

# RAIL TRANSIT, RESIDENTIAL MOBILITY, AND INCOME SEGREGATION

Final Report  
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## Executive Summary

This research project investigated how public investments in rail transit impact residential mobility, neighborhood change, and consequently levels of income segregation in urban America. It aimed to fill a gap in the current state of knowledge by investigating if lower-income residents tend to move out of new rail transit neighborhoods at a higher rate than other income groups and where potentially displaced residents move. The project also aimed to identify motivating factors that influence decisions to stay or leave a neighborhood impacted by new transit development through community-engaged scholarship that focused on the perspectives of local residents and that connected viewpoints of residents, researchers, and key stakeholders and decision makers. Given widespread investments in rail transit, the goal of the project was to provide information and perspectives that can be used to address social and public policy issues in many communities across the United States. The project also promoted technical literacy and education by engaging students and community partners in an applied, mixed-methods geography course.

The investigators employed a mix of multi-scalar methods. They analyzed an individual-level, longitudinal dataset to trace residential movements of individuals in and out of transit neighborhoods throughout the United States since 1970. They also conducted a qualitative analysis in neighborhoods along a new transit line in Charlotte, North Carolina, that involved interviews with key stakeholders at both the city and community scales as well as surveys and focus groups with neighborhood residents in proximity to stations of the new line.

The results showed that lower-income residents were not more likely to move out of a new transit neighborhood (on average), neither at a nationwide nor local scale. While residents in the case study attributed some of the changes in their property values and rents to the new transit line, it was only one of many factors. Survey respondents' view of the rail line's effect on their neighborhood was on average positive, particularly among frequent users, those residing near the center city, and Hispanics. Long-time residents were less likely to view it positively and African Americans' perception of the new line's effect on their neighborhood were not significantly different from other racial groups. The results from the qualitative analyses generally aligned with the quantitative findings. Residents perceived that newer developments near the new transit stations were developed for a particular younger, professional demographic, from out of town, not for long standing residents of the area. The quantitative analysis revealed a significant change in the racial profile of those moving in with an increase in White homebuyers and decline in African American homebuyers. The investigators also found differences in the discussion of the light rail line depending on residents' location with more noticeable changes in neighborhoods close to the city center. While more suburban residents feared that the train would bring about similar changes, the investigators found no significant evidence that this was currently happening. Finally, while the quantitative analyses showed some weak evidence of residential sorting, there was no evidence of rail transit having a significant impact on metropolitan level income segregation patterns.

In summary, the results suggested that while rail transit may have some impact on neighborhoods and their residents, it is only one of many factors, and the outcomes are highly context dependent which is in line with the current state of knowledge on the issue. Rail transit by itself is unlikely to cause displacement and lead to increasing levels of segregation.

## Introduction

Economic segregation, or the uneven spatial distribution of households by income, occupation, or educational status, has risen each decade since the 1970 and has grown in tandem with rising income inequality in the United States (Fry & Taylor 2012, Reardon & Bischoff 2011, Reardon et al. 2015, 2018, Watson 2009). As the gap between income levels has risen, so too has their spatial separation (Watson 2009, Reardon & Bischoff 2011). Increases in segregation have been driven by a decline in mixed or middle-income groups neighborhoods while the spatial concentration of wealth and poverty have risen (Reardon & Bischoff 2011, Fry & Taylor 2012). These trends have spurred alarm by academics and policy makers alike given the wealth of evidence that economic segregation leads to unequal social outcomes including adverse health effects, exposure to violence, poorer education outcomes, and lower intergenerational economic mobility (Do & Finch 2008, Evans & Schamberg 2009, Chetty et al. 2014, Sharkey & Faber 2014). In other words, the aggregate economic conditions of a neighborhood have a direct impact on the individuals residing in those neighborhoods.

The causal mechanisms behind increases in spatial income segregation has been relatively limited, focusing mainly on the important role that increasing income inequality plays in this process (Reardon et al. 2018). However, other underlying causes have received much less attention, including the role of metropolitan-wide policies (Glasmier & Farrigan 2007, Lens 2017). **The purpose of this research project has been to probe the role that one such policy, the implementation or extension of new rail transit systems, plays in contributing to rising levels of income segregation at the neighborhood and metropolitan scale.**

Investment in new transit systems across the United States has undergone a tremendous increase over the past two decades. These investments have been touted as both a sustainable transportation solution, and also an economic development strategy (Ferbrache & Knowles 2017). The competing objectives of providing a public mobility solution to connect lower-income residents with urban opportunities and spurring increased investment surrounding neighborhoods, potentially pricing out the residents who may benefit the most from the mobility improvements, has created a controversial paradox in their development (Dong 2017, Rayle 2015).

