

## TRANSPORT FINDINGS

# Did the A Line Arterial Bus Rapid Transit Affect Housing Values in Ramsey County, MN?

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## Transport Findings

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As arterial bus rapid transit (BRT) has become popular in the Twin Cities, local residents worry about the housing value uplift associated with these investments and the potential displacement of poor residents. Using a before-after treatment-control design, this study developed a difference-in-difference hedonic model to examine the effects of the A Line BRT on station-area housing values. After the funding announcement and opening, housing sales prices increased slightly. However, neither effect is statistically significant. The A Line encouraged ridership but had no effect on housing values. We will explain why the Green Line light rail increased property values whereas the arterial BRT did not.

## RESEARCH QUESTION

As a much cheaper alternative to rail transit, bus rapid transit (BRT) has recently gained momentum in the Minneapolis-St. Paul metropolitan area (Twin Cities). Currently, three BRT lines are in operation and eight more lines are at different planning stages (Metropolitan Council n.d.). Because the Green Line light rail, commencing in 2014, increased housing values along its corridor (Cao and Lou 2018), local residents worry about whether deploying BRT lines will bring about premiums and reduce housing affordability. This concern is not surprising because property value increase and gentrification may increase difficulty of poor households to retain their residences (Padeiro, Louro, and Da Costa 2019).

We applied a difference-in-difference (DID) hedonic pricing model to housing sales data in Ramsey County, MN, to answer the following research question: when and how much did the A Line BRT affect property values of station-area housing? This study used the same research design as Cao and Porter-Nelson (2016) and Cao and Lou (2018), but found no effect.

The A Line serves a 15.6-km corridor situated on Minnesota State Highway 51/Snelling Avenue where it connects the Rosedale Transit Center to the 46th Street Station ([Figure 1](#)). With a total project cost of \$27 million (1/35 of that of the 17.7-km Green Line light rail transit), it replaced three existing routes with a primary focus of increasing efficiency and speed by placing stations about 800 meters apart. The A Line uses unique buses and has fully-equipped stations similar to light rail stations. Its headway is 10 minutes for most of the day. It receives a preferential treatment of traffic signal priority at intersections. However, the A Line is regarded as an arterial BRT or low-level BRT because it operates in mixed traffic (Cain et al. 2009).

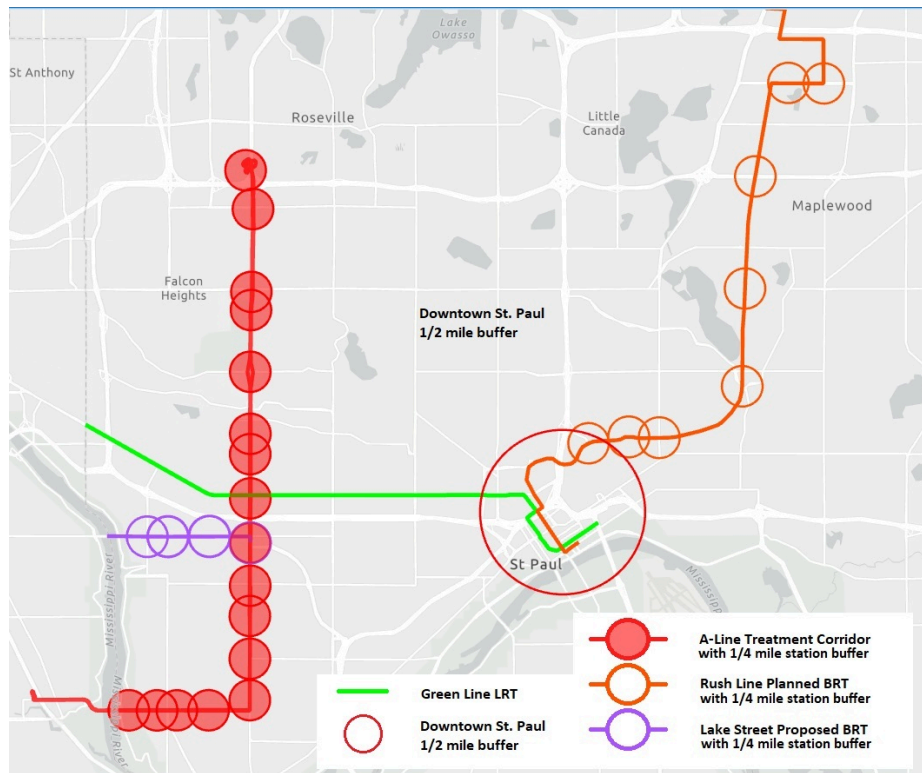


Figure 1.

