PART 3

Socioeconomic Impacts

Effects of Elevated Heavy-Rail Transit Stations on House Prices with Respect to Neighborhood Income

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There is debate surrounding the effect on the value of single-family homes of elevated heavy-rail transit stations in residential neighborhoods. Some contend that effects are adverse because transit stations impose noise, traffic, and other nuisances on neighborhoods, which reduces house values closer to these stations. Others contend that stations improve accessibility of neighborhood residents to commercial activity centers, which results in increased house values closer to elevated transit stations. Both positive and negative influences can be present. One hypothesis is that transit stations will have a positive effect on the values of homes in lower-income neighborhoods because the benefits of transit station accessibility more than offset any nuisances. On the other hand, transit stations may have a negative effect on values of homes in high-income neighborhoods because the nuisances of transit stations more than offset the benefits. Based on a study in Atlanta, Georgia, it is shown that elevated transit stations have positive price effects on homes in lower income neighborhoods and negative price effects on homes in higher income neighborhoods. Qualifications and policy implications are offered.

ELEVATED TRANSIT STATION EFFECTS ON HOUSE VALUES

Transit stations improve the accessibility of households to the central business district and other modes of urban activity. At first glance, single-family homes should be valued higher the closer they are to transit stations (*1–8*). Alternatively, where transit stations are above ground or elevated they can be associated with nuisances such as noise and increased pedestrian and automobile traffic near the station. Single-family house values can fall the closer they are to transit stations (*9–12*). Burkhardt (*13*) and Dornbusch (*14*) report that residential properties near San Francisco Bay Area Rapid Transit (BART) stations suffered value decreases because of nuisances. Baldassare et al. (*15*) report opinion survey research showing that where transit stations are elevated above residential areas there is reduced preference for living near those stations.

According to Li and Brown (*16*), both views may be correct. Some kinds of land use activities can generate both positive and negative price effects on single-family houses. Only if one influence is greater than another would the observed effect be positive or negative. Where the benefit effects of accessibility offset the nuisance effects, the observed price effects will be positive, but the slope will be dampened by underlying nuisance effects. Where the nuisance effects of accessibility offset the benefit effects, the observed price effect will be negative, but the slope will be dampened by underlying benefit effects.

Lower income households may value differently than higher income households the accessibility to elevated transit stations. Lower income households use public and rapid-rail transit systems more than higher income households (*17*). However, there is no empirical analysis of differential price effects of elevated transit station accessibility on single-family homes with respect to neighborhood income levels. This article helps close this gap in research.

STUDY AREA

To test the theory, there must be a study area in which the same transit station(s) can be evaluated for their price effects on the value of single-family homes in both lower and higher income neighborhoods. The study can further benefit from transit station planning and design that aims to minimize any adverse effects attributable to noise, traffic, lighting, safety, and general aesthetics or appearance. The conditions are met in one area of the Atlanta, Georgia, area: a portion of the "East Line" of the heavy-rail system run by the Metropolitan Atlanta Rapid Transit Authority (MARTA) (*18,19*).

The study area measures approximately 2.7 mi east to west by 1.7 mi north to south. Major highways define the area. The entire study area is within DeKalb County. The study area is further divided into "north" and "south" subareas divided by the MARTA track. The north subarea is predominantly white, middle class, with affluent sections. The south subarea is predominantly black, lower middle class, with low-income sections. The study area is the largest contiguous segment of the MARTA rail system accessing single-family residential neighborhoods with elevated transit stations. Three elevated stations serve this area. Those stations were constructed and opened in the late 1970s. The study area is also reasonably homogeneous in terms of housing stock age and household socioeconomic characteristics aside from various income levels observed along both sides of the tracks. This allows for relatively uncomplicated analysis of station influences.

