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Should I stay or should I go? A survey analysis of neighborhood change and residential mobility concerns around new light rail stations in Charlotte, NC

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ABSTRACT

In this article, we examine the effects of rail transit investments on residents' stated mobility intentions and perceptions of neighborhood changes using a survey analysis in Charlotte, North Carolina. We ask residents in neighborhoods along a new light rail line about their reasons for residing in their current neighborhood, thoughts about moving and the light rail's effect on their neighborhood. To control for city-wide housing market pressures, responses from one station-adjacent neighborhood are compared to responses from residents in a similar neighborhood elsewhere in the city while controlling for individual characteristics. Using a mixed-methods research approach, we find that while residents attribute some changes in their property values and rents to the light rail, it is only one of many factors affecting their neighborhood. Light rail also does not appear to affect residents' stated propensity to move out of these neighborhoods. Survey respondents' view of the light rail's effect on their neighborhood is also positive, on average. We find that the stated likelihood of moving is not related to the distance to the station nor to how frequently a resident uses the light rail. This article contributes to debates on transit-induced displacement and gentrification and provides context to neighborhood-scale quantitative analyses from residents' perspective.

1. Introduction

Cities across the United States have invested billions of dollars in light rail transit systems over the past few decades (Freemark, 2015; Kahn, 2007). Transit-oriented development (TOD) accompanying these new systems has also gained in popularity as an urban redevelopment strategy with goals of stimulating development and revitalizing declining or underutilized urban areas (Bernick and Cervero, 1997; Ferbrache and Knowles, 2017). Transit's economic development goals have raised fears of gentrification and the potential displacement of lower-income or auto-less residents that potentially stand to benefit the most from the increased accessibility brought by public transit investments (Delmelle and Nilsson, 2020; Rayle, 2015; Rosenthal, 2018).

These transit-induced gentrification and displacement concerns have spurred a growing body of literature that investigates the link between rail transit investments and neighborhood change, particularly gentrification, with mixed findings (Baker and Lee, 2019; Bardaka et al., 2018; Deka, 2017; Dong, 2017; Hess, 2018; Kahn, 2007; Nilsson and Delmelle, 2018; Padeiro et al., 2019; Pollack et al., 2010). Disaggregate studies on individual movements into and out of new rail transit neighborhoods find no disproportionate out-migration of lower-income residents, questioning the strength of the relationship between transit and displacement (Delmelle and Nilsson, 2020; Rodnyansky, 2018). Surveys of residents in rail transit neighborhoods have examined residents' attitudes towards rail transit, travel behavior, ridership, health outcomes, and reasons for living in transit-oriented development neighborhoods (Brown and Werner, 2011; Brown et al., 2019; Dill, 2008; Fan and Guthrie, 2012; Levine and Frank, 2007; Lund, 2006; Lund et al., 2004), but to a lesser extent existing residents' propensity of moving and their perceptions of the rail station's effect on their neighborhood. These survey-based studies are typically analyzed in isolation without considering the broader trends occurring across the metropolitan area. Most cities that have invested in light rail transit recently are those that have experienced large population growth and housing market pressures across an urban area (e.g., Atlanta, Charlotte, Dallas, Denver, Houston, Phoenix, Portland, Seattle). It is therefore important to compare responses in new transit neighborhoods with those in similar neighborhoods in other parts of the city that were not subject to such investments to disentangle the role of transit from other potentially confounding factors.

The aim of this paper is to investigate what effects rail transit investments have on stated intentions regarding residential mobility and

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residents' perception of the new station's effect on their neighborhood. Using Charlotte, NC, which opened its second light rail line in 2018, as a case study, we survey residents in station-adjacent neighborhoods regarding their reasons for residing in their current neighborhood, thoughts about moving and the light rail's effect on their neighborhood. Given the city's population growth, shrinking supply of affordable housing, and a high share of renters and lower-income residents in the surveyed neighborhoods, we expect residents along the transit corridor to have elevated mobility rates. Therefore, to control for factors that may contribute to high estimated probabilities of moving and citywide housing market pressures, responses from one station-adjacent neighborhood are compared to responses from a similar neighborhood away from the light rail line, while controlling for individual characteristics. We perform qualitative and statistical analyses on responses to closed- and open-ended questions from the survey, answering the following research questions: (i) are residents in new rail station neighborhoods more likely to consider moving from their neighborhood (compared to residents in similar neighborhoods elsewhere in the city), and (ii) what are the residents' perceptions of the new station's effect on their neighborhood?

This article contributes to debates on transit-induced displacement and gentrification and provides some context to neighborhood-scale quantitative analyses of these changes. While we do not investigate involuntary moves (or displacement) directly, this research contributes to our understanding of how residents perceive and experience changes in their neighborhoods after major public investments which can help decision makers more accurately gauge social and political responses to proposed investments.

The remainder of this paper is organized as follows. Section 2 reviews the current state of knowledge on the link between rail transit, neighborhood change and residential mobility with a focus on survey-based studies. Section 3 describes the study area and the data collection process. Our empirical approach featuring three logistic regressions based on survey responses is described in Section 4. Section 5 presents and discusses the results while Section 6 concludes.

2. Background

Rail transit is a major public investment that brings increased accessibility and new transit-oriented developments (TOD) to a neighborhood. As such, it can become a target for developers and real estate investment, which together with the accessibility benefits can place upward pressures on nearby land and property values (Debrezion et al., 2007; Padeiro et al., 2019). This has caused concerns regarding neighborhood change (or more specifically, gentrification) and affordability in neighborhoods near new rail transit investments and the potential out-migration of lower-income residents in favor of those willing and able to afford the higher land premiums and rents (Rayle, 2015; Delmelle and Nilsson, 2020).

A large body of literature has examined the effects of proximity to a rail transit station on property values (Atkinson-Palombo, 2010; Billings, 2011; Debrezion et al., 2007; Mohammad et al., 2013; Pilgram and West, 2018). It is well established that rail transit has some effect on property values; however, the magnitude and direction of these effects are highly context-dependent (e.g., metropolitan economic conditions, surrounding neighborhood conditions, type of system, station type, etc.) (Debrezion et al., 2007). Hence, it is not surprising that the literature examining the link between rail transit investments and neighborhood change has also generated mixed findings (Baker and Lee, 2019; Bardaka et al., 2018; Dunn, 2017; Dong, 2017; Hess, 2018; Kahn, 2007; Nilsson and Delmelle, 2018; Padeiro et al., 2019; Pollack et al., 2010).

It is difficult to infer from aggregate, neighborhood-level analyses whether changes arise from shifts in the socioeconomic circumstances of existing residents, the influx of new residents with different socioeconomic profiles, and/or the outmigration of the existing residents (Delmelle and Nilsson, 2020; Nilsson and Delmelle, 2020; Rayle, 2015; Zuk et al., 2018). The few studies that have examined individual movements in and out of new rail transit neighborhoods find no disproportionate outmigration of lower-income residents (Delmelle and Nilsson, 2020; Rodnyansky, 2018). Delmelle and Nilsson (2020) used a nationwide sample of movements out of new transit neighborhoods across the United States between 1970 and 2013 to estimate the probability of low-income residents exiting the neighborhood. They found that while low-income residents generally had higher mobility rates, those living in new transit neighborhoods were not more likely to move out compared to residents of other income groups. This relationship held true for both renters and homeowners. In a case study on Los Angeles, Rodnyansky (2018), found that lower-income residents were less likely to leave a neighborhood following the placement of a new transit station.