Previous research has been inconclusive on the role that transit plays in perpetuating gentrification, displacement, and subsequently broader income segregation trends. Theoretically, the transit holds the potential to reshape income segregation by impacting residential location choices. If transit is valued by residents - either for its accessibility benefits or for its associated amenities such as walkability and mixed-land uses - or both, then more people will want to live near new stations, driving up housing values and rents, and subsequently altering who moves into and out of nearby locations. Those unwilling or unable to afford increased rents will move elsewhere - possibly to lower-priced housing within the metro-

area further entrenching pockets of poverty, while higher-income residents will create new concentrations of wealth around the stations.

Our conceptual framework for understanding this process is shown in Figure 1 (from Nilsson & Delmelle 2020). According to this framework, the transit investment will impact the land-use and transport system - comprising land values, residential location decisions, and aggregate neighborhood changes. As land values change, the population moving in and out is impacted which alters the neighborhood scale profile. As the neighborhood changes, so too might land values and residential location decisions. Exogenous to this process are the role of others in accelerating or slowing this process in a way that it is not anticipated to spur uniform changes everywhere.

In this research project, we paid particular attention to the residential mobility impacts of transit investment, as they have been an under-investigated element in this process, especially as compared to research on neighborhood-level changes and land values. We investigated at multiple spatial scales, and using a variety of datasets, who moved into and out of new transit neighborhoods. We also performed an in-depth qualitative analysis in neighborhoods along a newly expanded light rail line in Charlotte, North Carolina to determine how residents perceived changes and whether they were considering moving in the near future because of the new line. Finally, we analyzed how the placement of new fixed-rail transit stations impacted neighborhood-level income diversity and metropolitan-level segregation trends across multiple US cities.

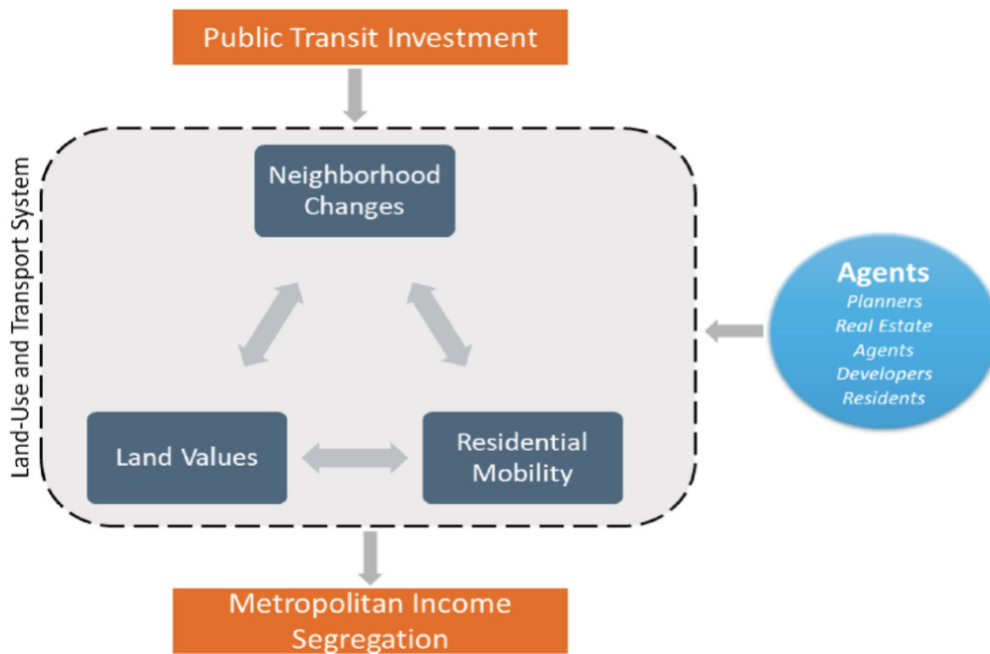


Figure 1. Conceptual Framework (Nilsson & Delmelle 2020)