Tables 1 through 3 illustrate north and south neighborhood socioeconomic, housing, and transit ridership characteristics. Table 1 shows that less than 10 percent of the population

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TABLE 1 DeKalb County East Line Population and Household Profile

Tract	Side of MARTA	1980 Pop.	1980 Households	Black Pop.	Percent Black	Percent Black in Study Area
202	North	2,024	1,150	66	3.26%	0.66%
203	North	3,022	1,380	552	18.27%	5.50%
204	North	2,268	1,163	303	13.36%	3.02%
Summary		7,314	3,693	921	12.59%	9.18%
205	South	4,485	1,515	4,407	98.26%	43.90%
206	South	1,509	539	1,500	99.40%	14.94%
207	South	3,243	1,023	3,210	98.98%	31.98%
Summary		9,237	3,077	9,117	98.70%	90.82%

Source: 1980 Detailed Population and Housing Census, Metropolitan Atlanta, Georgia, US Bureau of the Census.

TABLE 2 DeKalb County East Line House Value and Tenure Profile

Tract	Side of MARTA	Mean Family Income	Median Occupied Unit Value	Owner Occupied	Renter Occupied	Total Units	Percent Units Owner Occupied
202	North	$33,380	$77,500	335	809	1,144	29.28%
203	North	$20,150	$42,900	846	576	1,422	59.49%
204	North	$14,912	$36,800	402	763	1,165	34.51%
Summary		$22,620	$48,673	1,583	2,148	3,731	42.43%
205	South	$12,569	$17,700	665	843	1,508	44.10%
206	South	$13,347	$16,800	176	362	538	32.71%
207	South	$11,452	$18,600	406	618	1,024	39.65%
Summary		$12,334	$17,866	1,247	1,823	3,070	40.62%

Source: 1980 Detailed Population and Housing Census, Metropolitan Atlanta, Georgia, US Bureau of the Census.

north of the MARTA tracks is black, whereas less than 10 percent of the population on the south side is white. Table 2 shows that although house values on the north side of the tracks are more than twice those on the south side, owner occupancy rates are similar. Table 3 shows that both sides of the tracks contribute equally to transit ridership, although slightly more members of the labor force residing in the south use public transit to commute to work.

MODEL AND VARIABLE SPECIFICATION

The study methodology involved collecting sales of single-family homes recorded by the DeKalb County tax assessor during 1986. The universe is composed of 286 arms-length sales of single-family homes with 170 in the north subarea and 116 in the south subarea. The empirical model used is

$$P_i = b_0 + b_j e_i - b_2 TS_i + w$$

where

p_i = market price of a transacted home (i);
e_i = vector of extraneous variables (j) affecting each transacted home (i);
TS_i = value of distance of each transacted home (i) from a neighborhood transit station in 100-ft units; and
w = the stochastic disturbance.

The study evaluates the variation in detached single-family residential property prices with respect to transit station distance. Other variables are considered part of the e_j term,

TABLE 3 DeKalb County East Line Transit Use Profile

Tract	Side of MARTA	Labor Force	Transit Commuters	Percent Transit Commuters To Labor Force	Percent Transit Commuters In Study Area By Tract
202	North	1,249	242	19.38%	16.61%
203	North	1,626	266	16.36%	18.26%
204	North	1,290	214	16.59%	14.69%
Summary		4,165	722	17.33%	49.55%
205	South	1,582	339	21.43%	23.27%
206	South	483	113	23.40%	7.76%
207	South	1,127	283	25.11%	19.42%
Summary		3,192	735	23.03%	50.45%

Source: 1980 Detailed Population and Housing Census, Metropolitan Atlanta, Georgia, US Bureau of the Census.

including

- Square footage of both house and lot;
- Number of bathrooms and the number of stories;
- Presence of basement and foundation, the number of fireplaces, whether the house was situated on a corner lot, the presence of central air conditioning, whether the house was adjacent to a park, and the location inside the city of Decatur; and
- Household income and minority percent status at the census tract level based on the 1980 Census of Population and Housing.

House and lot size are used as controls. A positive association is expected.

Distance to the nearest MARTA station is measured in 100-ft units. The nonlinear term for station distance is computed as the square of distance. The quadratic specification allows one to detect convex or concave relationships. For the south subarea, the functional relationship between transit station proximity and sales price is hypothesized to be concave; the first-order sign will be negative and the second-order sign will be positive. For the north subarea, the functional relationship is hypothesized to be convex; the first-order sign will be positive and the second-order sign will be negative.

