IMPACTS OF LIGHT RAIL INVESTMENT ON COMMERCIAL LANDSCAPES IN TRANSIT NEIGHBORHOODS

by

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ABSTRACT

ELINA SHEPARD. Impacts of light rail investment on commercial landscapes in transit neighborhoods. (Under the direction of DR. ELIZABETH DELMELLE)

City governments across the country invest in rail transit to provide localized access to vital facilities for vulnerable groups of their populations, and to encourage development around transit lines and stations (Transit Oriented Development). Such developments however might pose a risk for smaller independently run businesses that could be unable to compete when saddled with increasing rent premiums, or culturally fit in with an influx of new residents. Such a phenomenon is often referred to as transit induced commercial gentrification. The main question addressed in this dissertation is what kind of changes do newly constructed light rail stations create for the existing local commercial environment? This question is addressed through analyses of three US cities that constructed their first light rail lines at approximately the same time, experienced similar influxes of new residents, and experienced similar economic growth patterns: Charlotte, NC, Phoenix, AZ, and Seattle, WA. A mixed qualitative and quantitative research design was adopted to gain a more comprehensive understanding of transit retail developments. The results of the study illustrate that commercial development around transit is sensitive to the local geographic context but the results are also consistent with existing empirical evidence and retail location theories. Results reveal some evidence of an increase in creative-cultural establishments such as art galleries around TODs in each of the three cities. Overall, however, the location of the light rail did not play a significant role in inducing a higher risk of retail establishments leaving when located in close proximity to transit stations as compared to similar locations elsewhere in the metropolitan area. Rather, the age and size

of the establishment were significant indicators. Nonetheless, interviews with small business owners in new transit locations revealed more challenges than opportunities associated with their location. The results of the study are important for informing policies as cities investing in light rail should consider budgeting for the unintended consequences for local businesses.

DEDICATION

I dedicate this work to my Mom and Dad

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CHAPTER 1: INTRODUCTION

Practitioners and scholars alike recognize the potential for transportation projects to impact local development, which has been well documented in the scholarly literature (Credit, 2018; Debrezion et al., 2007; Goetz et al., 2010; Ko & Cao, 2010; Hurst & West, 2014; Huddleston & Pangotra, 1990). While twentieth century studies have primarily focused on the impacts of automobile infrastructure, the role of public transport and its impact on the urban landscape has become an increasingly important field of inquiry. This research uptick is a reaction to the increased investment in transit projects across cities in the United States as both a mobility and economic development strategy. Public transportation is envisioned or promoted with the fair distribution of resources in mind, as it enables access to opportunities for those who would not have it otherwise, particularly, the auto-less. Cities also invest in transit projects as a way to encourage people to adopt more environmentally friendly forms of transportation. Regardless of the goal, a byproduct of these investments is often increased land values in areas in proximity to new transit stations (Nelson et al., 2015; Ko & Cao, 2010; Debrezion et al., 2007; Cervero & Duncan, 2002; Bowes & Ihlanfeldt, 2001) and new developments over time, thus shifting the commercial and residential landscape.

In a free market, organic growth in transit areas is expected to occur as a result of the increased accessibility of the location. Transit Oriented Development (further TOD), on the other hand, is a product of deliberate policies enforced by local governments through zoning regulations and supported by real estate developers to stimulate dense, mixed-used developments near transit stations. These changes pose a potential risk to existing, smaller

independently run business establishments (Gonzales et al., 2019) who may be unable to compete with increasing rent premiums or culturally fit in with the influx of new residents, a phenomenon often referred to as transit induced commercial gentrification, when it is spurred by transit, or more generally, as "street gentrification" (Patch, 2008), "industrial gentrification" (Curran, 2007); "retail change" (Meltzer & Capperis, 2016); "commercial revitalization" (Sutton, 2010) or "retail gentrification" (Sullivan & Shaw, 2011). Empirical details on the extent and mechanisms behind transit-induced commercial gentrification remain scarce and is the topic of this dissertation.

Commercial gentrification is commonly defined as a reinvestment in fiscally less attractive land and properties to make them more appealing for economically advanced entities and agents associated with increases in certain types of business (Ficano, 2013), and the disappearance of others (Ficano, 2013; Jeong et al., 2015; Ferm, 2016; Meltzer & Capperis, 2016). In the case of retail gentrification, the turn often occurs with big chain retail stores replacing small local establishments (Ferm, 2016; Meltzer & Capperis, 2016), while it can also take the form of "boutiquing" (Zukin et al., 2009; Zukin et al., 2016). These are associated with an inflow of higher-end boutique types of retail establishments catering to the interests, lifestyles, and income of wealthier residents. Commercial gentrification is thought to accompany residential gentrification (Curran, 2007; Avdikos, 2015; Chapple & Jacobus, 2009; Meltzer, 2016; Sullivan & Shaw, 2011) as different types of socio-economic and cultural groups tend to patronize different types of stores (Ley, 2003; Zukin et al., 2009; Ernst & Doucet, 2014), and businesses rely on their customer base patronizing their establishments (Logan & Molotch, 1987). This is especially true for small ethnic minority and immigrant owned stores as they develop closer ties with their

customer base and suffer the greatest loss of profits if their patrons leave (Raijman & Tienda, 2013; Wang, 2012; Toussaint-Comeau, 2008; Waldinger, 1993). Increased rents and lost customer base are not the only problems that businesses in transit areas might be expected to deal with, as the construction phase might also present a challenge (Meltzer & Capperis, 2016; Ray, 2017; Portillo, 2017).

Commercial gentrification is a two-sided process that incorporates both the "influx" side (i.e., incoming establishments) and "outflow" side (establishments that are likely to be replaced). The double-sided nature of commercial development around transit stations is thus the focus of this research. The main overarching question is what kind of changes do newly constructed light rail stations create for the local commercial environment? This question is in turn subdivided into three separate research questions:

1) What kind of small retail establishments are attracted to transit locations, and how do these patterns vary based on station type?
2) What is the survival probability for retail establishments located near new light rail stations and what factors are significant in explaining business survival?
3) How are changes in transit neighborhoods perceived by the owners of small retail establishments?

I address these research question with analyses of three US cities that constructed their first light rail lines at approximately the same time and experienced similar population and economic growth patterns: Charlotte, NC; Phoenix, AZ, and Seattle, WA. These cities have been selected as they share similar growth trends as well as the timeline of their light rail lines opening. Charlotte and Phoenix are both "Sunbelt" cities. What "Sunbelt" cities have in common is their car-oriented development trends and land use, which is a reflection

of disproportionate population growth that occurred in these regions after the World War II (Economist, 2017). The specifics of such automobile-centered infrastructure in these cities might create certain challenges for successful implementation of transit-oriented developments (Credit, 2018). To a certain extent, the trend continues today with Phoenix Metropolitan Area being within the top 10 when compared by the numeric population growth trends between 2010 and 2019, just as much as Seattle Metropolitan Area (within top 10 in the same category). The research design of this dissertation uses mixed, qualitative and quantitative methods to probe both general trends and in-depth meanings to gain a comprehensive understanding of transit retail developments in these three cities.

The results of the study illustrate that development around transit stations is sensitive to the local geographic context and is consistent with existing empirical evidence and retail location theories. Retail establishments that are dependent on larger parking facilities, such car dealerships or furniture stores tend to be located further away from more centrally located TODs, towards more peripheral urban settings, while those that benefit from increased foot traffic tend to be concentrated closer to TODs. Results reveal some evidence that creative-cultural establishments often associated with gentrification, especially art galleries, increased in concentration around TODs in each of the three cities. Overall, however, the location of the light rail did not play a significant role in inducing a higher risk of retail establishments leaving when located close to transit stations as compared to similar locations elsewhere in the metropolitan area, in the case of Charlotte. Rather, the age and size of the establishment were significant indicators, thus casting some doubt on the widespread nature of the transit-induced commercial gentrification hypothesis. Nonetheless, interviews with small business owners in new transit locations

revealed more challenges than opportunities associated with their location. Challenges often went beyond the loss of the feasibility of operating their business in a neighborhood that no longer suits their profile, but also included infrastructural challenges that the business might take time to adjust to. Importantly, some of the challenges cited could not be attributed solely to the transit line, but to broader challenges surrounding changing business climates in fast-growing cities. The results of the study are important for informing policies as cities investing in the light rail should consider budgeting for the unintended consequences for local businesses.

The remainder of this dissertation is presented as follows. Chapter 2 presents a review of existing scholarly literature examining commercial development around transit lines and stations and the transit-induced commercial gentrification hypothesis. Chapter 3 provides a more detailed discussion of the research questions. Chapter 4 explains the data and methods and Chapter 5 proceeds with results of the analysis. A discussion of the results is presented in Chapter 6 and Chapter 7 discusses the limitation of the research and avenues for future research.

Some materials in this dissertation are taken verbatim from the manuscript "Opportunities and Challenges for Small Businesses in New Transit Neighborhoods: Understanding impacts through in-depth interviews" co-authored by the author of the dissertation, as well as committee members Elizabeth Delmelle and Colleen Hammelman. The manuscript has been accepted for publication in Regional Science, Policy and Practice journal in March 2021 and is currently in production (as of April 1, 2021).

CHAPTER 2: LITERATURE REVIEW

This chapter is organized in the following way. First, the conceptual framework is discussed pertaining to commercial gentrification followed by the empirical evidence. The next part discusses the theoretical background behind transit-induced commercial gentrification followed by discussion of the relevant case studies. And finally, retail location theory followed by the empirical evidence of retail location in transit areas is discussed.

2.1. Commercial Gentrification

2.1.1. Defining Commercial Gentrification

Commercial gentrification is not a new phenomenon, however, only relatively recently have scholars begun separating it from the traditional meaning of gentrification pertaining to housing and residential changes. Commercial gentrification is commonly characterized by increased businesses turnover and churn and decreased businesses retention (Meltzer & Capperis, 2016); a decline in small 'mom and pop' businesses (Zukin et al., 2009), especially minority owned (Ong et al., 2014); and an influx of upscale chain stores and/or establishments catering to interests of particular population groups such as hip coffee shops, boutiques and high-end gourmet restaurants (Meltzer & Capperis, 2016; Zukin et al., 2009). Scholarly studies often referred to it as a "street gentrification" (Patch, 2008), "industrial gentrification" (Curran, 2007; Yoon & Currid-Halkett, 2015), "retail change" (Meltzer & Capperis, 2016), "commercial revitalization" (Sutton, 2010) or "retail gentrification" (Sullivan & Shaw, 2011). It is a global phenomenon with evidence from all over the world: Australia (Bridge & Dowling, 2001), Turkey (Ozdemir & Selcuk, 2017), China (Zheng & Kahn, 2013), South Korea (Jeong et al., 2015), UK (Ferm, 2016), the

Netherlands (Ernst & Doucet, 2014), and the United States (Sutton, 2010; Parker, 2018; Meltzer & Capperis, 2016; Curran, 2007 (industrial); Gonzales et al., 2019).

There are very few studies that investigate business closures and relocations, and none of them clearly define the "displacement" of businesses in the context of commercial gentrification. Rather, they tend to use language such as "decline", "disappearance" (Zukin et al., 2009), "churn" and "turnover" (Chapple & Loukaitou-Sideris, 2017). Yoon and Currid-Halkett (2015) consider the displacement of a business an involuntary relocation and closure due to its inability to pay rent, to sustain operation costs, a loss of its customer base, or due to inconveniences incurred because of construction, in the case of transit projects. Establishments that rent as compared to own could be at higher risks of displacement (Ray, 2017).

The common denominator across definitions is that the closure or relocation is involuntary. Some scholars caution against the separation of involuntary and voluntary reasons as choosing to move out of a property that one is unable to afford might be a voluntary decision, but it means the owner or renter does not really have any alternatives (Newman & Owen, 1982).

2.1.2. Causes of Commercial Gentrification

As is the case with residential gentrification, commercial gentrification has multiple explanations for how it arises. One is that as a neighborhood's population composition changes (meaning the customer base), so does the commercial composition (Meltzer, 2016; Meltzer & Capperis, 2016; Chapple & Jacobus, 2009; Sullivan & Shaw, 2011) as people tend to manifest their identities through their consumption practices (Sullivan & Shaw,

2011). In the first scenario, the products and services offered by the existing businesses become less relevant to changing demand in gentrified neighborhoods. Common examples of the type of commercial gentrification that follows residential includes an increase in 'hippy retailing', secondhand stores, stores with organic merchandize, bagel and coffee shops, and expensive sit-down restaurants (Ley, 1996; Waldfogel, 2008). These are typical "markers of cultural identity sought by gentrifiers" (Bridge & Dowling, 2001, p. 94).

While these changes indeed can boost the creation of new businesses, they can also produce more intense competition, increased land value and rents, and increased operational costs. Such a situation could seriously jeopardize existing businesses, especially those owned and run by ethnic minorities and immigrants (Ong et al., 2014) as these businesses are very reliant on their ethnic and immigrant communities. Meltzer (2016), however, points out in her study that changes in commercial environments due to demographics shifts might need a longer time to occur since commercial leases are longer than residential ones.

2.1.3. Empirical Evidence for Commercial Gentrification.

More studies have looked at shares of chain versus non-chain establishments in the context of commercial gentrification. They have generally concluded that in neighborhoods undergoing gentrification, small independent stores are likely to be replaced by large chain stores (Basker, 2005; Neumark et al., 2008; Haltiwandger et al., 2010; Zukin et al., 2009) that have more resources to afford higher rents and land values (Meltzer & Capperis, 2016). That might not be the case for some locations, such as New York, where commercial gentrification may manifest itself through an increased share of

small local chain boutique stores with very insignificant increase in large corporate chain establishments (Zukin et al., 2009). Some scholars caution against using a chain/small businesses dichotomy to study commercial gentrification. First, "firm size is not an a priori marker of commercial revitalization" (Sutton, 2010, p. 354). And second, large chain stores could bring positive changes to a neighborhood, including more jobs, health insurance and educational incentives for employees (Starbucks is one such example that does this). They can also provide frequently consumed goods at lower costs than local individual mom and pop stores (Chapple & Loukaitou-Sideris, 2017). A note worth mentioning here is that sometimes the stores carrying the same brand name could be operated as a chain store and as a franchise. In the latter scenario, the store uses the brand's name and practices established by the franchise granter (a chain corporate) and could still be considered a locally owned business as it shares similar types of risks that small independently owned store do (for example, dealing with inconveniences associated with the light rail construction phase).

2.1.4. Commercial Gentrification: Small Businesses

The outcome for small businesses in the context of gentrifying neighborhoods is not always negative. For example, Jeong et al. (2015) interviewed businesses owners in a revitalized part of Gyeongridan, Seoul, and found some of them to be more welcoming of changes than might be expected. For example, building owners were able to rent their property for a much higher rent and therefore earn greater revenue. Business owners who ran small pubs or restaurants were able to adapt to the tastes of the incoming young populations/students/young entrepreneurs, so their businesses could survive in the new environment.

Another study, by Pastak et al. (2019), looked at the motivations behind small business owners starting a business in post-industrial neighborhoods in Tallinn (Estonia) undergoing different stages of gentrification. The study concluded that business owners entering the neighborhood at different stages of gentrification had different motivations in mind. Businesses entering the neighborhood in pre-urban renewal stages were most attracted to the affordability of undeveloped post-industrial landscapes, while business owners entering at a later stage appreciated the authenticity of the neighborhood and the marketing opportunities it brought.

In addition to the aforementioned factors, Meltzer and Capperis (2016) highlight several other important considerations that may contribute to the success or failure of a local business. They argue that changes in physical infrastructure might both present opportunities and constraints for successful business functioning. One example could be the construction of light rail or a highway that separates businesses from their customer base or makes the location difficult to access. They also argue that as information about the environment in the neighborhood (for example, whether it is friendly or not for minority owned establishments) becomes more accessible, more businesses may feel secure (or not) to set up their establishments in these neighborhoods. It might also work the other way if the information about the troubled neighborhood is spread.

2.2. Transit Induced Commercial Gentrification

2.2.1. Conceptual Framework Behind Transit Induced Commercial Gentrification

Adding a transit station to a neighborhood is perceived as an amenity that provides increased accessibility (Agostini & Palmucci, 2008; Cervero, 2004; Mohammad et al.,

2013). A result of this increased accessibility is a greater demand for nearby locations which ultimately drives land prices up (Nelson et al., 2015; Ko & Cao, 2010; Debrezion, et al., 2007; Cervero & Duncan, 2002; Bowes & Ihlanfeldt, 2001). The ability of light rail projects to generate a positive city image is another bonus that developers seek to capitalize on (Knowles & Ferbrache, 2016), which in turn might result in further investments (SACTRA, 1999).

