

**A Hedonic Regression of Home Prices in King County, Washington,
using Activity-Specific Accessibility Measures**

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ABSTRACT

This study examines the influence of accessibility to different types of employment on single-family residential property values using hedonic regression analysis. Using tax assessors' property attribute records, regional travel demand model outputs, and real property sales transactions from King County, Washington in 1995 and 1998, a hedonic regression analysis is used to determine whether congested single-occupancy vehicle accessibility indices, specific to different types of employment, are significantly associated with property values. The results show that access to commercial and university uses is positively associated with sale prices, while access to K-12 educational and industrial uses is negatively associated with sale prices.

INTRODUCTION

This study examines the connection between single-family residential property values and accessibility in a polycentric metropolitan area. Although access to employment has been central to the theory of transport and urban economics since the origin of these fields, this study provides new evidence of the nature of the effects of accessibility on housing values, taking into account congestion in the transportation network and differences in accessibility effects by employment type. The effects on housing prices of dispersion of employment from the traditional CBD to suburban centers has been previously explored (1, 2), but this earlier empirical work used straight-line distance to centers as measures of accessibility, and they did not differentiate between types of employment within the centers. Moreover, substantial employment is dispersed outside of centers (3), so measures of access to employment that account for employment dispersal across the entire urban landscape are needed to avoid biased inferences about the nature of these effects. These issues are explored in this paper, using hedonic regression analysis of a large sample of housing sales, augmented by accessibility measures derived from a travel demand modeling system. The use of a travel demand model system allows development of accessibility measures that are based on congested travel times rather than free-flow times, and provides an opportunity to examine the effects of network capacity, congestion, and the spatial distribution of jobs by sector on property values.

The central question is whether, and how, accessibility to activities affects property values. Accessibility has long been accepted by urban economists as a central driver of property values, but it has often been represented simplistically, as in the one-dimensional distance from a single Central Business District (CBD) of the monocentric model (4). The focus of this study is to re-examine the effects of accessibility using measures that are sensitive to dispersed activity centers and to travel time delays resulting from congestion on the road network. A deeper understanding of the relationship between accessibility and property values can help determine how households value travel time delay (due to congestion) and diversity in activity destinations. It can also contribute to models of urban land use change by predicting how the market for housing will respond to changes in spatial employment distributions, transportation infrastructure, and congestion conditions.

THEORY

The concept of linking transportation costs and housing prices dates from early models of urban residential structure, beginning with the monocentric model of Alonso (4), which in turn drew on von Thünen's work on agricultural land rents (5). Alonso's monocentric model assumed that residential location decisions were made with respect to a single center of activity, the CBD, by trading off travel costs, assumed to increase linearly with distance to the CBD, and land rent. When households bid on housing, the travel cost savings of locations more proximate to the CBD allow them to bid higher on the purchase price of those locations while maintaining the same level of utility, generating a declining land rent gradient from the CBD. Muth extended the monocentric model by considering housing as a bundle of housing "services" and by differentiating households by income, with the ratio of the income elasticity of demand for housing to the income elasticity of travel costs producing different income distributions within the monocentric city (6). Mills relaxed the assumption of monocentric employment and allowed businesses to locate outside the CBD, but still within a monocentric orientation (7). Due to the intractability of the mathematical structure of the monocentric model, none of this early work addressed polycentric urban structures characteristic of modern cities, and transportation networks and congestion were not taken into account.

Generalization of the accessibility concept to account for dispersed employment came from Hansen, who borrowed the gravity model from physics to help explain travel patterns (8). The gravity model was used to assess the quantity of activity that could be accessed from a particular origin, discounting the quantity at each destination by a power of the transportation cost between them. Wilson refined the gravity model by incorporating probability statistics, resulting in an entropy-based form (9), in which attractiveness of the destination is divided by the exponent of the transportation cost between origin and destination. Gravity models have been widely used to model trip distribution, and as the basis for modeling residential location (10), but the connection between housing prices and accessibility that was at the core of the monocentric model was not carried forward in the work on gravity and entropy-based accessibility.

