Regional Science and Urban Economics 46 (2014) 57–72

Contents lists available at ScienceDirect

Regional Science and Urban Economics

journal homepage: www.elsevier.com/locate/regec

Public transit and urban redevelopment: The effect of light rail transit on land use in Minneapolis, Minnesota

Needham B. Hurst [a], Sarah E. West [b,*]

[a] Harvard Kennedy School, Cambridge, MA, USA
[b] Department of Economics, Macalester College, 1600 Grand Avenue, Saint Paul, MN 55105, USA

ARTICLE INFO

Article history:
Received 23 March 2013
Received in revised form 10 February 2014
Accepted 12 February 2014
Available online 22 February 2014

JEL classification:
R14
R42
R52

Keywords:
Land use change
Transit
Light rail
LRT
Difference-in-difference

ABSTRACT

This study uses a unique data set derived from parcel data and aerial photographs to estimate the effect of the introduction of light rail transit (LRT) on land use in Minneapolis, Minnesota. We measure detailed changes in land use before and after construction of the METRO Blue Line and exploit heterogeneity in starting land use type and neighborhood characteristics to examine the differential effects of proximity to light rail across space. Results show that properties within ½ mile of operational LRT stations experience a small increase in the likelihood of land use change relative to when the LRT is under construction, but neither construction nor operation of the line appears to affect land use change relative to the time before construction. Within the corridor, proximity to LRT increases the likelihood of land use change on single-family and industrial properties, but appears to have no effect on vacant land, commercial properties, and multi-family properties.

1. Introduction

Proponents of light rail transit (LRT) argue that it reduces vehicle dependency and emissions and induces land use change and urban redevelopment. By providing a travel alternative, light rail transit decreases transportation costs in areas close to stations, creating the incentive for households to locate near it. Developers respond by building multi-family housing, and businesses move to these denser areas to serve newly relocated households. On the other hand, rail service decreases the commuting cost of living farther from the city center, which theoretically induces development in and population movement to first-ring suburbs. The effects of transit improvements on land use and urban density are therefore ambiguous. This study uses property-level information to estimate the effect of the introduction of light rail on land use in Minneapolis, Minnesota. These data enable us to measure detailed changes in land use before and after the METRO Blue Line was put into operation, to use difference-in-difference estimation techniques to identify the effect of light rail, and to exploit heterogeneity in neighborhood characteristics and starting land use type to examine the differential effects of proximity to light rail across space.

The METRO Blue Line was Minnesota's first investment in light rail transit.[1] The $715.3 million dollar project began construction in early 2001 and was fully operational by December 2004. In the first year of operation, passengers boarded the light rail nearly 3 million times. In 2010, passengers took almost 10.5 million trips (Metro Transit, 2012). Plans for light rail in the corridor date back to a 1985 environmental impact assessment by the Minnesota Department of Transportation, which cites a need for auto-transit alternatives to ease a growing congestion problem (Metro Transit, 2010). Political will and federal dollars made those plans a reality, connecting downtown and neighborhoods along the line to two airport terminals, the Mall of America, and first-ring suburbs. According to the Metropolitan Council, the regional planning agency serving the Twin Cities' seven-county metropolitan area, the "Hiawatha line has proven to be a powerful catalyst for development in a corridor that once had large tracts of vacant and underutilized land" (Metropolitan Council, 2012). We know of no study, however, that isolates the effects of the Blue Line on land use change, controlling for other determinants of land use.

Previous research suggests that rail transit's effects on land use tend to be small for heavy rail systems, smaller for light rail systems, and even smaller in high-income areas (Vessali, 1996; Handy, 2005).

* Corresponding author. Tel.: +1 651 696 6482; fax: +1 651 696 6746.
E-mail addresses: needham_hurst@hks15.harvard.edu (N.B. Hurst), wests@macalester.edu (S.E. West).

[1] It was named the "Hiawatha Line" until 2013, when construction of the state's second LRT line, the METRO Green Line, was under way.

http://dx.doi.org/10.1016/j.regsciurbeco.2014.02.002

Those few studies that examine effects over several decades find that LRT proximity has considerable influence on the probability of land use change, but struggle to explicitly isolate the LRT effect on land use from other long-term factors (Landis et al., 1995; Cervero and Landis, 1997). Studies examining rail effects on property values have been more successful using difference-in-difference approaches like ours. Billings (2011), for example, compares housing prices in corridors that were considered but rejected for LRT to those within 1 mile of LRT stations and finds positive effects of proximity for single-family homes and condominiums but no effects for commercial property values. Gibbons and Machin (2005) compare prices of homes in London close to and unaffected by rail stations, before and after the stations were opened, and also find a positive effect of proximity.[2] McMillen and McDonald (2004) and Billings (2011) find that rail introduction affects home prices even before the trains go into operation.

Effects depend on neighborhood and spatial context. For example, Paez (2006) and Cervero and Landis (1997) find substantial variation in rates of land use change across the BART system. Studies of LRT's effect find a high degree of variation in station-area development patterns and price premiums (Cervero, 1994; Devett et al., 1980; Goetz et al., 2010; Hess and Almeida, 2007). In addition, in less-dense cities like Minneapolis where transportation by car is convenient, investment in LRT may not increase the marginal accessibility of a location enough to create incentives for residents and businesses to locate near stations (Billings, 2011; Handy, 2005). If there is no change in land demand near stations, land use change and dense development patterns will not occur without other government intervention (Giuliano, 1995).

