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The Contribution of Landscaping to the Price of Single Family Houses: A Study of Home Sales in Greenville, South Carolina[1]

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Abstract

The market for housing is often analyzed from the hedonic perspective where the characteristics of the house and its location together influence its market price. In this study, the contribution of the quality of landscaping to the house price is estimated. Using data from a sample of 288 recent home sales in Greenville, South Carolina, a linear in the logs regression of house price on house characteristics, location and landscape quality was estimated. A house that obtained an excellent landscaping rating from a local landscaping professional could expect a sales price of about 4 to 5 percentage points higher (depending on the size of the lot) than equivalent houses with good landscaping. Homes with landscaping appeal far below (fair or poor) neighboring homes with excellent landscapes can expect a sales price 8–10% below equivalent homes with good landscaping appeal.

Index words: landscape valuation, home prices, hedonic model.

Significance to the Nursery Industry

Real estate appraisers have guidelines that suggest the cost of some home improvements (like a fourth bedroom) are likely to be recovered in added sales price when the house is sold. Others, like central air conditioning, may only recover part of its cost in higher sale price. Unfortunately, there are few guidelines available to homeowners on the return in sales price that they might expect from added investments in landscaping their lots. This lack of information for homeowners may result in either under or over investment in landscaping relative to added market price from higher quality landscaping.

While many homeowners invest in landscaping because they value the aesthetic effects, they must make decisions on the scope of landscaping investments. These decisions are shaped by the household budget constraint as well as the price of the landscaping net of its effect on expected return to house price. Without information on these expected returns, households may be less likely to undertake landscaping investments.

Introduction

It is common in the landscape planning literature to focus on the use of alternative plants, structures and land area to improve the appearance and utility of the land resource available to homeowners. When it comes to advising people on the benefits of landscaping, the issue of the monetary returns to investments in landscapes is likely to be something like the following advice:

> For the money-minded person, a good landscape plan is a wise investment because it improves the appearance, provides climate control such as shade and windbreaks, and gives better use of the land area. All of these increase property values. (10, p. 3).

Of course, generalizations like these provide very limited guidance to homeowners on the size of the return that they might expect on an investment in higher quality landscaping. Several studies that use statistical controls for house characteristics have found that trees on the lot add value to homes (2, 12). However, these studies do not control for the influence that other landscape characteristics may have on the price of a house. Thus, they may be attributing a value to trees that, in fact, also reflects the contribution of plants, grasses, and other landscape features to a house price.

Little is known about the magnitude of the relationship between the general quality of the landscape and the sales price of a house. For new houses, many builders suggest an allowance of 2 to 4% of the home construction cost for general landscaping of the lot. How the quality of this landscaping influences the market price actually paid is largely a matter of speculation. In established neighborhoods with stately oaks and mature flowering shrubs, the landscape gives an added dimension to potential home buyers. Is it possible to impute a monetary value to the landscape in this situation?

The research described in this article uses a model of local housing markets to test for the presence and magnitude of possible relationships between landscaping quality and the sales price of homes. The goal is to provide reliable guidelines to homeowners on the returns they might expect from investments in landscaping activities. While the valuation of landscaping is highly subjective, and some note a theoretical vacuum in such matters (3), this research demonstrates that economic valuation techniques are both feasible and can provide some useful guidelines to homeowners at least from the perspective of the economic valuation of landscaping activities.

Materials and Methods

The market for single family homes is an example of the market for a heterogeneous good, i.e., a good with a set of

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distinct characteristics that affect its price (4). Homes have many physical and locational attributes that vary greatly even within a single community. Rosen (17) developed an economic model, the hedonic model, to isolate the contribution that individual characteristics of a heterogeneous good make to market price. Recent applications of the hedonic model in the housing market suggest that in most empirical applications the model meets the criteria needed for identification of demand and supply functions for these characteristics (4, p. 9–10).