While methods of analyzing generalized accessibility were being developed by Wilson and others, Rosen was developing a hedonic price theory to disentangle the bundle of housing services that contribute to housing prices (11). Using this theoretical basis, hedonic regression analysis estimates the implicit prices of characteristics of a house from a sample of housing sales transactions, though only the final sales price is actually observed. The whole housing good includes structural attributes, such as lot size and quality of construction, and spatial attributes, such as location within a good school district and proximity to the CBD. Accessibility to activities falls under these spatial

attributes. The estimated coefficients in the hedonic price regression model become estimates of the marginal prices for each of the individual attributes of the residential property. These do not represent willingness to pay functions, but reflect instead the aggregation of all the demand and supply functions in the market, or the envelope of demand and supply functions.

The present study draws on all three of these theoretical frameworks. We use hedonic regression to estimate the implicit prices associated with accessibility measures to dispersed employment by type, based on Wilson's entropy formulation. In the following section we briefly review relevant empirical research, before presenting the model specification and results.

EMPIRICAL RESEARCH

Much literature has focused on the impacts of specific transportation projects on property values using hedonic pricing models. Rather than examining the generalized accessibility provided by a comprehensive transportation system, these focus only on the proximity of residences to specific transportation facilities and usually limit the scope of the study based on some fixed distance from that facility. Early studies focused on highways (12, 13, 14, 15) and recent studies have focused largely on transit (16, 17).

The theory behind these studies differs from the preceding theory by focusing on the effect of specific transportation facilities as producing spatial externalities that are capitalized into nearby land values. These externalities may be positive (such as visibility for commercial uses) or negative (such as noise). Even access benefits are considered to be a direct externality of a transportation facility. Beyond the scope of individual transportation facilities, the attractiveness of a location will depend on multiple transportation facilities and their connectivity to activity destinations (18). While the results of these studies may be applicable to assess housing values effects in the immediate vicinity of transportation facilities, they do not provide much insight into the effects of more general measures of accessibility to activities across the metropolitan region on the transport network, either with or without congestion.

The most closely related empirical studies to that presented here are based on hedonic regression of housing sales on more generalized measures of accessibility. One study used travel demand model outputs to represent travel costs resulting from congested travel times, but used census tract median housing values and rents from the census rather than individual sales transactions as is standard for hedonic regression studies (19). Another study used generalized accessibility measures to aggregate all opportunities accessible to a particular property, inversely weighting them based on the travel costs (20). However, as found by Waddell et al, it is possible that a generalized accessibility measure cannot fully account for the value of proximity to the CBD (1).

We extend this empirical research by using hedonic regression to separately estimate implicit prices for entropy-based measures of accessibility to different types of employment, to test for differential valuation of accessibility by type of employment at the destination. In this study, commercial, educational (K-12), and industrial destinations were measured, in separate accessibility indices, using the quantity of employees of each type; university destinations were measured using the quantity of full-time-equivalent students enrolled. This study is the first, to our knowledge, to use activity-specific accessibility measures in a hedonic regression on disaggregated residential sales transactions. It goes one step further by using *congested* travel times in the calculation of the accessibility measures, derived from the outputs of a regional travel demand modeling system.

METHODOLOGY

Hedonic Regression Model

The hedonic regression model of housing sale price was estimated using ordinary least squares (OLS) regression. The dependent variable, housing sale price, and several of the continuous independent variables were implemented using logarithmic transformations. In this form, each estimated coefficient can be interpreted as the elasticity between the independent variable and the housing sale price. The specification of the hedonic model is shown in Equation 1:

$$\ln(\text{Price}_{i,y}) = \beta_{0,y} + \beta_{1,y} \mathbf{X}_{i,y} + \beta_{2,y} \mathbf{Y}_{i,y} + \beta_{3,y} \mathbf{A}_{i,y} + \varepsilon_{i,y}, \quad (\text{Equation 1})$$

where $\text{Price}_{i,y}$ = sale price for property i in year y ,

$\mathbf{X}_{i,y}$ = a vector of structural attributes for property i in year y ,

$\mathbf{Y}_{i,y}$ = a vector of spatial attributes for property i in year y ,

$\mathbf{A}_{i,y}$ = a vector of accessibility attributes for property i in year y ,
 $\beta_{0,y}, \beta_{1,y}, \beta_{2,y}, \beta_{3,y}$ = empirically estimated coefficients, and
 $\varepsilon_{i,y}$ = an error term assumed to be independent across observations and identically distributed from a normal distribution with mean zero and constant variance.