## Summary of Existing Research

### Rail Transit and Property values

The body of literature that has investigated the relationship between property values and rail transit is vast. The broader consensus of this work is that **impacts vary significantly and depend on several factors**. One such factor is the **type of station** and development around the station where transit-oriented development (TOD) aimed at promoting dense, mixed-use, walkable developments appear to generate higher premiums than park-&-ride stations, which in some cases can have a negative effect on housing prices (Atkinson-Palombo 2010, Duncan 2011a, 2011b, Hamidi et al. 2016, Zhong & Li 2016). A property's **distance from a station** can also influence the effect on housing prices. Some studies have suggested that properties closest to a station may experience negative externalities (e.g. noise) and therefore undergo price declines (Bowes & Ihlanfeldt 2001, Golub et al. 2012, Ke & Gkritza 2019). The **initial characteristics of the neighborhood** are another factor that have been suggested to have an impact, suggesting that larger increases can be found in higher income neighborhoods (Bowes & Ihlanfeldt 2011, Hess & Almeida 2007). Finally, **metropolitan-level factors matter**. Findings from case studies in different metropolitan areas have ranged from premiums greater than 10% on condominium prices in Charlotte (Billings 2011) to negative impacts along a new light rail line in Norfolk, Virginia (Wagner et al. 2017). Hess and Lombardi (2004) found that most successful TODs are in rapidly growing places with a strong local economy such as San Diego and absent from older cities like Buffalo or St. Louis. Many of these empirical findings are consistent with the preconditions for station-area development to occur which is generally in growing metropolitan areas with high demand for housing (Huang 1996). Absent of growth, it is unlikely to prompt enough existing residents to move within the metropolitan area near a station (Delmelle 2021).

### Rail Transit and Residential Mobility

**Studies on residential mobility responses to rail transit have been scarce** which is primarily due to the lack of convenient data sources to capture residential moves. Using surveys, studies have found some evidence that those moving into TODs are more likely to be younger or child-less couples (Cao & Schoner 2013, Cervero 2007, Liu et al. 2016). However, survey-based studies have also found that current residents in TODs and near new stations have lower-incomes and are more likely to be Hispanic or Asian (Cervero 2007, Liu et al. 2016) while others show the opposite – that they tend to have higher-incomes and are less likely to be Hispanic (Lund 2006). Studies employing data on residential moves in the context of rail transit stations are even more scarce. Besides the studies conducted by the authors of this report, Rodnyansky (2018) used local tax records in Los Angeles to **test whether lower-income residents tend to be displaced from rail transit adjacent neighborhoods and found that they were in fact less likely to move**.

## Rail Transit and Neighborhood Change

The net result of changes in land and housing values, residential mobility, and location choices is a change to the aggregate characteristics of a neighborhood. The evidence on rail transit's impact on neighborhoods is very consistent with the mixed findings associated with the property value literature. As summarized in Delmelle (2021) *"As the number of studies on the topic has increased, it is increasingly evident that gentrification is not the typical outcome that follows the placement of a new station. Rather, in some circumstances, when the existing pre-conditions are prime, transit may act as an accelerator to changes, but in many instances, does little to alter the trajectory of the neighborhood"*.

First, many neighborhoods do not change in the time after a station is built (Nilsson & Delmelle 2018). Of those that do, there are some similarities in the ways in which they change. For example, there is evidence of increasing shares of college educated residents and multifamily housing in census tracts near stations (Deka 2017, Dong 2017, Kahn 2007, Nilsson & Delmelle 2018). Changes have also been found to occur more often in neighborhoods close to TOD (as opposed to park-&-ride) stations and in fast-growing metropolitan areas (Baker & Lee 2019, Nilsson & Delmelle 2018). However, other studies on fast-growing cities found no evidence that new stations led to an increase in gentrification-type changes or reduced affordability in nearby neighborhoods (Baker & Lee 2019, Dong 2017). A number of studies have found no changes in the racial makeup of transit-adjacent neighborhoods (Barton & Gibbons 2017, Deka 2017, Nilsson & Delmelle 2018, Pollack et al. 2010). Though deviations from this null effect exist such as Hess (2018) who found rising shares of Whites coupled with growth in racial and ethnic diversity in more peripheral locations.