In this study, the first stage of a hedonic model of the market for single family homes is estimated. In hedonic models of housing markets, the price of the home is regressed on a vector of house characteristics and locational attributes. One of the characteristics in this study is the quality of the landscaping on lots of recent home sales. In the regression, neighborhood characteristics and the influence of house characteristics such as size (square footage), number of bedrooms, etc., on house price are held constant while evaluating the effect that improved quality of the landscape has on house price.

Before discussing the regression model and results, it is important to note that the data used for the analysis are confined to a single, medium size city, Greenville, South Carolina. Thus, the inferences drawn are valid only for the local housing market analyzed. Replications of the analysis for other communities may reveal variation in parameter estimates that reflect local preferences for landscaping that differ from those of households in Greenville.

The data used in this analysis were drawn from two sources. First, housing characteristics data were obtained for single family homes sold from 1991 to April 1993 (about 300) in the City of Greenville, South Carolina from the Greenville county tax assessors office (1). A partial listing of these characteristics and their statistical properties is presented in Table 1.

The mean house price was $99,086, with 75% of the homes falling between $69,000 and $119,500. The houses had an average of 2,401 square feet of living space, a mean lot of 15,472 square feet, while only 15% of the homes had four or more bedrooms. In addition, 38% of the houses had central air conditioning, 12.8% were less than 2 years old, and 25% had garages. Thus, the homes sold tended to be older, three bedroom homes on quarter acre lots.

The second source of data for the analysis was an on-site survey evaluation of the characteristics of the landscape for each of the homessold during this period. Landscape evaluations were completed by professional landscape design specialists that reside in the area. In addition to detailed evaluation of landscape features, the general landscaping quality of adjacent lots and the general neighborhood were assessed during the site visit. (See 16 for an evaluation of the landscaping characteristics.)

The quality of the landscaping was evaluated both from the point of view of the type, size, and condition of plants, trees, etc., used and how they were placed on the lot. Thus, the admittedly subjective concepts of balance, symmetry, sense of proportion and unity entered into the evaluations. Most of the landscapes were judged to be good (30%) or fair to average (29%). About 18% were excellent and 23% were poorly landscaped.

Locational attributes also influence home prices as noted earlier. The influence of three locational attributes are considered: traffic density, quality of neighborhood landscaping, and adjacent lot landscaping quality. Road traffic is light near 64% of the houses and medium near 20% of the houses. Only 16% of the houses are near heavy traffic.

The neighborhood landscaping category indicates that about two-third of the homes are in neighborhoods with good landscaping. Only 6% of the neighborhoods rate an excellent score and only 1% are poorly landscaped areas. Finally, nearly 19% of the homes sold were located in areas where the adjacent lots have excellent landscaping, while about 75% are good or average.

It is important to emphasize that the regression model is designed to capture the important influences on house prices—both landscaping and non-landscaping influences. Some non-landscaping features are held constant in the analysis by choice of the sample units. For example, variation in home sale prices that may occur because of differential zoning across lots and differential tax rates was eliminated by restricting the sample to homes in the same zoning classification (R6) and same tax district (City of Greenville).

Given measures of landscaping quality, neighborhood characteristics, and house attributes, it is possible to isolate the influence that higher quality landscaping may have on home prices through regression analysis.

The regression model estimated is (1):

$$\begin{aligned} \text{LPrice} = {} & b0 + b1\ \text{LArea} + b2\ \text{LSize} + b3\ \text{Air} + b4 \\ & \text{LRoom} + b5\ \text{Bed45} + b6\ \text{Nbhdqual} + b7 \\ & \text{Gar} + b8\ \text{Newer} + b9\ \text{LExsize} + b10 \\ & \text{LGdsize} + b11\ \text{Roadhvy} + b12\ \text{Aexcel} + e \end{aligned}$$

where,

LPrice = the natural log of the selling price,

b0 = the intercept in the regression,

bi = the regression coefficients and i = 1,2,...,12,

LArea = the natural log of the living area of the house in square feet,

LSize = the natural log of the lot size in square feet,

Table 1. Descriptive statistics for house, lot, and sales variables used in regressions.[z]

Variable	Mean	Standard deviation
Selling price	$98,974	$40,453.65
Square feet of the houses	2,408	920
Size of the lot (sq. feet)	15,515	7,106
Percent less than 2 years old	10.9%	
Room count (except bedrooms)	6.35	1.36
Percent with		
4 or 5 bedrooms	15.7%	
Garage	24.5%	
Central Air	38.0%	

[z]Computations by author from data supplied by the Office of Tax Assessor, Greenville County, SC.