Accessibility Measures

The accessibility measures were developed using data extracted from the Puget Sound Regional Council (PSRC) travel demand model. This model uses the state of the regional transportation system and the distribution of population and employment, aggregated into Transportation Analysis Zones (TAZs), to model the amount of automobile and transit travel generated across the Puget Sound area during the AM peak hour on a typical weekday. The two most recent calibrated base year models, for the years 1995 and 1998, were used. For this reason, the analysis here was restricted to sales transactions that occurred during those years.

The two outputs obtained from the PSRC travel model were 1) a listing of the assumed amount of employment within each TAZ, and 2) a table of AM peak-hour congested single-occupancy vehicle travel times between each pair-wise combination of any two TAZs. These two outputs were used to calculate the accessibility index for each TAZ using the entropy-based formula in Equation 2:

$$Acc_{i,y}^{\text{Commercial}} = \sum_{j \in \text{TAZs}} \left[\frac{Emp_{j,y}^{\text{Commercial}}}{e^{\alpha TT_{i,j,y}}} \right], \quad (\text{Equation 2})$$

where $Acc_{i,y}^{\text{Commercial}}$ = Accessibility in TAZ i to Commercial Employment in year y ,
 $Emp_{j,y}^{\text{Commercial}}$ = Number of Commercial Employment in TAZ j in year y ,
 $TT_{i,j,y}$ = Congested Travel Time between TAZs i and j in year y , and
 α = an empirically determined parameter.

To interpret this accessibility index, consider that for employment that is located at a travel time of zero minutes away from the origin TAZ, the resulting value would be equal to the number of jobs. The summation continues by adding jobs to the total index from nearby TAZs, but for each of these, the additional number of jobs is discounted based on the congested travel time required to access them. The summation continues for all TAZs in the metropolitan area. A similar formula was used to calculate access to education employment, industrial employment, and university enrollment.

The α -parameters in the entropy-based accessibility equations were optimized for each of four accessibility measures by using repeated trials to maximize the estimated regression model R^2 values and by monitoring the correlation coefficients to ensure that they did not exceed 0.8. The resulting α -parameters for Commercial, Educational, Industrial, and University Accessibility were 0.05, 0.15, 0.25, and 0.15, respectively.

A Geographic Information System (GIS) was used to associate the TAZ-based accessibility indices with all sales records whose parcel centroid was located within that TAZ's boundaries. Consequently, the precision of accessibility represented in the index is somewhat limited. However, because TAZ boundaries are defined primarily through the identification of geographic areas with relatively similar access to the regional roadway and transit network, the effect of this aggregation should be minimal.

DATA

The scope of this study included single-family residential home sales within King County, Washington State, during 1995 and 1998. Data was limited to these years because accessibility information, obtained from calibrated travel demand models, was only available for those years.

The dependent variable in this study, housing price, was obtained from a database of real property sales transactions maintained by the King County Tax Appraiser's Office. Summary statistics for the log of the sale price, which was used as the dependent variable in the hedonic regression models, are listed in TABLE 1.

Structural attributes included in the model were selected on the basis of their common use in other hedonic regression analyses, and they included area of the lot and structure, grade of the building (i.e. the quality level of the home when originally built), the condition (i.e. the current quality of the home relative to its original condition), the number of bathrooms (both full- and half-bath counts), and the age of the home. These structural attributes were

obtained from the King County Appraiser's Office database of the most current (i.e. Year 2001) recorded state of all parcels and residential buildings within the county. As such, there is some potential for temporal mismatch between the sales transactions themselves, which occurred in 1995 and 1998, and the structural attributes of the parcels and buildings associated with those sales. Because data on those attributes contemporary to the sales transactions are not available, the 2001 state of those attributes is taken as a reasonable proxy.

Spatial attributes were also included in this study, including first a set of indicator variables for views from the property of the Seattle skyline, Lake Washington, and other geographic features. Dummy variables were also created to indicate within which school district a parcel fell (omitting the dummy variable for the Seattle School District). Because no dummy variables were used to indicate the municipality of a parcel, these school district indicators captured variation not only in the attributes of a school system, but also of the municipality most associated with it.

