The Value of Bicycle Trail Access on Home Purchases

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Abstract
We use hedonic analysis of home sales data from the Twin Cities Metropolitan Area to estimate the effects of access to bicycle facilities on home value. The model includes proximity to three distinct types of bicycle facilities, controlling for local fixed effects and open space characteristics. Interaction terms help distinguish between preferences of city versus suburban homebuyers. Regression results show that off-street bicycle trails situated alongside busy streets are negatively associated with home sale prices in both the city and suburbs. Proximity to off-street bicycle trails away from trafficked streets in the city is positively associated with home sale prices, with negative result in the suburbs. On-street bicycle lanes appear to have no effect in the city and are a disamenity in the suburbs.

Policy implications include the following. Type of bicycling facility matters. On-street trails and roadside trails may not be as appreciated as many city planners or policy officials think. Second, city residents have different preferences than suburban residents. Third, larger and more pressing factors are likely influencing residential location decisions. The findings also suggest that urban planners and advocates need to be aware of the consequences of providing for bicycle facilities, as the change in welfare is not necessarily positive for all homeowners.

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Introduction

Many cities—through public dialogues, community initiatives, and other land use-transportation policies—are striving to enhance their “livability.” While “livability” is a relatively ambiguous term, there is emerging consensus on the following: the ease by which residents can travel by pedestrian or bicycle represents a critical component of this goal. Communities with well developed non-motorized infrastructure, either in the form of sidewalks, bicycle paths, or compact and mixed land uses are hypothesized to be more livable than those without. This is an often relied-upon argument used by advocates of bicycle paths or sidewalks.

If livability is cherished among residents, and one important component of livability includes bicycle paths, then it follows that living close to bicycle paths should be capitalized into home prices. Documenting this relationship would provide good news for advocates who often seek ways of monetizing the value of these public goods (bicycle facilities are non-market goods, making it difficult to attach an economic value to them).

Social or economic benefits can be measured either through stated preferences, in which users are asked to attach a value to non-market goods, or through revealed preferences. The revealed preference approach measures individuals’ actual behavior. This study measures homebuyers’ revealed preferences in the form of hedonic modeling to assess proximity to types of bicycle paths, in particular. The first part reviews previous literature on hedonic modeling focusing primarily on the dimension of open space and trails. The second part describes the setting for this work, our data, descriptive statistics, and methodological approach. Part three describes the results of a hedonic regression model and part four reports on the policy implications and relevant conclusions.

Review of Relevant Literature and Concepts

Discerning the relative value of non-market goods using hedonic modeling techniques is a method with a long history. Taylor (1916) used what are now called hedonic techniques to explain the price of cotton with its internal qualities, and later applications by Lancaster (1966) and Rosen (1974) standardized the method for consumer products such as houses. An extensive review of this literature (Sirmans and Macpherson 2003) documents nearly 200 applications that have examined home purchases to estimate values of several home attributes including structural features (e.g., lot size, a home's finished square feet, and number of bedrooms), internal and external features (e.g., fireplaces, air conditioning, garage spaces, and porches), natural environment features (e.g., scenic views), attributes of the neighborhood and location (e.g., crime, golf courses, and trees), public services (e.g., school and infrastructure quality), marketing, and financing.

As the literature describes various methods to assign value to housing characteristics, there are opportunities to increase the explanatory power of hedonic models. Recent contributions to the literature include more robust measures of accessibility, perceived school quality, and measures of environmental amenities. For example, Franklin and Waddell (2003) used a hedonic model to predict home prices in King County, Washington as a function of accessibility to four types of activities (Commercial, University, K-12 Schools, and Industrial). In assessing the relationship between public school quality and housing prices, Brasington (1999) found that proficiency tests, per-pupil spending, and student/teacher ratios most consistently capitalize into the housing market. Earnhart (2001) combined discrete-choice hedonic analysis with choice-based conjoint analysis to place a value on adjacent environmental amenities such as lakes and forests.

