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Transit Station Area Development and Demographic Outcomes

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FOREWORD BY EARL BLUMENAUER

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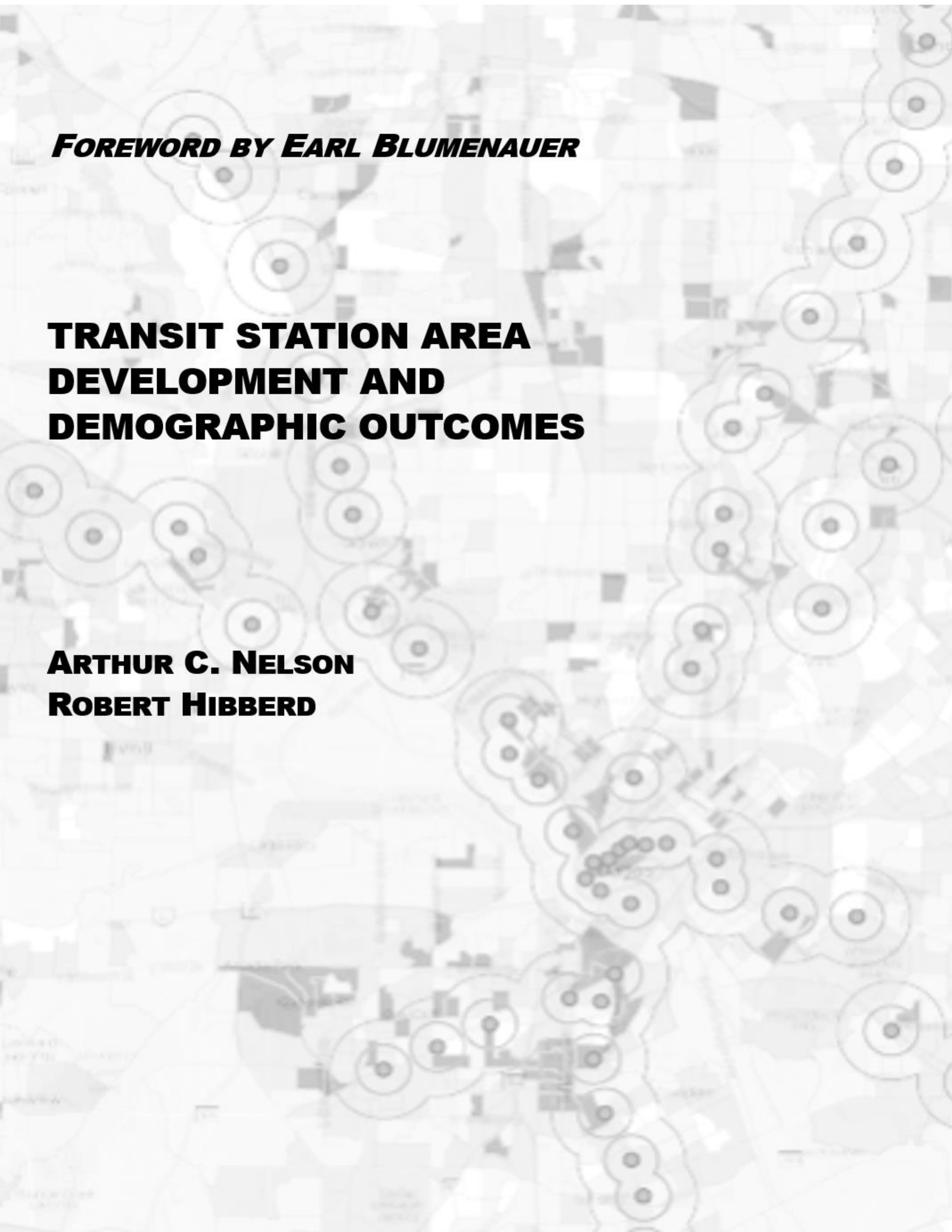

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16. Abstract

This report is the first comprehensive assessment of the extent to which transit station areas attract jobs, people and households, influence commuting mode choice, reduce vehicle kilometers traveled (VKT) as well as transportation costs, influence real estate value, and engender gentrification. Research reported in this article is based on 57 transit systems serving 42 metropolitan areas between the Great Recession of 2007-2009 and the global COVID-19 pandemic of 2020-2023. Station areas, comprised of land within 800 meters of light rail transit (LRT), streetcar transit (SCT), bus rapid transit (BRT), and commuter rail transit (CRT) stations added millions of new jobs and hundreds of thousands of new households during the study period. Overall, transit station areas attracted more than 20 percent of all new jobs as well as more than 20 percent of all new households in their regions, yet they comprise less than one percent of the urbanized land area in those regions. Growth around transit stations was dominated by Non-White persons along with large shares of regional growth from among all household types and householders under 65 years of age. Although the median household income of LRT and SCT station areas rose faster than their regions during the study period, this was not the case with respect to CRT and BRT station areas. Moreover, transit station areas accounted for a large share of their regions' change in renters. In addition, transit station areas gained a large share of regional workers who use transit, walked, or biked to work. Indeed, even before the pandemic, station areas added large shares of all workers in the region who worked from home. Furthermore, the closer households are to transit stations, the lower their annual VKT with associated transportation costs savings. However, the relationship between commercial rents and proximity to transit stations is mixed with mostly negative or statistically insignificant outcomes. These results call into question the efficacy of transit station planning, location, and design for most transit station areas if their intent is to achieve desired real estate investment outcomes. Nonetheless, there are several exemplars among individual systems to warrant emulating. Evidence of gentrification is also mixed with the exception that it is not evident around BRT station areas. Nevertheless, as demand grows for development near transit stations, gentrification pressures will increase. Policy approaches to mitigating adverse gentrification outcomes are outlined. Results from research reported in this article lead to implications that are offered for post-pandemic transit policy and planning on the theme of making transit station areas more attractive to people who seek walkable communities with multimodal options.

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To US Representative Earl Blumenauer for indefatigable leadership in local, state, and federal policymaking advancing smart growth, social and environmental justice, and mobility options, especially safe and abundant bicycle routes.

FOREWORD BY EARL BLUMENAUER

The COVID-19 pandemic changed where and how people live, work, and socialize. For those of us who care about vibrant, livable communities, part of our work is figuring out how those changes impact future urban planning. What do people want from their neighborhoods? How do they want to live? How do they want to get around? And how do we make transit an easy choice for them?

In this report, Arthur C. Nelson, Emeritus Professor of Urban Planning and Real Estate Development at the University of Arizona, and Robert Hibberd, a doctoral student, chronicle numerous economic and demographic changes that occurred in transit station areas between the Great Recession that ended in 2009 and the pandemic that started in 2020. Through detailed analysis of 57 transit systems operating in 42 metropolitan areas, they find that station areas accounted for more than 20 percent of regional job and household growth. This 20 percent growth occurred on *less than one percent* of the urbanized land base. The benefits of that 20 percent growth on a tiny amount of land are significant: reduced greenhouse gas emissions, reduced farmland and open space loss, increased walkability, increased access to transit, and more time with family and friends instead of burning a gallon of gas to buy a gallon of milk. Can this trend be sustained in the post-pandemic era? Yes. But sustaining it will require new approaches, new ways of thinking, and new ways of investing.

Recent surveys by the National Association of Realtors show that after the pandemic, more Americans want to live in walkable communities with transit accessibility. Yet at the current pace of building, Nelson and Hibberd estimate that it could take decades before the demand for walkable, transit accessible, livable communities is met.

Transit station areas disproportionately attract people who work from home. Why is this? For one thing, transit station areas offer more than sterile suburban communities can. That includes third places, enhanced shopping, restaurants, and multiple mobility options like transit, walking, and biking. While many suburbanites who work from home may suffer cabin fever, those who work from home in transit station areas often have opportunities just steps away.

The demographics of people living around transit stations have changed. Transit station areas are no longer hotbeds of young professionals. Instead, Nelson and Hibberd find that most people moving into transit station areas are established households including many with children. Families are realizing that life is easier if they don’t have to drive to the grocery store, if their kids can walk to the park themselves, and if they don’t have to spend all their time and money managing multiple cars.

This post-pandemic era also requires rethinking how we design transit-oriented areas. Tens of millions of American workers prefer working from home, at least some days of the week. Yet for the most part, transit station areas were designed to serve offices. This must change. Nelson and Hibberd argue that transit station areas need to pivot away from the preoccupation with meeting the needs of offices to meeting the needs of people who want to live there. After all, this is where the market is headed.

One concern Nelson and Hibberd raise that I share is mitigating adverse effects of transit station area growth on gentrification. Although their analysis shows that gentrification is not pervasive in every location across the country now, as demand for living in station areas grows gentrification pressures may increase. They offer a suite of approaches to mitigate adverse gentrification outcomes. As part of rethinking station areas to put people first, it is critical that planners ensure the people who live in the community now can benefit from investment and redevelopment.

This report helps us think about how to build the types of communities that people want post-pandemic. We must find ways to increase community connections, improve economic mobility, reduce greenhouse gas emissions, and ease people's lives. The federal government has an important role to play in supporting the development of these communities and making sure they meet the needs of people across the country. Nelson and Hibberd lay out important considerations as we all undertake that work.

Earl Blumenauer
Member of Congress

TRANSIT STATION AREA DEVELOPMENT AND DEMOGRAPHIC OUTCOMES

THE INFLUENCE OF TRANSIT STATION PROXIMITY ON JOBS, PEOPLE, HOUSEHOLDS, COMMUTING, AND REAL ESTATE VALUES WITH IMPLICATIONS FOR POST-PANDEMIC TRANSIT STATION AREA PLANNING

EXECUTIVE SUMMARY

This report is the first comprehensive assessment of the extent to which transit station areas attract jobs, people and households, influence commuting mode choice, reduce vehicle kilometers traveled (VKT) as well as transportation costs, influence real estate value, and engender gentrification. Research is based on analysis of 57 transit systems serving 42 metropolitan areas between the Great Recession of 2007-2009 and the global COVID-19 pandemic of 2020-2023. Station areas are comprised of land within 800 meters of light rail transit (LRT), streetcar transit (SCT), bus rapid transit (BRT), and commuter rail transit (CRT). These "station areas" comprise less than one percent of the urbanized land area in those regions. Key findings from research include:

- Nearly one million new jobs were added within 800-meters of LRT transit station areas or 28 percent of LRT regions followed by more than 600,000 new jobs each for BRT station areas comprising 28 percent of BRT regions and CRT station areas being 20 percent of CRT regions, finishing with nearly 300,000 new jobs in SCT station areas or 19 percent of SCT regions. Overall, transit station areas attracted more than 20 percent of all new jobs added to their regions. Impressive as these numbers are, they occurred on less than one percent of the urbanized land in those regions.

- Transit station areas increased more than their regional share of upper-wage jobs, lost regional share of middle-wage jobs, and held about steady in terms of the share of regional change in lower-wage jobs.

- BRT station areas added nearly 170,000 households followed by LRT station areas at more than 160,000 households, CRT station areas at more than 100,000 households and SCT station areas as more than 40,000 households. Household growth comprised about 40 percent, 20 percent, 12 percent, and 11 percent of the regional change in households, respectively. Transit station areas attracted more than 20 percent of all new households added to their regions, overall. There is some evidence that households are pushing jobs out of locations closest to LRT, SCT, and BRT transit stations.

- Transit station areas gained a larger share of householders in all age groups except those 65 years of age and above than their regions, but even in that age group transit station areas added households at about the same rate as their regions. Notably, whereas all transit regions lost households under 25 years of age, transit station areas for all systems added households in this age group. Among householders aged 25 to 44, which comprises the second largest number of households behind those aged 65 years and older, BRT station areas accounted for 61 percent of their entire region's share of such households

followed by LRT at 36 percent of their region, CRT at 25 percent of their region, and SCT at 20 percent of their region.

- Although Whites moved into transit station areas at disproportionately higher rates than elsewhere in regions, in absolute numbers, Non-Whites dominated population change in station areas.

- Consistent with gentrification expectations, median household income rose at a faster pace relative to transit regions in LRT and SCT station areas and less so in CRT station areas, but this was not the case with BRT station areas.

- Overall, rental housing tenure increased faster than their transit regions. BRT station areas accounted for 59 percent of the entire change in renters for their region, followed by 30 percent and 26 percent for LRT and CRT regions, respectively, and 18 percent for SDT regions.

- Transit station areas gained share of regional workers who use transit, walk or bike to work, or work at home. Indeed, even before the pandemic, station areas added large shares of all workers in the region who worked from home, ranging from 28 percent for BRT systems to 12 percent LRT systems and about 10 percent each for SCT and CRT systems.

- Research also finds that households reduce their annual vehicle kilometers traveled (VKT) as a function of LRT transit station proximity. While this seems sensible, this article is the first to show it.

- The association between commercial rents and proximity to transit stations is mixed and mostly negative or ambiguous, meaning there is not statistically significant outcome. Although office rents reveal a higher number of positive associations with respect to transit station proximity than retail or multifamily real estate, for most systems among all the modes, results are not positive. Indeed, outcomes are especially unimpressive for retail and multifamily property. Overall, these results call into question the efficacy of transit station planning, location, and design to achieve desired results in the real estate market. Nonetheless, there are several exemplars among individual systems to warrant their use as models for other systems to emulate.

- Although there is some evidence of gentrification, it does not appear to be widespread and may not be evident among BRT systems. On the other hand, the research reported in this article does not assess individual station areas where gentrification may be occurring. This is an area for future research.

Using insights from research, the article offers lessons for post-pandemic transit policy and planning. Notably, it concludes with a call to downplay the role of offices in transit station areas and increase the opportunity for people to live in them.

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INTRODUCTION

This report is the first comprehensive assessment of the extent to which transit station areas attract jobs, people and households, influence commuting mode choice, reduce vehicle kilometers traveled (VKT) as well as transportation costs, influence real estate value, and engender gentrification. Research is based on 57 transit systems serving 42 metropolitan areas between the Great Recession of 2007-2009 and the global COVID-19 pandemic of 2020-2023. Station areas, comprised of land within 800 meters of light rail transit (LRT), streetcar transit (SCT), bus rapid transit (BRT), and commuter rail transit (CRT) stations added millions of new jobs and hundreds of thousands of new households during the study period. Overall, transit station areas attracted more than 20 percent of all new jobs as well as more than 20 percent of all new households in their regions, yet they comprise less than one percent of the urbanized land area in those regions.

As will be seen, growth around transit stations was dominated by Non-White persons along with large shares of regional growth from among all household types and householders under 65 years of age. Although the median household income of LRT and SCT station areas rose faster than their regions during the study period, this was not the case with respect to CRT and BRT station areas. Moreover, transit station areas accounted for a large share of their regions' change in renters. In addition, transit station areas gained a large share of regional workers who use transit, walked, or biked to work. Indeed, even before the pandemic, station areas added large shares of all workers in the region who worked from home. Furthermore, the closer households are to transit stations, the lower their annual VKT with associated transportation costs savings.

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Evidence of gentrification is also mixed with the exception that it is not evident around BRT station areas. Nevertheless, as demand grows for development near transit stations, gentrification pressures will increase. Policy approaches to mitigating adverse gentrification outcomes are outlined. Results from research reported lead to implications that are offered for post-pandemic transit policy and planning on the theme of making transit station areas more attractive to people who seek walkable communities with multimodal options.

The report begins with literature reviews, theoretical perspectives, and research questions relating to the role of transit station proximity on various economic and demographic outcomes within transit station area. It continues with a framework for analyzing outcomes with respect to proximity to LRT, SCT, BRT, and CRT stations. This is followed by sections presenting research designs, hypotheses, methods, results, and interpretations relating the association between transit station proximity and change in jobs overall as well as by economic group, people overall and by White/Non-White population, households by type and age, households by income and tenure, and rents for office, retail, and multifamily real estate.

This report concludes with lessons for post-pandemic transit policy and planning including a call to downplay the role of offices in transit station areas and increase the opportunity for people to live in them.

TRANSIT STATION DEVELOPMENT LITERATURE, THEORIES, AND RESEARCH QUESTIONS

Cities and their metropolitan areas are formed and grow in large part by creating agglomeration economies (Glaeser 2011). This occurs when the average cost of production falls in part when firms pool their resources such as labor to increase productivity (Anas, Arnott and Small 1998). As more related firms cluster together, average production costs fall as productivity increases. Agglomeration economies can spill over into complementary sectors, thereby creating even more jobs (Holmes 1999). Cities become ever larger when agglomeration economies are exploited (Ciccone and Hall 1996).

Highways make it possible to sustain agglomeration economies by increasing the size of market areas. But increasing demand for highways can lead to congestion which reduces worker productivity and accessibility to markets, thereby undermining agglomeration economies (Glaeser and Kohlhase 2004). Indeed, new highway investments have been shown to reduce agglomeration economies resulting in a net cost to society (Boarnet 1997; Boarnet and Haughwout 2000). A key role of transit is to facilitate agglomeration economies by mitigating the transportation congestion effects of automobile traffic induced by agglomeration. Since public transit is essentially noncongestible, it can sustain agglomeration economies in high-density nodes as well as along the corridors that connect them (Voith1998).

Research shows that public transit enhances economic development, in part because of its role in facilitating agglomeration economies (Graham 2007; Nelson et al, 2009; Litman 2023). Transit thus plays a pivotal role in the development of metropolitan areas, especially near transit stations (Belzer et al., 2011). Not only is job growth facilitated but transit stations also attract households and their workers who seek improved accessibility to jobs as well as other services (Nelson et al. 2015). This can reduce automobile dependence by expanding mobility options.[1] Moreover, transit stations confer proximity rent premiums that increase land and real estate values near them (Higgins and Kanaroglou 2016). But there is an underlying concern that transit station proximity can lead to gentrification (Padeiro, Louro and da Costa 2019).

This section presents literature and identifies theories with respect to the association between transit station proximity and change in the share of regional jobs and jobs buy wage category, population generally as well as among Whites/Non-Whites, households by type and age along with their housing tenure and median household income, change in mode choice in the commute to work, reduction in vehicle kilometer traveled (VKT) [2] and associated reduction in transportation cost, and rents for office, retail, and multifamily rent. Implications for gentrification will also be addressed.

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[1] See https://tod.itdp.org/what-is-tod/eight-principles-of-tod.html.

[2] This metric is also known as vehicle miles traveled or VMT.

Literature, Theory, and Research Questions Relating to Transit Station Proximity and Jobs

As noted earlier, in theory, transit systems should facilitate economic development near transit stations because they reduce transportation costs and support higher intensity land uses (Shen 2013). Unfortunately, there is a thin literature on the association between the change in jobs and jobs by economic sector and proximity to transit stations.

A key assumption of transit systems is that they will generate jobs around transit stations. The first study to address this issue was conducted by Belzer, Srivastava and Austin (2011). They used Longitudinal Employment-Housing Dynamics (LEHD) data for 34 metropolitan areas for the years 2002 and 2008. "The type, number, and share of jobs were compared between blocks that lay within a half-mile of a fixed-guideway transit stop and those in the region as a whole" (p. 18).[3] A transit zone capture rate was calculated as the share of a sector's employment within 0.50 mile (about 800 meters) of a transit station compared to the region. A change in the capture rate from 2002 to 2008 was also estimated. Without differentiating employment shares between types of transit systems, Belzer, Srivastava and Austin found: (1) government employment accounted for 42 percent of all new jobs in the 0.50-mile transit zones; (2) knowledge-based jobs accounted for about 28 percent of the change; (3) only about 14 percent of the change in jobs were in manufacturing; and (4) 17 percent of new jobs were in wholesale trade. Note is made that this is study based on data mostly preceding the Great Recession of late 2007 through mid-2009.

In the only study focusing on bus rapid transit, Nelson et al. (2013) used shift-share analysis to measure the extent to which the number and sector-mix of jobs changed before (2004) and after (2007) the Eugene-Springfield (Oregon) BRT system was launched. They used InfoGroup data for jobs by sectors for specific firms via address-matching. Nelson et al. found that while the metropolitan area lost jobs between 2004 and 2010, jobs grew within 0.25 mile (about 400 meters) of BRT stations though not beyond. Notably, they found that of the combined shift of 710 jobs toward BRT station areas, only 12 were in the 0.25–0.50 distance band. Thus, essentially, the entire overall shift in jobs favoring BRT station areas occurred within 0.25 mile of them. They also speculated that the BRT system may have a resiliency effect. Where the Eugene-Springfield metropolitan area lost jobs between 2004 and 2010, jobs were added within 0.25 mile of BRTs stations.

Focusing on just light rail transit (LRT) systems, Cervero et al. (2004) reviewed development outcomes around LRT stations in several metropolitan areas. They found that in the early 2000s almost all of Portland's LRT stations had seen some new office, retail, and multifamily development. They also found that strong market demand around Dallas Area Rapid Transit LRT stations contributed to the near-term success of that system. In San Diego, Higgins, Ferguson, and Kanaroglou (2014) observe that although the southern end of the Trolley leading to the Mexican border has impressive ridership, development along the line has not occurred likely because of its alignment within an industrial corridor served by freight rail. Otherwise, their review of the academic literature revealed sparse analysis of land use changes around LRT stations and virtually none around BRT or SCT stations as of the early 2010s.

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[3] Some literature uses the term "fixed-guideway" or "fixed-route" transit systems to differentiate them from conventional bus service. This report focuses only on the four transit systems noted above.

One impediment to development in LRT corridors could be social stigma. Loukaitou-Sideris and Banerjee (2000) find that unattractive neighborhood characteristics such as low income, high unemployment, and crime along with physical barriers to LRT stations plus deteriorating housing stock along Los Angeles' Blue Line created a "derelict and forbidding" (p. 10) climate for investors.

There is some evidence that policies incentivizing development near transit stations make a difference. Fogarty and Austin (2011) note that new private investment around LRT stations in the central areas of Minneapolis and Charlotte is attributable to local policies facilitating development in TODs combined with growing regional economics, suitable land, and good transit connections at the neighborhood level. But not all TODs have seen desired levels of development. In Denver, development along the Southeast Corridor LRT was hampered by its location within a highway median (Fogarty and Austin 2011).

In Phoenix, Valley Metro (2013) reported that nearly $7 billion in new development had been invested in TODs served by LRT stations since 2004. Nonetheless, more development may have been hindered by real estate speculation shortly after station locations were announced (Kittrell 2012) combined by the Great Recession which impacted metropolitan Phoenix especially hard. Credit's (2018) later analysis of Phoenix used a pre-post design to measure the change in jobs around light rail stations based on 0.25-, 0.50-, and 1.00-mile (about 400-, 800, and 1,600-meter) buffers, finding increases in knowledge, retail, and service sector jobs.

More recent research has shown that jobs tend to concentrate near rail transit stations in Cleveland (Pasha et al. 2020).

On the other hand, some literature shows insignificant or ambiguous associations between job change and transit station proximity. In a review of four US metropolitan areas with new light rail transit stations between 2000 and 2015, Tyndall (2021) found that rail station proximity reduced employment density. Moreover, in their study of Atlanta's heavy rail transit system, Bollinger and Ihlanfeldt (1997) found small increases in employment around rail stations.

Lai, Zhou, and Xu's (2024) review of literature conclude that there is limited analysis of the link between employment change and transit stations, and that more studies are needed to close this gap. Indeed, there is very little to no research into the association between job change and proximity to streetcar or bus rapid transit systems, and no research assesses change comprehensively among large numbers of transit systems.

The research questions guiding research reported below are:

> Is there an association between transit station proximity and an increase in jobs?
>
> If so, does this association vary by economic sector?

Literature, Theory, and Research Question Relating to Transit Station Proximity and Wages

Scholars and civil rights organizations assert that America's transportation policies perpetuate social and economic inequity. Sanchez and Brenman (2008) and Brenman and Sanchez (2022), for instance, show that highway- based transportation investments limit the access of low-income and people-of-color to education, jobs, and services. Echoing their concern is the Leadership Conference Education Fund (Leadership Conference Education Fund, 2011a, 2011b), a civil rights organization which asserts that low-wage jobs are inaccessible to those who are transit-dependent. Public transit is seen as one way to connect people to low-wage jobs, reduce poverty, increase employment, and help achieve social equity goals (Blumenberg et al. 2002; Blumenberg and Manville, 2004; Sen et al. 1999). But does transit deliver on this promise?

Fan et al. (2012) provide an especially pertinent review of literature addressing this question. Citing Kain's (1968; 1992) pioneering work, they observe that the urban poor are harmed for want of affordable housing near job opportunities and reliable public transit to connect them to those jobs (see also Blumenberg et al., 2002; Sanchez, 2008).

A limiting factor in gaining access to lower-wage jobs is that the income from such jobs is often insufficient to buy and operate an automobile to access those jobs in the first place. Sanchez (1999) and Sanchez et al. (2004) note that it is difficult for public transit to reduce the spatial mismatch between lower-income jobs and residential options for a number of reasons, especially exclusionary zoning. One problem is that bus systems often do not provide sufficient service for the kinds of working hours that make low-skill/entry-level, temporary, and evening/weekend shift-work jobs feasible (Giuliano, 2005). Tansit systems—if they are more rapid and reliable than conventional buses—may be one way to connect lower-income workers from their lower-income neighborhoods to lower-wage jobs (Fan et al. 2012).

Unfortunately, there are very few empirical studies showing whether and the extent to which transit systems produce these outcomes. It seems that just as many studies report positive outcomes (Ong and Houston, 2002; Ong and Miller, 2005; Kawabata, 2002; 2003) as negative ones or those with ambiguous associations (Thakuriah and Metaxatos, 2000; Cervero et al. 2002; Bania et al., 2008).

Two other studies have shown different results. In the first, McKenzie (2013) studied neighborhoods in Portland, OR, to identify differences in transit access for those neighborhoods. Using 2000 Census and five-year (2005–2009 American Community Survey) data, McKenzie compares changes in levels of transit access across neighborhoods based on their concentrations of blacks, Latinos and poor households. The study found that neighborhoods with a high Latino concentration have the poorest relative access to transit, and that transit access declined for Black and Latino-dominated neighborhoods. McKenzie did not evaluate job growth along transit lines serving or near those neighborhoods, however.

The other is the study by Fan et al. (2012). They find that residential proximity to light rail stations and bus stops offering direct connection to rail stations are associated with statistically significant gains in accessibility to low-wage jobs. On the other hand, their analysis covered only a short period of time before the Great Recession: 2004 to 2007 but not since. The Center for Transportation Research at the University of Minnesota (Fan, et al., 2012) goes further by reporting that between 2004, when the Hiawatha Line LRT line opened, and 2007, just before the Great Recession, low-wage jobs accessible within 30 minutes of transit within Hennepin County grew by 14,000, with another 4,000 where the LRT was accessed directly by bus.

On the other hand, economic theory rooted in agglomeration economies, which is a desired outcome of transit investments, requires that aggregate wages increase as productivity improves (Bolter and Robey 2020). Thus, one would expect not only more jobs associated with transit as it facilitates agglomeration economies, but higher wages as well.

In sum, there are no studies showing the relationship between transit station proximity and wages differentiated by wage. Research reported below helps to close this gap in the literature.

The research question guiding the research presented later is:

> Is there an association between transit station proximity and change in concentration of jobs with respect to wages?

Literature, Theory, and Research Questions Relating to Transit Station Proximity and Demographic Change with Special Reference to Gentrification

Chapple and Loukaitou-Sideris (2019:91) lament:

> The vast literature on neighborhood change pays little attention to the role of infrastructure, particularly transit, in reshaping areas—and who lives in them.

Until 2014, only one study addressed population and housing change for all transit systems in the United States during the 2000s—the Center for Transit Oriented Development (2014)—but it did not differentiate by type of system or distance from transit stations, nor did it provide details on the race/ethnicity of people, households by age and type and income, or housing based on tenure. With limited focus, Hurst and West (2014) found a significant increase in single-family and multifamily development around LRT stations in Minneapolis which increased population density in those areas. Another study of the LRT system in Dallas found similarly (Al Quhtani and Anjomani 2021).

In more recent work using the American Community Survey (ACS) for 2013 and 2014, Nelson and Hibberd (2023) provided a national summary of the change in such demographic features as race/ethnicity, household type and age, and tenure for LRT, SCT, BRT, and heavy rail transit (HRT) systems but provided no data for specific systems. ACS 5-year sample data for 2013 also include the last years of the Great Recession of late 2007 through middle 2009.

No study, however, evaluates the association between transit station proximity and median household income, which is a key indicator of gentrification.

The research questions addressed in research presented below are:

> Over the period extending from the Great Recession to the Covid-19 pandemic, 2010-2019, is there an association between transit station proximity and change in the racial/ethnic mix of the population, household type and age, household income, and housing tenure?
>
> If so, does this vary by type of transit system?

The role of transit station proximity in engendering gentrification is addressed next.

Whither Gentrification? The Relationship between Transit Station Proximity and Gentrification

There is a large literature exploring the extent to which transit station proximity displaces existing residents and replaces them with higher income ones through a process called "gentrification".

What is "gentrification"? Marcuse (1985) characterized its features as including the arrival of younger, highly educated professionals in highly paid jobs and being mostly White. These new households replace older, working-class, lower-income, and minority households in neighborhoods near downtowns that are ripe for reinvestment (Bourne 1967). When near transit stations, gentrification can include changes to the socioeconomic composition of existing residents or other changes that shift the racial, ethnic socioeconomic, or housing characteristics of impacted neighborhoods (Delmelle 2017).

Delmelle (2021) presents the conundrum succinctly. An overall goal of transit is to improve mobility especially of lower-income and minority communities. Doing so elevates the economic opportunities available to residents, such as access to higher-paying jobs (Andersson et al. 2018, Jin and Paulsen 2018). But this can increase the demand for housing near transit stations that raises housing prices. This results in higher income households displacing lower-income ones through a process called "transit-induced displacement and gentrification" (Delmelle and Nilsson 2020). The process is further stimulated when transit-oriented developments (TODs) intentionally create dense, mixed-use and walkable developments near transit stations (Calthorpe 1993). This can lead to the displacement of vulnerable residents (Rayle 2015). Rising housing prices may reduce the supply of housing that is affordable to them near transit stations, thus exacerbating social equity (Newman and Wyly 2006) especially if transit investments are not proactive in assisting lower-income households to move toward transit opportunities.

Empirical research is mixed when testing for the presence of gentrification near transit stations, however. Delmelle (2021) notes several studies found the racial and ethnic composition of neighborhoods to remain unchanged after transit stations are introduced (Pollack et al. 2010; Barton and Gibbons 2017; Deka 2017; Nilsson and Delmelle 2018,)

Indeed, as Delmelle (2021) points out, many neighborhoods do not change at all after a transit station is built nearby. If they do change, it's mostly in the same direction as existing trends.

Moreover, even with an influx of new households, increasing housing supply need not lead to displacement of existing residents (Dong 2017; Baker and Lee 2019).

Delmelle (2021) concludes that "(t)he current state of the literature increasingly suggests that the impacts of transit on neighborhoods is either marginal or very difficult to quantify" (Delmelle 2021: 184). Qualitative research may be needed to uncover more subtle changes among neighborhoods near transit. Also, given that most studies have focused on system-wide outcomes, including this report, more research is needed at the micro scale of individual transit stations. More long-term research is also needed because neighborhood composition is often slow to change as households occupy their homes for decades if not generations. Finally, because most studies in this genre did not use micro-scale control areas to measure treatment outcomes in areas near transit stations, this is an area is need of additional research.

Heeding the call in the latter two respects is Qi (2023) who used census block groups (CBG) near transit stations as the treatment regime and compared change over long periods of time with matching control CBGs based on the *MatchIt* algorithm[4]. Based on this research, Qi concludes (with emphases added):

> "… **rail is more likely to induce gentrification than Bus Rapid Transit (BRT)** and that (gentrification) is more evident over long term than over short term for rail-served neighborhoods. These findings thus imply that the **BRT could help sustain the transit service to the most vulnerable**." (Qi 2023: 1)

Other research casts doubt on the whole notion that transit station proximity leads per se to gentrification. Padeiro, Louro and da Costa (2019) conducted a review of gentrification outcomes associated with transit proximity among papers published between 2000 and 2018. They concluded that gentrification is associated more with local dynamics than transit station proximity. Thus, associating demographic change with transit station proximity can lead to bias in research designs that may lead to "misinterpretations, thus ultimately leading to misguided conclusions and policies" (Padeiro, Louro and da Costa 2019: 733). Indeed, Dong's (2017) analysis of development near transit stations in Portland, Oregon, found that housing supply mattered most in either effecting or ameliorating gentrification outcomes.

The relevant research questions in this context are:

> During the study period, was there evidence of gentrification and if so, does it vary by transit mode and system?

[4] See https://gking.harvard.edu/matchit.

Literature, Theory, and Research Questions Relating to Transit Station Proximity and Change in Commuting Mode, Reduced Travel, and Reduced Transportation Costs with Social Equity Implications

There is scant research into the association between transit station proximity and change in commuting mode over time. Nor is there research into the association between transit station proximity and vehicle kilometers traveled (VKT) or reduced household travel costs. This avenue of inquiry has three related elements including the association between transit station proximity and:

- Reduced dependency on commuting to work via the automobile;
- Reduced VKT per household; and
- Reduced household transportation costs.

Literature, theory, and hypotheses related to each are reviewed below.

Reduced Automobile Dependency

In theory, transit station proximity should be associated with higher levels of walking, biking, and transit in their journey to work than more distant locations (Renne, 2009; Kwoka, Boschmann, and Goetz 2015; Ewing, Tian, and Lyons 2018). Indeed, households will self-select by moving toward transit stations to gain access to transit, whether they are transportation disadvantaged or prefer that option over others (Lund 2006; Guerra, Li, and Reyes 2022). In sum, there is no systematic research into the variation of commuting modes with respect to transit station proximity for such different commuting modes as transit (Litman 2023b), walking and biking, or even working at home.

Given the foregoing, this research question is posed:

> Is proximity to transit stations associated with increasing shares of walking, biking, transit use, and working at home and if so, is there variation by type of transit system?

Reduction in VKT with respect to transit station proximity is considered next.

Reduced Vehicle Miles Traveled

Unfortunately, the literature on the association between transit station proximity and VKT is thin. Studies by Ewing and Cervero (2010, 2017), and Ewing, Guang, and Lyons (2018) show that compact development and mixed land uses are associated with fewer trips and reduced VKT, but those studies do not address explicitly the role of transit stations in doing so. Rosenthal and Strange (2006) provide evidence that agglomeration economies between office and industrial properties can reduce VKT. Recent work by Ihlanfeldt (2020) shows that land use planning that integrates land uses and leads to higher density development can reduce VKT. But neither study focuses on transit station proximity and VKT. Another study by Park et al., (2018) find that living within a TOD result in more residents who walk and use transit more while driving less. The only directly relevant study is by Cervero and Arrington (2008) who found that TOD housing projects averaged 44 percent fewer vehicle trips per day than assumed by standard trip generation metrics. Their study was limited to a small sample of TODs in five metropolitan areas but did not measure change in VKT per household.

Given the foregoing, the following research question is posed:

> Is there an association between transit station proximity and VKT?

If so, households should also incur lower transportation costs. There should also be social equity implications as well. These areas of research as reviewed next.

Reduced Transportation Costs with Social Equity Implications

Conventional theory of location and land-use holds that household demand for location is a function of income, household size, and location costs. Location costs means in part the cost of transporting occupants to work, shopping, services, recreation, and other destinations. In theory, lower transportation costs are capitalized by the market into higher home prices or rents (Alonso 1964; Mills; Muth 1969). In effect, a household would be willing to pay more for a home that has lower transportation costs than alternatives. Unfortunately, mortgage lenders do not consider transportation costs in their underwriting. Home buyers thus "drive until they qualify" for a home that meets their needs even if high transportation costs are incurred. Hence, urban sprawl occurs along with its environmental, social, and economic inefficiencies.

In recent years a growing body of literature has argued that housing and transportation costs need to be considered together when considering housing affordability.[5] Ewing and Hamidi (2015) note that HUD's definition of affordability—where no more than 30 percent of a household's income would be spent on housing—along with indexes of others are "structurally flawed in that they only consider costs directly related to housing, ignoring those related to utilities and transportation" (Ewing and Hamidi: 5). Suppose total housing plus transportation costs consume 50 percent of a household's income. If the household's transportation costs could be reduced by half, however, it would not use the savings to buy a better home because mortgage underwriting would not recognize it.

Conceptually, transportation cost savings are realized by locating in or near such places as downtowns, mixed-use developments, and transit stations. Studies only estimate these savings in two ways. First, a suite of studies based on work by the Center for Neighborhood Technology uses secondary data to estimate the share of trips by mode and household type at the block group, and then derive vehicle miles traveled through inferences based on other secondary data. The actual distance from block groups to such points as downtowns and transit is not estimated directly.[6] For several household types, CNT's studies estimate housing costs that are constant across large geographies such as counties while transportation costs vary by block group.

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[5] See HUD's Location Affordability Portal for literature and other materials on the concept of housing plus transportation ("H+T") costs (see http://www.locationaffordability.info/).

[6] CNT has produced two significant generations of these studies. The first is reported in http://htaindex.cnt.org/map/ and the second in http://www.locationaffordability.info/default.aspx.

In an automobile-dependent economy, the number of vehicle miles traveled is directly associated with transportation costs.[7] Thus, locations that reduce household VKT also reduce transportation costs. Reductions in VKT can be converted into cost savings.

Unfortunately, the literature on the association between transit station proximity and household transportation costs is also thin. Although research shows that household transportation costs vary by density and location generally (Guerra and Kirschen 2016), none measures transportation cost savings with respect to distance from specific destinations. In a recent study, Dong (2021) found that households within a sample of TODs incurred fewer transportation costs than a control group outside them. Otherwise, Dong's assessment is that literature on the association between transit stations and VKT as well as costs is small and inconclusive (Dong 2021: 1). The research reported below helps close this gap.

There is also a social equity implication that is not addressed in literature. Although one aim of transit is to broaden accessibility options to lower-income households, the implicit objective is also to reduce accessibility costs (see Sanchez and Brenman 2008, Brenman and Sanchez 2022). This could be accomplished by reducing household VKT and associated transportation costs. There is no research into this.

The research questions posed in these respects are:

> Do household transportation costs vary by proximity to transit stations?
>
> If so, do lower-income households realize transportation cost savings with respect to proximity to transit stations?

The influence of transit station proximity on real estate rents is considered next. This is followed by the analytic strategy and presentation of results with interpretations.

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[7] For a review and data, see https://data.bts.gov/stories/s/Transportation-Economic-Trends-Transportation-Spen/bzt6-t8cd/.

Literature, Theory, and Research Questions Relating to Transit Station Proximity and Real Estate Rents

Real estate markets send important signals about the efficacy of public policy and planning. For instance, locating landfills near residential areas depresses nearby residential property value (Nelson, J. Genereux and M. Genereux 1992). Creating open spaces beyond urban growth boundaries creates amenity value that increases urban residential property value inside the boundary but also creates externality value that depresses farmland value outside (Nelson 1986). In the context of transit stations, there can be both positive and negative residential price effects depending on the extent to which transit station externalities are mitigated through planning and design (Nelson and McClesky 1990, Nelson 1992).

The literature begins with J. H. von Thünen (1826) who was the first to formalize the relationship between the center of cities and land value: as distance is reduced land values rise because land capitalizes both transportation cost savings and that higher densities lead to more economic exchange. More than a century later, a trio of urban economists adapted von Thünen's model to create modern urban location theory: Alonso (1964), Mills (1967) and Muth (1969). By assuming that all jobs are in the central business district (CBD) the "AMM theory" shows that as transportation costs increase from the CBD, land values fall at a declining rate. In the CBD, where transportation costs are the lowest, land prices are thus the highest. Only those land uses that can outbid others secure land in the center, forcing losing bidders to locate farther away in a process known as urban land use invasion and succession (Park et al. 1925).

But urban areas are not "monocentric." As one relaxes the constraints of the AMM monocentric city model, it is possible to imagine the same principles work only at smaller scales (Hajrasouliha and Hamidi 2017; Bogart 1998). For instance, rail transit stations are often located in or sometimes lead to small-scale versions of CBDs. Some land uses can realize transportation cost savings if they locate near transit stations and may be willing to pay more for proximity (in the form of rent) compared to other land uses. Numerous studies show negative bid-rent gradients with respect to distance from rail transit stations, meaning that as distance from transit stations increase real estate values fall, *ceteris paribus* (Al-Mosaind et al. 1993; Cervero 1984; Cervero and Duncan 2002; Debrezion et al. 2007; Hamidi et al. 2016; Mulley et al. 2016; Nelson and McClesky 1990; Nelson 1992; Nelson et al. 2015). In effect, station areas can become small scale downtowns. At the regional scale, major centers such as "Edge Cities" may emerge (Garreau 1991).

Refining the Standard Model to Include Externality Value

Theory often gets messy when confronting reality. In the case of the standard model of urban land rent, it may not always be the case that the revealed bid rent curve is downward sloping from the center. Instead, it can be upward sloping if the centers or nodes are sources of negative externalities. The concept of externalities as a necessary refinement to urban rent theory was hypothesized in 1977 by Richardson (1977) and expanded in 1980 by Li and Brown (1980). In 1990, Nelson and McClesky adapted these concepts to their analysis of single-family home values near heavy rail transit stations in Atlanta, Georgia (1990). Externalities can include environmental, physical, social, or other factors that reduce the attractiveness of being at or near the center (Nelson 1992). Their insights are reviewed here.

The urban land market capitalizes both "accessibility" value of rail station proximity as well as "externality" value associated with station noise, lights and glare, vehicle congestion during peak hours, and other nuisances. So long as accessibility value exceeds externality value, the urban land rent gradient will slope downward away from rail transit stations. However, it is possible for externality value to exceed accessibility value for reasons theorized by Richardson (1977), and Li and Brown (1980). Exhibit 1 shows potential relationships between transit stations considering both accessibility and externality value:

> The line R^a shows the land rent (R) curve with accessibility ("a") value from a rail transit station, u_0, outward to a point, u_1, where the accessibility effects of rail transit proximity are negligible, beyond which the overall market rent, unaffected by the presence of the rail transit station, R^m is revealed.
>
> Externality value of rail transit stations are shown in line R^n ("n" for negative externality). As distance from the rail station increases, the externality effects are reduced until they become zero at u^1.
>
> Accessibility and externality effects interact in the market leading to revealed positive or negative bid rent curves with respect to distance from rail transit stations to u_1. Line $R^a + R^n_1$ is revealed where overall accessibility effects outweigh externality effects. Line $R^a + R^n_2$ is revealed where overall externality effects outweigh amenity effects. Combined effects disappear at u_1 beyond which market rent, R^m ("m" for market) in the absence of accessibility and externality effects is revealed.

The literature addressing the combined effects of accessibility and externality values is inconclusive because it lacks systematic application of theoretical nuances we pose in this report.

The theoretical framework presented in Figure 1 can be disaggregated into at least four component parts that are revealed in the market and illustrated in exhibit 2 including:

> *Downward-sloping* relationship where rents fall as distance from stations increases in a liner or curvilinear form without an inflection point. This is the standard von Thünen/Alosno expectation. It reveals itself when there are no externality effects internalized in the market. This is a desirable real estate market outcome.
>
> *Upward-sloping* relationship where rents rise as distance from stations increases in a linear or curvilinear form without an inflection point. This may occur when the station itself is an unattractive location in the real estate market as development wants to position itself away from stations. This is an undesirable real estate market outcome.
>
> *Concave* relationship where externality value exceeds accessibility value at or near transit stations. As station distance increases, externality value dissipates as accessibility value associated with station proximity increases. At an inflection point, accessibility value

exceeds externality value. This is a signal that the market reflects externality value that might be overcome through better planning, station location, and station area urban design.

Convex relationship where rent falls with respect to transit station distance to an inflection point after which it rises. The implication is that transit station accessibility value exceeds externality value but at a declining rate to a point beyond which accessibility value is not revealed in the market.

While these are highly generalized relationships, they nonetheless help to describe transit station effects on real estate rent in the manner described in more detail later. Next is a review of research into the association between transit station proximity and real estate values reports mixed results.

Higgins and Kanaroglou offer the most complete review of studies into this relationship (2016 (see also Berawi et al. 2020; Zhang and Yen 2020). Nearly all studies focus on a particular metropolitan market, usually applied to a single mode, and frequently involving only a few to a few hundred cases. The vast majority of studies address associations between single-family home sales prices and proximity to transit stations even though transit stations are usually located in high intensity commercial and multifamily nodes. Thus, it is difficult to imagine credible transit station area policies and planning relying on just single-family home sales prices, but this seems to be the case. Very few studies assess the association between transit station proximity and office, retail, or multifamily values and those that do typically use a one-quarter mile (about 400 meters) to one-half mile (about 800 meters) buffer around transit stations assessing outcomes of properties within those circles compared to those outside.

The summary critique is that there is no coherent, systematic analysis of the relationship between transit station proximity by mode and the values of commercial real estate that dominate station areas such as office, retail, and multifamily properties. Research reported below closes this gap by addressing the following research question:

Is there an association between commercial real estate rent (per square meter) and proximity to rail transit stations holding other factors constant?

This is followed by a nuanced question:

If there is an association, is there evidence of negative externality or amenity effects with respect to transit station proximity?

The analytic framework guiding this report is presented next.