The lack of quantitative evidence to support the transit-induced gentrification and displacement hypothesis is not necessarily surprising as the gentrification literature more broadly has likewise struggled to quantify increased out-mobility rates (Easton et al., 2020). Qualitative research on displacement has broadened the discussion beyond the physical movement of individuals to encompass other experiences felt by residents as a neighborhood undergoes changes (Marcuse, 1985). For instance, even if residents do not leave, an influx of newcomers may lead to shifts in political and decision-making processes, and in the types of cultural amenities that are brought to a neighborhood (Hyra, 2015). In these situations, residents may experience a loss in their sense of place, even if they are not physically displaced (Davidson and Lees, 2010).

Studies based on primary survey data of residents in rail transit neighborhoods have examined residents' attitudes towards rail transit, travel behavior, ridership, health outcomes, and reasons for living in transit-oriented development neighborhoods (Brown and Werner, 2011; Brown et al., 2019; Dill, 2008; Fan and Guthrie, 2012; Levine and Frank, 2007; Lund, 2006; Lund et al., 2004; Jackson and Buckman, 2020), and to a lesser extent, existing residents' propensity of moving or their perceptions of the rail station's effect on their neighborhood. The studies that are most closely related to this paper are those by Brown and Werner (2011), Fan and Guthrie (2012), Lund (2006), Jackson and Buckman (2020) and, to some extent, Levine and Frank (2007).

Brown and Werner (2011) examined 51 residents' perceptions of rail-related neighborhood changes before and after a new light rail station was opened in a revitalizing neighborhood in Salt Lake City. Increases in housing costs, property taxes, housing improvement investments, and neighborhood economic opportunities were both anticipated and experienced with the new light rail station. Neighborhood reputation and sense of community showed modest anticipated and perceived enhancement, but mainly among continuing and new riders. Changes in crime or traffic were not expected or experienced, and child and pedestrian safety were noted to have improved, though residents had not anticipated this.

Drawing from 750 household surveys in 16 neighborhoods along four Twin Cities transitways, Fan and Guthrie (2012) found that respondents' views of transitways' impacts on neighborhoods was largely positive, though perceptions varied by transit corridor as well as by race. One corridor was viewed less positively by Asians than other racial/ethnic groups, whereas another was perceived more positively by African Americans than other groups. They also found that contrary to media coverage “articulating strongly held community concerns over gentrification and displacement of minority residents from Central Corridor neighborhoods” (p. 99), African-Americans' responses did not vary from others in their perception of transitway impacts. Newer residents were also more likely to view transit more positively. Similar positive sentiments regarding a new light rail station from residents living near a new light rail station in Denver were revealed by Jackson and Buckman (2020) in their survey of 166 local households. Positive opinions regarding the station's impact on neighborhood quality of life

and the neighborhood's trajectory were much stronger for newer and younger residents. Older residents and those with a longer tenure expressed some reservations on how the station and associated developments were contributing to changes in the neighborhood's character.

Lund (2006) studied characteristics and preferences of new residents (as opposed to existing) in TOD neighborhoods in the San Francisco Bay Area, Los Angeles and San Diego. The results from the 605 surveys collected in neighborhoods within walking distance of a light, heavy, or commuter rail station showed that the new residents in the TOD neighborhoods were similar to the general population of the area, although with higher incomes and less likely to be Hispanic. Only around a third of respondents reported access to transit as one of the top three reasons for moving to the neighborhood; they were equally or more likely to choose to live in a TOD because of lower housing costs or the quality of the neighborhood. This suggests that TODs likely meet a range of needs for residents, not just access to public transportation. Levine and Frank (2007) studied neighborhood preferences, actual neighborhood choices and desires for neighborhood change of 1455 residents in the Atlanta metro area with focus on land-use and transportation characteristics of the neighborhood. The results from the survey showed that the median respondent had a slight preference for a neighborhood environment with greater transit and pedestrian orientation than respondents' current neighborhoods.

In summary, we find two survey analyses related to neighborhood change in new station neighborhoods. One which is a case study performed in a single neighborhood which appears to have already experienced change before the station (Brown and Werner, 2011) and another conducted in multiple neighborhoods within the same city but for different transit modes (light rail, commuter rail and bus rapid transit), which may have heterogenous effects (Fan and Guthrie, 2012). We do not find any survey-based studies on the stated intention of moving out of a neighborhood that recently received a new rail transit station. Our study is unique in that it compares responses from surveyed residents in the station-adjacent neighborhoods with responses from a comparison area. This allows us to control - to the extent possible - for the potential effect of the presence of the light rail given that the two neighborhoods are similar in most aspects except for the proximity to light rail stations. We also survey multiple neighborhoods along a new line, including those that were not already showing significant signs of neighborhood change before (or after) the opening on the station. This allows us to avoid potential endogeneity in choosing neighborhoods where neighborhood change was already underway before the rail transit investment and which may be the reason for a rail transit station being placed there (Nilsson and Delmelle, 2018; Padeiro et al., 2019).

3. Study area and data collection

The city of Charlotte is located in Mecklenburg County, North Carolina. It the most populous city in the state of North Carolina with a population of 872,498 in 2018, an estimated increase of 18.6% since 2010 (Census, 2019a). While the fifth fastest growing city between 2017 and 2018 (Census, 2019b), the city's outlying towns grew at an even faster rate (Chemtob and Off, 2019). The large influx of new residents to the area has created an increasingly tight housing market, with rising house prices, rents, and a lack of affordable housing (UNC Charlotte, 2019). It has also led to an expansion of the city's transportation network. In 2007, the Charlotte Area Transit System (CATS) opened its first light rail line, the LYNX Blue Line, which runs from the city center to the southwest (see Fig. 1). This spurred both new, high-density developments as well as house price capitalizations along the line (Billings, 2011; Delmelle et al., 2014). Eleven years later, in March 2018, the city's second line, the Blue Line Extension, opened. Extending north from the center city, the new line runs through revitalizing, near-center-city neighborhoods such as Belmont, Villa Heights and NoDa, to single-family minority neighborhood including Sugar Creek and Hidden Valley, and finally terminates on the UNC Charlotte main campus in the University City area. It is around this new line and its stations where we collected surveys for this research together with surveys from what we will refer to as our comparison neighborhood.

Our neighborhood delineations in Fig. 1 follow the Charlotte/Mecklenburg's Quality of Life Study's Neighborhood Statistical Areas (NSAs).[1] However, we used zip codes to identify where survey respondents live. While zip codes are rather large geographic areas that do not neatly approximate what would be considered a neighborhood, their use as a geographic identifier is necessary to protect residents' privacy. Residents are likely to be reluctant to give an exact address and they are unlikely to know precisely which census unit or NSA they reside in. However, we narrow down our respondents to those residing in a neighborhood near a station by (i) sampling near stations, (ii) asking respondent about their distance/walk time to their nearest station, and (iii) asking potential respondents whether they reside in the neighborhood before handing them the survey. The light rail study area is comprised of respondents from the following zip codes: 28205, 28206, 28213 and 28262. These zip codes together with survey collection sites are mapped in Fig. 1. Survey responses gathered at the two (green) survey collection sites in the 28215-zip code were also included as one is in a light rail study area neighborhood and the other is 0.3 miles away. Survey respondents that reported other or no home address zip codes were excluded from the sample. Respondents from the center city and University City area zip codes were also excluded since the former already received light rail stations in 2007 with the original Blue Line and the latter contains many transient college students.

