Highway Capacity Improvements and Land Value Responses: Some Estimates of the Economic Impacts of Upgrading Roads

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ABSTRACT

Improvements to transportation networks, especially those in growing areas, tend to have impacts on local land markets. In principle, an improvement to a link in the network will confer economic benefits to adjacent and nearby properties. Depending on the type of improvement (construction of a new link, capacity addition to an existing link, or upgrading an existing link), the benefit could represent a reduction in the time cost of travel or other variable costs (fuel consumption or mileage-related vehicle depreciation). Urban economic theory would suggest that these benefits are capitalized into local property values, yielding a localized spillover benefit. This paper will explore the nature and magnitude of benefits accruing to nearby properties that arise from major highway construction or reconstruction projects, more precisely those that add capacity to an existing facility. Using a sample of property sales data for Minnesota (MN) counties from 2000 through 2007, we will explore the impacts of upgrading roads on nearby properties of varying type (residential, commercial) by fitting empirical models that predict the price of a given property as a function of structural, location and other relevant characteristics. We find that residential properties benefit from being near an access point on an improved highway, but are negatively affected by being near the facility itself. Our analysis of the ROC 52 reconstruction project in Rochester, MN, also reveals some evidence of a localized benefit for owners of commercial and industrial property near the improved highway in the years following construction.

Key words: economic impact—highways—Minnesota—transportation

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INTRODUCTION

Improvements to transportation networks, especially those in growing areas, tend to have impacts on local land markets. In principle, an improvement to a link in the network will confer economic benefits to adjacent and nearby properties. Depending on the type of improvement (construction of a new link, capacity addition to an existing link, or upgrading an existing link), the benefit could represent a reduction in the time cost of travel or other variable costs, such as fuel consumption or mileage-related vehicle depreciation. It could also represent an improvement to the level of access that a given transportation network provides. Urban economic theory would suggest that these benefits are capitalized into local property values, yielding a localized spillover benefit. This paper will explore the nature and magnitude of benefits accruing to nearby properties that arise from major highway reconstruction projects, more precisely those that add capacity to an existing facility.

Specifically, this paper will take as a case study the reconstruction of U.S. Highway 52 in Rochester, Minnesota, during the period from early 2003 through late 2005. Using a sample of property sales data from Olmsted County, Minnesota, covering the years 2000 through 2007, we estimate the impact of the reconstruction of U.S. Highway 52 (the “ROC 52” project) on nearby residential and commercial properties. The remainder of the paper proceeds as follows. The second section provides a conceptual framework for the interaction of transportation network improvements and land value, tied together through the concept of accessibility. The third section provides a brief introduction to Rochester and Olmsted County, the area under study in this paper. The fourth section introduces the data set and the empirical model to be applied to the property sales data from Olmsted County to analyze the effect of the ROC 52 project. The fifth section reports the results of the empirical analysis of residential and commercial property sales. The sixth and final section summarizes the findings of the research and suggests how they might be used to inform policy.

ACCESSIBILITY, LOCATION, AND URBAN GROWTH

Observed patterns of land use in cities largely reflect the interaction of transportation networks and land markets. The mediating factor that represents this interaction is the concept of *accessibility*. Accessibility can be loosely defined as the ease of reaching desired destinations. What exactly is meant by “desired destinations” can vary, but the term generally encompasses a set of activities that households engage in on a fairly frequent basis. The most important of these activities is employment, which has been consistently identified as one of the most important (and hence, most studied) influences on the location decisions of households. Other types of activities that households might value access to include shopping destinations, entertainment venues, or educational institutions (especially higher education institutions, which are more limited in supply). Locations with higher accessibility tend to command higher prices for land, while locations with less accessibility tend to be cheaper. In cases where land is very expensive, developers substitute additional capital for scarce land, resulting in higher development densities.

The notion of accessibility also extends to the location decisions of firms. Firms, depending upon the type of industry, may value access to other types of things that lead them to cluster in certain locations. Retailers may wish to locate near their customers and near other retailers or suppliers. This leads retailers to cluster together in certain locations, like shopping malls, which are often located in high-accessibility locations (e.g., near access points of major highways). Many office and professional services activities require access to workers, which leads firms specializing in these activities to choose more central locations with higher accessibility to their respective labor markets. The premiums these firms pay for high-accessibility locations reflect the increased productivity that those locations facilitate. Even more footloose industries, like light manufacturing and warehousing, respond to the locational incentives provided by existing transportation networks and locate in places with good highways and, where required, freight rail access.

Accessibility is fundamentally a dynamic concept in that transportation networks are being continually modified over time, and that firms and households respond to these changes to transportation networks and the accessibility they provide by eventually changing their location. These location decisions and the patterns of accessibility they represent eventually become capitalized into land markets, giving rise again to a different set of location incentives. Thus, we can say that land use and transportation systems and their associated patterns of accessibility are characterized by *feedback loops*, which affect all of the different actors in these systems. A stylized representation of these feedback loops, attributable to Levinson (1997), is presented in Figure 1. Note that in Figure 1, the direction of the feedback loops between different elements of the transportation and land use system are represented by the arrows connecting them and that the (+/-) signs indicate whether the feedback effects are positive or negative.