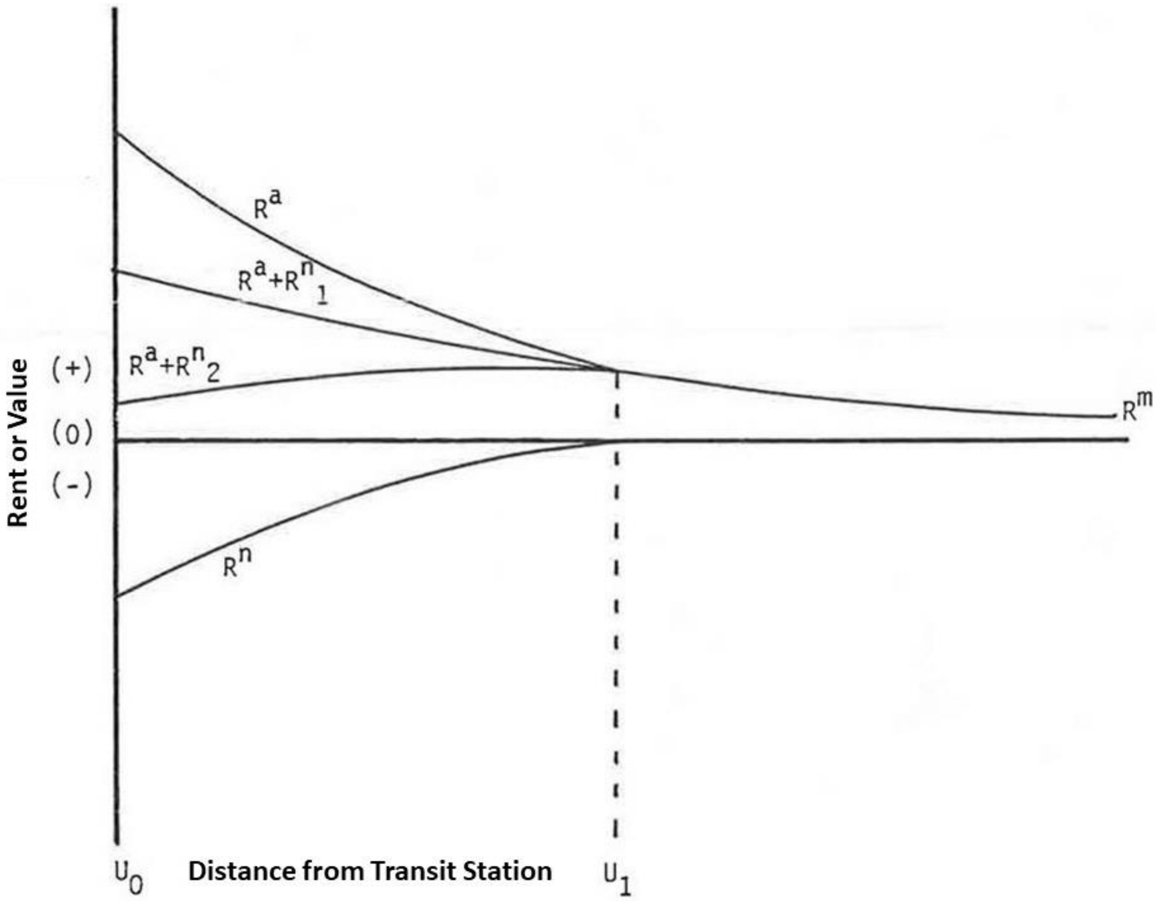

Exhibit 1
Amenity (R^a) and Externality (R^n) influences of transit stations/stops on proximate urban land rent (see text)
Source: Nelson and McClesky (1990).

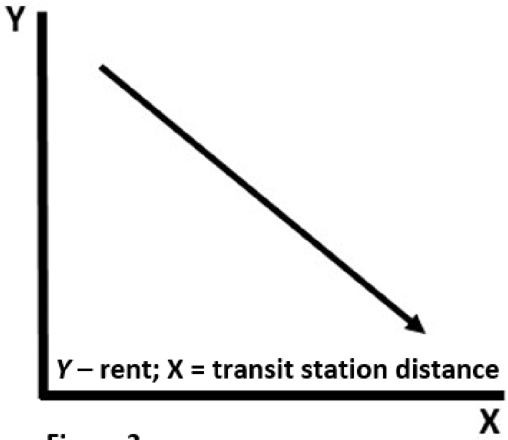

Figure 2a
Downward-sloping relationship where rents fall as distance from stations increases.

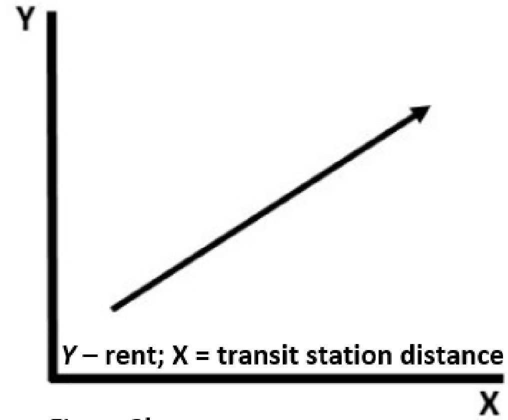

Figure 2b
Upward-sloping relationship where rents rise as distance from stations increases.

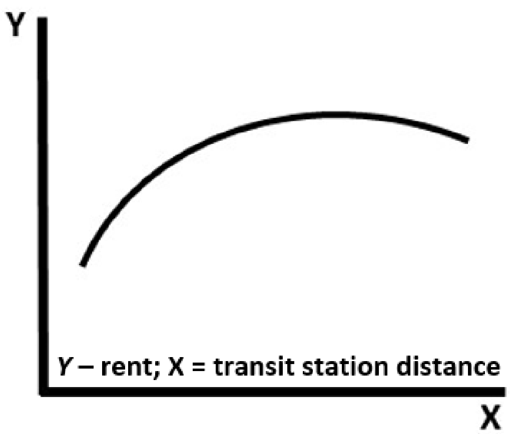

Figure 2c
Concave relationship where rents rise to an inflection point and then fall.

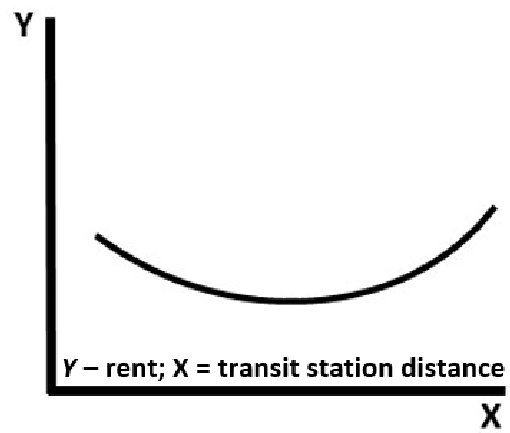

Figure 2d
Convex relationship where rents fall to an inflection point and then rise

Exhibit 2
Four alternative urban rent gradients with respect to transit station proximity
Source: Arthur C. Nelson

ANALYTIC FRAMEWORK

This report assesses how the distribution of jobs, demographic composition, commute mode, and transportation cost were influenced by transit station proximity between 2010 and 2019. It also assesses the relationship between transit station proximity and real estate values in 2019. The study period is thus between two of the most disruptive events in recent American history. The "Great Recession," which extended from December 2007 through June 2009, was the nation's most severe economic downturn since the Great Depression.[8] The was the COVID-19 global pandemic was the most severe since the "Spanish Flu" a century ago (Aassve et al. 2021). These twin economic disruptions changed financial markets on the one hand[9] and accelerated work-from-home trends on the other (Peiser and Hugel 2022). While the pandemic reduced transit ridership considerably as people worked from home to avoid crowds, ridership is recovering with many systems at or near pre-pandemic levels.[10] Indeed, the share of those working from home is also falling[11] although it seems unlikely that it will reach pre-pandemic levels for reasons noted in Peiser and Hugel (2022). Besides, the use of transit for commuting to work has always been exaggerated as non-work ridership is leading much of the transit recovery.[12]

The report assesses job, demographic, commuting, and real estate value outcomes with respect to 57 transit systems including 17 LRT, 11 SCT, 15 BRT, and 14 CRT systems (see exhibit 3) serving 42 metropolitan areas (see exhibit 4). Exhibit 5 compares key features of the five modes studied. The study does not include those systems operating in the complex, mature, and slow-growing "Megalopolis"[13] (Gottmann 1964) north of the Washington, DC metropolitan area or the very large metropolitan areas of Chicago, Los Angles, and San Francisco-Oakland that have complex transit networks that make it difficult to tease out differences between station areas served by overlapping systems. The selection of streetcar systems excluded "heritage" systems because they serve tourists primarily and have limited hours compared to standard systems. The exceptions are New Orleans and Tampa whose heritage systems operate during business hours and serve residents. The research includes the largest number of transit systems operating in the largest number of metropolitan areas that have been researched to date.

The overall study areas are called "transit regions" which are all the counties in a metropolitan area served by the transit mode being analyzed. Where a metropolitan area is served by more than one mode, the trans regions can vary. For instance, metropolitan Portland's LRT system serves three counties, its CRT system serves two, and its SCT system serves one.

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[8] For a review of causes and consequences, see https://www.federalreservehistory.org/essays/great-ecession-of-200709.

[9] For discussion on the longer term effects of the Great Recession on financial markets, see https://www.federalreservehistory.org/essays/great-recession-and-its-aftermath.

[10] Several perspective on COVI-19's effects on transit and recover are offered in https://www.brookings.edu/articles/ensuring-the-intertwined-post-pandemic-recoveries-of-downtowns-and-transit-systems/.

[11] For changing office market trends since COVID-19, see https://www.forbes.com/sites/davidmorel/2023/11/06/future-of-work-is-a-return-to-the-office-inevitable/?sh=6991f7f514fb.

[12] See note 3.

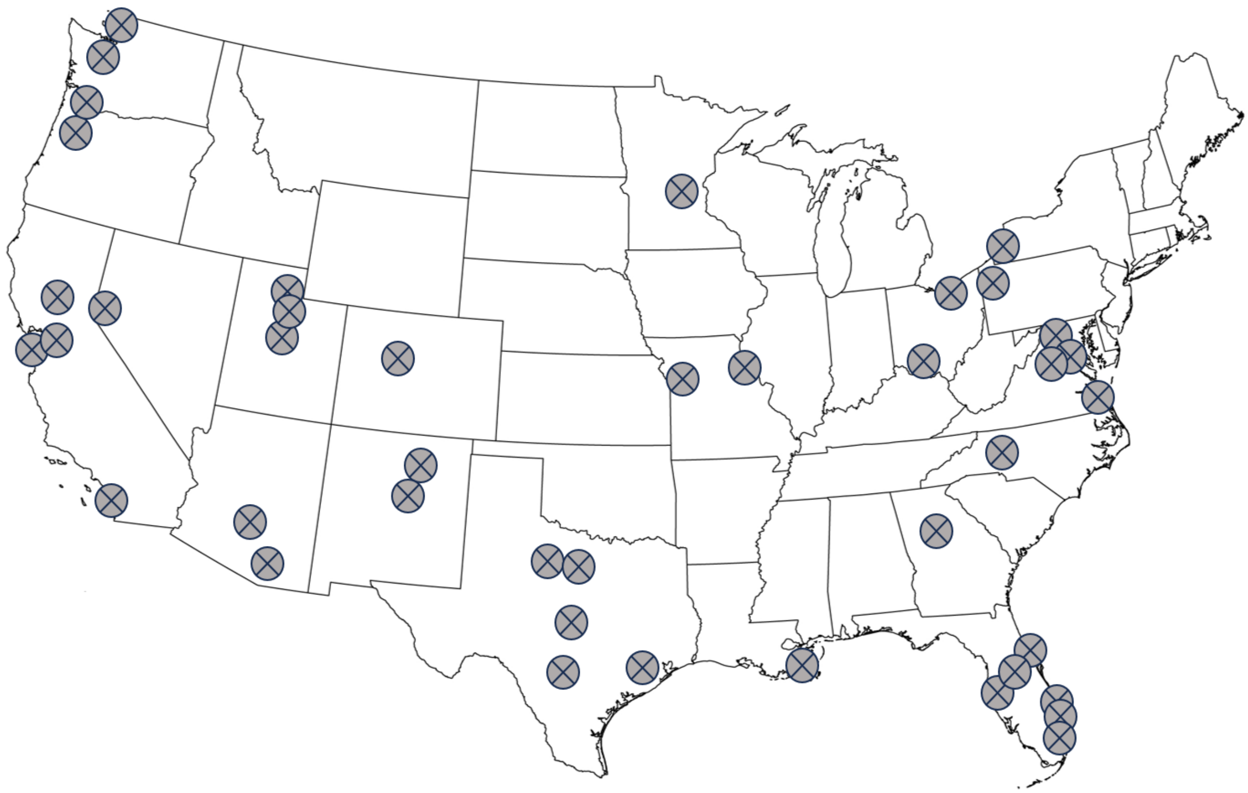
[13] In 2022, Megalopolis was home to about 50 million people occupying an area of land comparable to Iowa, about 56,000 square miles, which in 2022 was home to about 3 million people.

Exhibit 3
Transit Systems Studied with Abbreviations

Light Rail Transit—LRT	**Year**	**Streetcar Transit--SCT**	**Year**	**Bus Rapid Transit—BRT**	**Year**	**Commuter Rail Transit—CRT**	**Year**
BUF Buffalo	1984	**ATL** Atlanta	2014	**ABQ** Albuquerque*	2017	**ABQ** Albuquerque-Santa Fe	2006
CHR Charlotte	2007	**CIN** Cincinnati	2016	**AA** Arlington/Alexandria	2014	**AUS** Austin	2010
CLE Cleveland	1980	**DAL** Dallas	2015	**CLE** Cleveland	2008	**DFW** Dallas-Fort Worth	1996
DAL Dallas	1996	**KC** Kansas City	2016	**ESP** Eugene-Springfield	2007	**MIA** Miami SE Florida	1989
DEN Denver	1994	**PDX** Portland	2001	**KC** Kansas City	2005	**MIN** Minneapolis	1997
HOU Houston	2004	**SLC** Salt Lake City	2013	**MSP** Minneapolis-St. Paul	2016	**NSH** Nashville	2006
MSP Minneapolis-St. Paul	2004	**SEA** Seattle	2007	**NSH** Nashville	2009	**ORL** Orlando-Daytona	2014
NOR Norfolk	2011	**TAC** Tacoma	2003	**PHX** Phoenix	2009	**PDX** Portland	2009
PHX Phoenix	2008	**TAM** Tampa	2002	**PIT** Pittsburgh	1977	**SLC** Salt Lake City	2008
PIT Pittsburgh	1984	**TUS** Tucson	2014	**RNO** Reno	2010	**SD** San Diego	1995
SAC Sacramento	1987			**SLC** Salt Lake City	2008	**SJS** San Jose-Stockton	1998
PDX Portland	1986			**SA** San Antonio	2012	**SEA** Seattle-Tacoma	2000
SLC Salt Lake City	1999			**SD** San Diego	2014	**WDC** Washington DC	1984
SD San Diego	1981			**SEA** Seattle	2010	**WMDW** Washington – MARC**	1984
SJ San Jose	1987			**STK** Stockton	2007	**WVRE** Washington – VRE**	1992
SEA Seattle	2003						
STL St. Louis	1993						

*The Albuquerque BRT system started in 2017 but was suspended and restarted in 2019 because of rolling stock issues.
** WMDW means Maryland Area Rail Commuter (MARC) west route extending from Washington DC into Montgomery County and westerly to its terminus in West Verginia. WVRE means the Virginia Railway Express (VRE) routes connecting to Washington DC.
Source: Authors

Exhibit 4
Metropolitan Areas Serviced by Transit Systems Studied



Source: Authors

Exhibit 5
Key Features of Transit Modes Studied

Bus Rapid Transit (BRT)	
Right-of-way	Shared or dedicated lanes
Rolling Stock	Standard and articulated
Station Spacing	1 kilometer or more
Hourly Capacity	6,000-9,000
Typical Seats	75 per bus
Typical Length	2-30 kilometers
Typical Max. Speed	100 kph

Light Rail Transit (LRT)	
Right-of-way	Exclusive rail
Rolling Stock	1 to 4 cars
Station Spacing	1 to 5 kilometers or more
Hourly Capacity	18,000-20,000
Typical Seats	25 per car
Typical Length	10-100 kilometers
Typical Max. Speed	90 kph

Streetcar Transit (SCT)	
Right-of-way	Mixed flow
Rolling Stock	1 to 2 cars
Station Spacing	2-3 blocks to 1 kilometer
Hourly Capacity	1,500-7,500
Typical Seats	120 per car
Typical Length	5-15 kilometers
Typical Max. Speed	40 kph

Commuter Rail Transit (CRT)	
Right-of-way	Primarily with freight rail
Rolling Stock	1 to 4 cars
Station Spacing	10-25 kilometers or more
Hourly Capacity	60,000-90,000
Typical Seats	170 per car
Typical Length	30-150 kilometers
Typical Max. Speed	120 kph

Images from the top:
https://nitc.trec.pdx.edu/news/bus-rapid-transit-brt-boosts-property-values-eugene-oregon
https://www.oregonmetro.gov/max-tunnel-study
https://postdoc.arizona.edu/resources/transportation-and-parking
https://commons.wikimedia.org/wiki/File:Front_Runner_(1141456610).jpg
Note: Key features are composites of parameters assembled by the authors.

The individual study areas are divided further into census block groups (CBGs) that encompass the station itself ("station band") which extend roughly 200 meters outward depending on CBG geographies, the area between the station band and 400 meters away (the "400-meter band"), and the area between that and 800 meters from the station (the "800-meter band"). Collectively, these three bands constitute "station areas" that extend to 800 meters from transit stations.

These station area bands comprise very small shares of their transit regions, being less than one tenth of one percent for station bands, less than three tenths of one percent for the bands 400 meters from stations, and less than one percent for the entire 800-meter station area for LRT and BRT systems, and less than half that for SCT and CRT systems because of their limited number of stations.

Data for jobs is provided annually from the Longitudinal Employment-Household Dynamics database.[14] This study updates prior work using LEHD data that extended during the 2000s to the Great Recession and to the middle 2010s. It also includes more metropolitan areas and more transit modes than any prior study.

To date, no research has shown the relationship between transit station proximity and change over time with respect to population generally or in terms of race/ethnicity, households by age and type, housing tenure and median household income, and commute mode. This report does so American Community Survey (ACS) 5-year sample data.[15] Research reported below uses ACS 5-year data at the block group[16] level to measure change in these dimensions over time in 100-meter distance bands. The analytic protocol is described later. The ACS study periods are 2010-2014 and 2015-2019. Where just 2014 or 2019 is used in the ACS context, it means the respective sampling years.

Prior research into the change in jobs is limited to the first half-mile from transit stations using the Longitudinal Employment-Household Dynamics (LEHD) database.[17] LEHD are annual and recorded at the level of the census block. However, to conform to ACS 5-year sample geographies, census blocks are assembled into block groups using the protocols described below. Unlike the ACS, the LEHD is for each year. The study period used in this research is 2010 to correspond with the first year of the 2010-2014 ACS, and 2019 to correspond with the last year of the 2015-2019 ACS.

For vehicle kilometers traveled (VKT) and associated transportation costs with respect to LRT station proximity, this report uses version 3 of the US Department of Housing and Urban Development's Location Affordability Index (LAI).[18] Because of these data, this report is the first to show that transit station proximity reduces VKT for several types of households.

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[14] https://lehd.ces.census.gov/.
[15] For a review, see https://www.census.gov/data/developers/data-sets/acs-5year.html.
[16] Census block groups are comprised roughly of four to ten census blocks with considerable variation at the lower and higher end. For a description, see https://www2.census.gov/geo/pdfs/reference/GARM/Ch11GARM.pdf.
[17] For an orientation, see https://lehd.ces.census.gov/.
[18] https://www.hudexchange.info/programs/location-affordability-index/.

Proprietary rent data provided from CoStar data is used to estimate the market rent premium for transit station proximity for office, retail, and multifamily rental property for the year 2019, the year before the COVID-19 pandemic.

It is acknowledged that this research is not a counterfactual analysis in that one cannot know what would have happened in the absence of transit station intervention. Transit stations are usually placed in existing, built-up urban and suburban areas. Moreover, transit stations are not randomly selected but are instead an outcome of a decision-making process that chooses them from among many options. There is thus selection bias. Nonetheless, the aim of this analysis is to assess whether there is an association between transit stations and outcomes in terms of attracting jobs and people, reducing transportation cost, reducing dependency on the automobile for commuting, and influencing the value of real estate with respect to distance from transit stations.

As noted earlier, the research needs to be placed in a temporal context. The analysis is based on the period after the Great Recession of 2007–09 and before the COVID-19 pandemic of 2020–23. The study thus avoids analytic complications associated with disruptive economic events. As such, the work may be viewed as the benchmark period that provides context for analysis addressing pandemic and post pandemic outcomes. The nature of market responses to transit station proximity during this period can be used to frame guidance for transit station and land use planning during the post pandemic period.

Except for the regression analyses, descriptive analysis is used where changes are measured numerically and converted into percentages and ratios as the context warrants. All differences in change over the time periods are significant to at least $p < 0.10$ of the two-tailed t-test. Descriptive statistical tests and outcomes are thus not reported for brevity. Significance tests are shown and interpreted for regression analyses, however.

The next section assesses transit station proximity outcomes with respect to jobs.

Transit Station Proximity and Change in Jobs by Economic Group

This section presents results from a national analysis of the extent to which transit station proximity influences employment near those stations generally and for broad economic groups. It starts with the research design, data, and analytic method, followed by results and interpretations along with implications for post pandemic transit policy and planning. To summarize key points made earlier, there is scant research into the association between change in jobs and transit station proximity. The research questions guiding research presented here are:

> Is there an association between transit station proximity and an increase in jobs?
>
> If so, does this association vary by economic sector?

The null hypotheses relating to both questions assert no difference in the concentration of jobs with respect to transit station proximity over time.

Research Design, Data, and Analytic Method

The research questions lend themselves to quasi-experimental cross-section longitudinal analysis. The study period and study areas were described above. The data and methods used are reviewed below.

The data come from the LEHD for the years 2010 and 2019. Although data are available at the census block level, they are assembled to the block group level for comparability with ACS 5-year sample data (see above). Combing census blocks in this way also adds cases that might be too small in numbers at just the block level.

LEHD data are assembled into economic groups comprised of economic sectors shown in exhibit 6. These groups were selected because they align with common, large-scale land use categories for planning purposes. As such, they do not include natural resources sectors such as agriculture, forestry, fishing and mining, or construction because its employment is transient.

The analytic method uses a location quotient-type measure to show the relative change in concentration over time between the base year, 2010, and the end year, 2019. This is called a ***station quotient*** (SQ) because the analysis focuses on change in concentrations over time with respect to station proximity. Change in concentration over time is compared to "transit regions" which are all the counties in a metropolitan area served by the specific transit system being analyzed. That is, over time, does the concentration of jobs relative to the transit region increase (SQ > 1.0) or decrease (SQ < 1.0)?

The analysis is divided into distance bands from transit stations as follows. The "station band" includes block groups that overlap the transit station. Because block groups are comprised of about four to ten census blocks, their spatial extent covers up to the first two city blocks from the station. Although there is no standard size for a city block, a common width is about 300 to 360 feet[19] or roughly 100 meters. Units of 100 meters are used in the analysis.

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[19] See https://www.vintageisthenewold.com/game-pedia/what-is-the-average-size-of-a-city-block.

Exhibit 6
Assignment of Economic Sectors into Economic Groups for Analysis

NAICS	Economic Sector and Combination into Economic Groups
	Industrial
22	Utilities
	Manufacturing
42	Wholesale Trade
t	Transportation and Warehousing
	Retail, Food, Lodging
44-45	Retail Trade
72	Accommodation and Food Services
	Office
51	Information
52	Finance and Insurance
53	Real Estate and Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support and Waste Management and Remediation Services
81	Other Services (except Public Administration)
92	Public Administration
	Education
61	Educational Services
	Health
62	Health Care and Social Assistance
	Entertainment
71	Arts, Entertainment, and Recreation

Source: North American Industrial Classification System (NAICS) adapted by Arthur C. Nelson.

The second distance band extends up to 400 meters (about one quarter mile) from the transit station. The third distance band extends up to 800 meters (about one half mile) from the station. The scheme offers a simple way in which to measure and display change over time. In keeping with the "half-mile circle" commonly used in transit-oriented development (TOD) planning (Guerra, Cervero and Tischler 2012), analysis does not extend beyond 800 meters. Results are reported cumulatively for each distance band meaning the 800-meter band includes data for the station band and the 400-meter band plus the increment from 400 to 800 meters. This is done for brevity in reporting. As will be seen, the very largest share of change occurs within the station band with a smaller share occurring between it and the 400-meter band with often very little, no, or even negative change in the 400-to 800-meter increment. Summary exhibits are reported below while exhibits for each system for each mode are reported in the appendices.

Lastly, although statistical tests of significance are not reported in the exhibits, in fact all differences are significant to at least the 0.10 level of the two-tailed t-test. One reason for this is that the data themselves are not samples but rather reasonably accurate counts based on data reported by firms.[20]

Results and interpretations are offered next.

Results and Interpretations

Exhibit 7 shows descriptive results of job change by economic group between the economic disruptions, 2010-2019. For all modes, the share of jobs attracted to the area within 800 meters from transit stations are:

- Nearly one million new jobs or 28 percent of the LRT transit regions;
- Nearly 300,000 new jobs or 19 percent of the SCT transit regions;
- More than 600,000 new jobs or 28 percent of the BRT transit regions; and
- More than 600,000 new jobs or 20 percent of the CRT transit regions.

These would seem to be impressive outcomes given that LRT and BRT station areas comprise less than one percent of their transit regions while SCT and CRT stations comprise less than half of this. Perhaps even more impressive is the share of new jobs with just the innermost station band given these areas comprise less than one tenth of one percent of their transit regions. On the other hand, with SQs of less than 1.0, all bands *lost share* of change in jobs relative to their transit regions.

With variations in magnitudes, all station bands added jobs in all economic groups. The weakest group was the industrial group perhaps because it is more dependent on large areas of land that is expensive near transit stations. Education was weak in the first two distance bands perhaps for the same reason. The arts-entertainment-recreation group was the strongest.

Although job outcomes are notable in showing that transit station areas attract a disproportionate share of jobs to them, the trend does not extend to the closest station band. Indeed, jobs in the

[20] See https://lehd.ces.census.gov/data/.

education economic group fell for proximity to LRT, SCT and CRT stations and gained only slightly for proximity to BRT stations. In contrast, demographic changes were more impressive in the first and second station bands, as will be seen later. To some extent, people may be pushing jobs away from distance bands closest to transit stations.

Appendix Exhibit A provides station quotients for each of the LRT, SCT, BRT, and CRT systems studied. Readers can focus on those systems of interest to them. Selected observations are offered below.

Among LRT systems (see Appendix Exhibit A-1), Charlotte and Denver stand out for having SQs > 1.0 for most economic groups in most of the distance bands with many SQs well over 1.1. In contrast, Norfolk, Phoenix, and Pittsburgh fared least well. Nearly all systems gained higher shares of new jobs in the arts-entertainment-recreation economic group than their transit regions, and most did better in the retail-food-lodging economic group as well. On the other hand, for most LRT systems, outcomes lagged their transit regions in the office, education, and health economic groups. An interesting outcome is strong performance in the industrial economic group by many systems. One reason is that such things as brew pubs, bakeries, and fashion are classified as types of manufacturing.

Because they serve mostly just downtowns and nearby areas, SCT systems as a whole have a far smaller reach into their transit regions than LRT and BRT systems (see Appendix Exhibit A-2). It is thus not too surprising that their overall share of new jobs is less than the other modes. The individual systems of Portland and Seattle, and somewhat less so Tacoma, fared best among the 13 SCT systems studied. The Washington DC system also performed well in the bands farther away from transit stations. Several other systems performed well in the arts-entertainment-recreation group perhaps because SCT systems prioritize accessibility to those venues. These include Cincinnati, Salt Lake City, and Tucson. Overall, Atlanta's SCT system performed least well.

With few exceptions, BRT outcomes (see Appendix Exhibit A-3) are weak in that SQs are less than 1.0 meaning employment change lags behind their transit regions. Only the San Diego, Settle, and Alexandria-Arlington BRT systems have SQs of more than 1.0 across most economic groups. The Eugene-Springfield system performs the weakest followed by Stockton and Albuquerque. The latter's system, launched in 2017, was closed shortly thereafter and reopened in 2019 because of rolling stock manufacturing failures which may explain its economic performance. On the other hand, Albuquerque's demographic outcomes are mostly positive as will be seen below. By far the best-performing economic group was arts-entertainment-recreation which has SQs of over 1.0 across most systems.

Among CRT systems (see Appendix Exhibit A-4), Dallas-Fort Worth, Minneapolis-St. Paul, and San Jose-Stockton performed best during the study period. Many others did well such as Albuquerque-Santa Fe, Miami, Portland, Salt Lake City, and San Diego. Indeed, no CRT system produced weak outcomes relative to their transit regions in that very few SQs are below 0.80 and all had SQs of more than 1.0 in at least two economic groups. The best performing economic groups overall are retail-food-lodging and arts-entertainment-recreation. The industrial and office economic groups also performed well with a few exceptions.

In all cases, one must remember that the station band land areas are very small relative to their transit regions, meaning that what would appear to be a small SQ nonetheless reflects an important share of all new transit region jobs attracted to station areas. Thus, for example, where BRT performance lagged other modes, in the scheme of regional development patterns it was performing impressively despite serving station areas that accounted for very small portions of their transit regions.

The association between transit station proximity and change in wages during the study period is next.

Exhibit 7
Change in Jobs, Share of Change by Transit Station Band, and Station Quotients

Measure	LRT	SCT	BRT	CRT
Total				
Job Change (000s)	3,545.4	1,548.8	2,061.7	3,122.6
Station Band	428.1	80.8	385.1	267.2
400m Band	828.7	216.5	518.0	478.7
800m Band	990.6	287.8	612.7	639.7
Station Share	12%	5%	17%	9%
400m Share	23%	14%	24%	15%
800m Share	28%	19%	28%	20%
Station Quotient	0.94	0.91	0.96	0.99
400m Quotient	0.98	0.95	0.95	0.99
800m Quotient	0.97	0.98	0.96	0.98
Industrial				
Job Change (000s)	420.4	178.6	237.8	385.6
Station Band	26.1	6.4	27.8	58.4
400m Band	68.9	1.7	39.8	93.3
800m Band	66.9	3.3	48.9	102.1
Station Share	6%	4%	12%	15%
400m Share	16%	1%	17%	24%
800m Share	16%	2%	21%	26%
Station Quotient	0.92	0.96	0.96	1.05
400m Quotient	0.96	0.87	0.96	1.04
800m Quotient	0.94	0.88	0.96	1.00
Office				
Job Change (000s)	1,319.0	691.0	744.6	1,013.5
Station Band	214.6	56.7	179.1	116.1
400m Band	407.4	145.3	198.4	172.9
800m Band	456.8	172.5	236.7	252.2
Station Share	16%	8%	24%	11%
400m Share	31%	21%	27%	17%
800m Share	35%	25%	32%	25%
Station Quotient	0.95	0.92	0.98	1.02
400m Quotient	0.98	0.97	0.95	0.96
800m Quotient	0.97	0.99	0.96	0.97
Education				
Job Change (000s)	128.4	56.0	66.3	118.5
Station Band	(2.9)	(17.4)	4.8	(31.1)
400m Band	22.4	(7.9)	13.6	(1.3)
800m Band	29.3	23.7	17.2	3.9
Station Share	-2%	-31%	7%	-26%
400m Share	17%	-14%	21%	-1%
800m Share	23%	42%	26%	3%

Exhibit 7
Change in Jobs, Share of Change by Transit Station Band, and Station Quotients—continued

Measure	LRT	SCT	BRT	CRT
Education				
Station Quotient	0.91	0.75	0.96	0.72
400m Quotient	0.98	0.87	0.98	0.91
800m Quotient	0.98	1.04	0.98	0.93
Health				
Job Change (000s)	626.5	175.3	427.2	512.0
Station Band	88.2	1.9	48.5	27.9
400m Band	129.2	15.4	93.9	52.4
800m Band	167.2	14.2	112.7	81.6
Station Share	14%	1%	11%	5%
400m Share	21%	9%	22%	10%
800m Share	27%	8%	26%	16%
Station Quotient	0.98	0.86	0.88	1.03
400m Quotient	0.96	0.92	0.92	1.02
800m Quotient	0.96	0.90	0.92	1.02
Retail-Food-Lodging				
Job Change (000s)	577.2	276.7	744.6	646.3
Station Band	61.6	20.8	179.1	53.2
400m Band	113.8	40.6	198.4	90.4
800m Band	146.9	44.0	236.7	111.0
Station Share	11%	8%	24%	8%
400m Share	20%	15%	27%	14%
800m Share	25%	16%	32%	17%
Station Quotient	0.99	0.99	0.98	1.06
400m Quotient	1.01	1.03	0.95	1.04
800m Quotient	1.01	1.02	0.96	1.02
Arts-Entertainment-Recreation				
Job Change (000s)	79.1	41.7	61.7	95.4
Station Band	15.9	6.4	19.7	10.5
400m Band	29.3	12.1	22.1	18.3
800m Band	32.0	17.0	24.2	21.1
Station Share	20%	15%	32%	11%
400m Share	37%	29%	36%	19%
800m Share	41%	41%	39%	22%
Station Quotient	0.99	1.00	1.14	1.19
400m Quotient	1.05	1.09	1.04	1.14
800m Quotient	1.04	1.17	1.03	1.07

TRANSIT STATION PROXIMITY AND CHANGE IN WAGES

As noted earlier, an underlying objective of transit systems and their stations is to provide access to lower-wage jobs for lower-income households. This section explores the extent to which jobs by lower-, middle- and upper-wage categories changed with respect to transit station proximity during the study period.

The research question is:

> Is there an association between transit station proximity and change in concentration of jobs with respect to wages?

The null hypothesis asserts no difference in the concentration of jobs by wager category during the study period.

Research Design, Data, and Analytic Method

The research question lends itself to quasi-experimental cross-section longitudinal analysis. The data and methods used are reviewed below.

LEHD data are assembled into higher-, middle-, and lower-wage categories in roughly one-third allocations as shown in exhibit 8. Results and interpretations are discussed next.

Results and Interpretations

The change in jobs by wage category for each mode is reported in exhibit 9. Appendices exhibits B-1 through B-4 summarize reports for each system within each mode. Key findings from them will be highlighted below.

One observation stands out: transit region jobs in lower-wage category fell during the study period as well as for all station bands. Reasons are not immediately clear other than such jobs may have migrated to areas outside transit station areas and transit regions themselves. The most interesting outcome is that station areas as a whole gained share of higher-wage jobs while middle-income jobs lost the largest share of change. Although lower-wage jobs declined overall, SQs indicate that station areas nearly kept pace with their share of those jobs. In effect, higher-wage jobs gained regional share, middle-income jobs lost regional share, and lower-income jobs mostly maintained share of regional jobs.

These findings are not consistent with transit objectives, but they are consistent with economic expectations. By improving accessibility, transit stations should increase real estate values for the reasons explained above. To justify higher values, firms must improve their productivity and as such must hire workers with skills to do so. That means firms locating transit stations will tend to seek higher-skilled and thus higher-wage workers. At the other end of the spectrum, lower wage jobs would be priced out of locations proximate to transit stations.

Exhibit 8
Assignment of Economic Sectors into Wage Groups for Analysis

NAICS	Description	Mean Annual Wages	Category
44	Retail Trade	$25,779	Lower
71	Arts, Entertainment, and Recreation	$32,188	Lower
72	Accommodation and Food Services	$17,453	Lower
81	Other Services (except Public Administration)	$29,021	Lower
Weighted Mean Wages and National Share of Jobs		*$23,696*	*31%*
48	Transportation and Warehousing	$45,171	Middle
53	Real Estate and Rental and Leasing	$46,813	Middle
56	Administrative, Support, Waste Mgmt., Remediation	$35,931	Middle
61	Educational Services	$35,427	Middle
62	Health Care and Social Assistance	$44,751	Middle
Weighted Mean Wages and National Share of Jobs		*$41,723*	*35%*
22	Utilities	$94,239	Upper
31	Manufacturing	$54,258	Upper
42	Wholesale Trade	$65,385	Upper
51	Information	$83,677	Upper
52	Finance and Insurance	$88,677	Upper
54	Professional, Scientific, and Technical Services	$75,890	Upper
55	Management of Companies and Enterprises	$105,138	Upper
Weighted Mean Wages and National Share of Jobs		*$70,490*	*34%*

Source: County Business Patterns, 2013.

Exhibit 9
Change in Jobs by Wage Group by Mode and Transit Station Band with Station Quotients

Measure	LRT	SCT	BRT	CRT
Upper-Wage Job Change				
Upper-Wage (000s)	1,144.2	510.6	681.5	838.5
Station Area	209.9	47.6	139.7	104.7
To 400m	371.2	106.2	209.2	190.8
To 800m	393.7	114.3	246.8	250.5
Station Share	18%	9%	21%	12%
To 400m Share	32%	21%	31%	23%
To 800m Share	34%	22%	36%	30%
Station Quotient	0.99	0.97	0.98	1.04
To 400m Quotient	1.02	1.02	1.00	1.04
To 800m Quotient	1.00	1.02	1.00	1.02
Middle-Wage Job Change				
Middle-Wage (000s)	2,451.3	962.5	1,565.1	2,200.4
Station Area	322.3	70.0	301.6	166.5
To 400m	534.7	178.9	413.9	304.1
To 800m	659.5	238.8	487.7	390.5
Station Share	13%	7%	19%	8%
To 400m Share	22%	19%	26%	14%
To 800m Share	27%	25%	31%	18%
Station Quotient	0.85	0.86	0.91	0.90
To 400m Quotient	0.87	0.92	0.89	0.86
To 800m Quotient	0.88	0.98	0.89	0.84
Lower-Wage Job Change				
Lower-Wage (000s)	(442.6)	(53.8)	(315.9)	(267.6)
Station Area	(128.7)	(42.7)	(101.3)	(36.4)
To 400m	(134.8)	(77.9)	(152.9)	(68.9)
To 800m	(154.0)	(78.5)	(183.2)	(69.2)
Station Share	*loss*	*loss*	*loss*	*loss*
To 400m Share	*loss*	*loss*	*loss*	*loss*
To 800m Share	*loss*	*loss*	*loss*	*loss*
Station Quotient	0.93	0.85	0.97	0.96
To 400m Quotient	0.98	0.84	0.96	0.96
To 800m Quotient	0.98	0.86	0.96	0.98

Exhibit 9 supports economic expectations as opposed to policy aspirations. Indeed, the LRT 800-meter station areas accounted for 34 percent of all new higher-wage jobs in transit regions while BRT station areas accounted for 36 percent of the change and CRT station areas accounted for 30 percent. With their smaller footprint, SCT station areas accounted for 22 percent of the share of transit region higher-wage job change.

Middle-wage jobs accounted for more than two thirds of all the jobs added to station areas during the study period. While SCT station areas accounted for 25 percent of the change, the shares of change in middle-wage jobs were less in the other station areas with LRT at 27 percent, BRT at 31 percent, and CRT at 18 percent.

Outcomes for individual systems and modes are very different, however. Lower-wage jobs increased in two or more of the station bands in the Charlotte, Denver, Sacramento, Salt Lake City, San Jose, and San Diego LRT transit regions, even though among them only the Denver LRT transit region gained lower-wage jobs overall. The authors have personal knowledge of zoning, inclusionary housing, and other efforts used in all those transit regions. In this respect, lower-wage job policy aspirations are supported. In terms of upper-wage jobs, Charlotte, Cleveland, Portland, Seattle, and St. Louis gained higher shares of their transit regions than overall trends. Only Denver performed appreciably better overall in terms of middle-wage jobs.

In terms of SCT transit regions, only Cincinnati, New Orleans, Portland, Salt Lake City, Tacoma, and Washington DC gained lower-wage jobs in at least two station bands, and in all cases lower-wage jobs increased concentration over the study period. These outcomes are also consistent with policy aspirations. Otherwise, with a few exceptions, trends for individual systems followed overall lower-wage and middle-wage trends. Notable exceptions are Salt Lake City, Tacoma, and Tucson which lost higher-wage jobs during the study period, and Cincinnati and Kansas City which lost middle-wage jobs.

For BRT systems, the Nashville transit region was alone in adding lower-wage jobs in both the region and all three station bands. Eugene-Springfield also gained lower-wage jobs but they were located mostly away from transit stations. Although their regions lost lower-wage jobs, such jobs were added in at least two of the station bands in the Alexandria-Arlington and Salt Lake City transit regions. Among higher-wage jobs, only the Minneapolis-St. Paul transit region lost jobs in their transit station areas while Alexandria-Arlington and Cleveland were alone in losing middle-income jobs in their transit station areas.

Despite results overall showing declining lower-wage jobs in CRT transit regions, they increased in most of the CRT transit station areas. Moreover, transit station areas in those regions also increased their concentration of such jobs. Otherwise, CRT transit regions mostly followed overall trends for upper- and middle-wage jobs.

The discussion on commuting below will draw a relationship between lower- and middle-wage jobs and commuting costs incurred by selected households with respect to transit station proximity. Demographic changes and gentrification implications are presented next.

TRANSIT STATION PROXIMITY AND DEMOGRAPHIC CHANGE WITH SPECIAL REFERENCE TO GENTRIFICATION

This section assesses the association between transit station proximity and change in several demographic indictors generally. It also notes the rise of limited gentrification over the study period. The relevant research questions in this context are:

> During the study period, did the population change generally and if so, did the demographic composition of the population and households also change over time in terms of household type, householder age, median household income, and housing tenure?
>
> In addition, during the study period, is there evidence of gentrification and if so, does it vary by transit mode and system?

The null hypotheses relating to both questions assert no difference in the concentration over time with respect to transit station proximity and those features. The section proceeds with a review of the research design, data, and analytic methods.

Research Design, Data, and Analytic Method

As with the analysis of jobs, the research questions lend themselves to quasi-experimental cross-section longitudinal analysis. Analysis is reported with respect to:

- Population in general as well as White (defined as white non-Hispanic) and Non-White persons;
- Households based on those with and without children and single persons;
- Householder age based on under 25 years of age, 25 to 44, 45 to 64, and 65 years of age of or older;
- Median household income; and
- Housing tenure (own or rent).

The study period and study areas were described above. The data and methods used are reviewed next.

The data come from the ACS 5-year samples for 2014 and 2019. The 2014 sample extends from 2010 through 2014 which starts the year after the Great Recession, while the 2019 sample covers the period 2015 through 2019 or before the Covid-19 pandemic. Data are for census block groups (CBGs). Because ACS 5-year samples cover 5-year periods, those data are presented in terms of 2010-2014 for the ACS 2014 survey and 2015-2019 for the ACS 2019 survey.

Descriptive analysis is used where changes are measured numerically, by share of change in percentages, and SQs (station quotients) as described above. As noted earlier, all differences in change over the time periods are significant to at least $p < 0.10$ of the two-tailed t-test.

Results and Interpretations

Exhibit 10 reports changes in population generally as well as change in White/Non-White population during the study period with respect to transit station proximity. Other exhibits assess change with respect to household type (Exhibit 11), householder age (Exhibit 12), and median household income and tenure (Exhibit 14). These exhibits report changes for all transit systems by mode. The appendices report changes by station band and station quotients for each transit system by mode. Readers are encouraged to study results of systems in which they are interested. Selected findings for individual systems are discussed below.

Overall perspectives based on Exhibits 10 and 11 are offered first. Recall that transit station bands comprise very small shares of their transit regions. For LRT and BRT regions, these are about one tenth of one percent (0.1 percent) for the station band, about three tenths of one percent (0.3 percent) to the 400-meter band cumulative from the station, and about one percent (1.0 percent) cumulative to the 800-meter, which is roughly equivalent to the half-mile circle. For SCT and CRT regions, the shares are about half of these.

These small land areas accounted for disproportionately large shares of their transit regions' population and household growth. Across the entire 800-meter station area, LRT systems accounted for 15 percent of the change in population and 20 percent in the change of households while SCT systems accounted for eight and 12 percent, BRT systems accounted for 31 and 40 percent, and CRT systems accounted for eight and 11 percent of population and household change, respectively. In all cases, the much smaller station bands accounted for disproportionately large shares of population and household change with the 400-meter band being second and the 800-metyer band having the lowest share.

When comparing these changes to changes in jobs across all station bands, one should see that population and households are gaining shares (SQs are greater than 1.0) while jobs across nearly all economic groups are losing share (SQs are less than 1.0). The inference is that people and households are out-competing jobs for location near transit stations. To the authors' knowledge, this finding has not been reported in literature.

Exhibit 10 also shows an interesting White/Non-White trend. Although Whites accounted for very small shares of transit regions' population change—in the order of four percent to 17 percent depending on the transit mode, they accounted for disproportionate shares of growth within the 800-meter transit station areas. Notably:

- Whites accounted for 13 percent of transit region population change but 35 percent of them located within LRT transit station areas;
- Whites accounted for 17 percent of transit region population change but 63 percent of them located within SCT transit station areas;
- Whites accounted for four percent of transit region population change but 63 percent of them located within BRT transit station areas; and
- Whites accounted for 11 percent of transit region population change but 43 percent of them located within CRT transit station areas.

On the other hand, except for SCT systems, Non-Whites dominated total population change at 65 percent for LRT systems, 88 percent for BRT systems, and 59 percent for CRT systems. They also accounted for 35 percent of the share of station area growth for SCT systems. Moreover, for all systems, White and Non-White changes in shares of population are proportionately the largest at the station band.

Appendix exhibits C-1 through C-4 report station quotients (SQs) for overall share of population change and White/Non-White shares of change. With few exceptions, the share of Whites locating within station areas exceed that of Non-Whites although in nearly all cases Non-Whites dominated the absolute change in population. The reason is that Whites accounted for small shares of total population growth.

Changes in shares of households by type are reviewed next.

Exhibit 11 tracks the change in households and households by type during the study period. With minor exceptions, households generally and for each type grew at a faster pace within the transit station areas than transit regions as a whole. This finding bolsters the assertion earlier that people and households are displacing jobs near transit stations, pushing them away from transit stations. An important finding is that households with children were attracted to LRT and CRT transit station areas to a greater extent than their transit regions. Although the numbers and shares are small, they are not trivial. Planners may need to consider including demand for households with children as part of future transit station and land use planning. Appendix exhibits D-1 through D-4 reinforce these overall findings for most of the systems studied.

Exhibit 12 reports on change in householders by age during the study period. Consistent with gentrification expectations, younger householders (under 25 years of age) were added to all station area bands even as the number of such households fell in the transit regions. On the other hand, the absolute number of such households moving into station areas comprised is a very small share of total household change, being no more than about four percent for SCT, BRT, and CRT systems and well under one percent for LRT systems. In contrast, the change in householders between 25 and 44 years of age and 65 and more years of age were roughly comparable in magnitude and dominated total household change. Appendix exhibits E-1 through E-4 report trends for individual systems which mostly follows overall trends reported in exhibit 12.

Are these findings limited to the study period after the Great Recession and before the pandemic? Or do they portend important shifts in residential location demand going forward?