Accessibility measures were derived using the PSRC base year travel demand models for 1995 and 1998. These used the same transportation infrastructure assumptions that are used in all of PSRC's regional decision-making activities. The travel demand models also used population, employment, and university enrollment estimates whose totals were projected by the Washington State Office of Financial Management. These totals were allocated across the PSRC jurisdiction using the DRAM/EMPAL software package and through reviews by city and county staff. Summary statistics for the resulting accessibility measures are listed in TABLE 1.

Correlation coefficients were calculated for the four accessibility measures. To minimize correlation between accessibility measures, the employment types provided by PSRC were aggregated into three categories: commercial (including retail, office, and government employment), education (including only educational employment), and industrial (including manufacturing, warehouse, communications, transportation, and utilities). The resulting correlation coefficients, shown in TABLE 1, show that the Commercial Accessibility values are moderately correlated (at approximately 0.77) with both Industrial Accessibility and University Accessibility. All other correlation coefficients were below 0.6.

RESULTS

Three model specifications are presented here. The first, Model 1, is a base specification including non-accessibility factors only. Model 2 adds dummy variables to categorize ranges of accessibility values for each of the four accessibility measures. This model helps to evaluate the functional form of the accessibility variables. Model 3 employs a linear functional form for the accessibility measures. The results of the three models are summarized in TABLE 2.

As shown in the table, both models that included accessibility variables showed some improvement in the proportion of variance represented, even when adjusting for the number of variables. The linear model (Model 3) had a higher proportion of variance explained than the categorical model (Model 2).

Model 1: Base Specification

The base model of housing prices includes basic attributes of the housing lot, such as acreage and views, and attributes of the housing structure, such as age, condition, and floor space. The estimated coefficients for Model 1 are summarized in TABLE 3. All of the base specification variables are significant and all except the "Log of Age" variable carry the expected sign. Since no accessibility variables were included in this model, it is likely that this variable serves as a proxy for proximity to the Seattle CBD, since areas closer to the CBD tend to have older homes. We expect that by including accessibility, the sign of "Log of Age" would be reversed to negative, as found in (1).

Model 2: Categorical Accessibility

The specification of Model 2 includes dummy variables representing finite ranges of values for the two accessibility indices, retail and non-retail accessibility. Using dummy variables in an initial specification helps us identify the best functional representation of accessibility.

The estimated base-model coefficients for Model 2 are summarized in TABLE 3, and the estimated dummy variable coefficients are summarized in TABLE 4. For the most part, the base model coefficients behave similarly once the accessibility dummy variables have been added. As expected, the inclusion of accessibility factors has resulted in a negative sign for "Log of Age".

The accessibility coefficients themselves are summarized in TABLE 4. The relative magnitudes of the accessibility coefficients are shown in FIGURE 1. Roughly linear trends are identifiable for all four of the accessibility measures. Commercial Accessibility and University Accessibility appear to bring a premium on housing sale price, as indicated by the positive slopes over most of their ranges. Contrastingly, the negative slopes

associated with Education Accessibility and Industrial Accessibility suggest a penalty on housing price for those types of access. These results suggest that for commercial and university uses, housing consumers seek overall to minimize transportation costs, while for educational and industrial uses, housing consumers seek to minimize some externality associated with those uses. Schools may bring noise and juvenile drivers to a neighborhood, while industrial uses may bring noise, pollution, and poor visual aesthetics.

Model 3: Linear Accessibility

Informed by the results of Model 2, the functional form tested for the accessibility indices was a linear form, producing a log-linear relationship between sale price and accessibility. The estimated coefficients are summarized in TABLE 3. The estimated base-model coefficients for Model 3 all have the expected signs. As in Model 2, the inclusion of accessibility factors has resulted in a negative sign for “Log of Age”.

All four accessibility indices in Model 3 are significant, and their signs agree with the general trends found in Model 2 and illustrated in FIGURE 1. The highest magnitude coefficients were the negative coefficients, with Educational Accessibility having a larger coefficient than Industrial Accessibility. Commercial Accessibility had the lowest coefficient, which was positive. The University Accessibility coefficient was also positive. However, it is difficult to draw conclusions from the magnitude comparisons, since the perceived weight of one commercial employee may be very different from the perceived weight of one educational employee; the educational employee is in fact a proxy for many enrolled students.