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Air = a dummy variable equal to 1 for houses with central air conditioning and equal to 0 for houses without central air conditioning,

LRoom = the natural log of the number of rooms in the house, except bedrooms,

Bed45 = a dummy variable equal to 1 for homes with four or more bedrooms and equal to 0 for other homes,

Nbhdqual = a dummy variable equal to 1 for homes located in neighborhoods with excellent landscaping in general and equal to 0 for other homes,

Gar = a dummy variable equal to 1 for homes with a garage and equal to 0 for others,

Newer = a dummy variable for homes less that 2 years old and equal to 0 for others,

LExsize = the interaction term between lot size and Excellent landscaping. LExsize is equal to LSize for lots with excellent landscaping, and LExsize is equal to zero for other lots,

LGdsize = the interaction term between lot size and Good landscaping. LGdsize is equal to LSize for lots with Good landscaping, and LGdsize is equal to zero for other lots,

Roadhvy = a dummy variable equal to 1 for homes located near heavily traveled roads and equal to 0 for others,

Aexcel = a dummy variable equal to 1 for homes that have excellent landscaping on lots adjacent to their own and equal to 0 for others, and

e = the error term.

A linear in the logs (except in the dummy variables) regression was estimated after heteroscedasticity was found to be present in the linear model. The log transformations yielded a model that was consistent with a constant variance in the error term. The log transformation also greatly improved the absolute fit of the model. The standard error of the estimate (root mean square error) was substantially reduced relative to the mean of the dependent variable, house price. (See 7 for details of the econometric tests and procedures.)

The "variance inflation" or VIF measure for the presence of multicollinearity was used to identify explanatory variables that were collinear (thus, invalidating the "all else the same" assumption when interpreting the individual regression coefficients). Generally, the regression should have no VIFs greater than ten and the average should be less that two (15, p. 806). The model reported in Table 2 meets these criteria easily. Other regressions which included additional housing and location characteristics were more likely to exhibit problems with collinearity, though there was little effect on the parameter estimates for the landscaping variables as other variables were added.

Results and Discussion

In this section, the regression model used to test for the influence of better quality landscaping on home prices is presented and empirical results are discussed.

Non-landscape influences on sales price. Because the contribution that landscaping may make to housing prices can only be estimated if other influences are held constant, it is important to note what these other influences might be. In this study, these other influences are the non-landscape housing and site characteristics that affect house prices.

Looking at Column (2) in Table 2, the regression coefficients are consistent with findings in other recent studies of the housing market (e.g., 4, 11, 13). Increasing the living area of the house and the size of the lot both increase the price of the house, all else the same. The room count variable may also be interpreted as exerting a positive influence on price. The remaining regression coefficients on non-landscape variables reflect the effect of dummy variables on the log of the house price. Expected sales prices are higher for homes with central air (about 6% higher), four or more bedrooms (about 10% higher), that have garages (about 3% higher) though statistically not significant, that are less than two years old (about 3% higher), than houses without these characteristics, all else the same (for example, for the same size lot and living area in the house). Similarly, homes near heavily traveled roads appear to have prices 5% lower than other comparable homes (b11 is negative though not statistically significant at commonly accepted levels of making a type 1 error).