Distance to the central business district is typically included in housing price equations as a measure of relative locational advantage (*16*). A variable of the distance to the central business district is not included here because the entire study area lies approximately 3 to 5 mi from downtown Atlanta, making differences between sites small and because the travel time between stations is only 2 to 4 min.

Being adjacent to a park in this study area will be negatively associated with house value. The few parks in this area are large urban parks attracting thousands of users during sunny days. Parking, litter, loitering, and other nuisances affect adjacent homes.

Various house attributes will have a positive association with house values, including the presence of basement and foundation, the number of fireplaces, whether the house was situated on a corner lot, and the presence of central air conditioning.

Income is associated with minority status. In the study area, the higher the median household income of a census block group the lower the percent of households classified as minority by the census for 1980. In the south subarea, census block group incomes ranged from a low of about $9,400 with nearly 100 percent minority households to a high of about $14,000 with seven-eighths minority households. For the north subarea, census block group incomes ranged from a low of about $13,000 with one-sixth minority households to a high of more than $30,000 with 1 percent minority households. Although income is a proxy for both income and minority status, both are considered. The writer hypothesizes that income will be positively associated with house price in both the north and south subareas, but that percent minority population will have a negative association with house price in the north and a positive association in the south. Location inside the city of Decatur is used as a control, although most minority populations of the study area reside there.

Ordinary least-squares regression is used. The linear specification is used except that distance to MARTA stations is specified as quadratic and noninterval relationships are specified as binary (1,0). Except for control variables, only variables performing as hypothesized are used in final regression equations.

RESULTS

Regression results for south and north subareas are presented in Tables 4 and 5, respectively. All coefficients of non-control variables significant at the 0.10 level of the one-tailed *t*-test have the expected signs.

TABLE 4 Regression Results and Equation of South Side Home Sales

DEPENDENT VARIABLE:	Sales Price ($1)
NUMBER OF CASES:	116
MULTIPLE R:	0.622
SQUARED MULTIPLE R:	0.387
ADJUSTED SQUARED MULTIPLE R:	0.342
STANDARD ERROR OF ESTIMATE:	9444.472
F-RATIO	8.455

VARIABLE	COEFFICIENT	STD ERROR	T-Score
Constant	-30543.674	39944.629	-0.765
House Size, square feet	11.446	3.241	3.531*
Lot Size, square feet	0.421	0.276	1.525*
Basement (1,0)	6062.616	2520.597	2.405*
Location in Decatur City	10411.601	3653.165	2.850*
Census Tract Income, 1980 ($1)	0.593	0.307	1.931*
Census Tract Minority %, 1980	590.018	396.849	1.487*
Distance from Station, 100 ft units	-1045.601	227.434	-4.597*
Distance from Station, squared	15.559	3.480	4.471*

*Significant at 0.10 level of one-tailed test.

TABLE 5 Regression Results and Equation of North Side Home Sales

DEPENDENT VARIABLE:	Sales Price ($1)
NUMBER OF CASES:	170
MULTIPLE R:	0.778
SQUARED MULTIPLE R:	0.605
ADJUSTED SQUARED MULTIPLE R:	0.566
STANDARD ERROR OF ESTIMATE:	16357.358
F-RATIO	15.701

VARIABLE	COEFFICIENT	STD ERROR	T-Score
Constant	-4332.749	11823.430	-0.366
House Size, square feet	16.604	4.212	3.942*
Lot Size, square feet	0.200	0.192	1.045
Number of Stories	17896.569	6673.252	2.682*
Adjacent to Park (1,0)	-12051.036	5842.202	-2.063*
Foundation Present (1,0)	7113.912	3619.723	1.965*
Central Air Conditioning (1,0)	7561.525	5064.175	1.493*
Corner Lot (1,0)	-7600.764	4245.001	-1.791*
Number of Fireplaces	3646.128	2734.720	1.333*
Basement (1,0)	3865.805	2995.300	1.291*
Number of Full Bathrooms	4097.538	2694.691	1.521*
Location in Decatur City	-18050.796	4875.782	-3.702*
Census Tract Income, 1980 ($1)	1.921	0.437	4.398*
Census Tract Minority %, 1980	-220.435	126.083	-1.748*
Distance to Station, 100 ft units	965.724	633.330	1.525*
Distance to Station, squared	-23.156	15.600	-1.484*

*Significant at 0.10 level of one-tailed test.