Exhibit 10
Change in Population, Share of Change by Transit Station Band, and Station Quotients

Measure	LRT	SCT	BRT	CRT
Total Population				
Total Population	2,142,930	881,425	1,103,831	3,063,009
Station Band	128,264	38,713	107,117	105,665
400m Band	253,063	56,832	266,756	192,375
800m Band	326,407	74,221	340,815	250,962
Station Share	6%	4%	10%	3%
400m Share	12%	6%	24%	6%
800m Share	15%	8%	31%	8%
Station Quotient	1.07	1.14	1.01	1.15
400m Quotient	1.03	1.06	1.00	1.08
800m Quotient	1.01	1.04	1.00	1.04
White non-Hispanic Population ("White")				
Total White	276,023	145,593	44,437	325,615
Station Band	51,176	22,301	10,774	46,763
400m Band	91,100	35,355	32,087	73,936
800m Band	115,670	46,957	40,731	107,783
Station Share	19%	15%	24%	14%
400m Share	33%	24%	72%	23%
800m Share	42%	32%	92%	33%
Station Quotient	1.10	1.19	1.01	1.19
400m Quotient	1.06	1.12	1.01	1.11
800m Quotient	1.04	1.11	1.01	1.09
Non-White Population				
Total Non-White	1,866,907	735,832	1,059,394	2,737,394
Station Band	77,088	16,412	96,343	58,902
400m Band	161,963	21,477	234,669	118,439
800m Band	210,737	27,264	300,084	148,924
Station Share	4%	2%	9%	2%
400m Share	9%	3%	22%	4%
800m Share	11%	4%	28%	5%
Station Quotient	1.03	1.10	1.01	1.12
400m Quotient	1.00	0.99	0.99	1.06
800m Quotient	0.98	0.97	0.99	1.00

Exhibit 11
Change in Households by Type, Share of Change by Transit Station Band, and Station Quotients

Measure	LRT	SCT	BRT	CRT
Total Household Change				
Households (000s)	804,558	351,885	420,044	959,655
Station Band	64,741	19,424	55,292	45,360
400m Band	128,283	34,111	142,270	79,641
800m Band	163,561	41,176	167,764	105,770
Station Share	8%	6%	13%	5%
400m Share	16%	10%	34%	8%
800m Share	20%	12%	40%	11%
Station Quotient	1.10	1.13	1.03	1.20
400m Quotient	1.06	1.08	1.02	1.11
800m Quotient	1.03	1.06	1.01	1.07
Households with Children Change				
Households (000s)	90,597	33,930	5,707	98,614
Station Band	5,746	412	672	9,671
400m Band	7,438	205	(2,503)	13,643
800m Band	5,800	(78)	(1,628)	16,476
Station Share	6%	1%	12%	10%
400m Share	8%	1%	-44%	14%
800m Share	6%	-0%	-29%	17%
Station Quotient	1.04	1.02	1.00	1.18
400m Quotient	1.00	0.99	0.99	1.08
800m Quotient	0.99	0.98	0.99	1.05
Households without Children				
Households (000s)	713,961	317,955	414,337	861,041
Station Band	58,995	19,012	54,620	35,689
400m Band	120,845	33,906	144,773	65,998
800m Band	157,761	41,254	169,392	93,808
Station Share	8%	6%	13%	4%
400m Share	17%	11%	35%	8%
800m Share	22%	13%	41%	11%
Station Quotient	1.11	1.13	1.03	1.20
400m Quotient	1.07	1.08	1.03	1.11
800m Quotient	1.04	1.05	1.02	1.07

Exhibit 11
Change in Households by Type, Share of Change by Transit Station Band, and Station Quotients—continued

Measure	LRT	SCT	BRT	CRT
Single-Person Households				
Households (000s)	200,162	101,207	110,102	188,144
Station Band	25,897	10,200	21,060	15,828
400m Band	53,637	19,853	53,368	29,462
800m Band	64,806	21,935	56,837	40,265
Station Share	13%	10%	19%	8%
400m Share	27%	20%	48%	16%
800m Share	32%	22%	52%	21%
Station Quotient	1.11	1.12	1.04	1.23
400m Quotient	1.08	1.10	1.02	1.15
800m Quotient	1.05	1.06	1.01	1.10

Exhibit 12
Change in Households by Age, Share of Change by Transit Station Band, and Station Quotients

Measure	LRT	SCT	BRT	CRT
Total Households with Householders Under 25 Years of Age				
Households (000s)	(34,505)	(11,658)	(16,814)	(70,999)
Station Band	2,707	752	3,159	1,939
400m Band	2,431	2,276	7,999	1,292
800m Band	403	1,406	6,873	3,931
Station Share	Na	Na	Na	Na
400m Share	Na	Na	Na	Na
800m Share	Na	Na	Na	Na
Station Quotient	1.17	1.14	1.13	1.46
400m Quotient	1.11	1.17	1.12	1.22
800m Quotient	1.07	1.10	1.09	1.26
Total Households with Householders 25-44 Years of Age				
Households (000s)	222,606	124,080	127,184	183,461
Station Band	34,518	11,657	24,756	19,948
400m Band	63,621	19,838	66,697	34,505
800m Band	79,519	25,246	77,088	46,478
Station Share	16%	9%	19%	11%
400m Share	29%	16%	52%	19%
800m Share	36%	20%	61%	25%
Station Quotient	1.15	1.18	1.05	1.24
400m Quotient	1.09	1.12	1.04	1.15
800m Quotient	1.06	1.10	1.03	1.11
Total Households with Householders 45-64 Years of Age				
Households (000s)	156,087	56,252	21,248	228,247
Station Band	14,236	2,287	4,816	14,315
400m Band	25,191	3,979	7,287	23,934
800m Band	31,449	3,798	9,375	32,522
Station Share	9%	4%	23%	6%
400m Share	16%	7%	34%	10%
800m Share	20%	7%	44%	14%
Station Quotient	1.09	1.06	1.01	1.21
400m Quotient	1.04	1.04	1.00	1.11
800m Quotient	1.02	1.01	1.00	1.08

Exhibit 12
Change in Households by Age, Share of Change by Transit Station Band, and Station Quotients—continued

Measure	LRT	SCT	BRT	CRT
Total Households with Householders 65 Year or More Years of Age				
Households (000s)	460,370	183,211	288,426	618,946
Station Band	13,280	4,728	22,561	9,158
400m Band	37,040	8,018	60,287	19,910
800m Band	52,190	10,726	74,428	34,342
Station Share	3%	3%	8%	1%
400m Share	8%	4%	21%	3%
800m Share	11%	6%	26%	6%
Station Quotient	1.03	1.16	1.00	1.08
400m Quotient	1.02	1.06	0.99	1.03
800m Quotient	0.99	1.03	0.99	1.02

Note: Because the number of householders under 25 years of age decreased in transit regions during the study period but increased in all station area bands, the shares of station area change are noted as “Na” or not applicable.

Household attraction to transit stations is consistent with the emerging market demand for walkable communities, transit accessible communities, and “missing middle housing” communities (Nelson 2012, 2013, 2020; Parolek with Nelson 2020). For instance, the National Association of Realtors (NAR) periodically produces a “Community Preference Survey” (CPS). Since 2013, the NAR’s CPS has been applied to the nation’s 50 largest metropolitan statistical areas which account for most of the nation’s population and growth. It includes 2,000 adults of 18 years or older. The survey method used is called “stated preference” meaning that given a narrow set of plausible though opposite choices, which one would the respondent prefer.[21] Exhibit 13 summarizes key findings from its 2023 CPS. Key findings are reviewed.

First, note that more than half (53 percent) of respondents (from the 50 largest metro areas) would choose to own or rent an apartment or townhouse if they had an easy walk to shops and restaurants and a shorter commute to work. This is the highest share since the CPS has been performed.

Second, note that more than three-quarters (78 percent) of respondents would be willing to spend more to live in a community where one could easily walk to parks, shops, and restaurants. This is a substantial increase over the sentiment during the pandemic (57 percent) or before (60 percent). Taken together, it appears that as more workers work from home (see findings below), many want to do so in a neighborhood where it is easy for them to walk to places, and they are willing to pay for it (see also below).[22]

Unfortunately, these opportunities may only be available to about 13 percent of America’s urban households (Koschinsky and Talen 2015). Based on the NAR survey, the demand for living in walkable communities that are accessible to shops, restaurants, services, and with a short commute to work is about 70 million households in 2023 of which about 17 million lived in those kinds of communities now, leaving a gap of 53 million households.

In effect, surveys by America’s largest residential real estate association show that market demand for transit accessibility does not meet supply. Considering that since the Great Recession, America has averaged about 1.5 million new homes each year. It would thus take 35 years to meet current walkable community demand assuming all new homes were built in those communities. This does not include growth in households in the meantime.

The extent to which NAR’s findings apply to transit accessibility can be inferred as follows. Exhibit 11 shows that the metropolitan areas studied for this research added about 2.5 million households of which nearly 500,000 or about 20 percent located within the 800-meter station areas. Yet, exhibit 13 shows that among those considering a move, two-thirds (65 percent) want to locate where transit is nearby.

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[21] https://www.nar.realtor/reports/nar-community-and-transportation-preferences-surveys

[22] As the NAR survey findings are richly detailed in terms of demographics, income, region, and so forth, the authors anticipate working with the NAR to inform policy makers and planners about changing community preference trends.

Exhibit 13
Findings from 2023 Community Preference Survey, National Association of Realtors

Community Preference Survey Question	Pre-Pandemic 2017	Pandemic 2020	Post-Pandemic 2023
Given a choice: Would you prefer to own or rent an apartment or townhouse, and you have an easy walk to shops and restaurants and have a shorter commute to work. YES reported.	50%	48%	53%
If you were moving to a new home, would you be willing to spend more to live in a community where you could easily walk to parks, shops, and restaurants? YES reported.	60%	57%	78%
If you were deciding today where to live, please indicate how important each of the following would be to you: Having public transit nearby.	62%	56%	65%

Source: National Association of Realtors (2023).

Changes in median household income and housing tenure are shown in exhibit 14. Consistent with gentrification expectations reviewed earlier, median household income rose at a faster pace relative to transit regions (meaning SQs are above 1.0) in all the LRT and SCT station bands, and less so among the CRT station bands. The exception is that incomes for BRT station areas followed transit region trends. This is consistent with recent research reported by Qi (2023). Appendix exhibits F-1 through F-4 reinforce these overall trends with few exceptions.

Combined with the findings above showing that station areas gained households with householders under 25 years of age while transit regions lost such households, it appears that gentrification has emerged generally for all modes except BRT. However, Appendix exhibits F-1 through F-4 show that gentrification, based on the income metric, is not apparent universally. For instance, among LRT systems, gentrification is not evident in Charlotte, Cleveland, Dallas, Norfolk, Pittsburgh, Portland, Salt Lake City, and St. Louis. On the other hand, local housing construction during the study period was robust and appeared to meet local needs in the other metropolitan areas. This was not the case with such metropolitan areas as Denver, Minneapolis-St. Paul, Phoenix, San Diego, San Jose, or Seattle where gentrification is apparent.

Among SCT systems based on the income metric, only the metropolitan areas of Dallas, Kansas City, Salt Lake City, Tampa, and Tucson do not indicate it. In contrast, the downtown housing markets served by SCT systems in Cincinnati, Portland, Seattle, and Tacoma show evidence of gentrification, as does the SCT system serving much larger areas of New Orleans.

Although one could imagine *a priori* that proximity to CRT stations would not be favored in the market, median household income SQs of more than 1.0 thus indicating gentrification are found in Austin, Dallas-Fort Worth, Denver, Miami, and Seattle-Tacoma as well as the western line of MARC from Montgomery County to West Virginia.

While BRT systems generally do not reveal gentrification, median household income SQs of more than 1.0 are found in Cleveland, Eugene-Springfield, Nashville, Pittsburgh, and San Jose.

The conclusion drawn is that based solely on change in median household income, there is evidence of gentrification in all modes among many but not all transit systems. Gentrification in certain demographic respects noted above appears less prevalent. Nonetheless, as market demand for walkable communities with transit accessibility increases, gentrification seems likely to increase. Numerous interventions to mitigate adverse effects of gentrification are outlines later.

Changes in housing tenure are also reported in exhibit 11. Overall, with SQs above 1.0, rental housing increased at a faster pace than transit regions. Notably, BRT station areas accounted for 59 percent of the entire change in renters for their region, followed by 30 percent and 26 percent for LRT and CRT regions, respectively, and 18 percent for SDT regions. Appendix exhibits F-1 through F-4 report change in tenure and SQs over time for all modes and their systems. With few exceptions, rental housing within transit station areas increased at a faster pace, sometimes much faster pace, than their transit regions. The implication is that rental housing dominated change in housing stock within station areas during the study period.

The change in the mode journey to work with implications is presented next.

Exhibit 14
Change in Median Household Income and Housing Tenure by Transit Station Band, and Station Quotients

Measure	LRT	SCT	BRT	CRT
Change in Household Income in Dollars				
Income Change	$7,179	$2,686	$5,357	$14,097
Station Band	$11,243	$8,548	$3,474	$15,606
400m Band	$9,737	$8,678	$4,499	$13,977
800m Band	$8,928	$8,532	$4,143	$14,759
Station Quotient	1.08	1.09	0.99	1.02
400m Quotient	1.06	1.09	1.01	1.00
800m Quotient	1.05	1.09	0.99	1.02
Change in Homeowner Tenure				
Owner (000s)	412,239	174,590	217,590	393,805
Station Band	15,999	3,276	12,343	15,837
400m Band	33,995	5,934	34,445	25,272
800m Band	47,097	9,413	47,425	30,949
Station Share	4%	2%	6%	4%
400m Share	8%	3%	16%	6%
800m Share	11%	5%	22%	8%
Station Quotient	1.06	1.08	1.00	1.13
400m Quotient	1.02	1.03	1.00	1.07
800m Quotient	1.01	1.04	1.00	1.03
Change in Renter Tenure				
Renter (000s)	392,319	177,295	202,454	279,141
Station Band	48,742	16,148	42,949	31,148
400m Band	94,288	28,177	107,825	55,994
800m Band	116,464	31,763	120,339	71,243
Station Share	12%	9%	21%	11%
400m Share	24%	16%	53%	20%
800m Share	30%	18%	59%	26%
Station Quotient	1.12	1.14	1.05	1.35
400m Quotient	1.07	1.09	1.03	1.20
800m Quotient	1.04	1.06	1.02	1.13

Transit Station Proximity and Commuting Mode Choice

Literature reviewed earlier leads to the theory that transit systems and their stations alter commuting modes away from automobiles to transit, walking, biking, and working from home. Using ACS data, this section begins with the research design, choice of data, and discussion of the analytic method. It concludes with implications for post-pandemic transit and land use planning.

Given the literature and theory presented earlier, the first research question is:

> Is proximity to transit stations associated with increasing shares of walking, biking, transit use, and working at home and if so, is there variation by type of transit system?

The null hypothesis would assert no change in the non-auto commute by mode to work with respect to transit station proximity.

Research Design, Data, and Analytic Method

The research question lends itself to quasi-experimental research design. The treatment group would be those units of geography inside a prescribed study area while the control group would be outside.

Like the analysis reported above, ACS data are used for this analysis. Data on the mode choice to work are reported at the CBG level in 5-year survey increments. For reasons noted above, the 2010-2014 and 2015-2019 5-year samples are used. Because this is an exploratory analysis that compares changes among several ACS commuting mode choices, the research uses descriptive analysis of change between the ACS periods where station bands are the treatment and transit regions are the control. In all cases, differences are significant to at least the 0.10 level of the two-tailed t-test.

Results and Interpretations

For all transit systems in each mode, exhibit 15 reports changes in workers living in the transit region as well as within each of the transit station bands during the study period. It also reports the change in commuting mode to work along with SQs revealing changes in mode choice shares by station band relative to transit regions.

At first look, it does not appear that station bands influence change in using automobiles in the journey to work. The reason is that there is little difference between SQs for worker change by distance band and those commuting via automobiles. What is revealed, however, is that new workers gravitated to the use of transit and walking/biking modes to much greater extents than transit regions. For instance, although the 800-meter station area SQ for CRT systems is 1.19, its SQ for walking/biking to work rose to 1.36. Subject to further analysis, the reason may be new workers are choosing to live near CRT stations because that's where the workplace is located.

In the post-pandemic world, working from home would seem to be much more prevalent than before, although perhaps not to the degree it was during the pandemic (Peiser and Hugel 2022). Accordingly, the SQs for working from home are likely smaller before the pandemic than going forward. This is clearly an area in need of more research in the post-pandemic economy. Nonetheless, for persons working from home, access to transit may be attractive especially if it connects them to activities centers for shopping, services, and leisure as well as transportation such as airports and long-distance trains. This is one reason why demand for transit station accessibility may increase in the future even if new residents do not use transit in their journey to work.

The nature of change in commute mode choice among individual systems in each of the mode varies considerably, perhaps more so than any other dimension evaluated in this report. Readers are encouraged to study those systems of interest to them and compare those systems to others. Exhibit 16 identifies exemplary systems in terms of transit, walking/biking, and working at home for each mode. Systems are selected for having among the highest shares of change among all systems in a mode based on transit, walking and biking, and work at home. Reasons for these outcomes are not explored, however, which need future research. Among those systems the authors are familiar with, the location of transit stations in areas of existing development or in the path of planned development appears to make a difference. For instance, the Salt Lake City CRT system includes large scale redevelopment around CRT stations with easy pedestrian and biking access. The redevelopment areas are internally attritive with mixed land uses that facilitate those who work from home.

Research into the association between transit station proximity and vehicle kilometers traveled (VKT), and cost, is presented next.

Exhibit 15
Change in Commuting Mode by Mode

Measure	LRT	SCT	BRT	CRT
Workers				
Workers (000s)	1,913.8	799.4	1,073.1	2,509.5
Station Band	111.7	29.7	107.9	73.4
400m Band	240.0	54.1	296.0	144.3
800m Band	348.9	71.2	367.2	203.2
Station Share	6%	4%	10%	3%
400m Share	13%	7%	28%	6%
800m Share	18%	9%	34%	8%
Station Quotient	1.11	1.15	1.03	1.19
400m Quotient	1.06	1.09	1.03	1.11
800m Quotient	1.05	1.07	1.02	1.06
Automobile				
Auto (000s)	1,456.4	799.4	792.0	1,852.8
Station Band	76.7	29.7	71.8	55.2
400m Band	160.5	54.1	199.0	103.9
800m Band	239.4	71.2	252.5	142.5
Station Share	5%	4%	9%	3%
400m Share	11%	7%	25%	6%
800m Share	16%	9%	32%	8%
Station Quotient	1.10	1.15	1.02	1.18
400m Quotient	1.05	1.09	1.02	1.10
800m Quotient	1.04	1.07	1.02	1.05
Transit				
Transit (000s)	81.1	72.2	73.4	122.4
Station Band	12.6	4.3	12.1	5.9
400m Band	22.8	7.0	31.4	12.0
800m Band	29.4	9.1	37.6	17.1
Station Share	16%	6%	16%	5%
400m Share	28%	10%	43%	10%
800m Share	36%	13%	51%	14%
Station Quotient	1.18	1.13	1.04	1.24
400m Quotient	1.08	1.05	1.02	1.12
800m Quotient	1.06	1.02	1.02	1.08

Exhibit 15
Change in Commuting Mode by Mode—continued

Measure	LRT	SCT	BRT	CRT
Walk-Bike				
Walk-Bike (000s)	64.4	48.0	41.8	94.9
Station Band	11.5	9.7	9.8	5.9
400m Band	26.2	18.2	25.5	11.0
800m Band	36.5	23.1	27.0	15.4
Station Share	18%	20%	23%	6%
400m Share	41%	38%	61%	12%
800m Share	57%	48%	65%	16%
Station Quotient	1.15	1.26	1.09	1.36
400m Quotient	1.12	1.21	1.05	1.15
800m Quotient	1.11	1.17	1.02	1.08
Work at Home				
Work Home (000s)	281.2	115.4	138.9	337.6
Station Band	8.3	3.4	11.4	6.9
400m Band	23.5	8.4	31.9	15.2
800m Band	32.8	11.4	39.0	25.7
Station Share	3%	3%	8%	2%
400m Share	8%	7%	23%	5%
800m Share	12%	10%	28%	8%
Station Quotient	0.99	1.13	1.05	1.20
400m Quotient	1.00	1.20	1.04	1.13
800m Quotient	0.98	1.16	1.03	1.13

Exhibit 16
Exemplary Transit Modes for Large Shares of Transit, Walk/Bike, and Work at Home Change

LRT Systems	CHR	DEN	PHX	SLC	SJ
Transit					
Station Quotient	1.37	1.40	1.20	1.67	1.33
400m Quotient	1.33	1.26	1.08	1.25	1.07
800m Quotient	1.25	1.19	1.02	1.16	1.04
Walk/Bike					
Station Quotient	1.42	1.06	1.10	1.15	1.61
400m Quotient	1.54	1.06	1.08	1.19	1.30
800m Quotient	1.27	1.05	1.03	1.11	1.22
Work at Home					
Station Quotient	0.87	1.46	1.43	1.36	1.07
400m Quotient	1.42	1.17	1.24	1.16	1.16
800m Quotient	1.19	1.09	1.20	1.04	1.15
SCT Systems	**DAL**	**KC**	**TAC**	**TAM**	**WDC**
Transit					
Station Quotient	1.89	2.56	1.94	1.22	1.35
400m Quotient	1.10	2.17	0.96	1.56	1.36
800m Quotient	1.06	1.66	1.05	1.17	1.19
Walk/Bike					
Station Quotient	1.60	0.99	1.58	2.64	1.53
400m Quotient	1.70	1.13	1.21	1.31	1.27
800m Quotient	1.68	1.11	1.00	1.29	1.04
Work at Home					
Station Quotient	1.11	1.39	1.68	1.54	1.25
400m Quotient	1.19	1.23	1.16	0.99	1.20
800m Quotient	1.10	1.10	1.52	1.00	1.22
BRT Systems	**ABQ**	**AA**	**ESP**	**SD**	
Transit					
Station Quotient	1.49	1.30	1.90	1.15	
400m Quotient	1.23	1.17	1.23	1.09	
800m Quotient	1.27	1.10	1.24	1.08	
Walk/Bike					
Station Quotient	1.06	1.61	1.23	1.10	
400m Quotient	1.05	1.32	1.18	1.02	
800m Quotient	1.02	1.17	1.17	0.95	
Work at Home					
Station Quotient	1.28	1.11	1.26	1.22	
400m Quotient	1.11	1.19	1.32	1.07	
800m Quotient	1.02	1.19	1.05	1.09	

Exhibit 16
Exemplary Transit Modes for Large Shares of Transit, Walk/Bike, and Work at Home Change—continued

CRT Systems	AUS	DEN	SLC		
Transit					
Station Quotient	1.33	2.02	1.37		
400m Quotient	1.18	1.72	1.45		
800m Quotient	1.01	1.33	1.48		
Walk/Bike					
Station Quotient	2.04	2.54	1.71		
400m Quotient	1.67	1.47	1.37		
800m Quotient	1.29	1.40	1.16		
Work at Home					
Station Quotient	2.45	2.35	1.10		
400m Quotient	1.95	1.42	1.11		
800m Quotient	1.69	1.38	1.19		

Transit Station Proximity and Reduced Vehicle Kilometers Traveled with Associated Reduction in Transportation Costs

It seems an article of faith that travel demand measured in terms of distance traveled falls with respect to distance away from downtowns, activity centers, and transit stations. There is no research testing this in the context of transit stations, however. The research reported below is the first to do so in the context of distance to LRT stations. Future research can be expanded to include other transit modes.

The research question is:

> Do household vehicle kilometers traveled (VKT) vary by proximity to transit stations?

If so, then using parameters of such a finding can lead to estimates of transportation cost savings with respect to transit station proximity. This question leads logically to two more research questions posed earlier:

> Do household transportation costs vary by proximity to transit stations?
>
> If so, do lower-income households realize transportation cost savings with respect to proximity to transit stations?

The null hypotheses assert there is no statistically significant relationship between transit station proximity and VKT, and savings in transportation costs. What follows is the research design, data, and analytic method followed by results and interpretations.

Research Design, Data, and Analytic Method

The research question lends itself to quasi-experimental, cross-section analysis. Spatially related, cross-section data for household transportation cost is provided by the Department of Housing and Urban Development's Location Affordability Index (LAI). HUD has three LAI versions with the most recent, Version 3 based on census tracts (CTs) applied to the 2016 5-year ACS.[23] Because it covers much of the study period, those data are used for this analysis.

The LAI estimates household housing and transportation costs at the census tract level based for the following six household prototypes used in this analysis:

> Median-Income Family comprised of four persons with two commuters where the household earning the median household income (MHHI);
>
> Working individual being a single person earning 50 percent of the MHHI;
>
> Single Professional being also a single person though earning 135 percent of the MHHI;

[23] HUD has not updated its LAI database. The version used in this study, Version 3, is available at https://www.huduser.gov/portal/elist/2019-may_23.html.

Single-Parent Family being one adult with two dependents earning 50 percent of MHHI;

Moderate-Income Family being comprised of a family of three with one worker earning 80 percent of the MHHI; and

Dual-Professional Family comprised of four persons with two who together earn 150 percent of the MHHI.

Exhibit 17 reports the number of people and commuters for each household type.

The analysis applies HUD's LAI database to 17 LRT systems extending 3,200 meters (about two miles) from the closest LRT stations. Standard-form ordinary least squares regression model is adapted for analysis. The general model is:

Household VKT = ***f****(Households, Location, Metropolitan Area, Place Typology, LRT Station proximity)*

Where:

Household VKT is the dependent variable. This variable is logged with allows for interpretations of place typology and distance variables to ne percent change with respect to a unit change in VKT.

Households is the number of households in the CT, logged, to control for the variability of households occupying census geographic units. There is no *a priori* expectation for association between households in a CT and VKT.

Location means distance to the nearest freeway ramp (*freeway distance*). Other location controls are embedded in the Place Typology construct described below. Because freeways enable longer commutes (see Angle and Blei 2015), a positive association between freeway distance and VKT is hypothesized.

Metropolitan controls are simply the location of the CT in a given metropolitan area where an LRT system operates. (Norfolk is the referent as it is the smallest in terms of stations and track distance.) This variable is effectively a composite index of attributes unique to each metropolitan area and as such there are no *a priori* directions of association.

The spatial unit of analysis are census tracts, which are large spatial units with many containing one or more transit stations. Because of this, measuring distances from non-station CTs to those with CTs is problematic. The solution is to create a typology called "***Place Typology***" which is assigned to CTs. The typology is derived from cluster analysis that creates an index variable comprised of:

Jobs per acre;
Proportion of jobs that are retail and arts;
Total population per acre;

Total households per acre;
Percent of households with no children;
Percent of owner-occupied housing;
Intersections per square mile; and
Proportion of intersections with 3 to 4 vertices.

The method uses LEHD and census data to produce four statistically unique place types which also conform to *a priori* expectations. (For details about how this construct is specified, tested, and applied, see Nelson, Hibberd, Currans, and Iroz-Elardo 2021). They are:

High Mixed-Use/Accessibility (***High-MA***) Centers such as downtowns, suburban nodes, and other areas with high concentrations of jobs and people, high land use, and high levels of accessibility;

Moderate Mixed-Use/Accessibility (***Moderate-MA***) areas such as large combinations of CTs with modest mixes of jobs and people and lower connectivity between land uses, and often surrounding High-MA centers;

Low Mixed-Use/Accessibility (***Low-MA***) areas which are usually low density, residential areas that some might characterize as urban sprawl, and which are usually found between Moderate-MA and Poor-MA areas; and

Poor Mixed-Use/Accessibility (***Poor-MA***) areas which are dominated by very low-density residential development with no employment centers and the lowest levels of accessibility between land uses. *Poor-MA* will be used as the referent in analysis meaning that the variation in rents attributable to Place Typology will be estimated with respect to this variable, all other factors considered.

Theoretically, controlling for all factors, VKT will be lowest in the *High-MA* places and highest in the *Poor-MA* places, which are the referent.

LRT Station Proximity is the distance of the CT centroid to the nearest transit station in 200-meter increments to 3,200 meters (about two miles). It is hypothesized that the closer a CT is to a transit station the lower the VKT per household,

Related to this, if VKT is reduced, so are transportation costs as a share of household income, which is also reported.

Results are presented next along with interpretations.

Exhibit 17
HUD LAI Household Types

Household Type	Income	Persons in Household	Number of Commuters
Median-Income Family	100% of MHHI	4	2
Working Individual	50% of MHHI	1	1
Single Professional	135% of MHHI	1	1
Single-Parent Family	50% of MHHI	3	1
Moderate-Income Family	80% of MHHI	3	1
Dual-Professional Family	150% of MHHI	4	2

Note: MHHI means median household income for the metropolitan areas of the subject census tract.
Source: HUD (2019).

Results and Interpretations

Exhibit 18 reports regression results as well as change in household transportation costs. A total of 8,557 CTs are included in the analysis. The coefficients of determination show that 40 percent to 60 percent of the variation in mean household VKT is explained by the equations. The collinearity matrix (not reported for brevity) does not reveal problematic collinearities. Interpretations of regression results are followed by implcat9ions for transportation costs.

Results for Place Typologies show that, compared to the Poor-Mixed Use/Accessibility referent, households incurred progressively less VKT the closer CTs were to transit stations. Second, compared to households in CTs that are more than 3,200 meters from the nearest LRT station, VKT declines progressively with respect to station distance. While these results may be expected *a priori* they are nonetheless the first time these expectations have been confirmed. In other words, popular perceptions are supported by the evidence. These outcomes are consistent with hypotheses. But there are subtleties that need exploration.

The variation between household types is instructive. Four of the six household types have reasonably similar outcomes with respect to LRT station proximity: Median Household, Single-Parent, Moderate-Income, and Dual-Professional. Generally, VKT declines by about 12 to 15 percent across the study area.

In contrast, Working Individual Households at 50 percent of MHHI enjoyed the largest reduction in VKT at nearly 42 percent, followed by the Singel-Professional Households at 135 percent of MHHI at nearly 23 percent. These relationships are illustrated in exhibit 19. Why are these household types so much more sensitive to transit station location than the others? Perhaps as single-person households they have more flexibility to locate near transit stations than other household types because they can afford to live near them. In particular, single-person households can afford higher rent per square meter if their total space needs are modest, allowing them to live in smaller units. Also recall from above that single-person households are attracted to transit stations more so than other household types. Given their single status, if transit station proximity improves their access to jobs or other destinations, single-person households should be expected to locate near them more so than other households, which they do.

Exhibit 18 also shows cost savings attributable to transit station proximity. Transportation costs as a share of income fall for all household types with respect to transit station proximity. There is an anomaly, however. Single-parent households have the lowest income but also the highest transportation costs relative to income at 31.2 percent. Yet, proximity to LRT stations does not reduce their transportation costs much, at less than 14 percent in the closest distance band. Perhaps for these households, transit accessibility does not substitute for child-related trips transit does not serve. However, exhibit 18 goes on to simulate transportation cost savings that combine Place Typology with selected LRT station distances. When this is done, the single-parent household costs near LRT stations in High MA and Moderate MA Place Typologies fall substantially, more so than other household types that benefit as well, nonetheless.

The last analytic section evaluates the transit station proximity rent premiums for office, retail, and multifamily real estate. This is followed by implications for post-pandemic transit policy and planning.

Exhibit 18
Association between Vehicle Kilometers Traveled (VKT) and Light Rail Transit Station Proximity with to Household Type

Variable	Median-Income HH	Working Individual HH	Single Professional HH	Single-Parent HH	Moderate-Income HH	Dual-Professional HH
Constant	10.29	9.73	9.85	9.93	9.97	10.30
Household Control						
CT Households (log)	0.9%	1.7%	0.7%	0.6%	0.6%	1.0%
Location Control						
Freeway Distance (km)	**2.7%**	**4.2%**	**3.4%**	**2.7%**	**2.5%**	**2.6%**
Metropolitan Control						
Buffalo	-3.0%	-4.9%	-5.0%	-3.7%	-3.5%	-2.9%
Charlotte	-3.5%	-1.6%	-1.0%	-0.2%	-0.1%	-3.4%
Cleveland	-5.8%	-5.7%	-5.9%	-4.9%	-4.6%	-5.7%
Dallas	-1.1%	2.0%	1.7%	2.0%	1.9%	-1.1%
Denver	0.4%	-1.3%	0.1%	0.9%	0.9%	0.4%
Houston	-7.1%	-7.2%	-6.2%	-3.7%	-3.4%	-6.9%
Minneapolis-St. Paul	-5.0%	-6.2%	-6.5%	-3.6%	-3.3%	-4.8%
Phoenix	-5.9%	-5.3%	-4.6%	-2.8%	-2.5%	-5.8%
Pittsburgh	-9.7%	-19.2%	-13.5%	-10.0%	-9.4%	-9.5%
Portland	-2.0%	0.5%	-1.9%	-0.4%	-0.3%	-2.0%
Sacramento	1.3%	8.5%	5.5%	5.6%	5.2%	1.3%
Salt Lake City	1.9%	3.0%	0.2%	1.3%	1.3%	1.9%
San Diego	2.8%	11.0%	6.8%	5.4%	5.0%	2.8%
San Jose	3.6%	10.4%	5.7%	5.6%	5.4%	3.6%
Seattle	-2.7%	-16.4%	-3.8%	-0.3%	-0.1%	-2.6%
St. Louis	-1.2%	0.9%	-0.6%	0.3%	0.3%	-1.2%

Exhibit 18
Association between Vehicle Kilometers Traveled (VKT) and Light Rail Transit Station Proximity with to Household Type—continued

Variable	Median-Income HH	Working Individual HH	Single Professional HH	Single-Parent HH	Moderate-Income HH	Dual-Professional HH
Place Typology Control						
Low MA	-9.6%	-12.9%	-11.8%	-10.4%	-9.8%	-9.5%
Moderate MA	-19.7%	-26.4%	-23.7%	-20.6%	-19.4%	-19.4%
High MA	-30.7%	-54.4%	-38.1%	-31.4%	-29.4%	-30.1%
LRT Distance Band						
<200 meters	-14.5%	-41.8%	-22.8%	-13.7%	-12.3%	-13.9%
200-<400 meters	-14.1%	-32.0%	-17.8%	-12.9%	-11.9%	-13.7%
400-<600 meters	-14.7%	-21.2%	-18.0%	-13.6%	-12.5%	-14.3%
600-<800 meters	-14.7%	-20.9%	-17.7%	-13.1%	-12.1%	-14.3%
800-<1,000 meters	-12.6%	-15.9%	-14.4%	-12.0%	-11.2%	-12.3%
1,000-<1,200 meters	-11.4%	-15.8%	-13.5%	-10.9%	-10.2%	-11.2%
1,200-<1,400 meters	-12.2%	-14.8%	-13.0%	-11.3%	-10.5%	-12.0%
1,400-<1,600 meters	-9.9%	-15.2%	-12.3%	-8.8%	-8.2%	-9.6%
1,600-<1,800 meters	-9.5%	-11.5%	-10.4%	-8.3%	-7.8%	-9.3%
1,800-<2,000 meters	-10.8%	-12.4%	-11.4%	-10.0%	-9.5%	-10.7%
2,000-<2,200 meters	-9.0%	-12.5%	-10.3%	-8.4%	-8.0%	-8.9%
2,200-<2,400 meters	-7.0%	-8.3%	-7.4%	-6.5%	-6.1%	-6.9%
2,400-<2,600 meters	-8.0%	-9.5%	-8.7%	-7.3%	-7.0%	-7.9%
2,600-<2,800 meters	-7.2%	-23.8%	-8.8%	-6.8%	-6.4%	-7.1%
2,800-<3,000 meters	-7.1%	-10.8%	-9.7%	-7.4%	-7.0%	-6.9%
3,000-<3,200 meters	-7.0%	-9.4%	-7.7%	-6.6%	-6.3%	-6.9%

Exhibit 18
Association between Vehicle Kilometers Traveled (VKT) and Light Rail Transit Station Proximity with to Household Type—continued

Variable	Median-Income HH	Working Individual HH	Single Professional HH	Single-Parent HH	Moderate-Income HH	Dual-Professional HH
Performance Metrics						
Mean Annual VKT	42,262	24,095	26,115	29,409	30,898	42,710
Cases	8,557	8,557	8,557	8,557	8,557	8,557
R^2 adjusted	0.514	0.633	0.425	0.468	0.468	0.515
Standard Error of Estimate	0.122	0.394	0.186	0.132	0.123	0.119
F-ratio	245.959	379.498	172.074	204.543	204.493	246.256
Household Metrics						
Mean Household Income	$68,658	$31,829	$85,939	$31,829	$50,927	$95,488
Mean Annual Trans. Percent	23.0%	27.2%	12.1%	31.2%	21.4%	16.1%
Transportation Cost Simulation with Place Typology and Selected LRT Station Distances						
<200 meters @ High MA	-34.2%	-96.2%	-60.9%	-45.1%	-41.7%	-44.0%
600-<800 mewers @ Mod. MA	-29.2%	-47.3%	-41.4%	-33.7%	-31.5%	-33.7%
1,400-<1,600 meters @ Low MA	-19.5%	-28.1%	-24.1%	-19.2%	-18.0%	-19.1%

Note: All coefficients are significant at $p < 0.10$.
Comments: HH means household; CT means census tracts; km means kilometer; LRT means light rail transit; MA means mixed land use and accessibility; and coefficients in bold are significant at p < 0.10 of the one-tailed since the direction of association is predicted. Significance is not reported for household and metropolitan variables because they are controls.

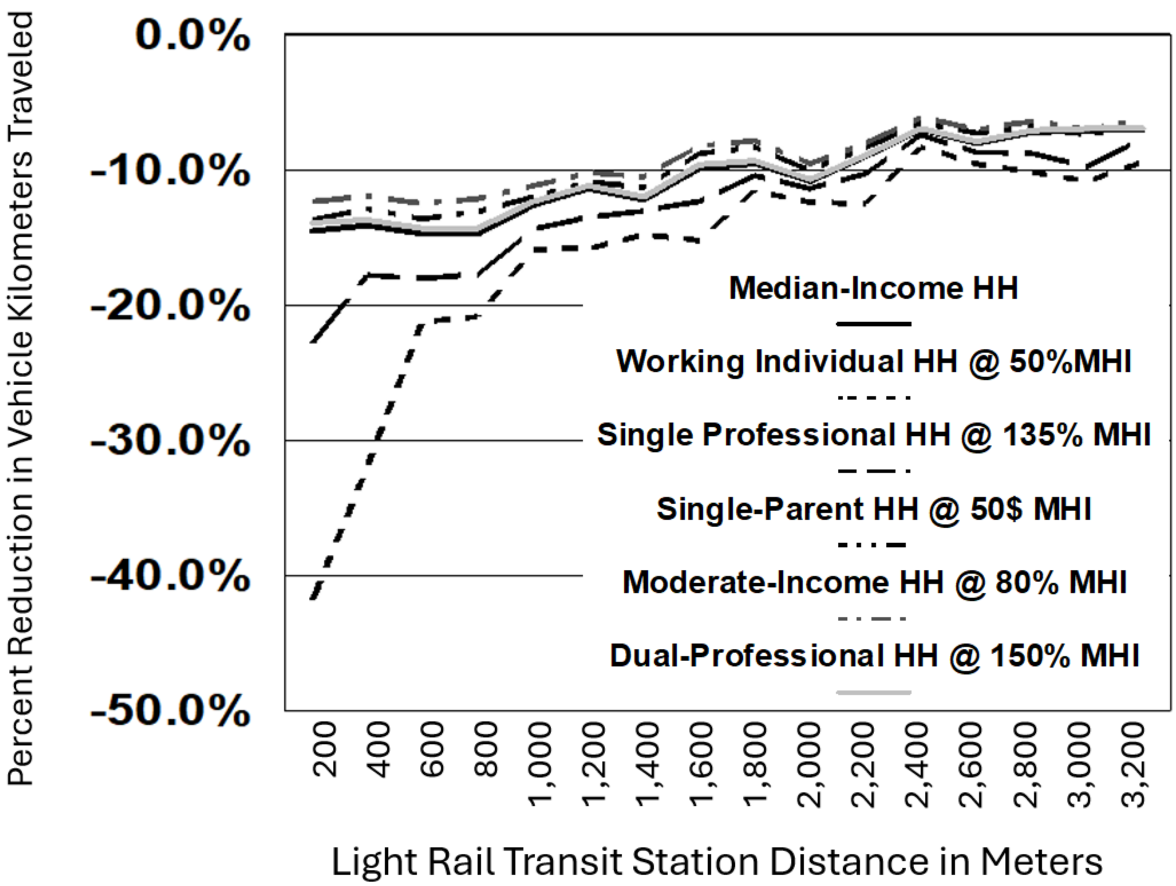

Exhibit 19
Variation in VKT Reduction by Household Type with Respect to LRT Station Distance

TRANSIT STATION PROXIMITY AND OFFICE, RETAIL, AND MULTIFAMILY RENTS

The last analytic section addresses the extent to which the real estate market values proximity to transit stations. CoStar commercial rent data are used for analysis. As will be shown, there is considerable variation in the influence of transit station proximity for each real estate type evaluated. An overall picture emerges to help guide post-pandemic transit and land use planning.

In review based on the earlier discussion, the principal research question is:

> Is there an association between commercial real estate rent (per square meter) and proximity to rail transit stations holding other factors constant?

But this question is nuanced as follows:

> If there is an association, is there evidence of negative externality or amenity effects with respect to transit station proximity?

These questions are applied to office, multifamily and retail real estate with respect to LRT, BRT, SCT and CRT station proximity. The research design, hypothesis, data, and analytic method is presented next. This is followed by results and interpretations, and then implications form post-pandemic transit and land use planning.

Research Design, Hypothesis, Data, and Analytic Method

The research questions lend themselves to cross-section analysis that compare changes in real estate rent with respect to transit station proximity by mode and individual systems. The null hypothesis posits no relationship. However, two outcomes can be revealed, both of which are consistent with theory. The accessibility theory noted earlier would result in a downward sloping rent gradient away from transit stations because as distance increases, accessibility is reduced. On the other hand, if transit stations themselves are sources of externalities such as noise, congestion, unattractive urban design and so forth, there would be an upward sloping rent gradient away from stations thereby offsetting the accessibility rent premium. At some point away from stations, the accessibility premium is expected to overcome externality effects (Nelson and McClesky 1990, Nelson 1992). Before that inflection point, however, both outcomes would be consistent with accessibility and externality theories.

The analysis requires data about real estate value. Many studies reviewed above used local property tax assessor data for sales of single-family residential property. This land use is popular because the number of cases is usually large. However, when evaluating multiple transit systems in several states where the efficacy of assessor data varies because of state and local regulations as well as data quality, other data are needed. For instance, to get around this limitation in their cross-section analysis of the association between BRT station proximity and single-family home values, Acton, Le and Miller (2022) used CoreLogic home sales data before and after BRT the inauguration of 11 BRT systems. Their study was limited to sales of single-family homes within or beyond 800 meters (about one-half mile) of BRT stations.

But transit station areas are often dominated by other than single-family residential properties, such as offices, retail operations, and multifamily projects. Unfortunately, there are no large-scale cross-section analyses of the relationship between different types of real estate and transit station proximity. Moreover, those few studies that exist focus on the same state and typically use one-quarter mile (about 400 meter) and one-half mile (about 800 meter) buffers around transit stations.

This study overcomes limitations of prior work through a national-scale, cross-section analysis of the association between real estate rents for three common types of real estate (office, retail, and residential) and transit station proximity for LRT, SCT, BRT, and CRT systems using fine-grained buffers of 100 meters to 800 meters from stations. The 100-meter buffer, roughly comparable to standard city block widths, overcomes limitations of continuous functional form approaches such as linear, log, inverse, quadratic models that mask important interactions between proximity and value where it is most important—at and very near transit stations.

This analysis uses CoStar commercial rent data. CoStar is the nation's largest centralized source of commercial real estate data.[24] CoStar rent data are used for office, retail, and multifamily residential rent data for 2019, which was the year before the COVID-19 pandemic. CoStar's rent data are converted into dollars per square meter per year.

Rent data are preferred over sales data for two reasons. First, there are many more rent cases than sale cases thus increasing sample size. For instance, whereas there are 63,644 LRT rent cases in this study, analysis using just CoStar sales would include only 2,544 cases spread across the 17 LRT systems studied. The large number of rent cases thus increases confidence in outcomes and allows for more fine-grained analysis of each system. Second, rent is a better indicator of current market conditions than sales because rent data reflect local economic conditions at the time, not conditions years or decades earlier when properties were sold.

The result is that this study is the nation's largest, most complete assessment of the relationship between transit station proximity and office, retail, and multifamily residential property values.

Multivariate ordinary least squares analysis is used to tease out the influence of transit station proximity on office, retail, and multifamily rent per square meter from among various features of properties. Using theoretical and research design foundations as a guide, the following general model is developed for empirical application (adapted from Nelson 2017).

[24] See https://www.costargroup.com/.

$$\mathbf{R}_i = f(\mathbf{S}_i, \mathbf{SES}_i, \mathbf{LU}_i, \mathbf{C}_i, \mathbf{M}_i, \mathbf{DB}_i) \qquad (1)$$

Where:

R is the asking rent per square meter for property *i*;

S is the set of structural attributes of property *i*;

SES is the set of socioeconomic characteristics of the vicinity of property *i*;

LU is the land use mix of the block group within which property *I* is located;

C is a set of centrality attributes of property *i* in this case being distance to the central business district (CBD) and nearest freeway/expressway ramps;

M is the metropolitan area within which property *i* is located—as metropolitan area conditions and markets vary between them, identifying the location of property *i* within its respective market helps control for metropolitan-specific influences; and

DB is the distance band of property *i* to a transit station.

Dependent Variable

R is the ***Asking Rent per Square Meter***. The study includes the universe of all office, retail, and multifamily properties from which all data are available as reported by CoStar. As CoStar data come from real estate brokerages participating in its network, its data exclude non-participating brokerages or entities that own properties not for rent such as owner-occupied properties. By logging the dependent variable, the semi-log model allows for coefficients to be interpreted as the percent change in rent attributable to a one-unit change in an independent variable such as an individual distance band (Statistical Data Services 2018).

Control Variables

S is the bundle of structure and lease restriction attributes for property *i* reported by CoStar including:

Gross Leasable Area in square meters with the expectation that there will be a positive association between office and multifamily building area and rent because larger buildings presumably include more amenities than smaller ones.

Effective Year Built which is the latter year of construction or year of renovation as reported by CoStar with the expectation that newer buildings will command higher rent than older ones.

Vacancy Rate as reported by CoStar with the expectation that the higher the vacancy rates the lower the rent. However, this may not always be the case as high demand markets could result in high vacancy rates as owners wait for higher paying tenants. Accordingly, signs may not be predictable especially considering that the study area is comprised of stable to rapidly growing central counties.