To perform our comparison of responses between a transit-adjacent neighborhood and a similar neighborhood that has not experienced any major public investment, we select one neighborhood along the light rail line, which we will refer to as the treatment neighborhood, and match it with another using a nearest neighbor matching technique. Because neighborhoods near the center city experienced revitalization long before the light rail opened (Dunn, 2017) and the University City area represents an exceptional case with its majority college student population, Hidden Valley and Sugar Creek remain the most viable options (see Fig. 1). Given possible housing market pressures from the previously gentrified NoDa neighborhood[2] in parts of the Sugar Creek neighborhood, we selected Hidden Valley as our treatment neighborhood. Hidden Valley is traditionally African-American with mostly single-story ranch houses that has not experienced any major investments or attention from the city other than the light rail.

To identify our comparison neighborhood, we apply the K-nearest neighbors (KNN) algorithm on a set of socioeconomic, demographic and housing characteristics which are included in Table 1. The KNN algorithm finds neighborhoods that have minimal differences (based on the Euclidean distance) in characteristics with our treatment neighborhood (Delmelle et al., 2020). Based on the top three candidates from the KNN matching, we performed windshield surveys where housing and business type(s) in the neighborhood were recorded together with notes regarding the quality of the housing stock (e.g., new developments, visible updates, dilapidated homes, etc.) and other investments in the area. Finally, we consulted with local experts to make a final selection. The final choice for comparison neighborhood, the Farm

[1] In 1998, the City of Charlotte in collaboration with University of North Carolina at Charlotte divided the city into 173 distinct planning districts called Neighborhood Statistical Areas (NSAs). The boundaries for the NSAs are based on census blocks and modified to correspond to perceived neighborhood boundaries of residents and real estate professionals in Charlotte. The 2017 NSA data is primarily based on 5-year American Community Survey estimates for 2013–2017, supplemented with data from the City of Charlotte (City of Charlotte, 2019; Billings, 2011).

[2] A popular arts district that underwent the most dramatic transformation in the city during the 2000–2010 decade, before the light rail extension was announced (Delmelle et al., 2013).

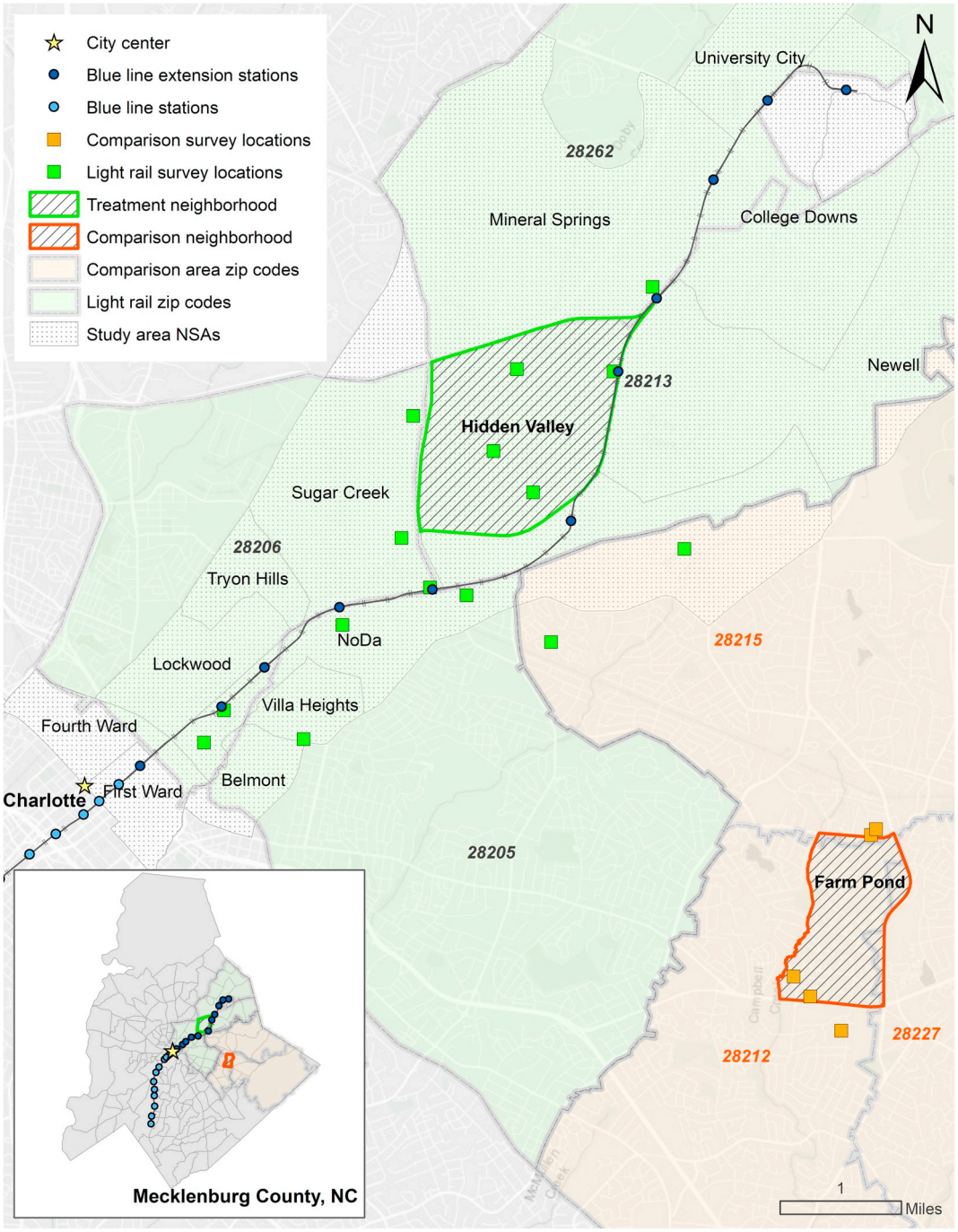

Fig. 1. Light rail area, treatment and comparison neighborhood in Charlotte, NC.

Pond neighborhood (see Fig. 1), had similar characteristics to Hidden Valley based on 2017 neighborhood data from Charlotte/Mecklenburg's Quality of Life Study (see footnote 1), looks similar aesthetically (based on windshield surveys), has not experienced any major public or private investments in the past decades. This neighborhood is also on the east side of the city and was accepted as a fair comparison by local experts including two senior faculty at UNC Charlotte who perform community engaged and real estate research in Charlotte and two community engagement professionals from the City of Charlotte.