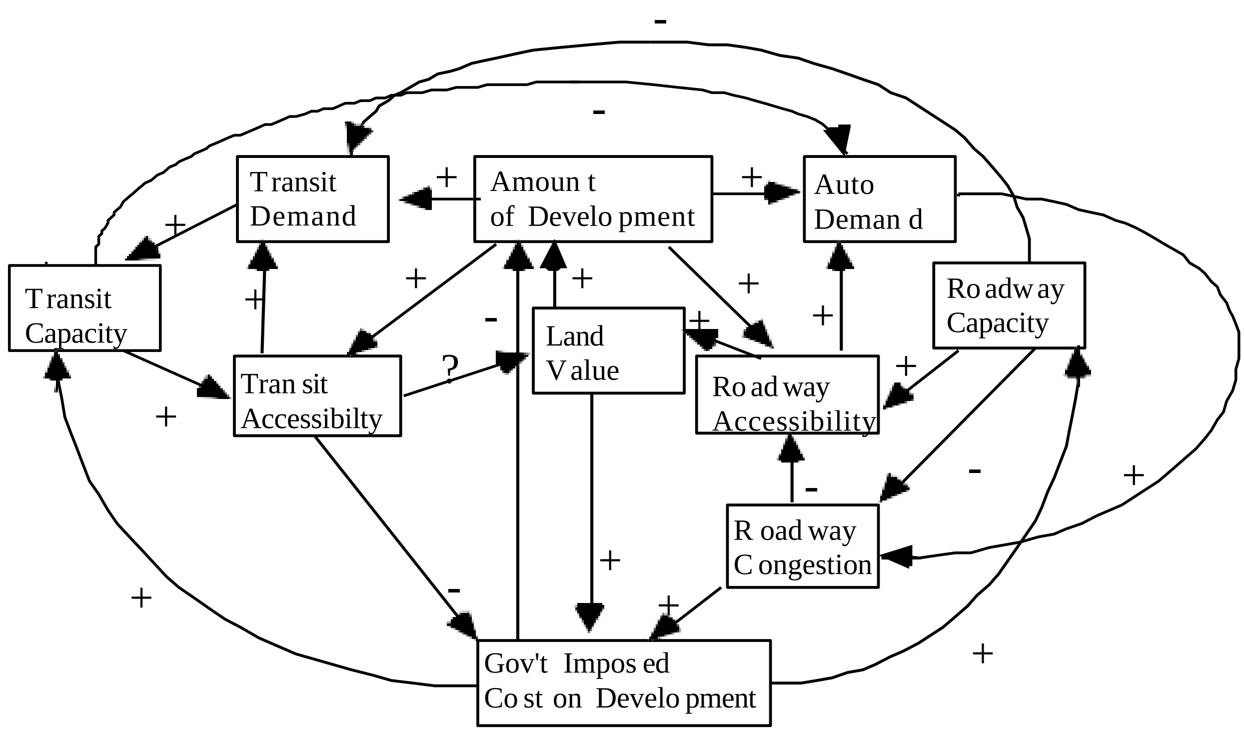

Figure 1. Feedbacks in systems of transportation and land use

The important points to note in Figure 1 are that increases in the capacity of each mode in response to rising demand lead to increases in land value and that allowing congestion to worsen leads to the opposite effect. That is because travel time acts as a disincentive to consumers to choose destinations that are further away, since consumers must expend resources to access those destinations. Increases in travel time or other travel costs reduces the number of destinations that can be feasibly accessed, given the budgets households are restricted to in terms of money or time. The feedback effects continue when the increases in land value caused by increases in accessibility in a given location lead to a larger amount of development, which again begets higher land values. In the long run, these positive and negative feedback effects tend to balance each other, with land prices playing a mediating role.

STUDY AREA

The Minnesota county we will use as a case study to estimate the effects of highway improvements on nearby property values is Olmsted County. Olmsted County is located in southeastern Minnesota, about 75 miles southeast of St. Paul via U.S. Highway 52. As of 2000, the county had a population of just under 125,000 with most of these residents living in the county's largest city, Rochester. Rochester's year 2000 population was reported as 85,806 by the U.S. Census Bureau and has more recently been estimated to be close to 100,000. As an outstate city that has experienced considerable population growth in recent years, Rochester and its surrounding county present a useful study area for examining the link between highway improvements and changes in property values.

The other major consideration in choosing Rochester and Olmsted County as a study area is that it presents an opportunity to evaluate the effects of a major, multi-year highway construction project. The reconstruction of an 11 mile section of U.S. Highway 52 in Rochester took place between 2003 and 2005. Known as the "ROC 52" project, this construction project rebuilt and expanded Highway 52 from four to six lanes between U.S. Highway 63 south of Rochester to 85th Ave. NW on the north end. While the project primarily involved reconstruction of an existing facility, patterns of access were altered as a result of the construction, and a new interchange was added along the rebuilt section. The total cost of the project was around $240 million, making it one of the largest highway construction projects in Minnesota history.

METHODOLOGICAL APPROACH AND DATA

Methodology

The method we use to estimate the effects of road network improvements is the method of *hedonic regression*. Hedonic regression models, as applied to housing markets, seek to estimate the price of housing (or other types of real property) by decomposing it into the bundle of services it provides (attributes), then estimating the implicit values that consumers place on each attribute. The method works best when it is possible to identify a larger number of attributes, especially those relating to the characteristics of structures (houses, commercial buildings, etc.). The base estimating equation (shown in equation [1]) is a standard, partial equilibrium approximation of the hedonic price function using the following form (McMillen and McDonald 2004):

$$\ln P_{it} = \alpha_t + \delta_t U_i + \boldsymbol{\beta}'\mathbf{X_i} + e_{it}\,, \qquad (1)$$

where lnP_{it} represents the natural logarithm of the price of property i at its sale at time t, α_t is an indicator variable for houses that sold during time period t, U_i is a dummy variable indicating that property i is within a given distance of an upgraded road segment, $\boldsymbol{\beta}$ is a vector of coefficients to be estimated, $\mathbf{X_i}$ is a matrix of characteristics of property i, and e_{it} is a disturbance term for property i at time t. The way we choose to identify the influence of the reconstructed highway is to construct buffer zones around upgraded segments of U.S. Highway 52, then identify properties within these buffer zones with the indicator variable, U_i. We also attempt to separate out the effect of proximity to an *access point* on the highway in addition to proximity to the roadway itself.

Separate models are estimated for the residential and commercial properties available in our data set. In the case of residential property sales, where a large sample is available, the full model will be estimated with interactions between location and time period of sale. For the smaller sample of commercial-industrial properties, a more limited model that ignores the nuisance effects of proximity to the highway right-of-way is applied. As the data sets represent relatively heterogeneous, cross-sectional samples of property sales, ordinary least squares (OLS) with heteroskedastic-consistent standard errors will be used to obtain the model parameters.