Landscaping influences on sales price. There are three ways in which landscaping is likely to affect the sales price of a house: the quality of landscaping in the neighborhood, the quality of landscaping on lots adjacent to the house in question, and the quality of landscaping on the lot itself. It is hypothesized that the size of the lot will interact with the quality of landscaping to affect house price. Excellent landscaping on one acre lots would require more of an investment than similar landscaping on quarter acre lots. The benefits of these investments are hypothesized to be capitalized into the selling price of the house.

Looking at Column (2) in Table 2, the regression coefficient on Nbhdqual indicates that neighborhoods with pervasive excellent landscaping tend to sell for about 7% more than similar homes in other neighborhoods. However, the b6 regression coefficient is not statistically different from zero at commonly accepted levels of significance.

As the landscaping becomes more closely identified with the house in question, the absolute impact of better landscaping on prices increases and the statistical properties of the parameter estimates improve. Looking first at the effect of excellent adjacent landscaping, Aexcel, on selling price, there is a surprisingly strong impact of about 10% on sales price, all else the same. This result is statistically significant at less than the .01 level. However, it is also important to recognize that this is an average impact over a range of houses that sell from about $50,000 to $200,000. In the next section it will be illustrated how this impact varies across

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typical homes in the low, mid and high price categories when other house characteristics are the same.

Expected price effects from improved landscaping by size of lot. Finally, consider how the expected sales price is affected by excellent or good landscaping on lots that vary in size from about 10,000 square feet to 45,000 square feet. The base for comparison between good or excellent landscaping is all other lots, i.e., those that have average or poor landscapes. Often, in neighborhoods where homes sell in the $125,000 to $200,000 range, there are no poorly and few average or fair landscaped lots so that the choice is whether or not to upgrade from good to excellent.

What kind of return on investment in better landscaping (good to excellent) can a homeowner expect? Turning again to Table 2, the regression coefficients on LExsize (b9) and LGdsize (b10) provide some help in answering this question. Note that the b9 coefficient is greater than b10. Excellent landscaping returns more than good landscaping. Both coefficients are statistically significant. (See 7 for the test of joint significance of b9 and b10 and a test for the difference between b9 and b10.) But, these are interaction coefficients so that the magnitude of the landscape quality effect on price increases with the size of the lot.

Perhaps the simplest way to reveal the joint impact of the quality of landscaping and lot size is to estimate the expected sales price of a house that is the same in all respects (as shown in Equation (1)) except one house has excellent landscaping while the other house has good landscaping. This is accomplished by estimating Price from Equation (1) for the following house. It has central air and the average number of rooms; it has four or more bedrooms and a garage; it is less than two years old and is not located on a heavily traveled road. Finally, the adjacent lots and neighborhood in general have excellent landscaping.

The results of estimating this equation for the Greenville sample are shown in Figure 1 and for selected size of lot ranges in Table 3. Looking first at Figure 1, note that the results of estimating Equation (1) have been converted from logs to their corresponding dollar values for the sales price (HPrice) along the vertical axis. (To correct for possible intercept term bias in linear in the logs models, the predicted values of price were adjusted using the correction in Kementa (9), p. 511, see 7 for details.)

Similarly, the lot size is shown in square feet along the horizontal axis (LSize). Note that the expected sales price ranges from about $109,000 to about $150,000 for homes that have average or poor landscaping (the AP curve closest to the horizontal axis). Note also that house price increases as lot size increases but at a decreasing rate (the slope of the AP curve becomes smaller as lot size increases). This simply indicates that, all else the same, the contribution of a given unit increase in lot size (say 1,000 square feet) to expected home prices becomes smaller as the lot size increases.

The middle Good curve is the result of allowing good landscaping on the otherwise identical home. It is always above the AP curve as expected and the vertical gap between the two curves can be used to estimate the contribution to sales price of improving landscaping from average/poor to good for houses in this price range. Similarly, the highest curve, Exel, shows the expected price on homes that have excellent landscaping, all else the same. The vertical gap between the Good and Exel curves yields the change in expected sales price for home on various sizes of lots. The

Table 2. Regression results for equation.