As Table 1 shows, the treatment and comparison neighborhood have a larger share of Blacks and Hispanics (both are majority-minority neighborhoods) and a lower share of Whites compared to the entire light rail extension corridor, which includes revitalizing near-center-city neighborhoods (Dunn, 2017). The treatment and comparison neighborhoods also have lower incomes, home sales prices and rents. Home ownership rates in the treatment area are somewhat lower than in the comparison area, but the share of rental single-family detached housing units is about the same for all three areas. The treatment and comparison area have lower shares of single-family housing compared to the entire light rail study area. In comparison to Mecklenburg County, all three areas have a greater share of minorities and lower income population. The houses are generally smaller and cheaper than in the rest of county and homeownership rates are lower.

Fig. 2 show trends in (A) median home values and (B) median (gross) rents for the entire county, block groups in the light rail area, and the treatment and comparison areas using decennial Census and 5-year American Community Survey estimates. The entire light rail corridor experienced a sharper increase in home values and rents between

Table 1
Means of neighborhood characteristics.

	Light rail area	Treatment	Comparison	Mecklenburg County
Population density (people per acre)	7.4	14.4	9.5	3.0
Median age	30.9	30.2	29.3	35.0
White (%)	25.9	5.8	11.0	48.0
Black (%)	49.6	56.0	41.5	31.0
All other races (%)	3.6	1.6	1.7	3.0
Asian (%)	6.4	1.0	7.7	5.0
Hispanic/Latino (%)	14.4	35.6	38.0	13.0
Median household income ($)	42,190	29,569	34,706	61,695
Single-family housing (%)	44.2	32.0	34.0	59.0
Average housing size (sq ft)	1440	1227	1575	2068
Average housing age	38.1	29.2	36.0	35.1
Single-family rental housing (%)	27.8	28.6	27.3	21.0
Average home sales price ($)	121,891	71,057	72,638	236,847
Home ownership (%)	36.9	21.0	38.2	57.0
Median gross rent ($)	874	734	801	1032

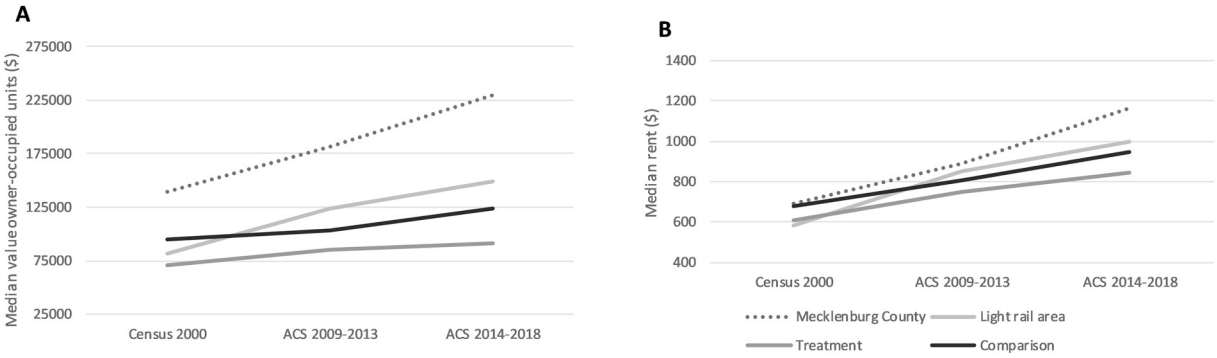

Fig. 2. (A) Home value and (B) rent trends.

2000 and 2013 compared to the treatment and comparison group. Much of this is likely driven by urban renewal in NoDa and other near center-city neighborhoods during this time as is shown in Fig. 3 (Dunn, 2017; Delmelle et al., 2013). Rents also increased at a faster rate compared to the county during this time, but then leveled off between 2013 and 2018 leading up to the opening of the light rail. This calls into question the light rail's potential effect on property value increases in areas close to the new stations leading up to the opening of the line. The treatment and comparison group exhibit very similar trends, particularly in terms of rents. While home values and rents have increased in both areas, they did so at a slower rate compared to the county in both time periods. Therefore, we do not expect out-migration of lower-income households to be higher in these neighborhoods compared to the average neighborhood in the city.

Surveys from the light rail neighborhoods were collected at neighborhood events, light rail stations, parks, and walkable areas along the extension between August 2018 and October 2019. The majority of surveys were collected during weekday afternoons/evenings in September of 2018 and 2019. Comparison surveys were collected between June and October 2018 at an apartment complex, a library, a YMCA and shopping centers. Locations were identified by the qualitative research lead based on pedestrian traffic and in collaboration with local residents and organizations. Fig. 1 shows all survey collection sites. Surveys were collected by researchers, trained undergraduate research assistants, and students enrolled in an undergraduate applied research methods course instructed by three of the authors. Given that many of the neighborhoods surveyed were in lower-income and minority neighborhoods where lack of trust of research and giving out personal information is likely heightened, we chose to collect data in-person. Tables were set up with pen-and-paper surveys in English and Spanish, clipboards, and a variety of snacks and beverages. Passersby were asked if they were willing to fill out the survey and receive a refreshment.

A total of 590 surveys were collected in the light rail neighborhoods and 192 in the comparison area.[3] After cleaning the samples from incomplete survey responses and surveys from people who lived in zip codes outside the study area, we end up with a light rail area sample of 289 and a comparison area sample of 115.[4]

4. Empirical approach

To answer our first research question regarding the stated likelihood of moving, we first estimate the impact of proximity to a station and neighborhood location on residents stated intention of moving, controlling for other individual characteristics. This analysis is performed on the entire light rail area described in previous section (not including the comparison neighborhood). The dependent variable is the response to the question *"Do you think you will be moving out of this neighborhood within the next few years?"* and is binary in nature. Therefore, our empirical model takes on a logistic functional form:

[3] Out of these, 25 and 13 were in Spanish in the light rail and comparison area neighborhoods, respectively.

[4] These numbers are similar to other neighborhood-based survey studies. For instance, Dill (2006) conducted a survey comparing on travel behaviors a new urbanist and a conventional neighborhood and had 185 and 136 valid surveys respectively. A similar study collected an n of 122 for the neotraditional neighborhood and n = 180 for the conventional neighborhood (Khattak and Rodriguez, 2005). Furthermore, it provides a sufficient number of observations and degrees of freedom needed for the statistical methods applied in this paper.