The Control corridors, the Rush Line (in orange) and B-Line (in purple), were selected by the Metropolitan Council and Ramsey County as future planned BRT routes in Ramsey County, Minnesota. In observational studies, controls should resemble treatments as closely as possible. Similar to the A Line corridor, the control corridors are key major arterials in the county, with mixed-use development along the corridors. 1 mile = 1609 meters.

## METHOD AND DATA

Following Cao and Lou (2018), this study adopted a treatment-control research design. The treatment was the A Line. When there are no equivalent corridors/areas in the region, researchers choose the best available controls when exploring the effects of rail transit on land development (Rodriguez, Vergel-Tovar, and Camargo 2016; Cervero and Landis 1997; Bhattacharjee and Goetz 2016). This study selected control corridors based on a 2013 Metro Transit study of planned future BRT networks (Figure 1). The A Line had its full funding grant agreement (FFGA) announced on February 13, 2015 and subsequently launched into service on June 11, 2016. We treated these two dates as key points in time for the project. The sample included houses that were within 400 m ( $\frac{1}{4}$  mile) of BRT stations and major bus stops in the control corridors, and were sold between January 2012 (three years before the FFGA announcement) and March 2020. The housing records were derived from the tax parcel data of the Ramsey County Assessor's Office. Table 1 shows that mean sales prices of houses in both corridors increased over time.<sup>1</sup> Houses in the A Line corridor were more expensive than those in the control

<sup>1</sup> In the Twin Cities, housing prices reached bottom in 2011.

Table 1. Mean sales prices (\$ per square meter)

Year	A Line corridor	Control corridors	Difference
2012	1974	1443	531
2013	2090	1756	334
2014	2098	1751	348
2015	2163	1841	322
2016	2203	1854	349
2017	2385	1882	502
2018	2474	1988	486
2019	2499	1855	644
2020	2381	2236	146

The A Line commenced in June 2016.

corridors. Except for 2012,<sup>2</sup> the price differences between the two areas were about \$320-350 per square meter. Therefore, housing prices in both areas before A Line implementation are comparable.

To distinguish whether an observed effect represents the value added by BRT or an effect of station locations (Ko and Cao 2013), a before-after analysis (i.e., a DID model) is in order. The DID hedonic pricing model is expressed as follows:

$$Y = f(S, G, A, O, O \times A, FFGA, FFGA \times A), \quad (1)$$

where  $Y$  is the sales price per square meter of a house;  $S$  denotes its structural factors;  $G$  represents its geographic features; and  $A$  is a dummy variable designating whether the house is confined in the treatment corridor. To examine the timing of value uplift by the A Line, two dummy variables ( $FFGA$  and  $O$ , indicating whether a house was sold following the announcement of the FFGA or operation of the A Line) and two interactive terms ( $O \times A$ ) and ( $FFGA \times A$ ) were included. The interactive terms are our policy variables of interest, consistent with Hurst and West (2014) and Cao and Lou (2018). If they are significant, the FFGA announcement and operation of the A Line affect housing values.

[Table 2](#) presents all variables used in this study and their descriptive statistics. Location variables were computed using ArcGIS and all other variables were from the tax parcel data. Housing sales prices were adjusted by the consumer pricing index (CPI).

<sup>2</sup> We tested a model using the data from 2013 to 2020 and found that neither FFGA nor opening of the A Line have a significant effect on housing prices.