Commercial changes that follow or accompany new transit stations are expected to vary depending on the type of station. Those adhering to Transit Oriented Development (TOD) principles that embrace dense, mixed-use, and pedestrian-oriented designs often foster a deliberate planning strategy that encourages new businesses and are thus prime for the most significant impacts on business activity as compared to Transit-Adjacent or Hybrid station areas (Ganning & Miller, 2020). TOD stations are also often closer to central business districts and therefore disentangling the effect of a station from the locational advantage of the CBD is a confounding factor in studies on commercial development or economic changes (Bhattacharjee & Goetz, 2016).

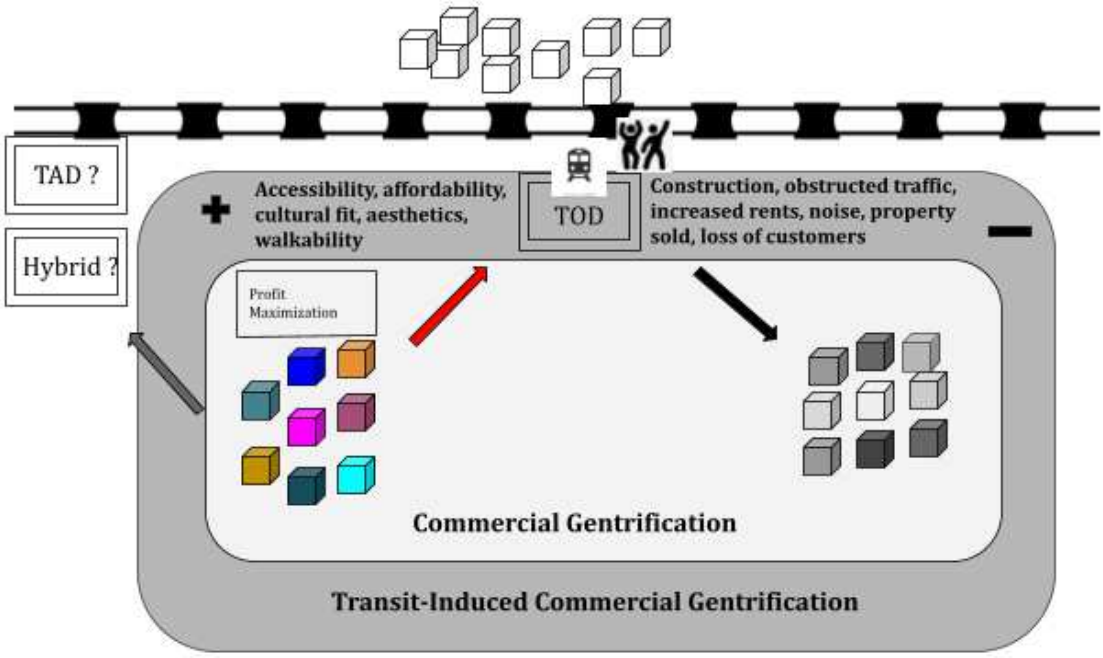

Figure 1. Conceptual framework behind transit induced commercial gentrification.

Overall, the mechanisms of transit induced commercial gentrification are illustrated in Figure 1. One of the limitations of the scheme is that it does not illustrate temporal side of transit development. In other words, it does not show when in the light rail timeline the changes would occur. Rather, it illustrates the events expected to occur (businesses move in and relocation). As Figure 1 shows, establishments (particularly retail), represented with colorful cubes on this scheme are attracted to TOD stations due to their characteristics such as increased accessibility, mixed-use of activities, affordability (perhaps at the beginning of light rail line operation before the development kicks in), walkability, aesthetics of infrastructure, suitable residential composition of the neighborhood, perhaps if new apartment complexes have been already introduced to the neighborhood. With that being said, the move could occur at different time frames both prior to and post-light rail station opening. Establishments that are moving into the transit neighborhood between the

announcement of a transit project and the actual transit line opening might be attracted by the anticipated benefits that the location is expected to generate. Establishments that have been in the light rail station area prior to the opening are shown as shown as white cubes on Figure 1. As transit development takes place and land values are elevated, establishments that are failing (cubes of grayish color) to catch up with growing rents or fit in with the new cultural and residential composition might struggle to stay in place. It is also possible that a business fails to stay in the neighborhood or remain operational because of factors unrelated transit. These factors include the age, size of the establishment, experience of the business operation, education, lack or absence of external support from local the chamber of commerce, to name a few. Younger establishments are generally more prone to closure compared to older and more established counterparts. It should also be noted that not all existing businesses are expected to relocate or close following a transit investment as some may adapt to the changing environment or some may be in locations where the underlying residential environment does not change, for example.

There is more empirical evidence on the influx of new establishments in transit areas as compared to the fortunes of existing businesses. The red and grey arrows illustrated in Figure 1 refer to establishments that are moving into the transit neighborhoods, while black one shows establishments that are leaving. Gray arrow points at the "TAD" and "Hybrid" that together with TOD refer to different types of transit developments. TOD as discussed briefly earlier in the dissertation refers to densely developed pedestrian-friendly, mixed-use transit developments. Transit Adjacent Developments, or TAD, is characterized by less dense developments, more surface parking, more segregated land uses, and very limited pedestrian infrastructure. Hybrid station types are in between, incorporating

features from both sides (Renne, 2009). The question mark next the gray arrow in Figure 1 illustrates a lack of knowledge on what kind of establishments are likely to be attracted to these types of light rail stations, a question this dissertation research seeks to address.

2.2.2. Empirical Evidence Behind Transit Induced Commercial Gentrification

One of the biggest challenges in attempting to generalize the state of empirical knowledge on development around transit lines is that the business categories are not consistent across studies. Some focus specifically on retail, however, even the way scholars differentiate retail from other categories varies (Olwert et al., 2020; Meltzer & Capperis, 2016; Schuetz, 2015). Some studies examine changes in business composition around transit stations without accounting for the size of establishments (Chapple et al., 2017) while others do account for the size of establishments as small businesses are perceived to be more vulnerable to the changes in neighborhoods (Basker, 2005; Neumark et al., 2008; Haltiwandger et al., 2010; Zukin et al., 2009), however, there is no consensus on what constitutes a "small" business. The Small Business Administration (Small Business Administration, 2019) defines business establishment size based on the average number of employees and average revenue, which in turn varies across different industries (based on NAICS codes). For example, for retail trade (NAICS codes – 44-45 the cut off for small business definition are based on revenue rather than the size). The United States Census Bureau definition of small business corresponds to the one developed by the Small Business Administration. When accounting for the share of the workforce cumulatively employed by the small businesses (less than 25%), The US Census Bureau argues for the feasibility of small business definition that has fewer than 20 people employed (Hait,

2021). This is the definition that was adopted in a similar study on small business trends in transit neighborhoods (Ong et al., 2014) and has been adopted in this dissertation research.

While much research has investigated the extent to which transit spurs economic growth, new stations are not always successful at attracting new developments. Loukaitou-Sideris and Banerjee (2000) list multiple factors that could discourage development around transit lines including retail near stations: 1) inconvenient unappealing location – far away from people and activities; 2) not enough density in proximity to station, 3) limited accessibility to stations: no park and ride option, or only accessible by car; 4) pedestrian unfriendly, 5) no urban design plan developed: no aesthetics, landscaping or connectivity with the surrounding environment; 6) 'broken window' syndrome – abandoned structures, broken windows, litter, etc. (Wilson & Kelling, 1982); 7) unreasonably high land costs in the inner-city neighborhoods; and 8) regulatory barriers.

2.3. Retail

2.3.1. Retail Location Theory

At the core of any retail location decision is profit maximization. There are three fundamental theories that form the backdrop for understanding retail location decisions. Hotelling's (1929) seminal work on the principle of minimum differentiation explains the propensity for retail establishments selling similar products to co-locate as a strategy for attracting customers seeking a particular product to certain areas of a city (Rogers, 1969; Lee, 1974; Nelson, 1958). A preeminent example is the clustering of automotive dealerships found across many urban areas (Litz & Rajaguru, 2008). Establishments that

offer compatible goods and services are also expected to co-locate according to Hotelling (1929) (Ratcliff, 1939; Parker, 1962).

At a regional scale, Central Place Theory (Christaller, 1933) explains the willingness of some businesses to pay for prime central, first-order locations to attract the largest customer base reachable within a minimum distance. This describes the more central location of department and specialty stores, while grocery and convenience stores are more plentiful and spread out (Brown, 1994). The theory also describes the range and threshold of higher and lower order goods and services. (i.e., the maximum distance people are willing to travel to purchase a certain good or service vs. the minimum demand needed for stores to stay viable). Central Place Theory suggests that relatively inexpensive goods that are purchased frequently (e.g., groceries, gasoline) have lower ranges and thresholds while more expensive, infrequently purchased goods (e.g., cars, jewelry) have higher ranges and thresholds. Finally, Spatial Interaction Theory explains the likelihood of customers to travel further distances to patronize stores that offer unique or very high-quality goods (Reilly, 1929; Reilly, 1931).

These traditional retail theories rest upon assumptions of a regulation-free urban environment, which is rarely the situation. Instead, businesses cannot freely choose their locations and are often bound by a spatial arrangement prescribed by local governments (Brown, 1994; Nilsson & Smirnov, 2018). Consequently, the location of establishments is often predetermined not only by market forces, but also by local government regulations such as zoning and the rules of shopping centers leasing commercial spaces (Davies & Benninson, 1978; Olwert et al., 2020).

2.3.2. Retail and Transit Theory

One example of such a governmental regulation is Transit Oriented Development. TOD often involves a deliberate strategy to encourage new developments in a mixed-use and dense, walkable environment. Government interventions that can help ensure that new TODs are successful include changes in zoning, parking requirements, density and use of development, landscaping and design requirements. Retail has been a core tenant of TOD (Calthorpe, 1993). As a result, retail establishments may opt to locate in these areas to take advantage of increased pedestrian traffic and other changes (Ma et al., 2014; Porter, 1997; Sukaryavichute et al., 2021).

The theoretical relationship between retail and new transit investments stems from the increased accessibility afforded by a new station that serves to elevate demand and subsequently rents (Chatman et al., 2016; Ratner & Goetz, 2013). The anticipated result of this is a churn in businesses among those most able and willing to afford rent premiums and whose businesses tailor to a potentially shifting locale clientele. This phenomenon is often referred to as “commercial gentrification” or “retail gentrification”. When transit stations are constructed within an existing urban area, the net economic impacts are thought to be more redistributive where growth is redirected toward station areas given that an automotive transportation network already exists (Huang, 1996). In other words, transit is not necessarily expected to generate new growth on its own, but in areas with a robust and growing local economy, new developments are expected to favor locations near a newly placed transit station.

2.3.3. Retail and Transit: Empirical Evidence

In overall, the empirical evidence on the relationship between transit and business fortunes (as opposed to new business generation) is rather limited. There is evidence demonstrating the positive property value impacts of transit projects and commercial development in adjacent areas, especially in cases where transit service is of high quality and the project is implemented with land use planning in mind to maximize associated accessibility benefits (Agostini & Palmucci, 2008; Cervero, 2004; Mohammad et al., 2013). The meta-analysis by Mohammad et al. (2013) concluded that rail investments tend to incur greater impacts on commercial properties rather than residential, and the benefits of locations in transit neighborhoods depreciate over time as the novelty factor of a new transportation system fades (Mohammad et al., 2013). Some other studies have revealed different transit impacts on economic development depending on the regional context – in some instances arguing that transit redirects existing economic growth in an area rather than generating new growth (Canales et al., 2019; Giuliano, 2004; Schuetz, 2015).

Despite retail's envisioned relationship with TOD, TODs are not always successful at attracting or maintaining retail establishments due to several factors (Ganning & Miller, 2020; Schuetz, 2015; Credit, 2018; Chatman et al., 2016; Ray, 2017). First, the station area design and aesthetic improvement of nearby properties including neighborhood characteristics and building types play an important role in the success of local retail establishments, including restaurants and specialized retail clusters (Ganning & Miller, 2020; Olwert et al., 2020). Second, retail is sensitive to its customer base as their consumption preferences, purchasing power, and cultural identities all shape the local market area and types of retail that locate there (Meltzer & Capperis, 2016; Sullivan &

Shaw, 2011; Lee & Moudon, 2006; Niles & Nelson, 1999). A change in a neighborhood's retail composition often mirrors broader socioeconomic changes that occur in the surrounding area (Meltzer & Capperis, 2016). If the transit station area is also undergoing demographic and socioeconomic changes in the form of gentrification, corresponding retail changes may include increases in higher-end and exclusive establishments such as jewelry stores or art galleries (Zukin et al., 2009; Bridge & Dowling, 2001; Olwert et al., 2020).

Third, the location along a transit line is not homogenous in terms of its attractiveness for retail. Proximity to downtowns and other hubs such as universities benefit certain establishments, especially restaurants (Ganning & Miller, 2020; Olwert et al., 2020). However, those requiring larger parking areas or land to sell products such as furniture stores, car dealerships, or gas stations are less likely to favor mixed-use developments that reduce parking spaces to encourage transit use (Mukhija & Shoup, 2006, Chatman et al., 2016) or to pay a price premium to be located near stations (Olwert et al., 2020). Fourth, planning strategies may serve to intentionally pursue retail or commercial development and therefore play a role in the success of a station in attracting new development. Other plans intended to increase ridership or conform to TOD design principles such as parking restrictions around stations can serve to inadvertently disrupt existing businesses, as discussed previously (Chatman et al., 2016). Finally, retail establishments are particularly vulnerable to closures (Ray, 2017) unlike restaurants or other service industries, and they might face more challenges during the construction phase of transit projects as they rely more on street foot traffic. The benefits of a location with increased accessibility can be challenged by the losses due to the temporary construction, ironically reducing access that the transit location is designed to enhance. Retail

establishments also tend to operate on shorter leases compared to restaurants (Benjamin et al., 1990; Main, 1989) that would require more capital investment (Ray, 2017). That might be another negative factor for retail establishment operation as they possibly have to deal with more frequent rent increases.

Case studies on retail generation along new transit corridors have yielded contrasting results. For instance, Credit (2018) found that retail businesses increased by 28% along the new rail corridor in Phoenix, Arizona, but ascribing these changes to rail alone was confounded by other nearby developments. In a more recent analysis, Credit (2019) studied more established transit corridors and did find evidence that proximity to transit stations was significantly associated with new retail, services, and food industries. Schuetz (2015), on the other hand, did not find evidence that new transit stations led to increases in new retail employment in California. Chapple and Loukaitou-Sideris (2017) found no significant relationship between transit proximity and commercial gentrification in Los Angeles and the San Francisco Bay area, but they warned that this might be not universal across all transit neighborhoods across the country, stressing the need for further studies on this matter

One of the most recent studies on business survival in transit neighborhoods conducted by Ray (2017) identified that construction associated inconveniences increase the likelihood of failure for business establishments in immediate adjacent areas (within 400 m) by 46%, however these failures are weakly related to the loss of revenues in these establishments. Ray (2017) also argues ownerships of property (vs renting) might be a crucial factor in predicting the survival of business establishments in transit neighborhoods. A study conducted by Phillips and Kirchhoff (1989) concluded that on average, more small

businesses fail than survive. Since then, more research has been conducted that investigated the factors that would explain the differences in survival trends among different types of establishments. It has been further determined that factors such as human capital (Bates, 1990), size and age (Evans, 1987; Giovannetti et al., 2011), and type of establishment affect survival rates among businesses. The time of entry is important as well, as the survival probability is lower for newly opened businesses (Giovannetti et al., 2011). As very few studies have previously examined business survival in transit settings ((Ray, 2017) is the closest both in method and in context), there is very little opportunity for results comparison with regards to other studies. Ray (2017) concluded that survival rates are lower for establishments located closer to the stations, where the construction related impacts expectedly have been the largest. Loss in revenue did not appear to be a significant factor that could predict business survival/exit patterns. The study by Ray suggests that most businesses located in the light rail neighborhoods survived past the 19-year observation end point (38% at 400 m distance), however the risks are much higher for retail establishments.

The literature to date on the impacts of new transit stations and business outcomes is overwhelmingly quantitative, focusing on counts of new establishments or employment opportunities. Qualitative approaches on the other hand, including interviews, are useful for providing rich descriptions and perspectives on phenomena. While such approaches do not often seek to provide the broad generalizations that might emerge from quantitative studies with large data sets, they are fruitful for exploring multiple dimensions of complex phenomena (Sherraden & Barrera, 1995).