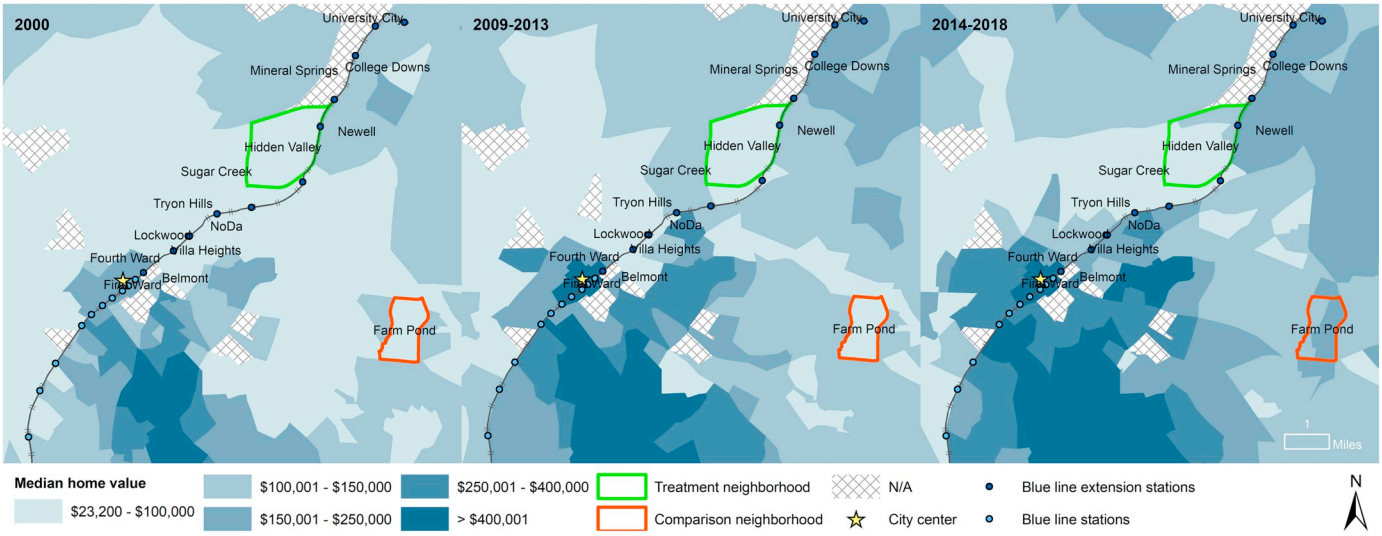

Fig. 3. Median home value owner-occupied units 2000, 2013 and 2018.

$$ln\left[\frac{P_{Moving}}{1-P_{Moving}}\right] = b_0 + b_1 Dist_i + b_2 Use_i + b_3 CC_i + b'X_i + e_i \quad (1)$$

where i denotes the respondent and the dependent variable is the probability of moving (or more specifically, the odds of considering a move compared to not considering a move). $Dist_i$ is a categorical variable of the reported distance to the nearest station which equals 1 if respondent i lives less than half or one mile from the nearest station and zero otherwise. Greater than one mile is the reference outcome.[5] The reason for including this variable is to gauge whether there is a significant difference in responses between those living closer to the station vs. further away. A rail station's direct area of influence on for example property values might be very localized and occur in the immediate proximity around stations. However, secondary, indirect or spillover effects on for example property values can occur from spatial proximity not only to the station itself but from new developments and upgrades in the more immediate area around the station (Nilsson and Delmelle, 2018). This may explain why research on house price capitalizations of new rail transit finds significant results up to one mile or more from new stations (Billings, 2011; Bowes and Ihlandfeldt, 2001; Debrezion et al., 2007). Other research suggests that TOD planning areas should be extended up to one mile and that the size of impact area is relatively flexible (Petheram et al., 2014). Use_i indicates whether the respondent is a frequent user of the light rail, which is defined as using it multiple times a week or more often (zero otherwise). The hypothesis is that those that use/benefit from it the most are likely to be more willing to pay an additional premium to stay. CC_i is a dummy variable which equals one if the respondent is from a neighborhood close to the center city (defined as those living in zip codes 28205 or 28206, see Fig. 1) or zero if the respondent lives in one of the more suburban neighborhoods (defined as zip codes 28213 and 28262). Neighborhoods in and around the center city have experienced elevated rates of re-investment in the past two decades as opposed to the more suburban neighborhoods in Charlotte (Dunn, 2017; Delmelle et al., 2013) which has resulted in increased property values (Fig. 3). Finally, X_i is a vector of respondent specific controls such as age, race, income, home ownership status and tenure, which may influence the probability of moving.

To investigate whether respondents in neighborhoods adjacent to the new light rail stations have a higher reported probability of moving, we estimate the following logistic model to test for the difference in probability of moving between the treatment and comparison group while controlling for individual specific characteristics:

$$ln\left[\frac{P_{Moving}}{1-P_{Moving}}\right] = b_0 + b_1 Treat_i + b'X_i + e_i \quad (2)$$

where our variable of interest, $Treat_i$, equals one if the respondent reported living within one mile of a station in the 28213 zip code and zero if the respondent is from the comparison neighborhood described in the previous section (also see Fig. 1). One mile is chosen due to the reasons listed above, in order to catch the broader neighborhood around the station which is likely to experience either direct or indirect/spillover impacts from the new transit station. Similar to the model in Eq. (1), X_i is a vector of respondent specific controls such as age, race, income, home ownership status and tenure, which may contribute to the probability of considering a move.

Using rankings of most cited reasons for residing in and moving out of the neighborhood, we examine the motivations of residents to reside in their current neighborhood and reasons for considering moving out of the neighborhood. To do so, we estimate a set of logit models on responses to an open-ended question regarding the light rail's effect on the neighborhood. In the first model, the dependent variable is coded 1 if the comment is solely positive and zero if negative or mixed/neutral. In the second model, the dependent variable is coded 1 if the comment is solely negative and zero if positive or mixed/neutral. These estimations are performed only on responses from the light rail neighborhoods (not the comparison neighborhood). On the right-hand side of the equation, we include the same set of light rail related variables as in the model in Eq. (1) while controlling for socioeconomic and demographic characteristics of the respondent (X_i):

$$ln\left[\frac{P_{Positive}}{1-P_{Positive}}\right] = b_0 + b_1 Dist_i + b_2 Use_i + b_3 CC_i + b'X_i + e_i \quad (3)$$

The dependent variable is the log of odds of getting solely positive (/negative) sentiments towards the light rail vs. getting negative (/positive) and/or mixed/neutral sentiments.

5. Results

Table 2 shows descriptive statistics of respondents in the entire light rail study area (including the treatment but not the comparison neighborhood), treatment, and comparison neighborhoods.

[5] We also estimated the model with more disaggregate categories (< 0.5 mile, 0.5–1 mile, 1–1.5 miles and > 1.5 miles) with no changes to the qualitative interpretation of the results. Hence, in interest of having a sufficient number of degrees of freedom, we reduced this variable to a binary in the final model specification.

Table 2
Descriptive statistics of respondents.

	Light rail area	Treatment	Comparison
Thinking of moving	34.9%	31.0%	49.1%
Female	58.7%	62.0%	59.2%
White	15.4%	3.3%	10.8%
Black	67.6%	78.3%	64.6%
Asian or other	7.7%	3.3%	4.6%
Hispanic	9.3%	15.0%	20.0%
Age 18–34	39.3%	31.7%	30.5%
Age 35–64	46.7%	54.1%	51.9%
Age 65 +	14.0%	14.2%	17.6%
Household income < $25 K	33.0%	35.2%	31.7%
Household income $25 K–$50 K	35.4%	36.1%	37.4%
Household income $50 K–$75 K	20.6%	19.4%	18.7%
Household income > $75 K	11.0%	9.3%	12.2%
Less than a HS diploma	4.0%	5.0%	6.2%
HS diploma/GED	23.2%	35.0%	26.2%
Some college/Associate's	31.0%	32.5%	19.2%
College degree or higher	41.8%	27.5%	48.4%
Own their home	33.4%	37.9%	39.0%
Tenure in years (mean & sd)	11.0 (13.9)	12.9 (14.5)	8.7 (8.8)
N	289	109	115

Table 3
Light rail area model results.