## Rail Transit and Income Segregation

Besides studies on changes in income composition at the neighborhood level, there are **no studies on rail transit's impact on city or metropolitan-level income segregation** that the authors of this report are aware of. **At the neighborhood level**, some studies have found that incomes increased in new transit neighborhoods (Bardaka et al. 2018, Pollack et al. 2010). However, such findings may be the results of the research design which compares changes in transit neighborhoods to changes at the city level. Others, who have applied a more careful set of comparison neighborhoods, have found that such changes are dependent on the neighborhood's initial income composition with large and positive increases for the highest income neighborhoods and weak or negative for poorer (Heilmann 2018).





## Research Objective 1: Residential Movement Into and Out of New Transit Neighborhoods

### *Do low-income residents disproportionately exit new transit neighborhoods?*

**Our first research objective questioned whether lower-income residents disproportionately leave neighborhoods following the opening of a new, nearby rail transit station.** This objective sought to quantify the hypothesized displacement of lower-income residents resulting from increased property values and rents brought about by the new station. We addressed this first research question using the Panel Study on Income Dynamics (PSID) dataset, the longest representative longitudinal population survey in the United States, to trace residential movements out neighborhoods that were within 5 years (before or after) of receiving a new transit station. Our analysis spanned the nation since 1970, but we also separated the analysis by decade, distinguished between renters and homeowners, and we varied our definition of what we considered to be close to a transit station (from within a  $\frac{1}{4}$  walking catchment area to any census tract that touched a  $\frac{1}{2}$  mile buffer around the station) and for different time periods before and after the station opened.

The results of our analysis showed that on average, across the nation, lower-income residents were more likely than other residents to move from one time period to the next. This is consistent with the understanding that lower-income residents tend to be more mobile than others. **However, we found no evidence that living in a neighborhood near a new transit station had any impact on the odds of moving out of a neighborhood.** Thus, the results of this first research question suggested that on average, across the entire country, we are unable to find significant supporting evidence that lower-income residents have disproportionately left in anticipation of or following the opening of a new rail transit station. This does not mean it never occurs, but simply that it is not a systematic or automatic occurrence (Delmelle & Nilsson 2020).

### *Are Eviction Rates Higher in New Transit Neighborhoods?*

Studying displacement by examining residential movements is imperfect as displacement implies an involuntary move. As a follow-up to our first study, we subsequently tested the same hypothesis using an alternative indicator of displacement: evictions and eviction filing rates. By definition, an eviction is an involuntary move and theoretically, a landlord may raise rents as demand for living near a station increases. If a resident is unable to afford this increased rent, the resident is at risk of being evicted. To test this alternative indicator, we looked at four cities in the United States that built or expanded rail lines between 2005 and 2009: Newark, New Jersey; San Diego, California; Seattle, Washington; St. Louis, Missouri. We compared eviction

rates and eviction filing rates between ‘gentrifiable’ neighborhoods – or those with a median income below the city average and a large share of older homes – near the new stations and similar neighborhoods elsewhere in the cities. **Overall, we found little evidence that eviction and eviction filing rates differed between the transit and non-transit neighborhoods.**

(Delmelle et al. 2021a)



### *Who is moving into new transit neighborhoods?*

The previous two analyses examined who was moving out of new transit neighborhoods, and so for our third question related to this objective, we turned to trends in who was moving into these neighborhoods. For this analysis, we used longitudinal data from the Home Mortgage Disclosure Act (HMDA) to compare changes in mortgage applicants by race and income in a case study of Charlotte, North Carolina. We used a quasi-experimental design, selecting ‘case’ or ‘treatment’ neighborhoods as those intersecting a half mile radius around stations in a newly opened light rail extension line and ‘control’ neighborhoods as those with similar initial characteristics, away from the transit line.