Data

The Minnesota Department of Revenue (DoR) maintains data on all property transactions within the state. These data are reported by the counties and assembled into a larger, statewide database. For the present study, sales data have been collected from Olmsted County for the years 2000 through 2007. Attributes of each property listed in the data set include the property sale price, city and county of sale, indicators for the type of water features on each parcel (lakes, rivers, swamps, etc.), total and tillable acreage and an assessment of its value, as well as several other attributes.

Residential Sales

The property sales data are available for the period from October 1999 to September 2007, with a total of more than 38,000 property transactions recorded during this period. Of the 38,000 records, about 26,000 are residential, providing a potentially large sample for estimation. Parcel shapefiles were obtained from Olmsted County in order to map the geographic location of the parcels. Along with the necessary parcel data, additional building characteristics were collected from the county’s property records division, providing information on important attributes such as square footage, number of bedrooms and bathrooms, and heating/cooling systems. The property sales files were first joined to the parcel data, then to the building characteristics. The process of joining the sales data to the parcel files resulted in the loss of a large number of records, including all of the 1999 records and most of the 2000 records. About 15,100 residential sales records were successfully joined. The second step, joining the building characteristics, resulted in the loss of about 150 additional records. Finally, some cleaning was done to the data, in order to try to identify sales that represented errors or non-arms-length transactions. In all, about 60 additional records were removed from the sample. The final sample that was used for estimation contained 14,900 observations.

Figure 2 displays the location of the residential property sales in Olmsted County. It is apparent from the map that most of the sales in the county during this period are clustered around the city of Rochester. The larger number of sales causes the location of some observations to be obscured. To provide more detail, Figure 3 centers the map view on the city of Rochester and identifies the reconstructed section of Highway 52, along with a set of buffer rings around the reconstructed highway at one-fourth mile intervals.

Our data set is divided into three periods, organized around the period coinciding with the major construction work on the ROC 52 project. A pre-construction period is comprised of sales occurring prior to April 2003. Sales from between April 2003 and September 2005 are identified as construction period observations, and any sales following this period are considered post-construction observations. We then created variables that designate the location of the property relative to the upgraded section of Highway 52 and also identify the period of sale. Thus, we can identify whether the effect of the location of property relative to the highway changes over time during the three periods of study.