	Log of odds ratios for probability of moving		
	All	Homeowners	Renters
Distance to nearest station			
< 0.5 mile	0.774	1.888	0.583
0.5–1 mile	1.121	1.286	1.028
Usage			
Multiple times per day or week	0.892	0.457	0.959
Area along rail			
Near city center (vs. suburban)	0.721	1.540	0.534*
Respondent characteristics			
Age 18–34	1.819**	3.832	1.787*
Age 50 +	1.639	0.840	2.698**
Black	0.985	0.339	1.404
Female	0.859	0.833	0.838
Household income < $50 K	1.648*	0.656	2.102**
At least some college education	1.782*	1.390	2.113**
Own home	0.519*		
Tenure (years)	0.966**	1.013	0.944*
N	289	97	192
Pseudo R^2	0.10	0.14	0.09

***, **, *indicates significance at the 1%, 5% and 10% significance level.

Approximately one third of residents in the light rail and treatment area reported that they are considering moving within a few years. The corresponding number in the comparison neighborhood is close to 50%.

Comparing our survey population with aggregate neighborhood statistics shown in Table 1, we find that the sample of respondents in the light rail area corresponds well to the aggregate neighborhood characteristics. However, the share of Black respondents in the entire light rail area is higher than expected. Similarly, we have a greater than expected share of Blacks in the treatment and control groups. Those surveyed in the treatment and comparison neighborhood have similar characteristics. While the comparison neighborhood respondents have marginally higher shares of white and Hispanic residents (as expected from neighborhood demographics in Table 1), the majority of both groups are Black or African American. Age and income distribution are also very similar with a majority earning less than the median household income in Charlotte, which was at $58,202 in 2017 (Census, 2019a). Respondents in the comparison group have slightly higher educational attainment than in the treatment group. These differences will be controlled for when estimating the model in Eq. (2). While homeownership rates among the two groups are similar (but higher than expected in the treatment given characteristics in Table 1), residents in the treatment neighborhood have higher tenure rates than in the comparison group.

Our first set of results pertain to the model in Eq. (1), which we estimated on responses from residents in all the light rail area neighborhoods. The main variable of interest is whether the distance to the nearest station matters in terms of a resident's propensity to move. Fig. 4a shows the distribution of respondents by distance to the nearest station and whether a respondent is considering moving or not within the next few years. Overall, the distribution between those considering staying vs. moving look similar, suggesting that proximity to the station does not influence the probability of moving.

Table 3 shows the estimation results for the model outlined in Eq. (1). We estimate the model on the full sample and separated by homeownership status since renters are generally more transient. As expected from Fig. 4, neither of distance to the nearest light rail station variables are significant. In other words, those within close proximity to a station (whether within half a mile or between half a mile and one mile) are not more likely to consider a move than those further away from station. As expected, based on existing literature, homeowners are

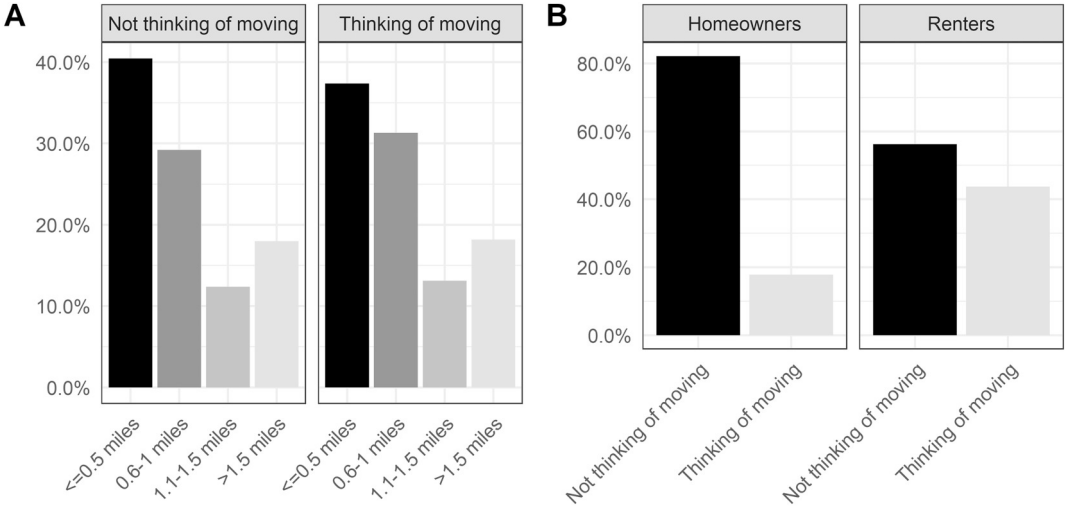

Fig. 4. Considering moving vs. (A) proximity to nearest light rail station and (B) homeownership.

less likely to consider moving compared to renters. The near city center dummy (1 if in near center city neighborhoods, 0 if in suburban neighborhoods along the rail line) is significant for renters, suggesting that renters in light rail neighborhoods near the center-city are less likely to consider a move.

Since the results for the homeowners are lacking statistical power, the following interpretations pertain to renters. With regards to respondent characteristics, we find that younger residents are more likely to consider moving compared to middle age residents (i.e., age group 35 to 49) which is consistent with research on actual movements (Ellen and O'Regan, 2011; Martin and Beck, 2018). Black or African American respondents are not significantly more likely to move than respondents of other races. Those living in households that earn less than the city median household income are more likely to consider a move. This is expected as lower-income residents generally have elevated rates of mobility due to precarious financial situations and greater risk of evictions (Delmelle and Nilsson, 2020; Newman and Wyly, 2006). Finally, homeowners and those that have lived in their neighborhood for a longer period of time are less likely to consider a move. That renters are generally more mobile is a finding that is consistent across the residential mobility literature (Coulson and Grieco, 2013; Delmelle and Nilsson, 2020; Martin and Beck, 2018). We also estimated the model with an alternative specification for the tenure variable where we consider whether the person lived in the neighborhood before the announcement of the light rail (in 2011). Overall, the results remain robust and confirm that renters that have lived in their neighborhood longer (since before the announcement) are less than half as likely to consider moving compared to those that moved to the neighborhood after the announcement. These results are statistically significant at the 5% level and available upon request from the authors. For homeowners, the odds ratio is less than one, but insignificant.

Given that moving is a complex decision affected by many factors beyond what our survey questions encapsulate, we analyzed responses to the question asking why residents were considering moving. The most frequently cited reasons included (1) Other, (2) rent or property value change, (3) change in neighborhood character, (4) change in family size, and (5) closer to work. If respondents checked “Other”, they could explain what these reasons were in an open-ended question. Out of the 30 that choose to do so, the single most common reason was because they intended to buy a home (n = 11). Others listed college or graduation (n = 4), job transfer (n = 2) and downsizing (n = 1). It appears that the light rail was not a particularly important determinant in considering a move. Housing market pressures (increasing rents/home values), however, were. While it is possible that these rent/value changes are associated with the introduction of the light rail, housing values and rents have, on average, increased at a faster rate elsewhere in the city as shown in Fig. 2. These results could also indicate that those wanting to buy a home have to move out of the neighborhood in order to do so due to a lack of affordable homes in the area. However, as indicated in Table 1, home sales prices in these neighborhoods are relatively low compared to elsewhere in the county. Furthermore, as noted in Fig. 5 below, the most common reason cited for living in the treatment neighborhood is housing costs.

