	0.001749 (0.001429)	-0.00275 (0.002905)
Environmental and Other Variables				
Air pollution level	0.003628*** (0.000446)	0.003018"' (0.000795)	0.001711' (0.000980)	0.001385 (0.001822)
Elevation	0.112917"' (0.022255)	0.057816 (0.040387)	0.145970"' (0.050886)	0.080201 (0.101655)
Stream index	5.769153' (3.508143)	0.136912 (4.743174)	2.718428 (3.471781)	-2.45472 (4.997460)
Open space index	-0.13298' (0.078190)	1.104523' (0.622875)	0.510627"' (0.194339)	-2.38335 (2.392161)
Road index	5.717221"' (1.895744)	-0.10782 (2.459966)	-4.81926"' (1.319406)	-3.21930' (1.753147)
Number of Observations	1,397	350	557	247
System weighted R^2	0.69	0.78	0.78	0.79

Note: Standard errors are in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Decreasing stability means increasing number of newer residents because newer residents are relatively less concerned with the cost of living (including house price) and relatively more concerned with attributes of houses (Spain 1993; Dubbink 1984). Consequently, an increase in newer residents increases house price.

All but one distance variable in the second home area and one distance variable in the primary home area are statistically significant at the 5% level. All the distance variables of the rural-dominated communities and one distance variable of the urban-dominated communities are statistically significant at the 5% level in the second home area. These results show clear distinctions across the communities of the primary home and second home areas.

The coefficient of travel time to work is negative and statistically significant at the 1% level in the second home area, while not significant in the primary home area. This indicates that while there is a preference to be closer to work in the second home area, people of the primary home area are indifferent to driving longer distances to meet their other housing requirements. This is a surprising result because there are more retirees in the second home area and more people would prefer to be closer to work in the primary home area. Although there is no clear answer for this unexpected result, greater distance to CBD from the second home area may increase the significance of distance to work relative to other housing requirements.

Decreasing distance to the closest major city increases house values in the second home area but it has no significant effect in the primary home area. The insignificant effect in the primary home area is explained by relatively closer distance to the major city in the primary home area (14 km closer than second home area in average). The demand to live near a major city lowers as houses are closer to a major city. The marginal implicit price for reducing the distance to the closest major city by 1 km, evaluated at the overall mean house value in the second home area, yields an estimate of $39 in increased house value.

Increasing distance to the closest major road increases house values in the second home area, while it decreases house values in the primary home area. A major road is desirable to live near, in the primary home area, but is desirable to live far from, in the second home area. The marginal implicit price of reducing the distance to the closest major road by 1 km, evaluated at the mean house value in the primary home area, yields an estimate of $1 16 in increased house value; evaluated at the mean house value in the second home area, it yields an estimate of $67 ($64 in the rural-dominated communities and $337 in the urban-dominated communities) in decreased house value. The greater marginal implicit price in the urban-dominated communities reflects the greater congestion of heavy traffic caused by a major road.

The coefficient of distance to the closest major open space is negative and statistically significant at the 1% level in the rural-dominated communities of the primary home and second home areas. The coefficient of the distance to the closest lake is significant at the 5% level only in the rural-dominated community of the second home area but is not significant in any of the communities in the primary home area. According to our results, in the rural-dominated communities, major open space is desirable to live near regardless of housing type of the area while a lake is desirable to live near only in the second home area. In addition, major open space is somewhat more desirable to live near than is a lake.

The results on the coefficients of environmental and other variables are generally expected with the exception of air pollution level. We would expect the variable of air pollution levels to represent the degree to which one would choose to distance from the pollution. However, the positive coefficient of the rural-dominated communities (an increase in air pollution level increases house values) may more strongly reflect the convenience associated with areas of higher air pollution (e.g., commercial areas). Air pollution does not seem to be a concern because the air quality of the overall area is considered to be good.