CHAPTER 3: RESEARCH QUESTIONS

The previous chapter provided an overview of the theoretical framework for understanding transit's expected impact on retail and prior empirical evidence on its relationship. As discussed, transit locations have the potential to attract new retail and potentially endanger existing establishments through a loss in their customer base as neighborhood demographic shifts accompany transit, through increased rents, or by circumstances beyond the business' control that force them to either move out or close. These latter challenges fall under the umbrella of a transit-induced commercial gentrification hypothesis for which there have been considerably fewer studies as compared to the established body of literature investigating residential transit-induced gentrification (Baker & Lee, 2019; Bardaka et al., 2018; Dong, 2017; Nilsson & Delmelle, 2018; Padeiro et al., 2019).

The dissertation contributes to this research gap by examining changes in the types of retail establishments that are concentrated around transit stations. It also attempts to model the role of transit station proximity on a business' propensity to close or relocate, and through in-depth interviews with business owners on the opportunities and challenges associated with proximity to a new station. Below, I discuss these three main research objectives and their associated questions.

3.1. Change in Retail Composition Around Transit Stations

The intentionality of transit investments is often viewed through the prism of Transit Oriented Development (TOD) and Transit Adjacent Development (TAD). TOD stations are dense, pedestrian focused, with well-connected multimodal infrastructure, and

diverse land uses, while TAD has little pedestrian infrastructure, more industrial land uses, and auto-focused retail (Renne, 2009). Most rail transit stations in the United States are TAD, as TODs are still in minority (Cervero et al., 2004), though Renne (2009) argues that TAD stations could transition into TOD as more transit-oriented development occurs.

A fundamental benefit of Transit Oriented Development is accessibility (Curtis & Scheuer, 2010; Papa & Bertolini, 2015; Grossi et al., 2020). In theory, such developments with their mixed-us land uses, pedestrian friendly infrastructure, and density result in increased accessibility that may attract certain retail establishments (Lyu et al., 2020; Cervero et al., 2004; Curtis et al., 2009) with limited localized impact if the city does not have an extended transit network (Grossi et al, 2020). The retail landscape surrounding new stations is expected to change as new businesses that are willing and able to pay a potential price premium for these newly invested-in locations move in while others may opt to move out – either willingly or without other options (Lee & Moudon, 2006). The empirical evidence on retail dynamics surrounding new transit stations is mixed – with some findings support that stations encourage new retail, while others emphasize the contextual importance of the station's physical environment (Ganning & Miller, 2020; Schuetz, 2015; Credit, 2018; Chatman et al., 2016). Most of these studies examine changes in the commercial landscape without considering the relative changes between specific types of retail establishments (retail subsector) (Chapple et al., 2017; Ong et al., 2014; Ganning & Miller, 2020). This dissertation addresses this gap by examining changes in the specific retail subsectors around new transit stations.

Specifically, I address the following research questions with respect to the changing composition of retail establishments around transit stations.

1) How does the concentration of different retail trade subsectors differ between different types of stations (TOD; TAD; Hybrid)?
2) How has the concentration of different retail subsectors changed over time (from 2009 to 2013)?
3) Are there general trends in these patterns or do patterns differ across cities?

3.2. Survival Analysis and Hazard Rates for Retail Establishments in Transit Neighborhoods

As discussed, locations near light rail stations are associated with certain risks for local businesses that might force them to close for good or relocate. The nature of these risks varies. One of the most discussed risks in the scholarly literature is increased land values (Weisbrod & Reno, 2009; Bartholomew & Ewing, 2011; Fogarty et al., 2008; Nelson et al., 2015; Ko & Cao, 2010; Debrezion et al., 2007; Cervero & Duncan, 2002; Bowes & Ihlanfeldt, 2001). Increased values mean that landowners may seek to benefit from the increases in value by either selling their property or by raising rents. Both scenarios present a challenge for businesses (Chapple & Loukaitou-Sideris, 2017; Ray, 2017) that might push them into closure or relocation.

Another set of circumstances associated with location in transit neighborhoods that might be detrimental for a business' chance of survival are challenges over the construction time (Ray, 2017). Loss of a customer base due to the changing nature of the neighborhood residential composition (Portillo, 2017; Meltzer, 2016; Meltzer & Capperis, 2016) is another risk factor for local establishments. Additional factors that might impact business' survival success regardless of its location includes its sector, size, age, and corporate structure (Phillips & Kirchhoff, 1989; Everett & Watson, 1998; Bates & Nucci, 1989;

Bates, 1995; Van Praag, 2003; Eubanks & Wiczer, 2017). Retail establishments are perhaps the most vulnerable to changes in a customer base, while the barriers to entry in this sector are generally low (Ray, 2017), reliance on customer base and sensitivity to its changes is high (Zukin et al., 2009; Meltzer & Capperis, 2016).

This part of the dissertation is designed to investigate trends in business survival in retail establishments located next to the light rail stations. The questions this part of dissertation addresses are as follows:

1) Is proximity to a new transit station significant in explaining the probability of business survival?
2) What are the risks of business failure in transit locations?
3) What other factors impact business survival in treatment and control neighborhoods?

3.3. Opportunities and Challenges for Small Businesses in New Transit Neighborhoods

While there is some evidence that new transit stations can serve as an incubator for new businesses, particularly in the case of retail, services, and food (Credit, 2019), the design and walkability of the surrounding area is an important determinant in the success of business generation (Ganning & Miller, 2020). What is less established is the impact that new transit stations have on existing businesses. The purpose of this third set of research questions is therefore to fill this gap by investigating the impacts of new transit stations on small businesses. To do so, I perform semi-structured interviews with owners or managers of small businesses in Charlotte, NC; Phoenix, AZ; and Seattle, WA, currently or formerly located near newly constructed transit stations to answer the following questions:

1) What opportunities and challenges exist for operating small businesses in new transit neighborhoods?
2) What are the business owners' perception of changes in the local business or residential environment?

Together, the questions posed for each of the research objectives enables a complete view on commercial trends in transit neighborhoods. Answers to questions associated with all three objectives together provides additional context to the "accumulation" side of commercial development around transit stations and seeks to understand the broad trends of business departure from transit neighborhoods and their contributing factors. Addressing these questions in three case study areas also enables a comparison to be made by geography to infer how consistently the results hold across cities.

CHAPTER 4: RESEARCH DESIGN

4.1. Study Area

The three selected case study cities for this research are Charlotte in North Carolina, Phoenix including Mesa and Tempe in Arizona, and Seattle with SeaTac and Tukwila in Washington (Figure 2). These three cities share similar economic and population growth patterns and a similar timeline in stations opening. The Blue LYNX line in Charlotte opened in 2007, the Valley Metro Rail (Starter Line) in Phoenix opened in 2008, and finally, the Sound Transit Line 1 (formerly Central Link) in Seattle opened in 2009.

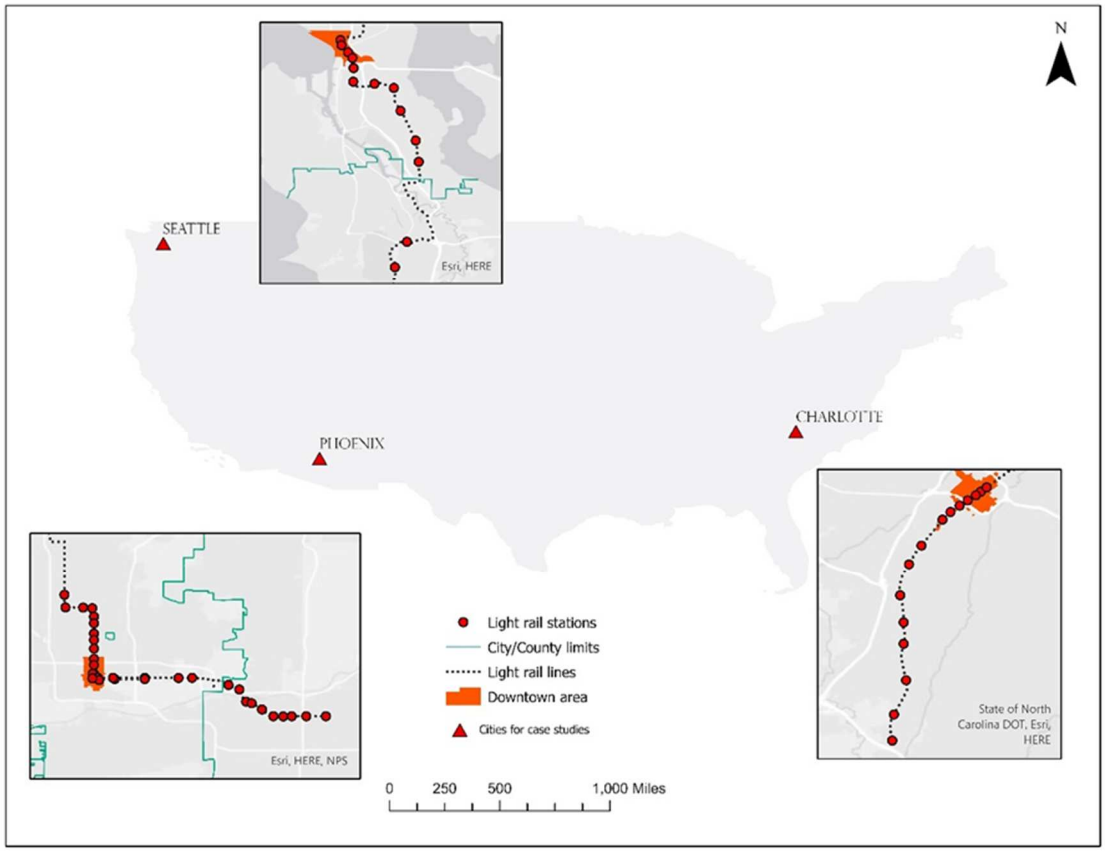

Figure 2. Location of selected case study cities.

The three cities have undergone similarly strong population and economic growth patterns (Sharf, 2018; US Census Bureau QuickFacts, 2019) over the past few years, as

shown in Table 1. In 2017, Charlotte had an annual population growth of 2.04%, with 1.75% in Phoenix and 1.97% in Seattle. As for job growth in 2017, all three selected cities demonstrated similar growth dynamics with 2.41% in Charlotte, 2.17% in Phoenix and 2.62% in Seattle. In terms of wage growth patterns in 2017, the three cities underwent slightly more diverse growth patterns with Phoenix having the lowest rate of 3.59%, Charlotte at 4.84% and Seattle at 7.52%. When comparing the population trends for a longer observational period (2010-2019 estimates), it appears that the selected cities (proxied by counties) share similar population growth trends, with Charlotte (Mecklenburg County) growing by 20%, Phoenix (Maricopa County) growing by 17% and Seattle (Kings County) by 16% respectively (US Census Bureau, 2020).

Table 1. Characteristics of selected light rail lines and respective cities

City	Charlotte, NC	Phoenix, AZ	Seattle, WA
System	LYNX Blue line	Valley Metro Rail	Central Link
System Length Total	9.6 miles	26 miles	20.3 miles
Year opening of 1st line	2007	2008	2009
Number of stations in the study	15	33	13
Population growth, 2017	2.04%	1.75%	1.97%
Job growth, 2017	2.41%	2.17%	2.62%
Wage growth, 2017	4.84%	3.59%	7.52%

In civilian labor force (% of population aged 16+) in 2015-2019	71.6%	67.1%	73.5%
Bachelor's degree or higher among population aged 25+ in 2015-2019	44.3%	28.6%	64%

4.2. Data

Data for this research comes from several sources. Neighborhood characteristics, proxied by census tracts, were obtained from the Longitudinal Tracts Database (LTDB) created by Logan et al. (2014). The datasets from the LTDB are based on the US full count and sample decennial censuses starting from 1970 and ending with 2010 (most recent at the moment of dissertation defense), and the American Community Survey sample data of 2008-2012. While the lack of exact data overlap for business and neighborhood characteristics likely introduces some bias, this could be minimized as changes in commercial environments generally take a longer time to occur (Meltzer, 2016). The datasets include population and housing characteristics such as population, race, median income, housing types, and employment characteristics. The biggest advantage of this database is that it provides estimates of demographic and socio-economic characteristics while accounting changes in tract boundaries over time.

Business data for this research comes from the Reference USA Business database owned and managed by Data Axle (previously known as Infogroup). The database contains information on businesses in the United States by year, including its locational information, industry category (by NAICS - North American Industry Classification System), address, sales volume, number of employees, and other categories. And finally, for the qualitative

part of this research, data was collected through transcribed interviews with research participants.

4.3. Methodology

4.3.1 Research Objective # 1 Methodology

Across the three cities, 61 stations are examined - 15 in Charlotte, 33 in Phoenix, and 13 in Seattle. For each station, a station category was applied - Transit-Oriented Development (TOD), Transit-Adjacent Development (TAD), and Hybrid, based on the classification developed by Renne & Ewing (2013) and Scheer et al. (2017). Neither of these sources included four stations in Seattle: Westlake, University Street, Pioneer Square, and International District/Chinatown. For this study, these stations were categorized as TOD due to the nature of mixed-use, dense development around them. The classification of stations is presented in Figure 3. Between the three cities, 12 stations are in the Hybrid category, 16 in TOD, and the remaining 33 are classified as TAD. Most stations are located outside of the Central Business Districts (47), while only 14 are within their respective CBDs. As seen on the map (Figure 3), most TOD stations are located within the respective CBD districts. CBD districts are defined as zoning class: “Downtown”, “Downtown Core” or “Uptown mixed-use”.

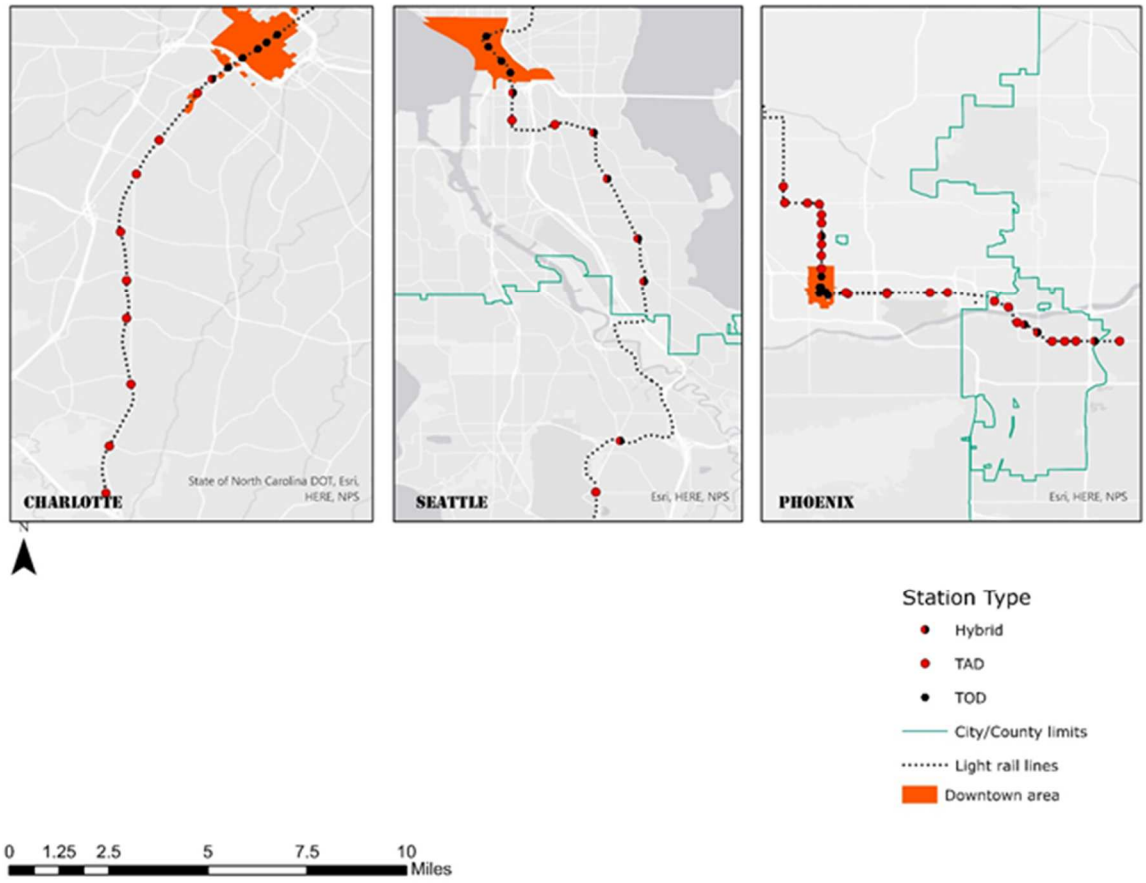

Figure 3. Distribution of LRT stations in selected case studies by station types.