Our application here focuses on the relative impact of bicycle lanes and trails. To the casual observer, bicycle lanes and trails may be considered a single facility where any type of bicycle trail would have the same attraction. A more detailed approach, however, suggests otherwise because of the possible effect of different types of bicycle facilities. Three different types of trails/lanes are examined: (1) trails on existing streets (demarcated by paint striping, hereafter referred to as "on-street lanes"); (2) trails are adjacent to existing roadways (hereafter "roadside trails") but are separated by curbs or mild landscaping (these facilities are sometimes referred to as "black sidewalks" in the local lexicon because they are nothing more than blacktop in the usual location of sidewalks); (3) other trails are clearly separated from traffic and often within open spaces (hereafter "non roadside trails"). For the latter category, it is important to explain and control for the degree to which open space versus the bike trail contained within the open space contribute to a home's value. In many metropolitan areas in the US, bike trails and open space share a spatial location and at minimum exhibit similar recreational qualities. On-street lanes or roadside trails are often on or near roads. In some cases they will be on well-used collector streets or trunk highways; in others they may be on neighborhood arterial streets. While infrastructure usually has an attraction element, home-buyers tend to be repelled by immediate proximity to busy roadways. Any attraction of bicycle facilities therefore depends on the design speed of the roadway facility and the average daily traffic. Any research failing to account for any of these factors will misestimate the independent value of bicycle trails.

It is therefore important to consider relevant literature estimating the value of open space and its context. For example, Quang Do (1995) found that homes abutting golf courses sell for a 7.6 percent premium over others. Other studies interact measures of both proximity and size of various open spaces (Mahan, Polasky et al. 2000; Lutzenhiser and Netusil 2001). Geoghegan (2002) compared the price effects of the amount of permanent and developable open space within a one-mile radius. Smith et al. (2002) examined the fixed and adjustable open spaces along a new Interstate highway corridor. Other approaches further disaggregate developable and non-developable open space in terms of ownership type and land cover (Irwin 2002). Some studies seek to attach values to views of open space. Benson et al. (1998) created a series of dummy variables for four different qualities of ocean views, as well as lake and mountain views.

Luttik (2000) combined the vicinity and view approaches, dividing the geography into three levels of proximity.

Anderson and West's work (2004) is particularly relevant to this work. They modeled both proximity and size of six specific open space categories, comparing effects on home prices between the city and suburb. They found that proximity to golf courses, large parks, and lakes has a positive effect on home prices in the city, with no significant results in the suburbs. The effects of open space on home prices also increased with the size of the open space. Proximity to small parks and cemeteries tended to reduce sale prices. To our knowledge, only one application focuses on proximity to bicycle trails. Lindsey (2003) performed a hedonic analysis of 9,348 home sales, identifying properties falling inside or outside a half-mile buffer around fourteen greenways in Marion County, Indiana. This research found that some greenways have a positive, significant effect on property values while others have no significant effect. A survey in Vancouver found that the majority of realtors perceive little effect of bicycle trails on home values, either positive or negative (City of Vancouver 1999). However, two-thirds of respondents also indicated that they would use bicycle trail proximity as a selling point.

Given the novelty of our application, theory is derived from a combination of sources, including existing published work (described in part above), consumer theory, and anecdotal evidence. Our first underpinning is derived from a local county commissioner who claims that bike facilities – like libraries – are goods everyone appreciates (McLaughlin 2003). Such a claim comports with the frequent assertions from bicycle trail advocates. Assuming an ability to account for the possible disutility of living on a busy arterial, bicycle facilities – no matter their type – positively contribute to home value. However, this hypothesis needs to be tempered based on the findings of Anderson and West. Their analysis suggests that open spaces and by association, bicycle facilities, may be perceived and valued differently depending on whether they are located in the city or suburbs.

Unlike other attributes, which tend to be more universally valued (e.g., home size, number of bathrooms), we hypothesize that trails may be more appreciated by *subsets of the population*. Households residing in cities have higher rates of walking or cycling, particularly for work purposes (Barnes 2004; Krizek and Johnson 2004); owing to the increased cycling use. Here, city residents are thus hypothesized to attach a higher value to the three types of bicycle facilities.