The number of ***Stories*** includes with the expectation that the taller the building the higher the mean rent.

For office real estate, this includes ***Class A*** and ***Class B*** office space which are considered the highest and next highest quality in the office market, commanding rents accordingly. ***Class C*** office space is the referent.

For retail real estate, this includes ***Regional/Community Mall***, ***Power Center***, ***Lifestyle Center***, ***Strip Retail***, and ***General Retail*** as defined by CoStar with the referent being all other retail property.

For multifamily real estate, this includes ***Subsidized*** units such as Section 8 rental vouchers and Low-Income Housing Tax Credit units among others, and ***Restricted*** units such as those for persons 55 and more years of age and students among others. While one may assume a priori that subsidized and restricted units rent for less than market rate units, because the unit of measure is rent per square meter it is conceivable that these units rent for more per square meter than market rate units even if the units themselves rent for less. Accordingly, signs of association cannot be predicted.

The **SES** dimension is comprised of ***Median Household Income*** from the five-year sample of the 2019 American Community Survey (ACS) for the block group within which a CoStar property is located, for which a positive association is expected with respect to rent (Xiao 2016).

LU is an index of land-use mix in the block group within which property *i* is located such as the nature of surrounding land uses, street characteristics, and related. This variable is based on work by Ewing and Hamidi (2018) who devised an entropy calculation as a proxy for land use mix. The higher the index score then the greater the mix. Higher rents should result because of efficiencies gained in the interaction between land uses. However, if LU mix is associated with congestion, poor urban design and other externalities, a negative association will be revealed. Both directions of association are possible (see also Nelson and Hibberd 2021).

Two variables comprise the **C** dimension: distance from the 100 percent corner[25] of the central business district (***CBD***) in meters and distance from the nearest ***Freeway*** ramp also in meters. Both are computed from geographic information systems. Negative associations between rent and CBD and Freeway proximity are expected.

The **M** dimension is comprised of the individual metropolitan areas within which the transit stations that we studied are located. As these are controls which account for idiosyncrasies of metropolitan markets, no direction of associations is predicted.

[25] For a review of this concept, see https://en.wikipedia.org/wiki/100_percent_corner.

DB is a proxy measure for functional form based on 100-meter distance bands from transit stations. It is preferred over other functional forms because it gives planners direct information on the extent to which the real estate market responds to transit station proximity in relatively fine-grained discrete units of distance. As noted earlier, the alternative linear, semi-log, doble-log, quadratic and other functional forms do not generate the kind of insights planners need to choreograph land uses and infrastructure investment proximate to transit stations. While some studies use distance bands as well, they are usually limited to one-quarter or one-half mile distance (400 or 800-meter) bands or occasionally both. But that assumes all relevant interactions which are useful for planners occur only within those large distance bands (Higgins and Kanaroglou 2016; Nelson 2017). The 100-meter distance band approach also allows for fine-grained tests of statistical significance for each distance band separately. Building on prior work by Nelson and Hibberd (2019) and Nelson et al, (2021), the 100-meter distance band approach extends to 800 meters or equivalent to the half-mile circle (Guerra, Cervero, and Tischler 2012). The 100-meter metric are also equivalent roughly to a typical city block width although variations are considerable.

The term “transit station” needs to be clarified. It is meant to include any station or stop of a particular mode. For instance, BRT systems often include upgraded bus stops along with station-like platforms but not always.

Exhibit 20 summarizes the control and treatment variables, sources of data, measures, and predicted signs.

The database used in this analysis is comprised of nearly 340,000 cases making it the largest cross-section analysis of the association between real estate value and transit station proximity reported in the literature. This includes nearly 110,000 cases each for LRT and CRT systems, more than 70,000 cases for BRT systems, and nearly 50,000 cases for SCT systems. In terms of real estate types, the study includes nearly 200,000 office cases, nearly 84,000 retail cases, and more than 55,000 multifamily cases.

Results and interpretations come next.

Results and Interpretations

Overall results for each mode are reported in exhibit 21 for commercial real estate, exhibit 22 for retail real estate, and exhibit 23 for multifamily real estate. Results for each system for each mode and real estate type are reported in Appendix H for office, Appendix I for retail, and Appendix J for multifamily real estate where exhibits 1 through 4 of each report results for LRT, SCT, BRT and CRT modes, respectively. Although the focus of the following discussion is on overall results, insights from specific systems will also be offered by reference to the appendices. Readers are encouraged to study results for those individual systems of interest to them. Finally, for brevity, Appendices H through J report results for only the station distance bands and regression performance metrics, but not for control variables. Those appendices include the station sign of direction for the first distance band and revealed functional forms based on the distance bands comprising the first 400 meters (about one-quarter mile).

Exhibit 20
Variables, Data Sources, Measurement Type, and Predicted Associations with Respect to Rent per Square Meter

Variable	Data Source	Measure	Predicted Sign
Dependent Variable			
Rent			
Rent per Square Meter (logged)	CoStar	Continuous	NA
Control Variables			
Structure Controls			
Gross Leasable Area ($100m^2$)	CoStar	Continuous	+
Mean Unit Size ($100m^2$), Multifamily	CoStar	Continuous	-
Stories	CoStar	Continuous	+
Effective Year Built	CoStar	Continuous	+
Vacancy Rate	CoStar	Continuous	+/- *See text*
Structure Controls—Office			
Class A Office	CoStar	Binary	+
Class B Office	CoStar	Binary	+
Class C Office	CoStar	Binary	Referent
Structure Controls—Retail			
Regional/Community Mall	CoStar	Binary	NA
Power Center	CoStar	Binary	NA
Lifestyle Center	CoStar	Binary	NA
Strip Retail	CoStar	Binary	NA
Retail General	CoStar	Binary	NA
All Other Retail	CoStar	Binary	Referent
Structure Controls—Multifamily			
Subsidized	CoStar	Binary	NA
Restricted	CoStar	Binary	NA
All Other Multifamily	CoStar	Binary	Referent
Socioeconomic Control			
Median Household (HH) Income	Census ACS	Continuous	+
Land Use Control			
Land-Use Mix Index	Computed	Continuous	+/- *See text*
Centrality Control			
Distance from CBD	Computed	Continuous	-
Distance from Freeway Ramp	Computed	Continuous	-

Exhibit 20
Variables, Data Sources, Measurement Type, and Predicted Associations with Respect to Rent per Square Meter—continued

Variable	Data Source	Measure	Predicted Sign
Metropolitan Control			
Metropolitan Area Location	Census	Binary	NA
Norfolk excluded from LRT*	Census	Binary	Referent
Tacoma excluded from SCT*	Census	Binary	Referent
Eugene-Springfield excl. from BRT*	Census	Binary	Referent
Portland excluded from CRT*	Census	Binary	Referent
TREATMENT VARIABLES			
Station Distance Band Treatment			
0-100m	Computed	Binary	+/- *See text*
>100m-200m	Computed	Binary	+/- *See text*
>200m-300m	Computed	Binary	+/- *See text*
>300m-400m	Computed	Binary	+/- *See text*
>400m-500m	Computed	Binary	+/- *See text*
>500m-600m	Computed	Binary	+/- *See text*
>600m-700m	Computed	Binary	+/- *See text*
>700m-800m	Computed	Binary	+/- *See text*
Beyond 800 meters	Computed	Binary	Referent

*These systems were selected as referents because they are the smallest of their modes in terms of passenger miles.
Comment: NA means no direction of association is predicted—see text for discussion; "m" means meters and m^2 means square meters; HH means households; LRT means light rail transit; BRT means bus rapid transit; SCT means streetcar transit; and CRT means commuter rail transit.

Although there are no *a priori* expectations of goodness of fit outcomes, literature suggests that ordinary least squares regression analysis usually explain about one fifth to two-thirds of the dependent variable variation with respect to the control and treatment variables. Note is made that while some analysts are preoccupied with achieving high levels regression model coefficients of determination (R^2), too many variables can lead to over-specification. It is best to emphasize the variables most relevant to the question along with relevant controls are sufficient to avoid serious omitted variable bias (a form of endogeneity) in the model.

Because the direction of association with respect to metropolitan area is not predicted, significance-test outcomes are not reported for them below. For other variables where significance is $p < 0.10$ of the one-tailed t-test (because directions of association are predicted), coefficients are highlighted in bold. The bottom of the exhibits report metrics for mean rent per square meter ("m^2"), the number of cases for each regression, the adjusted coefficient of determination ("R^2"), the standard error of estimate, the F-Ratio, and the mean rent per square meter for the study area.

The bottom of the exhibits below shows the revealed directions of association of rents with respect to the first station distance band, which includes the transit station, called "Station Sign," and "Functional Form" revealed across the first four distance bands spanning 400 meters where there are at least two significant coefficients and at least one of which is at the first or second distance bands. (This protocol is also used in the regression appendices.) Consistent with theoretical outcomes explained above, functional form choices are negative or downward with respect to distance from transit stations thus revealing that accessibility value dominates, positive or upward revealing externality value dominates, concave (downward then upward slopes) revealing accessibility value prevails over externality value to an inflection point, convex (upward then downward slopes) revealing externality value prevails over accessibility value to an inflection point, or ambiguous where there is no discernable relationship perhaps because accessibility and externality values cancel each other over the study area.

Results and interpretations are presented for differences in outcomes with respect to office, retail, and multifamily real estate, respectively, by mode. Differences between LRT, SCT, BRT, and CRT modes with respect to each of the real estate types will also be noted. Key results from the appendices will be interwoven into insights at the end of this section.

Exhibit 21
Variation in Office Rents with Respect to Transit Station Proximity by Mode

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Constant	**2.286**	Constant	**1.981**	Constant	**1.709**	Constant	2.063
Structure Controls							
GLA (1000 m2)	-1.183E-004	GLA (1000 m2)	**2.273E-003**	GLA (1000 m2)	**4.484E-008**	GLA (1000 m2)	**9.882E-009**
Class A	**0.313**	Class A	**0.315**	Class A	**0.317**	Class A	**0.224**
Class B	**0.098**	Class B	**0.083**	Class B	**0.096**	Class B	**0.060**
Stories	**0.003**	Stories	0	Stories	**0.006**	Stories	**0.011**
Effective Year Built	**0.001**	Effective Year Built	**0.001**	Effective Year Built	**0.001**	Effective Year Built	**0.000**
Vacancy	**-0.001**	Vacancy	**-0.001**	Vacancy	**-0.001**	Vacancy	**-0.001**
Socioeconomic Control							
Med. HH Inc ($1000)	**1.497E-003**	Med. HH Inc ($1000)	**1.105E-003**	Med. HH Inc ($1000)	**1.751E-006**	Med. HH Inc ($1000)	**2.065E-006**
Land-Use Control							
Land-Use Mix	**-0.009**	Land Use Mix	-0.008	Land Use Mix	**0.028**	Land Use Mix	**-0.011**
Centrality Controls							
CBD (m)	**-1.581E-006**	CBD (m)	**-8.189E-006**	CBD (m)	**-7.439E-007**	CBD (m)	**-9.123E-007**
Freeway (m)	**-4.206E-006**	Freeway (m)	**3.684E-006**	Freeway (m)	**-1.403E-006**	Freeway (m)	**-1.828E-006**
Metropolitan Controls							
Buffalo	-0.205	Atlanta	-0.315	Albuquerque	-0.237	Albuquerque-Santa Fe	-0.297
Charlotte	0.158	Cincinnati	-0.576	Arlington-Alexandria	0.461	Austin	0.300
Cleveland	-0.182	Dallas	-0.333	Cleveland	-0.180	Dallas-Fort Worth	-0.089
Dallas	0.137	Kansas City	-0.476	Eugene-Springfield	-0.001	Denver	0.058
Denver	0.136	New Orleans	-0.477	Kansas City	-0.070	Miami SE Florida	0.322
Houston	0.155	Portland	-0.198	Minneapolis-St. Paul	0.097	Minneapolis-St. Paul	-0.043
Minneapolis-St. Paul	0.096	Salt Lake City	-0.451	Nashville	0.235	Nashville	0.060
Phoenix	0.090	Seattle	0.029	Pittsburgh	-0.146	Orlando-Deltona	-0.047
Pittsburgh	-0.112	Tampa	-0.211	Reno	-0.011	Salt Lake City-Ogden-Provo	-0.210
Portland	0.207	Tucson	-0.522	Salt Lake City	-0.049	San Diego	0.199
Sacramento	0.133	Washington	0.354	San Antonio	0.195	San Jose-Stockton	0.504

Exhibit 21
Variation in Office Rents with Respect to Transit Station Proximity by Mode—continued

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Metropolitan Controls							
Salt Lake City	-0.054			San Diego	0.346	Seattle-Tacoma	0.197
San Diego	0.339			San Jose	0.771	Washington DC	0.564
San Jose	0.790			Seattle	0.373	Washington-MDW	0.093
Seattle	0.407					Washington-VRE	0.141
St. Louis	-0.069						
Station Distance Band Treatment							
0-100m	**-0.007**	0-100m	**0.031**	0-100m	**0.026**	0-100m	**0.086**
>100m-200m	**0.014**	>100m-200m	**0.018**	>100m-200m	**0.172**	>100m-200m	**0.045**
>200m-300m	**0.039**	>200m-300m	**0.082**	>200m-300m	-0.006	>200m-300m	**0.033**
>300m-400m	-0.001	>300m-400m	**0.021**	>300m-400m	**0.036**	>300m-400m	0.001
>400m-500m	**0.022**	>400m-500m	**0.045**	>400m-500m	0.003	>400m-500m	**0.013**
>500m-600m	**0.030**	>500m-600m	**0.041**	>500m-600m	**0.012**	>500m-600m	**0.037**
>600m-700m	**0.011**	>600m-700m	-0.012	>600m-700m	**0.019**	>600m-700m	**-0.049**
>700m-800m	**0.019**	>700m-800m	**0.044**	>700m-800m	**0.030**	>700m-800m	**0.088**
Performance Metrics							
R^2	0.570	R^2	0.654	R^2	0.663	R^2	0.537
Standard Error	0.232	Standard error	0.203	Standard error	0.240	Standard Error	0.255
F-ratio	2478.789	F-ratio	2067.562	F-ratio	2354.390	F-ratio	2294.212
Cases	63,664	Cases	31699	Cases	38,355	Cases	65,300
Mean Rent/m^2/year	$253.68	Mean Rent/m^2/year	$246.01	Mean Rent/ m^2/year	$266.24	Mean Rent/m^2/year	$283.08
Station Sign	***Negative***		***Positive***		***Positive***		***Positive***
Functional Form	***Upward***		***Concave***		***Concave***		***Downward***

Comments: "GLA" means gross leasable area; "Med. HH Inc." means median household income; "LRT" means light rail transit; "BRT" means bus rapid transit; "SCT" means streetcar transit; "CRT" means commuter rail transit; "m" means meter while "m^2" means square meter; "Washington MDE" means Maryland Area Commuter Rail (MARC) West route; "Washington VRE" means Virginia Railway Express; and bold coefficients mean $p < 0.10$ for relevant variables (see text).

Exhibit 22
Variation in Retail Rents with Respect to Transit Station Proximity by Mode

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Constant	**-1.212**	Constant	**-3.677**	Constant	**2.214**	Constant	2.854
Structure Controls							
GLA (1000 m2)	**-0.000E+000**	GLA (1000 m2)	-7.298E-007	GLA (1000 m2)	**-4.990E-003**	GLA (1000 m2)	**-6.756E-007**
Reg/Com Mall	**0.116**	Reg/Com Mall	**9.200E-002**	Reg/Com Mall	**0.247**	Reg/Com Mall	-0.049
Power Center	**0.202**	Power Center	**0.228**	Power Center	**-0.055**	Power Center	0.011
Lifestyle Center	**0.281**	Lifestyle Center	**0.236**	Lifestyle Center	**-0.017**	Lifestyle Center	-1.281E-006
Strip Retail	**-0.037**	Strip Retail	-0.032	Strip Retail	**-0.055**	Strip Retail	-4.424E-007
Retail General	**0.053**	Retail General	0.027	Retail General	**-0.017**	Retail General	-0.381
Effective Year Built	**0.002**	Effective Year Built	**3.000E-003**	Effective Year Built	**0**	Effective Year Built	**0.001**
Vacancy Rate	**0.000**	Vacancy Rate	**-1.000E-003**	Vacancy Rate	**0**	Vacancy Rate	**3.100E-006**
Socioeconomic Control							
Med. HH Inc ($1000)	**2.862E-003**	Med. HH Inc ($1000)	**3.944E-006**	Med. HH Inc ($1000)	**2.639E-003**	Med. HH Inc ($1000)	**0.025**
Land-Use Control							
Land Use Mix	0.014	Land Use Mix	**5.300E-002**	Land Use Mix	**0.063**	Land Use Mix	0.145
Centrality Controls							
CBD (m)	**-0.000E+000**	CBD (m)	**-3.004E-006**	CBD (m)	**0.13**	CBD (m)	0.222
Freeway (m)	**-0.000E+000**	Freeway (m)	**1.083E-006**	Freeway (m)	**0.251**	Freeway (m)	0.284
Metropolitan Controls							
Buffalo	-0.184	Atlanta	-0.298	Albuquerque	-0.515	Austin	0.113
Charlotte	0.249	Cincinnati	-0.593	Cleveland	-0.578	Dallas-Fort Worth	-0.198
Cleveland	-0.156	Dallas	-0.381	Eugene-Springfield	-0.241	Denver	0.053
Dallas	0.124	Kansas City	-0.569	Kansas City	-0.537	Miami SE Florida	0.292
Denver	0.318	New Orleans	-0.372	Minneapolis-St. Paul	-0.356	Minneapolis-St. Paul	-0.225
Houston	0.161	Portland	-0.285	Nashville	-0.18	Nashville	-0.070
Minneapolis-St. Paul	0.056	Salt Lake City	-0.399	Pittsburgh	-0.468	Orlando-Daytona	0.005
Phoenix	0.070	Seattle	-0.039	Reno	-0.335	Salt Lake City-Ogden-Provo	-0.135
Pittsburgh	-0.063	Tampa	-0.354	Salt Lake City	-0.309	San Diego	0.230
Portland	0.259	Tucson	-0.509	San Antonio	-0.218	San Jose-Bay Area	0.335

Exhibit 22
Variation in Retail Rents with Respect to Transit Station Proximity by Mode—continued

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Metropolitan Controls							
Sacramento	0.102	Washington DC	0.354	San Diego	0.096	Seattle-Tacoma	0.096
Salt Lake City	0.086			San Jose	0.255	Washington DC	0.483
San Diego	0.539						
San Jose	0.651						
Seattle	0.432						
St. Louis	-0.033						
Station Distance Band Treatment							
0-100m	**0.104**	0-100m	**0.206**	0-100m	**0.024**	0-100m	0.063
>100m-200m	0.029	>100m-200m	**0.266**	>100m-200m	**0.071**	>100m-200m	**0.197**
>200m-300m	**0.085**	>200m-300m	**0.185**	>200m-300m	**0.045**	>200m-300m	0.043
>300m-400m	0.028	>300m-400m	**0.317**	>300m-400m	**0.095**	>300m-400m	-0.031
>400m-500m	0.010	>400m-500m	**0.217**	>400m-500m	**0.028**	>400m-500m	-0.008
>500m-600m	0.011	>500m-600m	0.132	>500m-600m	**0.072**	>500m-600m	0.018
>600m-700m	0.021	>600m-700m	**0.148**	>600m-700m	0.023	>600m-700m	0.005
>700m-800m	-0.007	>700m-800m	**0.256**	>700m-800m	**0.039**	>700m-800m	-0.005
Performance Metrics							
R^2	0.281	R^2	0.382	R^2	0.293	R^2	0.388
Standard Error	0.339	Standard Error	0.407	Standard Error	0.282	Standard Error	0.352
F-ratio	192.968	F-ratio	66.520	F-ratio	203.174	F-ratio	333.437
Cases	17,644	Cases	3,558	Cases	17,627	Cases	16,779
Mean Rent/m2/year	$226.72	Mean Rent/m2/year	$247.38	Mean Rent/m2/year	$194.06	Mean Rent/m2/year	$226.72
Station Sign	*Positive*		*Positive*		*Positive*		*Ambiguous*
Functional Form	*Downward*		*Convex*		*Convex*		*Ambiguous*

Comments: "GLA" means gross leasable area; "Med. HH Inc." means median household income; "LRT" means light rail transit; "BRT" means bus rapid transit; "SCT" means streetcar transit; "CRT" means commuter rail transit; "m" means meter while "m^2" means square meter; and bold coefficients mean $p < 0.10$ for relevant variables (see text).

Exhibit 23
Variation in Multifamily Rents with Respect to Transit Station Proximity by Mode

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Constant	**-3.850**	Constant	**-3.419**	Constant	**-3.452**	Constant	-3.660
Structure Controls							
GLA (1000 m2)	**0.000E+000**	GLA (1000 m2)	**2.654E-003**	GLA (1000 m2)	**3.309E-007**	GLA (1000 m2)	**3.188E-007**
Stories	**0.026**	Stories	**-0.001**	Stories	**-0.001**	Stories	**-0.001**
Average Unit Size	**-0.001**	Average Unit Size	**-0.096**	Average Unit Size	**0.002**	Average Unit Size	**0.022**
Subsidized	**-0.101**	Subsidized	**-0.197**	Subsidized	**0.025**	Subsidized	**0.002**
Restricted	**-0.223**	Restricted	**0.029**	Restricted	**0.005**	Restricted	**0.005**
Effective Year Built	**2.000E-003**	Effective Year Built	**0.002**	Effective Year Built	**-0.113**	Effective Year Built	**-0.142**
Vacancy Rate	**0.004**	Vacancy Rate	**0.003**	Vacancy Rate	**-0.244**	Vacancy Rate	**-0.251**
Socioeconomic Control							
Med. HH Inc ($1000)	**3.104E-003**	Med. HH Inc ($1000)	**3.499E-003**	Med. HH Inc ($1000)	**2.703E-006**	Med. HH Inc ($1000)	3.383E-006
Land-Use Control							
Land Use Mix	**0.083**	Land Use Mix	**0.117**	Land Use Mix	**0.08**	Land Use Mix	0.109
Centrality Controls							
CBD (m)	**-0.000E+000**	CBD (m)	**-2.332E-006**	CBD (m)	**-8.871E-007**	CBD (m)	**-1.110E-006**
Freeway (m)	**-0.000E+000**	Freeway (m)	**-5.394E-006**	Freeway (m)	**-3.370E-006**	Freeway (m)	**-2.058E-006**
Metropolitan Controls							
Buffalo	0.032	Atlanta	-0.038	Albuquerque	-0.477	Albuquerque-Santa Fe	-0.348
Charlotte	-0.094	Cincinnati	-0.273	Arlington-Alexandria	0.110	Austin	-0.038
Cleveland	-0.134	Dallas	-0.007	Cleveland	-0.451	Dallas-Fort Worth	-0.121
Dallas	0.059	Kansas City	-0.212	Eugene-Springfield	-0.312	Denver	0.103
Denver	0.256	New Orleans	0.032	Kansas City	-0.462	Miami-SE Florida	0.133
Houston	-0.048	Portland	0.112	Minneapolis-St. Paul	-0.207	Minn.-St. Paul	-0.058
Minneapolis-St. Paul	0.111	Salt Lake City	-0.061	Nashville	-0.251	Nashville	-0.112
Phoenix	-0.077	Seattle	0.298	Pittsburgh	-0.314	Orlando-Daytona	-0.137
Pittsburgh	-0.006	Tampa	-0.011	Reno	-0.314	Portland	-0.038
Portland	0.170	Tucson	-0.248	Salt Lake City	-0.322	Salt Lake City-Ogden-Provo	-0.188

Exhibit 23
Variation in Multifamily Rents with Respect to Transit Station Proximity by Mode—continued

LRT Variables	LRT Beta	SCT Variables	SCT Beta	BRT Variables	BRT Beta	CRT Variables	CRT Beta
Metropolitan Controls							
Sacramento	0.119	Washington DC	0.436	San Antonio	-0.379	San Diego	0.265
Salt Lake City	-0.016			San Diego	0.133	San Jose	0.431
San Diego	0.444			San Jose	0.326	Seattle-Tacoma	0.158
San Jose	0.628			Seattle	0.076	Washington DC	0.332
Seattle	0.378					Washington VRE	0.243
St. Louis	-0.136						
Station Distance Band Treatment							
0-100m	0.025	0-100m	0.008	0-100m	-0.016	0-100m	**0.347**
>100m-200m	**0.043**	>100m-200m	**0.061**	>100m-200m	-0.009	>100m-200m	**0.071**
>200m-300m	**0.055**	>200m-300m	**0.127**	>200m-300m	-0.028	>200m-300m	0.023
>300m-400m	**0.049**	>300m-400m	**0.165**	>300m-400m	**-0.021**	>300m-400m	**0.066**
>400m-500m	**0.021**	>400m-500m	**0.153**	>400m-500m	-0.004	>400m-500m	**0.033**
>500m-600m	**0.026**	>500m-600m	**0.229**	>500m-600m	**-0.025**	>500m-600m	**0.054**
>600m-700m	**0.056**	>600m-700m	**0.089**	>600m-700m	**0.044**	>600m-700m	**0.033**
>700m-800m	**0.026**	>700m-800m	**0.176**	>700m-800m	0.012	>700m-800m	**0.067**
Performance Metrics							
R^2	0.593	R^2	0.636	R^2	0.545	R^2	0.552
Standard Error	0.252	Standard Error	0.266	Standard Error	0.303	Standard Error	0.259
F-ratio	1178.518	F-ratio	757.059	F-ratio	575.118	F-ratio	989.552
Cases	28,380	Cases	12,959	Cases	15,791	Cases	26,436
Mean Rent m2/year	$186.44	Mean Rent m2/year	$185.37	Mean Rent m2/year	$222.39	Mean Rent m2/year	$206.39
Station Sign	***Ambiguous***		***Ambiguous***		***Ambiguous***		***Positive***
Functional Form	***Convex***		***Upward***		***Ambiguous***		***Downward***

Comments: "GLA" means gross leasable area; "Med. HH Inc." means median household income; "LRT" means light rail transit; "BRT" means bus rapid transit; "SCT" means streetcar transit; "CRT" means commuter rail transit; "m" means meter while "m^2" means square meter; "Washington VRE" means Virginia Railway Express; and bold coefficients mean $p < 0.10$ for relevant variables (see text).

Results and Interpretations for Office Rents

Results for office rents with respect to transit station proximity are more robust across the modes than the other real estate types but patterns are not consistent. At the station, rent is negatively associated with LRT proximity thus revealing externality dominance, but it is positive for the other three modes revealing accessibility dominance. Functional forms are not nearly as consistent with other modes. At the extremes are LRT and CRT which reveal upward and downward sloping gradients across the first 400 meters, respectively, and in both cases, most coefficients are significant through the 800-meter study areas. The main difference between the two modes is that whereas LRT station areas serve mostly areas outside of downtowns many of which are in transition, CRT stations a few and far between, and in urban areas tend to be at highly developed nodes such as Denver's central station, San Diego's downtown terminal, and so forth.

The office rent functional form with respect to SCT is concave revealing downward sloping values from stations reflecting accessibility value at the station but then the slope turns upward before flattening out across the study area. One interpretation is that other land uses outbid office near SCT stations; this is explored below. Likewise, despite having a pronounced value increment near but not at the BRT station, the influence of BRT station proximity on office rents is modest. Inasmuch as BRT systems run along commercial corridors dominated by retail and multifamily real estate, this outcome appears to make sense. Results and interpretations for real estate are offered next.

Considering individual transit systems, office rent outcomes are inconsistent. Among LRT systems (see Appendix exhibit H-1), station proximity confers negative outcomes among six of the 12 systems that have significant coefficients at the station band and those with positive coefficients are usually modest. Only Buffalo, Cleveland and Denver have positive rent premiums through half or more of the 800-meter study areas. Notably, coefficients for several first and second-generation LRT systems are negative or ambiguous including Pittsburgh, Portland, San Diego, and San Jose, with modest outcomes revealed for Sacramento. The initial lines of these systems were placed in existing freight rail corridors and down freeway medians thereby inhibiting the ability of the market to respond favorably to transit station proximity.

Among SCT systems (see Appendix exhibit H-2), seven of the 11 systems with positive coefficients at the station band are positive but they are mostly modest in magnitude, with two exceptions noted later. Only three SCT systems—Dalles, New Orleans, and Tucson, have positive rent premiums extending to the first three or four distance bands. The magnitudes of the Dallas and Tucson coefficients are in the lower double-digit percentages.

With the exception of the San Jose BRT system (see Appendix exhibit H-3), the 12 significant BRT office rent premiums are evenly split between positive and negative at the station. Only the San Antonio and San Jose BRT systems have positive, significant coefficients to at least the fifth distance although three of the first four distance band coefficients for Kansas City are also positive. Notably. San Jose's coefficients reveal about a 22 percent premium at the station band rising to 68 percent in the second and still averaging about 20 percent through the rest of the distance bands. The combination of Silicon Valley land constraints and planning to steer offices to BRT stations may help explain this outcome. A similar outcome is seen with respect to the San Jose-Stockton (Altamont Express) CRT system.

Nine or nearly two-thirds of the 14 CRT systems with significant coefficients at the station band are positive (see Appendix exhibit H-4). Six CRT systems had mostly positive, significant coefficients to at least the third distance band. Three of those—Denver, San Diego, and San Jose—have double-digit positive rent premiums led by San Jose that averages more than 20 percent premium over the first three distance bands. As this appears to be the only study into the association between CRT station proximity and office rents, transit and land use planners should see the opportunity to encourage office real estate investment near CRT stations. On the other hand, the post-pandemic office market may be challenged through the 2020s if not beyond.[26]

Results overall and for specific modes and systems are quite different with respect to retail rent outcomes as will be seem next.

Results and Interpretations for Retail Rents

As alluded to above, retail rents are positive across nearly all distance bands for BRT systems. However, SCT systems dominate retail rent outcomes with premiums averaging more than 20 percent across the first five distance bands. Retail clearly outbids other real estate for location near SCT stations. This makes sense because SCT systems serve mostly downtown areas and nearby nodes that themselves are traditional retail centers. In contrast, retail performs well only in the first and third distance bands from LRT stations and only in the second distance band from CRT stations. An interpretation is that both these systems serve mostly office and multifamily real estate where retail is a complementary activity.

Otherwise, across all modes, retail premiums with respect to individual transit station distances are meager. For LRT (see Appendix exhibit I-1), 12 of the 17 systems show ambiguous results at the station band. Of the rest, only Salt Lake City has significant coefficients from the station out to three distance bands, but they also reveal impressive premiums of 31 percent. 54 percent and 19 percent, respectively.

With respect to SCT (see Appendix exhibit I-2), 8 of 12 systems show no significant coefficients at the station band. However, three systems reveal positive, sizeable premiums from the station band to the third distance band for Portland and Tucson, and mostly to the sixth distance band for Tampa. Tampa and Tucson average more than a 40 percent premium above the mean across all the referenced significant distance bands.

As for BRT (see Appendix exhibit I-3), nine of the 13 systems had no significant coefficients at the station band and only San Antonio had positive coefficients from the station band outward though including all eight bands to 800 meters albeit all with single-digit premiums.

Rounding out this assessment, CRT systems (see Appendix exhibit I-4) had no significant coefficients at the station band and only two systems had significant coefficients within the first four distance bands.

[26] See https://www.mckinsey.com/mgi/our-research/empty-spaces-and-hybrid-places.

A key finding overall from this research, which is apparently the first to assess retail rent associations with respect to transit station proximity for all four of the modes reported, is that it is rare for retail real estate to value proximity. But it also may be that transit and land use planners have not facilitated retail opportunities near transit in a way that responds to market opportunities. After all, the few instances where retail rents are robust, rent premiums range from the low double-digits to into the 40- and even the 50-percentages.

Results and Interpretations for Multifamily Rents

BRT results with respect to multifamily rents stand out for being not significant near BRT stations and negative where they are significant farther away. The multifamily real estate market does not apparently value proximity to BRT stations. On the other hand, it may be that BRT accessibility and externality values offset each other near stations. This is plausible considering that BRT routes tend to be along busy commercial corridors impacted by noise, heavy traffic, and lower valued real estate compared to real estate near LRT, SCT, and CRT stations. But there is another interpretation: since there is no association between multifamily rents and BRT station proximity, this may indicate reduced gentrification pressure for lack of demand among younger and higher earning households. Such an outcome would be consistent with demographic findings for BRT station proximity presented above as well as research by Qi (2023).

In contrast, multifamily rents are influenced by proximity to LRT, SCT, and CRT stations in different ways. Where the LRT functional form is convex, rising and then falling, the SCT functional form rises mostly continuously from the second through sixth distance band thus suggesting that proximity to SCT stations reduces rent. One reason may be the streetcars are located along some of the busiest downtown streets which include noise, crowding, congestion, and so forth.

The biggest surprise, however, is the nature of rent relationships with respect to CRT station proximity. At the station, rents are nearly 35 percent higher than the study area mean, falling dramatically to about 7 percent above the mean in just the second distance band and falling gradually through the fifth distance band. Inasmuch as CRT stations are often located at regional hubs, some households may be willing to pay a premium to access CRT systems for jobs, services, shopping, and so forth. Nonetheless, this phenomenon is worthy of additional study.

Very few systems reveal significant associations between transit station proximity and multifamily rent. For LRT systems (see Appendix exhibit H-1), only two systems show a positive association at the station band while just two more reveal negative associations meaning 13 of 17 LRT systems studied have ambiguous station area outcomes. While Pittsburgh, a first-generation LRT system, revealed negative associations throughout the first five distance bands, Charlotte, a second-generation LRT system, revealed a 30 percent positive premium at the station band falling to a 17 percent premium in the fourth. Cleveland, Houston, Norfolk, Sacramento, Salt Lake City, and San Diego all had at least one positive coefficient in the first two distance bands and at least one more in the next two. Those coefficients range from the middle single-digits to low 20-percentages.

With respect to SCT systems (see Appendix exhibit J-2), only Atlanta (positive) and New Orleans (negative) have significant coefficients at the station band. However, across the first four distance bands, those systems plus Tucson have coefficients indicating that rents range into the 30- to 40-percentage points above the mean.

Of the 15 BRT systems in the study, six have significant coefficients at the station band which are split evenly between positive and negative (see Appendix exhibit J-3). Only Cleveland and Kansas City have multiple, positive coefficients among the first four distance bands. Notably, both those systems connect downtowns to major regional centers such as universities, medical centers, conference facilities and mixed-use complexes. None of the other BRT systems in the study served such a mix of major activity nodes.

Among the 15 CRT systems studied, only San Diego has a positive coefficient at the station band, and it indicates that multifamily rents are nearly 46 percent higher than the regional mean. Indeed, the second distance band reveals a significant coefficient indicating rents nearly 50 percent higher than the mean. While the third distance band has an ambiguous coefficient the fourth is significant showing rents at 13 percent higher than the mean.

Insights From Analysis

Regression results are mostly disappointing. In theory, transit stations must influence real estate markets ideally by becoming an economic subcenter around which development is attracted. Doing so bids up the value of land and real estate as a function of transit station distance. Negative results suggest the market is responding in undesirable ways that could be overcome by mitigating externalities (see Nelson and McClesky 1990). However, except for office development near most transit stations in the study, SCT, BRT, and CRT transit stations do not appear to be positive attractors of retail or multifamily development. Inasmuch as post-pandemic office demand is unlikely to return to pre-pandemic levels over the next several years (Peiser and Hugel 2022), planners and policymakers may no longer be able to depend on meeting the demand for offices as a reason for making new transit investments. Something else is needed.

Results for multifamily rent are especially disappointing. As noted earlier, households are increasingly drawn to walkable communities, especially those with multimodal access. Demographic analysis presented above supports this assertion based on the extent to which transit stations attracted disproportionate shares of regional development during the study period. Yet, transit station proximity does not appear to be valued in the multifamily market overall or among most of the systems studied.

Despite disappointing results, there are lessons to be learned based on outcomes associated with individual transit systems. For instance, the San Antonio BRT system is unique in conferring positive rent results on retail real estate across the entire 800-meter study area. Planners might study how that city's BRT planning and urban design led to this outcome. Likewise, given positive BRT outcomes with respect to multifamily rent premiums, systems in Cleveland and Kansas City should be studied for lessons. With respect to SCT systems, only Tucson stands out as having favorable outcomes across all real estate types studied; perhaps planners can learn lessons from that system. Among CRT systems, San Diego likewise stands out as having consistently favorable outcomes for all real estate types.

Transit station proximity and gentrification implications are discussed next.

TRANSIT STATION PROXIMITY AND GENTRIFICATION

The mature of the concern about transit investments engendering gentrification has been reviewed above. Descriptive and quantitative findings have been offered above mostly suggesting that geneticizing appears to be limited. This section summaries gentrification concerns and ley findings.

All neighborhoods and communities change over time. Their composition changes as society around them changes. Sometimes, public intervention can destroy neighborhoods such as what happened during the "urban renewal" period. But sometimes the absence of public intervention can facilitate decline from which recovery can be very slow. When it comes to transit, the concern by some is that those new investments will lead automatically to the displacement of existing households by those who are different in such respects as race/ethnicity, income, education, and so forth through a process called "gentrification." The extent to which new transit investment merely accelerates underling gentrification trends is not known. The reason is that research is mixed on how gentrification processes work and their magnitude. Nonetheless, that gentrification occurs is not in dispute. That it is not widespread is also not in dispute. Also not in dispute is that it does not automatically occur with any new transit investment.

Descriptive research presented in the report shows evidence of gentrification in a few LRT, SCT, and CRT systems. Yet this does not appear to be the case with respect to BRT systems. These findings are consistent with those of Qi (2023).

Other gentrification evidence is offered indirectly through quantitative, regression analysis. That is, if transit station proximity is associated with higher rents per square meter, gentrification may be revealed as an outcome of pricing. Yet, for most systems, multifamily rent with respect to transit station proximity is ambiguous (no statistically significant association) and nearly as many systems show negative (lower rent) outcomes than positive (higher rent) ones. Moreover, just because rent per square meter might increase does not mean that rent per unit also increases. Indeed, as shown above, households near transit stations are likely to incur reduced commuting costs and many do not need any cars thereby realizing savings even if rents are higher. [27]

Nonetheless, jurisdictions with FGT systems may be wise to anticipate adverse outcomes of their transit systems and pursue policies to mitigate undesirable outcomes. Avenues are outlined below.

An overall summary of key research findings with implications for transit policy and planning concludes this report.

[27] Several perspectives of Boarnet et al. 2017 are applied in here.

SUMMARY OF FINDINGS WITH IMPLICATIONS FOR POST-PANDEMIC TRANSIT POLICY AND PLANNING

This concluding section summarizes key findings and offers approaches to meeting the market demand for living near transit stations while also addressing potential gentrification concerns. Concluding observations for post-pandemic transit policy and planner are also offered.

Key Findings

Findings are organized in jobs and wages, people and households, commuting mode choice and change in VKT as well as reduced transportation cost, and real estate markets with respect to transit station proximity.

Jobs and Wages

The change in jobs and wages during the study period (2010-2019) were measured with respect to cumulative distance bands from transit stations to about 200 meters—called the "station band", then to 400 meters cumulatively, and finally to 800 meters cumulatively. All bands comprise the "station area". Despite the 800-meter transit station areas occupying less than one percent of their transit region's urbanized land area (and less than half that for SCT and CRT systems), these station areas accounted for 28 percent of the jobs in LRT regions, 19 percent in SCT regions, 28 percent in BRT regions, and 20 percent in CRT regions.

Overall, nearly all station bands added jobs in all economic groups. The weakest group was the industrial group perhaps because it is more dependent on large areas of land that would seem to be expensive near transit stations. Education was also weak in the first two distance bands perhaps for the same reason. The arts-entertainment-recreation group was the strongest.

However, the station band itself accounts for the smallest share of job change over time. Indeed, despite impressive outcomes noted above, most distance bands for most economic groups lost share of jobs relative to their transit regions. One reason may be that people and households dominate change in the station band and the 400-meter band, as will be summarized below.

Research also explored the change in jobs based on lower-, middle-, and upper-wage jobs. Stations areas gained share of upper-wage jobs, lost share of middle-wage jobs, and held about steady in terms of the share of regional change in lower-wage jobs. Although some policymakers view station areas as potential attractors of lower- and middle-wage jobs, the finding that upper-wage jobs gained the largest share of change is consistent with economic expectations. By improving accessibility, transit station areas become more productive, thus leading to more upper-wage jobs. But there are exceptions where indeed lower-wage jobs were attracted to a few individual transit system station areas.

People and Households

This report explored the change in demographic composition by station distance band in terms of population generally as well as by White/Non-White dichotomy, households by type and age, median household income, and housing tenure (own or rent). It did so with special reference to identifying potential gentrification.

During the study period, most regions lost White population, and, in all regions, Non-Whites accounted for the largest share if not all the change. In regions that added Whites, they tended to congregate within transit station areas at a rate disproportionate to Non-Whites. However, in absolute numbers, Non-Whites dominated population change in station areas.

Consistent with population change, households overall and by type grew at a faster pace within the transit station areas than transit regions. Recall that although jobs were added to station areas, the share of job change was below the pace of transit regions overall. This finding bolsters the notion that people and households are displacing jobs near transit stations, pushing them away from transit stations. One surprise is that households with children were attracted to LRT and CRT transit station areas to a greater extent than their transit regions. Planners may need to consider including demand for households with children as part of future transit station and land use planning.

A key indicator of gentrification is the extent to which the change in households is dominated by younger householders. Indeed, younger householders (under 25 years of age) were added to all station area bands even as the number of such households fell in the transit regions. On the other hand, the absolute number of such households moving into station areas comprised very small shares of total household change, being no more than about four percent for SCT, BRT, and CRT systems and well under one percent for LRT systems. In contrast, the change in householders between 25 and 44 years of age dominated transit region total household change. Noetheless, transit station areas also attracted larger shares of householders aged 45 to 65 years of age than their transit regions. And they even attracted households aged 65 and more years of age at a rate comparable to their transit regions.

Another indicator of gentrification is the extent to which new households in transit areas earn substantially higher incomes than those already living there. Consistent with gentrification expectations, median household income rose at a faster pace relative to transit regions in all the LRT and SCT station areas and less so in CRT station areas. This was not the case with BRT station areas, which is consistent with recent research reported by Qi (2023).

Change in housing tenure is another gentrification indicator. Overall, rental housing tenure increased at a faster pace among LRT, SCT, and CRT systems than transit regions and at an even faster pace in BRT station areas.

While evidence of gentrification is not widespread, the research did not focus on individual station areas that may be prone to gentrification. This is an area of future investigation.

Commuting Mode Choice, Reduced VKT, and Reduced Transportation Cost

The change in the use of non-automobile mode to work, change in working from home, and change in vehicle kilometers traveled and along with transportation costs with respect to transit station proximity were evaluated. In terms of change in the mode choice to work, data show that new workers added to transit station areas used transit and walking/biking modes more than proportionate to transit regions.

Another metric was considered. In the post-pandemic world, working from home would seem to become much more prevalent than before the pandemic. Yet, even before the pandemic, the share of workers working from home increased more rapidly in SCT, BRT, and CRT station areas than in transit regions while the LRT shares were proportionate to their transit regions. For persons working from home, access to transit may be attractive especially if it connects them to centers for shopping, services, and leisure as well as transportation such as airports and long-distance trains. This is clearly an area in need of more research in the post-pandemic economy.

Analysis of the influence of transit station proximity on VKT was divided into six prototypical household types ranging in income, number of workers, and single-parent status. For all household types, VKT was reduced the closer they lived to LRT transit stations, but there were important differences between groups. Four of the six household types have reasonably similar outcomes with respect to LRT station proximity: Median Household, Single-Parent, Moderate-Income, and Dual-Professional. Generally, VKT declines by about 12 to 15 percent across the study area. For all household types, transportation costs as a share of income fell with respect to LRT station proximity.

However, Working Individual Households at 50 percent of MHHI enjoyed the largest reduction in VKT at nearly 42 percent, followed by the Singel-Professional Households at 135 percent of MHHI at nearly 23 percent. These household types may be much more sensitive to transit station location than the others because these single persons have the flexibility to locate near transit stations, they need smaller spaces, and they can afford higher rents.

Special note is made of the relatively small reduction in VKT among single-parent households, who have the lowest income but the highest transportation costs relative to income. For them, transit accessibility does not substitute for all the other trips that transit does not access which in the case of children may be school-related destinations and various child-related services.

Real Estate Markets

The final analysis presented evaluated the association between office, retail, and multifamily rents with respect to transit station proximity. The is the largest and most comprehensive analysis reported in literature.

The association between commercial rents and proximity to transit stations is mixed and mostly negative or ambiguous, meaning there is not statistically significant outcome. Although office rents reveal a higher number of positive associations with respect to transit station proximity than retail or multifamily real estate, for most systems among all the modes, results are not positive.

The outcomes are less impressive for retail and multifamily property. Overall, these results call into question the efficacy of transit station planning, location, and design to achieve desired results in the real estate market. Nonetheless, there are several exemplars among individual systems to warrant their use as models for other systems to emulate. Given the shift in office workplace dynamics after the pandemic, policymakers and planners may need to shift priorities to make transit more attractive to retail and multifamily real estate investment. This is discussed in more detail below.

Addressing Gentrification

The principal danger of gentrification is that existing lower-income households are pushed out of their homes and replaced by higher income households because of transit investments. For now, this does not seem to be a universal outcome, but planning may be needed to mitigate adverse gentrification trends if they emerge.

A case study of Portland's LRT system is instructive. Dong's (2017) analysis did not find gentrification around transit stations in area where it was expected. Dong surmised that the City's long-standing policy to increase housing supply near transit stations reduced gentrification pressures. Supporting Dong's findings, analysis of rents in Portland reported in this report does not show a premium with respect to transit station proximity. Could it be that the supply of housing near transit stations in Portland is so robust that it offsets rent premium effects? Would this be the case with other systems such as Denver which has likewise steered new housing into transit station areas over several decades? This is clearly an area in need of research.

Nonetheless, the authors' perspective based on the weight of the evidence when tied to theory is that perhaps transit stations are mislocated or badly designed thus resulting in externality or ambiguous rent outcomes with respect to transit station proximity. Research is needed to assess the extent to which urban design and regulatory changes can lead to positive outcomes.

