GOOD SYSTEMS
A UT Grand Challenge

Assessing spatial-temporal disparities in the impacts of light rail transit on residential property values through Bayesian modeling: an empirical study in Austin, Texas

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Introduction

During the pandemic, the increases in residential property values have drawn concerns from academia and practitioners (Florida, 2022). These increases in expenditure could force residents and renters to spend extra money on living and reduce their budgets in other fields.

Regarding this concern, researchers and practitioners have worked on approaches, and the transit-oriented-development (TOD) is a popular tool of this approach, creating livable conditions surrounding public transit services (Ibraeva et al., 2020; Sandoval, 2021). In addition, light rail transit (LRT) is a potent public transit service and has been applied in TOD (Arrington, 2003). Moreover, Project Connect is s typical TOD with LRT, and its impacts on housing affordability need further and precise investigations.

Research Goal

Previous studies have noted the impacts of LRT (Chapple et al., 2017; Rayle, 2015). However, most focused on the high population density cases, while few identified the inflection points or thresholds of these impacts in moderate-density areas. Thus, this study focuses on the impacts of LRT on residential property values in a moderate population density case, Austin, Texas, as the empirical case, aiming to fill the research gaps.

Methods

In this study, we focused on the impacts of LRT (MetroRail) on single-family residential property values within 5-km LRT catchments in the City of Austin. We captured the housing transaction data from 20019 to 2015.

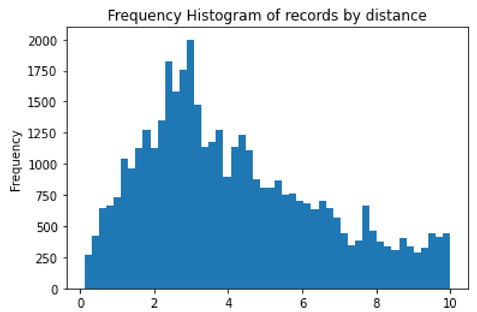
Related housing status (year built, CDOM, a condition defined as poor, and pier beam as the foundation), built environment (the number of construction permits, bus stops, distance to downtown, distance to commercial land use, distance to mix land use, distance to the office, distance to open area, distance to motorway/highway, distance to major roads, and distance to residential roads), and neighborhood factors (median household income, gender, and race) data are accordingly collected in the final dataset.

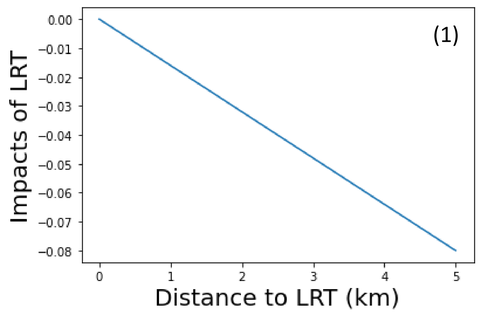
Models and Results

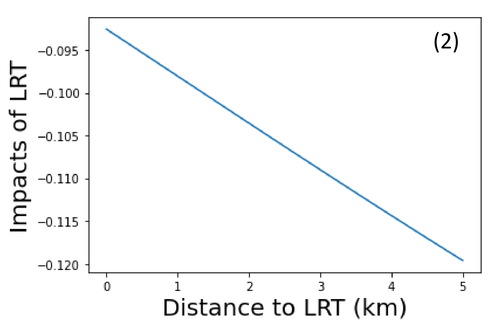
- Equation 1 (RMSE=0.417): $y = LRT\ dummy * distance * \beta\_distance + median\ housing\ prices + f(hs, be, nf)$
- Equation 2 (RMSE=0.414): $y = LRT\ dummy * f1(distance) + median\ housing\ prices + f(hs, be, nf)$
- Equation 3 (RMSE=0.402): $y = f1(time) * f1(distance) + median\ housing\ prices + f(hs, be, nf)$
- Equation 4 (RMSE=0.416): $y = LRT\ dummy * f2(distance) + median\ housing\ prices + f(hs, be, nf)$
- Equation 5 (RMSE=0.405): $y = f1(time) * f2(distance) + median\ housing\ prices + f(hs, be, nf)$

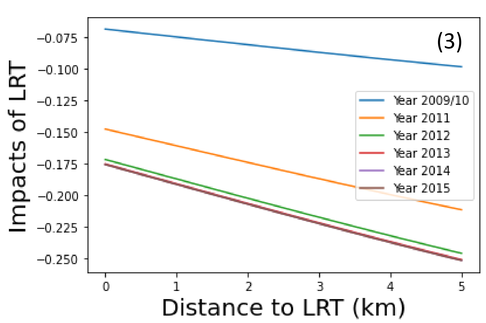
where $distance$ is the Euclidean distance from properties to the closest LRT stations. $LRT\ dummy$ is the dummy variable of time: 2009-2010 is 0 and 2011-2015 is 1. $Median\ housing\ prices$ is the median residential properties transaction prices in Austin of each year. hs, be, and nf are housing status factors (e.g., year built, stories, CDOM), built environment factors (e.g., number of permits, public transit services, accessibility to other land uses), and neighborhood sociodemographic and economic factors (e.g., race and median household income).

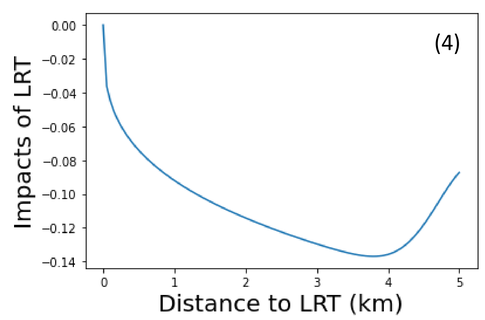
$f1(x) = \frac{A}{(1+exp(\beta*(d-x)))}$ $f2(x) = \frac{A1}{x*\beta1} + A2 * exp(\frac{-(x-\beta2)^2}{2*\beta3^2})$

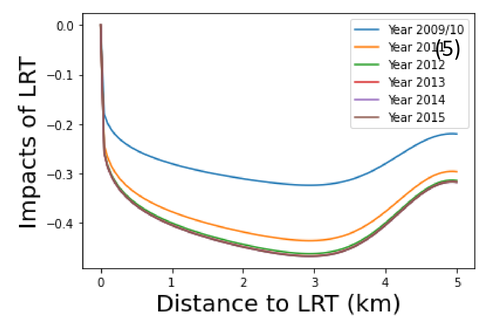












Conclusion

1. Property prices within the catchments (5 km) are lower than the citywide average price. It is an interesting finding indicating that the attractiveness of public transit services may not be as significant as the suburban lifestyle. In the City of Austin, at least before 2015, residents valued residential properties far away from light rail transit facilities more.
2. Single-family properties within the catchments far from LRT facilities likely have low prices. This finding is consistent with previous studies, saying LRT services within the catchments could drive housing values. Hence, considering the displacement within the catchments should be critical.
3. Although distance impacts on prices are negative, the prices of properties with a distance larger than four kilometers are significantly higher than the others, and the lag effect of LRT services is significant and around one year. Based on this finding, the properties whose distances are 0-1 km and 4km-5km distance should be preferably considered in the anti-displacement initiatives.

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