2009 and 2013 are selected as the starting and end dates to track and analyze changes in retail business composition around the light rail stations. This period is chosen based on the desire to analyze changes in all three cities after their lines opened, but to avoid the financial crisis of 2008 when businesses might have been disrupted. This is a limitation of the research since the opening date year is different for each city's line and so the stages of development may vary slightly. The analysis includes establishments with a primary NAICS code, or secondary NAICS code listed as 44-45: "Retail Trade" and intentionally excludes all businesses that are home-based (i.e., PO box addresses), and

businesses that have no employees or sales records to exclude vending machines, ATMs, charging stations, and other irrelevant establishments.

To focus on small businesses, only establishments with 1 to 20 employees are included in the analysis, following previous small business definitions (Ong et al., 2014). Finally, some businesses operate as franchises and are maintained in this study as independent stand-alone establishments, though level of their autonomy varies from chain to chain (Lafontaine & Slade, 2014; Solis□Rodríguez & González□Díaz, 2017; Hajdini & Raha, 2018).

To identify patterns of retail concentration around different types of stations over time, Location Quotient is calculated as follows (Equation 1):

$$LQ = \frac{ei/e}{Ei/E} \quad (1)$$

Where e_i is total number of businesses in retail subsector i in the transit station area, e is total number of businesses in the station area, E_i is total number of businesses in retail subsector i in the reference area, in this case the MSA, and finally, E is the total number of businesses in the MSA. The method identifies which retail subsectors have a relatively higher or lower presence in transit station areas compared to the MSA as a whole. The number of businesses in each category of retail trade is used as a proxy for retail specialization to estimate the competitive advantage as well as vulnerabilities on an intraurban level. LQs greater than 1 indicate a relatively higher presence of a particular retail subsector in the station areas compared to the MSA, while an LQ lower than 1 is a sign of weaker presence of a retail subsector. For example, an LQ equal to 2 means that a particular retail trade subsector (for example, gift shops) are 2 times more concentrated in

the station areas than in the MSA on average. In the economic base literature, location quotients are often used a measure of specialization where LQs greater than 1.25 (as a rule of thumb) suggest that a region is an "exporter" (Isserman, 1977; Galambos & Schreiber, 1978), i.e., it produces more of a product than what is expected for the average region and hence likely serves an outside demand. The same logic could be applied to the intraurban retail landscape, where it is expected that most neighborhoods would have a certain level of various low-range goods and services (e.g., a grocery store, gas station, the neighborhood bar, etc.). Hence, larger LQs for certain retail subsectors could signal clusters of retailers (e.g., clusters of car dealerships or an entertainment district with multiple bars) which are often able to pull customers from a larger range as they can enjoy benefits of comparison shopping (Chung & Kalnins, 2001). Examining changes in the LQ of transit neighborhoods over time sheds light onto which retail subsectors develop a competitive advantage in these locations and which subsectors may lose this advantage and thus may struggle to remain.

For the ease of interpretation, retail establishments (NAICS 44-45) are grouped into 9 subsectors based on three-digit NAICS codes, similarity in business characteristics (e.g., range of good, frequency of purchase, dependence on customers arriving by car and/or foot, or a combination of such). The 9 subsectors include: Motor vehicle and parts dealers; Home and garden; Food and beverage stores; Health and personal care stores; Gas stations; Clothes, accessories, and sporting goods stores; Arts, crafts, music, hobby, second-hand and book stores; General merchandise stores; Miscellaneous store retailers. Details on which three-digit NAICS codes are represented in each subsector are included with Appendix A.

For the analysis, first, the LQ is calculated for each retail subsectors within a ¼ mile radius around each LRT station in each of the three selected cities followed by all three cities combined, and finally differentiated by station type. Where warranted, a closer look is taken at the individual LQs of specific NAICS categories of retailers within the subsectors.

4.3.2. Research Objective # 2 Methodology

The second research objective uses a comparative research design of post light rail opening trends where business survival rates in transit neighborhoods are compared to survival rates within a set of non-transit neighborhoods during the time period 2009-2013. Because of intense data processing, only the case of Charlotte is taken for this third analysis. This research design involves two phases, described in greater detail below. First, a set of comparison neighborhoods are selected using a propensity score matching method. Then, a survival analysis is used to test the hypothesis that there is positive relationship between proximity to a transit station and business failure after a station opened as compared to similar businesses in similar types of neighborhoods, but not near transit during the same time period. This analysis therefore allows to test the relationship between business survival/failure trends and location in transit neighborhood after the beginning of the light rail operation. Due to data limitation however, it does not allow to infer causality.

4.3.2. a) Propensity Score Matching

To compare whether survival rates in transit neighborhoods are higher or lower than what may be expected for businesses in similar neighborhoods, it is important to select

comparison areas that have similar characteristics to the treated (in this case, transit) neighborhoods.

To identify control neighborhoods with a similar set of characteristics to minimize selection bias, a propensity score matching is conducted (Rosenbaum & Rubin, 1983). The method has also been used in few recent studies examining impacts of light rail stations on residential changes (Wetwitoo & Kato, 2019; Nilsson & Delmelle, 2020; Delmelle et al., 2020). Previous transit related studies comparing treatment neighborhoods with control neighborhoods for the latter group chose either older stations and neighborhoods that were further from the treatment station (Schutz, 2015; Zheng & Kahn, 2013) or stations of planned or not yet built light rail lines (Billings, 2011; Canales et al., 2019) or auto-accessible areas (Credit, 2018).

In general terms, propensity score is a probability of the examined unit of analysis (participant) or neighborhood (in the case of this study) is assigned to the treatment group given the observed characteristics. The method aims to achieve a balance in the observed characteristics and create unbiased randomized environments.

Propensity score matching is expressed through the formula (2):

$$e(X) = pr(Z = 1/X) \quad (2)$$

where $e(X)$ is a propensity score, or in other words, a probability for the unit of analysis to be assigned to the treatment group, with X being pretreatment characteristics and Z refers to the assignment to one of the comparison groups (1 for treatment, and 0 for control).

To select comparable treatment and control neighborhoods for the business survival analysis in this study, the LTDB database is used to find neighborhoods similar to the

transit neighborhoods. Given the lack of business data in the pre-period, the matching can only be performed on neighborhood and not business characteristics in the period before the light rail lines in the different cities opened. Hence, we are not able to test for pre-intervention parallel trends in the dependent variable or compare before and after intervention business survival trends. Otherwise, a pseudo-experimental approach using difference-in-differences estimation would have been possible where causality could have been inferred. The current study design does not guarantee similarity in the characteristics of the businesses in the treatment and control neighborhoods or a pre-post type of study. While we are not able to infer causality, we are able to test the hypothesis of whether survival rates among small businesses tend to be significantly higher (or lower) in neighborhoods that have recently received a light rail station and potential differences in survival trends while controlling for certain key characteristics between businesses in the two types of neighborhoods (see Section 4.3.2).

From the LTDB database the following variables are extracted: total population, white population, population with college degree, population engaged in manufacturing, median household income, multi-unit housing, housing units built more than 30 years ago, and housing heads moved into units less than 10 years ago. These variables were based upon prior studies that have used similar sets of variables (Pathak et al., 2017; Delmelle et al., 2020). On top of the extracted variables from the database, additional characteristics are calculated including the percent change between two years of observations (2000 and 2010) and annual shares of each variable. While the time frame for selected neighborhood data does not fully coincide with the timelines of light rail stations opening, it could potentially introduce a bias in the interpretation of the results, though the bias is likely

minimal as changes in commercial environments (Meltzer, 2016) take time to occur. To further minimize selection bias of control neighborhoods, those within a mile from the examined light rail line are removed as well as any other existing light rail lines in the cities. The complete list of variables extracted and calculated is included in Appendix B.

The list of downloaded census tracts is then uploaded in ArcGIS Pro to select those that are within ¼ of a mile from the light rail stations (treatment neighborhoods) and those that are further out (for control neighborhoods) within the county (Mecklenburg for Charlotte). The list of treatment and potential control neighborhoods is then uploaded back to R to run the propensity score matching model using the MatchIt Package in R (Ho et al., 2011). A one-to-one matching ratio is applied to the model (Figure 4), resulting in an equal distribution of control and treatment neighborhoods as shown in Figure 5, below. Figure 4 illustrates the distribution of propensity scores between pairs of "Raw" and "Matched", and "Control" and "Treatment" neighborhoods. As shown by this figure, matched neighborhoods have much more similar distribution of propensity scores compared to the pair of raw scores.

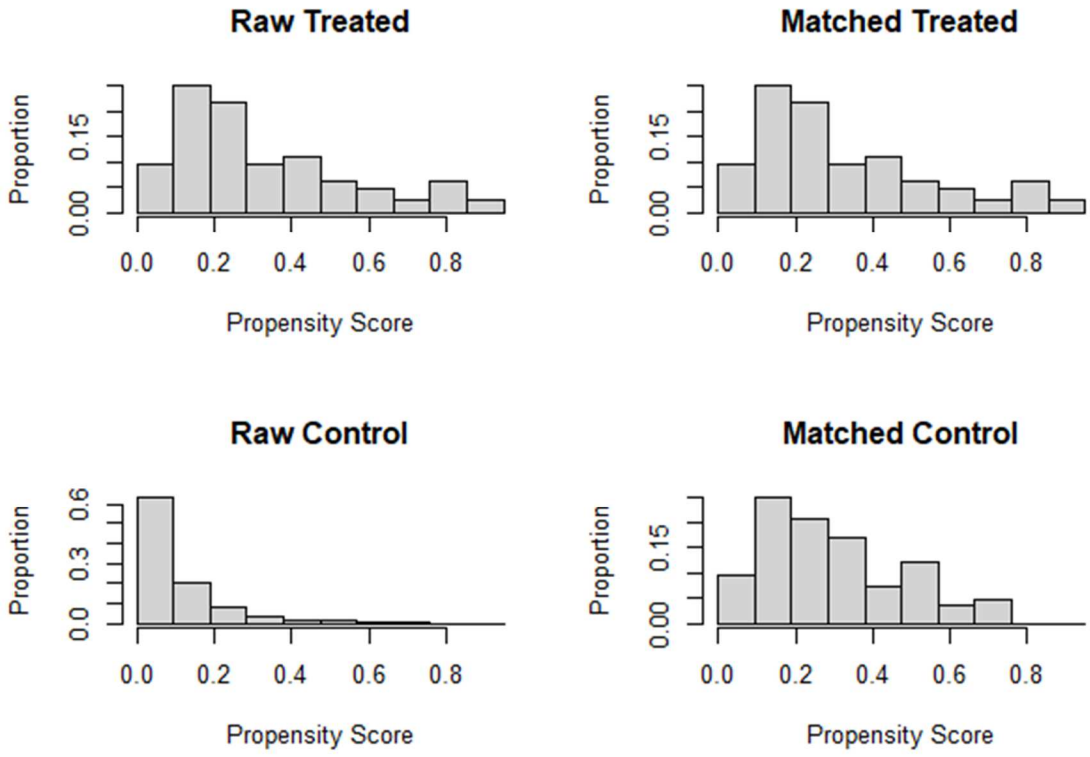

Figure 4. Results of propensity score matching: distribution of propensity scores between raw/matched and control/treatment neighborhoods.

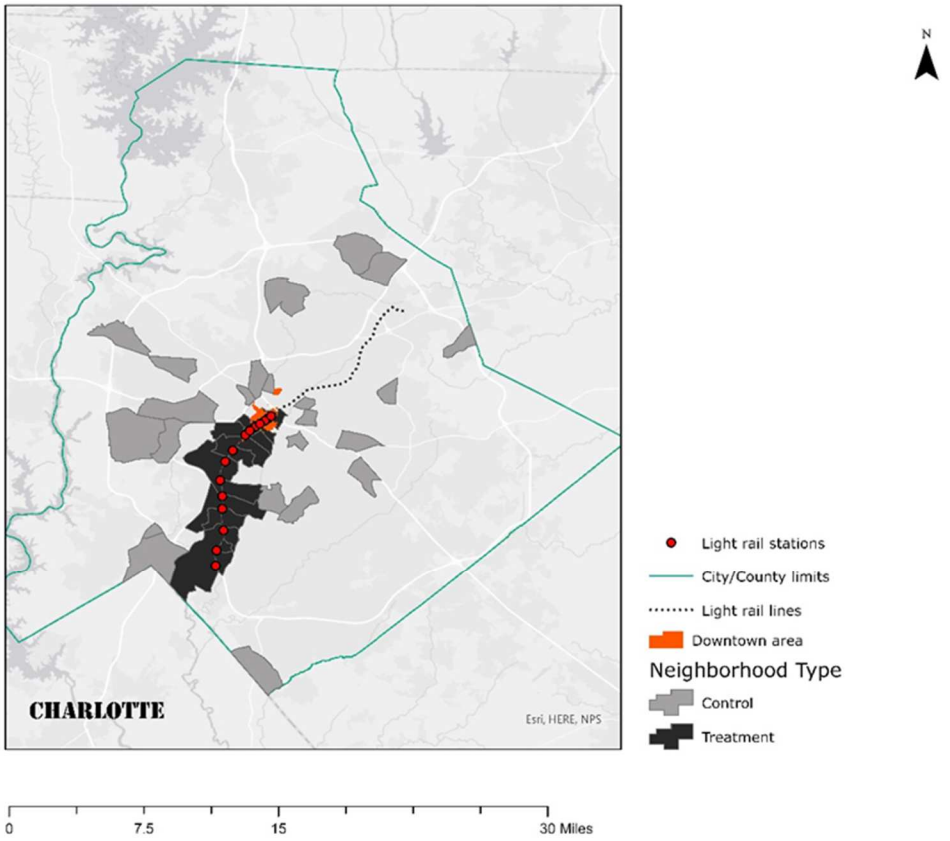

Figure 5. Distribution of control and treatment neighborhoods in Charlotte, NC.

4.3.2. b) Survival Analysis

Survival analysis is a commonly used technique applied to determine time to an event. The survival analysis is first executed using the Kaplan-Meier nonparametric model to identify the duration of survival patterns for retail establishments in the treatment and control neighborhoods in Charlotte. The second step of survival analysis is carried out using a Cox Proportional Hazard model to estimate the role of risk factors in the survival of retail establishments. Both types of models are widely used among scholars exploring business survival patterns (Gemar et al., 2016; Gemar et al., 2019; Lane et al., 1986; Crapp & Stevenson, 1987).

The Kaplan-Meier model calculates the probability of survival, measured by the number of observed subjects that pass over a certain point as the treatment event has been applied. It is often used for descriptive purposes to see how the trends behave. To run the Kaplan-Meier model, two variables are calculated: “Time” and “Event”. Time refers to the number of years the business was in operation during the observed period: from 2007 to 2014 for Charlotte. Another variable used for this model is “Event” which is a binary variable with 1 (business closed in the observed time frame) and 0 (the observation has been right censored - meaning that the last year of observation has been 2014, and further destiny of establishment is unknown).

The Cox Proportional Hazards model is the most widely used survival model across different disciplines. The model estimates the significance of factors (parameters) in determining the survival rates or commonly referred to as “hazard rates”**.** “Hazard” could be defined as a probability that an event will occur, which in the case of this research translates into the probability of business leaving the transit neighborhood or closing. One of the major assumptions of Cox Proportional Hazard model (this is also a limitation of the model and it is further discussed in the limitation chapter), is that the hazard factor is supposed to remain constant over the observed period. Realistically, it is hardly possible when applicable to establishment survival in transit neighborhoods, as different businesses might show different propensities for the perils of business operation as some local and temporary events might impact the outcome.