We found that the opening of the light rail line did not have a significant impact on the income profile of loan applicants. Rather, proximity to the center city was more important in explaining the prevalence of higher-income applicants. **We did find that the rail line was significant in explaining changes in the racial profiles of applicants. After the new rail line was announced,**

**White applicants were significantly more likely to apply for loans in transit-adjacent neighborhoods while Black applicants were significantly less likely to.** A closer inspection of these trends showed that they were most pronounced in neighborhoods closer to the city center, and importantly, close to a previously gentrified neighborhood in the city, NoDa, where the new rail line was advertised most frequently according to our text analysis on property listings. **We further found evidence that the combined effect of a declining share of Black loan applicants and increasing share of White applicants in some neighborhoods along the new rail line (close to the city center) resulted in a shift in the overall racial composition of these neighborhoods.** (Delmelle et al. 2021b)

### *Summary Statement on Research Objective 1*

These three complementary studies used individual-level data on moves into and out of new transit neighborhoods at various spatial scales. Our first two analyses incorporated a larger number of cities and neighborhoods (the entire United States and four US cities) while our last analysis only examined trends in Charlotte, North Carolina. Our only significant findings related to transit's impact on residential sorting were for the case of Charlotte where we were able to detect a measurable change in the racial composition of new transit neighborhoods, especially in neighborhoods close to other desirable amenities such as proximity to the city center, walkability, and close to a previously gentrified neighborhood with a large share of breweries. We therefore are led to the conclusion that **transit's impacts on residential sorting are very localized, detectable only in certain neighborhoods where conditions are primed for changes to take place.**



## Research Objective 2: Residential Location Choices of Those Leaving New Transit Neighborhoods

**Our second research objective asked of those lower-income residents who do move out of transit neighborhoods, do they relocate to neighborhoods of a lower socioeconomic composition?** An argument could be made that even if transit does not cause significant displacement, segregation and residential sorting may still be impacted as a rise in housing values limits the overall supply of affordable housing. Therefore, if lower-income residents decide to leave a neighborhood – either voluntarily or involuntarily, their only option may be neighborhoods of a lower socioeconomic status. In that case, concentrations of poverty elsewhere in the city will become more entrenched and new pockets of prosperity may emerge around new stations. There has been very limited work that has examined where those who leave neighborhoods that may be undergoing gentrification, relocate to and none for the specific instance of how new transit stations shape these movements. To answer this question, we again used the Panel Study on Income Dynamics to determine the likelihood that a lower-income resident from a neighborhood with a new transit station moves to a neighborhood of a lower socio or higher socioeconomic composition. We performed the same analysis for higher-income residents and also separated by renters and homeowners.

We found that, overall, those moving following the opening of a new station tended to either move within their same neighborhood or to one of the same socioeconomic status. We found that in a few instances – specifically in larger neighborhoods that were less accessible to the station – lower-income residents had a higher chance of moving to a more disadvantaged neighborhood. On the other hand, we found that higher-income homeowners who left just before the station opened (but after its opening was announced) had a higher likelihood of upgrading to a neighborhood of a higher socioeconomic status. **Taken together, these results demonstrate that new transit stations do have some impact on where residents move to in a way that may serve to further increase patterns of income segregation. Middle and higher-income homeowners for example, may be better able to take advantage of rising property values and move to a higher-income, and possibly higher-opportunity neighborhood, while this same benefit was not reciprocated to lower-income homeowners or renters (Nilsson & Delmelle 2020a).**