Elasticities

To explore the relationship between the four accessibility measures and sale price represented in Model 3, point elasticities were calculated for all of the continuous independent variables. Depending on the relationship between the dependent and independent variable as specified in the model, the elasticities were calculated using Equation 3:

$$E_k = \begin{cases} \beta_k \bar{x}_k & \text{if semi - log or} \\ \beta_k & \text{if log - log,} \end{cases} \quad (\text{Equation 3})$$

where E_k = Point elasticity for independent variable k ,
 β_k = Estimated coefficient for independent variable k , and
 \bar{x}_k = Average value of independent variable k from the data sample.

The resulting elasticities are listed in TABLE 3. These elasticities indicate that property values are inelastic to accessibility, but in varying degrees depending on the sector. Commercial accessibility had the highest elasticity, with a one-percent increase in accessibility raising property values by 0.96%. Educational and Industrial accessibility were negatively elastic, with one-percent increases lowering property values by 0.23% and 0.13%, respectively. University accessibility was the least elastic, with a one-percent increase raising property values by only 0.04%. These results are influenced, in part, by the relative magnitudes of the employment in each category, with commercial employment accessibility having almost 200 times as large a scale as the other categories.

Assumptions of Ordinary Least Squares Estimation

To evaluate the robustness of the model specification, we tested for heteroskedasticity and temporal autocorrelation, and we subjectively evaluated the potential for relevant variables to have been omitted and for the accessibility measures to be endogenous to the model specification. To test for heteroskedasticity in Model 3, a Breusch-Pagan test was conducted. The Breusch-Pagan χ^2 was calculated to be 7,168, which is significant with greater than 99% probability, indicating that there is heteroskedasticity in the model. In other words, the variance of the error term in the model evidently varies across observations.

Temporal autocorrelation was tested using the Durbin-Watson d test on cases ordered by date of sale. The resulting d -statistics, shown in TABLE 2, were inconclusive for all models. Spatial autocorrelation is also likely in the models, although no quantitative measures of spatial autocorrelation have been computed. Even with the spatial attributes included in the model, some unexplained tendency for proximate homes to sell at similar prices probably remains, due to the absence of such neighborhood attributes as identity and reputation, crime levels, and demographics.

The presence of heteroskedasticity and, potentially, autocorrelation suggests that there may be some key variables omitted in the model. These could include neighborhood-based statistics discussed above. Also, the

effects of the accessibility measures may be accentuated by the tendency for high-access locations to have a greater number of bidders, driving prices in those locations higher than locations with fewer bidders.

The reverse relationship between housing sale prices and accessibility is difficult to characterize due to multiple potential results. An increase in housing values may suggest an increase in affluence, which could imply that a neighborhood would use some above-average political clout to affect the development of new transportation facilities; whether they would favor greater or fewer roads is unclear.

Certainly business location decisions respond in part to the needs of the employees, explaining the trend in the 1990's of businesses to locate in suburban centers instead of in the CBD. This trend is one example of how lower land values in the suburbs of a city may induce employment to increase in suburban centers, which would in turn increase the accessibility measures in those suburbs.

Simulation Results

To examine the relationship between travel costs and property values, a simulation was conducted in which the overall travel times between a typical home and all potential destinations were increased and decreased by 10%. Drawing from sample averages, the test home was a 17-year-old three-bedroom two-bath house of 1,670 square-feet situated on a 9,200 square-foot lot and located within the City of Seattle school district. Its base property value, as predicted by Model 3, was \$176,975. The results of the simulation found that a 10% increase in travel times decreased the home's value to \$167,540 (a 4.79% decrease). A 10% reduction in travel times increased the home's value to \$182,667 (a 3.80% increase).

Some variants of Model 3 were tested to determine whether there remained a tendency for properties near the CBD to have higher sale prices than those farther away, even after accounting for accessibility. These tests preliminarily found that after accounting for accessibility, properties near the CBD tend to have *lower* values than others. However, whether this effect is continuous has not yet been determined.

CONCLUSIONS

The results in Model 3 suggest that access to each of the four activity types has an effect on the value of a home. However, only two of these effects, those of Commercial Accessibility and University Accessibility, were positive, and thus could be explained as the capitalization of benefits of accessibility into housing prices. The other two effects, for Educational Accessibility and Industrial Accessibility, were negative, suggesting that benefits from access to these uses are outweighed by negative effects associated with proximity. For example, industrial uses may create noise, air pollution, groundwater pollution, and poor aesthetics in the areas immediately surrounding the sites, with the effects decaying with distance from the sites. Negative externalities associated with educational uses may include noise and localized traffic congestion.

