The Effect of Relative Size on Housing Values in Durham

Durham Research Paper

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Introduction

Real estate economics raises an interesting question about how markets value relative house size in a neighborhood. What do consumers more highly value, a relatively small house in a neighborhood of large houses or a relatively large house in a neighborhood of small houses? This has been a paradoxical question that has resulted in a variety of contradicting answers by both real estate agents and economists. Real estate agents have frequently given contradicting recommendations regarding this debate, arguing that the most profitable deal is to buy a low-end house in a top-tier neighborhood while also maintaining that buying the largest house in a neighborhood results in the most cost-efficient purchase. Likewise, academic literature has produced many perplexing theories regarding the valuation of homes based on relative size. Atypicality, conspicuous consumption, and fiscal capitalization are three prominent rationales for how markets value house size relative to the surrounding neighborhood composition. In the present study, I will utilize public data (obtained from Zillow) on housing sales in six different Durham neighborhoods to estimate the effects of relative size of houses on their selling price.

Theoretical Framework

The following section contains a detailed description of each of the three popular theories: atypicality, conspicuous consumption, and fiscal capitalization. The summaries for each theory and their respective effects on housing prices are summarized in Table 1.

I) Atypicality Effect

The atypicality effect is based on Haurin's model (1988), which explains why houses with "unusual attributes take longer to sell" (Turnbull et al, 2006). In essence, there are few buyers who have a strong preference for atypical houses, therefore resulting in a longer time for the market to match the supply of these atypical houses with prospective buyers. However, Haurin's model focuses entirely on the selling time of the house, whereas in the present model (Turnbull et al, 2006), we shift focus instead to the *price* effects of atypicality.

To begin, imagine a particular neighborhood comprised of a variety of different house sizes. Let's suppose that the type of buyer who is most attracted to the houses in this neighborhood is the type who most prefers the average-size house in this neighborhood j, $\hat{H}_j$. Let P denote this buyer's valuation of a house with size H (which may or may not differ from $\hat{H}_j$). The indirect utility function for this type of buyer is $V(P, \delta)$, where the difference in house size H from the average for the neighborhood is given by the parameter: $\delta = H - \hat{H}_j$. The assumption of this atypicality model is therefore, $(\partial V/\partial|\delta|) < 0$, indicating that atypical houses in the neighborhood (either larger than average or smaller than average) will result in lower offers from a typical buyer. The competitive pricing condition is $V(P,\delta) = U^0$, where U^0 is the buyer's opportunity cost (alternatively, the expected utility from purchasing elsewhere). By implicitly differentiating the competitive pricing condition, we can compare the value of any house in a heterogeneous neighborhood with an identical house in a different, homogenous neighborhood. Using the properties of indirect utility ($\partial V/\partial P = -H$), we derive the pricing effect of atypicality as

$$\frac{\partial P}{\partial|\delta|} = \frac{\partial V/\partial|\delta|}{H} < 0$$

This equation implies that houses that are either larger or smaller than the average for the neighborhood will sell at a discount (Turnbull et al, 2006). Intuitively, this derivation is logical: if larger/smaller than average houses are considered atypical by potential buyers, then they will take longer to find a suitable match, and therefore they will be sold at a lower price when compared to similarly sized houses in a homogenous neighborhood (when controlling for time on the market).

I) Conspicuous Consumption Effect

Under the parameters of the conspicuous consumption effect, which stems from the ideas originally developed by Veblen (1899), consumers obtain "additional utility from demonstrating their greater affluence by buying a house that is larger than surrounding houses" (Turnbull et al, 2006). This effect has been popularized in contemporary real estate culture as the "pride of ownership," whereby owners of larger houses in a neighborhood obtain greater utility from "showcasing" their wealth. In terms of the capitalization model outlined above, the assumption of the conspicuous consumption model is $(\partial V/\partial \delta) > 0$. Differentiating the competitive pricing condition yields $(\partial P/\partial \delta) > 0$. The implication of this equation is that there is greater value placed on houses that are larger-than-average ($\delta > 0$), resulting in a premium on their sale prices compared to an otherwise identical house in a homogenous neighborhood. The reverse logic applies for the relatively small house in a neighborhood of larger houses: a smaller-than-average house signals lower wealth ($\delta < 0$), thereby reducing the inherent utility and causing these houses to be sold at a discount (Turnbull et al, 2006).