Table 4
Treatment vs. comparison neighborhood model results.

	Log of odds ratios for probability of moving		
	All	Homeowners	Renters
Light rail neighborhood	0.342***	0.144***	0.417**
Age 18–25	3.378***	5.435**	2.922*
Black	1.844*	0.433	3.125***
Household income $50 K–$75 K	0.482*	0.602	0.390
Some college/Associate's degree	1.816*	3.930**	1.256
Own home	0.460**		
Tenure (years)	0.984	1.018	0.958
N	224	89	135
Pseudo R^2	0.13	0.19	0.11

***, **, *indicates significance at the 1%, 5% and 10% significance level.

Our next analysis considers whether residents in one of the light rail area neighborhoods, the treatment neighborhood (see Fig. 1), are more likely to consider a move than residents from a similar (comparison) neighborhood in a part of Charlotte that has not been subject to any major public investments (also see Fig. 1). As already noted in Table 2, the characteristics of the respondents in the two neighborhoods are very similar. However, we still need to control for individual level characteristics. The estimation results for the model in Eq. 2 are presented in Table 4. As expected from the descriptive statistics in Table 2, residents in the treatment neighborhood are significantly less likely to report a move. This holds true after controlling for individual specific characteristics and for homeowners as well as renters.

The results also show that renters are more likely to consider a move, particularly Black or African American renters, results which are in line with those found by Delmelle and Nilsson (2020) pertaining to actual moves. Further note that in the model including just the light rail area neighborhoods (Table 3), Blacks are not more likely to move than other races. This suggests that Black respondents from the comparison area neighborhood are driving the higher likelihood of considering a move in the results presented in Table 4. This is confirmed by tabulating the data that show 69% of Black renters in the comparison

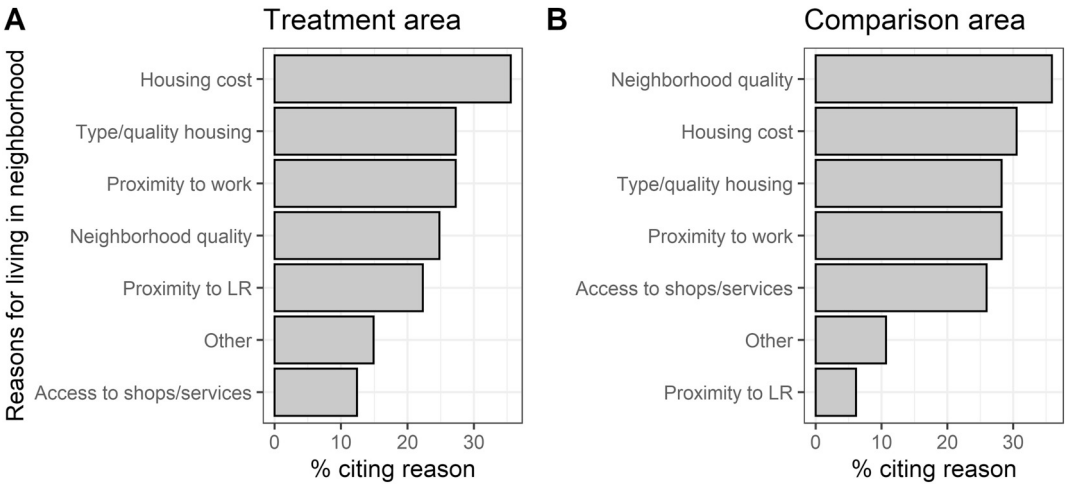

Fig. 5. Reasons for residing in neighborhood: (A) treatment vs. (B) comparison.

Fig. 6. Reasons for considering moving: (A) treatment vs. (B) comparison.

neighborhood reporting that they considered moving, while the corresponding number in the treatment neighborhood was 47%. Given similar distributions in income between Black renters in the two neighborhoods (82% of Black renters below city median household income in both neighborhoods), there must be something else that is driving this difference. One reason behind the lower mobility rates in the treatment neighborhood could be that it is a neighborhood with a stronger sense of community and higher tenure rates (12.9 years on average in the treatment neighborhood vs. 8.7 years in the comparison neighborhood). The remaining significant variables in Table 4 suggest that homeowners with some college or an Associate's degree (compared to those with less than a high school diploma, a high school diploma/GED, or a college degree or higher) are more likely to consider a move.

We next examine the reasons residents selected for why they chose to live in their neighborhood. Fig. 5 shows the most cited reasons (respondents could choose multiple) for living in (a) the treatment neighborhood and (b) the comparison neighborhood. Housing cost is the top reason for living in the treatment neighborhood and the second in the comparison neighborhood. Neighborhood quality is the most cited reason in the comparison neighborhood while it ranked fourth in the treatment neighborhood. Type and quality of housing is the second most cited in the treatment neighborhood and third in the comparison. Proximity to the light rail is the fifth most cited reason in the treatment neighborhood, just above other reasons and access to shops and services.

Forty-seven respondents reported other reasons for living in the treatment neighborhood than the options listed in the survey. Out of these, 10 listed family as a reason for living in their neighborhood, 9 mentioned that they grew up there, 6 wanted to be close to school or the university, and 3 mentioned proximity to bus stops or highways. Remaining responses pertained to proximity to the city center, friends, church and bars (1 each).

What are then some of the reasons for considering a move? The responses are very similar between the treatment and comparison group (Fig. 6). Not surprising, since housing cost is the main reason for residing in the treatment neighborhood, rent or property value change is the main reason for considering moving out of the neighborhood. In the comparison neighborhood, the main reason for moving is “Other” which is also the second most cited reason for the treatment neighborhood. The difference between the two stated reasons are small in both groups.

As for changes in rent or property value, close to 90% of respondents in both groups reported an increase in the last few years, an unsurprising finding given Charlotte's recent growth. When prompted to comment on what resident's thought these prices changes could be attributed to, 147 participants wrote a response (along the entire light rail corridor, not just the treatment neighborhood). Out of these, 39 mentioned the light rail, sometimes in combination with other factors. However, this response is possibly biased because the survey was about the light rail and respondents may have been more prompted to mention it. The second most cited reason (n = 27) was overall city population growth and increased demand for housing. Another 24 mentioned neighborhood or housing upgrades/improvements, gentrification, new homes or businesses in the area. Other reasons included overall increases in cost of living and inflation, property revaluations,[6] that it did not change or they did not know, and proximity to the city center.

In the comparison neighborhood, 50 participants responded to the open-ended question regarding why they thought their rent or property value had changed. Like the respondents in transit corridor, overall city population growth, increased demand for housing and limited availability of affordable housing in the city was the top response (n = 22). Seven mentioned neighborhood or housing upgrades/improvements, gentrification, new homes or businesses in the area. Four of the participants attributed the change to overall increases in cost of living and inflation. Other answers included property revaluation or that they did not know why it changed.