Setting and Data

Our investigation is based in the Twin Cities (Minnesota) Metropolitan Area which proves to be an almost ideal laboratory for a variety of reasons. First, the Twin Cities boasts an almost unparalleled system of off-street bike paths for any major metropolitan area in the U.S., totaling over 2,722 kilometers (1,692 miles). While not nearly as extensive, striped on-street bike lanes are common as well. The network of on- and off-street trails is accessible to most Twin Citians, with 90 percent of homes within 1,600 meters (one mile) of an off-street trail. In fact, in many communities within the metropolitan area, over 90 percent of the homes have some form of facility within 400 meters (one-quarter mile).

Second, several municipalities and county governments pursue active roles in constructing and maintaining these facilities. The Grand Rounds Parkway in Minneapolis, considered by many to be the crown jewel of parks and recreational trails in Minnesota, consists of more than 70 km (43 miles) of off-street paved trails along the city's chain of lakes, the Mississippi River, and Minnehaha Creek. Hennepin County, which includes the city of Minneapolis and many of its suburbs, works in cooperation with the Three Rivers Park District to build and maintain the largest network of off-street trails in the metro area (Jackson and Newsome 2000). Many off-street trails in Hennepin and other counties are located on former railroad rights-of-way for the dual purposes of recreation and preservation of the land for future transit corridors. Other off-street trails in the Twin Cities follow arterial and collector streets. The cities of Chanhassen, Eden Prairie, and Plymouth have extensive networks of these roadside trails, with somewhat smaller networks in Maple Grove, Roseville, Eagan, and Apple Valley. Roseville is the only inner-ring suburb with a substantial network of off-street trails. Third, Twin Citians comprise a population who appears to cherish such trails, particularly in the summer months. For example, Minneapolis ranks among the top in the United States in the percentage of workers (2.63%) who self-report as being a regular bicycle commuter (Dill and Carr 2003).

Consistent with the prevailing literature, our hedonic model assumes a competitive market in which homebuyers are seeking a set of home attributes that can be tied to a location. Locations are defined by structural attributes (*S*) (including internal and external attributes), neighborhood characteristics (*N*), location and accessibility (*L*), and environmental amenities (*A*). We build an equilibrium hedonic price function on these assumptions, where the market price of a home (P_h) depends on the quantities of its various attributes:

$$P_h = P(S, N, L, A)$$

The Regional Multiple Listing Services of Minnesota, Inc. (RMLS) maintains home sale data from major real estate brokers in Minnesota. This database includes all home sales in Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties in 2001, totaling 35,002[i] home sale purchases, including structural attributes of each home. Each home's address was mapped and married with GIS features for spatial analysis using ArcGIS.

Table 1 lists each variable, its definition, and descriptive statistics. We measure location attributes through simple calculations of linear distance to the nearest central business district (either Minneapolis or St. Paul) (*cbdnear*) and the nearest major highway (*hwynear*). A third location variable (*busy)* indicates the presence of an arterial street fronting the home.

Neighborhood attributes include school district and demographic variables; while severely affected by residential sorting and considered to be endogenous (thereby affecting the bias of the results) they were included because the explanatory power they contribute. Standardized test scores capitalize into home sale prices and are an effective measure of perceived school quality (Brasington 1999). *Mca5_att* represents the sum of the average math and reading scores achieved by fifth grade students taking the Minnesota Comprehensive Assessment. Scores associated with suburban homes are measured at the school district level, while Minneapolis and St. Paul scores are assigned to elementary school attendance areas. Demographic variables are derived from the 2000 United States Census. We include the percentage of people in the census tract who do not classify themselves as Caucasian (*Pctnonwt)* and the average number of people in each household in the census tract (*Avghhsize)*.

Measures of Interest and Methodology

Measures of Distance to Bicycle Facility

Our application focuses on bicycle facilities and to a certain extent, open space. Examples of the facilities and trails in this setting are shown in Figure 1. Detailed GIS data allowed us to discern all bike trails in the region, separately identifying on- and off-street facilities which are distributed across both major open space corridors (e.g., railway lines, rivers, and lakes) and other roadways. We marry the MLS data for every home sale in the seven county study area from 2001 with the location of these trails.