Dependent variable: LPRICE
Analysis of variance

Source	DF	Sum of squares	Mean square	F value	Prob>F
Model	12	22.73344	1.89445	37.913	0.0001
Error	261	13.04174	0.04997		
C Total	273	35.77518			

Root MSE	0.22354	R-square	0.6355
Dep Mean	11.43322	Adj R-sq	0.6187
C.V.	1.95515		

Parameter estimates

	Variable	Parameter estimate	Standard error	t-Statistic	Prob >	Variance inflation
	(1)	(2)	(3)	(4)	(5)	(6)
b0	Intercep	6.400648	0.41816907	15.306	0.0001	0.00000000
b1	LArea	0.352769	0.04534712	7.779	0.0001	1.53945546
b2	LSize	0.143719	0.03979608	3.611	0.0004	1.37898267
b3	Air	0.062427	0.03091297	2.019	0.0445	1.23854483
b4	LRoom	0.448951	0.08227597	5.457	0.0001	1.52243945
b5	Bed45	0.104146	0.04613228	2.258	0.0248	1.54399025
b6	Nbhdqual	0.076677	0.06080773	1.261	0.2084	1.11483764
b7	Gar	0.025887	0.03188820	0.812	0.4176	1.03005281
b8	Newer	0.025713	0.04601428	0.559	0.5768	1.13201125
b9	LExsize	0.013479	0.00411027	3.279	0.0012	1.26950363
b10	LGdsize	0.009272	0.00329471	2.814	0.0053	1.14049326
b11	Roadhvy	-0.048241	0.03718662	-1.297	0.1957	1.04082040
b12	Aexcel	0.104258	0.03730872	2.794	0.0056	1.15624541

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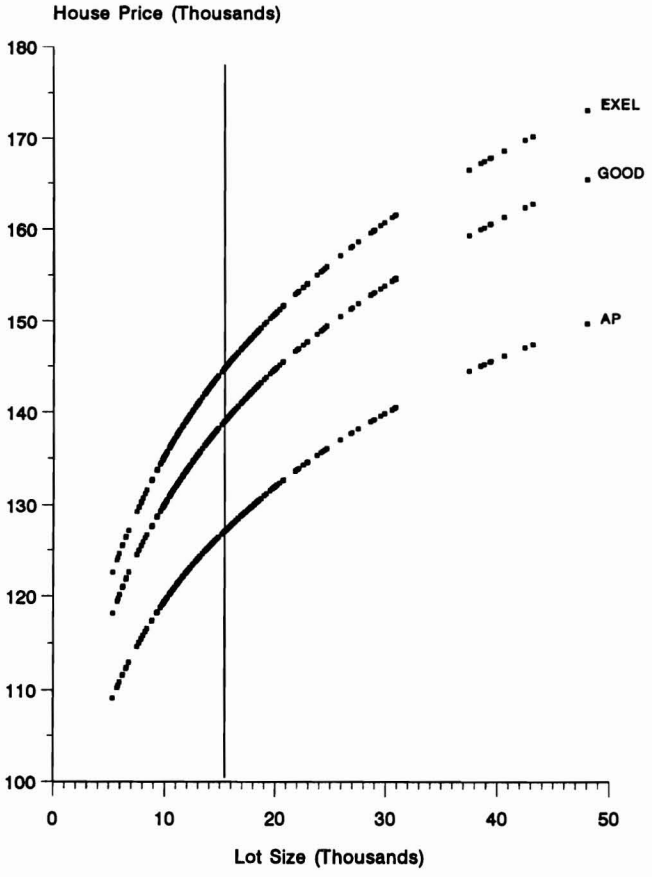

Fig. 1. Price versus size of lot, excellent neighborhood.