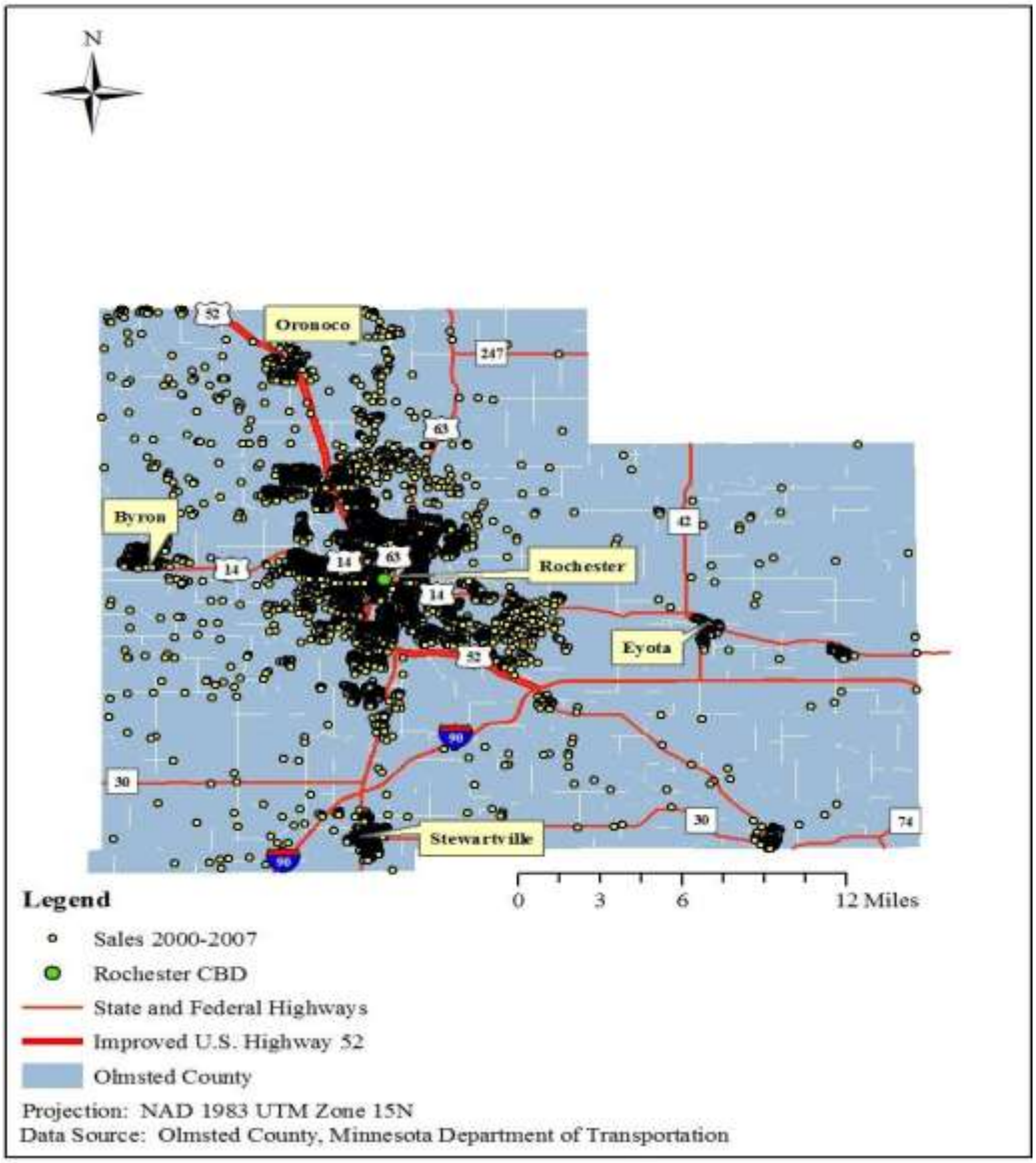

Figure 2. Location of residential property sales in Olmsted County, 2000–2007

We also considered the possibility that proximity to the highway may generate both positive and negative externalities. Other hedonic price modeling applications in the field of transportation, primarily those concerned with the effect of proximity to rail transit stations, have attempted to separate the positive effects of access to the improved network (e.g., stations) from the nuisance effects that the network infrastructure itself generates (e.g., noise, pollution) (Chen et al. 1998, Goetz et al. 2009, Hess and Almeida 2007). To operationalize this concept, we kept the variables representing sales within various distance bands of the improved highway to serve as proxies for the nuisance effects of the highway. We also created new variables that measure network distance to the nearest access point (interchange) on the improved section of Highway 52, essentially a measure of local accessibility to the upgraded highway. This variable is also split into temporal intervals, coinciding with the pre-, post-, and under construction periods of the ROC 52 project, to determine if the value of highway access changes over time. Thus, the marginal effect of the highway improvement is the net effect of the positive and negative externalities (access versus nuisance effects). Table 1 provides a list of the variables used in the analysis of residential property sales. In addition to those listed in the table, we also included dummy variables for the month and year of sale. The month of sale variables use January as the reference category. The year-specific indicators are defined for 2001 through 2007, leaving the period from October 2000 to the beginning of 2001 as the point of reference. Also of note, a variable is defined representing distance to the central business distance district (CBD) of Rochester. This variable is a proxy measure for regional employment accessibility, as more disaggregate measures were not available. The CBD distance measure is seen as an acceptable proxy, as most of Rochester's major employers, including the Mayo Clinic, are located there. A set of descriptive statistics for the residential property sales data is provided in Table 2.

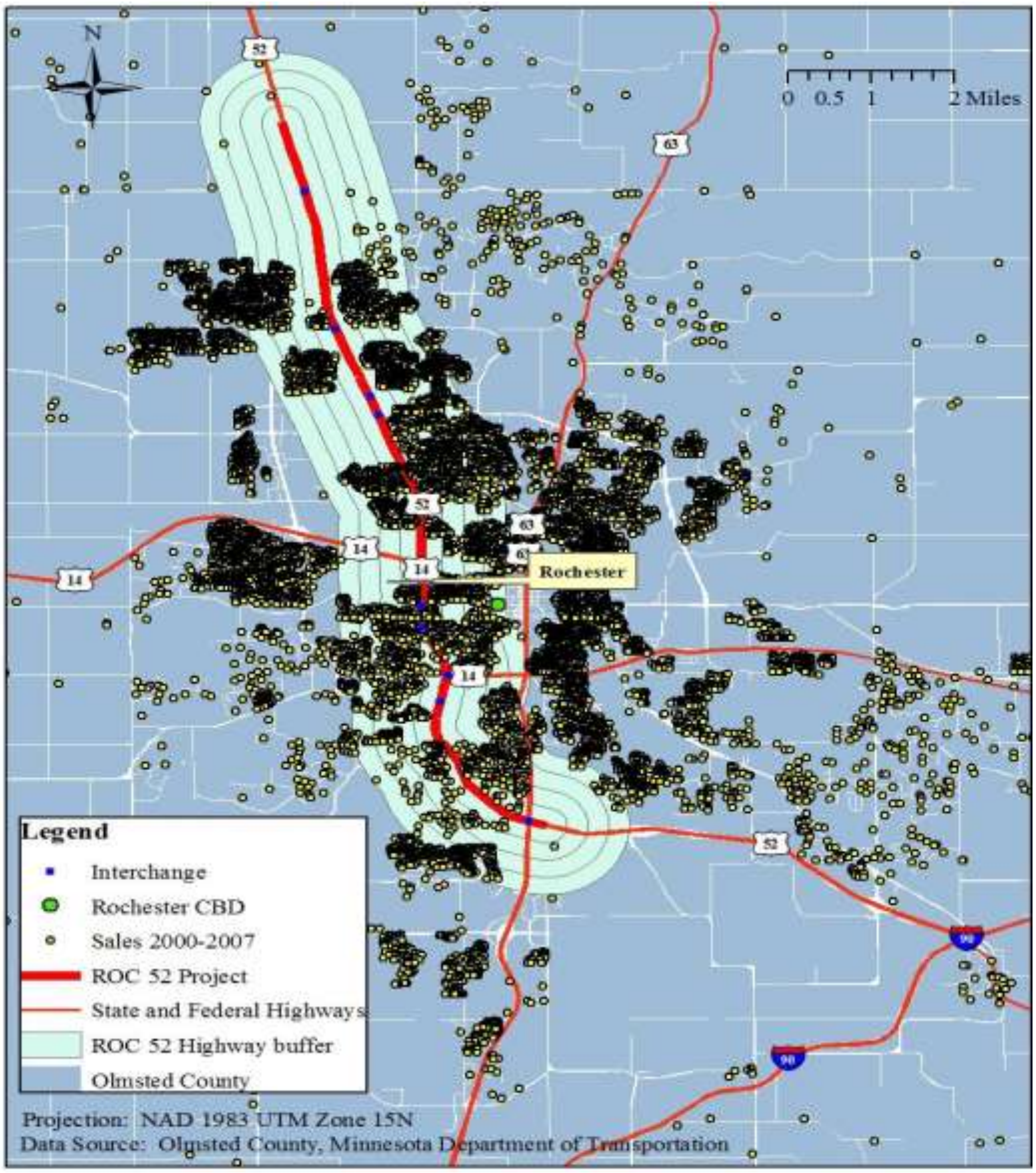

Figure 3. Location of ROC 52 project and residential property sales in Rochester, 2000–2007