Nonetheless, policies and planning should be put into place in advance of potential gentrification trends in the post-pandemic era. Readers are referred to the authors' extensive discussion addressing gentrification options in the context of Complete Streets (Nelson and Hibberd 2024). Additional perspectives are offered here.[28]

The driver of gentrification is insufficient supply of housing relative to demand. In the absence of suitable supply, existing homes are acquired by speculators and converted into more expensive homes. One solution is identifying and acquiring existing housing stock in target areas and preserving it for existing tenants and other income tenants once they leave. Community development corporations and housing preservation trusts among others are often used for this purpose but financial challenges prevent larger scale preservation efforts.

Although affordable housing and housing preservation programs serve mostly rental housing needs, more can be done to promote ownership among households who would otherwise be displaced. Community land trusts (CLKTs) and other forms of share equity entities are one

[28] See https://www.jchs.harvard.edu/blog/strategies-for-responding-to-gentrification for elaborations and additional perspectives.

approach to doing this.[29] CLTs sell homes to qualifying households but retain ownership of the land thus reducing sales prices, perhaps by a quarter to third or even more. In some states where the CLT is a nonprofit organization, the land owned by it can be exempted from property taxes. This reduces the CLT's holding costs. Owners can sell their homes through a profit-sharing arrangement with the CLT (where sellers retain most of the gain) but the home must be sold to another qualifying household.

The preservation of local business should also be pursued where needed to preserve local heritage, culture, and history among other reasons. Some approaches include community outreach and engagement, others require changes to local regulations such as eliminating zoning declaring a local business a nonconforming use, but still others require special forms of financing such as below market loans and tax abatement among others.[30]

The principal limitation with these and many other approaches is money. Federal, state, local, and foundation grants, individual philanthropy, and other conventional sources of money can meet only part of the overall needs. What else can be done?

One approach that is being considered in Tucson, Arizona, is a "value added reinvestment initiative" or VARI program. Conceptually, new tax, fee and other general fund revenues derived from new development along a transit corridor would be identified. In this case, it would be the streetcar corridor launched in 2014. At the present time, the City does not know the extent to which the streetcar corridor generates new revenues since 2014. Once those revenues are known, the City Council could apportion some of them for gentrification mitigation and other programs related to the City's transit corridors. No special district is needed because the process is within the City's discretionary budgeting authority.

Other cities could consider allocating a share of new tax increment funds that flow into general funds after tax increment financing bonds are retired. Subject to special district restrictions, some of those funds may be used for gentrification mitigation programs.

Needless to say, gentrification and displacement mitigation are areas that need more research into causes, consequences, and especially solutions. This is important because if post-pandemic transit policy and planning is going to be effective in generating economic, social, and other benefits associated with transit, ensuring those benefits do not come at the cost of some people and businesses ought to be a requirement of good public policy.

The report concludes with observations going forward in a post-pandemic world.

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[29] See https://www.lincolninst.edu/publications/working-papers/2022-census-community-land-trusts-shared-equity-entities-in-united.

[30] For several ideas and case studies, see https://ilsr.org/8-policy-strategies-cities-can-use-to-support-local-businesses/.

Concluding Observations for Post-Pandemic Transit Policy and Planning

The COVID-19 pandemic changed everything or so it seems, especially the role of transit. Traditionally, transit systems were designed to carry workers to downtown offices as well as connect secondary nodes often with their own offices. In a post-pandemic world, reliance on offices served by transit needs to be rethought. Research reported in this report may provide some insights on the rationale to do so.

Recall above that more than half of American households want to live in walkable communities that include mobility options. Yet, only about 13 percent live in walkable communities (Koschinsky and Talen 2015). By one reckoning, if all new homes built were in walkable communities, it would take 35 years just to meet current demand, let alone new growth-related demand.

Maybe the time has come to recast transit to serve people first. This may include several initiatives.

First, transit station areas, especially planned transit-oriented developments (TODs), may need to be recast as mostly areas for people. While TODs certainly include residential components and the authors do not mean to understate it, station area planning might be rethought to become areas even more attractive to people and households with supporting retail and service functions as well as region-serving retail, food service, lodging, and arts, entertainment, and recreation. An important driver of this suggestion is that the change in the share of people working from home during the study period was larger in transit station areas than transit regions. Perhaps they move to locations near transit stations because of the amenities provided in these areas that are important for those who would otherwise be working and living in their home all day.

Consider also that transit station areas accounted for larger shares of the change in young households (under 25 years of age) than transit regions which is consistent with conventional wisdom. They also attracted larger shares of householders aged 25 to 44 and 45 to 65 years of age than their transit regions. They even attracted households aged 65 and more years of age at a rate comparable to their transit regions. In other words, transit station areas perform far better than their regions in attracting households of nearly all ages. Notably, BRT station areas attracted 61 percent of all new households of 24-44 years of age followed by LRT station areas at 36 percent, CRT station areas at 25 percent, and SCT station areas at 20 percent. These are impressive figures considering this age group accounted for the second largest share of total change in transit regions, behind those 65 years of age and older. Even in the next age group, those between 45 and 64 years of age, BRT station areas attracted 44 percent regional growth followed by 20 percent for LRT station areas. Clearly, transit station areas attracted households disproportionately higher than transit regions despite station areas comprising less than one percent of the regions' urbanized land.

Second, opportunities to walk and bike within transit station areas, and between them, need to be enhanced. Canepa (2007) shows that removing barriers and creating safe, pleasant walking and bicycle connections between transit stations can extend the proverbial half-mile circle (about 800 meters) to a mile (about 1,600 meters) and more. Doing so also advances public health (see also Ewing and Hamidi 2016).

Third, the role of offices in transit station areas may need to be downplayed. Peiser and Hugel (2022) express surprise that offices played as large as role as they did before the pandemic given technological advances allowing people to work remotely. The pandemic corrected for over-reliance on traditional offices. But the new work-from-home place need not be the home office, either. The concept of working from home often means working in "third places" such as local coffee shops, libraries, and open-air venues among others.[31] Moreover, remote offices that are not in the home or in third places includes using a small, private office away from home, often in co-working arrangements that are not in employers' offices.[32] Ideally, these would be within walking, biking, or short transit ride distance. Related to this, efforts to convert excess office space into residential or mixed uses needs to be facilitated through policies, subsidies, and other efforts. Conversions, however, are more difficult and costly than many assume.[33]

Fourth, local governments need to step up their efforts to facilitate residential and complementary development in transit station areas, especially those outside of downtowns. For instance, the authors estimate that the land area comprising the half-mile (roughly 800-meter) circle of all LRT and SCT station areas in the Mountain West states is comprised mostly of aging one- and two-floor structures beyond their economic useful life as well as their parking lot (Nelson and Hibberd 2021). Much of this area has a floor-area-ratio of about 0.25 meaning the structure is equivalent to 25 percent of the land area while the rest of the land is a parking lot. The authors' analysis found that all the growth in the respective transit regions could occur on existing parking lots. Redevelopment of these parking lots would include conversions into walkable communities dominated by "middle housing" (Parolek with Nelson 2020) with multimodal access. The effort likely requires new planning, market, and financial analyses, as well as modernizing local land use regulations. It also requires new investments in infrastructure though much of the infrastructure that is needed may already be available.

Lastly, the planning and design of transit station areas need to make them places where people and businesses are attracted and not repulsed. As successful as transit station areas are in attracting jobs and people in such a small area of land relative to their regions, research into the influence of station proximity on real estate values reported in this report challenges the overall efficacy of transit station area planning and design. In addition to meeting emerging market needs, redoubling the urban design of transit stations and their surroundings can improve their performance and enhance the benefits of transit systems in the post-pandemic era.

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[31] See https://www.brookings.edu/articles/third-places-as-community-builders/ and https://www.thebalancemoney.com/great-places-to-work-outside-your-home-office-1794789.
[32] See https://hbr.org/2023/02/research-how-coworking-spaces-impact-employee-well-being.
[33] See https://www.brookings.edu/articles/myths-about-converting-offices-into-housing-and-what-can-really-revitalize-downtowns/.

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APPENDICES A SERIES THROUGH J SERIES
Appendix A series reports job share of change and station quotients (SQs).
Appendix B series reports wage share of change and station quotients (SQs).
Appendix C series reports population change and station quotients (SQs).
Appendix D series reports household type change and station quotients (SQs).
Appendix E series reports householder age change and station quotients (SQs).
Appendix F series reports median household income and tenure change and station quotients (SQs).
Appendix G series reports commute mode share change and station quotients (SQs).
Appendix H series reports place type and distance band regression rent coefficients for office.
Appendix I series reports place type and distance band regression rent coefficients for retail.
Appendix J series reports place type and distance band regression rent coefficients for multifamily.

Metropolitan Area Abbreviations used in Appendix exhibits series.

Abbreviations	Name
AA	Alexandria-Arlington
ABQ	Albuquerque
ASF	Albuquerque-Santa Fe
ATL	Atlanta
AUS	Austin
BUF	Buffalo
CHR	Charlotte
CIN	Cincinnati
CLE	Cleveland
DAL	Dallas
DC	District of Columbia (see also WDC)
DEN	Denver
DFW	Dallas-Ft. Worth
ESP	Eugene-Springfield
HOU	Houston
KC	Kansas City
MDE	Maryland Area Rail Commute (MARC) - East
MDW	Maryland Area Rail Commute (MARC) - West
MIA	Miami Southeast Florida
MRC	Maryland Area Rail Commute (MARC)
NO	New Orleans
NOR	Norfolk
NSH	Nashville

Metropolitan Area Abbreviations used in Appendix exhibits—continued

Abbreviations	Name
ORL	Orlando-Deltona
PDX	Portland
PHX	Phoenix
PIT	Pittsburgh
RNO	Reno
SA	San Antonio
SAC	Sacramento
SD	San Diego
SEA	Seattle
SJ	San Jose
SJS	San Jose-Stockton
SLC	Salt Lake City
STK	Stockton
STL	St. Louis
TAC	Tacoma
TAM	Tampa
TUS	Tucson
VRE	Virginia Railway Express
WDC	Washington DC (see also DC)

Appendix Exhibit A-1. Light Rail Transit Station Area Job Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Total	3,545,413	19,640	238,758	48,014	588,968	312,388	379,350	159,858	(2,905)	474,066	36,474	216,405	106,211	159,898	220,424	262,870	259,223	65,771
Station Band	428,138	5,924	30,456	4,982	71,245	46,827	2,150	33,686	(8,555)	18,295	(1,164)	56,861	12,346	30,538	31,988	85,886	8,075	(1,402)
400m Band	828,668	813	59,340	8,974	132,129	119,984	9,580	53,104	(8,091)	46,521	(2,403)	110,481	24,061	48,900	52,366	110,901	51,514	10,494
800m Band	990,562	(673)	60,705	8,288	171,543	149,783	12,616	52,799	(7,509)	66,590	2,397	118,049	38,044	74,695	51,584	125,379	55,888	10,384
Station Quotient	0.94	1.06	1.07	1.00	0.91	0.99	0.85	1.01	0.85	0.85	0.94	0.98	0.92	0.92	0.97	1.04	0.85	0.92
400m Quotient	0.98	0.97	1.08	1.01	0.92	1.03	0.87	1.03	0.88	0.90	0.93	1.02	0.93	0.94	0.99	1.03	0.97	0.98
800m Quotient	0.97	0.95	1.06	1.00	0.93	1.03	0.87	1.01	0.91	0.90	0.96	1.00	0.95	0.95	0.95	1.03	0.94	0.97
Industrial	420,363	4,000	24,660	3,211	71,565	32,322	70,019	8,434	(640)	55,701	(3,054)	31,546	8,985	23,350	32,255	14,619	34,107	9,283
Station Band	26,105	186	3,296	(2,886)	(1,532)	3,926	(4,686)	(2,314)	(1,136)	(1,055)	(465)	9,198	2,201	3,793	5,096	(1,631)	8,532	5,582
400m Band	68,913	(406)	3,416	(4,086)	9,575	8,102	(5,223)	445	(955)	3,882	(592)	19,994	(2,015)	5,334	10,200	(591)	12,857	8,976
800m Band	66,928	(584)	3,233	(4,103)	4,408	11,718	(6,400)	(3,077)	(1,560)	4,119	(1,471)	16,060	(1,655)	15,333	8,225	1,659	14,708	6,315
Station Quotient	0.92	1.11	1.10	0.64	0.82	1.09	0.75	0.85	0.67	0.78	0.95	1.05	0.96	0.92	0.95	0.91	1.14	1.21
400m Quotient	0.96	0.83	1.06	0.70	0.89	0.99	0.76	0.97	0.77	0.89	0.97	1.10	0.80	0.92	1.01	0.93	1.14	1.27
800m Quotient	0.94	0.83	1.02	0.72	0.85	1.01	0.75	0.87	0.82	0.88	0.91	1.01	0.82	0.98	0.96	0.95	1.12	1.13
Office	1,318,989	10,869	118,621	29,251	246,873	112,658	129,263	52,579	1,491	167,277	20,728	83,911	(1,385)	59,850	41,648	129,104	87,559	28,692
Station Band	214,604	2,763	21,404	7,512	46,454	7,154	15,649	18,189	(2,446)	11,410	206	28,095	(4,120)	13,846	(296)	63,280	(11,469)	(3,027)
400m Band	407,418	2,988	44,554	9,837	66,814	54,721	19,402	20,792	(1,738)	29,729	(2,040)	48,570	(1,275)	24,394	(2,390)	73,255	14,809	4,996
800m Band	456,766	4,087	45,673	6,781	94,174	64,879	18,747	19,234	(1,642)	33,094	(776)	52,807	(2,314)	35,499	(4,685)	74,051	12,990	4,167
Station Quotient	0.95	1.01	1.07	1.03	0.99	0.85	0.96	1.05	0.83	0.87	0.92	0.97	0.96	0.92	0.91	1.16	0.74	0.87
400m Quotient	0.98	1.00	1.05	1.03	0.93	1.00	0.97	1.01	0.88	0.96	0.90	1.02	1.00	0.98	0.89	1.11	0.92	0.96
800m Quotient	0.97	1.02	1.04	0.97	0.96	1.01	0.95	1.00	0.89	0.92	0.91	1.02	0.99	0.98	0.88	1.07	0.90	0.95
Education	577,224	(1,536)	36,024	7,948	99,220	57,108	76,899	7,693	84	86,092	(1,033)	35,871	25,094	23,478	49,749	30,445	45,942	(1,854)
Station Band	61,556	(757)	1,910	2,079	7,148	7,608	2,534	(3,690)	(8)	4,742	50	6,768	3,824	7,660	8,738	7,245	5,661	44
400m Band	113,828	(1,287)	5,713	2,893	11,866	12,167	2,661	(223)	(928)	9,061	2,191	13,256	5,278	9,704	15,402	12,910	12,981	183
800m Band	146,948	(1,304)	5,988	3,236	22,675	13,959	3,515	2,988	(971)	12,245	472	15,012	8,308	15,097	15,817	17,234	12,072	605
Station Quotient	0.99	0.88	0.91	1.26	0.93	1.00	0.94	0.83	0.99	1.04	1.01	0.94	1.07	1.08	0.99	1.05	1.05	1.01
400m Quotient	1.01	0.85	1.06	1.24	0.91	0.96	0.92	0.95	0.84	1.02	1.13	0.96	0.96	1.04	1.01	1.09	1.11	1.02
800m Quotient	1.01	0.88	1.02	1.23	0.97	0.95	0.93	1.03	0.86	1.05	1.03	0.96	1.00	1.05	0.97	1.12	1.01	1.03

Appendix Exhibit A-1. Light Rail Transit Station Area Job Change and Station Quotients by System —continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Health	128,409	(6,726)	18,965	(4,476)	49,252	16,374	(12,996)	14,244	(2,646)	15,081	(6,643)	4,064	2,566	20,424	482	10,799	13,473	(3,828)
Station Band	(2,865)	(587)	498	(3,996)	7,010	8,446	(14,301)	12,728	(2,188)	(1,961)	(3,112)	76	1,985	(10,574)	2,114	1,722	481	(1,206)
400m Band	22,408	(1,037)	1,329	(3,590)	25,986	9,195	(14,348)	11,774	(1,336)	(5,381)	(4,326)	4,343	4,115	(9,779)	4,947	1,293	343	(1,120)
800m Band	29,317	(1,557)	1,376	(3,569)	21,745	17,812	(8,957)	12,578	(1,343)	(5,994)	(5,921)	5,363	4,266	(9,151)	554	2,138	870	(893)
Station Quotient	0.91	0.97	1.21	0.61	0.88	1.38	0.69	1.35	0.90	0.84	0.38	0.96	1.37	0.27	1.13	1.37	1.36	0.92
400m Quotient	0.98	0.91	1.50	0.78	1.14	1.21	0.72	1.25	1.03	0.77	0.72	1.07	1.30	0.34	1.22	0.96	0.88	0.98
800m Quotient	0.98	0.89	1.23	0.80	1.03	1.49	0.87	1.23	1.03	0.79	0.65	1.08	1.25	0.43	1.01	0.99	0.89	1.00
RFL	626,513	7,264	21,774	2,099	66,072	40,791	59,431	50,956	(862)	84,307	6,562	30,656	50,730	15,143	64,689	53,767	39,655	33,479
Station Band	88,229	3,444	641	(638)	6,426	14,566	11,190	5,035	(2,685)	1,014	278	7,801	3,534	10,875	12,163	9,934	2,699	1,952
400m Band	129,220	(683)	701	566	5,165	20,747	16,037	12,689	(2,896)	3,101	(235)	14,997	9,226	11,382	16,120	14,743	6,602	958
800m Band	167,195	(3,517)	363	2,465	11,540	22,037	14,918	13,787	(1,743)	13,313	(3,822)	16,559	19,915	6,743	24,444	17,508	9,120	3,565
Station Quotient	0.98	1.17	1.05	0.85	0.87	1.67	0.94	0.91	0.82	0.73	1.01	0.97	1.00	1.30	1.18	0.97	1.45	0.91
400m Quotient	0.96	0.88	0.90	1.05	0.82	1.29	0.98	0.98	0.84	0.76	0.93	0.97	0.93	1.16	1.15	1.02	1.07	0.83
800m Quotient	0.96	0.78	0.80	1.17	0.86	1.13	0.96	0.95	0.94	0.88	0.71	0.97	0.96	0.96	1.03	1.04	0.93	0.87
AER	79,102	3,003	4,412	5,272	8,324	8,709	6,028	8,600	(77)	11,896	3,306	3,598	1,154	3,373	947	4,290	7,037	(770)
Station Band	15,900	906	(157)	2,686	1,715	1,012	1,822	2,831	(16)	2,159	998	757	497	997	(1,386)	661	1,169	(751)
400m Band	29,266	1,144	370	2,952	2,370	2,539	1,235	4,783	(175)	2,028	1,728	1,410	1,777	1,651	519	2,146	2,860	(71)
800m Band	32,038	2,035	829	3,082	1,959	3,321	1,250	4,867	(177)	2,313	1,919	2,090	1,952	1,871	(973)	2,490	3,175	35
Station Quotient	0.99	1.11	0.69	1.31	0.99	0.92	1.04	1.07	1.03	1.07	1.07	0.91	1.12	0.98	0.70	0.87	1.15	0.88
400m Quotient	1.05	1.16	0.81	1.22	0.99	0.95	0.93	1.14	0.88	1.01	1.08	0.95	1.43	1.03	1.04	1.07	1.28	1.03
800m Quotient	1.04	1.49	0.88	1.21	0.91	0.99	0.93	1.14	0.88	1.01	1.10	1.00	1.38	1.00	0.90	1.11	1.30	1.04

Comments: ***RFL*** means retail-food-lodging and ***AER*** means arts-entertainment-recreation. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit A-2. Streetcar Transit Station Area Job Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Total	1,548,847	209,178	42,618	311,247	18,970	40,922	106,532	159,898	259,223	57,232	175,211	41,682	126,134
Station Band	80,764	(10,306)	2,196	13,164	(5,091)	11,066	31,245	1,949	30,544	5,874	12,067	(1,136)	(10,808)
400m Band	216,536	16,948	1,516	33,478	(9,994)	28,700	34,966	4,164	42,400	4,389	16,113	2,140	41,716
800m Band	287,835	22,004	1,788	55,948	(12,939)	31,119	46,957	3,840	40,721	10,883	17,532	2,060	67,922
Station Quotient	0.91	0.61	0.95	0.95	0.85	0.90	1.02	0.86	1.17	1.00	0.90	0.86	0.60
400m Quotient	0.95	0.87	0.94	0.94	0.82	1.00	0.99	0.88	0.95	0.89	0.90	0.92	1.42
800m Quotient	0.98	0.89	0.94	1.00	0.79	1.01	0.99	0.86	0.93	0.97	0.91	0.92	1.78
Industrial	178,605	10,761	4,958	40,817	2,293	757	17,751	23,350	34,107	9,058	22,954	9,954	1,845
Station Band	6,383	(78)	3,373	(786)	0	(184)	596	103	3,832	1,466	(35)	175	(2,079)
400m Band	1,709	(2,988)	3,141	(1,327)	(155)	(53)	(240)	(39)	2,133	1,495	(1,240)	244	738
800m Band	3,252	(3,341)	3,180	(2,612)	8	131	593	213	3,038	1,308	(1,081)	139	1,676
Station Quotient	0.96	0.73	2.01	0.82	0.96	0.92	0.87	0.84	1.62	0.99	0.74	0.86	0.09
400m Quotient	0.87	0.56	1.74	0.82	0.93	0.95	0.80	0.82	0.94	0.99	0.61	0.87	1.16
800m Quotient	0.88	0.59	1.73	0.79	0.96	0.97	0.83	0.84	0.96	0.93	0.63	0.84	1.47
Office	691,010	147,355	10,355	143,123	4,246	11,971	39,509	59,850	87,559	10,081	81,595	7,413	87,953
Station Band	56,729	(5,316)	(4,246)	14,756	271	3,945	19,021	(146)	16,112	2,900	8,563	(1,147)	2,016
400m Band	145,267	24,997	(4,781)	20,981	(4,881)	8,984	21,069	1,130	15,505	(17)	11,329	(1,998)	52,949
800m Band	172,503	26,337	(4,396)	23,553	(6,905)	8,757	24,524	643	13,395	3,759	12,292	(1,827)	72,371
Station Quotient	0.92	0.53	0.86	1.05	0.98	0.91	1.01	0.75	1.27	1.05	0.91	0.86	0.91
400m Quotient	0.97	0.92	0.86	0.93	0.87	1.00	0.98	0.84	0.92	0.87	0.94	0.83	3.36
800m Quotient	0.99	0.92	0.87	0.94	0.84	0.98	0.99	0.80	0.90	1.03	0.96	0.84	4.22
Education	276,688	28,525	6,099	45,876	11,042	13,577	16,833	23,478	45,942	15,121	41,606	8,731	19,858
Station Band	20,763	(2,434)	1,782	28	1,496	5,641	4,714	1,047	7,231	359	1,163	528	(792)
400m Band	40,575	(2,701)	3,211	6,148	1,491	9,718	4,470	1,428	10,571	852	2,656	201	2,530
800m Band	43,953	(1,135)	3,022	6,542	1,266	11,379	4,047	1,662	8,116	1,039	2,692	209	5,114
Station Quotient	0.99	0.50	1.25	0.85	1.11	0.94	1.04	1.04	1.33	0.91	0.93	1.03	0.62
400m Quotient	1.03	0.63	1.47	1.09	1.07	1.00	0.97	1.00	1.09	1.04	1.09	0.93	1.24
800m Quotient	1.02	0.73	1.37	1.06	1.02	1.02	0.94	1.00	0.97	1.01	1.08	0.93	1.63

Appendix Exhibit A-2. Streetcar Transit Station Area Job Change and Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Health	55,971	2,863	1,425	16,135	(4,154)	1,520	3,144	20,424	13,473	2,553	(1,248)	1,966	(2,130)
Station Band	(17,379)	755	(156)	(2,569)	(1,049)	(3,942)	1,075	191	356	107	892	(937)	(12,102)
400m Band	(7,905)	324	37	(2,560)	(1,007)	566	1,459	122	2,853	208	2,417	(822)	(11,502)
800m Band	23,653	157	(13)	22,560	(1,065)	832	6,148	129	2,687	278	2,495	(861)	(9,694)
Station Quotient	0.75	1.08	0.67	0.12	0.43	0.52	1.06	1.30	0.94	1.22	1.06	0.91	0.43
400m Quotient	0.87	0.98	1.00	0.79	0.46	0.97	1.10	0.77	1.05	0.94	1.11	0.91	0.47
800m Quotient	1.04	0.96	0.95	1.51	0.47	0.98	1.19	0.76	1.03	0.95	1.12	0.91	0.56
RFL	175,261	10,205	8,252	32,901	284	11,113	16,863	15,143	39,655	10,779	15,346	8,317	6,403
Station Band	1,936	(1,468)	(375)	(776)	(5,436)	3,237	2,927	(50)	1,156	755	79	(227)	2,114
400m Band	15,402	(859)	(3,752)	5,738	(5,622)	7,292	4,214	426	7,628	1,548	(83)	4,343	(5,471)
800m Band	14,185	(744)	(3,667)	768	(6,303)	7,638	5,369	38	7,757	3,976	78	4,251	(4,976)
Station Quotient	0.86	0.76	0.77	0.69	0.15	0.83	1.03	0.76	0.83	1.10	0.98	0.71	2.92
400m Quotient	0.92	0.84	0.44	1.00	0.26	1.02	1.07	1.10	0.94	0.92	0.83	1.43	0.47
800m Quotient	0.90	0.85	0.46	0.84	0.26	1.02	0.99	0.83	0.93	1.01	0.84	1.38	0.52
AER	41,710	4,134	5,069	4,265	1,027	3,019	1,493	3,373	7,037	1,111	4,039	1,166	5,977
Station Band	6,431	(1,698)	1,804	(211)	(96)	2,409	369	102	2,324	240	1,175	427	(414)
400m Band	12,135	(1,993)	3,609	1,236	343	2,766	584	146	2,765	228	1,219	495	737
800m Band	16,975	456	3,609	1,953	228	2,824	1,074	253	3,490	232	1,222	495	1,139
Station Quotient	1.00	0.29	1.39	0.74	0.79	1.06	0.94	1.09	1.53	1.29	1.43	2.91	0.18
400m Quotient	1.09	0.33	1.97	1.02	1.08	1.00	0.98	1.12	1.28	1.22	1.37	2.08	1.09
800m Quotient	1.17	0.83	1.97	1.14	1.00	1.00	1.02	1.41	1.26	1.21	1.37	2.08	1.37

Comments: ***RFL*** means retail-food-lodging and ***AER*** means arts-entertainment-recreation. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit A-3. Bus Rapid Transit Station Area Job Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Total	2,146,143	35,633	21,861	48,014	74,228	35,542	159,858	108,349	36,474	37,732	159,898	177,696	220,424	262,870	319,263	49,624
Station Band	367,425	(15,695)	3,037	(14,922)	1,074	6,691	(2,398)	7,669	(2,724)	3,330	9,734	31,791	80,146	19,143	97,244	1,805
400m Band	508,321	(13,081)	9,115	(17,741)	2,871	4,337	(1,087)	55,347	8,069	4,287	7,512	34,836	59,400	72,959	124,304	2,596
800m Band	603,457	4,712	(4,471)	(19,568)	4,390	7,895	1,666	59,729	10,317	1,513	19,529	42,593	70,437	80,913	135,362	5,066
Station Quotient	0.96	0.75	1.01	0.82	0.55	0.96	0.79	0.84	0.94	0.92	0.98	0.98	1.07	0.92	1.01	0.83
400m Quotient	0.95	0.81	1.10	0.83	0.56	0.94	0.86	1.00	0.97	0.90	0.90	0.94	0.97	1.05	0.97	0.83
800m Quotient	0.96	0.93	0.86	0.83	0.57	0.95	0.90	1.00	0.97	0.85	0.91	0.95	0.99	1.04	0.96	0.85
Industrial	237,768	191	4,387	3,211	8,029	2,440	8,434	14,785	(2,480)	9,666	23,350	14,687	32,255	14,619	45,587	19,964
Station Band	27,751	(273)	84	(3,470)	480	(3,356)	(359)	1,712	513	256	3,372	(2,326)	10,816	(792)	12,380	611
400m Band	39,805	(702)	9,124	(3,206)	508	(3,225)	(2,625)	5,001	(4,637)	479	2,990	(2,065)	11,230	4,255	12,400	1,976
800m Band	48,865	(650)	8,057	(3,432)	1,028	(3,324)	(2,966)	6,371	(5,736)	471	9,247	(3,017)	12,042	3,122	15,139	2,196
Station Quotient	0.96	0.95	0.86	0.50	0.81	0.64	0.74	0.88	1.05	0.91	1.04	0.67	1.02	0.82	1.00	0.72
400m Quotient	0.96	0.90	4.02	0.72	0.79	0.71	0.62	0.95	0.93	0.95	1.01	0.73	1.01	1.08	0.97	0.77
800m Quotient	0.96	0.92	2.55	0.73	0.87	0.73	0.73	0.97	0.92	0.93	1.00	0.70	1.02	1.03	0.97	0.77
Office	744,563	15,323	9,383	29,251	22,146	9,229	52,579	40,200	22,779	9,527	59,850	65,048	41,648	129,104	100,741	547
Station Band	179,072	(4,265)	1,467	8,975	(427)	2,085	(2,026)	(1,403)	2,935	1,671	1,479	24,755	45,408	9,577	45,708	(789)
400m Band	198,424	(4,323)	(1,276)	3,529	(751)	200	(4,019)	21,874	9,436	2,551	211	18,487	32,019	39,853	44,627	(1,729)
800m Band	236,682	10,041	(14,727)	2,098	(405)	3,266	(3,650)	24,400	10,844	1,815	5,425	22,895	33,743	42,767	46,807	(1,828)
Station Quotient	0.98	0.76	1.01	1.08	0.41	0.96	0.61	0.79	0.93	0.97	0.87	1.13	1.20	0.93	1.04	0.95
400m Quotient	0.95	0.78	0.90	0.93	0.41	0.94	0.70	0.97	0.97	0.98	0.78	0.96	1.07	1.07	0.95	0.91
800m Quotient	0.96	1.06	0.68	0.91	0.42	0.97	0.76	0.97	0.97	0.91	0.89	0.99	1.07	1.06	0.95	0.92
Education	393,181	6,698	2,765	7,948	14,339	11,496	7,693	19,441	1,002	3,192	23,478	49,273	49,749	30,445	58,787	8,620
Station Band	60,247	(279)	612	1,077	820	2,251	113	8,688	(2,386)	(237)	1,853	2,930	4,882	3,705	17,558	(131)
400m Band	102,332	1,017	968	2,936	1,445	2,544	231	13,901	582	(1,109)	2,068	8,093	8,885	6,297	27,319	(820)
800m Band	111,664	326	1,292	2,227	2,047	2,931	940	13,255	(340)	(601)	3,336	9,948	13,763	7,403	25,436	(385)
Station Quotient	0.94	0.90	1.00	1.07	0.72	0.97	0.97	1.07	0.95	0.93	1.02	0.87	0.94	1.02	1.02	0.80
400m Quotient	0.97	0.94	1.01	1.23	0.70	0.96	0.98	1.12	1.00	0.90	0.99	0.97	0.97	0.98	1.02	0.76
800m Quotient	0.96	0.92	1.02	1.12	0.72	0.97	1.02	1.06	0.99	0.92	1.01	0.98	1.02	0.98	0.97	0.79

Appendix Exhibit A-3. Bus Rapid Transit Station Area Job Change and Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Health	66,320	(2,629)	3,766	(4,476)	5,932	(4,110)	14,244	3,910	(5,672)	350	20,424	(58)	482	10,799	15,033	1,243
Station Band	4,779	(14,298)	80	(3,783)	(166)	(1,417)	(414)	(498)	(8,195)	77	1,215	(5,404)	(5,475)	3,993	2,471	(995)
400m Band	13,600	(13,316)	41	(3,618)	(154)	(1,396)	1,885	(717)	(4,954)	(141)	1,110	(3,662)	(17,013)	4,161	9,814	(1,418)
800m Band	17,202	(12,100)	131	(3,640)	(543)	(1,252)	1,889	(776)	(5,668)	(4,262)	1,681	(1,405)	(15,332)	5,684	10,799	(1,213)
Station Quotient	0.96	0.33	0.86	0.85	0.47	0.98	0.79	0.69	0.84	1.22	1.23	0.64	0.86	1.02	1.00	0.79
400m Quotient	0.98	0.53	0.80	0.86	0.56	1.00	1.03	0.86	0.97	0.76	1.02	0.80	0.71	1.01	1.14	0.79
800m Quotient	0.98	0.60	0.87	0.87	0.58	1.02	1.01	0.86	0.97	0.69	1.02	0.95	0.74	1.04	1.13	0.83
RFL	427,220	14,032	1,157	2,099	17,382	11,187	50,956	16,564	11,395	4,722	15,143	34,827	64,689	53,767	47,817	11,898
Station Band	48,547	2,644	704	(20,421)	251	6,391	375	(4,948)	2,787	737	318	10,771	13,809	422	10,175	2,687
400m Band	93,906	3,545	121	(20,605)	1,279	6,075	3,783	7,473	2,467	1,436	220	13,270	13,407	13,625	18,523	3,930
800m Band	112,721	6,419	200	(20,352)	1,428	5,747	4,553	8,219	5,950	2,732	(3,631)	13,624	15,181	16,635	21,998	5,527
Station Quotient	0.88	0.94	5.20	0.55	0.39	1.12	0.87	0.59	0.97	1.02	0.99	0.97	1.14	0.63	1.05	0.95
400m Quotient	0.92	0.89	1.01	0.59	0.42	1.09	1.09	1.07	0.95	0.98	0.89	0.96	0.97	0.94	1.00	0.98
800m Quotient	0.92	0.96	1.02	0.61	0.43	1.02	1.06	1.08	0.98	1.01	0.43	0.95	0.98	0.97	0.98	0.97
AER	61,654	315	1,476	5,272	1,447	1,043	8,600	5,315	3,359	887	3,373	4,636	947	4,290	8,268	523
Station Band	19,666	883	107	3,024	(318)	458	279	1,624	810	264	223	1,066	2,172	1,341	3,243	71
400m Band	22,148	527	196	3,069	14	330	379	3,777	2,497	148	222	724	1,809	1,519	2,788	88
800m Band	24,205	403	609	3,160	111	360	620	3,891	2,681	321	437	737	1,988	1,618	3,490	65
Station Quotient	1.14	1.52	0.96	1.23	0.21	1.05	2.32	0.86	0.93	1.11	0.90	1.54	1.45	1.45	1.09	0.93
400m Quotient	1.04	1.17	1.14	1.13	0.50	0.98	1.75	1.20	1.02	0.96	0.89	0.84	1.29	1.14	0.95	0.93
800m Quotient	1.03	1.11	1.38	1.15	0.55	0.99	1.83	1.16	1.01	1.05	1.06	0.83	1.25	1.11	0.98	0.89

Comments: ***RFL*** means retail-food-lodging and ***AER*** means arts-entertainment-recreation. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit A-4. Commuter Rail Transit Station Area Job Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	DC	MDE	MDW	VRE
Total	3,122,617	29,681	135,778	116,279	441,556	152,202	112,747	305,356	92,455	206,581	199,926	233,297	296,892	68,886	49,730	40,687	122,887	43,563
Station Band	267,158	4,252	10,117	16,772	57,841	2,665	(4,332)	19,273	8,215	43,825	17,008	34,047	31,047	1,170	2,352	17,046	(4,603)	(381)
400m Band	478,653	3,576	31,707	43,078	70,340	12,267	4,560	28,745	11,865	72,037	18,089	59,867	49,566	(6,000)	13,980	24,179	18,327	1,955
800m Band	639,716	11,663	40,165	56,153	86,918	11,677	11,373	40,781	17,418	92,926	20,498	79,197	79,603	(2,337)	17,302	27,716	10,394	3,399
Station Quotient	0.99	1.01	0.88	1.14	1.12	0.98	0.65	0.88	0.97	1.26	1.11	0.97	1.11	0.90	0.95	1.32	0.83	0.90
400m Quotient	0.99	0.95	0.98	1.18	1.05	0.94	0.82	0.86	0.94	1.18	0.95	1.00	1.12	0.84	1.03	1.16	1.00	0.96
800m Quotient	0.98	1.00	0.97	1.01	1.06	0.91	0.85	0.87	0.94	1.17	0.95	0.96	1.08	0.86	1.04	1.13	0.93	0.96
Industrial	385,601	(3,568)	19,421	15,848	39,180	16,345	19,038	33,358	8,680	26,050	26,798	43,932	37,217	1,288	2,381	7,955	(4,506)	9,689
Station Band	58,420	601	3,895	3,445	25,048	314	1,420	264	2,711	12,218	1,746	(3,385)	7,503	(67)	688	(484)	3,021	93
400m Band	93,300	593	4,983	6,309	31,378	(2,636)	3,448	1,624	2,990	13,916	4,721	(2,252)	16,586	(1,015)	2,730	(1,043)	11,345	(4,234)
800m Band	102,109	1,372	4,831	7,720	36,700	(1,982)	4,238	4,755	5,115	16,956	5,457	(9,349)	17,428	(1,014)	3,553	(2,132)	8,671	(4,602)
Station Quotient	1.05	1.26	1.06	0.95	1.30	0.99	2.81	0.75	1.24	2.10	1.09	0.72	1.11	0.69	0.98	0.70	2.09	1.05
400m Quotient	1.04	1.21	1.06	0.94	1.26	0.72	1.36	0.83	1.11	1.25	1.08	0.75	1.25	0.71	1.03	0.67	3.16	0.43
800m Quotient	1.00	1.23	1.01	0.93	1.27	0.80	1.24	0.88	1.14	1.22	1.11	0.70	1.16	0.71	1.04	0.62	1.93	0.54
Office	1,013,517	15,006	50,601	33,578	138,774	51,212	50,997	87,463	40,393	66,895	34,603	81,486	76,506	28,825	23,089	(6,767)	58,119	7,255
Station Band	116,060	389	26,950	5,098	19,537	2,086	(9,833)	7,429	2,567	13,496	9,418	24,818	11,292	(2,592)	(906)	15,887	(12,107)	(261)
400m Band	172,892	(1,595)	34,388	19,862	24,747	9,613	(13,229)	6,426	3,414	25,998	5,835	33,425	16,393	(12,894)	(2,601)	18,168	(465)	1,707
800m Band	252,155	3,038	39,685	21,741	28,587	10,812	(8,119)	10,187	4,009	37,033	7,045	48,165	34,316	(12,027)	(1,518)	18,849	(5,498)	3,612
Station Quotient	1.02	0.86	1.24	1.47	1.09	1.42	0.39	0.86	0.81	1.10	1.17	1.24	1.24	0.82	0.87	1.98	0.55	0.89
400m Quotient	0.96	0.80	1.26	1.51	1.04	0.97	0.47	0.81	0.79	1.10	0.97	1.14	1.20	0.81	0.85	1.48	0.88	1.01
800m Quotient	0.97	0.89	1.15	1.00	1.03	0.94	0.58	0.84	0.76	1.15	0.97	1.08	1.16	0.82	0.87	1.39	0.82	1.02
Education	646,273	8,034	40,505	21,379	119,749	8,031	15,728	89,570	15,950	32,227	45,064	26,084	66,958	14,770	14,986	13,308	25,227	(2,329)
Station Band	53,162	(530)	10,554	5,413	6,488	(2,310)	3,071	3,300	931	8,126	2,190	8,164	4,030	622	2,015	(352)	430	64
400m Band	90,444	48	14,991	6,832	8,658	(1,891)	7,334	5,037	2,008	14,186	2,927	11,075	5,505	2,731	2,294	1,850	2,168	1,539
800m Band	110,970	1,154	19,675	11,008	10,983	(4,553)	6,661	5,002	3,088	16,580	4,685	12,981	6,950	3,380	1,965	1,752	2,191	1,153
Station Quotient	1.06	0.83	1.28	1.23	0.98	0.65	2.52	0.88	0.85	1.20	1.05	1.35	0.97	1.03	1.15	0.81	0.97	1.05
400m Quotient	1.04	0.91	1.27	1.10	0.98	0.84	1.52	0.90	0.87	1.22	0.94	1.24	0.95	1.18	1.08	0.93	0.99	1.21
800m Quotient	1.02	0.96	1.27	1.06	1.00	0.77	1.24	0.86	0.88	1.18	0.96	1.16	0.92	1.23	1.01	0.91	0.95	1.11

Appendix Exhibit A-4. Commuter Rail Transit Station Area Job Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Health	118,544	(2,435)	(9,619)	11,656	17,646	13,038	1,305	6,662	816	23,355	(852)	6,191	15,831	7,294	(9,586)	4,628	13,282	3,758
Station Band	(31,102)	205	(33,625)	152	(109)	29	(86)	(241)	123	(962)	1,043	971	216	(320)	505	(950)	550	(24)
400m Band	(1,337)	(1,165)	(26,222)	1,729	(2,674)	1,100	3,131	3,836	86	3,786	1,293	273	1,006	(22)	12,229	132	1,553	(998)
800m Band	3,887	(1,268)	(28,395)	3,485	(1,828)	992	3,130	3,760	104	3,400	1,334	5,851	1,755	217	12,305	1,930	1,570	(1,937)
Station Quotient	0.72	1.32	0.28	3.26	0.84	0.90	0.67	0.48	1.08	0.62	1.64	1.11	0.94	0.82	1.66	0.54	0.80	0.86
400m Quotient	0.91	0.83	0.54	1.21	0.71	1.11	4.35	1.02	1.01	1.22	1.56	0.95	0.99	0.84	5.88	0.91	0.82	0.88
800m Quotient	0.93	0.84	0.53	1.56	0.78	1.02	2.82	1.01	1.01	1.03	1.38	1.14	1.01	0.87	5.07	1.03	0.82	0.83
RFL	511,995	9,443	12,428	15,147	68,228	41,420	14,948	20,907	12,418	23,079	62,989	51,359	47,557	10,124	9,938	12,517	22,510	18,442
Station Band	27,864	1,124	1,528	460	2,562	1,197	1,225	3,842	31	6,262	1,484	(815)	3,297	473	(2,182)	1,756	773	(356)
400m Band	52,375	2,987	2,161	1,459	2,547	1,635	1,282	5,208	622	6,973	1,907	10,890	3,723	1,312	(3,311)	4,022	1,046	1,999
800m Band	81,566	5,229	2,534	1,465	3,232	1,438	2,070	8,369	1,375	10,415	1,700	14,306	11,039	3,238	(2,827)	5,818	835	3,052
Station Quotient	1.03	1.47	1.30	1.49	1.00	2.69	2.51	1.00	0.78	2.10	1.08	0.57	1.45	1.07	0.45	1.42	1.10	0.57
400m Quotient	1.02	1.42	1.29	2.12	0.93	1.29	1.09	0.93	0.94	1.59	0.86	0.87	1.15	1.16	0.50	1.46	0.94	0.95
800m Quotient	1.02	1.38	1.02	1.15	0.92	1.04	1.14	0.98	1.01	1.53	0.80	0.87	1.10	1.50	0.58	1.27	0.86	0.97
AER	95,379	436	5,105	2,791	11,355	5,528	2,937	35,905	1,548	5,823	2,128	2,147	7,296	2,099	392	583	1,757	731
Station Band	10,458	767	(908)	257	83	226	259	338	141	1,063	177	2,531	1,513	2,799	(338)	305	209	(25)
400m Band	18,289	481	(691)	980	(190)	1,880	2,483	1,263	240	1,217	218	3,030	1,763	3,064	(333)	374	353	1,392
800m Band	21,143	401	366	1,863	372	1,944	2,643	1,255	557	1,612	(1,181)	2,666	2,083	3,064	1	583	345	1,295
Station Quotient	1.19	1.71	0.40	3.05	0.81	7.01	4.36	1.04	1.44	0.95	1.52	1.79	1.20	52.62	0.54	1.90	1.24	0.91
400m Quotient	1.14	1.20	0.47	0.96	0.72	1.41	2.24	1.37	1.48	0.87	1.06	1.72	1.18	2.07	0.64	1.38	1.18	1.49
800m Quotient	1.07	1.13	0.71	1.02	0.85	1.16	1.83	1.19	1.16	0.89	0.75	1.37	1.13	2.07	0.97	1.41	1.08	1.31

Comments: ***RFL*** means retail-food-lodging and ***AER*** means arts-entertainment-recreation. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit B-1. Light Rail Transit Station Area Job Change by Wage Category and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Upper-Wage	1,144,237	7,561	80,900	18,873	199,129	88,279	113,483	32,807	(2,668)	125,776	13,465	72,079	12,281	48,895	61,923	129,296	105,492	36,666
Station Band	209,943	(803)	15,890	7,133	28,668	10,925	10,933	1,396	(2,996)	7,121	1,123	29,376	4,460	6,956	10,452	53,892	13,718	11,699
400m Band	371,197	(361)	25,143	8,398	48,911	44,608	11,511	9,169	(2,274)	24,114	1,450	47,403	7,797	14,885	11,842	60,800	36,059	21,742
800m Band	393,746	(218)	25,498	5,842	56,998	53,172	13,294	5,772	(2,502)	21,663	2,613	46,456	8,071	26,247	9,132	61,749	38,754	21,205
Station Quotient	0.99	0.91	1.10	1.13	0.93	0.94	0.98	0.95	0.77	0.89	0.96	1.09	1.01	0.88	0.99	1.04	0.98	1.12
400m Quotient	1.02	0.94	1.07	1.09	0.92	1.03	0.97	1.00	0.90	1.01	0.96	1.10	1.02	0.93	0.97	1.02	1.12	1.17
800m Quotient	1.00	0.94	1.06	1.03	0.91	1.03	0.97	0.97	0.92	0.94	0.97	1.05	1.01	0.95	0.93	1.00	1.08	1.12
Middle-Wage	2,451,271	63,077	83,123	52,333	319,159	174,410	288,803	179,935	15,383	276,052	71,220	124,824	97,849	96,887	208,586	141,618	158,217	99,795
Station Band	322,274	11,088	3,440	1,718	61,728	36,654	36,484	50,853	2,729	24,729	913	24,404	1,876	22,363	14,101	12,375	11,682	5,137
400m Band	534,684	7,599	10,338	6,137	88,347	58,450	46,577	60,250	5,215	34,636	6,479	61,791	7,657	27,298	31,277	27,987	42,860	11,786
800m Band	659,501	6,370	10,399	8,154	103,535	71,986	54,030	63,993	6,070	60,743	2,879	68,994	18,624	33,631	52,259	36,307	47,580	13,947
Station Quotient	0.85	1.01	1.03	0.86	0.89	1.14	0.80	1.11	0.82	0.79	0.76	0.81	0.70	0.90	0.66	0.64	0.88	0.79
400m Quotient	0.87	0.81	0.89	0.96	0.87	1.06	0.82	1.01	0.89	0.77	0.92	0.94	0.72	0.88	0.76	0.76	1.01	0.81
800m Quotient	0.88	0.76	0.87	0.98	0.88	1.01	0.85	0.95	0.88	0.83	0.79	0.95	0.77	0.81	0.81	0.80	0.91	0.81
Lower-Wage	(442,559)	(53,764)	60,433	(27,901)	25,367	5,273	(73,642)	(70,236)	(15,365)	18,526	(64,819)	(7,257)	(22,986)	(164)	(80,739)	(27,890)	(35,936)	(71,459)
Station Band	(128,688)	(4,330)	8,262	(4,094)	(23,175)	(4,867)	(35,209)	(19,470)	(8,212)	(15,541)	(4,081)	(1,085)	1,585	(2,722)	1,876	14,944	(18,327)	(14,242)
400m Band	(134,786)	(6,519)	20,602	(5,963)	(15,440)	4,413	(38,324)	(19,159)	(10,969)	(16,330)	(11,203)	(6,624)	1,652	503	1,679	14,969	(28,467)	(19,606)
800m Band	(154,013)	(6,992)	21,565	(6,104)	(3,990)	8,568	(44,251)	(19,388)	(11,004)	(23,316)	(15,091)	(7,559)	3,777	5,514	(18,009)	17,024	(33,399)	(21,358)
Station Quotient	0.93	1.00	1.09	0.94	0.78	0.91	0.65	0.89	0.78	0.74	1.09	1.01	1.17	0.95	1.19	1.41	0.78	0.91
400m Quotient	0.98	0.95	1.26	0.94	0.89	1.02	0.67	0.97	0.73	0.82	1.00	0.98	1.14	1.01	1.18	1.29	0.81	0.93
800m Quotient	0.98	1.00	1.23	0.95	0.95	1.04	0.67	0.99	0.77	0.81	0.97	0.98	1.17	1.05	1.06	1.28	0.82	0.95