The linear functional form fit all four accessibility measures well in the model of log-of-sale-price. The consequent log-linear relationship suggests that for any fixed-unit change in the number of accessible jobs (or, for universities, a quantity of enrollment) to a home, there is a commensurate *percentage*-increase in the value of the home.

Because the results of this study were significant and the functional forms of the relationships were clearly identified, the results could be adapted for predicting market valuation of homes with respect to generalized accessibility. The simulation exercise demonstrates how a potential reduction in travel times could be evaluated with respect to its effects on home values. As shown by the simulation, the overall effect of increased accessibility on the market value of the sample home is positive, but the response is relatively inelastic. A similar simulation could be implemented as part of a larger model of real estate market behavior or as a component of a land development model. By updating market valuations of single-family homes in response to accessibility changes, this kind of model could more realistically simulate the effects of changing concentrations of activities, new transportation facilities, or increased congestion on roadways.

Some limitations in this study include the following:

- The use of some other functional form of accessibility (such as a power-based or Gaussian form) may more accurately represent how access to jobs is perceived than the entropy-based accessibility that was used in this study, and these should be compared using further empirical analysis.
- There is a likelihood of unobserved similarities in proximate homes that affect housing price, causing spatial autocorrelation. An alternate model form may be able to account for this spatial autocorrelation.

- The use of TAZs to represent accessibility implies a significant spatial aggregation of effects that may be inappropriate; some level of disaggregation of accessibility within TAZs would help alleviate this effect.
- The perceived accessibility used by households when valuing homes may be more strongly affected by free-flow travel times or by network distances than by congested travel times, since these are easier to accurately observe. This suggests that a two-part accessibility index (with two separate coefficients) may be appropriate, with one term representing the free-flow travel time and the second term representing the perceived increment in delay experienced during, for example, the AM peak hour.
- Only auto-based accessibility was considered at this stage in the current study. Consequently, accessibility associated with walking proximity or transit service was disregarded. It would be beneficial in the future to incorporate the accessibility associated with these non-SOV modes into the model. Particularly, intermodal comparisons of the optimal dispersion factors (i.e. the α -parameter in the Equation 2) and of the elasticities of property value to accessibilities would aid in assessing the relative effects of improvements in automobile, transit, and non-motorized transportation facilities.

This study advances understanding of the effects of generalized accessibility in polycentric urban areas on housing prices, the limitations mentioned notwithstanding. Further research will seek to address these limitations and incorporate these innovations into improving the design of integrated land use and travel demand models.

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TABLE 1. Summary Statistics for Accessibility Variables

Statistics	Summary Statistics (Calculated Across Sales Transactions)				Correlation Coefficients (Calculated Across TAZs)			
	Mean	Std. Dev.	Min.	Max.	Comm. Access.	Educ. Access.	Indust. Access.	Univ. Access.
Log of Age	12.16	0.46	9.83	13.48				
Commercial Accessibility	166,652	61,862	8,250	319,950	1.000	0.535	0.770	0.776
Educational Accessibility	964.88	429.59	0.39	2,176.30	0.535	1.000	0.360	0.504
Industrial Accessibility	1,281.00	1,050.48	0.01	7,618.30	0.770	0.360	1.000	0.498
University Accessibility	1,330.55	1,550.06	0.09	9,667.34	0.776	0.504	0.498	1.000

TABLE 2. Model Comparison

Model	Number of Observations	R^2	Adjusted R^2	Durbin-Watson d-statistic
Model 1: Base Specification	41,600	0.65986	0.65962	1.643
Model 2: Categorical Accessibility	41,598	0.71215	0.71170	1.825
Model 3: Linear Accessibility	41,598	0.71642	0.71620	1.849