II) Fiscal Capitalization Effect

The Fiscal Capitalization effect can effectively be summarized by Hamilton's demonstration (1976) that local property tax can lead to "price differentials for large or small houses in heterogeneous communities not observed for the same size houses in homogeneous communities" (Turnbull et al, 2006). Although his formulation was originally applied to housing variation within a federal jurisdiction, the implications can also apply to variation in housing size within the context of a local neighborhood.

To illustrate this effect, assume that the bundle of all government services provided by property taxes, G, is the same for all households (regardless of variations in size), and that M_i is the money budget for individual households.

1) Buyer's utility for y (non-housing consumption) and H_i (housing) → $U(y, H_i, G)$.

2) Gross-of-Property tax unit price of house H_i → $(1+t)P_i$

3) The utility for house H_i → $U(M_i - (1+t)P_iH_i, H_i, G)$

Therefore, property tax rate (t^m) needed for government services (G) in a heterogeneous housing community is given by

$$t^m = \frac{G}{\sum_i n_i P_i^m H_i}$$

where the superscript *m* indicates market values in the *heterogeneous* community.

Using similar logic, the property tax rate needed for an equivalent level of government services in a *homogenous* community can be derived:

$$t^i = \frac{G}{NP_i^i H_i}$$

where N represents the total number of houses in the community. The competitive pricing condition for a prospective buyer in the heterogeneous neighborhood is given by

$U(M_i – (1 + t^m)P_i^m H_i, H_i, G) = U(M_i – (1+ t^i)P^i H_i, H_i, G).$

Consequently, the pricing condition requires

$(1 + t^m)P_i^m H_i = (1+ t^i)P_i^i H_i$

After substituting with the previous equations and rearranging the variables, we arrive at

$(P_i^m – P_i^i)NH_i = 1 – (P_i^m H_i)/(PH^*)$

where PH* is the market value of the average size house in the heterogeneous neighborhood. Thus, in the heterogeneous community, the three sizes of houses ($H_L > H^* > H_S$) yield the following unit price relationship:

$$P_L^m < P^* < P_S^m.$$

This equation implies that large houses have lower unit prices, and small houses have higher unit prices when compared with the average house in a heterogeneous neighborhood. Essentially, larger houses suffer from a larger effective property tax bill for comparable services, as a result of having a greater taxable value (Turnbull et al, 2006). Therefore, the capitalization of this "net fiscal disadvantage" for relatively larger houses in the community results in relatively larger houses being sold at a discount and relatively smaller houses being sold at a premium.

Table 1: Summary of the Economic Theories and Their Price Effects

	Price Effect	
Theory	Smaller house	Larger house
Atypicality	−	−
Fiscal capitalization	+	−
Conspicuous consumption	−	+

Empirical Analysis

In the empirical study, I used the public online database Zillow to collect a sample of single-family, owner-occupied housing transactions undertaken in Durham, North Carolina. The data set covers 60 total transactions over the past 36 months (April 2010 through April 2013), and is sub-categorized into 6 distinct, heterogeneous neighborhoods with varying house sizes. The neighborhoods are all roughly one quarter-mile in diameter, and represent a random sample of the typical Durham community (refer to the Appendix for specific locations of each region). Table 2 summarizes the means and standard deviations of the pertinent variables used in this study.

Sales price, number of days on the market (DOM), the square footage of living area (Livarea), lot area, and year of construction are all directly obtained for each individual transaction through Zillow. The *Age* is calculated as the difference between the date of construction and the date of sale. The *Discount* variable is calculated as: 1- selling price/listing price. The most important variables that are central to this study are those that measure the size of the house relative to the other houses in the immediate neighborhood. I have used six independent, binary dummy variables (not shown in the tables) to control for the neighborhood/location designation of each of the homes. Indexing all houses within a quarter-mile radius of house i by J, the standardized measure which I used to measure relative house size is:

$$Localsize_i = \frac{Livarea_i - \sum_{j \in J} Livarea_j / N_i}{\sum_{j \in J} Livarea_j / N_i}$$

The relative size variables, $Larger_i$ and $Smaller_i$, are continuous variables intended to measure the deviations of individual house sizes from the Local Mean Living Area, and are defined as the absolute value of $Localsize_i$. Therefore:

$Larger_i = |Localsize_i|$ for $Localsize_i > 0$, and =0 otherwise

$Smaller_i = |Localsize_i|$ for $Localsize_i < 0$, and =0 otherwise.