Table 1. List of variables included in Olmsted County residential sales model

Variable Name	Description
ln SalePrice	Natural logarithm of sale price
Bedrooms	Number of bedrooms
Bathrooms	Number of bathrooms
BedBath	Bedrooms * Bathrooms
Age	Age of house
AgeSq	Age of house squared
FinishedSqFt	Square ft of house
AirCond	Dummy variable representing houses with air conditioning
River	Dummy variable representing house with river frontage
Condo	Dummy variable denoting housing unit as a condominium
TillAcre	Tillable acres of land
NTAcre	Non-tillable acres of land
CBDdist	Distance from Rochester CBD
Byron	Dummy variable for houses in city of Byron
2001	Dummy variable representing sale in year 2001
2002	Dummy variable representing sale in year 2002
2003	Dummy variable representing sale in year 2003
2004	Dummy variable representing sale in year 2004
2005	Dummy variable representing sale in year 2005
2006	Dummy variable representing sale in year 2006
2007	Dummy variable representing sale in year 2007
Feb	Dummy variable representing sale in month of February
March	Dummy variable representing sale in month of March
April	Dummy variable representing sale in month of April
May	Dummy variable representing sale in month of May
June	Dummy variable representing sale in month of June
July	Dummy variable representing sale in month of July
August	Dummy variable representing sale in month of August
September	Dummy variable representing sale in month of September
October	Dummy variable representing sale in month of October
November	Dummy variable representing sale in month of November
December	Dummy variable representing sale in month of December
1/4Mile	Dummy variable for location within 1/4 mile of upgraded highway
1/2Mile	Dummy variable for location within 1/2 mile of upgraded highway
3/4Mile	Dummy variable for location within 3/4 mile of upgraded highway
Mile	Dummy variable for location within 1 mile of upgraded highway
1/4Mile01	1/4Mile * 2001
1/4Mile02	1/4Mile * 2002

Table 2. List of variables included in Olmsted County residential sales model (continued)

1/4Mile03	1/4Mile * 2003
1/4Mile04	1/4Mile * 2004
1/4Mile05	1/4Mile * 2005
1/4Mile06	1/4Mile * 2006
1/4Mile07	1/4Mile * 2007
1/2Mile01	1/2Mile * 2001
1/2Mile02	1/2Mile * 2002
1/2Mile03	1/2Mile * 2003
1/2Mile04	1/2Mile * 2004
1/2Mile05	1/2Mile * 2005
1/2Mile06	1/2Mile * 2006
1/2Mile07	1/2Mile * 2007
3/4Mile01	3/4Mile * 2001
3/4Mile02	3/4Mile * 2002
3/4Mile03	3/4Mile * 2003
3/4Mile04	3/4Mile * 2004
3/4Mile05	3/4Mile * 2005
3/4Mile06	3/4Mile * 2006
3/4Mile07	3/4Mile * 2007
Mile01	Mile * 2001
Mile02	Mile * 2002
Mile03	Mile * 2003
Mile04	Mile * 2004
Mile05	Mile * 2005
Mile06	Mile * 2006
Mile07	Mile * 2007

Table 3. Descriptive statistics for Olmsted County residential property sales data

Variable	Mean	S.D.	Median	Min	Max
ln SalePrice	12.027	0.468	11.967	9.210	16.244
Bedrooms	1.855	1.643	2	0	11
Bathrooms	1.486	1.231	2	0	9
BedBath	4.217	4.850	3	0	50
Age	31	28	22	1	149
AgeSq	1761	2841	484	1	22201
FinishedSqFt	1630	575	1472	70	12432
AirCond	0.807	0.395	1	0	1
River	0.001	0.028	0	0	1
Condo	0.007	0.085	0	0	1
TillAcre	0.040	1.083	0	0	71
NTAcre	0.503	2.504	0	0	234
CBDdist	4.168	3.505	3.070	0.142	20.087
Byron	0.040	0.196	0	0	1
2001	0.099	0.299	0	0	1
2002	0.029	0.167	0	0	1
2003	0.148	0.355	0	0	1
2004	0.161	0.368	0	0	1
2005	0.208	0.406	0	0	1
2006	0.193	0.395	0	0	1
2007	0.140	0.347	0	0	1
Feb	0.054	0.226	0	0	1
March	0.074	0.262	0	0	1
April	0.084	0.278	0	0	1
May	0.112	0.315	0	0	1
June	0.146	0.353	0	0	1
July	0.100	0.299	0	0	1
August	0.103	0.304	0	0	1
September	0.081	0.273	0	0	1
October	0.078	0.268	0	0	1
November	0.067	0.251	0	0	1
December	0.058	0.235	0	0	1
1/4Mile	0.064	0.245	0	0	1
1/2Mile	0.109	0.312	0	0	1
3/4Mile	0.109	0.311	0	0	1
Mile	0.096	0.295	0	0	1
1/4Mile01	0.007	0.082	0	0	1
1/4Mile02	0.001	0.037	0	0	1

Table 4. Descriptive statistics for Olmsted County residential property sales data (continued)

1/4Mile03	0.010	0.101	0	0	1
1/4Mile04	0.011	0.103	0	0	1
1/4Mile05	0.012	0.111	0	0	1
1/4Mile06	0.012	0.110	0	0	1
1/4Mile07	0.009	0.092	0	0	1
1/2Mile01	0.010	0.100	0	0	1
1/2Mile02	0.004	0.060	0	0	1
1/2Mile03	0.017	0.130	0	0	1
1/2Mile04	0.019	0.137	0	0	1
1/2Mile05	0.020	0.141	0	0	1
1/2Mile06	0.020	0.141	0	0	1
1/2Mile07	0.016	0.125	0	0	1
3/4Mile01	0.012	0.107	0	0	1
3/4Mile02	0.003	0.057	0	0	1
3/4Mile03	0.015	0.123	0	0	1
3/4Mile04	0.019	0.136	0	0	1
3/4Mile05	0.022	0.147	0	0	1
3/4Mile06	0.021	0.144	0	0	1
3/4Mile07	0.014	0.118	0	0	1
Mile01	0.011	0.103	0	0	1
Mile02	0.003	0.055	0	0	1
Mile03	0.013	0.115	0	0	1
Mile04	0.015	0.123	0	0	1
Mile05	0.022	0.146	0	0	1
Mile06	0.018	0.132	0	0	1
Mile07	0.012	0.110	0	0	1

Commercial-Industrial Property Sales

Between 2000 and 2007, over 1,200 commercial and industrial property sales were recorded in Olmsted County—enough to permit a small-scale analysis of the impact of the ROC 52 project. As with the residential property data, the commercial-industrial sales data needed to be first mapped and then joined to data on building characteristics. The process of matching the sales data to the county's parcel records resulted in a loss of about half of the transactions, leaving 647 observations. Joining these data to a set of building attributes resulted in a loss of an additional 145 records. Finally, the data were cleaned to weed out non-arms-length transactions, leaving a total of 471 observations for the analysis. The location of these properties, along with the highway network, is mapped in Figure 4.