Insert figure 1 here

Figure 1: Examples of off-street bicycle trails, on-street bicycle lanes, and open space

Some on-street and off-street trails are located alongside busy trafficked streets, which is presumably a propelling characteristic for home locations. We therefore divide the off-street layer into roadside and non-roadside trails based on proximity to busy streets. We then calculate distance to the nearest roadside trail, non-roadside trail, and on-street bicycle lane for each home. As previously mentioned, we also measure distance to open space as a central variable, classifying such areas by type: active or passive[ii].

Measures of Density of Bicycle Facilities

Motivated by Anderson and West's (2004) findings that proximity and size of open space matters, we also theorize it to be important to consider not only the distance to facilities but also the density of trails around a particular home. The overall density (length) of different facilities within a buffer area may also be appreciated by homebuyers. They might value a well-connected system of trails, which are prevalent in many areas throughout the Twin Cities metropolitan area. We therefore calculate the kilometers of trails within buffer distance. See, for example, Figure 2 showing an example home in Minneapolis and how we measured open space and density of bicycle facilities by differing radii of 10, 20, 50, 100, 200, 400, 800, and 1600 meters.

[insert figure 2 here]

Figure 2: Off-street trails and open space within 200, 400, 800, and 1600 meters of a Minneapolis house

Interaction terms

Many of the structural attributes used in this application tend to be universally valued (e.g., home size, number of bathrooms). Several of the spatial attributes employed, however, are hypothesized to vary by segments of the population; that is, urbanites versus suburbanites sort themselves differently according to dimensions of open space and the sort. Again, this distinction was found by the application in Anderson and West for the same region. We therefore generate interaction terms (e.g., city multiplied by independent variable) to measure the attributes that may vary spatially. Doing so allows us to pool the sample of urban and suburban homes, but still allows us to parsimoniously estimate a single model that preserves the integrity of the differing preferences. This single model provides coefficients that describe the effect of common attributes while producing different coefficients for the spatial attributes that may vary across suburbanites and urbanites[iii].

Fixed Effects

As with any analysis of this type, there are omitted attributes to consider. When estimating phenomena associated with the real estate market this dimension is particularly important. There are likely spatial attributes—not captured by any of our measures—which invariably affect home value. These attributes may include but are not limited to general housing stock of neighboring homes, the reputation effects of different neighborhoods or unobserved characteristics of the neighborhood.

Lacking fixed effects, variation across all observations in all neighborhoods is used to identify the effect of interest. However, given the spatial correlation that is likely between proximity to bicycle facility with other variables, this effect is susceptible to omitted variable bias. We control for bias introduced by potential omitted variables by using local fixed effects, a dummy variable for each RMLS-defined market area (104 areas in our region). These boundaries mostly follow city limits in suburban areas and divide the central cities into several neighborhoods that closely follow similarly natured real-estate markets. By controlling for fixed effects we are estimating the effect of proximity to a bicycle trail, assuming a household has already decided to locate in one of the 104 MLS areas in the region. While more accurate, this process makes it difficult to identify the impact of bicycle trail proximity because it in effect reduces the variation of the variables of interest. Michaels and Smith (1990) support this claim, showing that dividing a market into submarkets results in less robust estimates of the effects of hazardous waste site proximity.

Results and Discussion

Our final model (shown in Table 2) is an OLS regression to predict the effect of bicycle trail proximity on home sale prices. We employ a logged dependent variable and also log transformations of several continuous independent variables, indicated by an *ln* following the variable name. All structural and location variables are statistically significant and have the expected signs. Home values increase with number of bedrooms, bathrooms, lot size, finished square feet, fireplaces, garage stalls, proximity to a central business district, and school quality. Home values decrease with age and percent non-white in the census tract. Similarly, proximity to a freeway has a negative effect on home value, which implies that the disamenity effects of freeways (e.g., noise, pollution) likely outweigh any accessibility benefits within particular neighborhoods. Looking at some of the location and amenity variables reveals a different story. Open space coefficients are generally consistent with Anderson and West's (2004) findings. Suburbanites value passive open space over active recreational areas. City residents also value lakes and golf courses, but active open space does not affect sale price.