I estimated the effects of the various housing characteristics on selling price using multiple regression analysis. The equation is based on contemporary hedonic pricing models, with the log of sales price as a function of DOM, house characteristics, neighborhood characteristics (dummy), and time trends (36 months) to capture broad market conditions. The results of the regression are reported in Table 2 (with the exception of the six dummy variables).

In the current model, it can be seen that older houses sell for less than newer houses, and that net area is more valuable than living area. However, the relative size variables are the main variables of interest to this study, and their positive coefficients indicate that both larger and smaller houses sell at a premium relative to equivalently sized houses in a homogenous neighborhood. The quadratic term on these relative size variables indicate that the price premium increases at a decreasing rate as the size differential between the houses and their neighborhood competitors increase.

Conclusion

The *larger* and *smaller* price effect estimates do not support Haurin's atypicality hypothesis (which state that larger and smaller houses would both be sold at discounted prices), but are consistent with the combined theories of Veblen's Conspicuous Consumption Theory and Hamilton's Fiscal Capitalization Theory. The negative price effect of fiscal capitalization on relatively larger houses is overshadowed by the positive price effect from conspicuous consumption. Similarly, the negative price effect of conspicuous consumption on relatively smaller houses is overshadowed by the positive price effects of fiscal capitalization. Although the results are not consistent with Haurin's Atypicality hypothesis, we cannot say with certainty that its effects are not present. Instead, we can only conclude that, if atypicality effects do exist, they are dominated by the stronger forces of conspicuous consumption and fiscal capitalization. However, it is also important to note that the empirical evidence offered here is the result of a very small sample size (N=60) collected with very limited resources. Additionally, the sample only pertains to a small cluster of neighborhoods in a small region (Durham), making it very difficult to generalize these findings to a national scale. To build on to the findings of this study, it is imperative in future empirical studies to extract MLA data on a larger scale in order to determine if the previous relationships are generalizable to other regions. An extended analysis could also incorporate additional variables related to the demographics of the neighborhoods in order to arrive at more precise and accurate results.

References

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Appendix

Table 2 Description of Variables and Summary Statistics

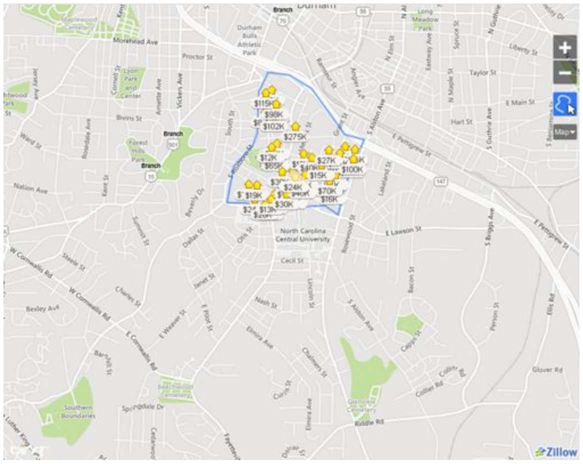
	Description	Average	Std. Dev.	Min	Max
Price	Selling Price of Home	60233.33333	54246.64847	7500	275000
DOM	Days on the market	246.3166667	283.5414352	18	1188
Livarea	Square feet of living area	1408.55	379.0704252	1000	2780
Lotarea	Square feet of lot area	7871.766667	3984.197826	3920	30056
Lotsqft	Square feet of lot size/10,000	0.787176667	0.398419783	0.392	3.0056
Netarea	Square feet of other area	6463.216667	3957.996292	2295	28952
Year	Year of construction	1945.683333	40.29993131	1900	2011
Age	Age of House	67.31666667	40.29993131	2	113
Discount	% discount from list price	0.077083333	0.418414574	-0.759	0.865
Month	Time Trend Variable	24.65	8.996845021	2	35
Averagearea	Average area of houses	1408.55	163.0139097	1146.1	1677.4
Localsize	Deviation from local mean living area	9.02056E-18	0.227484998	-0.38356981	0.657326815
Larger	Positive deviations from LMLA	0.084474597	0.163382959	0	0.657326815
Smaller	Negative deviations from LMLA	0.084474597	0.102672395	0	0.38356981