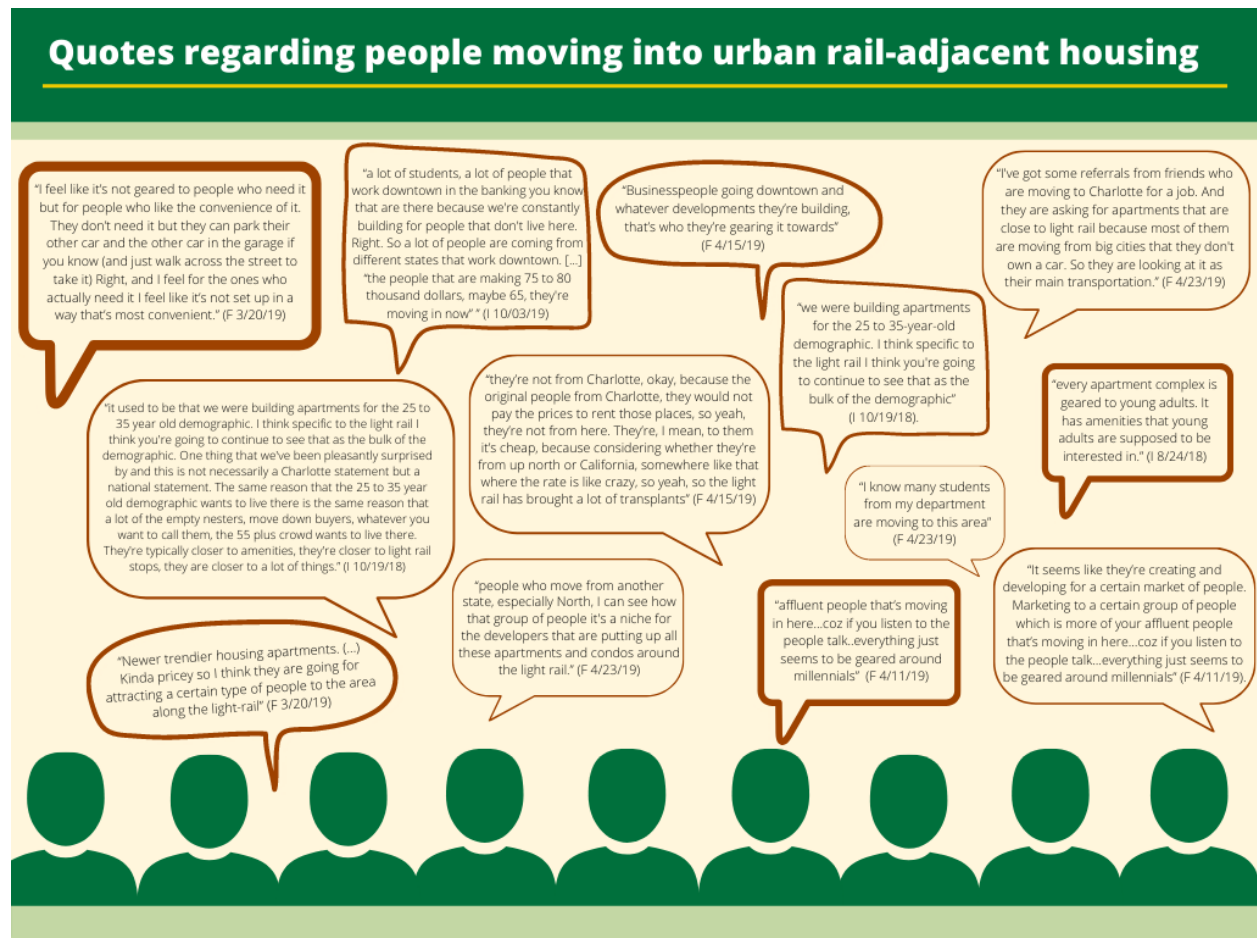
## Research Objective 3: Reasons for Leaving Transit Neighborhoods and Residents Perception of Change

Attempting to quantify displacement is a challenge as no readily available dataset is designed for that specific purpose. In particular, they do not provide the reasons behind relocation decisions both into and out of neighborhoods. Our third research objective took an in-depth, qualitative approach involving surveys and focus groups with residents and interviews with key stakeholders along a newly extended rail line in Charlotte, North Carolina. Using results from our survey, taken both in neighborhoods near the new light rail line and in a comparison neighborhood that had similar socio-demographic characteristics, but was located elsewhere in the city, **we questioned whether residents in a new rail station were more likely to consider moving from their neighborhood as compared to those in the control neighborhood and also asked about residents' perceptions about the impact of the new station on their neighborhood.**

Our survey effort resulted in a sample of 289 completed surveys in the light rail area and 115 in the comparison area. We found that residents who lived within a mile of the new transit station in a low-income neighborhood were significantly less likely to state that they were considering moving out as compared to those in the comparison neighborhood. Those surveyed also tended to hold a positive view of light rail's impact on their neighborhood - this was more so the case for those that used the light rail on a regular basis, that live in a neighborhood close to the city center, and for Hispanic residents. Long-time residents were less likely to view it as positive (Nilsson et al. 2020).