Examining the effect of bicycle facilities reveals a complex story; results are different because we measure three types of facilities for two different populations (urban and suburban). Our discussion separates the findings for city and suburban residents—a matter that is also addressed by using the interaction terms. First, city residents clearly value proximity to non-roadside trails (after controlling for open space). As Minneapolis is well endowed with many off-road facilities and appears to exhibit a relatively high cycling population, this comes as little surprise. The opposite is true for trails alongside busy streets, however, even when controlling for adjacency to the streets themselves. On-street bicycle lanes have no significant effect in the city. The possible reason for this is that in general, the nature of on-street facilities differs considerably between Minneapolis and St. Paul[iv].

As in the city, suburban homes near roadside trails sell for less than those further away, even when controlling for busy streets. The same is true for on-street bicycle lanes, for which there was no statistically significant effect in the city. Suburban off-street trails appear to negatively influence home prices, unlike in the city. We suggest several reasons for this. First, it may be the case that because of decreased cycling use, suburbanites simply do not value access to trails. Such proximity may not even factor into their use or option value of their home purchase locations. Second, counter acting phenomena may be taking place. Some suburbanites may indeed value such trails. However, their preferences may be overshadowed out by a combination of the following factors. Some of the suburban trails are along former railway beds. If these property values were formally depressed because of such an externality, such legacy effect may likely still be in effect. Uncertainty surrounding future uses of such corridors, such as commuter rail, could compound any legacy affect. Snowmobiling introduces additional externalities common to exurban trails. Most notable, many suburbanites simply appreciate the seclusion of their settings. Proximity to trails—no matter their character—may be an indication of unwanted people passing by or other symptoms that run counter to factors that prompted their decision.

Similar analysis employing measures of the density of bicycle facilities did not reveal statistically significant findings in any of the models estimated.

Because the policy variables of interest and the dependent variable are logged, the coefficients can be directly interpreted as elasticities. However, we provide the results of an effect analysis to more concretely estimate values. In Table 2 the last two columns present the effect of moving a median-priced home 400 meters closer to each facility than the median distance, all else constant[v]. We find that in the city, the effect of moving a median-priced home 400 meters closer to a roadside bicycle trail reduces the sale price $2,272. Assuming a home were be 400 meters closer to a non-roadside trail would net $510. While all relationships between bicycle facility proximity and home sale prices are negative in the suburbs, the effect analysis shows significant variation in the magnitude of those relationships. The effects of moving a home 400 meters closer to a roadside bicycle trail is -$1,059 compared to only -$240 for a non-roadside trail.

Conclusion and Future Research

There are several important implications for our results, which confirm our hypothesis that the three types of trails influence home sale prices in different ways. They demonstrate the importance of controlling for bias induced by omitted spatial variables. Such bias is especially relevant for large complex and polycentric housing markets (such as in the Twin Cities, with two CBDs) and in areas where factors that influence home price differ tremendously by neighborhood. We use local neighborhood fixed effects to reduce spatial autocorrelation and also lead to more robust coefficient estimates. Of course, using this methodology—while technically sound and robust—also makes it more difficult to detect the effects of such proximity because we are now comparing homes within MLS areas. Furthermore, it is unclear how the values of these results might be affected by omitted variable bias.

Our results also robustly test whether urbanites and suburbanites perceive and value bicycle facilities differently. The use of interaction terms between city and suburb reveals this difference in preferences between city dwellers and suburbanites. We measure bicycle facilities in different ways. Distance to nearest facility is the measure discussed in detail above. Models that were estimated to examine the role of trail density did not produce statistically significant findings. The comprehensiveness of the Twin Cities' bicycle trails may contribute to a lack in variation among trail densities near homes. Left unknown in this application is how different types of facilities might be valued according to different cycling *trip* purposes, for either urbanites or suburbanites.