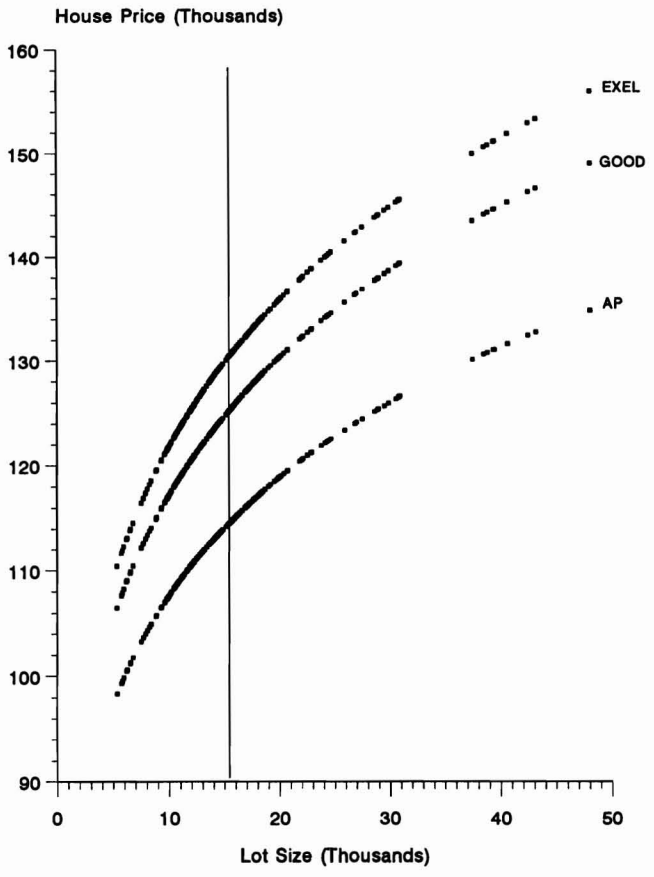

Fig. 2. Price versus size of lot, good neighborhood.

vertical line at about 16,000 square feet for lot size represents the mean lot size for the Greenville sample.

Turning next to Table 3, the dollar and percentage changes for improved landscaping for homes depicted by Figure 1 are shown for properties of selected lot sizes. Looking first at the predicted house price on average/poorly landscaped lots, note that it increases steadily as the lot size increases from 10,000 square feet to about an acre, 42,500 square feet. As the lot landscaping improves from poor/average to good, in this range of homes, expected price increase by about 8 to 10% (see Column 6). However, care must be used in interpreting this estimate. There are not likely to be many homes in this price range with less than good landscaping. Thus, homes with less than good landscaping would be "outliers" and tend not to be up to neighborhood standards. These results suggest that there is a large penalty to pay for being well below standards in a given neighborhood. Recall that landscaping on adjacent lots and in the general neighborhood is excellent.

For these homes, a more likely choice is whether or not to upgrade from good to excellent. In this case, once a lot is already rated good, then further upgrading results in a expected price return of about 4 to 5% over the home on a good lot.[3]

To gain further insight into the effect of nearby quality of landscaping on the price of a given home, Equation (1) was reestimated for homes that are adjacent to lots with less than excellent landscaping, all else the same. The results are plotted in Figure 2. Note that the effect of having less than excellent landscaping on adjacent lots is to shift all three of the Hprice/Lotsize curves down from where they were located in Figure 1. Houses on average/poor lots now range in price from about $98,000 to about $135,000. Looking next at Table 4, it can be seen that though the percentage effects of better landscaping on house prices are the same as found in Table 3, the dollar landscape premium effects have fallen by about $500 to $700 for good to excellent and by about $1,000 to $1,500 for the average/poor to good upgrades. Thus, all else the same, having a lot that is better landscaped (excellent) than neighboring lots (good) is less valuable than improving your lot to the excellent rating of adjacent lots.