The coefficient of elevation is statistically significant at the 1% level in both areas; decreasing elevation in the primary home area and increasing elevation in the second home area increase house value. The marginal implicit price of increasing elevation by 10m, evaluated at the overall mean house value in the primary home area, yields an estimated $78 in decreased house values; evaluated at the overall mean house value in the second home area, it yields an estimated $63 in increased house value. This finding indicates that the residents in the second home area enjoy a better view at a higher elevation, but people in the primary home area sacrifice view to meet other housing requirements at a lower elevation.

Increasing the stream index increases house value in the second home area reflecting the preference of ease of access to stream. The coefficient of road index is negative and statistically significant at the 1% level in both areas while it is positive and statistically significant at the 1% level in the rural-dominated communities of the second home area. This implies that increasing roads in the neighborhoods decreases house value with the exception of rural-dominated communities of the second home area. While there is a preference of convenience for having greater accessibility to roads in remote areas, the negative utility caused by roads repels people otherwise.

The predicted average house price by number of second homes for the rural-dominated, rural-moderate, urban-moderate, and urban-dominated communities using equation (5) is shown in Figures 2-5. The correlation between the average house value and number of second homes in the rural-dominated, rural-moderate, urban-moderate, and urban-dominated communities are 0.46, 0.20, 0.25, and 0.04, respectively. The second home effect is statistically significant at the 5% level for the overall area; it is statistically significant at the 1% level for the both rural communities but it is not significant in urban communities (Table 6). In the overall second home area, the percent of the effect of second homes on house price is 1.7% of the average house value, $59,791. This means that if second homes were not developed, the average house value of the area would be $58,760, which is $1,031 lower than the overall average house value. In the rural-dominated communities, the percent of the effect of second homes on house values is 4.2% of the average house value, $56,245. This means that if the second homes were not developed, the average house value of the area would be $53,867, which is $2,378 lower than the average house value. In the rural-moderate communities, the percent of the effect of second homes on house values is 2.6% of the average house value, $63,745. This means that if second homes were not developed, the average house value of the area would be $62,106, which is $1,639 lower than the average house value.

6. Conclusions

The results of this study show the differences in relationship between house prices and their attributes in community specifications of housing type and population density. Although socioeconomic attributes generally have consistent influences on house prices regardless of the community specifications, the distance and environmental attributes have differing influences on house price according to community specifications. Furthermore, distance and environmental attributes are valued more heavily in the rural communities and the second home areas relative to the urban communities and the primary home areas.

Figure 2. Relationship between the predicted average housing price and the number of second homes for the rural-dominated communities

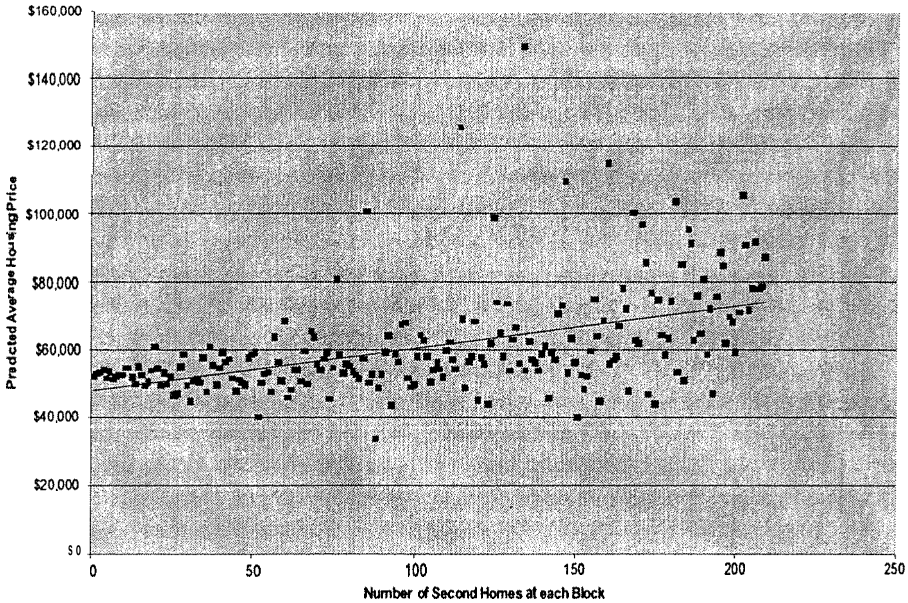


Figure 3. Relationship between the predicted average housing price and the number of second homes for the rural-moderate communities