South Subarea

The regression results for the south subarea show the variables performing as hypothesized. They are house size, lot area, house age, presence of a basement, census block group minority percent, and census block group income. Distance from elevated transit stations is significantly associated with house value in the theorized manner. The farther a house is from an elevated transit station, the lower its value. The quadratic terms shows a concave relationship, as hypothesized.

North Subarea

The regression results for the north subarea show the variables performing as hypothesized. They are house size, number of stories, proximity to park, foundation, central air conditioning, location on corner lot, number of fireplaces, basement, number of full bathrooms, percent of census block group population that is minority status, and census block group income. Distance from elevated transit stations is significantly associated with house value in the theorized manner with respect to the first-order relationship. The farther a house is from an elevated transit station, the higher its value. The relation of house value to distance from an elevated heavy-rail station is convex, as hypothesized.

INTERPRETATION AND POLICY IMPLICATIONS

There are two interesting sets of interpretations. The first concerns the condition under which positive and negative price effects can be generated by the same transit stations on single-family homes in neighborhoods of varying income levels. The second concerns the relationship between neighborhood income levels and transit station accessibility in terms of price effects.

Positive Price Effects

Among homes in the south subarea, the results show that elevated heavy-rail transit stations have a positive price effect on houses. Where households depend on rail transit because of income, one could generalize these results to suggest that price effects will be positive. The extent to which the observed price effects are dampened by nuisance effects cannot be determined for reasons explained by Li and Brown (*16*). On the other hand, one must consider that nuisance effects may be minimized because of special design and planning by MARTA to protect neighborhoods from adverse effects (*18,19*).

Negative Price Effects

Results for the north subarea show that transit station proximity is associated with negative price effects on home sales. The analysis suggests that among higher-income neighborhoods, transit stations may reduce values of nearby homes. It is possible that some or all of this effect is associated with distance from minority-dominated neighborhoods. This writer cannot say for sure whether observed effects are related to transit station distance or distance from minority-dominated neighborhoods. On the other hand, a large number of control variables were employed, including census block group income and minority percent and location inside the city of Decatur. Moreover, results are as hypothesized. A final consideration is that both north and south neighborhoods contribute equally to public transit ridership. Nonetheless, more research is needed where interaction between neighborhoods of various minority composition can be controlled. This writer therefore suggests that, until such research is done, one cannot say for sure that results reported here can be generalizable.

Policy Implications

Elevated heavy-rail transit stations will have negative price effects on homes if they are associated with noise, traffic, and other forms of nuisance. They will have positive price effects if they are associated with improving the accessibility of residents to opportunities found throughout the urban area. In lower-income neighborhoods, the price effect will be positive. That is, the closer to a station a single-family home is located, the higher its sales price, all other factors considered. The benefit effects of accessibility more than offset any nuisance effects, at least among lower value homes in lower income neighborhoods. In higher income neighborhoods, transit station proximity may be associated with lower home value. Higher value homes may be more sensitive to nuisance effects than by improvements in accessibility. Rapid-rail transit authorities need to be aware of these differential influences to anticipate the effect of elevated heavy-rail transit stations in residential neighborhoods.

A simple benefit-cost relationship can be constructed from the first-order coefficients on the distance-from-MARTA-station variable. With the use of simplified assumptions and first-order coefficients, total estimated benefits accruing to the south subarea are about $10 million. This is the aggregated value created by improving accessibility through elevated heavy-rail transit. Total estimated losses accruing to properties in the north subarea are in the order of $9 million. However, until there is research that can better control for interaction effects between neighborhoods of varying minority composition, these negative benefits must be viewed with skepticism.