The results of the regression analysis show a positive impact on housing prices in Greenville, South Carolina from improved landscaping. The effects emanate from better landscaping on the lot in question as well as on adjacent lots. It is prudent to recognize that the dollar returns from landscaping will vary with the size of the lot and the general price range of houses under consideration. The model estimated suggests a percentage return in the 4 to 5% range for upgrades from good to excellent landscaping on homes that are otherwise similar in the $119,000 to $147,000 price

[3]It may be risky to distinguish between good and excellent landscaping effects on price. An alternative model that uses a combined excellent/good interaction term with lot size was estimated. The interaction coefficient, b9, 10 is 0.01070 with a p value of 0.0003. Predicted values using the same criteria shown in Table 3 indicate an excellent/good price premium over average/poor lots from 9.6 to 12.2%.

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Table 3. Returns[z] to improved landscaping for homes with similar attributes in the $116,000 to $172,000 range, Greenville, SC.

Lot size sq feet	Avg/poor landscape predicted house price ($)	Landscape premium			
		Excellent over good		Good over average/poor	
		($)	(%)	($)	(%)
10,000	119,469	5,141	4.0	10,651	8.9
16,000	127,818	5,812	4.2	12,003	9.4
20,000	131,194	6,155	4.3	12,693	9.6
30,800	140,433	6,868	4.4	14,123	10.1
42,500	147,085	7,445	4.6	15,276	10.4

[z]Calculated by the author using regression results in Table 2 and the following characteristics: Central Air, Garage, mean number of rooms, four or more bedrooms, less than two years old, not located on a heavily traveled road, with excellent general neighborhood and adjacent lot landscaping.

Table 4. Returns[z] to improved landscaping for homes with similar attributes in the $103,000 to $153,000 range, Greenville, SC.

Lot size sq feet	Avg/poor landscape predicted house price ($)	Landscape premium			
		Excellent over good		Good over average/poor	
		($)	(%)	($)	(%)
10,000	107,641	4,632	4.0	9,596	8.9
16,000	115,163	5,236	4.2	10,815	9.4
20,000	118,916	5,546	4.3	11,437	9.6
30,800	126,529	6,188	4.4	12,725	10.1
42,500	135,522	6,708	4.6	13,764	10.4

[z]Calculated by the author using regression results in Table 2 and the following characteristics: Central Air, Garage, mean number of rooms, four or more bedrooms, less than two years old, not located on a heavily traveled road, with excellent general neighborhood and less than excellent adjacent lot landscaping.

range. The same model predicts returns of 8 to 10% for upgrading the landscape from average/poor to good. These estimates suggest that landscapes that are substantially less appealing than those in the same price range can expect a large (8 to 10%) penalty for not keeping up with the competition. Making the decision to upgrade to the highest level of landscaping if neighboring lots are excellent will return 4 to 5% to the homeowner at the time of sale.

These results provide some guidelines to homeowners as they make decisions on how much they can expect in added sales price if they invest in landscaping upgrades. The returns are influenced by lot size and the current condition of the landscape relative to other homes in the same general price range. Proper use of the regression model requires the analyst to specify the housing submarket of interest (e.g., older homes with fewer than four bedrooms, etc.). Then, the comparisons over different landscaping quality can be evaluated for expected price effects within these submarkets.

The results obtained in this research are robust with respect to small changes in model specification. For example, a monthly time trend variable was not significant and had little influence on the size of the other regression parameters. Further, the statistical properties of the model suggest that the underlying assumptions of the regression are met and thus the inferences drawn are reliable. While the model presented is less detailed on housing attributes than some (e.g., 11), the addition of other attributes added little to the explanatory power (R-square) of the model. Still, there is room for added detail in terms of the explanatory variables for the housing market analysis and the scoring procedure for landscaping quality.

Finally, it is important to reiterate that the results presented here are for a single medium sized community in the Southern Piedmont region. Landscaping attributes in places unlike the Piedmont, e.g., Arizona, will be qualitatively different and homeowners may place higher or lower implicit values on landscaping than Greenvillians do. And, in a complete hedonic model these implicit prices for a housing characteristic like landscaping can be used to discover the underlying demand and supply functions for the characteristic. At this juncture, nothing can be said about the price or income elasticities of demand for the landscaping.

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