TABLE 3. Estimated Model Coefficients

Independent Variable	Model 1 (Base Specification)		Model 2 (Categorical Accessibility)		Model 3 (Linear Accessibility)		
	β	t	β	t	β	t	E
Constant	7.786	175.308**	7.549	172.851**	7.191	168.077**	--
Log of Building Size	0.282	38.399**	0.284	41.912**	0.278	41.465**	0.282
Log of Lot Size	0.042	16.326**	0.072	29.340**	0.078	32.350**	0.042
Log of Average Bedroom Size	0.078	12.399**	0.052	8.882**	0.056	9.642**	0.078
Log of Number Bathrooms	0.067	10.760**	0.050	8.672**	0.048	8.304**	0.067
Within 1 Year Old	0.081	10.397**	0.016	2.189*	0.010	1.418	--
Log of Age	0.007	2.628**	-0.038	-12.162**	-0.038	-14.865**	0.007
Building Grade	0.164	82.981**	0.138	74.154**	0.135	72.906**	1.003
Condition	0.058	22.423**	0.052	21.586**	0.050	21.176**	0.167
Mountain View	0.017	7.242**	0.016	6.972**	0.018	8.038**	--
Lake View	0.089	36.029**	0.099	42.928**	0.095	41.761**	--
Commercial Accessibility			Accessibility Measures		$6*10^{-6}$	71.056**	0.962
Educational Accessibility	Not		Implemented as		$-302*10^{-6}$	-41.928**	-0.227
Industrial Accessibility	Included		Dummy Variables;		$-104*10^{-6}$	-43.933**	-0.134
University Accessibility			See TABLE 4 for details.		$30*10^{-6}$	16.907**	0.039

Key: β = estimated coefficient; t = Student's two-tailed t -statistic; E = point elasticity; * = significant at $p < 0.05$; ** = significant at $p < 0.01$.

Note: Dummy variables indicating school district membership were also included in the model specification but are omitted here.

TABLE 4. Model 2 Estimated Accessibility Coefficients

Accessibility Measure	Index	Range	β	t
Commercial Accessibility (in Employees)	0.	0-32,000	-0.054	-1.585
	1.	32,001-64,000	-0.069	-5.028**
	2.	64,001-96,000		<i>omitted</i>
	3.	96,001-128,000	0.138	21.169**
	4.	128,001-160,000	0.249	29.590**
	5.	160,001-192,000	0.388	37.922**
	6.	192,001-224,000	0.544	47.980**
	7.	224,001-256,000	0.715	56.464**
	8.	256,001-288,000	0.874	58.097**
	9.	> 288,000	1.005	55.315**
Educational Accessibility (in Employees)	0.	0-200	0.063	4.774**
	1.	201-400	0.041	5.169**
	2.	401-600		<i>omitted</i>
	3.	601-800	-0.063	-9.581**
	4.	801-1,000	-0.133	-20.734**
	5.	1,001-1,200	-0.152	-21.206**
	6.	1,201-1,400	-0.175	-23.443**
	7.	1,401-1,600	-0.236	-24.905**
	8.	1,601-1,800	-0.308	-28.354**
	9.	1,801-2,000	-0.287	-21.327**
	10.	> 2,000	-0.353	-17.434**
Industrial Accessibility (in Employees)	0.	0-750	0.076	13.233**
	1.	751-1,500	0.043	10.056**
	2.	1,501-2,250		<i>omitted</i>
	3.	2,251-3,000	-0.074	-14.607**
	4.	3,001-3,750	-0.169	-24.620**
	5.	3,751-4,500	-0.231	-21.238**
	6.	4,501-5,250	-0.358	-16.133**
	7.	5,251-6,000	-0.295	-6.594**
	8.	6,001-6,750		<i>insufficient data</i>
	9.	6,751-7,500		<i>insufficient data</i>
	10.	> 7,500	-0.446	-4.418**
University Accessibility (in Full-Time-Equivalent Enrollment)	0.	0-1,000	-0.037	-4.747**
	1.	1,001-2,000	-0.037	-5.231**
	2.	2,001-3,000		<i>omitted</i>
	3.	3,001-4,000	0.041	5.416**
	4.	4,001-5,000	0.051	5.218**
	5.	5,001-6,000	0.114	10.119**
	6.	6,001-7,000	0.165	10.682**
	7.	7,001-8,000	0.204	10.859**
	8.	8,001-9,000	0.224	7.995**
	9.	> 9,000	0.056	0.673

Key: β = estimated coefficient; t = Student's two-tailed t -statistic; * = significant at $p < 0.05$; ** = significant at $p < 0.01$.

FIGURE 1. Model 2 Accessibility Coefficients by Range-Specific Dummy Variables