Cox proportional hazard function is an example of a semi-parametric model that allows for the inclusion of covariates (both categorical and numerical) unlike previously discussed models. Dependent variables are the duration in years when the business exists

in the neighborhoods, and the status that indicates whether the business left or is still operating in the neighborhood. Independent variables are the age of the business, household income, size of the business (in term of number of employees) and type of observation (treatment or control). The inclusion of these variables in the study has been informed by prior studies that pointed to various characteristics that explain business failure such as, size, age, and corporate structure, and industry (Phillips & Kirchhoff, 1989; Everett & Watson, 1989; Bates & Nucci, 1989; Bates, 1995; Van Praag, 2003; Eubanks & Wiczer, 2017; Ray, 2017). Household income is used as proxy of residential wealth in the neighborhood with higher income levels potentially creating higher risks for business exit. Besides these, other variables have been included as well, such as population, sales, and productivity (distribution of sales by employment). The population variable is included to see if there is any correlation between population size and hazard rates for business survival. The assumption is that if population is high, it is likely as densely developed areas, which is either a TOD or a downtown (or both) both with expectedly high land value premiums. In high density areas, the risks for businesses could be higher than in less dense ones. Business revenue or sales is another important variable as number of employees that SBA (Small Business Administration) uses to define small business category. However, this variable alone could not be counted as a measure for business success or failure, as businesses might selling goods in different categories of value (for example, jewelry and cars on one hand and books on the other). To address this, a new category is created that divides sales revenue by the number of employees in the establishments. This is consistent with the study conducted by Ray (2017) who also ruled out a significant relationship between business failure and loss of revenue. The number of observations (between the

two types of neighborhoods) is 2,779 businesses. Formally, the model is expressed as follows:

$$h(t) = h_0(t) \times exp(b_1x_1 + b_2x_2 + \ldots + b_px_p) \quad (3)$$

where *t* denotes to survival time; *h(t)* is the hazard function defined by variables (x_1, x_2,..., x_p), with *p* referring to the number of independent variables, and the coefficients (b_1, b_2,..., b_p) describing the impact (i.e., the effect size) of these variables. h_0 is called the baseline hazard. It refers to the measure of hazard if all the independent variables included in the model are zero. The *t* in *h(t)* means that hazard (probability of surviving) may change over time.

Table 2 provides summary statistics for all the variables included in different versions of the model. Table 3 provides summary statistics for the same variables but separate for each group (neighborhood types).

Table 2. Summary statistics on variables included in the survival model

Name of the variable	Description	Min	Max	Median	Mean
Time	Time in years the business has been present in the neighborhood	1.000	8.000	2.000	3.595
Event	Status of the establishment: 1 - exited, 0 - right censored	0.000	0.000	0.000	0.4692
AGE	Age of establishments from the year it appeared in the Yellow pages to the last year the business has been present	0.000	30.000	4.000	7.359
EMPSDT	Number of employees	0.0	10000	4.0	14.5
SLSVDT	Number in sales (in thousand dollars)	0	585400	878	2925

SLSEMPRAT	Ratio between sales and employment	0.0	2042.0	214.9	243.1
pop10	Population in 2010	1	4881	3425	3282
hinc0a	Household income in 2010	-999	95609	42708	49474
TRCNTR	Control or Treatment neighborhood	0.000	1.000	1.000	0.6358

Table 3. Summary statistics on variables (by neighborhood type)

Name of the variable	Treatment				Control			
	Min	Max	Median	Mean	Min	Max	Median	Mean
Time	1.00	8.00	2.00	3.47	1.000	8.000	3.000	3.808
Event	0.000	1.000	0.000	0.472	0.000	1.0000	0.000	0.4644
AGE	0.000	30.000	4.000	7.288	0.00	30.000	4.000	7.483
EMPSDT	0.00	10,000.00	3.00	15.45	0.00	1000.00	4.00	12.84
SLSVDT	0	585400	808	3138	0	81354	952	2554
SLSEMPRAT	0.0	2042.0	219.6	249.2	0.0	2042.0	209.0	232.5
Pop10	407	4811	3414	3207	1	4881	4034	3413
Hinc0a	11063	95066	42708	50036	-999	95609	31103	48494
TRCNTR	1	1	1	1	0	0	0	0

It is clear from the table (Table 3) that businesses located in two types of neighborhoods in overall have similar neighborhood characteristics, including the population size, household income, as well similar business characteristics, such as age, and numbers of employees. This allows for relatively unbiased interpretation of the results

with regards to similarity of business composition and neighborhood characteristics in two groups of neighborhoods.

For the survival analysis the SURVIVAL package (Therneau, 2020) and SURVMINER (Kassambara et al., 2021) were used in R.

4.3.3. Research Objective # 3 Methodology

Most studies examining business trends and patterns have been predominantly quantitative in nature. Yet, the literature on entrepreneurship has become enriched over the past several decades with an influx of qualitative studies and methods seeking to gain a more in-depth and comprehensive meaning of entrepreneurial trends (Jeong et al., 2015; Pastak et al., 2019; Parker, 2018; Rankin & McLean, 2015; Gandhi & Minner, 2017; Atsan, 2016; Williams & Needham, 2016; Sacchi et al., 2014). While commercial gentrification is still a relatively unexplored phenomenon, several studies have been conducted that discuss perceptions of business owners in gentrified neighborhoods (Pastak et al., 2019; Jeong et al., 2015; Parker, 2018). In all the cases, interviews have been conducted to collect the narratives.

Thus, the third research objective uses a qualitative strategy to provide perspectives of business owners on their opportunities and challenges associated with being in a transit location. To achieve this, thirty-five semi-structured interviews were conducted, which is close to the numbers of participants engaged in the similar studies where the owners of businesses were interviewed (50 – Jeong et al., 2015; 30 – Pastak et al., 2019; 29 – Parker, 2018; 25 – Rankin & McLean, 2015; 19 – Gandhi & Minner, 2017; 13 – Atsan, 2016). One of the advantages of semi-structured interviews is the flexibility that it allows for the

interviewer, when the questions are not strictly determined prior to the interview and followed during the interview but adjusted with the flow of the conversation.

In total, approximately 1,250 business owners were contacted via email, website contact form, phone, or social media (250 in Phoenix, 400 in Charlotte, and 600 in Seattle) The differences in recruitment numbers are explained by the similar trends in total numbers of business that matched the participants profile in each city. In other words, Seattle, in overall had more businesses that matched the selection criteria compared to Phoenix and Charlotte. Potential participants were first identified through the Reference USA US Business database (Reference USA, 2019). An initial selection of potential businesses was created by identifying all retail (including food retail, restaurants, and financial services), independent, small businesses (1-20 employees) in the database located within a quarter mile of a light rail station at some point. Businesses that closed, relocated, or remained were all retained in the initial selection set database.

In total, thirty-five business owners replied and participated in interviews. As described below, these respondents represented a variety of business type, time in operation, and location, thus providing a useful cross-section of establishments. Thirty-three interviews were conducted by phone while two participants preferred to answer questions in a written email format. Participants were asked questions about their business (ownership, history of operation, services and goods provided), reasons to open a business in the light rail neighborhood and reasons to relocate, and their observations of changes taking place in the neighborhood. Most phone interviews were recorded except for four instances when the participants either opted not to or voice recording software malfunctioned, and so field notes were taken instead. Voice-recorded interviews were

transcribed using a third-party transcription service and were coded and analyzed following a content analysis approach using NVivo 12.

Among the participants, one represented a Phoenix non-profit organization supporting local small businesses, one was an independent consultant with experience working with small businesses during and post light rail construction in Phoenix, and the remaining 33 were owners or managers of small businesses in Charlotte, Phoenix, and Seattle. The opinion of a consultant in tables further in the manuscript is referred to as "+1". Thirteen business owners were in Charlotte and Seattle each and 10 were in Phoenix. Only five participants owned the property where their business operated while the remaining 28 were renters. Twenty-two of the businesses had a storefront while the remaining were either a home or business office, an online store or offered a delivery service to customers.

The breakdown of type of establishment is shown in Table 4. The majority are smaller retail stores or cafes, restaurants, or breweries. The average age of participating businesses across the three cities is similar: 18.3 years in Charlotte, 22.1 years in Phoenix, and 24.8 years in Seattle. Twenty-three of the 32 businesses remain located in the light rail neighborhood; 12 were present prior to the opening of the station, while 11 moved in after it was operational. Two business owners permanently closed their establishment while nine relocated outside the vicinity of the new rail line.

Table 4. Classification of establishments recruited for the interview

Type of establishment	Number of establishments.	Charlotte	Phoenix	Seattle
Boutique stores, jewelry, clothes, souvenirs, books, antique	9	2	4	3
Cafes, restaurant, breweries	8	2	3	3
Consulting	5	3	0	2
Beauty services (hair, nail, tattoo)	3	2	1	0
Wholesale	1	1	0	0
Art gallery	1	0	0	1
Other services	6	3	2	1

Once the collected narrative has been transcribed by the third-party company, NVIVO 12 software was used to organize the collected data through coding. Coding is a useful technique qualitative scholars use to organize, reduce, and analyze the portions of qualitative data. One of the biggest benefits of coding is that it allows for reflexivity and critical thinking while processing the research data. Rounds of coding could enhance one's understanding of patterns and relationships to build new forms of knowledge. There are several strategies that could be applied to coding of qualitative information. Thus, one could perform a content analysis, which is in fact very quantitative in nature as it deals with number of instances a meaningful word or phrase appears in the data. The alternative

approach to coding is where the researcher looks for manifest or latent messages in the text trying to interpret the meanings of these messages and its relevance to the examined theory.

In the dissertation several rounds of coding have been performed. First, the portions of transcribed interviews as well as notes taken during the interviews that were not recorded have been assigned codes. The initial round of coding was to reduce data and cut the irrelevant parts of the interviews based on the research questions that have been formulated at the research proposal development stage. Both, descriptive and analytic codes have been used to structure and analyze data. Portions of transcribed interview texts and notes were assigned to a particular code such as "renting", "owning", "crime", "theft", "building sold" among others, that in turn were organized in a larger group of themes such as "challenges in operating the business", "benefits of location in transit neighborhoods", "perception of change", "business description". Some of these categories have been created based on the previous studies, for example increased foot traffic as a beneficial circumstance for business located in transit neighborhoods (Ganning & Miller, 2020); business deterrents, such as neglected neighborhoods conditions (Chapple & Loukaitou-Sideris, 2017); or poor station design (Loukaitou-Sideris & Banerjee, 2000; Ganning & Miller, 2020). Some of these categories have been developed during the coding process.

CHAPTER 5: RESULTS

5.1. Research Objective # 1

As discussed earlier, this part of the research explores changes in retail concentrations around different types of stations, differentiated from each other by the level of transit development, with TOD being the most densely developed (Renne, 2009), TAD being the least densely developed, and Hybrid stations in between TOD and TAD in terms of development according to Renne's (2009) station classification. The results below are provided by comparing retail concentration around transit stations across researched cities, followed by comparisons across different station types.

5.1.1. Cities

Figure 6 shows the LQs for small retail establishments around light rail stations in Charlotte in 2009 and 2013 by retail subsector (as defined in the previous section). The retail trade subsectors are presented in ascending order based on their primary NAICS code. As can be seen from Figure 6, in 2009, two years after the line LYNX Blue Line became operational, the highest concentration of retail establishments was observed in the Arts, crafts, and hobby subsector with an LQ over 1.5. This advantage increased between 2009 and 2013. The only other subsector with an LQ over 1.25 in 2009 was the Home and garden subsector. However, the relative concentration of these retail stores decreased in station areas by 2013. Most other subsectors had an LQ below 1 in 2009 and their relative concentrations further reduced in 2013 (e.g., general merchandise and miscellaneous stores). Clothing and motor vehicle related stores were some of the few that experienced a relative increase in concentration during the observed time, however, they still had LQs less than 1. At a closer inspection of the LQs of specific categories of retail establishments

(Appendix C) in the Arts, crafts and hobby subsector, the increase in the LQ for this subsector appears to have been mainly driven by art dealerships whose LQ increased from 2.59 in 2009 to an LQ greater than 3 in 2013, hobby and game stores increased from 0.42 in 2009 to 1.35 in 2013, and gift and souvenirs stores increased from 1.39 in 2009 to almost 2 in 2013. Interestingly, the bookstore concentration in the same subsector dropped from 2.91 in 2009 to almost 1 in 2013. Bookstores decreasing in concentration could possibly be explained by their struggling overall position in the booming e-commerce economy, while art dealers and souvenirs stores are thriving on in-person customer experience, thus less subject to e-commerce trends. The increase in concentration of these kinds of establishments might also point at undergoing population shift with art galleries and souvenirs store being a form of a cultural manifestation (art galleries) or to allure adjacent foot traffic (souvenirs stores) (Zukin et al., 2009; Zukin et al., 2016; Hubbard, 2017). The decrease in subsectors concentration of miscellaneous store retailers and general merchandize stores is perhaps also a symptom of ongoing e-commercialization of retail trade or competition with the libraries for bookstores (Hemmeter, 2006).

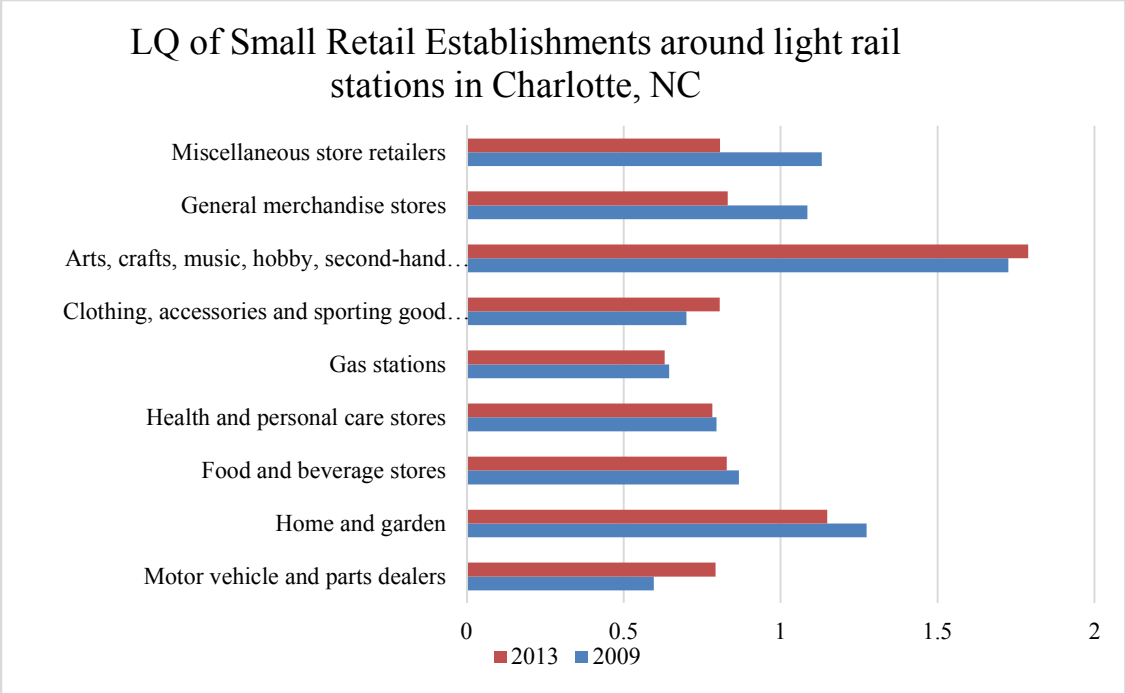

Figure 6. LQ of Small Retail Establishments around light rail stations in Charlotte, NC in 2009 and 2013, by retail trade group.

For the case of Phoenix (Figure 7), relative retail concentrations largely remained stable between 2009 and 2013 with the highest concentration of establishments in the Arts, crafts, and hobbies subsector, the only subsector with an LQ greater than 1.25 in both years. Unlike in the case of Charlotte, the relative concentration of businesses in this subsector decreased during the timeframe. However, like Charlotte, art dealerships underwent a large increase in concentration, from 0.67 in 2009 to 2 in 2013. Interestingly, from 2009 there was a significant drop in the concentration of jewelry stores around light rail stations (from 2.31 in 2009 to 1.38 in 2013). Overall, 4 out of 9 subsectors experienced a decline in their LQs between 2009 and 2013, suggesting that the corridor became more diversified rather than specialized during this time.