The set of attributes of the commercial-industrial properties that could be used to predict property values were somewhat limited, though important features such as building size and age were included. More general location variables were developed, measuring distance from the CBD as well as distance from the nearest highway. Parcel acreage was measured, and was divided into urban and rural acreage. Year-specific dummy variables were again added to attempt to measure any secular trends in prices during the period of observation. Most of the variables used to model commercial-industrial property prices are in fact a subset of the variables used in the analysis of residential property sales.

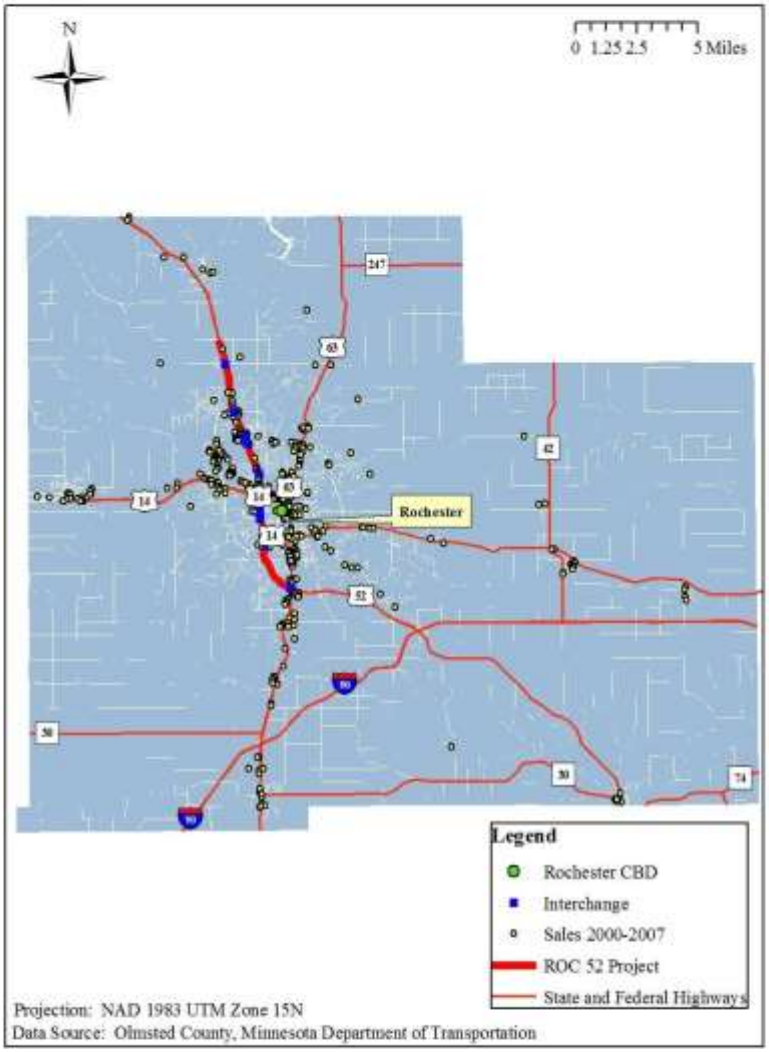

Figure 4. Location of commercial-industrial property sales in Olmsted County, 2000–2007

The effects of the upgrade of Highway 52 were measured by defining a variable similar to that used in the residential property analysis, in which network distance to the nearest access point on the improved section of highway is measured during specific time periods. The reasons for doing so were basically twofold. First, there was little reason to believe that externalities from highway traffic would have the same effect on commercial and industrial properties as on residential properties. Second, the smaller sample size for the commercial-industrial properties made difficult the method of identifying distance bands around the improved highway, since the number of observations in each location during each specific period were not consistently large enough to permit valid statistical inference. Instead, a continuous approximation is used to represent the relationship between proximity to the improved highway and property values. Since another variable is included in the model accounting for the distance to the nearest highway for all properties in the sample, the distance variable that is specific to the ROC 52 project should be seen as capturing the presence of any premium that is associated solely with the effect of this project.

RESULTS

Residential Properties

Results of the fitted model for the residential property sales data are presented in Table 3. The fitted model explains more than two-thirds of the variation in residential property prices using a limited set of structural attributes, some variables representing location and amenities, and the transportation attributes of interest. The coefficient on the bedroom variable is negative indicating that, controlling for the square footage of a residential unit, an additional bedroom has no value, though it should be noted that the estimated coefficient is small and statistically insignificant. The bathroom variable is significant, with an additional bathroom adding about 2.8% to the value of a house.

Table 5. Hedonic price model for residential property sales in Olmsted County, 2000–2007

Variable	Coefficient	S.D.	t-value	Sig.
Bedrooms	-0.029	0.006	-4.96	***
Bathrooms	0.014	0.005	2.71	***
BedBath	0.013	0.002	5.44	***
Age	-0.006	0.0004	-13.11	***
AgeSq	0.0000168	0.00000385	4.36	***
FinishedSqFt	0.0005	0.00002	20.06	***
AirCond	0.063	0.008	7.57	***
River	0.326	0.100	3.25	***
Condo	-0.150	0.042	-3.62	***
TillAcre	0.007	0.009	0.71	
NTAcre	0.011	0.019	0.57	
CBDdist	-0.009	0.002	-4.36	***
Byron	0.023	0.016	1.43	
2001	-0.010	0.020	-0.48	
2002	0.049	0.025	1.94	*
2003	0.010	0.019	5.23	***
2004	0.132	0.020	6.62	***
2005	0.163	0.019	8.64	***
2006	0.179	0.019	9.59	***
2007	0.171	0.020	8.72	***
Feb	0.034	0.015	2.20	**
March	0.015	0.015	0.98	
April	0.041	0.014	2.92	***
May	0.053	0.014	3.92	***
June	0.061	0.013	4.58	***
July	0.057	0.014	4.01	***
August	0.056	0.014	3.96	***
September	0.034	0.015	2.32	**