Next, eleven focus groups were conducted with residents in neighborhoods along the light rail corridor in Charlotte between March and May 2019, with a total of 75 participants. Most of the participants were African American and two focus groups were held in Spanish to accommodate the growing Spanish-speaking population in the area. Most participants remarked on the large number of apartment complexes being constructed along the path of the rail extension. These are primarily higher-end apartments with amenities catered towards younger, professional residents who are not transit-dependent (e.g. fitness room, saltwater pool, pet-grooming facility, parking garages). Closer to the center city, participants commented on the significant number of homes that were either demolished and replaced by a luxury dwelling or significantly remodeled. Those moving into these new homes were White, replacing the largely black population that lived there before. In addition, commercial changes in those close to the city-center neighborhoods included business catered towards the population moving into the new apartment complexes: breweries, gyms, coffee shops, etc. (see Figure 2 for illustrative quotes regarding who is moving into rail-adjacent housing). These comments are consistent with our modeling results on changes in the racial profile of mortgage applicants in these neighborhoods and subsequent shifts in the racial profile of these neighborhoods (Delmelle et al. 2021b)

Further out in older, suburban, established African American communities, focus group participants expressed a fear that the rail station would bring about similar changes that were underway in neighborhoods close to the city center. Many homeowners remarked that they were frequently approached by investors offering them cash for their homes, but most were resolute in their desire to stay. While residents in these further, older suburban neighborhoods expressed displacement fears, we found little evidence suggesting these concerns had been realized in the two years following the opening of the station. As an illustrative quote: *“I don’t know firsthand that people are being priced out. I’ve only heard that this can happen, this will happen. I don’t even know what the facts are about that. Whether it’s actually happening. Or it’s just a fear that it will. (1 10/24/19)”* (Schuch & Mushipe 2021).



**Figure 2.** Illustrative quotes from respondents moving into rail-adjacent housing

**Overall, the results of these qualitative analyses generally align with our quantitative findings. Residents perceived that newer developments near the new transit stations were developed for a particular younger, professional demographic, from out of town, not for long standing residents of the area. While race was not identified by focus group participants - our quantitative analysis revealed a significant change in the racial profile of those moving in with an increase in White homebuyers and decline in African American homebuyers. As with our quantitative analysis, we also found differences in the discussion of the light rail line**



**depending on where it was located. The changes that were noticeable were in neighborhoods close to the city center, while further north, residents feared that the train would bring about similar changes, but we found no significant evidence that this was currently happening.**



## Research Objective 4: Rail Transit and Spatial Income Segregation

Our fourth research objective sought to connect our full conceptual framework from residential mobility and sorting to neighborhood changes, and finally to income segregation at the metropolitan scale. To do so, we studied 11 metropolitan areas that implemented a new light rail transit line between 2000 and 2005 and first tested how the opening of the line impacted neighborhood-level income diversity and then how it impacted metropolitan-wide income segregation in the 50 largest MSAs in the United States. **For the 11 MSAs, we found no significant evidence that proximity to new stations resulted in significantly different changes in the income diversity of nearby neighborhoods, compared to similar neighborhoods elsewhere in the city.** Changes in the share of different income groups between 1990, 2000, and 2010 in new transit neighborhoods were remarkably small in our sample of 11 cities. **We also found no significant impact of access to rail transit stations on metropolitan-wide income segregation.** Rather, we found that increases in income segregation is associated with a rising share of children in the population and a growing housing market (Nilsson & Delmelle 2020b).



## Summary of Findings

We found that, on average, lower-income residents are not more likely to move out of a new transit neighborhood, neither at a nationwide nor local scale. While residents in the case study of neighborhoods along the LYNX Blue Line Extension attributed some of the changes in their property values and rents to the new transit line, it was only one of many factors. Survey respondents' view of the rail line's effect on their neighborhood was on average positive, particularly among frequent users, those residing near the center city, and Hispanics. Long-time residents were less likely to view it positively and African Americans' perception of the new line's effect on their neighborhood were not significantly different from other racial groups. The results from the qualitative analyses generally aligned with the quantitative findings. Residents perceived that newer developments near the new transit stations were developed for a particular younger, professional demographic, from out of town, not for long standing residents of the area. The quantitative analysis revealed a significant change in the racial profile of those moving in with an increase in White homebuyers and decline in African American homebuyers. The investigators also found differences in the discussion of the light rail line depending on residents' location with more noticeable changes in neighborhoods close to the city center. While more suburban residents feared that the train would bring about similar changes, the investigators found no significant evidence that this was currently happening. Finally, while the quantitative analyses showed some weak evidence of residential sorting, there was no evidence of rail transit having a significant impact on metropolitan level income segregation patterns.

For more information and links to all articles produced during this project, visit the project website: <https://pages.charlotte.edu/lightrailstudy/>

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