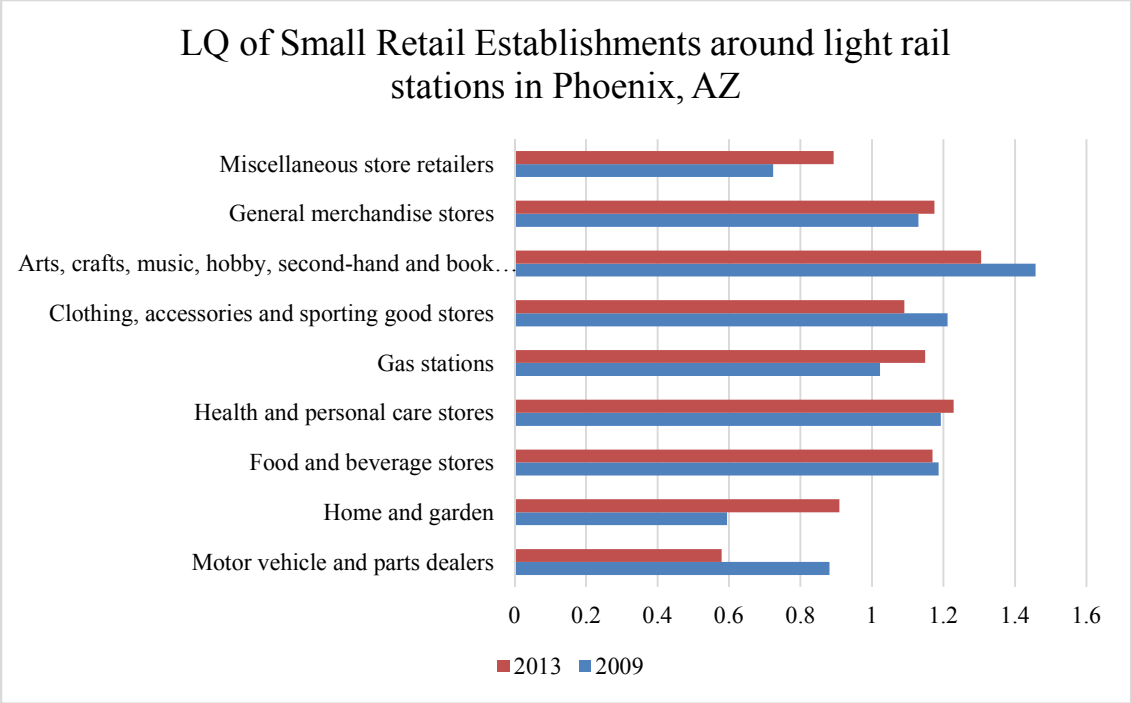

Figure 7. LQ of Small Retail Establishments around light rail stations in Phoenix, AZ in 2009 and 2013, by retail trade group.

For the case of Seattle (Figure 8) which has a more complete transit system compared to Charlotte and Phoenix, only three retail subsectors had LQs greater than 1.25 in 2009: General merchandise stores; Arts, crafts, and hobby; and Clothing and accessories. The LQ of these (General merchandize and Clothing and accessories) declined between 2009 and 2013, except from the Arts, crafts and hobby subsector which experienced a modest increase. Unlike in Phoenix and Charlotte, the increase is not driven by art dealerships, which in fact declined from 2.43 in 2009 to 1.79 in 2013, but with a slight increase in the LQ in bookstores (from 1 in 2009 to 1.34 in 2013) and in gift and souvenirs stores (1.26 in 2009 to 1.67 in 2013). Just as with Charlotte, that could be a sign of undergoing cultural shift where small retailers are adapting for changing customer base needs. Finally, no other sector increased to a value greater than one, again pointing to a relatively diversified retail environmental around transit stations.

Figure 8. LQ of Small Retail Establishments around light rail stations in Seattle, WA in 2009 and 2013, by retail trade group.

5.1.2. Stations and Station Types

This section presents an analysis of retail subsectors concentration by station types (Figures, 9, 10, and 11 and Appendix D) and analyzes changes in those patterns over the observed period of time.

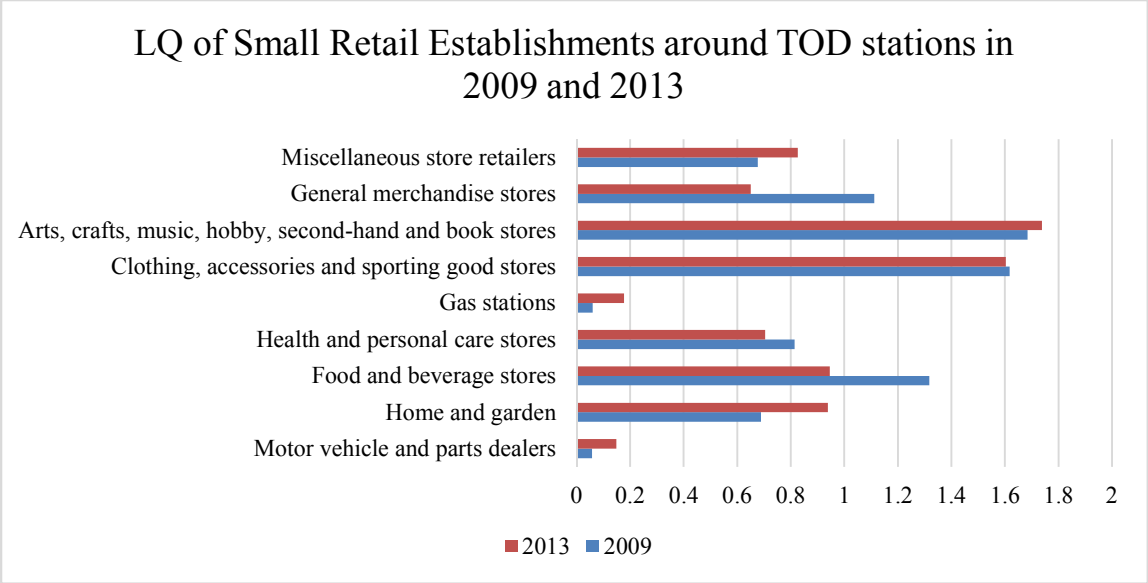

Figure 9. LQ of Small Retail Establishments around TOD stations in 2009 and 2013, by retail trade group.

As Figure 9 illustrates, two retail subsectors have significant retail concentrations (over 1.6) around TOD stations and they maintained it for both years: Arts, crafts and hobby stores; and Clothing and accessories. First, it mimics the patterns of retail concentration in Seattle (Figure 8), discussed above, as the LQ of those subsectors in Seattle was also relatively large (around 1.3). High concentration of these kinds of establishments might be explained by the fact that TODs are predominantly located within the downtown areas (Figures 3) with expectedly high concentration of retail activity catering towards interests of tourists and other downtown visitors. At the detailed level, this appears to be driven by different types of clothing stores: men's clothing stores (3.74 in 2009); women's clothing stores (2.75 in 2009); clothing accessories stores (1.32 in 2009), and jewelry stores (around 2 in 2009). A high concentration of the Arts crafts and hobby subsector is mainly due to a high concentration of bookstores that tended to increase its presence over time (from 1.41 in 2009 to 2.21 in 2013), gift and souvenirs stores that also maintained their significant concentration over the observed period (around 1.7 on

average), as well as a significant presence of art galleries that however decreases over time (from 5.36 in 2009 to 3.86 in 2013). That might be because art galleries require a significant amount of space, which might be expensive to maintain in the downtown areas of the cities. The reasons for that might be a downsizing philosophy in art which focuses on temporary exposition of art rather than permanent making the maintenance of large real estate spaces not feasible (Schumacher, 2014). The fact that the opposite trend is present in Charlotte and Phoenix, where the LQs for these types of establishments is growing, might suggest these cities' creative scene is just beginning while Seattle's was more established and may now have started to regress.

As for retail trade subsectors in Hybrid station types (Figure 10), concentrations are very weak meaning the retail landscape around these station types is more diversified. Only a few trends are worth mentioning such as the significant concentration of general merchandize stores that dropped from 2 in 2009 to around 1 in 2013. The opposite trend is observed in the Arts crafts and hobby subsector that increased over time from around 1 in 2009 to 1.5 in 2013. In the case of Hybrid stations, this growth in retail concentration is driven by art galleries with its presence concentration growing from below 0.76 in 2009 to 3.35 in 2013. Given the decrease of these types of establishment in TOD stations it is possible to assume that they tend to gradually move further down the line away from the downtown area. Just like TOD stations, there is an increase in gift and souvenirs stores from 1.90 in 2009 to 2.40 in 2013. This is an interesting observation that might point at similarity of transit adjacent development between Hybrid and TOD stations, and also might support the idea that station types might evolve over time (Renne, 2009).

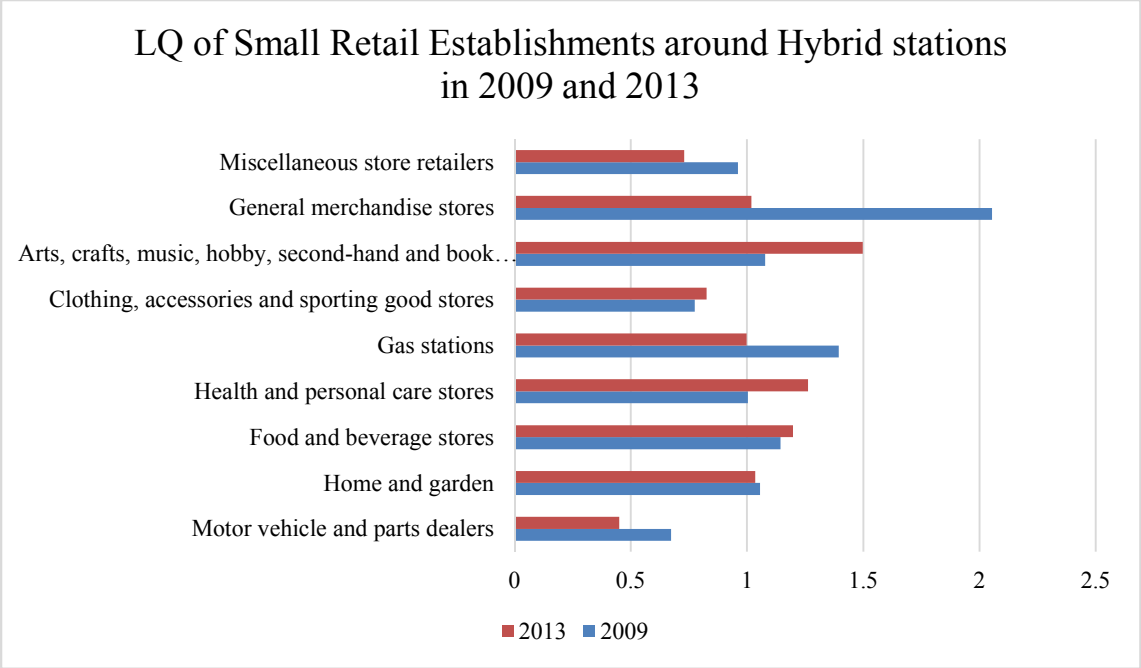

Figure 10. LQ of Small Retail Establishments around Hybrid stations in 2009 and 2013, by retail trade group.

Finally, for TAD stations (Figure 11), it is hard to ignore that the nature of retail transit development differs from those of TOD and Hybrid discussed above. Only two subsectors have higher than expected concentrations (with LQs around 1.4), which remains constant over the observed period: general merchandize stores and gas stations. The numbers behind the general merchandize stores subsector concentration could be explained by the high LQ values for various department stores. This is also expected as those stores require larger parking spaces which would be most feasible to attain in the areas in the periphery with more affordable land values.

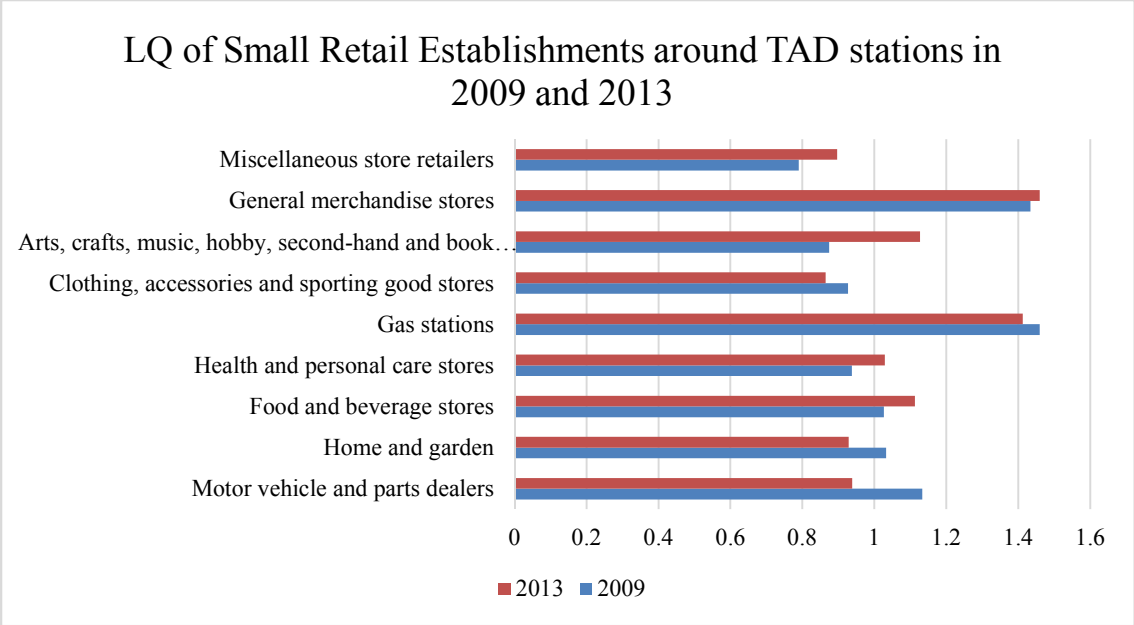

Figure 11. LQ of Small Retail Establishments around TAD stations in 2009 and 2013, by retail trade group.

5.2. Research Objective # 2

This part of the dissertation explores the survival patterns for retail establishments located in transit neighborhoods in Charlotte, as well as the risk factors that might drive the establishments out of the neighborhood. This part of the research however does not account for the characteristics specific to business operation (such management style, business plan, knowledge of business processes, education) as well as national and global trends, such as e-commercialization or industrial trends (Nilsson et al., 2019; Van Praag, 2003; Kalleberg & Leicht, 2017; Korunka et al., 2011) These characteristics likely have more potential in explaining the business turn over in transit neighborhoods. As a part of this research objective, I seek to understand whether proximity to a new transit station significant is in explaining the probability of business survival? What are the risks of business failure in transit-adjacent locations? And finally, what other factors impact business survival in treatment and control neighborhoods?

To answer these research questions, first, the Kaplan-Meier survival model was applied to compare survival trends in transit (treatment) and non-transit (control) neighborhoods. The estimated results are presented in Figure 12. The graph illustrates the Kaplan-Meier survival mode by establishments in control neighborhoods (in black) and in treatment (in red). The results of the analysis suggest that the survival trends over the course of 8 years (from 2007 to 2014) are very similar between retail establishments in transit and non-transit neighborhoods (around 40%). In other words, 40% of establishments will still be in place after approximately 8 years after the opening of stations. This is similar to the estimates by Ray (2017) who found that over the course of 9-year time period (including the construction phase), just over half of establishments survived through the construction (55% within a quarter-mile buffer around the station).

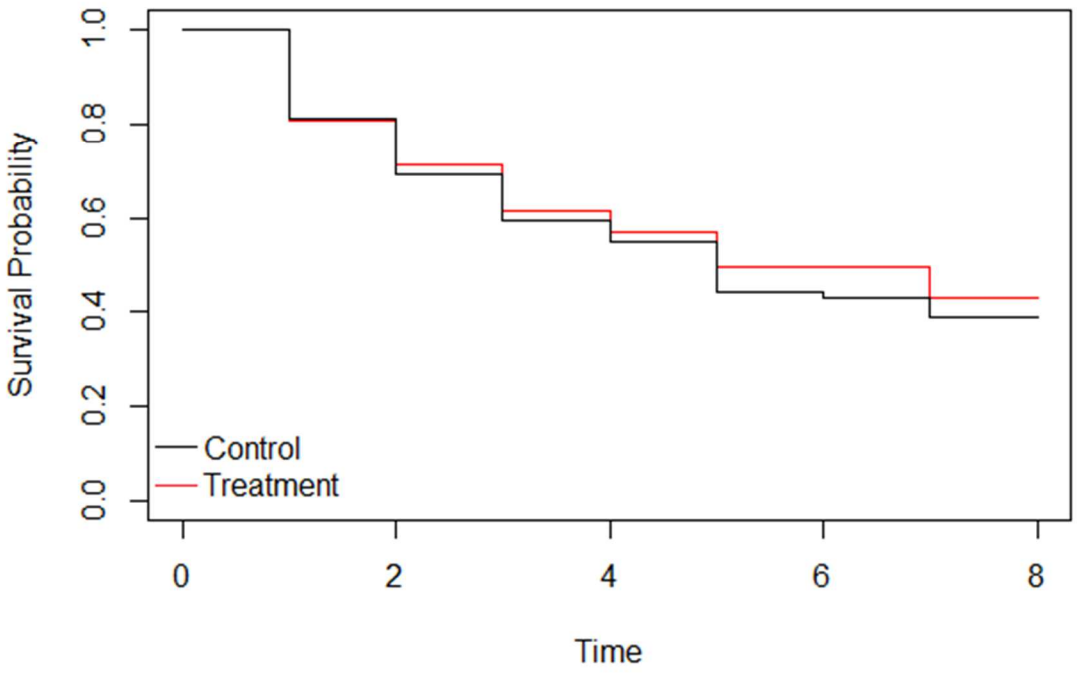

Figure 12. Results of non-parametric Kaplan-Meier survival model.