Table 6. Hedonic price model for residential property sales in Olmsted County, 2000–2007 (continued)

October	0.050	0.015	3.44	***
November	0.038	0.016	2.33	**
December	0.056	0.015	3.72	***
1/4Mile01	0.018	0.026	0.68	
1/4Mile02	-0.052	0.090	-0.58	
1/4Mile03	-0.056	0.020	-2.86	***
1/4Mile04	0.012	0.019	0.63	
1/4Mile05	-0.010	0.020	-0.51	
1/4Mile06	-0.013	0.016	-0.81	
1/4Mile07	0.052	0.031	1.69	*
1/2Mile01	0.028	0.021	1.37	
1/2Mile02	0.061	0.033	1.83	*
1/2Mile03	-0.001	0.017	-0.04	
1/2Mile04	-0.010	0.016	-0.61	
1/2Mile05	-0.008	0.014	-0.55	
1/2Mile06	0.016	0.015	1.04	
1/2Mile07	0.025	0.017	1.48	
3/4Mile01	0.034	0.020	1.75	*
3/4Mile02	0.052	0.038	1.36	
3/4Mile03	0.005	0.016	0.33	
3/4Mile04	-0.0004	0.019	-0.02	
3/4Mile05	0.003	0.014	0.21	
3/4Mile06	0.010	0.015	0.66	
3/4Mile07	0.045	0.018	2.51	**
Mile01	0.003	0.027	0.11	
Mile02	0.017	0.033	0.52	
Mile03	0.016	0.017	0.93	
Mile04	-0.017	0.019	-0.89	
Mile05	-0.024	0.012	-2.07	**
Mile06	0.004	0.018	0.20	
Mile07	-0.034	0.028	-1.24	
Constant	11.176	0.043	259.61	***
N = 14,900				
Adjusted R^2	0.682			

Notes:

Dependent variable is the natural logarithm of SALEPRICE

* = variable is statistically significant at $p < 0.1$ level

** = variable is statistically significant at $p < 0.05$ level

*** = variable is statistically significant at $p < 0.01$ level

Both the age and age squared variables are significant, indicating that the desirability of a house (as indicated by its selling price) declines with age, though the rate of decline decreases as age increases. The square footage variable, which is used here largely as a statistical control, has a coefficient of 0.0005. This may be interpreted to mean that a 100 square foot increase in the floor space of a house is associated with a 5% increase in its value. The presence of air conditioning is also estimated to add about 6% to the value of a house. Properties identified as condominiums sell for about 15% less than comparable detached units.

The coefficients on the land acreage variables have the expected sign, but appear not to be significant. River frontage does appear to have a significant effect, with homes with river frontage selling for about 30% more than homes without. Location relative to the Rochester CBD also has a significant effect, with each additional mile from the CBD being associated with a 1% decline in the price of a house.

Variables representing month and year of sale are also significant. The month dummies (which are suppressed from Table 3) are all statistically significant with the exception of March. The coefficients exhibit a pattern of increases during the warmer months of the year, with a peak during summer. The year dummies for 2001 through 2007 trace out the upward trend in home prices in Olmsted County throughout the first half of the decade. Prices in 2006 were, on average, nearly 21% higher than in 2000, controlling for all of the variables entered into the current model.

The effects of the upgrade of Highway 52 are reflected in the coefficients of the variables representing time and location, as well as the set of variables measuring access distance to the improved highway during the pre-construction, construction, and post-construction periods. Figure 5 plots the effects of proximity to the improved highway over time, as measured by the dummy variables denoting distance from the highway during specific time periods.

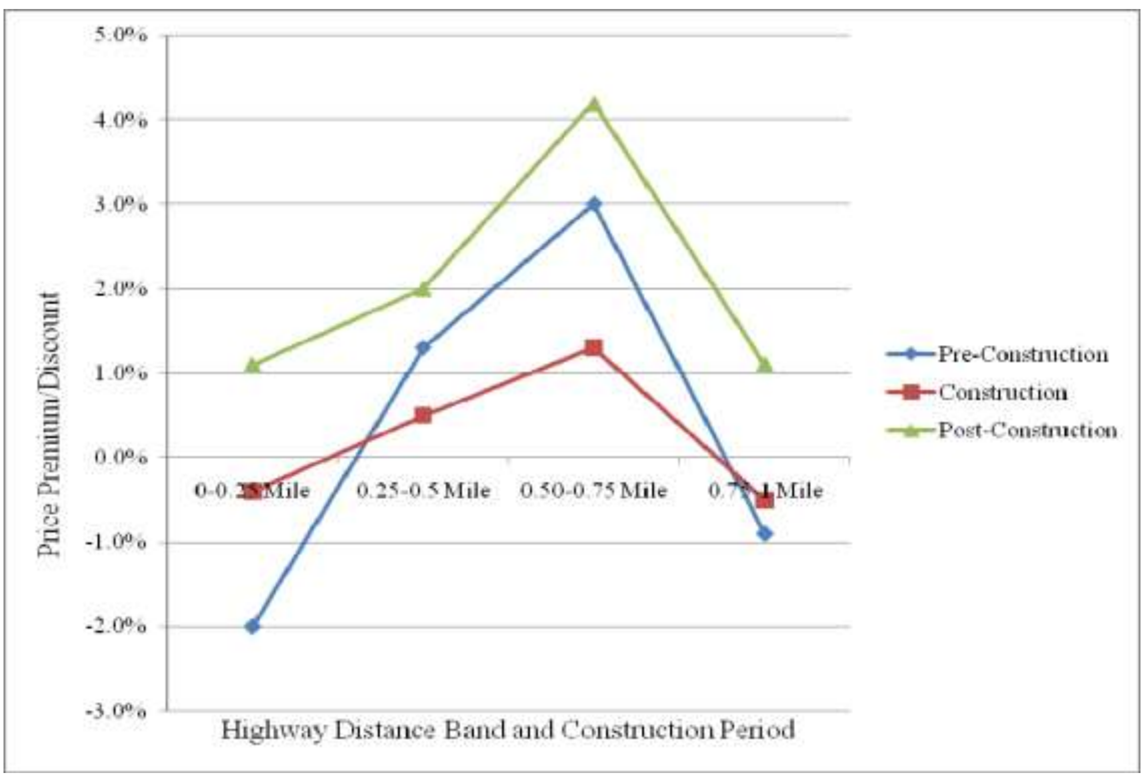

Figure 5. Price effects of proximity of residential properties to upgraded U.S. Highway 52