Other refinements would enhance the approach used here to estimate the value of bicycle facilities. Introducing a stated preference element akin to Earnhart's (2001) application could yield more robust estimates. Additional stratification of variables would also augment our understanding. We divided bicycle trails into on-street, roadside and non-roadside facilities in the city and suburbs. Further data collection efforts aimed at identifying other differentiating characteristics among facilities, such as trail width and adjacent land cover, would allow the implementation of a hedonic travel cost model to place a value on such characteristics (Smith and Kaoru 1987).

Assigning future benefits based on a hedonic model presents complications, as new environmental amenities can take years to capitalize into housing prices. Ridell (2001) shows that cross-sectional studies may underestimate the benefits of these goods, and provides an approach for capturing delayed benefits. In addition to delayed benefits, future benefits also present an opportunity for refining model specification. Shonkweiler's (1986) methodology accounts for the potential conversion of rural land to urban uses, revealing that this qualitative consideration reduces estimation error. More generally, there is value with repeated sales modelling. Cross-sectional hedonic pricing studies may lead to upward biased estimates. An outstanding question lies in the degree to which changes in bicycle infrastructure lead to changes in housing prices. Repeated sales models don't suffer from the same problems of omitted variable bias, and as a result may find smaller effects than cross-section effects.

From a policy perspective, this research produces three important insights (which are likely peculiar to the US context of the application). First, type of trail matters. On-street trails and roadside trails may not be as appreciated as many city planners or policy officials think. Second, city residents have different preferences than suburban residents. Third and as suspected, larger and more pressing factors are likely influencing residential location decisions. Using fixed effects detects such considerations in terms of neighborhood quality and character. Overall, our results suggest that off-street bicycle trails add value to home sale prices in the city, implying a contribution to social livability. No positive and significant relationship, however, is found for other types of facilities in either city or suburb. In fact, bicycle trails exhibit a disutility in suburban settings. Our results suggest that the consequences of providing for bicycle facilities are context dependent; the change in welfare is not necessarily positive for all homeowners.

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Table 1. Descriptive Statistics of sample.

	Variable Name	*Description*	*Mean*	*Standard Deviation*	*Median*
Environmental Amenities (A)	*contrnr*	CITY: distance to nearest on-street bicycle lane (meters)	1276.31	947.90	1023.55
	cnrtrnr	CITY: distance to nearest non-roadside bicycle trail (meters)	799.42	517.82	711.29
	crstrnr	CITY: distance to nearest roadside bicycle trail (meters)	1293.81	716.20	1219.16
	sontrnr	SUBURBS: distance to nearest on-street bicycle lane (meters)	1580.51	2240.18	979.82
	snrtrnr	SUBURBS: distance to nearest non-roadside bicycle trail (meters)	1099.89	1732.29	602.92
	srstrnr	SUBURBS: distance to nearest roadside bicycle trail (meters)	1359.35	1728.01	911.83
	cactive	CITY: distance to nearest active open space (meters)	340.15	203.41	315.35
	cpassive	CITY: distance to nearest passive open space (meters)	683.10	396.64	633.76
	cactive	SUBURB: distance to nearest active open space (meters)	569.92	1176.45	290.07
	spassive	SUBURB: distance to nearest passive open space (meters)	760.73	641.12	613.09
Structural Attributes (S)	*bedrooms*	Number of bedrooms	3.12	0.91	3.00
	bathroom	Number of bathrooms	2.14	0.88	2.00
	homestea	Homestead status	0.86	0.34	1.00
	age	Age of house	35.88	28.97	27.00
	lotsize	Size of lot (square meters)	2097.98	8053.17	968.00
	finished	Finished square feet of floor space	1871.01	908.66	1708.00
	firepls	Number of fireplaces	0.70	0.76	1.00
	garagest	Number of garage stalls	1.72	1.02	2.00
Location (L)	*hwynear*	Distance to nearest major highway (meters)	1672.32	1821.44	1149.58
	cbdnear	Distance to nearest central business district (meters)	17558.59	10409.61	16374.75
	busy	Home is on a busy street	0.05	0.21	0.00
Neighborhood Attributes (N)	*mca5_att*	Standardized test score in school district	4760.46	276.78	4836.10
	pctnonwt	Percent nonwhite in census tract	12.51	14.02	7.82
	avghhsiz	Persons per household in census tract	2.67	0.40	2.66