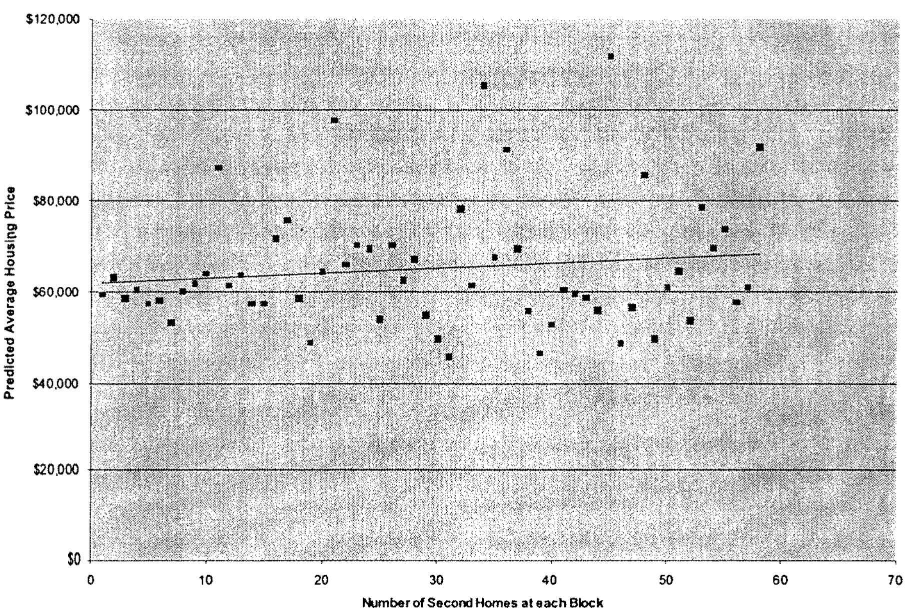


Figure 4. Relationship between the predicted average housing price and the number of second homes for the urban-moderate communities

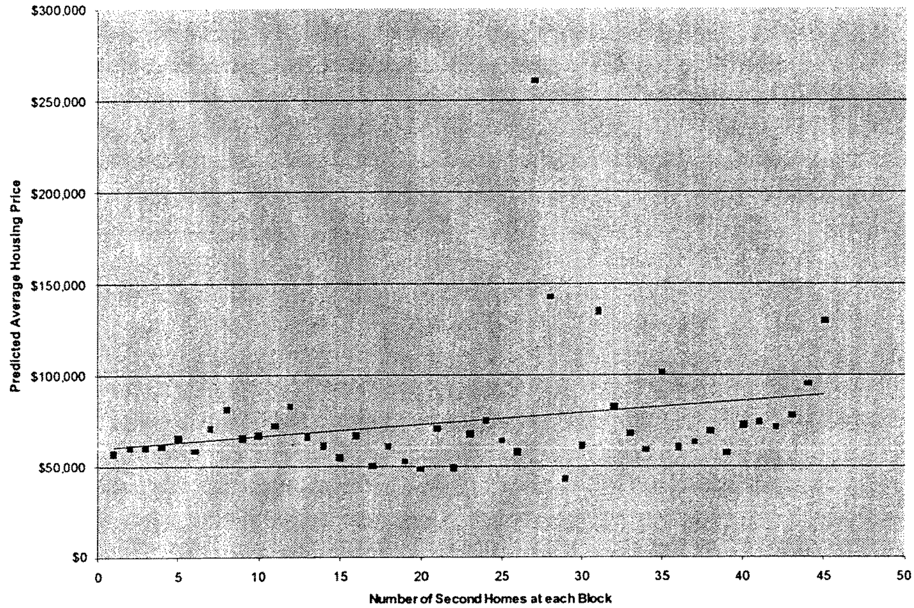


Figure 5. Relationship between the predicted average housing price and the number of second homes for the urban-dominated communities