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit B-2. Streetcar Transit Station Area Job Change by Wage Category and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	DC	All
Upper-Wage	93,215	9,632	100,677	10,562	2,885	34,522	48,895	105,492	7,223	69,081	4,723	23,707	510,614
Station Band	(4,276)	2,653	10,430	1,461	598	15,234	(632)	15,750	(1,307)	6,679	5	963	47,558
400m Band	16,392	2,157	13,457	1,778	2,138	16,998	(580)	36,356	(1,170)	7,770	(104)	11,013	106,205
800m Band	16,237	2,420	15,791	40	1,999	20,009	(569)	36,233	(1,465)	8,634	(258)	15,201	114,272
Station Quotient	0.50	1.02	1.10	0.97	0.95	1.03	0.73	1.31	0.77	1.10	0.94	1.07	0.97
400m Quotient	1.05	1.00	0.97	0.97	1.00	1.01	0.75	1.12	0.79	1.04	0.92	2.82	1.02
800m Quotient	1.02	1.01	0.98	0.92	0.99	1.01	0.76	1.09	0.79	1.05	0.89	3.50	1.02
Middle-Wage	82,300	47,835	188,141	22,942	38,642	77,047	96,887	158,217	44,356	71,947	51,389	82,771	962,474
Station Band	3,923	(1,016)	3,427	(5,144)	8,731	12,610	602	9,171	5,702	26,566	19,370	(13,942)	70,000
400m Band	11,601	(3,783)	33,883	(10,618)	25,868	14,005	2,694	25,780	9,177	31,423	23,591	15,287	178,908
800m Band	11,882	(3,054)	55,720	(11,315)	27,314	34,510	2,232	25,465	11,979	31,740	23,561	28,744	238,778
Station Quotient	0.80	0.64	0.71	0.34	0.71	0.93	0.74	0.87	1.03	1.50	1.61	0.39	0.86
400m Quotient	0.81	0.55	0.95	0.39	1.07	0.87	0.78	0.83	0.91	1.32	1.34	0.94	0.92
800m Quotient	0.81	0.58	1.06	0.39	1.07	1.06	0.71	0.81	0.92	1.31	1.32	1.15	0.98
Lower-Wage	28,328	(21,309)	(5,701)	(18,766)	430	(15,976)	(164)	(35,936)	(2,876)	23,264	(18,565)	13,428	(53,843)
Station Band	(9,886)	545	(3,415)	(1,131)	1,777	858	1,277	6,090	1,432	(21,408)	(20,556)	1,722	(42,695)
400m Band	(11,213)	3,091	(17,124)	(991)	1,267	553	1,099	(20,681)	(3,693)	(22,895)	(21,024)	13,681	(77,930)
800m Band	(6,389)	2,369	(18,747)	(1,496)	2,248	(12,764)	1,275	(23,215)	78	(22,676)	(20,897)	21,685	(78,529)
Station Quotient	0.44	1.18	0.86	1.06	1.03	1.13	1.21	1.38	1.32	0.33	0.24	1.23	0.85
400m Quotient	0.60	1.34	0.77	1.09	1.02	1.11	1.11	0.85	0.70	0.39	0.27	2.87	0.84
800m Quotient	0.74	1.28	0.77	1.06	1.03	0.91	1.11	0.86	1.03	0.40	0.29	3.75	0.86

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit B-3. Bus Raid Transit Station Area Job Change by Wage Category and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Upper-Wage	681,466	18,157	12,169	18,873	16,680	14,986	32,807	35,198	15,308	7,399	48,895	51,378	61,923	129,296	122,952	6,001
Station Band	139,716	(2,548)	2,421	4,219	(81)	9,059	(2,078)	8,690	2,930	2,166	1,646	9,294	37,573	7,914	41,196	496
400m Band	209,226	(3,444)	620	4,950	798	7,002	(5,720)	28,102	6,590	1,984	716	12,878	40,252	35,519	57,797	1,091
800m Band	246,828	10,438	(86)	3,732	1,345	7,682	(5,377)	30,732	8,670	1,480	6,693	13,867	42,300	37,861	61,214	809
Station Quotient	0.98	0.68	1.05	1.04	0.56	1.05	0.51	0.92	0.96	1.17	0.88	0.94	1.09	0.97	0.99	0.92
400m Quotient	1.00	0.68	0.90	1.03	0.61	0.99	0.57	1.16	0.98	1.04	0.83	0.96	1.08	1.10	0.99	0.94
800m Quotient	1.00	1.12	0.87	1.00	0.63	1.00	0.70	1.16	0.99	0.97	0.90	0.96	1.09	1.08	0.98	0.92
Middle-Wage	1,565,076	40,350	13,444	52,333	38,376	34,042	179,935	51,386	77,271	28,032	96,887	124,441	208,586	141,618	188,655	48,400
Station Band	301,632	6,970	(1,400)	(5,183)	671	6,679	4,532	(23,833)	33,496	1,172	4,556	33,589	59,633	27,773	41,053	7,286
400m Band	413,907	14,045	6,169	(10,871)	786	7,118	18,039	7,051	41,630	2,238	4,941	30,114	54,254	49,007	72,642	10,961
800m Band	487,703	19,538	(6,932)	(10,465)	6,419	9,328	19,507	10,232	50,270	13,278	5,205	39,483	58,427	55,495	82,501	14,799
Station Quotient	0.91	0.84	0.57	0.71	0.31	0.86	1.24	0.47	1.02	0.73	0.94	1.00	1.18	1.07	0.90	0.72
400m Quotient	0.89	0.90	1.36	0.68	0.31	0.85	1.47	0.80	0.97	0.73	0.92	0.82	0.91	1.17	0.92	0.76
800m Quotient	0.89	0.96	0.58	0.68	0.40	0.87	1.28	0.83	0.97	1.03	0.69	0.87	0.91	1.15	0.91	0.79
Lower-Wage	(315,891)	(24,577)	(2,679)	(27,901)	14,219	(17,743)	(70,236)	13,631	(62,251)	(7,087)	(164)	(7,406)	(80,739)	(27,890)	(35,374)	(11,606)
Station Band	(101,286)	(20,010)	2,033	(13,634)	50	(9,326)	(4,486)	20,318	(39,962)	(570)	2,258	(11,091)	(25,594)	(17,441)	9,286	(6,328)
400m Band	(152,918)	(23,853)	2,385	(11,974)	757	(9,592)	(12,685)	16,156	(42,829)	(858)	1,164	(8,145)	(44,169)	(14,816)	(14,968)	(10,025)
800m Band	(183,192)	(25,537)	2,580	(13,206)	(4,098)	(9,282)	(12,744)	14,396	(51,209)	(14,282)	4,597	(10,568)	(39,342)	(16,127)	(20,046)	(11,246)
Station Quotient	0.97	0.73	1.21	0.73	0.74	0.88	0.80	1.30	0.85	1.05	1.18	0.79	0.91	0.69	1.16	0.84
400m Quotient	0.96	0.77	1.16	0.82	0.77	0.90	0.69	1.11	0.94	1.05	1.07	0.90	0.85	0.90	1.00	0.79
800m Quotient	0.96	0.79	1.13	0.81	0.60	0.93	0.77	1.07	0.94	0.76	1.15	0.89	0.90	0.91	0.99	0.80

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit B-4. Commuter Rail Transit Station Area Job Change by Wage Category and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Upper-Wage	838,484	8,586	69,836	23,910	99,545	36,093	27,518	66,523	30,971	51,076	36,643	107,285	95,229	11,613	6,302	449	28,847	1,121
Station Band	104,742	1,965	25,728	4,730	8,274	2,602	2,541	6,511	4,013	22,712	9,884	12,811	7,915	465	(2,621)	(438)	393	(590)
400m Band	190,819	1,432	30,977	18,301	11,363	5,706	9,439	6,830	4,037	30,391	25,208	23,086	17,186	318	495	1,802	1,609	813
800m Band	250,492	6,804	34,746	19,116	15,537	9,270	10,389	8,954	6,586	41,998	25,280	28,012	34,946	681	1,092	447	(2,109)	1,672
Station Quotient	1.04	1.03	1.36	1.43	0.92	1.58	1.05	0.92	1.03	1.63	1.18	0.85	1.02	0.98	0.87	0.97	0.95	0.79
400m Quotient	1.04	0.94	1.31	1.34	0.92	0.99	1.23	0.87	0.92	1.24	1.27	0.89	1.14	0.93	0.97	1.06	0.98	1.03
800m Quotient	1.02	1.06	1.20	1.05	0.93	1.00	1.10	0.87	0.93	1.28	1.25	0.84	1.16	0.94	0.98	1.01	0.87	1.05
Middle-Wage	2,200,388	45,384	67,524	77,523	268,647	143,527	75,314	82,621	43,928	140,953	217,456	141,742	201,045	66,258	83,045	54,252	87,782	116,316
Station Band	166,536	826	12,289	3,128	28,588	2,198	(12,665)	6,925	1,432	10,566	3,463	8,079	13,363	4,616	870	18,421	30,034	222
400m Band	304,064	3,690	27,420	10,789	41,872	9,267	(17,893)	35,977	2,573	21,758	(10,929)	22,868	23,006	(6,889)	10,359	32,403	48,551	8,333
800m Band	390,509	5,754	31,123	13,704	47,197	7,907	(12,054)	41,605	3,849	29,445	(8,870)	48,276	31,966	(4,608)	13,212	38,559	45,644	11,047
Station Quotient	0.90	0.67	0.95	0.72	1.16	1.14	0.14	0.77	0.81	0.90	0.70	0.66	1.19	0.80	0.65	3.09	1.73	0.72
400m Quotient	0.86	0.73	1.24	0.90	1.11	0.86	0.27	1.06	0.84	0.95	0.35	0.80	1.07	0.60	0.81	2.33	1.75	0.75
800m Quotient	0.84	0.74	1.04	0.76	1.05	0.75	0.43	1.04	0.83	0.99	0.38	0.92	0.85	0.62	0.85	1.93	1.45	0.74
Lower-Wage	(267,563)	(27,054)	(18,919)	(1,034)	26,740	(44,046)	2,121	124,721	4,906	(14,600)	(83,369)	(37,828)	(44,909)	(13,471)	(48,147)	(22,477)	(240)	(79,891)
Station Band	(36,416)	(235)	(29,623)	6,967	16,747	(3,258)	6,180	1,496	1,059	6,925	2,711	11,394	6,573	(4,166)	1,533	(1,821)	(37,551)	(141)
400m Band	(68,920)	(3,773)	(28,787)	8,081	11,231	(5,272)	12,903	(19,413)	2,750	13,927	2,622	10,487	4,784	(253)	154	(10,702)	(34,160)	(7,741)
800m Band	(69,171)	(2,632)	(27,173)	14,462	15,312	(8,526)	12,288	(17,231)	3,813	14,553	2,630	(1,668)	6,659	785	(825)	(12,206)	(35,421)	(10,146)
Station Quotient	0.96	1.20	0.60	1.57	1.31	0.77	2.62	0.82	1.04	1.30	1.43	1.57	1.30	0.76	1.32	1.01	0.23	1.34
400m Quotient	0.96	1.05	0.71	1.30	1.11	0.96	1.75	0.52	1.08	1.36	1.28	1.37	1.19	1.06	1.22	0.86	0.50	1.05
800m Quotient	0.98	1.14	0.79	1.29	1.14	0.94	1.44	0.59	1.07	1.29	1.25	1.12	1.18	1.09	1.19	0.89	0.57	1.07

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit C-1. Light Rail Transit Station Area Population Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Total	2,142,930	(1,339)	106,016	(20,062)	420,150	227,108	377,022	84,923	(144)	381,428	(7,428)	115,031	75,023	69,976	132,930	85,901	186,505	(20,134)
Station Band	128,264	(374)	284	2,808	14,917	12,533	6,581	6,187	439	9,159	928	9,286	9,846	10,917	13,407	25,876	3,194	2,276
400m Band	253,063	(103)	8,435	713	34,739	27,379	16,276	11,196	1,065	17,874	(731)	26,059	19,108	22,930	21,662	36,505	15,698	839
800m Band	326,407	(1,149)	9,339	(353)	49,130	38,634	6,514	17,457	(1,550)	28,632	164	34,399	19,350	28,905	31,250	38,915	27,101	(331)
Station Quotient	1.07	0.97	0.92	1.14	1.07	1.09	1.03	1.08	1.03	1.08	1.03	1.01	1.13	1.11	1.05	1.18	1.06	1.07
400m Quotient	1.03	1.00	1.08	1.03	1.03	1.03	0.99	1.05	1.04	1.04	1.00	1.01	1.06	1.08	1.02	1.08	1.05	1.02
800m Quotient	1.01	0.99	1.04	1.01	1.01	1.02	0.95	1.05	0.96	1.03	1.01	1.01	1.02	1.04	1.01	1.04	1.06	1.01
White	276,023	(14,708)	23,048	(34,649)	64,534	111,723	5,153	15,210	(1,624)	110,145	(23,703)	43,543	(4,303)	26,595	(95)	(19,443)	33,192	(32,000)
Station Band	51,176	474	1,384	622	6,887	8,957	3,955	3,313	459	4,861	69	4,147	1,537	6,214	2,330	5,161	880	(74)
400m Band	91,100	213	6,691	126	11,646	18,530	10,094	4,864	634	7,015	(1,311)	6,137	1,096	13,942	4,802	4,597	7,234	(1,255)
800m Band	115,670	(175)	6,853	(10)	18,220	24,575	5,624	8,161	(499)	9,576	(531)	9,412	(951)	17,292	4,192	4,320	11,684	(2,073)
Station Quotient	1.10	1.11	1.22	1.10	1.21	1.15	1.27	1.11	1.11	1.15	1.03	1.02	1.06	1.12	1.04	1.20	1.08	1.03
400m Quotient	1.06	1.03	1.31	1.05	1.11	1.06	1.19	1.07	1.09	1.07	1.01	0.99	1.02	1.09	1.03	1.09	1.14	1.01
800m Quotient	1.04	1.02	1.20	1.05	1.09	1.04	1.11	1.07	0.98	1.05	1.02	1.00	1.00	1.06	1.02	1.07	1.12	1.01
Non-White	1,866,907	13,369	82,968	14,587	355,616	115,385	371,869	69,713	1,480	271,283	16,275	71,488	79,326	43,381	133,025	105,344	153,313	11,866
Station Band	77,088	(848)	(1,100)	2,186	8,030	3,576	2,626	2,874	(20)	4,298	859	5,139	8,309	4,703	11,077	20,715	2,314	2,350
400m Band	161,963	(316)	1,744	587	23,093	8,849	6,182	6,332	431	10,859	580	19,922	18,012	8,988	16,860	31,908	8,464	2,094
800m Band	210,737	(974)	2,486	(343)	30,910	14,059	890	9,296	(1,051)	19,056	695	24,987	20,301	11,613	27,058	34,595	15,417	1,742
Station Quotient	1.03	0.84	0.72	1.15	0.99	1.00	0.94	1.00	0.99	1.01	1.09	0.96	1.19	1.06	1.05	1.17	0.99	1.10
400m Quotient	1.00	0.93	0.91	0.99	0.97	0.98	0.92	0.98	1.02	1.00	0.97	1.02	1.08	1.02	1.00	1.07	0.94	1.02
800m Quotient	0.98	0.92	0.91	0.97	0.95	0.98	0.89	0.99	0.95	0.99	0.96	1.01	1.03	0.98	0.99	1.03	0.96	1.00

Comments: **White** means non-Hispanic or Latino and **Non-White** means all others. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit C-2. Streetcar Transit Station Area Population Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Population	881,425	69,100	10,317	157,925	18,049	22,374	47,235	69,976	186,505	1,783	142,610	34,063	58,947
Station Band	38,713	1,887	994	6,643	2,192	(543)	6,400	1,042	8,259	883	1,265	3,394	5,397
400m Band	56,832	(27)	1,444	10,157	2,662	(978)	9,980	343	17,201	1,879	2,605	3,608	8,954
800m Band	74,221	6,655	1,273	11,593	2,670	424	9,992	(969)	24,085	0	3,169	3,225	10,225
Station Quotient	1.14	1.19	1.15	1.25	1.36	0.93	1.13	1.14	1.21	1.00	1.20	1.19	1.33
400m Quotient	1.06	0.93	1.07	1.11	1.22	0.93	1.12	0.96	1.16	1.02	1.03	1.09	1.13
800m Quotient	1.04	1.12	1.03	1.09	1.14	0.95	1.06	0.91	1.14	0.00	1.01	1.05	1.06
White	145,593	18,413	(8,164)	(24,489)	6,044	6,761	18,232	26,595	33,192	303	23,875	(6,318)	29,189
Station Band	22,301	579	754	4,564	1,746	(1,123)	4,177	1,125	4,570	183	911	1,004	3,691
400m Band	35,355	(819)	2,273	7,269	2,168	1,055	5,366	(224)	8,170	572	1,761	1,465	6,688
800m Band	46,957	4,128	2,442	8,401	2,343	2,441	6,221	(1,121)	11,300	0	2,222	376	7,632
Station Quotient	1.19	1.21	1.22	1.42	1.40	0.89	1.13	1.37	1.30	0.99	1.43	1.13	1.45
400m Quotient	1.12	0.84	1.30	1.29	1.31	0.96	1.09	0.95	1.18	1.01	1.11	1.10	1.37
800m Quotient	1.11	1.24	1.20	1.29	1.25	0.98	1.07	0.92	1.15	0.00	1.14	1.03	1.20
Non-White	735,832	50,687	18,481	182,414	12,005	15,613	29,003	43,381	153,313	1,480	118,735	40,381	29,758
Station Band	16,412	1,308	240	2,079	446	580	2,223	(83)	3,689	700	354	2,390	1,706
400m Band	21,477	792	(829)	2,888	494	(2,033)	4,614	567	9,031	1,307	844	2,143	2,266
800m Band	27,264	2,527	(1,169)	3,192	327	(2,017)	3,771	152	12,785	0	947	2,849	2,593
Station Quotient	1.10	1.17	1.03	1.13	1.29	0.98	1.16	0.83	1.08	0.99	0.99	1.29	1.19
400m Quotient	0.99	0.99	0.86	0.99	1.08	0.90	1.24	0.97	1.11	1.01	0.95	1.07	1.02
800m Quotient	0.97	1.04	0.85	0.98	1.00	0.92	1.08	0.88	1.12	0.02	0.90	1.08	0.99

Comments:
White means non-Hispanic or Latino and **Non-White** means all others. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit C3. Bus Rapid Transit Station Area Population Station Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Population	1,103,831	6,429	24,482	(20,062)	18,576	18,049	84,923	39,440	(17,425)	26,951	69,976	163,755	132,930	85,901	249,962	41,553
Station Band	107,117	(1,294)	6,321	1,794	1,484	4,892	(417)	5,192	(1,952)	2,180	355	7,799	9,397	3,748	40,193	9,007
400m Band	266,756	(1,962)	15,099	2,172	6,276	9,568	(1,546)	14,055	(3,378)	4,578	1,326	23,573	27,172	9,802	99,760	16,557
800m Band	340,815	(3,038)	16,728	1,275	7,631	10,452	518	20,159	(9,076)	5,532	343	29,980	34,578	22,843	123,284	20,215
Station Quotient	1.01	0.97	1.27	1.16	1.02	1.05	0.94	0.99	1.01	1.06	0.94	1.03	1.03	1.00	1.07	1.04
400m Quotient	1.00	0.99	1.16	1.03	1.05	1.02	0.94	0.99	1.01	1.01	0.95	1.04	1.02	0.98	1.03	0.99
800m Quotient	1.00	0.98	1.11	1.01	1.04	1.02	0.96	1.00	1.00	1.00	0.94	1.04	1.02	1.01	1.03	1.00
White	44,437	(11,471)	8,940	(34,649)	8,251	6,044	15,210	16,512	(35,531)	8,397	26,595	10,321	(95)	(19,443)	51,518	(7,810)
Station Band	10,774	(277)	3,641	1,261	1,018	5,637	(485)	2,630	(6,388)	395	(763)	1,680	(312)	821	9,803	(642)
400m Band	32,087	(1,375)	7,858	2,623	3,728	11,643	(2,319)	8,873	(15,502)	197	(2,797)	5,115	2,193	2,916	26,794	(2,423)
800m Band	40,731	(1,897)	7,653	2,521	4,652	10,714	(590)	10,523	(19,265)	913	(5,584)	7,086	3,579	2,961	33,813	(2,224)
Station Quotient	1.01	1.03	1.27	1.37	1.04	1.14	0.97	1.01	1.00	1.02	0.94	1.07	0.99	1.06	1.04	1.00
400m Quotient	1.01	1.02	1.13	1.19	1.05	1.09	0.95	1.03	1.00	0.96	0.92	1.09	1.02	1.07	1.03	0.97
800m Quotient	1.01	1.02	1.06	1.13	1.04	1.06	0.99	1.02	1.00	0.99	0.90	1.11	1.02	1.05	1.03	0.99
Non-White	1,059,394	17,900	15,542	14,587	10,325	12,005	69,713	22,928	18,106	18,554	43,381	153,434	133,025	105,344	198,444	49,363
Station Band	96,343	(1,017)	2,680	533	466	(745)	68	2,562	4,436	1,785	1,118	6,119	9,709	2,927	30,390	9,649
400m Band	234,669	(587)	7,241	(451)	2,548	(2,075)	773	5,182	12,124	4,381	4,123	18,458	24,979	6,886	72,966	18,980
800m Band	300,084	(1,141)	9,075	(1,246)	2,979	(262)	1,108	9,636	10,189	4,619	5,927	22,894	30,999	19,882	89,471	22,439
Station Quotient	1.01	0.93	1.28	1.03	0.95	0.93	0.89	0.97	0.99	1.07	0.90	1.02	1.05	0.96	1.07	1.03
400m Quotient	0.99	0.96	1.20	0.94	1.06	0.93	0.93	0.95	0.99	1.03	0.93	1.02	1.01	0.94	1.00	0.97
800m Quotient	0.99	0.96	1.20	0.94	1.02	0.96	0.93	0.98	0.97	0.99	0.94	1.02	1.01	0.98	1.00	0.97

Comments: **White** means non-Hispanic or Latino and **Non-White** means all others. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit C-4. Commuter Rail Transit Station Area Population Change and Station Quotients by System

[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Population	3,063,009	23,426	269,716	395,734	138,357	417,475	96,783	68,811	248,767	79,804	213,068	177,808	164,688	366,695	73,312	87,072	80,702	151,889
Station Band	105,665	2,422	23,934	4,113	13,175	4,658	2,027	216	6,496	2,526	13,831	(117)	12,038	4,814	4,073	4,231	1,539	5,801
400m Band	192,375	1,162	43,405	5,259	20,452	13,540	3,943	2,163	5,721	3,276	20,065	2,203	21,946	4,332	5,345	14,785	9,192	13,265
800m Band	250,962	1,380	58,872	1,069	26,890	1,112	3,890	4,384	5,274	5,442	36,886	3,270	31,717	10,771	8,369	17,466	14,639	16,511
Station Quotient	1.15	1.10	2.07	1.08	1.85	1.03	1.06	0.93	1.09	1.11	1.22	0.94	1.13	1.23	1.77	1.07	0.99	1.09
400m Quotient	1.08	1.00	1.66	1.02	1.39	1.03	1.05	0.98	0.98	1.01	1.16	0.99	1.08	0.99	1.16	1.15	1.03	1.04
800m Quotient	1.04	1.00	1.41	0.93	1.24	0.94	1.01	0.99	0.94	1.03	1.13	0.98	1.05	1.00	1.14	1.10	1.02	1.02
White	325,615	(14,882)	111,985	(14,222)	69,160	(93,017)	27,656	34,547	22,153	29,859	120,179	5,161	(29,467)	86,631	36,042	(19,591)	(11,813)	2,115
Station Band	46,763	371	13,207	2,502	9,040	(2,457)	1,216	(367)	1,711	2,043	8,447	258	2,808	2,103	2,631	521	519	2,282
400m Band	73,936	149	25,423	983	13,920	(2,752)	2,610	795	766	392	12,108	2,543	6,464	1,092	3,737	978	234	4,310
800m Band	107,783	56	36,285	4,103	18,613	(7,119)	1,287	3,878	(622)	1,511	23,126	3,046	9,847	4,076	5,416	(921)	422	4,203
Station Quotient	1.19	1.12	2.27	1.29	2.06	0.89	1.06	0.89	1.09	1.21	1.17	1.02	1.16	1.19	1.86	1.07	1.04	1.11
400m Quotient	1.11	1.05	1.89	1.06	1.51	0.98	1.07	0.96	1.00	0.98	1.13	1.08	1.15	1.00	1.17	1.07	1.02	1.06
800m Quotient	1.09	1.04	1.66	1.13	1.39	0.93	1.01	1.02	0.97	1.00	1.11	1.05	1.14	1.02	1.17	1.01	1.02	1.04
Non-White	2,737,394	38,308	157,731	409,956	69,197	510,492	69,127	34,264	226,614	49,945	92,889	172,647	194,155	280,064	37,270	106,663	92,515	149,774
Station Band	58,902	2,051	10,727	1,611	4,135	7,115	811	583	4,785	483	5,384	(375)	9,230	2,711	1,442	3,710	1,020	3,519
400m Band	118,439	1,013	17,982	4,276	6,532	16,292	1,333	1,368	4,955	2,884	7,957	(340)	15,482	3,240	1,608	13,807	8,958	8,955
800m Band	148,924	1,324	22,587	2,711	8,277	8,231	2,603	506	5,896	3,931	13,760	224	21,870	6,695	2,953	18,387	14,217	12,308
Station Quotient	1.12	1.07	1.88	0.96	1.57	1.09	1.12	1.10	1.07	0.91	1.43	0.83	1.13	1.29	1.60	1.06	0.92	1.06
400m Quotient	1.06	0.96	1.44	0.98	1.23	1.05	1.00	1.07	0.97	1.04	1.26	0.89	1.04	0.94	1.11	1.19	1.03	1.01
800m Quotient	1.00	0.96	1.20	0.91	1.10	0.93	1.05	0.93	0.92	1.03	1.18	0.91	1.00	0.93	1.09	1.15	1.01	0.99

Comments: **White** means non-Hispanic or Latino and **Non-White** means all others. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit D 1. Light Rail Transit Station Area Household Type Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Households	804,558	7,802	39,145	6,244	143,666	80,662	143,366	26,049	1,956	127,852	14,096	42,458	23,573	26,710	41,475	25,501	73,299	7,414
Station Band	64,741	(146)	487	1,816	11,140	5,856	3,595	3,473	860	3,328	1,127	5,066	2,318	4,993	4,349	12,496	2,636	1,347
400m Band	128,283	248	3,913	1,246	21,350	14,611	9,815	6,193	1,002	7,968	1,352	13,298	5,062	10,435	7,758	16,230	9,809	1,588
800m Band	163,561	95	3,910	1,399	29,451	18,446	6,641	7,794	930	11,812	2,271	16,821	6,082	13,590	10,828	16,325	14,250	2,916
Station Quotient	1.10	0.95	0.99	1.18	1.25	1.11	1.06	1.15	1.16	1.07	1.04	1.03	1.06	1.14	1.05	1.26	1.32	1.06
400m Quotient	1.06	0.99	1.09	1.03	1.12	1.06	1.04	1.09	1.09	1.06	1.00	1.03	1.03	1.11	1.02	1.11	1.11	1.02
800m Quotient	1.03	0.98	1.03	1.02	1.07	1.03	0.99	1.07	1.04	1.04	1.01	1.02	1.01	1.06	1.02	1.06	1.08	1.03
With Children	90,597	(5,391)	2,469	(9,497)	25,926	9,599	38,311	3,194	(874)	25,577	(6,042)	2,699	1,436	2,635	(202)	(5,252)	17,174	(8,530)
Station Band	5,746	(192)	(271)	111	150	421	691	3	121	341	(71)	18	923	693	479	1,746	249	334
400m Band	7,438	(162)	183	(300)	1,953	472	1,109	147	(48)	986	(918)	224	1,401	635	824	1,632	250	(259)
800m Band	5,800	(934)	(219)	(547)	2,161	944	(136)	344	(74)	2,063	(1,327)	239	1,393	517	1,116	39	780	(559)
Station Quotient	1.04	0.85	0.77	1.12	0.97	1.04	1.07	0.99	1.15	1.04	1.03	0.99	1.14	1.08	1.04	1.17	1.10	1.13
400m Quotient	1.00	1.01	1.02	1.03	1.02	0.99	0.98	1.00	1.01	1.03	0.96	0.99	1.07	1.01	1.02	1.07	0.96	1.02
800m Quotient	0.99	0.93	0.95	1.02	1.00	1.00	0.93	1.01	1.02	1.04	0.96	0.99	1.04	1.00	1.02	1.02	0.99	1.02
No Children	713,961	13,193	36,676	15,741	117,740	71,063	105,055	22,855	2,830	102,275	20,138	39,759	22,137	24,075	41,677	30,753	56,125	15,944
Station Band	58,995	46	758	1,705	10,990	5,435	2,904	3,470	739	2,987	1,198	5,048	1,395	4,300	3,870	10,750	2,387	1,013
400m Band	120,845	410	3,730	1,546	19,397	14,139	8,706	6,046	1,050	6,982	2,270	13,074	3,661	9,800	6,934	14,598	9,559	1,847
800m Band	157,761	1,029	4,129	1,946	27,290	17,502	6,777	7,450	1,004	9,749	3,598	16,582	4,689	13,073	9,712	16,286	13,470	3,475
Station Quotient	1.11	0.96	1.05	1.19	1.32	1.11	1.04	1.18	1.15	1.07	1.04	1.04	1.02	1.15	1.05	1.28	1.38	1.04
400m Quotient	1.07	0.98	1.09	1.03	1.14	1.07	1.04	1.11	1.11	1.06	1.01	1.04	1.01	1.15	1.02	1.12	1.14	1.02
800m Quotient	1.04	0.99	1.04	1.03	1.09	1.04	1.01	1.09	1.05	1.04	1.02	1.03	1.00	1.10	1.01	1.07	1.10	1.02
Single	200,162	6,913	16,525	8,183	42,838	13,979	36,127	8,151	1,893	29,812	10,347	8,876	2,181	5,095	2,347	(2,276)	4,762	9,504
Station Band	25,897	(236)	470	1,147	5,978	2,194	1,629	1,611	853	1,074	588	2,035	239	1,552	1,550	2,686	1,291	1,236
400m Band	53,637	(53)	1,667	1,209	11,290	5,459	5,323	3,350	1,129	2,850	1,221	6,131	179	3,204	2,823	3,226	4,221	2,037
800m Band	64,806	487	1,685	1,664	15,249	5,613	4,287	3,771	1,312	3,229	1,865	6,616	800	4,846	2,513	2,529	5,260	3,080
Station Quotient	1.11	0.87	1.10	1.23	1.35	1.11	1.07	1.14	1.36	1.03	1.04	1.05	1.01	1.12	1.08	1.26	1.48	1.11
400m Quotient	1.08	0.94	1.04	1.05	1.20	1.09	1.10	1.12	1.24	1.04	1.02	1.07	0.99	1.12	1.07	1.13	1.15	1.06
800m Quotient	1.05	0.98	0.99	1.05	1.13	1.04	1.05	1.08	1.18	1.01	1.02	1.05	1.01	1.11	1.03	1.08	1.11	1.05

Comments: **With Children** or **No Children** means households with or without children, respectively. **Single** means single-person households. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit D-2. Streetcar Transit Station Area Household Type Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Households	351,885	37,571	12,811	59,624	14,636	3,410	17,634	26,710	73,299	21,932	48,703	18,584	16,971
Station Band	19,424	516	835	3,473	1,764	(1,237)	4,701	736	4,996	132	894	52	2,562
400m Band	34,111	695	1,596	8,380	2,089	(2,630)	5,917	751	10,954	171	1,793	546	3,849
800m Band	41,176	2,527	1,734	8,905	2,260	(3,356)	5,989	591	14,794	641	2,576	549	3,966
Station Quotient	1.13	1.08	1.20	1.20	1.45	0.91	1.16	1.32	1.22	0.99	1.25	0.97	1.41
400m Quotient	1.08	1.00	1.14	1.22	1.30	0.92	1.12	1.01	1.18	0.96	1.11	1.01	1.18
800m Quotient	1.06	1.06	1.09	1.18	1.21	0.93	1.07	0.98	1.15	1.00	1.12	0.99	1.08
With Children	33,930	1,243	(113)	2,107	567	(5,385)	851	2,635	17,174	4,053	7,074	(104)	3,828
Station Band	412	96	(75)	176	(53)	(4)	(185)	(11)	51	(115)	132	5	395
400m Band	205	(10)	(271)	544	17	(779)	140	(465)	249	(236)	159	(10)	867
800m Band	(78)	154	(291)	660	4	(1,372)	(76)	(893)	469	(163)	202	52	1,176
Station Quotient	1.02	1.91	0.83	1.22	0.76	1.16	0.85	0.96	0.97	0.40	1.54	1.01	1.37
400m Quotient	0.99	0.97	0.85	1.21	1.03	1.04	1.05	0.75	1.03	0.65	1.10	0.99	1.24
800m Quotient	0.98	1.08	0.87	1.17	1.00	1.02	0.97	0.72	1.04	0.86	1.07	1.03	1.16
No Children	317,955	36,328	12,924	57,517	14,069	8,795	16,783	24,075	56,125	17,879	41,629	18,688	13,143
Station Band	19,012	420	910	3,297	1,817	(1,233)	4,886	747	+4,945	247	762	47	2,167
400m Band	33,906	705	1,867	7,836	2,072	(1,851)	5,777	1,216	10,705	407	1,634	556	2,982
800m Band	41,254	2,373	2,025	8,245	2,256	(1,984)	6,065	1,484	14,325	804	2,374	497	2,790
Station Quotient	1.13	1.02	1.24	1.16	1.47	0.85	1.17	1.44	1.23	1.03	1.20	0.95	1.42
400m Quotient	1.08	0.98	1.21	1.18	1.31	0.88	1.11	1.07	1.18	0.99	1.09	1.00	1.17
800m Quotient	1.05	1.03	1.13	1.15	1.22	0.89	1.07	1.06	1.15	1.01	1.12	0.98	1.06
Single	101,207	18,132	6,382	20,265	6,104	10,185	4,571	5,095	4,762	2,931	13,336	4,578	4,866
Station Band	10,200	59	709	1,721	1,379	(347)	2,797	405	1,722	92	516	(52)	1,199
400m Band	19,853	414	1,088	4,961	1,641	(255)	3,439	495	5,080	233	1,399	27	1,331
800m Band	21,935	544	1,076	4,853	1,721	(39)	3,651	708	5,906	419	1,919	249	928
Station Quotient	1.12	0.91	1.28	1.14	1.59	0.82	1.16	1.48	1.15	1.03	1.23	0.94	1.54
400m Quotient	1.10	0.97	1.17	1.22	1.41	0.85	1.13	1.07	1.19	1.02	1.21	0.97	1.16
800m Quotient	1.06	0.93	1.10	1.17	1.30	0.85	1.09	1.09	1.14	1.04	1.23	1.00	1.03

Comments: **With Children** or **No Children** means households with or without children, respectively. **Single** means single-person households. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit D-3. Bus Rapid Transit Station Area Household Type Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Households	420,044	3,980	15,450	6,244	6,685	14,636	26,049	22,809	14,890	17,719	26,710	22,955	41,475	25,501	95,608	11,224
Station Band	55,292	1,319	3,612	1,133	1,042	3,671	(187)	4,044	3,304	1,362	889	1,321	4,005	1,025	17,889	2,046
400m Band	142,270	2,172	8,548	2,274	3,791	7,476	(572)	10,894	9,707	3,157	1,738	5,312	12,089	2,755	46,775	4,365
800m Band	167,764	2,220	9,345	2,326	3,871	7,816	(90)	13,066	9,550	3,789	1,601	6,010	15,796	5,179	55,054	5,293
Station Quotient	1.03	1.03	1.26	1.21	1.10	1.07	0.95	1.01	1.00	1.06	0.98	1.01	1.04	0.99	1.07	1.02
400m Quotient	1.02	1.00	1.15	1.06	1.11	1.03	0.95	1.00	1.01	1.01	0.96	1.04	1.03	0.98	1.04	1.00
800m Quotient	1.01	1.00	1.10	1.03	1.05	1.02	0.97	1.01	1.00	0.99	0.95	1.03	1.04	0.99	1.03	1.00
With Children	5,707	(7,878)	4,976	(9,497)	505	567	3,194	4,308	(8,056)	3,075	2,635	(7,820)	(202)	(5,252)	22,986	(7)
Station Band	672	(1,852)	25	(60)	176	(528)	(107)	221	(1,402)	102	15	(21)	275	(110)	3,720	471
400m Band	(2,503)	(4,602)	712	(694)	529	(1,450)	(195)	447	(3,337)	298	51	(367)	1,094	(1,641)	8,215	(79)
800m Band	(1,628)	(5,652)	784	(1,060)	468	(1,381)	17	778	(4,831)	275	(279)	(304)	1,182	(1,096)	11,187	(221)
Station Quotient	1.00	0.85	0.89	1.00	1.11	0.91	0.95	0.96	1.01	0.99	0.98	1.03	1.02	1.01	1.08	1.04
400m Quotient	0.99	0.91	1.10	0.84	1.10	0.90	0.97	0.95	1.01	0.99	0.98	1.01	1.03	0.96	1.02	0.97
800m Quotient	0.99	0.93	1.02	0.89	1.04	0.92	1.00	0.96	0.99	0.97	0.97	1.02	1.02	1.00	1.04	0.98
No Children	414,337	11,858	10,474	15,741	6,180	14,069	22,855	18,501	22,946	14,644	24,075	30,775	41,677	30,753	72,622	11,231
Station Band	54,620	3,171	3,587	1,193	866	4,199	(80)	3,823	4,706	1,260	874	1,342	3,730	1,135	14,169	1,575
400m Band	144,773	6,774	7,836	2,968	3,262	8,926	(377)	10,447	13,044	2,859	1,687	5,679	10,995	4,396	38,560	4,444
800m Band	169,392	7,872	8,561	3,386	3,403	9,197	(107)	12,288	14,381	3,514	1,880	6,314	14,614	6,275	43,867	5,514
Station Quotient	1.03	1.09	1.34	1.24	1.09	1.09	0.95	1.02	1.00	1.08	0.99	0.99	1.04	0.97	1.06	1.02
400m Quotient	1.03	1.03	1.16	1.09	1.10	1.05	0.94	1.02	1.00	1.00	0.95	1.04	1.03	0.98	1.05	1.03
800m Quotient	1.02	1.02	1.12	1.06	1.05	1.03	0.95	1.02	1.00	0.99	0.94	1.02	1.04	0.98	1.03	1.02
Single	110,102	7,367	4,312	8,183	2,930	6,104	8,151	3,233	11,953	2,783	5,095	15,548	2,347	(2,276)	4,308	3,532
Station Band	21,060	1,721	1,205	724	668	1,593	200	642	2,074	571	448	1,090	1,303	(49)	3,260	794
400m Band	53,368	4,066	3,038	1,720	2,404	2,828	408	1,464	6,371	1,241	1,001	3,410	2,955	(601)	9,228	1,913
800m Band	56,837	4,779	3,112	1,591	2,153	2,852	456	1,875	7,685	1,307	977	3,172	4,197	(1,878)	8,364	2,366
Station Quotient	1.04	1.06	1.18	1.19	1.16	1.04	1.00	1.00	0.99	1.10	1.07	1.00	1.07	1.01	1.06	1.05
400m Quotient	1.02	1.02	1.13	1.06	1.17	0.99	0.99	0.99	1.00	1.03	1.05	1.01	1.03	0.99	1.05	1.03
800m Quotient	1.01	1.02	1.08	1.02	1.07	0.98	0.98	1.00	1.00	1.00	1.02	0.98	1.05	0.96	1.03	1.02

Comments: **With Children** or **No Children** means households with or without children, respectively. **Single** means single-person households. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit D-4. Commuter Rail Transit Station Area Household Type Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Households	959,655	9,426	85,697	118,525	49,079	110,021	34,598	32,485	92,642	28,163	67,137	48,803	43,842	127,196	20,737	25,840	21,352	43,597
Station Band	45,360	1,250	10,380	3,710	5,329	1,797	1,684	456	3,059	992	4,555	(235)	3,765	1,532	2,087	2,670	862	1,499
400m Band	79,641	1,092	17,798	3,939	8,627	4,450	3,332	1,617	2,976	1,410	6,423	1,259	7,553	2,066	3,549	4,594	3,857	3,993
800m Band	105,770	1,466	23,701	3,596	12,569	865	3,596	2,526	4,115	2,714	11,445	2,323	11,483	4,857	4,245	4,922	4,567	5,834
Station Quotient	1.20	1.15	2.07	1.46	1.79	1.05	1.21	1.00	1.13	1.09	1.22	0.92	1.11	1.17	1.91	1.17	1.02	1.06
400m Quotient	1.11	1.03	1.62	1.15	1.47	1.05	1.18	1.02	1.01	1.02	1.14	1.01	1.08	1.01	1.31	1.16	1.05	1.04
800m Quotient	1.07	1.02	1.39	1.03	1.32	0.96	1.10	1.01	0.98	1.06	1.12	1.02	1.06	1.01	1.20	1.10	1.02	1.03
With Children	98,614	(12,733)	17,448	14,563	9,434	(8,449)	(155)	8,375	29,143	2,421	14,500	2,046	(3,459)	26,979	4,469	(7,393)	3,920	7,791
Station Band	9,671	4	2,652	586	1,735	235	(231)	231	920	457	1,428	(108)	904	71	192	141	216	375
400m Band	13,643	(872)	4,675	554	2,612	362	(301)	254	939	527	2,045	(297)	1,377	(727)	314	1,259	913	191
800m Band	16,476	(1,459)	5,296	4,449	2,222	(1,103)	(428)	620	615	576	3,788	(619)	(109)	(182)	770	1,173	1,381	(521)
Station Quotient	1.18	1.11	2.54	1.52	1.94	1.06	0.90	1.07	1.13	1.31	1.20	0.88	1.14	1.00	1.70	1.07	1.03	1.05
400m Quotient	1.08	0.96	1.91	1.12	1.46	1.04	0.93	0.97	1.03	1.11	1.15	0.93	1.09	0.81	1.31	1.20	1.05	0.99
800m Quotient	1.05	0.93	1.46	1.54	1.20	0.96	0.93	1.00	0.94	1.08	1.12	0.92	1.01	0.93	1.31	1.13	1.04	0.95
No Children	861,041	22,159	68,249	103,962	39,645	118,470	34,753	24,110	63,499	25,742	52,637	46,757	47,301	100,217	16,268	33,233	17,432	35,806
Station Band	35,689	1,246	7,728	3,124	3,594	1,562	1,915	225	2,139	535	3,127	(127)	2,861	1,461	1,895	2,529	646	1,124
400m Band	65,998	1,964	13,123	3,385	6,015	4,088	3,633	1,363	2,037	883	4,378	1,556	6,176	2,793	3,235	3,335	2,944	3,802
800m Band	93,808	2,925	18,405	3,661	10,347	1,968	4,024	1,906	3,500	2,138	7,657	2,942	11,592	5,039	3,475	3,749	3,186	6,355
Station Quotient	1.20	1.16	1.94	1.42	1.73	1.04	1.41	0.97	1.12	1.01	1.24	0.92	1.09	1.21	1.93	1.22	1.02	1.06
400m Quotient	1.11	1.05	1.53	1.13	1.48	1.05	1.29	1.04	1.01	0.98	1.14	1.03	1.06	1.06	1.31	1.14	1.05	1.06
800m Quotient	1.07	1.05	1.35	1.03	1.37	0.96	1.16	1.02	1.00	1.04	1.12	1.03	1.08	1.04	1.19	1.08	1.01	1.08
Single	188,144	11,510	28,714	27,054	10,265	19,931	12,132	3,997	14,337	5,204	11,279	(1,032)	633	11,332	5,816	10,330	4,209	11,353
Station Band	15,828	532	4,070	2,028	1,676	1,080	711	321	805	242	1,264	(543)	237	626	1,146	1,248	349	233
400m Band	29,462	1,001	6,566	1,558	2,641	1,924	1,879	609	423	843	1,710	(278)	1,523	821	2,078	1,588	1,967	1,833
800m Band	40,265	1,497	8,846	3,044	4,882	1,112	2,621	840	755	1,250	2,155	449	3,062	1,790	1,943	1,818	1,316	2,807
Station Quotient	1.23	1.10	1.87	1.57	1.69	1.16	1.34	1.22	1.12	1.04	1.25	0.82	1.03	1.23	2.37	1.31	1.06	1.01
400m Quotient	1.15	1.03	1.49	1.13	1.45	1.10	1.31	1.09	0.99	1.11	1.17	0.97	1.09	1.06	1.40	1.20	1.12	1.10
800m Quotient	1.10	1.04	1.30	1.13	1.38	1.01	1.27	1.07	0.99	1.12	1.10	1.03	1.11	1.06	1.22	1.12	1.02	1.10