Table 2. Regression Results

Variable Name	*Description*	*Coefficient*	*Standard Error*	*t-statistic*	*Effect of 400m Closer*
contrln	CITY: distance to nearest on-street bicycle lane (ln)	0.003950	0.002689	1.47	
cnrtrln	CITY: distance to nearest non-roadside bicycle trail (ln)	-0.007851	0.003732	-2.1*	$ 509.85
crstrln	CITY: distance to nearest roadside bicycle trail (ln)	0.022772	0.003777	6.03**	$ (2,271.63)
sontrln	SUBURBS: distance to nearest on-street bicycle lane (ln)	0.003334	0.001272	2.62**	$ (364.02)
snrtrln	SUBURBS: distance to nearest non-roadside bicycle trail (ln)	0.003858	0.001325	2.91**	$ (239.65)
srstrln	SUBURBS: distance to nearest roadside bicycle trail (ln)	0.010230	0.001419	7.21**	$ (1,058.73)
cactive	CITY: distance to nearest active open space (meters)	-0.000024	0.000012	-1.96*	$ 1,425.36
cpassive	CITY: distance to nearest passive open space (meters)	-0.000065	0.000007	-9.08**	$ 3,860.35
cactive	SUBURB: distance to nearest active open space (meters)	0.000006	0.000001	3.88**	$ (442.80)
spassive	SUBURB: distance to nearest passive open space (meters)	-0.000028	0.000002	-12.86**	$ 2,066.40
bedrooms	Number of bedrooms	0.033037	0.001570	21.05**	
bathroom	Number of bathrooms	0.079976	0.002018	39.63**	
homestea	Homestead status	-0.027259	0.003481	-7.83**	
ageln	Age of house (ln)	-0.092578	0.001759	-52.65**	
lotsize	Size of lot (square meters)	0.000003	0.000000	21.68**	
finished	Finished square feet of floor space	0.000168	0.000002	82.14**	
firepls	Number of fireplaces	0.068749	0.001768	38.89**	
garagest	Number of garage stalls	0.075257	0.001268	59.37**	
hwynear	Distance to nearest major highway (meters)	0.000009	0.000001	10.35**	$ (637.20)
cbdnrln	Distance to nearest central business district (ln)	-0.056065	0.006926	-8.09**	$ 9,861.10
busy	Home is on a busy street	-0.033351	0.005096	-6.54**	
mca5_att	Standardized test score in school district	0.000160	0.000010	15.34**	
pctnonwt	Percent nonwhite in census tract	-0.004014	0.000183	-21.99**	
avghhsiz	Persons per household in census tract	0.038961	0.004481	8.7**	
	Constant	11.314800	0.079957	141.51**	

Number of observations: 35,002
Adjusted R-squared: 0.7920

** Significant at p<0.01
*   Significant at p<0.05

[i] Our sample began with 42,750 records. Geocoding and removing records with missing or unreasonable data (e.g., homes with zero bathrooms, zero square feet, or built before 1800) reduced our sample to 35,002. The relatively small number of records removed still provided an even distribution of home sales across the metro area.

[ii] Active open spaces are primarily used for recreation, and are comprised of neighborhood parks and some regional parks. Passive open spaces are less accessible on foot. They include areas such as golf courses, cemeteries, and large regional parks that are accessible only through designated entrance points and often only by car.

[iii] Open space and bicycle variable names are prefixed by a c for city and s for suburb.

[iv] In Minneapolis, several of the streets in the downtown core have bicycle lanes (although there are few home sales downtown). Most other on-street bicycle lanes are on busy commuting arterials or around the University of Minnesota commercial district. On-street lanes in St. Paul are a different story. They tend to be along a well maintained boulevard-type corridor (Summit Avenue) and the Mississippi River corridor. These counteracting effects between Minneapolis and St. Paul may possibly cancel out one other.

[v] The median sale prices in the city and suburbs for 2001 were $148,475 and $184,500, respectively. No significant relationship was found between home prices in the city and proximity to on-street bicycle lanes, so no effect is estimated in Table 2.