The Kaplan-Meier survival model is non-parametric so to estimate the significance of other factors associated with business survival, a Cox Proportional Hazard was estimated next. Multiple models were run to find a best fitting one. The final model includes a treatment indicator variable (1 if within a quarter mile of a station, 0 if in a control neighborhood), number of employees (as a proxy for size of the establishment), age (years since opening), and the median household income in the neighborhood in which the business is located in 2010 as a proxy for purchasing power at the location. The results of this model are presented below (Table 5).

Table 5. Results of Cox proportional hazard model, coefficients and hazard rates

	coef	exp(coef)	se(coef)	z	Pr(>|z|)
Treatment/Control	7.552e-02	1.078e+00	5.780e-02	1.307	0.19132
Age	-5.418e-02	9.473e-01	4.687e-03	-11.562	< 2e-16 ***
Employment	-5.531e-03	9.945e-01	1.765e-03	-3.134	0.00172 **
Household Income 2010	-2.513e-06	1.000e+00	1.037e-06	-2.424	0.01536 *
With significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
N = 2,779					
Concordance = 0.684 (se = 0.009)					
Likelihood ratio test = 206.8 df(4), p=<2e-16					
Wald test = 163.1 4 df(4), p=<2e-16					
Score (logrank) test = 163.9 df(4), p=<2e-16					

As can be seen from the results, the age of the establishments appears to be the most significant, as well as size of employment, and less so neighborhood household income, while the dummy variables pertaining to business location in transit/control neighborhoods is not significant. As for the signs, all three (except Treatment/Control) are negative, meaning that with a decrease in household income, employment, and age, the hazard risks (the risks of "exit" from the neighborhood) increases. These results are in line with previously conducted studies that determine that age and size of establishments are crucial determinants of business success or failure (Evans, 1987; Giovannetti, 2011; Haltiwandger, et al., 2010; Basker, 2005; Neumark et al., 2008) suggesting that factors internal to the

business operations are of relatively higher importance than market area attributes (Nilsson, et al., 2019).

The Table 5 also includes the Hazard rate (exp(coeff)), which refers to the probability for the event to occur at a given time t, given that the subject (business in this case) is at risk of exiting at time t. The Null hypothesis is that HR is equal to 1. Any values that are below or lower than 1 point to rejecting the null hypothesis. If HR is positive, it means that the event will be more likely to happen with an increase in the value of the variable. If HR is negative, that means the event is less likely to happen with the 1-point increase in value of the parameter. The results are illustrated with a Forest plot (Figure 13) together with the confidence interval for each estimate. The interrupted line of 1 is a line of no effect.

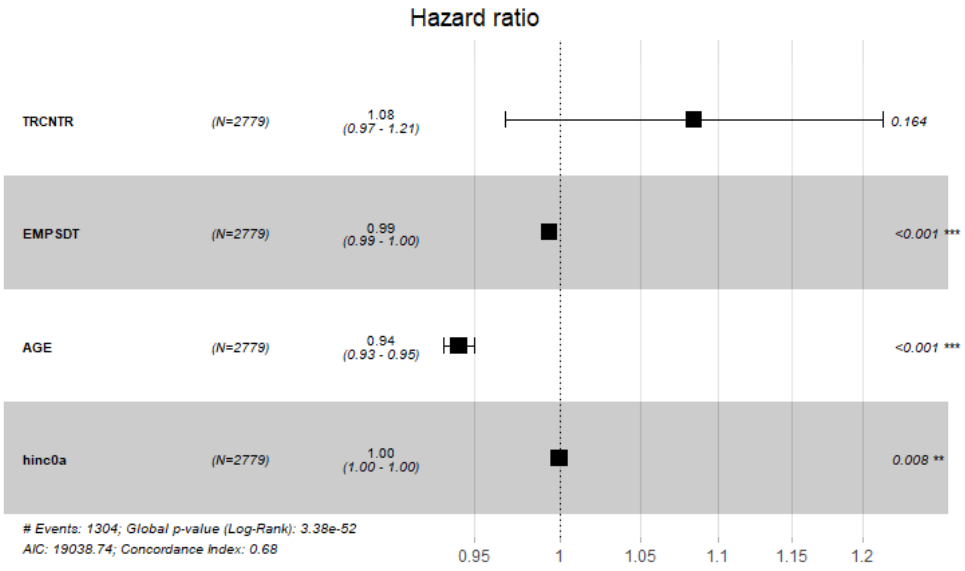

Figure 13. Forest plot illustrating the results of Cox proportional hazard model.

As seen from the graph, there is no difference in outcome for businesses surrounded by neighborhoods with different household incomes (HR is 1). Employment also does not play a big role in it, while age has the most significant predictor of business survival. While

the dummy variable referring to Treatment (1) and Control (0) neighborhood indicates the positive Hazard Rate, meaning that establishments in treatment neighborhoods are in more risk of exit, this relationship is not statistically significant.

5.3. Research Objective # 3

The transit gentrification hypothesis assumes that as locations become more accessible, establishments that are most willing to benefit from such location areas will outbid others, resulting in a churn of businesses. As a result, establishments that cannot afford the increased rent premiums, or whose customers are gone might be compelled to leave the neighborhood. In some cases, businesses that do not need the location next to the light rail stations (like large warehouses in former industrial locations) or establishments that need more parking spaces for patrons than transit adjacent regulations allow might find their new environment not matching their business needs. To what extent these patterns hold true, very little empirical evidence has been assembled yet.

Commercial gentrification is a two-sided process that accounts for some businesses leaving neighborhoods and others coming in. The parts discussed include the analysis of perceived opportunities and challenges for business owners located in transit neighborhoods, followed by a discussion of participants' input on what changes they have observed in their neighborhoods.

The answer for this research question is designed to provide a context for two previously discussed research parts to paint a more complete picture of transit commercial developments pertaining to small retail stores.

5.3.1. Opportunities

The first part is the perceived benefits of being in proximity to a new transit station. The key themes that emerged are identified in Table 6. The benefits mentioned by the participants are ranked from the most to least cited and include foot traffic, affordability of space, location close to the customers, suitable zoning ordinance, convenience for employees, cultural attractiveness of the neighborhood, and absence of competition. The most referenced opportunity associated with transit station proximity is increased foot traffic, consistent with the work by Ganning and Miller (2020). As stated by the owner of a supplements store in Phoenix: "Foot traffic is about half – people that are just cruising in is about half of our business." The owner of a distillery in Charlotte has shared similar sentiment saying that "I knew the place has huge growth potential and I knew that we would have foot traffic."

Perhaps contrary to the theoretical expectation of elevated rents along new transit corridors, the second most frequently cited benefit of the transit location was affordability, at least when the business opted to locate there, which may have been pre-transit. Out of five participants who cited affordability of the spot, two have been located in the same location prior to the light rail line opening. The owner of the floral business in Charlotte has mentioned that they "had a seven-year lease on our space and the prices were very affordable when we moved in."

Four businesses mentioned proximity to customers as a benefit of the transit location, alluding to a particular clientele who either works or resides in transit locations. For example, the owner of one floral business in Charlotte said:

"My reasons was I found that the majority of my clients who are, you know, between the age of 25 and 35, the majority of them worked uptown...So you know, I decided to bite the bullet and move closer to where my clients were because then, you know, they could leave their office half an hour early and be at me at 20 till five and we wrapped up with our meeting by six o'clock and I could still be home for dinner with my family. So, it was more of going where the clients were."

Three businesses in Charlotte noted that zoning constraints limited the places where their business could operate, forcing them to a nearby transit location. In each of these instances, the business needed to be located in an area zoned as heavy industrial, and given the transit line's placement through previously under-utilized, industrial parcels, the transit proximate location perhaps inadvertently helped guide their location decisions. These include businesses often associated with gentrification including a distillery and cidery whose intra-urban location constraints have been discussed in the literature (Nilsson et al., 2019). The owner of the distillery business in Charlotte has described the situation perfectly:

"We would physically have to go to the city, request a zoning change to TOD, which there are certain advantages to that, like parking and things like that. But the main problem for us would be the moment we did that; we would have to upgrade all the sidewalks. It would be like a $40,000 hit that we would have to be willing to take. And right now, that's just not – we don't see an advantage to it."

Two participants noted the importance of proximity to the light rail station for their employees. The most strongly held sentiment perhaps came from the director of the advocacy organization in Seattle who commented that transit access was one of the most important location factors, considering the needs of both employees and visitors:

"Like I think a lot of folks, many of our staff members do not own a car. I don't know exactly how many. People would not be able to work for us. They would find another job if we did not have good transit access."

Finally, a couple of participants included their location in a hip neighborhood (1) and limited surrounding competition (1) as benefits accruing from their location.

Table 6. Perceived benefits of location in transit neighborhood

Issues	Businesses		Count	Charlotte	Phoenix	Seattle
Foot Traffic	Supplements 1 Phoenix Distillery 1 Charlotte Cidery 1 Charlotte Café 1 Seattle	Clothes 1 Seattle Beauty salon 1 Phoenix Café 1 Phoenix Café 2 Phoenix	8	2	4	2
Affordable space	Wholesale 1 Charlotte Floral 1 Charlotte Clock 1 Phoenix	Beauty Salon 1 Charlotte Fabrics 1 Charlotte	5	4	1	0
Close to customers	Floral 1 Charlotte Jewelry 1 Seattle	Clothes 1 Phoenix Café 2 Phoenix	4	1	2	1
Suitable zoning	Distillery 1 Charlotte Cidery 1 Charlotte	Wholesale 1 Charlotte	3	3	0	0
Convenient for employees	Consulting 2 Seattle	Consulting 1 Seattle	2	0	0	2
Location in a hip neighborhood	Consulting 1 Charlotte		1	1	0	0
No competition for the business	Beauty Salon 2 Charlotte		1	1	0	0
Total			24	12	7	5

5.3.2. Challenges

Despite the benefits of locating near a new transit station discussed above, many more challenges were raised by small business owners (Table 7). Table 7 discusses challenges cited by the participants they either have experienced themselves in the transit neighborhoods or based on their knowledge of other local small business experiences. The list includes respondents' perception that the presence and activities of people experiencing

homelessness can be disruptive, challenges with increased rent (which in some cases served as an impetus to relocate) and increased traffic, construction related disturbances, reduction in parking space, changed zoning ordinance, and reported problems for customers, crime, and others.

Table 7. Challenges cites by participants while operating/managing business in transit neighborhood

Issues	Business mentioned		Count	Charlotte	Phoenix	Seattle
People experiencing homelessness near stations. Perceived increase in surrounding drug activity.	Beauty Salon 2 Charlotte Floral 1 Charlotte Cidery 1 Charlotte Beauty Salon 1 Phoenix Café 1 Phoenix	Jewelry 1 Seattle Café 1 Seattle Café 2 Seattle Consulting 1 Charlotte Art 1 Seattle	10	4	2	4
Rent Increase (A reason to relocate from TOD, or a current pressing issue while still in TOD)	Photography 1 Charlotte Printing 1 Charlotte Wholesale 1 Charlotte Clothes 1 Phoenix Consulting 1 Seattle	Cidery 1 Charlotte Café 1 Seattle Distillery 1 Charlotte Floral 1 Charlotte	9	6	1	2
Increased traffic	Printing 1 Charlotte Wholesale 1 Charlotte Restaurant 1 Phoenix Book 1 Seattle	Jewelry 1 Seattle Consulting 2 Seattle Consulting 1 Charlotte Consulting 3 Charlotte	8	4	1	3
Property being sold (Repurposed or demolished under new owner as a reason to leave)	Beauty Salon 1 Charlotte Beauty Salon 2 Charlotte Clothes 1 Charlotte	Wholesale 1 Charlotte Fabrics 1 Charlotte Art 1 Phoenix	6	5	1	0

Construction of light rail line	Printing 1 Charlotte Independent 1 Phoenix Fabrics 1 Phoenix	Supplements 1 Phoenix Recreational 1 Phoenix Café 1 Phoenix	5+ 1	1	4	0
Crime (shooting, theft)	Floral 1 Charlotte Fabrics 1 Charlotte	Jewelry 1 Seattle Café 2 Seattle	4	2	0	2
Parking space (loss or intrusion)	Consulting 1 Charlotte Books 1 Seattle	Beauty Salon 1 Charlotte Café 1 Seattle	4	2	0	2
Issues with zoning at TOD neighborhood	Distillery 1 Charlotte Floral 1 Charlotte	Cidery 1 Charlotte	3	3	0	0
Space is too little for the proper functioning of business	Floral 1 Charlotte	Café 1 Seattle	2	1	0	1
Total			51	28	9	14

Some of the issues discussed by the participants included the increasing presence of individuals experiencing homelessness (which was described as disruptive) and a perceived increase in surrounding drug activity may not be unique to the transit location. Yet, among the ten people who mentioned inconveniences for business operations due to the presence of groups they described as undesirable (the most cited issue), two specifically tied the presence and occasional disruptive activities of those experiencing homelessness with the proximity of the nearby transit station. The owner of a beauty salon in Phoenix stated: "The downside of that is a lot of homeless people are riding that Light Rail and they hang out at the platform". The owner of the beauty salon in Charlotte reported that the business had problems with those experiencing homelessness "busting in doors and sleeping inside of there". The owner of the art gallery in Seattle reported that while the presence of those experiencing homelessness was a disruption to the business: "and there's a lot of yelling, a lot of loud noises that are – I think that – well, I know they frighten away

some of the people that would otherwise wanna come here, especially at night", the owner is sympathetic of the situation and supports the activities of the nearby non-for profit organization that provides people experiencing homelessness with food and housing: "they provide food and I think housing among other things for the homeless population in Seattle, which is really awesome." Overall, this perception of disruption on the part of business owners could fit under Chapple and Loukaitou-Sideris' (2017) 'broken windows' category of plausible business deterrents near transit stations.

The second most cited challenge by business owners was increased rent. Nine participants responded that increased rent was a concern. Two participants in Charlotte attributed increases in rents as a reason for them to relocate out of the light rail station neighborhood. One distillery owner noted:

> "We were paying a $7.70 per a square foot and, when the lease came up, they wanted 26…That was huge. We couldn't afford this. So, we immediately told them we couldn't do that, and they already found people who are willing to pay for all that stuff."

A photography business owner in Charlotte similarly reported: "My new rent, they overall raised the rent of most of the tenants, an average of 40 something percent. My rent would have gone up about 90% and I couldn't afford that."

Complaints among the entrepreneurs in economically upgrading transit neighborhoods is not endemic to just Charlotte, Phoenix or Seattle. Small business owners in the California reportedly have been subject to the similar challenges (Chapple & Loukaitou-Sideris, 2017; Loukaitou-Sideris, 2007).

Increased traffic is another concern of participants. Eight business owners remarked that increased traffic was an inconvenience, both for the businesses itself (if it relies on delivery, for example) and for the customers. One restaurant owner in Phoenix connected

this traffic to the light rail: "Longer lights, waiting times, and sometimes having to wait twice as long because of the light, a train coming through where you would wait at the stoplights." One jewelry business owner in Seattle cited a potentially unintended traffic generator in the design of the light rail system:

> "When they designed the light rail station, they didn't put any location for people to be dropped off if they are going to the airport. And there are a few hotels around there, so the hotels have buses, and then cabs to bring tourists to the light rail station, but there is no facility for that. And then also people who are going on vacations and things attempts to drop people off there as well, and they are stymied by that… So, it's made it difficult, and that compounds the traffic."

The poor design of a station based on the previous studies is something that could discourage commercial activities in the neighborhood (Loukaitou-Sideris & Banerjee, 2000; Ganning & Miller, 2020).