Two studies analyze the effects of the Blue Line on station-area land use.[3] The Center for Transit Oriented Development (2011), examines three LRT lines: the Blue Line, and light rails in Denver and Charlotte. It finds that areas around all three lines experienced substantial amounts of development, with the area around the Blue Line adding nearly 7 million square feet of new development between 2003 and 2009. In all three cities, the majority of the new development was residential; in Minneapolis, residential development made up 86%. The study finds that much development occurred on previously vacant sites, suggesting that increased land values from LRT may have helped convert vacant land to more productive uses. As the authors acknowledge, however, the study does not control for other factors that affect land use.

Focusing on the effects of the Blue Line LRT 1 year after it opened, Goetz et al. (2010) compare unadjusted land use indices before and after the construction on the line began, and find no effect on land use patterns. Because station areas vary substantially in their initial land use and demographic characteristics, not adjusting estimates of land use change for the effects of these covariates may mask the effects of LRT. In addition, the effects of LRT on land use are likely to take place over a longer time period.

Our study controls for other determinants of land use change and extends the study time frame. We combine parcel level data with land use data derived from aerial photographs to construct a panel of parcels with characteristics measured during the time period before construction (1997–2000), during construction (2000–2005), and during the first 6 years of operation (2005–2010). We use difference-in-difference specifications to isolate the effect on land use change of being within ½ mile of a future but nonexistent station area from being within ½ mile when LRT is under construction or operational.[4] Our land use and demographic variables further control for the possibility that parcels near stations are more or less likely to change use not because of proximity to LRT but because of other characteristics correlated with proximity. We compare parcels within ½ mile to those in the rest of Minneapolis and check robustness by further narrowing the comparison sample to parcels between ½ and 1 mile as well as to a set of nearest-neighbor matches obtained by propensity score matching. We also examine the effect of proximity to stations within the ½ mile corridor and test the credibility of our results by conducting the analysis using distances to nonexistent stations placed along the line between actual stations.

Our results suggest that proximity to LRT during construction or operation has no effects on land use change relative to preconstruction. Proximity to LRT during operation has a small positive effect on land use change relative to the construction period, and LRT construction and operation may offset the decreased probability of land use change for properties farther from the city center. Within the corridor, proximity to LRT stations increases land use conversion on industrial and single-family parcels. Proximity to LRT stations appears to have no effect on land use change on commercial or multi-family properties, and perhaps most surprisingly, on vacant land. We obtain, however, very similar estimates using distances to nonexistent stations, so caution should be used when interpreting these results.

In Section 2, we provide background on the METRO Blue Line. In Section 3, we describe our data. In Section 4, we examine land use and demographic trends before and after the introduction of the line. In Section 5, we explain our estimation methods and present results. Finally, in Section 6 we conclude and offer suggestions for further research.

2. The METRO Blue Line

The METRO Blue Line stretches 12.3 miles from the Mall of America in the south to downtown Minneapolis in the north. The line crosses the municipalities of Minneapolis, Bloomington, and Richfield and stops at 19 stations. For 6 of the 12 Minneapolis stations, the line follows Highway 55/Hiawatha Avenue, the “Hiawatha Corridor”, one of the city's major north-south freight rail and automobile corridors (see Fig. 1). Since the 1950s, transportation planners considered a broad range of options for the Hiawatha Corridor. Engineers widened it in the 1960s to accommodate a freeway connecting downtown Minneapolis to southern suburbs and the airport, but suspended the project when planners opted to make Interstate 35 W the main north-south freeway in the city. The corridor remained in limbo through the 1980s, as planners debated whether, among other options, to construct a freeway, introduce express bus lines, or transform the corridor into a parkway. Many of these options involved a light rail, but “real progress on the project…took place during the [Governor Jesse] Ventura administration when the legislature made major appropriations in both 1998 and 1999” (Goetz et al., 2010, p. 12). Such appropriations were contingent on obtaining federal funding; the federal government awarded $334.3 million to the project in January of 2001.

Other agencies made plans at around the same time; in 1999 the Minneapolis Community Development Agency identified development opportunities for 9.4 million new square feet of commercial space and 3750 new dwelling units in the LRT corridor. The study focused on redevelopment and adaption of underutilized industrial and commercial sites near the Downtown East, Lake Street, 46th Street, and Bloomington station areas. Planners estimated that LRT would draw 7000 new units of housing to the corridor by 2020 (Metro Transit, 2010).

[2] A growing body of literature uses difference-in-difference or matching estimators to identify effects of spatially-varying urban policies. Studies, for example, use such techniques to examine the effect of urban redevelopment programs on employment in the U.S. (Hanson and Rohlin, 2013) and in the U.K. (Gutiérrez Romero, 2009), or of urban growth boundaries on rates of development (Dempsey and Plantinga, 2013).

[3] Others examine the effects of the line on property values and ridership. Goetz et al. (2010) find that 1 year after the line opened, proximity to the Hiawatha LRT increased housing values on the west side of the line. Ko and Cao (2013) use a difference-in-difference framework and data on commercial and industrial properties through 2008, and find that proximity to LRT increases values of those properties. Cao and Schoner (2014) use a mailed self-administered survey to explore the effect of the Hiawatha LRT on transit use; responses indicate that the line promotes ridership among residents that moved to the corridor before the line went into use, but not among those who moved in afterwards.

[4] Our choice of a ½ mile radius is consistent with the previous literature (Cervero and Landis, 1997; CTOD 2011; Goetz et al., 2010). Our results confirm that the effects of LRT are restricted to within this radius.