The research suggests that substantial social benefits may be realized by placing elevated heavy-rail transit stations in areas that will positively capitalize on the presence of the facility.

REFERENCES

1. B. W. Allen and R. Mudge. *The Impact of Rapid Transit on Urban Development*. Rand Corporation Paper P-5246. The Rand Corporation, 1974.
2. D. Boyce, B. Allen, R. Mudge, P. B. Slater, and A. M. Isserman. *The Impact of Rapid Rail on Suburban Residential Property Values and Land Development Analysis of the Philadelphia High Speed Line*. Wharton School, University of Pennsylvania, Philadelphia, 1972.
3. F. W. Davies. Proximity to a Rapid Transit Station as a Factor in Residential Property Values. *Appraisal Journal*, 1970, pp. 554–572.

4. G. W. Davies. The Effect of a Subway on the Spatial Distribution of Population. *Journal of Transport Economics and Policy*, 1972, pp. 126–136.
5. S. C. Langfield. *The Balanced and Orderly Development of the Site in Close Proximity to a Metro Station as a Contributor to a More Healthy and Economically Viable Urban Environment in the Washington Metropolitan Area*. Urban Transportation Center, Washington, D.C., 1971.
6. D. B. Lee, et al. *Case Studies and Impacts of BART on Prices of Single Family Residences*. Institute of Urban and Regional Development, University of California, Berkeley, 1973.
7. S. R. Lerman, D. Damm, E. Lerner-Lamm, and J. Young. *The Effect of the Washington Metro on Urban Property Values*. UMTA, U.S. Department of Transportation, 1978.
8. E. H. Spengler. *Land Values in New York in Relation to Transit Facilities*. Columbia University Press, New York, N.Y., 1930.
9. J. D. Burnell. Industrial Land Use, Externalities, and Residential Location. *Urban Studies*, Vol. 22, 1985, pp. 399–408.
10. R. G. Ridker and J. A. Henning. 1967. The Determinants of Residential Property Values with Special Reference to Air Pollution. *Review of Economics and Statistics*, Vol. 49, 1967, pp. 246–257.
11. J. P. Crecine, O. A. Davis, and J. E. Jackson. Urban Property Markets. *Journal of Law and Economics*, Vol. 10, 1967, pp. 79–99.
12. D. M. Grether, and P. Mieszkowski. The Effects of Nonresidential Land Uses on the Prices of Adjacent Housing: Some Estimates of Proximity Effects. *Journal of Urban Economics*, Vol. 8, 1980, pp. 1–15.
13. R. Burkhardt. *Summary of Research: Joint Development Study*. The Administration and Managerial Research Association of New York City, New York, 1976.
14. D. M. Dornbusch. *BART-Induced Changes in Property Values and Rents. Land Use and Urban Development Projects, Phase I, BART*. Working Papers. WP 21-5-76. U.S. Department of Transportation; U.S. Department of Housing and Urban Development, 1975.
15. M. Baldassare, R. Knight, and S. Swan. Urban Service and Environmental Stressor: The Impact of the Bay Area Rapid Transit System on Residential Mobility. *Environment and Behavior*, Vol. 11, No. 4, 1979, pp. 435–450.
16. M. M. Li, and H. J. Brown. Micro-Neighborhood Externalities and Hedonic Housing Prices. *Land Economics*, Vol. 56, No. 2, May 1980, pp. 125–141.
17. P. Newman and J. Kenworthy. *Cities and Automobile Dependence*. Gower Technical, Sydney, Australia, 1989.
18. S. McClesky. *Investigating the Effect of Elevated Heavy-Rail Transit Station Planning and Design on Single Family House Prices*. M.S. thesis. City Planning Program, Georgia Institute of Technology, Atlanta, 1988.
19. A. C. Nelson and S. McClesky. Influence of Elevated Transit Stations on Neighborhood House Values. In *Transportation Research Record 1266*, TRB, National Research Council, Washington, D.C., 1990.

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