Table 3 Results for Log of Sales Price Equation

	Coefficients	t Stat	
Intercept	37.920	2,531.898	
DOM	0.017	3,634.370	***
LivArea	-0.018	-0.001	
NetArea	0.004	0.000	
Age	-0.006	-155.959	***
Month	0.013	72.753	***
Lotsqft	-47.710	0.000	
Larger	2.862	70.360	***
Smaller	3.989	75.129	***
Lotsqft^2	-0.072	-19.085	***
Larger^2	-3.821	-59.517	***
Smaller^2	-9.501	-61.242	***
Adjusted R^2	0.780		

Key ***=indicates significance at the 1% level

Neighborhood 1



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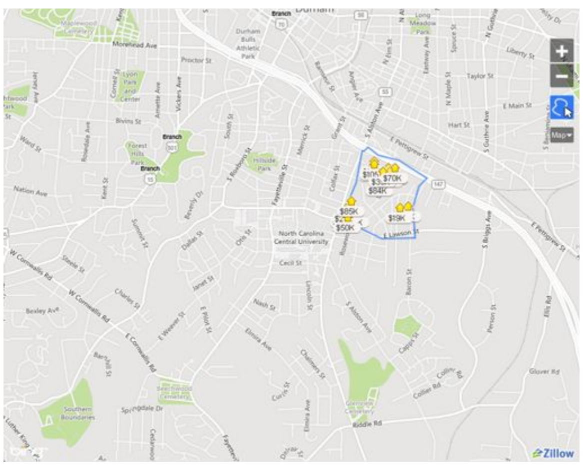

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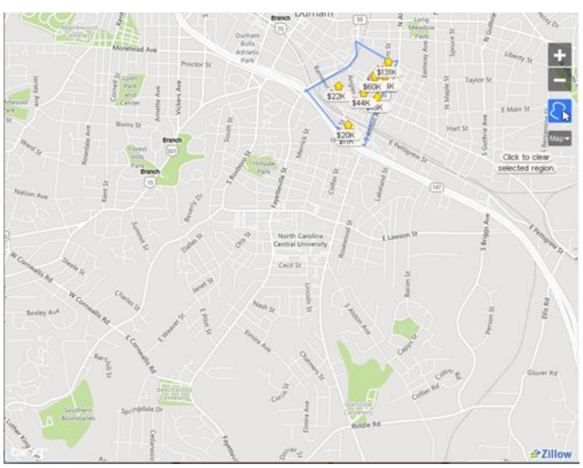

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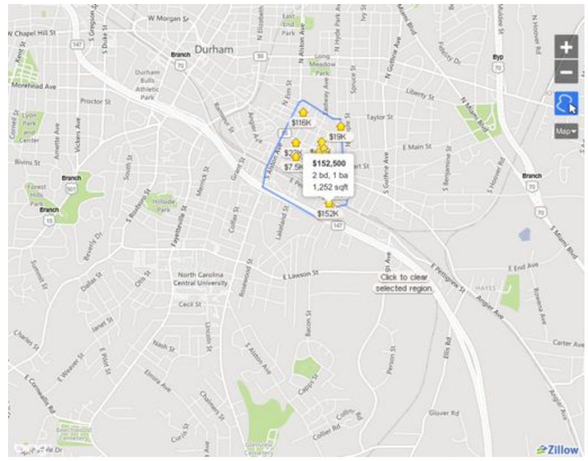

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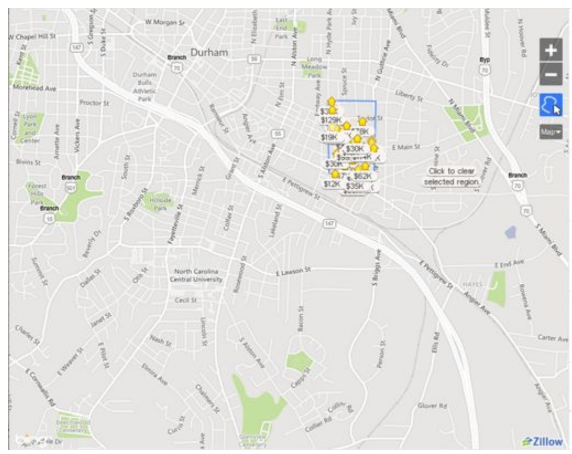

Neighborhood 6