Table 2. Variables and descriptive statistics

Variables	Definition	Mean	Std. Dev.	Min	Max
Sales Price	Adjusted price using CPI (\$1000)	309	130	27	1209
Floor Space	Living area in square meter	147	55	41	474
Sale Price Per Floor Space	Sale price (\$) per square meter	2151	621	198	4341
Year Constructed	Year when house was built	1933	29	1869	2019
Single Family House	Dummy variable noting single family house	0.87	0.34	0	1
Multifamily House	Dummy variable noting two/three family house	0.065	0.247	0	1
Townhouse	Dummy variable noting townhouse	0.023	0.150	0	1
Condo	Dummy variable noting condominium dwelling	0.041	0.198	0	1
Presence of Garage	Dummy variable noting garage	0.90	0.30	0	1
Basement	Dummy variable noting basement	0.95	0.22	0	1
Bedrooms	Number of bedrooms	3.31	1.02	1	11
Total Rooms	Number of rooms	7.08	1.87	2	19
Stories	Number of floors	1.33	0.47	1	3
Distance to Downtown St. Paul	Straight-line distance to downtown St. Paul (km)	6.65	1.66	1.09	9.83
Treatment	Dummy variable noting houses in the A Line corridor	0.69	0.46	0	1
Opening	Dummy variable noting the sale of house after opening of BRT (June 2016)	0.59	0.49	0	1
FFGA	Dummy variable noting the sale of house after FFGA (Jan. 2015) and before opening	0.05	0.22	0	1

## FINDINGS

We estimated the hedonic model using a linear regression. [Table 3](#) presents model results. The effects of all the significant housing attributes on sales price are consistent with our expectation. Distance to downtown St. Paul is positively associated with housing value, congruent with Cao and Lou (2018).

After controlling for these variables, the treatment dummy variable has a significant and positive coefficient, indicating that houses in the A Line corridor were more expensive than those in the control corridors. Dummy variables for FFGA and opening are also significant although the former is at the 0.1 level. Their positive coefficients suggest that county wide, housing sales prices increased during this period of time. The two policy variables ( $O \times A$  and  $FFGA \times A$ ) have positive coefficients. However, they are not statistically significant, suggesting that the A Line had not affected housing value. Note that we also developed a model with an additional control corridor (the West 7<sup>th</sup> Street) and reached the same conclusion.

Why did the Green Line increase property values while the A Line did not? The Green Line operates on rail tracks whereas the A Line operates in mixed traffic. Home buyers, as well as developers, may regard the A Line as less permanent than a light rail line and paying a premium for potentially temporary access is risky (Currie 2006). The Green Line was supported by

Table 3. Linear regression for sales price per square meter

Variables	Coefficients	P-Value
Constant	-653	0.448
Single Family Home	430	0.000
Townhome	103	0.218
Garage	174	0.000
Presence of Basement	295	0.000
Year Constructed	0.5	0.280
Total Rooms	50	0.000
Bedrooms	-71	0.000
Stories	162	0.000
Floor Space	-4	0.000
Distance to Downtown St. Paul	154	0.000
Treatment	206	0.000
FFGA	150	0.098
<b>Treatment * FFGA</b>	<b>33</b>	<b>0.776</b>
Opening	316	0.000
<b>Treatment * Opening</b>	<b>15</b>	<b>0.764</b>
Number of Observations	1900	
R <sup>2</sup>	0.438	

1. FFGA = full funding grant agreement.
2. Bold variables are policy variables.
3. The reference category for housing type is multifamily house.
4. Condo is highly correlated with presence of basement and hence was manually removed from the model.
5. The largest variation inflation factor is 5.35, which is associated with Treatment \* Opening.

zoning changes and parking reduction (Cao and Lou 2018) but there were no transit-supportive land use policies for the A Line. By adopting strategies such as making fewer stops, off-board fare payment, and signal priority, the A Line travels faster than regular buses. For branding, A Line buses use the same exterior design and colors as light rail trains. However, some car drivers in the corridor did not notice service changes brought by the A Line and others regarded the A Line just as regular buses, as suggested by car users' responses to our self-conducted field survey.

In 2017, the A Line served 4,700 riders per weekday, higher than the projection of 4,000 riders. The absence of house price increases eases the displacement concern of local residents. Therefore, the A Line is objectively serving the public of Western Ramsey County as it was designed to. The arterial BRT was created to serve the people who call that area home and has continued to do so without destabilizing the housing market in the area. However, without value uplift and land development along the A Line, it is a challenge to reach the goal of 8,000 daily riders in 2030.



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