Comments: **With Children** or **No Children** means households with or without children, respectively. **Single** means single-person households. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit E-1. Light Rail Transit Station Area Householder Age Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Under 25	(34,505)	(1,426)	106	1,519	(4,231)	(4,892)	(1,409)	(4,071)	(616)	(5,070)	97	(2,531)	(4,236)	(509)	(9,236)	824	1,643	(976)
Station Band	2,707	(248)	87	362	545	453	628	245	199	861	(42)	(654)	(292)	279	(595)	410	111	358
400m Band	2,431	(136)	416	138	388	(715)	1,228	(187)	181	1,487	(228)	(672)	(253)	620	(1,420)	287	1,081	844
800m Band	403	(255)	351	34	104	(1,333)	556	262	22	1,811	(3)	(1,046)	(701)	292	(2,433)	464	1,616	662
Station Quotient	1.17	0.70	1.18	1.34	1.29	1.31	1.32	1.30	1.70	1.42	0.89	0.92	1.01	1.17	1.04	1.21	1.18	1.27
400m Quotient	1.11	1.02	1.26	0.98	1.12	1.03	1.18	1.10	1.36	1.32	0.86	1.03	1.15	1.16	1.01	1.02	1.28	1.32
800m Quotient	1.07	1.00	1.16	0.94	1.08	1.00	1.13	1.18	1.11	1.28	0.99	1.00	1.08	1.07	0.98	1.03	1.23	1.16
25-44	222,606	3,116	8,186	1,192	31,840	30,266	49,957	9,490	1,224	15,360	10,719	12,031	5,015	8,619	8,365	699	35,064	82
Station Band	34,518	7	351	1,207	5,701	3,335	1,792	2,023	350	1,206	602	2,655	810	2,731	1,777	7,779	1,392	800
400m Band	63,621	398	2,391	738	11,720	8,492	4,950	3,392	(72)	2,951	1,254	5,302	3,164	4,465	3,580	7,350	4,762	576
800m Band	79,519	262	2,107	988	15,968	11,275	3,018	4,338	159	5,031	1,603	7,159	3,386	5,556	3,914	5,203	8,181	1,371
Station Quotient	1.15	0.98	1.08	1.36	1.29	1.17	1.07	1.22	1.16	1.10	1.04	1.07	1.06	1.20	1.06	1.38	1.37	1.11
400m Quotient	1.09	1.04	1.17	1.06	1.20	1.10	1.06	1.12	0.94	1.10	1.02	1.04	1.10	1.11	1.05	1.15	1.09	1.03
800m Quotient	1.06	1.00	1.08	1.07	1.15	1.08	1.01	1.10	0.99	1.10	1.01	1.04	1.06	1.07	1.03	1.07	1.09	1.05
45-64	156,087	(4,471)	16,532	(10,396)	58,536	13,728	37,821	(4,906)	(532)	46,609	(10,137)	4,143	4,293	5,554	3,194	4,074	8,685	(11,086)
Station Band	14,236	(14)	91	(93)	3,195	1,074	906	543	47	1,019	(293)	1,140	1,391	1,026	878	2,633	659	34
400m Band	25,191	(283)	933	(760)	5,417	3,652	2,380	1,126	404	1,743	(780)	2,287	490	2,559	565	4,725	2,100	(461)
800m Band	31,449	(452)	1,248	(1,408)	7,911	3,786	1,813	540	192	2,597	(927)	2,691	1,177	3,103	2,265	5,648	2,035	(770)
Station Quotient	1.09	1.02	0.96	1.02	1.26	1.07	1.08	1.11	1.05	1.08	1.00	1.05	1.15	1.10	1.05	1.18	1.31	1.05
400m Quotient	1.04	0.98	1.05	0.98	1.07	1.08	1.04	1.10	1.17	1.02	1.00	1.03	1.00	1.10	1.01	1.12	1.13	1.02
800m Quotient	1.02	0.99	1.04	0.95	1.04	1.04	1.01	1.04	1.06	1.01	1.01	1.02	1.01	1.06	1.02	1.09	1.06	1.02
65+	460,370	10,583	14,321	13,929	57,521	41,560	56,997	25,536	1,880	70,953	13,417	28,815	18,501	13,046	39,152	19,904	27,907	19,394
Station Band	13,280	109	(42)	340	1,699	994	269	662	264	242	860	1,925	409	957	2,289	1,674	474	155
400m Band	37,040	269	173	1,130	3,825	3,182	1,257	1,862	489	1,787	1,106	6,381	1,661	2,791	5,033	3,868	1,866	629
800m Band	52,190	540	204	1,785	5,468	4,718	1,254	2,654	557	2,373	1,598	8,017	2,220	4,639	7,082	5,010	2,418	1,653
Station Quotient	1.03	1.00	0.74	1.07	1.19	0.99	0.87	1.04	1.10	0.89	1.09	1.00	0.94	1.06	1.10	1.12	1.25	0.93
400m Quotient	1.02	0.97	0.86	1.09	1.02	0.98	0.92	1.09	1.11	1.02	1.00	1.04	0.96	1.12	1.05	1.06	1.05	0.95
800m Quotient	0.99	0.98	0.85	1.10	0.97	0.95	0.88	1.07	1.06	0.97	1.00	1.02	0.94	1.10	1.01	1.03	1.00	0.98

Comments: **Under 25**, **25-44**, **45-64**, and **65+** means householders under 25 years of age, between 25 and 44 years of age, between 45 and 64 years of age, and 65 years of age or older, respectively. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit E-2. Streetcar Transit Station Area Householder Age Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Households	(11,658)	282	401	(1,741)	(105)	(3,190)	(2,123)	(509)	1,643	(1,510)	(2,634)	505	(2,677)
Station Band	752	171	116	137	302	(495)	(108)	(18)	430	57	(15)	157	18
400m Band	2,276	177	362	870	272	(1,206)	(36)	(152)	1,513	33	(35)	452	26
800m Band	1,406	(5)	110	862	323	(1,831)	(359)	(125)	2,030	162	(13)	86	166
Station Quotient	1.14	1.64	1.51	1.13	1.71	0.97	1.12	0.92	1.19	1.52	1.04	1.16	1.35
400m Quotient	1.17	1.25	1.22	1.35	1.37	0.90	1.18	0.76	1.32	1.17	1.06	1.16	1.33
800m Quotient	1.10	0.98	1.02	1.31	1.33	0.87	1.09	0.86	1.32	1.35	1.11	1.00	1.47
25-44	124,080	7,273	8,799	14,966	5,827	306	5,986	8,619	35,064	6,556	15,286	2,896	12,502
Station Band	11,657	186	546	2,708	1,065	(931)	1,886	464	3,328	(107)	736	(191)	1,967
400m Band	19,838	(64)	929	5,119	1,242	(1,888)	2,144	809	7,423	(10)	1,262	(263)	3,135
800m Band	25,246	1,524	1,152	5,874	1,276	(2,300)	2,170	653	9,699	172	1,483	(17)	3,560
Station Quotient	1.18	1.09	1.22	1.31	1.39	0.87	1.14	1.45	1.26	0.84	1.56	0.83	1.53
400m Quotient	1.12	0.94	1.15	1.27	1.31	0.90	1.09	1.15	1.22	0.94	1.22	0.90	1.28
800m Quotient	1.10	1.13	1.14	1.25	1.22	0.91	1.05	1.06	1.18	0.99	1.22	0.97	1.15
45-64	56,252	13,530	(5,081)	18,272	621	(1,374)	2,000	5,554	8,685	3,158	15,686	(5,038)	239
Station Band	2,287	(86)	5	136	298	(501)	1,000	192	792	92	76	(94)	377
400m Band	3,979	250	80	979	273	(707)	1,428	115	748	75	254	57	427
800m Band	3,798	570	44	823	338	(984)	1,496	57	1,296	17	240	72	(171)
Station Quotient	1.06	0.81	1.05	0.99	1.49	0.94	1.16	1.35	1.21	1.13	1.02	0.92	1.27
400m Quotient	1.04	1.05	1.07	1.09	1.21	0.98	1.15	1.00	1.06	1.02	1.02	1.06	1.09
800m Quotient	1.01	1.04	1.05	1.04	1.16	0.98	1.10	0.97	1.07	0.98	0.98	1.06	0.98
65+	183,211	16,486	8,692	28,127	8,293	7,668	11,771	13,046	27,907	13,728	20,365	20,221	6,907
Station Band	4,728	245	168	492	99	690	1,923	98	446	90	97	180	200
400m Band	8,018	332	225	1,412	302	1,171	2,381	(21)	1,270	73	312	300	261
800m Band	10,726	438	428	1,346	323	1,759	2,682	6	1,769	290	866	408	411
Station Quotient	1.16	1.24	1.34	1.66	2.13	0.96	1.29	1.18	1.02	0.98	1.03	1.14	1.18
400m Quotient	1.06	1.28	1.13	1.33	1.61	0.89	1.22	0.81	1.05	0.87	1.04	1.03	0.98
800m Quotient	1.03	1.03	1.15	1.21	1.19	0.90	1.14	0.82	1.03	0.96	1.19	1.03	0.97

Comments: **Under 25**, **25-44**, **45-64**, and **65+** means householders under 25 years of age, between 25 and 44 years of age, between 45 and 64 years of age, and 65 years of age or older, respectively. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit E-3. Bus Rapid Transit Station Area Householder Age Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Under 25	(16,814)	(2,957)	1,548	1,519	(620)	(105)	(4,071)	1,249	(142)	652	(509)	(5,008)	(9,236)	824	2,010	(1,547)
Station Band	3,159	(22)	150	306	279	144	(85)	1,002	177	260	(65)	(233)	(202)	166	1,067	(95)
400m Band	7,999	(474)	123	666	933	255	(356)	2,504	917	638	(80)	(870)	(372)	701	2,718	(276)
800m Band	6,873	(766)	239	876	658	180	(460)	2,514	893	743	(150)	(825)	(898)	648	2,662	(711)
Station Quotient	1.13	1.25	1.16	1.26	1.31	1.05	1.01	1.25	1.03	1.44	0.95	1.07	1.19	1.06	1.12	1.13
400m Quotient	1.12	1.12	0.77	1.08	1.22	1.03	0.96	1.21	1.08	1.30	1.02	1.05	1.22	1.11	1.09	1.13
800m Quotient	1.09	1.10	0.85	1.09	1.13	1.02	0.97	1.15	1.06	1.14	0.98	1.10	1.16	1.04	1.05	1.01
25-44	127,184	(489)	3,775	1,192	2,926	5,827	9,490	11,812	10,238	4,783	8,619	7,080	8,365	699	39,628	2,788
Station Band	24,756	(1,014)	2,234	867	467	2,460	(306)	1,589	2,225	484	45	560	1,516	782	10,715	559
400m Band	66,697	(2,051)	5,092	1,448	1,629	5,556	(694)	5,742	6,797	1,471	55	2,992	5,343	1,551	27,680	908
800m Band	77,088	(2,377)	5,017	1,463	1,924	6,117	(517)	6,800	7,014	1,539	(182)	3,241	6,658	3,054	32,287	1,255
Station Quotient	1.05	0.91	1.35	1.46	1.15	1.12	0.90	0.97	1.00	1.06	0.95	1.02	1.04	1.05	1.10	1.02
400m Quotient	1.04	0.96	1.21	1.09	1.16	1.09	0.93	1.01	1.02	1.08	0.95	1.08	1.05	1.02	1.07	0.99
800m Quotient	1.03	0.96	1.14	1.05	1.10	1.09	0.95	1.01	1.00	1.03	0.93	1.06	1.05	1.04	1.06	0.99
45-64	21,248	(3,568)	3,918	(10,396)	(3,243)	621	(4,906)	684	(12,620)	1,970	5,554	339	3,194	4,074	13,219	2,392
Station Band	4,816	635	875	(210)	(93)	(93)	(442)	730	(3,284)	259	446	162	323	(522)	3,550	538
400m Band	7,287	600	2,290	(287)	(198)	(923)	(1,179)	534	(8,072)	336	965	927	1,337	(1,821)	6,859	1,155
800m Band	9,375	366	2,332	(630)	(567)	(1,133)	(1,644)	729	(9,425)	324	980	1,310	1,867	(1,499)	8,337	1,415
Station Quotient	1.01	1.11	1.21	0.90	1.02	0.98	0.92	1.05	0.99	1.06	1.03	1.02	1.01	0.93	1.07	1.03
400m Quotient	1.00	1.03	1.16	1.04	1.04	0.94	0.94	0.98	0.99	0.98	1.01	1.05	1.02	0.93	1.02	1.01
800m Quotient	1.00	1.03	1.09	1.00	1.00	0.94	0.94	0.99	0.99	0.98	1.00	1.06	1.02	0.96	1.02	1.01
65+	288,426	10,994	6,209	13,929	7,622	8,293	25,536	9,064	17,414	10,314	13,046	20,544	39,152	19,904	40,751	7,591
Station Band	22,561	1,720	353	170	389	1,160	646	723	4,186	359	463	832	2,368	599	2,557	1,044
400m Band	60,287	4,097	1,043	447	1,427	2,588	1,657	2,114	10,065	712	798	2,263	5,781	2,324	9,518	2,578
800m Band	74,428	4,997	1,757	617	1,856	2,652	2,531	3,023	11,068	1,183	953	2,284	8,169	2,976	11,768	3,334
Station Quotient	1.00	1.15	1.13	1.07	1.05	1.14	1.07	0.93	1.01	0.97	0.98	1.00	1.13	0.94	0.95	1.02
400m Quotient	0.99	1.03	1.06	0.99	1.10	1.07	1.01	0.94	1.00	0.86	0.89	1.00	1.02	0.96	0.99	1.01
800m Quotient	0.99	1.03	1.10	0.98	1.05	1.02	1.04	0.97	1.00	0.91	0.90	0.96	1.06	0.94	0.98	1.01

Comments: **Under 25**, **25-44**, **45-64**, and **65+** means householders under 25 years of age, between 25 and 44 years of age, between 45 and 64 years of age, and 65 years of age or older, respectively. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit E-4. Commuter Rail Transit Station Area Householder Age Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Under 25	(70,999)	(4,885)	(10,432)	(9,052)	(5,333)	(7,459)	(2,321)	709	(5,608)	(1,019)	1,248	(11,273)	(1,857)	(1,600)	(3,198)	(3,532)	(511)	1,523
Station Band	1,939	303	459	379	55	(139)	(1)	(12)	177	34	299	(13)	133	110	48	233	4	(41)
400m Band	1,292	162	163	312	16	(406)	90	115	73	261	193	110	(111)	(58)	72	184	544	(113)
800m Band	3,931	42	(319)	4,028	288	(608)	(52)	302	14	327	340	(246)	289	(236)	(58)	57	730	(207)
Station Quotient	1.46	3.65	2.57	2.23	1.48	0.92	1.09	0.84	1.65	1.19	1.25	1.24	1.26	1.40	1.67	2.32	1.06	0.82
400m Quotient	1.22	1.64	1.51	1.41	1.32	0.93	1.24	1.21	1.28	1.51	1.05	1.50	1.03	0.99	1.47	1.59	1.56	0.84
800m Quotient	1.26	1.40	1.26	2.73	1.50	0.91	1.05	1.34	1.20	1.46	1.04	1.09	1.16	0.95	1.24	1.31	1.39	0.83
25-44	183,461	(4,995)	30,248	21,104	26,599	(11,586)	4,167	15,222	30,359	5,327	23,070	8,626	4,228	46,655	16,037	(9,543)	(5,862)	(9,434)
Station Band	19,948	308	5,412	2,337	2,495	683	618	86	1,023	495	2,369	(678)	1,572	660	1,624	707	234	(14)
400m Band	34,505	(369)	9,619	2,451	3,784	1,849	1,702	273	1,371	311	3,441	(934)	2,467	1,120	2,778	2,157	980	488
800m Band	46,478	(800)	12,749	3,978	6,596	400	1,738	544	1,476	857	5,553	(1,504)	3,931	2,546	3,519	1,697	1,036	677
Station Quotient	1.24	1.17	2.01	1.56	1.56	1.15	1.22	0.93	1.07	1.15	1.24	0.75	1.14	1.23	2.16	1.19	1.08	1.03
400m Quotient	1.15	0.98	1.65	1.22	1.31	1.14	1.26	0.94	1.04	1.01	1.19	0.88	1.08	1.05	1.37	1.30	1.10	1.06
800m Quotient	1.11	0.95	1.42	1.19	1.29	1.04	1.17	0.95	0.99	1.06	1.14	0.89	1.07	1.06	1.30	1.17	1.07	1.05
45-64	228,247	(5,435)	34,474	44,137	11,430	44,477	2,602	2,888	25,759	3,604	15,537	5,564	10,436	19,269	452	3,712	4,459	12,319
Station Band	14,315	(108)	3,184	646	2,066	994	612	209	1,265	133	1,502	(122)	937	320	338	1,108	104	1,043
400m Band	23,934	(229)	5,727	591	3,840	2,058	650	629	620	(125)	2,217	761	2,811	449	380	1,196	917	1,312
800m Band	32,522	(93)	7,844	2,962	4,445	1,380	488	1,265	1,050	315	3,666	1,384	3,354	273	200	1,157	722	2,456
Station Quotient	1.21	1.00	2.19	1.25	2.48	1.11	1.23	1.15	1.24	1.04	1.32	0.93	1.10	1.13	1.90	1.21	1.00	1.15
400m Quotient	1.11	1.01	1.73	1.04	1.94	1.07	1.12	1.12	0.99	0.95	1.23	1.09	1.12	1.03	1.17	1.11	1.04	1.03
800m Quotient	1.08	1.03	1.48	1.21	1.49	1.00	1.05	1.15	0.98	1.02	1.18	1.10	1.07	0.98	1.04	1.07	1.01	1.06
65+	618,946	24,741	31,407	62,336	16,383	84,589	30,150	13,666	42,132	20,251	27,282	45,886	31,035	62,872	7,446	35,203	23,266	39,189
Station Band	9,158	747	1,325	348	713	259	455	173	594	330	385	578	1,123	442	77	622	520	511
400m Band	19,910	1,528	2,289	585	987	949	890	600	912	963	572	1,322	2,386	555	319	1,057	1,416	2,306
800m Band	34,342	2,317	3,427	4,131	1,240	(307)	1,422	415	1,575	1,215	1,886	2,689	3,909	2,274	584	2,011	2,079	2,908
Station Quotient	1.08	1.17	2.36	1.48	1.96	0.91	1.25	0.92	1.01	1.13	1.02	1.13	1.08	1.05	1.08	1.07	0.99	0.99
400m Quotient	1.03	1.02	1.52	1.17	1.26	0.94	1.19	0.96	0.95	1.08	0.94	1.09	1.07	0.88	1.17	1.02	0.99	1.08
800m Quotient	1.02	1.02	1.31	1.81	1.11	0.85	1.14	0.87	0.93	1.05	1.02	1.14	1.06	0.97	1.11	1.09	0.95	1.01

Comments: **Under 25**, **25-44**, **45-64**, and **65+** means householders under 25 years of age, between 25 and 44 years of age, between 45 and 64 years of age, and 65 years of age or older, respectively. Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit F-1. Light Rail Transit Station Area Median Household Income and Tenure Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Income	$7,179	$359	$3,462	$2,093	$1,557	$17,652	$313	$129	($62)	$12,357	$230	$131	$12,345	$346	$16,931	$33,725	($415)	$1,584
Station Band	$11,243	$1,612	($2,385)	($7,904)	$2,026	$17,239	$2,709	$4,644	$352	$8,792	$1,324	$498	$18,077	$1,525	$17,900	$38,731	$4,673	$2,300
400m Band	$9,737	$1,071	$1,273	($1,261)	$591	$20,894	$573	$2,666	$458	$9,551	$58	$1,078	$14,480	$1,142	$17,286	$33,888	$2,968	$2,770
800m Band	$8,928	$504	$2,131	($55)	($57)	$19,965	$962	$1,144	$974	$9,525	$386	$615	$12,637	$1,114	$15,808	$33,227	$2,318	$2,346
Station Quotient	1.08	1.04	0.93	0.87	1.01	1.08	1.04	1.08	1.01	1.04	1.02	1.01	1.12	1.02	1.08	1.08	1.07	1.02
400m Quotient	1.06	1.02	0.98	0.92	0.99	1.10	0.99	1.04	1.00	1.07	1.00	1.02	1.09	1.01	1.07	1.04	1.04	1.02
800m Quotient	1.05	1.01	0.98	0.96	0.98	1.09	1.01	1.02	1.02	1.05	1.00	1.01	1.03	1.01	1.04	1.04	1.03	1.02
Homeowner	412,239	2,859	13,565	(6,726)	61,504	55,632	62,817	12,557	608	91,693	3,552	34,331	16,077	19,800	21,692	11,002	37,668	(6,592)
Station Band	15,999	(76)	66	134	1,865	1,066	1,022	344	(53)	718	1,018	1,786	1,776	1,667	1,199	2,427	381	659
400m Band	33,995	28	1,189	30	2,180	4,708	3,084	1,224	175	1,424	691	4,655	2,322	4,772	3,244	3,482	2,009	(200)
800m Band	47,097	(269)	934	283	3,327	6,967	3,014	1,241	127	2,324	881	7,025	2,991	6,272	4,882	3,676	3,355	67
Station Quotient	1.06	0.92	0.97	1.06	1.14	1.01	1.06	1.02	0.96	1.04	1.09	1.01	1.12	1.09	1.03	1.11	1.08	1.11
400m Quotient	1.02	0.99	1.11	1.02	0.99	1.02	1.05	1.04	1.03	1.00	1.01	1.00	1.02	1.09	1.03	1.04	1.06	1.01
800m Quotient	1.01	0.97	1.03	1.04	0.98	1.01	1.04	1.02	1.00	0.99	1.01	1.00	1.01	1.04	1.02	1.02	1.05	1.02
Renter	392,319	4,943	25,580	12,970	82,162	25,030	80,549	13,492	1,348	36,159	10,544	8,127	7,496	6,910	19,783	14,499	35,631	14,006
Station Band	48,742	(70)	421	1,682	9,275	4,790	2,573	3,129	913	2,610	109	3,280	542	3,326	3,150	10,069	2,255	688
400m Band	94,288	220	2,724	1,216	19,170	9,903	6,731	4,969	827	6,544	661	8,643	2,740	5,663	4,514	12,748	7,800	1,788
800m Band	116,464	364	2,976	1,116	26,124	11,479	3,627	6,553	803	9,488	1,390	9,796	3,091	7,318	5,946	12,649	10,895	2,849
Station Quotient	1.12	0.95	0.98	1.22	1.26	1.17	1.04	1.20	1.35	1.10	0.96	1.07	1.01	1.18	1.06	1.36	1.46	1.00
400m Quotient	1.07	0.98	1.04	1.00	1.17	1.10	1.01	1.11	1.13	1.10	0.98	1.08	1.04	1.14	1.02	1.17	1.12	1.01
800m Quotient	1.04	0.98	1.00	0.99	1.11	1.06	0.96	1.09	1.07	1.09	1.00	1.06	1.02	1.09	1.01	1.10	1.09	1.01

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit F-2. Streetcar Transit Station Area Median Household Income and Tenure Change Station and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Income	$2,686	$15,137	($325)	($94)	$446	$7,640	$191	$346	($1,998)	$0	$10,915	$8,301	$21,405
Station Band	$8,548	$4,490	$2,422	($532)	($2,776)	$14,124	$3,697	($33)	$9,079	$3,976	$6,686	$4,150	$28,001
400m Band	$8,678	$7,215	$1,970	$499	$881	$13,561	$1,357	$1,464	$4,628	$890	$10,875	$4,472	$32,333
800m Band	$8,532	$20,281	$2,494	$236	$5,364	$12,156	$645	($799)	$3,306	$239	$7,219	$4,196	$29,329
Station Quotient	1.09	0.97	1.04	1.00	0.95	1.08	1.05	1.00	1.15	1.57	0.95	0.97	1.03
400m Quotient	1.09	0.89	1.02	1.01	0.98	1.10	0.98	1.01	1.07	1.48	0.99	0.98	1.12
800m Quotient	1.09	1.16	1.06	1.00	1.10	1.07	1.01	0.98	1.06	1.46	0.95	0.97	1.12
Homeowner	174,590	15,848	3,800	12,316	3,077	3,762	12,283	19,800	37,668	16,537	25,153	17,177	7,169
Station Band	3,276	243	366	408	102	356	344	155	683	238	54	102	225
400m Band	5,934	481	659	744	200	796	598	(94)	1,223	333	475	37	482
800m Band	9,413	1,387	752	1,237	256	809	834	(184)	2,576	700	380	43	623
Station Quotient	1.08	1.76	1.64	1.18	1.14	1.00	0.99	1.13	1.21	1.72	0.99	1.04	1.03
400m Quotient	1.03	1.20	1.47	1.09	1.12	0.99	1.00	0.90	1.09	1.42	1.07	0.95	1.01
800m Quotient	1.04	1.20	1.29	1.12	1.09	0.98	0.99	0.89	1.12	1.28	1.01	0.94	1.00
Renter	177,295	21,723	9,011	47,308	11,559	(352)	5,351	6,910	35,631	5,395	23,550	1,407	9,802
Station Band	16,148	273	469	3,065	1,662	(1,593)	4,357	581	4,313	(106)	840	(50)	2,337
400m Band	28,177	214	937	7,636	1,889	(3,426)	5,319	845	9,731	(162)	1,318	509	3,367
800m Band	31,763	1,140	982	7,668	2,004	(4,165)	5,155	775	12,218	(59)	2,196	506	3,343
Station Quotient	1.14	0.99	1.09	1.16	1.46	0.87	1.24	1.47	1.20	0.90	1.35	0.97	1.75
400m Quotient	1.09	0.93	1.06	1.22	1.31	0.88	1.19	1.12	1.18	0.93	1.12	1.07	1.30
800m Quotient	1.06	0.99	1.03	1.16	1.21	0.90	1.12	1.07	1.15	0.95	1.17	1.04	1.13

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit F-3. Bus Rapid Transit Station Area Median Household Income and Tenure Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Income	$5,357	$273	$309	($32)	($113)	$329	$129	($458)	($3,047)	$523	$346	$826	$16,931	$33,632	($188)	$12,164
Station Band	$3,474	$398	($1,164)	$6,240	$1,082	$21	$248	$586	$28	($125)	($1,861)	($601)	$14,060	$29,482	$1,727	$10,106
400m Band	$4,499	($542)	$931	$1,025	($4,038)	$153	$214	$841	$239	($217)	($3,964)	$226	$15,635	$33,696	$1,223	$9,693
800m Band	$4,143	$133	($2,451)	$881	$992	$87	($30)	$177	($4,968)	($116)	($372)	$503	$15,780	$34,951	$1,008	$9,106
Station Quotient	0.99	1.00	0.99	1.24	1.04	0.99	1.00	1.02	1.05	0.99	0.97	0.97	0.98	1.00	1.02	1.02
400m Quotient	1.01	0.98	1.00	1.04	0.94	0.99	1.01	1.03	1.05	0.99	0.92	1.00	1.01	1.06	1.01	1.01
800m Quotient	0.99	1.00	0.98	1.03	1.02	1.00	1.00	1.01	0.96	0.99	0.99	1.00	1.01	1.05	1.01	1.00
Homeowner	217,590	4,098	5,002	(6,726)	3,003	3,077	12,557	13,220	6,038	12,305	19,800	10,964	21,692	11,002	54,148	5,835
Station Band	12,343	75	948	(6)	163	527	(422)	1,768	(90)	336	190	430	104	(289)	4,611	(40)
400m Band	34,445	(36)	2,558	(81)	453	815	(689)	4,587	347	767	(212)	1,115	1,231	(367)	13,548	(194)
800m Band	47,425	155	2,743	(310)	419	843	(234)	5,881	235	1,109	(196)	1,548	3,473	(273)	18,110	224
Station Quotient	1.00	0.98	1.21	1.01	1.03	1.02	0.91	1.03	0.99	1.08	0.94	1.04	0.97	0.94	1.03	0.95
400m Quotient	1.00	0.97	1.17	1.00	1.01	1.00	0.95	1.00	0.99	1.00	0.90	1.02	0.99	0.97	1.02	0.95
800m Quotient	1.00	0.98	1.08	0.98	0.99	0.99	0.98	1.01	0.99	1.01	0.91	1.03	1.02	0.97	1.02	0.96
Renter	202,454	(118)	10,448	12,970	3,682	11,559	13,492	9,589	8,852	5,414	6,910	11,991	19,783	14,499	41,460	5,389
Station Band	42,949	1,244	2,664	1,139	879	3,144	235	2,276	3,394	1,026	699	891	3,901	1,314	13,278	2,086
400m Band	107,825	2,208	5,990	2,355	3,338	6,661	117	6,307	9,360	2,390	1,950	4,197	10,858	3,122	33,227	4,559
800m Band	120,339	2,065	6,602	2,636	3,452	6,973	144	7,185	9,315	2,680	1,797	4,462	12,323	5,452	36,944	5,069
Station Quotient	1.05	1.08	1.28	1.19	1.12	1.07	0.99	1.00	1.02	1.08	1.06	1.00	1.08	1.01	1.09	1.10
400m Quotient	1.03	1.03	1.13	1.03	1.14	1.02	0.94	1.01	1.03	1.03	1.10	1.04	1.05	0.98	1.05	1.04
800m Quotient	1.02	1.02	1.11	1.01	1.09	1.01	0.95	1.01	1.01	1.01	1.03	1.03	1.04	1.00	1.04	1.03

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit F-4. Commuter Rail Transit Station Area Median Household Income and Tenure Change and Station Quotients by System

[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Income	$14,097	$6,274	$18,740	$12,283	$17,850	$10,777	$15,484	$15,023	$10,870	$19,704	$14,902	$16,931	$27,897	$21,471	$21,405	$4,003	$3,121	$13,699
Station Band	$15,606	$2,690	$20,336	$20,501	$36,333	$10,912	$9,662	$6,267	$8,709	$21,513	$14,117	$13,198	$30,217	$26,119	$24,725	($1,201)	$5,277	$15,198
400m Band	$13,977	$4,255	$23,215	$20,549	$16,990	$6,306	$10,186	$10,275	$10,248	$14,361	$13,308	$19,815	$25,452	$17,072	$21,692	$5,281	$2,595	$14,960
800m Band	$14,759	$5,089	$22,474	$17,622	$25,165	$8,509	$10,505	$13,532	$10,337	$13,904	$14,741	$18,903	$27,286	$15,562	$27,555	$5,847	$1,636	$15,129
Station Quotient	1.02	0.96	1.01	1.10	1.20	1.08	0.93	0.86	0.98	1.10	1.01	0.94	1.01	1.17	0.99	0.94	1.03	1.03
400m Quotient	1.00	1.00	1.07	1.13	0.94	0.96	0.95	0.89	1.02	0.99	1.00	1.01	0.98	1.08	0.96	1.04	1.00	1.02
800m Quotient	1.02	0.99	1.10	1.11	1.08	1.02	0.95	0.98	0.98	0.99	1.03	1.01	1.00	1.03	1.03	1.03	0.99	1.03
Homeowner	397,490	6,398	51,131	34,671	26,718	(10,808)	15,432	17,344	36,480	23,082	46,118	20,443	14,477	68,825	7,297	10,049	8,234	21,599
Station Band	15,837	447	3,920	759	2,815	(305)	432	14	390	979	1,745	268	1,372	615	(139)	1,279	(95)	941
400m Band	25,272	703	7,916	1,160	4,954	(1,970)	184	(10)	19	876	2,161	865	1,954	1,048	(130)	1,842	419	2,326
800m Band	30,949	659	10,428	19	5,410	(5,267)	228	1,107	277	980	5,247	1,354	2,562	1,823	208	2,404	516	3,014
Station Quotient	1.13	1.08	2.10	1.38	1.92	0.97	1.06	0.91	0.99	1.33	1.13	1.06	1.10	1.17	0.79	1.10	0.97	1.08
400m Quotient	1.07	1.03	1.79	1.30	1.50	0.92	0.99	0.91	0.93	1.04	1.04	1.06	1.04	1.07	0.90	1.07	1.00	1.05
800m Quotient	1.03	1.01	1.50	0.96	1.30	0.87	0.98	0.99	0.94	1.01	1.07	1.06	1.03	1.02	0.97	1.07	0.99	1.04
Renter	561,650	3,028	34,566	83,854	22,361	120,829	19,166	15,141	56,162	5,081	21,019	28,360	29,365	58,371	13,440	15,791	13,118	21,998
Station Band	31,148	803	6,460	2,951	2,514	2,102	1,252	442	2,669	13	2,810	(503)	2,393	917	2,226	1,391	957	558
400m Band	55,994	389	9,882	2,779	3,673	6,420	3,148	1,627	2,957	534	4,262	394	5,599	1,018	3,679	2,752	3,438	1,667
800m Band	71,243	807	13,273	(1,626)	7,159	6,132	3,368	1,419	3,838	1,734	6,198	969	8,921	3,034	4,037	2,518	4,051	2,820
Station Quotient	1.35	1.27	2.07	1.44	1.68	1.10	1.70	1.23	1.21	0.96	1.33	0.83	1.11	1.16	2.78	1.24	1.09	1.03
400m Quotient	1.20	1.03	1.53	1.07	1.42	1.12	1.48	1.23	1.06	1.02	1.28	0.98	1.10	0.97	1.53	1.19	1.10	1.02
800m Quotient	1.13	1.05	1.33	0.83	1.34	1.01	1.29	1.05	1.01	1.11	1.20	0.99	1.08	1.00	1.34	1.11	1.03	1.02

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit G-1. Light Rail Transit Station Area Commute to Work Mode Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Workers	1,913,783	14,147	84,461	17,832	300,092	207,496	221,167	82,360	7,405	303,276	24,925	120,274	88,180	69,478	163,709	99,641	152,161	26,657
Station Band	111,749	(8)	1,161	1,810	14,703	11,375	5,390	5,904	868	7,223	1,118	10,804	7,203	8,698	10,277	19,781	3,030	2,412
400m Band	239,957	27	7,885	2,150	27,226	27,467	13,454	9,053	1,642	15,655	2,366	27,905	16,482	20,557	24,382	29,472	15,867	3,757
800m Band	348,945	(12)	9,726	2,962	43,642	41,149	7,253	15,099	212	27,230	4,590	40,097	21,546	28,197	38,222	37,242	24,916	6,874
Station Quotient	1.11	0.97	0.99	1.15	1.19	1.15	1.08	1.17	1.10	1.12	1.02	1.04	1.13	1.15	1.03	1.22	1.17	1.08
400m Quotient	1.06	0.97	1.12	1.04	1.06	1.06	1.03	1.06	1.09	1.08	1.00	1.03	1.08	1.12	1.03	1.08	1.14	1.04
800m Quotient	1.05	0.97	1.08	1.05	1.05	1.06	0.97	1.08	0.95	1.09	1.02	1.03	1.04	1.07	1.03	1.05	1.11	1.05
Automobile	1,456,416	12,363	65,144	12,833	252,450	150,262	194,515	56,946	6,485	250,982	9,530	82,276	75,057	51,957	124,948	72,035	71,337	19,253
Station Band	76,744	(209)	728	1,142	11,218	6,750	3,849	3,382	531	4,846	1,230	6,326	5,975	5,371	8,578	14,140	446	2,441
400m Band	160,511	235	4,739	902	22,426	15,415	8,930	5,159	1,116	11,203	1,386	16,572	14,508	14,310	20,185	20,454	4,033	2,787
800m Band	239,401	667	6,226	2,028	35,828	25,673	4,505	8,316	539	21,490	3,181	24,153	19,711	20,363	30,656	24,988	5,659	5,418
Station Quotient	1.10	0.91	0.98	1.13	1.16	1.12	1.06	1.17	1.05	1.10	1.07	1.03	1.15	1.10	1.06	1.19	1.00	1.13
400m Quotient	1.05	0.99	1.07	1.02	1.06	1.03	1.00	1.07	1.07	1.08	1.02	1.02	1.10	1.10	1.04	1.06	1.07	1.04
800m Quotient	1.04	1.00	1.06	1.05	1.05	1.04	0.96	1.07	0.98	1.10	1.04	1.03	1.06	1.06	1.03	1.03	1.03	1.05
Transit	81,132	588	49	(1,471)	2,496	5,794	(3,360)	5,055	(187)	275	4,563	13,635	(947)	3,218	4,463	11,466	41,012	(2,299)
Station Band	12,645	(47)	129	373	729	1,554	(193)	1,760	67	388	(551)	2,008	224	1,583	1,103	2,634	1,177	(293)
400m Band	22,799	(291)	543	354	570	3,363	439	1,665	(141)	430	(400)	5,941	(196)	2,106	1,585	3,369	3,652	(383)
800m Band	29,448	(811)	573	240	1,408	4,035	(248)	2,417	2	240	(174)	7,075	(529)	2,654	2,477	4,384	6,376	(671)
Station Quotient	1.18	0.88	1.37	1.52	1.30	1.40	0.96	1.41	1.33	1.20	0.77	1.01	1.23	1.67	1.18	1.33	1.25	0.89
400m Quotient	1.08	0.84	1.33	1.19	1.03	1.26	1.22	1.11	0.84	1.08	0.87	1.07	1.00	1.25	1.08	1.07	0.96	0.97
800m Quotient	1.06	0.78	1.25	1.13	1.09	1.19	1.02	1.11	1.04	1.02	0.91	1.04	0.96	1.16	1.08	1.04	0.98	0.96
Walk/Bike	64,393	(1,212)	1,039	1,030	5,544	5,887	909	4,035	5,057	6,407	1,150	5,532	(1,350)	2,414	6,068	5,526	19,048	(277)
Station Band	11,479	245	212	233	1,588	792	1,204	141	26	733	506	836	(3)	663	1,330	1,686	1,161	126
400m Band	26,174	(56)	1,141	497	1,908	1,976	2,616	1,515	385	1,459	799	2,129	101	1,671	1,765	2,409	6,853	210
800m Band	36,480	(63)	1,230	378	2,980	2,722	1,201	2,798	(8)	1,641	668	4,789	(172)	1,928	2,108	3,280	10,429	571
Station Quotient	1.15	1.50	1.42	1.12	1.61	1.06	1.66	0.94	0.67	1.10	1.78	1.02	1.07	1.15	1.10	1.61	1.39	1.08
400m Quotient	1.12	1.06	1.54	1.15	1.20	1.06	1.30	1.06	0.93	1.08	1.19	1.02	1.09	1.19	1.05	1.30	1.24	1.06
800m Quotient	1.11	1.07	1.27	1.08	1.22	1.05	1.18	1.10	0.63	1.03	1.09	1.10	1.05	1.11	1.03	1.22	1.19	1.10

Appendix Exhibit G-1. Light Rail Transit Station Area Commute to Work Mode Change and Station Quotients by System—continued

[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Work at Home	281,152	3,163	16,720	5,364	41,245	43,463	27,244	13,262	(4,638)	41,164	10,532	16,691	13,098	12,418	18,201	8,423	18,036	9,184
Station Band	8,298	(33)	168	15	1,046	1,978	802	453	131	1,047	(130)	1,383	607	1,064	(1,108)	634	231	10
400m Band	23,463	(1)	1,440	219	2,415	5,738	1,848	263	179	1,850	608	2,531	1,359	2,369	(348)	2,184	736	875
800m Band	32,799	207	1,495	73	3,346	7,549	1,953	722	(393)	2,700	938	3,164	1,311	3,106	482	3,105	1,758	1,283
Station Quotient	0.99	0.66	0.87	0.81	1.11	1.46	1.22	1.09	3.50	1.43	0.61	1.12	1.10	1.36	0.71	1.07	1.09	0.77
400m Quotient	1.00	0.77	1.42	0.90	1.05	1.17	1.03	0.84	3.17	1.24	0.87	0.97	1.00	1.16	0.82	1.16	0.96	1.13
800m Quotient	0.98	0.92	1.19	0.82	0.97	1.09	1.16	0.89	1.48	1.20	0.87	0.94	0.86	1.04	0.86	1.15	1.05	1.07

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit G-2. Streetcar Transit Station Area Commute to Work Mode Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Workers	799,442	77,742	27,500	139,313	28,124	17,389	56,803	69,478	152,161	51,626	101,236	27,468	50,602
Station Band	29,698	1,120	1,151	4,502	2,455	701	4,668	1,001	7,423	551	959	970	4,197
400m Band	54,104	625	2,803	9,696	2,721	2,045	7,451	1,384	15,529	757	1,867	1,597	7,629
800m Band	71,204	5,528	3,036	10,785	3,254	3,913	8,213	1,155	21,019	1,753	2,199	1,607	8,742
Station Quotient	1.15	1.20	1.23	1.14	1.49	0.93	1.09	1.25	1.28	1.17	1.24	1.12	1.34
400m Quotient	1.09	0.92	1.25	1.14	1.32	0.94	1.08	1.00	1.21	1.01	1.02	1.07	1.21
800m Quotient	1.07	1.11	1.15	1.11	1.26	0.95	1.03	0.95	1.17	1.07	1.01	1.03	1.10
Automobile	552,571	50,061	21,702	122,043	25,828	9,159	34,162	51,957	71,337	42,670	82,051	25,480	16,121
Station Band	10,904	736	781	2,656	2,141	(1,511)	1,950	875	1,116	138	528	519	975
400m Band	17,957	452	1,979	6,014	2,140	(1,275)	2,642	691	1,593	459	951	882	1,429
800m Band	24,078	3,290	2,109	6,573	2,662	(1,281)	2,789	683	2,424	1,217	1,150	778	1,684
Station Quotient	1.07	1.25	1.32	1.07	1.59	0.83	1.09	1.30	1.11	0.98	1.12	1.14	1.20
400m Quotient	1.01	0.95	1.32	1.08	1.32	0.90	1.06	0.97	1.02	1.00	0.97	1.06	1.05
800m Quotient	1.00	1.11	1.17	1.06	1.27	0.91	1.01	0.95	1.02	1.06	0.97	1.01	1.00
Transit	72,169	7,090	246	890	(1,037)	(122)	10,206	3,218	41,012	3,872	890	(834)	6,738
Station Band	4,310	89	(31)	347	109	6	1,046	(21)	1,321	217	8	(34)	1,253
400m Band	7,014	26	(72)	166	156	(315)	1,494	(70)	2,689	155	60	(126)	2,851
800m Band	9,069	212	(140)	155	113	(170)	1,960	(144)	3,737	305	76	51	2,914
Station Quotient	1.13	1.21	0.87	1.89	2.56	1.01	1.05	0.75	0.98	1.94	1.22	0.94	1.35
400m Quotient	1.05	0.85	0.89	1.10	2.17	0.93	1.01	0.77	0.94	0.96	1.56	0.86	1.36
800m Quotient	1.02	0.93	0.86	1.06	1.66	0.98	1.01	0.72	0.93	1.05	1.17	1.15	1.19
Walk/Bike	47,999	2,857	431	3,416	2	2,669	4,879	2,414	19,048	(833)	(329)	(708)	14,153
Station Band	9,731	87	345	688	(7)	1,146	1,201	13	4,034	81	200	544	1,399
400m Band	18,242	(345)	522	1,740	119	1,314	2,174	137	9,482	54	291	687	2,067
800m Band	23,137	508	526	2,151	125	2,368	2,040	54	12,364	(62)	319	580	2,164
Station Quotient	1.26	0.98	1.25	1.60	0.99	1.12	1.10	0.92	1.36	1.58	2.64	1.36	1.53
400m Quotient	1.21	0.64	1.21	1.70	1.13	0.99	1.13	1.03	1.31	1.21	1.31	1.24	1.27
800m Quotient	1.17	1.02	1.15	1.68	1.11	1.04	1.05	0.91	1.26	1.00	1.29	1.17	1.04

Appendix Exhibit G-2. Streetcar Transit Station Area Commute to Work Mode Change and Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Work at Home	115,440	11,921	4,540	15,535	3,890	4,801	6,921	12,418	18,036	5,956	17,613	4,366	9,443
Station Band	3,431	42	106	554	151	925	253	135	593	96	184	64	328
400m Band	8,356	176	421	1,303	165	2,196	725	525	1,164	121	386	484	690
800m Band	11,409	1,116	444	1,335	170	2,869	883	508	1,473	327	430	627	1,227
Station Quotient	1.13	0.86	1.43	1.11	1.39	0.94	0.92	3.43	1.34	1.68	1.54	0.98	1.25
400m Quotient	1.20	0.92	2.14	1.19	1.23	1.01	1.03	2.13	1.19	1.16	0.99	1.44	1.20
800m Quotient	1.16	1.36	1.46	1.10	1.10	1.00	0.98	1.33	1.09	1.52	1.00	1.45	1.22