This brings us to our final analysis, where residents were asked to comment more generally on their thoughts on the light rail's effect on their neighborhood. Among all the light rail area respondents (including the treatment, but excluding the comparison neighborhood), 230 wrote an answer to this question. Of those, 64.5% were strictly positive about the light rail's effect on their neighborhood. They mentioned affordability, increased accessibility/connectivity/mobility, less traffic, pollution and reduced traffic speed. Only 17.5% of responses were negative in nature, pertaining to increased traffic (particularly having to wait a long time at turn lights), gentrification, increased rent and property tax, displacement, noise, lack of parking (if not by a park-n-ride station), increases in crime (bringing in people from other areas), and not enough bus connectivity. Finally, 12% of responses mentioned a combination of the positive and negative attributes listed above. We estimate the model outlined in Eq. (3) to determine the contributing factors to these positive or negative sentiments. The results for this model are shown in Table 5. In the table, the first column pertain to the model with the dependent variable be equal to 1 if the response was solely positive in nature and zero if negative, mixed or neutral. The second column contains the results for when the dependent variable is

[6] During the time in which the surveys were collected (2018–2019) the county performed a county-wide revaluation, the first since 2011, resulting in a median increase in residential property values of 43% (Portillo, 2019).

Table 5
Perception of the light rail's effect on the neighborhood.

	Positive	Negative
Distance to nearest station		
< 0.5 mile	0.506**	1.318
0.6–1 mile	0.536*	0.943
Usage		
Multiple times per day or week	1.217	0.244***
Area along rail		
Near city center (vs. suburban)	1.387	0.329*
Respondent characteristics		
Age 18–34	0.479**	1.717
Age 50+	0.818	0.519
Black	1.211	0.493
Hispanic	2.765	0.131*
Female	0.552**	1.670
Household income < $50 K	1.142	1.057
At least some college education	0.725	0.948
Own home	1.552	0.747
Tenure (years)	0.965**	1.034
N	230	230
Pseudo R^2	0.08	0.13

***, **, * indicates significance at the 1%, 5% and 10% significance level.

equal to 1 if the response was solely negative in nature and zero if positive, mixed or neutral. Results are presented as odds ratios.

The results suggest that those that live near a new station are less likely to have a positive perception of the light rail's effect on their neighborhood, compared to those that live further away. However, they are not more likely to have a negative perception. Those who use the light rail on a regular basis, live in a neighborhood along the line that is close to the center city, and Hispanics are less likely to have a negative perception of the light rail's effect on their neighborhood. Similar to Fan and Guthrie (2012) and Jackson and Buckman (2020), who found that newer residents were more likely to view transit favorably, we also find that the longer a resident has lived in the neighborhood the less likely they are to view it positively. Also, in line with the findings by Fan and Guthrie (2012), African-Americans' responses did not significantly vary from others in their perception of the light rail's impact on their neighborhood.

6. Concluding remarks

This paper investigates the effects rail transit investments have on potential residential mobility and residents' perception of the new station's effect on their neighborhood. We surveyed residents in neighborhoods adjacent to stations of a new light rail line in Charlotte, NC, which opened in 2018, and in a similar, comparison neighborhood further from any major public investments. Our findings suggest that while residents in neighborhoods along the new light rail line appear to attribute some of the changes in their property values and rents to transit, it is only one of many factors. In fact, our results suggest that residents that live within one mile of a new rail transit station in a low-income neighborhood are significantly less likely to consider moving out of their neighborhood compared to residents in the low-income comparison neighborhood. We also find that the stated probability of moving is not related to the distance to the station nor to how frequently a resident uses the light rail. These findings are in some contrast to a previous analysis along this same corridor that found a significant shift in the racial composition of those applying for home mortgages. The share of White applicants significantly increased while Blacks declined suggesting that neighborhoods were undergoing dramatic transformations following the announcement of the new light rail line (Delmelle et al., 2020). However, that analysis also underscored the heterogeneity of those results along the corridor, emphasizing the importance of proximity to previously gentrified neighborhoods and to the city center in driving overall changes. In this analysis, we focused on a neighborhood that was further from the city center and otherwise had limited gentrification pressures prior to the opening of the new light rail station.

Survey respondents' view of the light rail's effect on their neighborhood is positive, on average. This is especially true among those that use the light rail on a regular basis, live in a neighborhood along the line that is close to the center city, and Hispanics. Like Fan and Guthrie (2012) in Minneapolis and Jackson and Buckman (2020) in Denver, we find that long-time residents are less likely they are to view it positively and that African-Americans' perception of the light rail's effect on their neighborhood is not significantly different from other racial groups. African-Americans are also not any more likely to move out a light rail neighborhood when compared to residents of other races in the same neighborhoods. When we compare the treatment and comparison neighborhood, we find elevated probabilities of considering a move among Black renters. However, this result is not specific to the light rail neighborhood and appears to be driven by respondents in the comparison neighborhood where 69% of Black renters reported they were considering moving, compared to 47% in the treatment neighborhood. These results can provide some explanation to the findings by Deka (2017), Nilsson and Delmelle (2018) and Pollack et al. (2010) who all find no significant changes in racial composition in transit neighborhoods.

For decision makers, a better understanding of how residents perceive and experience changes in their neighborhoods after a major public investment, and how this may differ between different groups of residents, can help gauge social and political responses to proposed investments. It provides guidance on what issues to address in public hearing and outreach efforts. To some extent, it also provides insight on concerns raised by a broader range of residents and who to target for public information as public hearings may only attract a limited set of voices. Finally, understanding what features of a neighborhood residents' value can help with neighborhood preservation efforts, developing stations plans and associated transit-oriented development.

The closest study to ours is the one by Fan and Guthrie's (2012); however, ours differ as they examined various modes of transit that may have heterogenous effects on resident perceptions. The use of a comparison neighborhood in a survey study is also a contribution of this paper as it adds some contextualization to broader trends in housing supply and price demands affecting a city. Yet this study is not without limitations. First, stated intentions of moving or not moving may not translate into action. Hence, we cannot make inferences regarding actual displacement or a lack thereof. We also do not capture residents that may already have moved. However, we can speak to existing (both long- and short-term) residents' perception of changes in their neighborhood and current intensions of moving or staying in the neighborhood. Second, responses were collected during a relatively narrow time frame (the year of opening and the year after). We are therefore unable to capture changes in perceptions as well as residents that may already have moved out due to effects occurring before the actual opening of the new line. It may also be that changes occur at a later stage. Third, the sample size is somewhat small which lends less statistical power to the results. Fourth, we appear to have captured more homeowners than expected based on neighborhood characteristics in the light rail neighborhoods. Given that survey responses are voluntary and therefore based on self-selection, any sampling strategy is subject to potential self-selection bias (Braver and Bay, 1992). However, to mitigate potential bias from homeowners' responses we break up the analysis between renters and homeowners since renters are generally more transient. Finally, as with any case study, some of the results may be unique to Charlotte and the neighborhoods along the line studied. Suggestions for future research include longitudinal surveys (that begins at the time of announcement, through construction, opening and a few years after), larger sample sizes, and in other cities with different housing market conditions, transit system types and sizes.

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