The set of points representing various distances from the improved highway during each time period trace out a rough price gradient for highway proximity. As the figure indicates, houses closest to the highway sold for slightly less than those not near the highway during the pre-construction and construction periods. During the post-construction period, they sold for slightly more (around 1%). Houses three-quarters of a mile from the improved highway appear to obtain a slight premium during *all* periods, with the largest premium occurring during the post-construction period. In order to attempt to sort out the effects of access to the improved highway, the separate variables representing distance to the nearest highway access point are included. The coefficients on these variables were expected to be negative, indicating that some premium would be placed on having access to the improved highway nearby. As Table 3 indicates, the coefficient representing access distance during the pre-construction period is negative, though very small and not statistically different from zero at the $p > 0.1$ level. The coefficients representing access during the period of major construction and post-construction are both slightly positive, though also statistically insignificant.

Overall, we were unable to detect any premium associated with being located near an access point to the improved highway. Conversely, the dummy variables used to represent proximity to the highway itself do show a slight positive effect at certain distances (0.5 to 0.75 miles). These findings seem to suggest that, at least for residential properties, nuisance effects of being near a highway interact with the effect of the access that the highway provides in subtle ways. This result should, however, be qualified by noting that in each case the magnitude of the effect of the improved highway (whether positive or negative) was quite small, and that only a handful of the variables representing the effects of the highway improvement showed statistically significant (non-zero) effects.

Commercial-Industrial Properties

The model fitted to the Olmsted County commercial-industrial data is shown in Table 4. The coefficient on the square footage variable indicates that each additional 1,000 prime square ft of space add about 1.5% to the price of a commercial-industrial property. Building age is also significant, with each additional year of age associated with a 1% decline in price. The value of commercial-industrial land is indicated by the coefficient estimates for the two acreage variables. An additional acre of urban land adds about 17% to the value of a property, while an acre of rural land (identified as being outside an incorporated town) adds about 2%. Distance from the Rochester CBD appears to be a significant factor in explaining commercial property values, as it is for residential properties. Here, we find that each additional mile from the CBD is associated with a roughly 5% decline in value. Of note, this price gradient appears to be much steeper than the one estimated for residential properties (about 1% for each mile from the CBD).

The variable representing distance to the nearest highway appears to have a rather large influence on property values. On average, property values fall by more than 36% for each additional mile from the nearest highway. This finding appears to underscore the importance of highway access for commercial and industrial properties, a finding that is also readily apparent from the location of these properties in Figure 4. Beyond this effect, the variables representing proximity to access points on the reconstructed section of Highway 52 also appear to be significant. The variable representing highway access during the pre-construction period indicates that for every mile of distance from the nearest access point on the rebuilt Highway 52, property values fall by about 2.5%. This is *in addition to* the more general effect of proximity to highways for all properties in Olmsted County. The variables representing access distance during the construction and post-construction periods have the same sign but a smaller coefficient, indicating that the distance gradient for access to the improved highway may have flattened out over time, with the effect of the improved highway possibly being present at further distances from access points following completion of the ROC 52 project. On one hand, this may be evidence of a real, accessibilityrelated improvement due to the reconstruction project. On the other hand, the estimated standard errors for each of the three coefficients on the access variables are large enough that we may not rule out the possibility that there is no real difference between the true values of the three coefficient estimates, and that the differences observed in our model are due to chance variation. Nonetheless, our evidence suggests that the effect of the ROC 52 access distance variable is non-zero, meaning that the project resulted in at least some increment in property values for commercial and industrial properties.

CONCLUSIONS

In this paper we have examined the effects of a major highway reconstruction and expansion project on residential and commercial-industrial property values in Olmsted County, Minnesota. Using a set of property sales data from periods before, during, and after the major construction took place, we found tentative evidence that, following an initial decline in prices during construction, residential properties within one mile of the improved Highway 52 saw a small increase (less than 2%) in sale price during the post-construction period. Our examination of commercial-industrial property sales from the same period (2000–2007) revealed no unique, statistically significant effect on prices that could be attributed to the completion of the ROC 52 project. However, our analysis did indicate that, in general, highway access is highly valued among commercial and industrial property owners.

Our analysis revealed some small, yet positive effects on property values in response to a highway reconstruction and expansion project. In general, studies of new transportation links such as highway or urban rail links tend to find larger increments in property values near the new facility. The presence of this price effect provides an opportunity for local governments or transportation authorities to capture a portion of this increment in value, a practice known as *value capture* (Batt 2001, Stopher 1993). Value capture policies may be a particularly attractive alternative for transportation finance in fast-growing locations, where increases in the demand for travel outstrip the resources available from conventional sources (e.g., fuel or property taxes, etc.) to finance infrastructure improvements (Vadali et al. 2009).

Several types of value capture policies exist that may be applied in the case of highway network improvements. These range from policies that capture the value associated with development on top of a link (e.g., sale of air rights) to policies that attempt to recover a portion of land value increases within a geographically-defined area near an improved transportation link. The latter include policies such as special assessments, tax increment financing, and impact fees. In the United States, there is some recent experience with the use of impact fees on new highway corridors to draw upon (Boarnet and DiMento 2004).

Value capture policies hold promise for improving the equity with which transportation is financed. In particular, they target a restricted group of non-user beneficiaries from investments in transportation networks that under current methods of transportation finance receive benefits that are disproportionately greater than the costs they bear. New transportation projects may generate accessibility benefits that impart windfall gains on owners of nearby property. The use of value capture techniques as one component of financing plans for transportation projects helps to level this playing field by reallocating costs to align more closely with the benefits received across a wider set of beneficiaries.

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