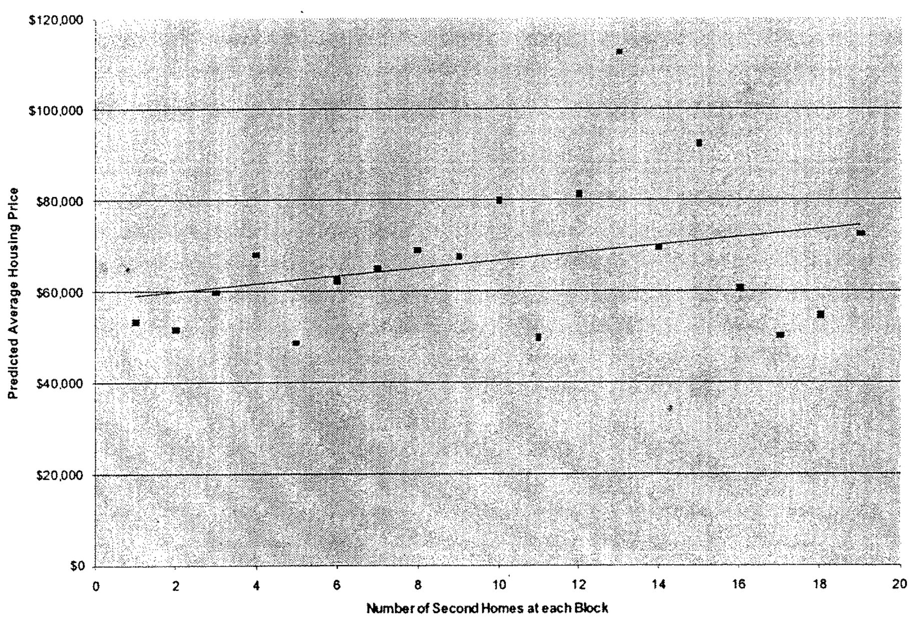


Table 6. Impact of second homes on house price

	Average housing price($/unit)	Second home effect ($/unit)	Percent change of average housing price
Rural-dominated	56,245	2,378*** (362)	4.2%
Rural-moderate	63,745	1,639*** (376)	2.6%
Urban-moderate	63,337	572 (479)	0.9%
Urban-dominated	59,990	-973 (571)	-1.6%
Overall	59,791	1,031** (436)	1.7%

Note: Standard errors are in parenthesis. ** and *** indicate statistical significance at the 5% and 1% levels, respectively.

Attributes of distance to the closest major road and elevation have an opposite effect on house price, depending on the presence of second homes in the neighborhood. The convenience of living closer to major roads is appealing to people in the primary home areas, while living far from the congestion of the heavy traffic of major roads is appealing to people in the second home area. People in the second home area enjoy a better view at a higher elevation, while people in the primary home area give up a better view to meet other housing requirements at a lower elevation.

There are attributes which significantly affect housing prices in the second home area, yet are insignificant in the primary home area. While there is a preference to be away from crowds in the primary home area of rural-dominated communities, population density does not seem to be significant in other areas. People prefer to be closer to work in the second home area, however, people of the primary home area arc indifferent to driving longer distances to meet their other housing requirements. Decreasing distance to the closest major city increases house values in the second home area. In the rural-dominated communities, it is desirable to live near major open space regardless of housing type of the area, while it is desirable to live near a lake only in the second home area. Increasing the stream index increases house value in the second home area reflecting a preference for ease of access to a stream.

Finally, we found that the presence of second homes in the neighborhood significantly influences housing prices of the overall area. The impact of second homes on house price is mainly evident in the rural communities. Furthermore, marginal effect of second homes is greater in the rural-dominated communities than in the rural-moderate communities, and it is not significant in either of the urban communities. The effect of second home on house price based on the predicted value from the hedonic property price method isolated second home effect on house price but it may not fully reflect property values under certain circumstances where spillover effect of second home development is significant. Examples of the spillover effect of second home development may include development of commercial areas for the services of second home residents. If the spillover effect is significant, we might underestimate the second home effect on house price.

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