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit G-3. Bus Rapid Transit Commute to Work Mode Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Workers	1,073,123	10,957	15,119	17,832	17,726	28,124	82,360	51,088	24,759	29,126	69,478	99,542	163,709	99,641	202,192	36,671
Station Band	107,928	291	5,090	1,086	1,919	6,342	(494)	10,717	6,837	2,193	2,418	3,528	7,691	3,976	33,285	7,369
400m Band	296,009	1,875	11,713	3,322	7,019	14,141	(395)	30,172	18,018	5,533	6,008	14,916	25,602	15,876	86,460	16,563
800m Band	367,229	3,020	12,449	3,813	8,667	16,235	1,004	35,213	19,180	6,900	7,804	19,273	32,910	26,261	105,845	18,846
Station Quotient	1.03	0.97	1.32	1.20	1.13	1.09	0.89	1.05	1.01	1.11	0.96	1.00	1.01	0.98	1.10	1.09
400m Quotient	1.03	0.99	1.18	1.14	1.15	1.06	0.92	1.05	1.01	1.07	0.96	1.08	1.01	1.00	1.05	1.04
800m Quotient	1.02	0.99	1.12	1.09	1.11	1.06	0.94	1.04	1.01	1.04	0.96	1.08	1.01	1.02	1.05	1.02
Automobile	792,011	11,378	7,018	12,833	16,395	25,828	56,946	38,247	7,768	26,756	51,957	87,838	124,948	72,035	111,541	34,841
Station Band	71,847	(545)	2,582	907	1,143	6,410	(772)	8,922	2,494	2,111	1,727	3,207	3,752	2,314	14,628	6,990
400m Band	199,037	599	5,654	2,520	4,958	13,931	(1,283)	23,877	7,227	5,129	4,397	13,696	14,864	10,453	37,856	16,048
800m Band	252,496	1,998	6,127	2,906	6,381	16,243	(132)	27,873	8,236	6,718	5,792	16,987	20,732	18,863	47,827	18,292
Station Quotient	1.02	0.94	1.34	1.40	1.08	1.13	0.87	1.06	1.01	1.17	0.96	1.01	0.97	0.97	1.06	1.09
400m Quotient	1.02	0.98	1.19	1.20	1.17	1.08	0.91	1.05	1.01	1.10	0.96	1.09	0.99	1.00	1.03	1.05
800m Quotient	1.02	0.99	1.13	1.12	1.12	1.09	0.94	1.04	1.01	1.08	0.96	1.08	1.00	1.03	1.02	1.03
Transit	73,382	(567)	2,623	(1,471)	189	(1,037)	5,055	678	4,837	(39)	3,218	(34)	4,463	11,466	43,698	1,431
Station Band	12,094	304	1,657	224	379	(24)	(157)	221	768	(60)	(101)	(348)	928	529	8,586	281
400m Band	31,407	508	3,832	347	660	(74)	(140)	546	2,385	108	(102)	(530)	2,367	1,856	21,618	475
800m Band	37,614	663	3,607	467	782	(316)	34	559	2,473	(281)	293	(509)	2,726	3,311	26,020	533
Station Quotient	1.04	1.49	1.30	1.48	1.90	1.13	0.85	1.05	0.97	0.90	0.76	0.73	1.15	0.85	1.09	1.28
400m Quotient	1.02	1.23	1.17	1.13	1.23	1.13	0.93	1.03	0.98	1.18	0.85	0.93	1.09	0.87	1.02	0.88
800m Quotient	1.02	1.27	1.10	1.14	1.24	1.05	0.96	1.01	0.97	0.89	1.06	0.96	1.08	0.93	1.01	0.89
Walk/Bike	41,800	(1,162)	1,744	1,030	(673)	2	4,035	2,298	791	694	2,414	769	6,068	5,526	21,275	(1,177)
Station Band	9,791	(126)	557	(30)	245	(433)	155	282	1,032	(26)	238	158	872	707	7,355	(124)
400m Band	25,469	(398)	1,463	426	744	(881)	507	1,206	1,923	(92)	545	289	2,076	1,764	19,141	(363)
800m Band	27,044	(626)	1,497	342	866	(913)	351	1,547	1,299	(80)	491	392	1,547	1,629	22,380	(417)
Station Quotient	1.09	1.06	1.61	0.93	1.23	0.83	1.02	0.89	1.11	0.88	1.63	1.05	1.10	1.05	1.23	1.01
400m Quotient	1.05	1.05	1.32	1.07	1.18	0.87	1.04	1.03	1.04	0.87	1.64	1.00	1.02	0.95	1.14	0.99
800m Quotient	1.02	1.02	1.17	1.02	1.17	0.87	0.96	1.09	0.99	0.89	1.13	1.02	0.95	0.91	1.11	1.01

Appendix Exhibit G-3. Bus Rapid Transit Commute to Work Mode Change and Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AA	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Work at Home	138,946	2,205	2,607	5,364	1,066	3,890	13,262	8,810	12,020	2,415	12,418	8,311	18,201	8,423	22,846	1,810
Station Band	11,373	575	245	(24)	143	352	232	1,058	2,698	182	713	240	1,548	156	2,105	279
400m Band	31,870	1,207	808	(101)	644	930	439	3,800	6,999	589	1,519	784	4,003	964	6,132	544
800m Band	39,009	1,217	1,177	(57)	464	1,111	635	4,444	7,874	663	1,541	1,372	5,095	1,554	7,392	603
Station Quotient	1.05	1.28	1.11	0.70	1.26	0.92	0.88	0.94	1.05	1.54	1.44	1.04	1.22	0.89	1.02	1.05
400m Quotient	1.04	1.11	1.19	0.69	1.32	0.95	0.82	1.11	1.08	1.96	1.19	1.07	1.07	0.97	1.01	0.98
800m Quotient	1.03	1.02	1.19	0.76	1.05	0.96	0.85	1.08	1.04	1.39	1.02	1.27	1.09	0.98	0.98	0.96

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit G-4. Commuter Rail Transit Commute to Work Mode Change and Station Quotients by System
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Workers	2,509,491	18,029	188,058	292,957	121,947	380,902	93,960	70,599	176,133	71,549	173,537	191,450	164,260	282,720	60,969	49,959	52,994	88,097
Station Band	73,429	1,695	15,408	4,916	8,395	3,404	1,940	521	4,658	1,474	8,842	(490)	8,196	2,178	3,688	2,720	1,628	3,030
400m Band	144,336	1,844	28,705	7,332	13,939	11,004	4,219	2,243	4,604	2,170	12,450	2,992	16,989	4,363	5,058	7,474	6,138	8,849
800m Band	203,170	2,038	39,860	3,321	21,405	8,213	3,684	4,968	6,140	4,828	23,999	3,412	26,672	9,207	7,076	8,732	9,428	12,577
Station Quotient	1.19	1.17	2.10	1.39	1.93	1.02	1.10	0.93	1.14	1.05	1.26	0.83	1.12	1.17	1.96	1.07	1.01	1.08
400m Quotient	1.11	1.04	1.66	1.19	1.51	1.05	1.12	0.97	0.99	0.97	1.16	0.99	1.07	1.04	1.19	1.14	1.04	1.06
800m Quotient	1.06	1.02	1.43	0.94	1.35	0.95	1.01	1.02	0.95	1.03	1.15	0.95	1.05	1.03	1.16	1.09	1.02	1.05
Automobile	1,852,790	19,826	151,537	254,351	91,192	308,735	65,948	53,936	143,259	54,653	137,487	146,980	130,850	170,876	19,826	(4,977)	39,419	52,081
Station Band	55,204	1,349	12,058	4,132	5,714	2,756	1,328	432	4,618	819	6,545	(1,037)	6,343	1,327	645	2,371	1,145	1,838
400m Band	103,906	1,609	22,623	6,225	10,034	8,536	2,335	1,669	4,161	969	8,983	1,249	12,694	2,842	984	6,208	4,502	4,716
800m Band	142,506	1,627	32,433	1,657	14,428	7,038	1,417	3,748	4,804	3,064	18,298	737	19,096	6,552	1,691	7,296	7,153	5,977
Station Quotient	1.18	1.14	2.17	1.41	1.81	1.02	1.07	0.94	1.20	1.00	1.23	0.74	1.13	1.14	1.48	1.22	1.01	1.06
400m Quotient	1.10	1.03	1.68	1.20	1.49	1.04	1.06	0.97	1.02	0.93	1.12	0.95	1.08	1.05	1.12	1.29	1.04	1.04
800m Quotient	1.05	1.01	1.47	0.92	1.33	0.96	0.97	1.01	0.95	1.01	1.13	0.91	1.04	1.05	1.11	1.24	1.03	1.02
Transit	122,432	(498)	1,105	3,227	4,151	1,878	3,482	1,245	2,190	4,786	6,056	3,850	15,515	52,912	9,637	2,170	875	8,002
Station Band	5,934	127	244	(88)	484	9	168	(30)	283	264	502	69	1,410	427	1,333	3	468	343
400m Band	11,995	109	367	(184)	952	137	37	(16)	467	672	918	225	2,135	889	1,307	251	1,058	1,918
800m Band	17,135	147	204	710	1,129	(1,078)	15	75	390	968	1,702	253	3,893	1,366	1,581	(132)	836	3,234
Station Quotient	1.24	1.95	1.33	0.73	2.02	0.99	1.51	0.63	1.95	1.24	1.37	1.11	1.19	1.40	1.94	0.89	1.17	1.10
400m Quotient	1.12	1.42	1.18	0.75	1.72	1.04	0.97	0.80	1.69	1.19	1.45	1.16	1.04	1.05	1.17	0.95	1.11	1.14
800m Quotient	1.08	1.38	1.01	1.37	1.33	0.72	0.95	1.00	1.31	1.23	1.48	1.09	1.11	0.96	1.14	0.88	1.04	1.16
Walk/Bike	94,936	(1,681)	3,144	5,428	5,602	1,809	6,032	2,780	2,419	663	4,077	7,894	5,684	23,270	17,492	9,257	1,216	939
Station Band	5,879	(61)	1,132	215	871	195	131	(26)	(13)	(2)	776	337	350	517	1,248	(122)	(272)	343
400m Band	10,965	(173)	1,689	415	992	255	1,181	226	76	(6)	943	342	1,187	818	1,579	64	(178)	600
800m Band	15,414	(235)	1,735	1,083	2,523	171	1,470	267	198	108	907	(152)	2,175	815	2,422	191	(227)	733
Station Quotient	1.36	0.96	2.04	1.14	2.54	1.37	1.39	0.62	0.85	0.95	1.71	1.47	1.00	2.50	2.49	0.61	0.60	1.92
400m Quotient	1.15	0.95	1.67	1.09	1.47	1.11	1.78	1.11	0.95	0.95	1.37	1.06	1.03	1.22	1.09	0.82	0.86	1.19
800m Quotient	1.08	0.97	1.29	1.28	1.40	1.04	1.41	0.98	0.99	1.04	1.16	0.82	1.05	0.93	1.13	0.82	0.88	1.15

Appendix Exhibit G-4. Commuter Rail Transit Commute to Work Mode Change and Station Quotients by System—continued
[Quotients > 1.0 mean the distance band gained more share of jobs 2010-2019 than the transit region.]

Measure	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC	MDE	MDW	VRE
Work at Home	337,552	2,136	35,060	32,153	19,774	50,303	15,601	11,426	26,139	9,781	26,221	21,810	10,739	32,216	9,789	(4,313)	8,312	19,561
Station Band	6,881	225	1,848	559	1,287	(17)	340	170	(17)	380	762	71	184	(28)	266	205	354	203
400m Band	15,226	379	3,790	796	1,875	(45)	759	271	286	661	1,189	822	1,302	25	605	463	629	925
800m Band	25,720	546	5,302	1,717	3,218	(228)	790	773	1,047	734	2,580	1,941	1,695	442	761	577	1,331	1,665
Station Quotient	1.20	1.67	2.45	1.89	2.35	0.68	1.52	1.03	0.62	2.00	1.10	0.89	0.92	0.69	2.37	3.75	1.18	0.92
400m Quotient	1.13	1.27	1.95	1.47	1.42	0.68	1.69	0.82	0.75	1.34	1.11	1.11	1.11	0.76	1.49	3.93	1.04	1.01
800m Quotient	1.13	1.24	1.69	1.59	1.38	0.65	1.23	1.08	0.86	1.23	1.19	1.25	1.06	0.91	1.19	3.82	1.08	1.08

Comments: Whole numbers, in thousands, are the change during the study period. See text for description of Station Quotients. Station areas are distance from the station being the station band, the 400-meter band includes the station band, and the 800-meter band includes the entire station area.

Appendix Exhibit H-1. Office Rent with Respect to Light Rail Transit Station Proximity

Variable	ALL	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Station Distance																		
0-100m	**-0.007**	**0.146**	**0.095**	**0.107**	**-0.030**	**0.019**	**0.115**	-0.006	0.016	0.001	**-0.041**	0.007	**0.042**	**0.029**	**-0.086**	**-0.152**	**-0.042**	**-0.053**
>100m-200m	**0.014**	0.004	**0.144**	**0.169**	**-0.074**	**0.033**	-0.011	-0.013		**-0.089**	0.041	**0.054**	**0.005**	**0.061**	**-0.036**	**-0.107**	**-0.012**	**0.064**
>200m-300m	**0.039**	**0.266**	**0.095**	**0.108**	0.011	**0.083**	**0.117**	**0.052**		**0.115**	**0.111**	0.004	0.079	**0.114**	**-0.129**	**-0.057**	**0.095**	**0.065**
>300m-400m	-0.001	**0.209**	0.054	**0.054**	-0.061	**0.162**	0.039	-0.032	-0.005	**-0.052**	0.048	-0.029	**-0.124**	**0.119**	**-0.114**	**-0.113**	**0.124**	**-0.066**
>400m-500m	**0.022**	0.005	0.049	0.048	**-0.086**	**0.064**	0.053	-0.020	-0.041	**-0.109**	-0.025	0.014	**0.050**	**0.117**	**-0.126**	**-0.054**	**-0.069**	-0.033
>500m-600m	**0.030**	0.018	0.053	0.178	**0.151**	-0.017	**0.116**	0.036	0.075	**-0.107**	**0.059**	0.018	**0.087**	0.011	**-0.064**	**-0.061**	0.021	0.034
>600m-700m	**0.011**	-0.023	0.130	0.104	**-0.121**	-0.014	-0.066	-0.029	-0.075	-0.022	0.096	**0.048**	**0.114**	-0.029	**-0.060**	0.005	0.002	-0.015
>700m-800m	**0.019**	**0.165**	0.058	0.114	**0.265**	-0.091	0.163	0.023	0.032	-0.027	0.013	**0.064**	-0.015	**0.098**	-0.012	**-0.102**	0.061	0.047
Performance																		
R^2	0.570	0.247	0.419	0.313	0.236	0.197	0.182	0.085	0.201	0.304	0.457	0.293	0.359	0.277	0.358	0.319	0.450	0.313
Standard Error	0.232	0.168	0.171	0.181	0.226	0.225	0.234	0.255	0.156	0.188	0.187	0.173	0.182	0.210	0.252	0.319	0.197	0.199
F-ratio	2478.79	33.63	123.63	61.95	118.12	68.89	75.51	21.08	2.55	124.54	56.78	51.23	50.27	38.53	145.08	200.64	140.36	57.72
Cases	63,664	1,791	3,058	2,404	6,840	4,994	6,126	3,291	360	8,070	1,915	4,108	2,692	2,232	4,060	4,179	4,395	3,149
Rent/m2/year	$253.68	$162.20	$243.29	$165.34	$238.47	$242.32	$239.45	$227.26	$297.48	$222.02	$185.63	$244.94	$228.91	$197.10	$295.73	$517.66	$321.98	$192.44
Station Sign	*Negative*	*Positive*	*Positive*	*Positive*	*Negative*	*Positive*	*Positive*				*Negative*		*Positive*	*Positive*	*Negative*	*Negative*	*Negative*	*Negative*
Functional Form	*Upward*	*Upward*	*Convex*	*Convex*	*Down*	*Upward*	*Upward*			*Upward*	*Upward*		*Down*	*Upward*	*Convex*	*Upward*	*Convex*	*Upward*

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit H-2. Office Rent with Respect to Streetcar Transit Station Proximity

Variable	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Station Distance													
0-100m	**0.031**	**-0.055**	-0.016	**0.148**	**0.066**	**0.097**	**0.094**	**-0.112**	**0.034**	**-0.048**	**0.021**	**0.133**	**-0.059**
>100m-200m	**0.018**		**0.063**	**0.166**		**0.106**	**-0.038**		0.014	**0.095**	0.057	**0.132**	0.003
>200m-300m	**0.082**	-0.028	**0.182**	**0.152**	**-0.131**	**0.124**	**0.131**	-0.022	0.024		**0.075**	**0.167**	
>300m-400m	**0.021**	0.092	0.058	**0.051**	**0.068**	**0.122**	-0.012	0.021	**0.109**	**-0.044**	**0.100**	0.009	0.008
>400m-500m	**0.045**	**-0.214**	0.029	**-0.091**	**0.107**	0.084	**0.107**	0.052	**0.078**	-0.025	**-0.201**	0.053	**0.145**
>500m-600m	**0.041**	0.039	**-0.308**	0.014	**0.156**	**0.282**	**0.055**		-0.007	0.027	**-0.148**	-0.042	**0.143**
>600m-700m	-0.012	-0.030	**-0.121**	0.023		-0.011	0.049	0.016	**-0.076**	-0.017	0.004	**0.048**	-0.035
>700m-800m	**0.044**	**-0.158**	0.140	**0.146**	**-0.083**	-0.086	0.026	-0.021	0.009	**0.104**	**0.057**	-0.062	
Performance													
R^2	0.654	0.411	0.161	0.315	0.304	0.123	0.289	0.266	0.448	0.231	0.215	0.383	0.358
Error	0.203	0.228	0.224	0.204	0.170	0.228	0.170	0.212	0.198	0.167	0.188	0.137	0.179
F-ratio	2,067.56	141.559	21.461	105.483	51.351	5.033	59.086	51.575	199.276	33.070	75.632	81.847	87.538
Cases	31,699	3,419	1,922	4,089	1,849	517	2,569	2,232	4,395	1,819	4,373	2,346	2,169
Rent/m2/year	$246.01	$222.64	$170.96	$220.51	$183.88	$190.88	$252.82	$197.10	$321.98	$224.48	$234.35	$181.03	$463.76
Station Sign	*Positive*	*Negative*		*Positive*	*Positive*	*Positive*	*Positive*	*Negative*	*Positive*	*Negative*	*Positive*	*Positive*	*Negative*
Functional Form	*Down*		*Upward*	*Convex*	*Down*	*Upward*	*Concave*			*Upward*	*Upward*	*Upward*	

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit H-3. Office Rent with Respect to Bus Rapid Transit Station Proximity

Variable	All	AA	ABQ	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Station Distance																
0-100m	**0.026**	**0.003**	**0.071**	**0.030**	0.017	**0.097**	**-0.136**	**-0.065**	-0.009	0.005	**-0.090**	**0.056**	**-0.071**	**0.218**	**-0.010**	**-0.054**
>100m-200m	**0.172**	0.049	0.081	**0.079**	**-0.218**	**-0.083**	**-0.200**	**-0.088**	**-0.033**	**0.058**		**0.113**	**-0.015**	**0.681**	**0.041**	-0.041
>200m-300m	-0.006	-0.005	**0.138**		0.065	**0.156**	**-0.116**	-0.005	**0.065**	**0.138**		**0.030**	-0.001	**0.083**	**-0.042**	-0.047
>300m-400m	**0.036**	0.051	**0.076**	**0.073**	**0.076**	**0.033**	-0.005	**-0.090**	**-0.189**	0.017	0.107	**0.064**	0.049	**0.312**	**-0.059**	**0.151**
>400m-500m	0.003	-0.010	-0.111	**0.081**		0.008	-0.033	**-0.065**	**-0.044**	**0.084**		**0.056**	0.030	**0.231**	-0.006	0.002
>500m-600m	**0.012**	-0.015	**0.938**	0.022	0.037	**0.128**	-0.098	-0.025	**0.048**	**0.129**	0.057	0.021	0.018	**0.115**	-0.004	
>600m-700m	**0.019**	0.027	**0.169**	**0.239**	0.004	**0.195**	**-0.212**	**0.095**	**0.057**	**0.201**	0.114	0.021	**0.111**	**0.148**	**-0.067**	-0.013
>700m-800m	**0.030**	0.044	-0.069	**0.127**	0.087	**0.059**	**-0.120**	**-0.378**	**-0.050**	0.072	0.115	0.018	-0.025	**0.147**	**0.028**	-0.063
Performance																
R^2	0.663	0.187	0.000	0.301	0.207	0.315	0.104	0.442	0.470	0.324	0.267	0.129	0.000	0.441	0.452	0.345
Error	0.240	0.187	0.000	0.183	0.151	0.169	0.253	0.187	0.193	0.168	0.212	0.192	0.000	0.289	0.199	0.203
F-ratio	2354.390	13.421	12.549	61.858	6.305	48.298	22.175	117.447	119.932	34.758	55.095	26.475	125.165	184.143	255.450	18.317
Cases	38,355	867	813	2404	346	1849	3291	2644	2418	1266	2232	3087	4060	4179	5560	559
Rent/m2/year	$266.24	$351.03	$159.52	$165.34	$196.57	$183.88	$227.26	$254.92	$177.85	$198.80	$197.10	$190.83	$295.73	$517.66	$307.83	$186.23
Station Sign	*Positive*	*Positive*	*Positive*	*Positive*		*Positive*	*Negative*	*Negative*			*Negative*	*Positive*	*Negative*	*Positive*	*Negative*	*Negative*
Functional Form	*Upward*		*Upward*	*Upward*	*Upward*	*Concave*	*Concave*	*Down*	*Convex*	*Upward*		*Convex*	*Upward*	*Concave*	*Concave*	*Upward*

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station Sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit H-4. Office Rent with Respect to Commuter Rail Transit Station Proximity

Variable	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	VRE	WDC	MRC
Station Distance																	
0-100m	**0.086**	**0.086**	**0.106**	**-0.106**	**0.124**	**-0.075**	-0.052	**0.030**	**0.049**	**-0.037**	**0.065**	**0.194**	**0.266**	**-0.029**	**0.026**	**-0.030**	-0.019
>100m-200m	**0.045**	0.072	-0.018	**-0.113**	**0.255**	**-0.139**	0.020	**0.060**	**-0.042**	-0.003	**0.097**	**0.287**	**0.199**	**0.043**	**0.092**	0.016	
>200m-300m	**0.033**	0.040	**-0.133**		**0.201**	**-0.260**	**-0.162**	**-0.103**	0.046	0.018	0.013	**-0.075**	**0.197**	**0.025**	**-0.194**	**0.155**	-0.043
>300m-400m	0.001	0.036	**0.080**	-0.033	**0.233**	-0.048	**-0.082**	0.006	**-0.032**	0.021	-0.012	**0.203**	**-0.051**	0.041	-0.045	**0.135**	0.016
>400m-500m	**0.013**	**0.200**	0.023	**-0.167**	**0.111**	**-0.119**	0.227	-0.027	**-0.096**	0.011	**0.080**	**0.124**	**-0.378**	**0.045**	0.054		**-0.044**
>500m-600m	**0.037**	-0.024	0.012	0.006	**0.060**	-0.031	-0.074	**0.160**	**0.041**	-0.085	0.029	**0.192**	0.010	-0.004	**-0.099**	0.025	**-0.177**
>600m-700m	**-0.049**		**0.033**	**-0.173**	**0.089**	-0.037	0.032	**0.073**	-0.026		**-0.040**	**-0.121**	-0.031	0.017	-0.026	0.110	-0.121
>700m-800m	**0.088**	**0.118**	**0.160**	**0.145**	0.031	**-0.006**	**-0.145**	**-0.154**	**-0.056**	-0.028	**0.033**	**0.291**	-0.012	**0.087**	-0.035		**-0.044**
Performance																	
R^2	0.537	0.279	0.318	0.317	0.326	0.166	0.104	0.422	0.349	0.336	0.339	0.395	0.476	0.527	0.395	0.355	0.282
Error	0.255	0.207	0.227	0.204	0.212	0.236	0.269	0.201	0.208	0.162	0.204	0.245	0.353	0.194	0.229	0.179	0.240
F-ratio	2294.212	27.662	113.575	112.903	66.637	117.555	18.243	122.908	207.178	46.769	116.277	148.395	239.890	457.660	138.904	86.387	65.495
Cases	65,300	1,171	4,343	4,095	2,442	10,533	2,673	3,008	6,916	1,539	4,054	4,060	4,738	7,379	3,384	2,169	2,796
Rent/m2/year	$283.08	$166.79	$337.34	$220.53	$261.74	$293.18	$233.99	$246.43	$210.28	$231.80	$185.79	$295.73	$478.56	$287.28	$287.94	$463.76	$248.64
Station Sign	*Positive*	*Positive*	*Positive*	*Negative*	*Positive*	*Negative*		*Positive*	*Positive*	*Negative*	*Positive*	*Positive*	*Positive*	*Negative*	*Positive*	*Negative*	
Functional Form	*Down*		*Down*	*Down*	*Convex*	*Down*		*Convex*	*Down*		*Upward*	*Convex*	*Down*	*Convex*	*Convex*	*Convex*	

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit I-1. Retail Rent with Respect to Light Rail Transit Station Proximity

Variable	ALL	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Station Distance																		
0-100m	**0.104**	-0.184	**0.325**	-0.118	0.315	0.137	**-0.374**	-0.092	0.235	-0.048		0.104	**0.484**	**0.310**	-0.126	**0.282**	0.343	
>100m-200m	0.029	-0.069	-0.037	0.154	0.159	**0.099**	-0.019	-0.067	0.410	0.089		0.084	**-0.170**	**0.542**	-0.151	0.193	-0.163	0.154
>200m-300m	**0.085**	**0.458**	**0.271**	-0.474	0.072	**0.057**	-0.222	-0.119	**-0.027**	-0.020	**2.021**	**0.266**	-0.156	**0.194**	**-0.258**	**0.512**	**0.259**	**0.490**
>300m-400m	0.028	**0.415**		-0.110	**0.245**	0.014	0.000	**0.374**	-0.237	0.105	**-0.445**	0.043	0.176	0.119	0.113	0.197	**-0.454**	0.004
>400m-500m	0.010		0.003	**-0.547**	**0.333**	0.022	-0.223	-0.170	**-0.034**	**-0.253**	-0.018	-0.049	-0.106	0.066	**-0.232**	0.153	0.161	**0.565**
>500m-600m	0.011		-0.077		0.109	-0.009	0.105	0.036		0.003		0.078	-0.017	**-0.231**	0.128	0.038	0.139	0.131
>600m-700m	0.021	0.597	-0.436	**0.673**	**-0.204**	0.013	-0.237		**0.058**	0.106		-0.108	0.033	-0.091	0.072	-0.254	0.205	0.104
>700m-800m	-0.007				**-0.419**	-0.004	-0.005	-0.185	-0.146	0.132	0.051	-0.010	0.248	-0.109	-0.109	-0.080	-0.107	0.301
Performance																		
R^2	0.281	0.074	0.250	0.112	0.240	0.102	0.230	0.049	0.018	0.251	0.269	0.154	0.176	0.169	0.130	0.094	0.206	0.187
Error	0.339	0.382	0.372	0.363	0.379	0.266	0.457	0.503	0.316	0.369	0.388	0.386	0.311	0.388	0.429	0.468	0.404	0.397
F-ratio	192.968	1.656	5.975	3.068	20.628	59.813	16.443	1.817	1.045	21.916	6.952	3.083	4.322	4.360	4.423	2.477	6.550	6.141
Cases	17,644	140	269	295	1242	10347	1035	288	46	1249	260	230	312	331	459	285	430	426
Rent/m2/year	$224.65	$141.79	$234.31	$140.51	$187.20	$237.70	$205.62	$192.85	$169.48	$180.52	$167.29	$229.27	$182.45	$193.04	$292.73	$376.47	$270.53	$166.00
Station Sign	*Positive*		*Positive*				*Negative*						*Positive*			*Positive*		
Functional Form	*Down*		*Down*			*Down*							*Down*	*Convex*		*Upward*		

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit I-2. Retail Rent with Respect to Streetcar Transit Station Proximity

Variable	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Station Distance													
0-100m	**0.206**	0.355	0.032	0.072	**0.376**		**0.194**		0.256	0.032	**0.480**	**0.422**	-0.066
>100m-200m	**0.266**	0.371	**0.522**	0.433	0.244	**0.684**	**0.138**		0.023	0.226	**0.539**	**0.462**	-0.073
>200m-300m	**0.185**	-0.082		0.198	0.201	0.267	**0.375**	**0.520**	0.171	-0.006		**0.413**	0.141
>300m-400m	**0.317**			**1.932**	**-0.704**	**1.053**	0.146	0.303	0.088		**0.610**		-0.215
>400m-500m	**0.217**	-0.445		**0.810**	**0.303**	**1.143**		0.267	0.202	-0.198	**0.685**		-0.406
>500m-600m	0.132	-0.231			**-0.010**		-0.176		0.234		**0.633**		
>600m-700m	**0.148**	-0.260	0.431	**0.337**	0.070	0.241	-0.026	**0.416**	0.036		**-0.410**	0.204	
>700m-800m	**0.256**	-0.215	-0.412	**0.285**		**1.119**	**0.321**	0.280	-0.304				0.085
Performance													
R^2	0.382	0.205	0.148	0.330	0.167	0.524	0.308	0.161	0.193	0.262	0.110	0.156	0.248
Error	0.407	0.501	0.483	0.381	0.316	0.385	0.278	0.390	0.407	0.322	0.396	0.389	0.390
F-ratio	66.520	3.801	2.677	14.736	3.832	3.473	4.493	4.729	6.124	4.683	3.320	7.834	4.936
Cases	3,558	220	213	546	285	77	142	373	440	168	335	560	199
Rent/m2/year	$247.38	$255.79	$660.81	$192.37	$150.56	$240.97	$212.32	$199.83	$270.58	$202.98	$194.82	$173.50	$484.41
Station Sign	*Positive*				*Positive*		*Positive*				*Positive*	*Positive*	
Functional Form	*Convex*					*Upward*	*Concave*				*Upward*	*Convex*	

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit I-3. Retail Rent with Respect to Bus Rapid Transit Station Proximity

Variable	All	ABQ	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA
Station Distance														
0-100m	**0.024**	0.005	**0.385**	-0.784	0.087	**-0.214**	-0.056	-0.037	0.075	-0.083	**0.076**	-0.126	0.158	**-0.098**
>100m-200m	**0.071**	0.028	0.155	-0.016	**0.201**	**0.338**	0.100	-0.057	0.093	**-0.291**	**0.083**	-0.001	0.065	0.086
>200m-300m	**0.045**	-0.029	-0.021	0.126	0.039		0.051	**0.433**	0.276	-0.194	**0.054**	0.084	**0.236**	0.024
>300m-400m	**0.095**	-0.027	0.008	0.420	0.284	**0.369**	**-0.296**	**0.324**	0.100	-0.294	**0.087**	0.399	0.285	**0.206**
>400m-500m	**0.028**	-0.009	**0.713**		**0.206**		-0.159		-0.168	0.027	**0.030**	**0.303**	0.012	0.185
>500m-600m	**0.072**	0.004		0.285	**0.356**	**1.051**	-0.112	**0.182**	0.198		**0.078**	0.036	0.177	0.176
>600m-700m	0.023	0.000	-0.280		0.087	-0.139	-0.015	-0.092	0.198	-0.349	**0.046**	-0.099	**0.673**	-0.093
>700m-800m	**0.039**	**0.106**	**-0.382**	-0.243	0.239	**-0.466**	0.063	0.169	-0.143	**0.617**	**0.044**	-0.004	**0.314**	-0.103
Performance														
R^2	0.293	0.047	0.116	-0.107	0.152	0.079	0.211	0.251	0.140	0.163	0.157	0.125	0.101	0.208
Error	0.282	0.226	0.362	0.548	0.319	0.280	0.450	0.393	0.564	0.389	0.231	0.430	0.466	0.403
F-ratio	203.174	3.811	3.028	0.776	3.398	9.440	2.904	5.557	2.033	4.373	96.542	4.268	2.601	6.618
Cases	17,627	1,080	295	38	256	1680	136	260	122	331	10,241	459	285	430
Rent/m2/year	$0.00	$143.04	$140.51	$206.97	$144.15	$171.92	$227.86	$167.29	$211.85	$193.04	$190.83	$292.73	$376.47	$270.53
Station Sign	*Positive*		*Positive*			*Negative*					*Positive*			*Negative*
Functional Form	*Convex*					*Upward*					*Convex*			*Upward*

Comments: Because the COVID-19 pandemic occurred when Alexandria-Arlington and Stockton BRT retail data were to be collected, they are excluded from analysis. Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station Sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit I-4. Retail Rent with Respect to Commuter Rail Transit Station Proximity

Variable	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	WDC
Station Distance															
0-100m	0.063	-0.112							0.490	-0.133		0.028			
>100m-200m	**0.197**	**0.252**	0.058		0.011				**0.709**	-0.045	0.528	-0.098	**0.945**	-0.089	-0.428
>200m-300m	0.043	0.002	**-0.640**		-0.053	-0.212		-0.059		**0.432**	0.276	**0.552**	*0.314*		
>300m-400m	-0.031	-0.004	**-0.340**	**-0.455**	0.016	**-0.785**	-0.268	**-0.524**	**0.549**	-0.036	-0.287	**0.419**	*0.277*	-0.021	
>400m-500m	-0.008	-0.053	**-0.254**		-0.005	0.135	-0.042	0.519	**1.557**	-0.031	**0.394**	0.159	-0.026	-0.185	**-0.694**
>500m-600m	0.018	0.006	-0.121	-0.011	0.033	**-0.202**	-0.454		0.309	-0.279	**0.307**	**0.307**	**0.387**	-0.277	0.160
>600m-700m	0.005	-0.025	-0.009	0.075	-0.069	**-0.311**	**1.911**		0.299	0.136	**0.204**	-0.136	0.173	0.090	-0.402
>700m-800m	-0.005	0.027	-0.228	0.247	0.043	**-0.281**	0.836			-0.216	**-0.208**	0.294	0.086	-0.007	0.238
Performance															
R^2	0.388	0.125	0.200	0.144	0.150	0.141	0.081	0.205	0.277	0.138	0.131	0.129	0.095	0.221	0.287
Error	0.352	0.246	0.374	0.415	0.244	0.475	0.523	0.450	0.418	0.451	0.427	0.454	0.482	0.393	0.396
F-ratio	333.437	35.673	5.100	13.452	52.257	22.871	2.303	3.881	6.441	2.039	7.473	5.940	2.751	11.140	6.682
Cases	16,779	4,592	296	1,113	5,247	2,275	224	146	243	124	775	637	300	608	199
Rent/m2/year	$226.72	$148.77	$272.52	$184.52	$241.54	$304.59	$205.83	$228.47	$239.60	$252.54	$195.90	$297.32	$382.69	$251.90	$484.41
Station Sign															
Functional Form									*Concave*			*Down*			

Comments: Because the COVID-19 pandemic occurred when MARC and VRE CRT retail data were to be collected, they are excluded from analysis. Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. “Station Sign” refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. “Functional Form” is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit J-1. Multifamily Rent with Respect to Light Rail Transit Station Proximity

Variable	ALL	BUF	CHR	CLE	DAL	DEN	HOU	MSP	NOR	PHX	PIT	PDX	SAC	SLC	SD	SJ	SEA	STL
Station Distance																		
0-100m	0.025	0.094	**0.302**	0.044	**-0.038**	-0.021	**0.123**	0.005	-0.061	0.035	**-0.241**	**-0.030**	-0.112	**0.121**	0.104	-0.056	0.056	-0.107
>100m-200m	**0.043**	-0.070	**0.229**	**0.129**	0.004	0.069	**-0.039**	0.071	**0.172**	-0.018	**-0.311**	-0.019	**0.184**	0.095	**0.133**	0.022	0.030	-0.010
>200m-300m	**0.055**	**0.284**	**0.220**	**0.092**	-0.029	-0.035	0.200	**-0.023**	**0.274**	**0.113**	**-0.156**	-0.013	**0.072**	**0.114**	**0.114**	0.036	0.104	-0.013
>300m-400m	**0.049**	**0.173**	**0.165**	**0.150**	-0.013	0.039	**0.124**	-0.065	**0.295**	**0.049**	**-0.262**	0.031	0.003	**0.054**	**0.056**	0.009	**0.060**	**0.098**
>400m-500m	**0.021**	**0.142**	0.096	0.029	**-0.058**	-0.004	**0.174**	0.022		**0.111**	**-0.216**	0.025	0.005	-0.033	0.018	-0.022	0.025	**-0.102**
>500m-600m	**0.026**	**0.220**	0.074	0.060	0.010	**-0.069**	**0.081**	**-0.052**	0.174	**0.088**	-0.065	**0.067**	0.021	**0.075**	-0.007	**-0.131**	**0.075**	0.045
>600m-700m	**0.056**	0.078	0.081	0.072	0.001	-0.022	**0.175**	0.033	**0.373**	0.033	0.074	**0.049**	**0.067**	0.054	-0.001	0.002	**0.153**	0.021
>700m-800m	**0.026**	0.130	0.019	**0.112**	0.027	0.015	0.060	0.009	0.105	0.025	-0.078	0.008	0.019	0.059	0.021	-0.135	0.038	0.064
Performance																		
R^2	0.593	0.330	0.552	0.300	0.427	0.392	0.512	0.346	0.495	0.402	0.357	0.529	0.351	0.396	0.350	0.319	0.507	0.337
Error	0.252	0.257	0.212	0.252	0.202	0.241	0.194	0.213	0.201	0.203	0.278	0.246	0.220	0.209	0.259	0.311	0.267	0.259
F-ratio	1178.518	9.138	40.632	21.274	132.586	81.152	128.868	62.138	13.066	87.807	24.489	119.052	36.130	16.902	100.761	44.911	161.003	23.007
Cases	28,380	315	613	900	3368	2359	2321	2200	223	2453	806	1995	1237	461	3515	1778	2955	824
Rent/m2/year	$186.44	$153.38	$139.66	$130.10	$154.33	$203.47	$144.69	$167.14	$147.37	$133.91	$160.38	$184.26	$162.01	$146.37	$228.16	$313.79	$247.99	$131.02
Station Sign			*Positive*		*Negative*		*Positive*				*Negative*	*Negative*		*Positive*				
Functional Form	*Convex*		*Down*	*Concave*			*Down*		*Upward*		*Convex*		*Down*	*Down*	*Down*			

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station Sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit J-2. Multifamily Rent with Respect to Streetcar Transit Station Proximity

Variable	All	ATL	CIN	DAL	KC	NO	PDX	SLC	SEA	TAC	TAM	TUS	WDC
Station Distance													
0-100m	0.008	**0.256**	-0.162	0.077	-0.085	**-0.545**	0.039						
>100m-200m	**0.061**	-0.203		0.006	0.015	**0.198**	-0.074		-0.080		0.184	**0.345**	
>200m-300m	**0.127**	**0.399**		-0.050	0.205	**0.340**	0.045	**-0.405**	0.001	0.114		0.245	0.027
>300m-400m	**0.165**	0.134	**0.331**	0.077	**0.184**	0.083	**0.122**	0.033	**-0.138**	**0.276**		**0.401**	-0.041
>400m-500m	**0.153**		0.041	0.029	**0.197**	-0.034	**0.084**	0.106	**0.193**	-0.074	**-0.326**	0.182	0.163
>500m-600m	**0.229**		0.023	0.075		**0.160**	**0.081**		**0.172**	**0.337**			0.050
>600m-700m	**0.089**		**0.243**	-0.062	-0.051	0.190	0.058		0.019	**0.415**	0.035	0.011	0.308
>700m-800m	**0.176**	**0.584**	0.018	0.116	-0.248	0.214	**0.119**		**0.112**	**0.312**	0.069		
Performance													
R^2	0.636	0.522	0.349	0.472	0.421	0.682	0.537	0.392	0.505	0.349	0.549	0.3	0.595
Error	0.266	0.259	0.255	0.197	0.243	0.229	0.263	0.210	0.268	0.242	0.217	0.227	0.272
F-ratio	757.059	41.930	26.577	91.498	23.674	12.652	91.016	22.213	168.607	25.615	53.582	23.866	80.638
Cases	12,959	894	811	1927	563	104	0	461	2955	780	650	853	870
Rent/m2/year	$185.37	$158.09	$118.92	$159.37	$126.33	$180.85	$0.00	$146.37	$247.99	$158.99	$151.77	$117.51	$317.43
Station Sign		*Positive*				*Negative*							
Functional Form	*Upward*	*Upward*				*Upward*						*Upward*	

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station Sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit J-3. Multifamily Rent with Respect to Bus Rapid Transit Station Proximity

Variable	All	AA	ABQ	CLE	ESP	KC	MSP	NSH	PIT	RNO	SLC	SA	SD	SJ	SEA	STK
Station Distance																
0-100m	-0.016	-0.005	-0.141	**0.224**	-0.126	**0.096**	-0.049	-0.008	-0.022	-0.039	-0.024	**0.118**	**-0.063**	**-0.146**	**-0.040**	
>100m-200m	-0.009	-0.094	0.027	**0.222**	**-0.223**	**0.124**	0.008	0.019	-0.005	-0.085	0.123	**-0.050**	0.010	0.010	**-0.055**	0.139
>200m-300m	-0.028	-0.053	0.053	**0.119**	-0.001	**0.119**	-0.050	0.001	0.030	0.012	-0.156	-0.011	**-0.046**	-0.018	**-0.086**	0.197
>300m-400m	**-0.021**	**0.440**	**-0.064**	0.052	0.050	**0.172**	-0.068	0.017	0.025	0.040	-0.091	-0.034	**-0.064**	-0.052	**-0.056**	-0.302
>400m-500m	-0.004	-0.002	**-0.104**	0.020	0.096	**0.190**	-0.043	-0.040	0.089	-0.072	**-0.176**	0.046	-0.002	0.027	-0.013	**-0.530**
>500m-600m	**-0.025**	-0.304	-0.019	**0.137**	0.099	**0.230**	-0.018	0.023	**-0.150**	0.020	-0.047	0.032	**-0.085**	**0.146**	**-0.042**	-0.373
>600m-700m	**0.044**	**4.593**	-0.021	**0.594**	-0.143	**0.136**	-0.052	0.005	**0.274**	**0.120**	-0.058	0.003	**-0.060**	0.032	0.002	-0.055
>700m-800m	0.012	0.076	**-0.071**	0.051	0.166	**0.270**	-0.010	0.032	-0.017	-0.049	-0.043	-0.008	-0.023	0.071	-0.026	0.594
Performance																
R^2	0.545	0.316	0.460	0.337	0.316	0.454	0.344	0.572	0.359	0.492	0.387	0.412	0.350	0.319	0.507	0.041
Error	0.303261495	0.468	0.188	0.245	0.302	0.236	0.214	0.229	0.277	0.216	0.211	0.173	0.259	0.311	0.267	1.032
F-ratio	575.118	7.310	16.700	25.024	5.057	25.632	61.707	32.560	24.720	16.833	16.281	32.317	100.603	44.800	160.722	1.656
Cases	15791	233	351	900	168	563	2200	450	806	312	461	850	3515	1778	2955	249
Rent/m2/year	$222.39	$134.71	$129.41	$130.10	$148.37	$126.33	$167.14	$166.09	$160.38	$148.72	$146.37	$146.63	$228.16	$313.79	$247.99	$199.72
Station Sign				*Positive*		*Positive*						*Positive*	*Negative*	*Negative*	*Negative*	
Functional Form				*Down*		*Upward*						*Down*	*Convex*		*Convex*	

Comments: Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. “Station Sign” refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. “Functional Form” is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant coefficients revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.

Appendix Exhibit J-4. Multifamily Rent with Respect to Commuter Rail Transit Station Proximity

Variable	All	ABQ	AUS	DFW	DEN	MIA	MSP	NSH	ORL	PDX	SLC	SD	SJS	SEA	VRE	WDC
Station Distance																
0-100m	**0.347**				0.003							**0.457**				
>100m-200m	**0.071**		-0.036		-0.033		0.242	-0.051	0.069	**-0.256**		**0.485**				
>200m-300m	0.023	-0.055	0.021	0.040	-0.061	0.041	-0.068	**-0.571**	**0.209**	**0.172**		0.190	0.101	0.010	0.007	0.048
>300m-400m	**0.066**	**0.278**	-0.064	-0.041	-0.011	0.062	0.020	**0.297**	**0.202**	0.068	-0.167	**0.131**	-0.124	0.075	-0.147	
>400m-500m	**0.033**		0.051	-0.015	0.064	-0.009	0.061		0.079	-0.021	-0.068	**0.086**	**0.221**	-0.093	-0.018	
>500m-600m	**0.054**	0.000	-0.032	**0.175**	**0.423**	-0.050	0.006	**-0.310**	0.110	0.010	-0.009	**0.136**	-0.013	0.026	0.013	0.026
>600m-700m	**0.033**	-0.117	0.040	**0.095**	0.030	-0.030	**0.212**		0.043	-0.040	-0.018	**0.235**	0.017	**-0.130**	-0.042	0.006
>700m-800m	**0.067**	**0.130**	-0.038	0.020	-0.006	0.117	0.156	-0.014	**0.143**	0.028	-0.044	**0.123**	-0.029	0.003	**0.168**	0.008
Performance																
R^2	0.552	0.455	0.401	0.449	0.400	0.391	0.333	0.583	0.528	0.509	0.296	0.352	0.086	**-0.127**	-0.090	-0.012
Error	0.259	0.189	0.245	0.200	0.252	0.226	0.222	0.226	0.212	0.172	0.397	0.259	0.315	0.566	0.589	0.594
F-ratio	989.552	19.283	41.299	141.360	53.381	112.063	46.989	40.179	35	31	0.209	102	0.312	0.266	0.206	0.273
Cases	26,436	351	1,083	2,930	1,496	2,941	1,660	450	555	517	19	3515	46	271	59	80
Rent/m2/year	$206.39	$129.41	$190.84	$154.38	$216.34	$187.05	$170.02	$166.09	$151.26	$164.85	461	$228.16	1778	3735	650	870
Station Sign	*Positive*											*Positive*				
Functional Form	*Down*							*Upward*	*Down*	*Upward*		*Convex*				

Comments: Because the COVID-19 pandemic occurred when MARC CRT multifamily data were to be collected, they are excluded from analysis. Bold coefficients mean $p < 0.10$ for relevant variables (see text). By multiplying by 100, significant coefficients can be interpreted as higher or lower rents per square meter as a percent of the mean. "Station Sign" refers only to significant coefficients that are either ***Positive***, meaning that rents are higher than the mean at the station, or ***Negativ***e, meaning rents are lower than the mean at the stations. "Functional Form" is the shape of association based on at least two significant coefficients among the closest four to the transit station where at least one is first or second closets distance bands. ***Upward*** means upward sloping significant revealing externality value exceeds accessibility value close to transit stations. ***Down*** means downward sloping significant coefficients from the first distance band revealing accessibility value exceeds externality value close to transit stations. ***Convex*** means upward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are downward sloping revealing accessibility value exceeds externality value beyond the inflection point. ***Concave*** means downward sloping significant coefficients from the first station band to an inflection point after which significant coefficients are upward sloping revealing accessibility value exceeds externality values to the inflection point after which externality value exceeds accessibility value. Blank entries in station distance cells means there were insufficient cases. No functional form noted means there is an ambiguous, non-significant association between rent and transit station proximity revealed within the distance bands used for this determination as noted above.