Another reason mentioned by participants was purchase of their former rental space – this often resulted in the business moving out of the area because the physical demolition of the property followed with the subsequent construction of a new building that would not accommodate the former purpose. Out of six participants who cited change in property ownership as a reason for relocation, four mentioned that their previous location was partially or completely physically demolished, which made the further occupation of the space impossible: "They actually didn't tear it down. They tore everything down except for the exterior of the building and remodeled it and brought in all corporate" said the owner of the beauty salon in Charlotte. In two cases, an apartment complex was built instead and in two other cases, a new office space emerged. In the case of one art business in Phoenix, the owner had no other options when their former location transitioned into HUD housing.

Disturbances associated with the construction phase of the light rail was another concern among those whose business was in operation before and while the light rail was built. “When the Light rail was under construction; those people were out of business for close to six months. It was horrible.” – said the owner of an art studio. For businesses with fewer competitors in the city (for example, a Fabrics store in Phoenix), the impacts of construction were less acute as they offer fairly unique merchandise, so customers were willing to overcome the burden. Another café owner in Phoenix noted that construction-related disturbances were accentuated by a lack of additional community-based support for surrounding businesses during that phase:

> “There wasn’t a lot of marketing. There wasn’t a lot of signage or things of that nature. So, it’s just the biggest downfall to it is just the lack of the community being able to support the businesses that are along the light rail.”

Along the same lines, new rail construction that created changes in physical infrastructure impeded customers in finding businesses. An art business owner in Phoenix elaborated:

> “When I did have people come to me or if I hosted a class like if I hosted a face painting class; it was a bitch. People couldn’t get to me. The GPS did not help them find me. They didn’t know how to go down the street, make a U-turn, come back around. You know what I mean? It was a ludicrous experience.”

A reduction in parking spaces often accompanies TOD zoning ordinances to encourage people to take the light rail rather than drive. This caused some complaints among business owners who remarked that there were not enough remaining spots for employees or customers. To this end, a café owner in Seattle remarked: “They ended up taking – where you deliver and what not – they take the parking away.”

5.3.3. Perceptions of Transit-Induced Commercial Gentrification

When approached with questions on the overall impression of change in the neighborhood's commercial landscape as a result of the new station (Table 8), 18 participants mentioned that they either have been subject to closures or relocations themselves or they have seen other small businesses closed or relocated over time. One café owner in Phoenix elaborated:

> "So, over 90% of the businesses that were once at the light rail have closed down…And I am talking about local businesses. I am not talking about corporate companies. However, now that we see is a lot of gentrification happening. Larger developers coming in and starting businesses. So, it really does take a toll of small, local businesses."

The owner of a cafe in Seattle that relocated out of the transit area said his business was the last mom and pop store left:

> "In the time that I owned a business, I watched literally all the little "mom and pop" shops – when their leases would burn up, the building owners would just increase the rent to a point where you would have to re-pool your entire business to make sense of how much it would cost to stay there."

The owner of a printing business in Charlotte also noticed that commercial development has a high turnover:

> "A lot of old buildings have been converted to those little shop type things, and those businesses – I don't see many of them lasting very long. They come in, they get a little splash at first, and then, all of a sudden, you wake up one morning, they're locked up and gone... I don't think they're that successful."

Six participants reported that they observed small business being replaced by chain stores but acknowledged that chain stores were not immune to business challenges as they also experienced closures.

While addressing whether businesses received any financial and/or advisory support from the third-party organization, most interview participants responded negatively. One clothing business owner located in the historic district in Seattle argued

that being a part of the district and "protected" by the preservation efforts of a local non-profit that supports businesses helps him to stay afloat:

> "The area that we're in is a historic neighborhood, so there's actually a mandate against opening national brands… So, the only national brands are companies that actually started in Pike Place Market, like the original Starbucks, and Sur la Table, and a couple other small companies that have started here… There is a couple different foundations involved in the preservation of Pike Place Market."

Table 8. Perceived impacts of light rail stations on the adjacent retail

Issues	Businesses		Count	Charlotte	Phoenix	Seattle
Commercial landscape in surrounding neighborhood changing or gentrifying	Art 1 Phoenix Beauty Salon 1 Phoenix Beauty Salon 2 Charlotte Independent 1 Phoenix Fabrics 1 Phoenix Books 1 Seattle Printing 1 Charlotte Cidery 1 Charlotte Wholesale 1 Charlotte	Café 1 Phoenix Recreational 1 Phoenix Jewelry 1 Seattle Café 1 Seattle Restaurant 1 Seattle Beauty Salon 2 Charlotte Consulting 2 Charlotte Clothes 1 Charlotte Clothes 1 Phoenix	18	7	7	4
Small businesses replaced by chain stores	Café 1 Seattle Jewelry 1 Seattle Beauty Salon 2 Charlotte	Photography 1 Charlotte Printing 1 Charlotte Café 1 Seattle	6	3	0	3
Light rail IS NOT a booster for the development	Consulting 2 Seattle (Amazon campus/facilities) Clothes 1 Phoenix (ASU – Arizona State University) Jewelry 1 Seattle (Amazon campus/facilities) Restaurant 1 Seattle (Amazon campus/facilities) Floral 1 Seattle (Amazon campus/facilities)		5	0	1	4
Light rail and gentrification: light rail as a booster for the development	Consulting 2 Charlotte Photography 1 Charlotte	Distillery 1 Charlotte Consulting 1 Charlotte	4	4	0	0
Didn't notice any changes in the TOD neighborhood	Art 1 Seattle	Clothes 1 Seattle	2	0	0	2
Total			35	14	8	13

Five business owners, who argued that the new light rail station had nothing to do with the surrounding changes, suggested that other economic forces were more responsible to ongoing urban transformations. In the case of Seattle, the presence and growth of corporate Amazon facilities was brought up by one consulting business owner: "A lot of that I think is driven by the explosive growth of Amazon."

On the opposite spectrum, four participants agreed that light rail was a catalyst of change in the commercial landscape that took place after the light rail opening. Only two business owners reported that they did not observe any changes in the commercial landscape at all.

Overall, small businesses in transit neighborhoods appear to experience inconveniences and enjoy and benefit from the positive sides that such location might bring. Challenges appear to be more often reported compared to benefits among participants and include concerns that are associated with location in transit neighborhoods as well as non-transit related local trends. The results of this part provide a more in-depth vision of general trends discussed in sections with other two research objectives.

CHAPTER 6: DISCUSSION AND CONCLUSION

Cities across the United States are increasingly using transit projects such as a light rail as a revenue generating tool designed to attract and enable economic development around transit stations (Newman & Kenworthy, 2013; Taylor & Samples, 2002; Ratner & Goetz, 2013; Mackett & Babalik-Suteliffe, 2003; Chatman & Noland, 2014). The resulting increased accessibility, economic activities, and foot traffic around transit stations often lead to higher demand and competition for locations near these stations by both businesses and developers, causing increases in surrounding land values (Nelson et al., 2015; Ko & Cao, 2010; Debrezion et al., 2007, Cervero & Duncan, 2002; Bowes & Inhanfeldt, 2001). This scenario presents a challenge for existing business establishments to keep up with increasing land values or rents, to adjust their business models to align with new economic realities or changing customer base, or to remain open through disruptions caused by the construction phase of the transit project (Portillo, 2017; Meltzer & Capperis, 2016). Businesses that do not survive these disruptions may either relocate to new markets or move to affordable locations, or they may shut their doors, replaced by new establishments that can afford to pay a premium for those locations or that better meet the changing local clientele.

The first research objective of this dissertation took a micro-scale analysis on the dynamics of retail subsectors near transit stations in three US cities: Charlotte, NC; Phoenix, AZ, and Seattle, WA. Using a Location Quotient to capture relative competitive concentrations of subsectors in transit areas compared to the greater metropolitan area, I provide insight on the uniqueness of the transit economy according to different types of stations. Results show that despite the alleged divide between theoretical and practical

perceptions of TOD and other types of stations (Ganning & Miller, 2020), that does not seem to be the case in this study. TOD stations generally attract more establishment types that could be reached by foot and that are more dependent on foot traffic, such as art dealers, bookstores, news dealers and newsstands, while TAD seems to attract more car reliant establishments, such as car dealerships, tire stores, home centers, household appliances, etc.). TOD stations tend to be in the CBD areas, so the patterns of retail around TOD in this case might be caused by proximity to CBD (Bhattacharjee & Goetz, 2016).

The analysis of concentration of retail trade subsector by city revealed a higher presence of arts, crafts, and hobby subsectors in all three cities, though the cities have not seen a significant change in concentration of these subsectors over time, which might be due to these changes taking longer to occur or there is other part of town where these establishments just as likely could be attracted to. The highest locational concentration of these subsectors is mostly driven by establishments such as art galleries, gift and souvenirs stores, bookstores, and newsdealers. Such numbers could possibly point at the fact that some of the transit neighborhoods might be undergoing some sort of cultural shift as these types of establishments have been identified in the previous studies as a "signal" for undergoing neighborhood transformation.

The analysis of retail trends through the prism of location specialization around transit stations might point to some vulnerabilities in certain retail sectors and a competitive advantage, among others. My argument is that retail trade subsectors that are not highly concentrated (LQ = or < 1) or those that have witnessed a declining LQ over the observed period are in a higher risk category. Retail sub sectors with LQ that are greater than 1 are likely to have a competitive advantage in a station area. Likely, there is a demand for this

kind of establishment and the business is likely patronized outside of the immediate location. Meltzer and Capperis (2016) examined retail turnover in New York City and argued that among the different types of retail trade, those that sell necessity and frequently consumed goods (hardware stores, meat markets, grocery stores, fruit and vegetable markets, fish and seafood markets, optical good stores, etc.) are more likely to survive local market shocks or changes in consumer demand compared to those that offer less frequently consumed and discretionary goods (motor and vehicle parts, dealers, electronic stores, building materials stores, sport goods, musical instruments). In this study, I did not find overwhelming evidence to support this notion. Shifts in the retail concentration are likely to occur as stations "evolve" from TAD to Hybrid, and from Hybrid to TOD.

With respect to business survival, results of this analysis indicated that retail establishments located in transit neighborhoods have relatively high 8-year survival rates (up to 40% of establishments survived past 8-year mark) consistent with the establishments that are in similar neighborhoods outside of the transit area (the control group). When accounting for other variables, the result of this analysis suggests that the age of the establishment is the most important factor in determining business survival, meaning that business specific characteristics rather neighborhood related characteristics have a higher potential in explaining the outcome for establishments located in transit neighborhoods. Other significant factors include the size of the establishment and its neighborhood's household income. The key variable of interest, location close to a new transit station was not significant in explaining a small business' probability of closing. This study therefore fails to find significant evidence that new transit stations cause more small businesses to close as compared to similar businesses elsewhere in the city, casting some doubt on the

widespread nature of the transit-induced commercial gentrification hypothesis. A small gap in survival trends between establishments in transit neighborhood and non-transit neighborhoods might indicate that locations close to the light rail stations might be not a contributing factor for survival of retail establishments as was hypothesized. In addition, overall high business survival trends might be explained by a limited observation timeline. Some previous studies indicated that significant transformations might take time to occur, so changes might be not present at the earlier stages of transit line operation. As for the factors that did contribute to exit rates, age and size of establishment were expectedly significant, with smaller and younger establishments having higher failure risks, consisted with prior studies on business survival (Phillips & Kirchhoff, 1989; Bates & Nucci, 1989). Interestingly, household income did not appear to play a significant role in indicating hazard risks. Also, the local context of where the line has been built might play a role. The examined light rail line in Charlotte was built in a formerly industrial neighborhood. While today this area is built up with a big number of apartment complexes, back in 2010, the residential (and commercial) development was not that present. Overall, results of this part of research are in line with those of the first part of the analysis that did not reveal drastic changes in the retail sector or subsector composition of transit areas.

The study conducted by Ray (2017) is perhaps the closest to this part of the dissertation in terms of the methodology used to estimate the survival trends in transit neighborhood. Ray used a logit regression model to estimate the significance of impacts on business survival, and incorporated different sectors, such as wholesale, services, food and entertainments. She also used a different dataset (NETS - National Establishments Time Series) and different time interval (that included the construction phase of the light

rail). The study by Ray concluded that business in transit neighborhood have overall high survival rates when not accounting for various characteristics.

Despite the limited quantitative evidence supporting dramatic retail changes in transit locations, the third research objective sought to understand opportunities and challenges of being located in a new transit neighborhood. Through interviews with 33 small business owners located within a quarter mile of a transit station in Charlotte, North Carolina; Phoenix, Arizona; and Seattle, Washington, I questioned what challenges and opportunities businesses face in the context of the new transit station, and their perceptions of commercial gentrification in the surrounding neighborhoods.

Overall, more challenges than opportunities were raised by participants. As expected, increases in rent was one of the top concerns, and in some instances, such increases were the catalyst for businesses relocating out of that space. Most participating business owners were renting their properties. Concerns about crime and the perception of potential disturbances from the presence of those experiencing homelessness in all three cities were also cited as challenges. The literature is inconclusive on whether new transit stations do lead to increases in crime (Billings et al., 2011; Wu & Ridgeway, 2020), but research has suggested that at least perceptions of crime are heightened around stations which may negatively impact businesses (Spicer & Song, 2017). With respect to comments surrounding the perceived increase in the presence of those experiencing homelessness, this research and the literature does not indicate that the transit system causes such an increase. But these interviews do illuminate that such perceptions or concerns were prevalent among business owners, who cited it as a problem associated with transit.

Other negative impacts reported included inconveniences during the construction phase, zoning changes, a decline in parking, increased traffic congestion, and the selling of a business' rental unit. Many of these factors are consistent with Loukatou-Sideris and Banerjee's (2000) list of reasons why businesses may find transit locations undesirable.

The opportunities associated with the new transit location included increased foot traffic, being close to customers, affordability, and zoning suitability. The cited benefit of foot traffic reinforces the modeling analysis of Ganning and Miller (2020) who note the importance of walkability in predicting an increase in businesses around stations. The latter two may be an artifact of the fact that new transit lines are often located through previously industrial or underutilized land that may be affordable and offer zoning advantages for businesses such as breweries or cideries.

When discussing what changes in the neighborhood participants observed, many business owners remarked on the closure of businesses in the neighborhood. Whether those have been shut down completely or just moved out of the area is hard to say. Several participants directly attributed these changes to the presence of the light rail, while an almost equal group of participants argued that the changes taking place in the neighborhood could be ascribed to other factors beyond the light rail, such as the presence of Amazon facilities and a university. This argument is supported by Ganning and Miller (2020) who argue that other opportunities beyond the physical area of the stations such as access to highways, proximity to other facilities, such as a university, or location at CBD might encourage retail activities. It is also consistent with research on more general neighborhood changes surrounding transit stations that emphasize that transit may serve to accentuate

change when other desirable amenities (walkability, proximity to uptown and to other changing neighborhoods) are also present (Delmelle et al., 2020).

Finally, while only few of the participants reported on the support of third-party organizations, it appeared to be a crucial factor for at least one of the business owners. His small business located in the historic district was protected from competition from large chain stores by the non-profit organizations and historic preservation ordinances, such as PPCOD (Pike/Pine Conservation Overlay District) that prohibit entrance of large retailers and demolition of buildings to preserve the authenticity of the neighborhood. Thus, adding to the antecedents stalling the economic development in transit neighborhoods (Loukaitou-Sideris & Banerjee, 2000), it would make sense to add the active presence of strong business supporting organizations.

The economic impacts of new transit stations have largely been examined from a quantitative perspective, and they have primarily addressed whether new stations serve as an incubator for business creation. In this dissertation research, I took an alternative vantage point and investigated the scale of transit retail development around different station types by calculating Location Quotients of retail stores and subsectors and estimating factors that could be meaningful in explaining the differences in outcomes for different business establishments through a survival analysis. Finally, I examined the opportunities and challenges faced by small businesses located in transit-proximate neighborhoods using analysis of conducted interviews with the owners of small businesses.

Such a triangulation of methods is present in the scholarly research but is not yet common in the studies of neighborhood changes (Loukaitou-Sideris et al., 2019; Hwang &

Sampson, 2014; Chapple, 2009; Hammel & Wyly, 1996; Brown-Saracino, 2017). The benefits of such approach are hard to underestimate. Triangulation of methods (particularly where there is a combination of qualitative and quantitative methods) in the research is a way to enhance the validity of the research findings. By employing qualitative methods, it is possible to add a layer of knowledge that explains the human perceptions, behavioral patterns, attitudes, and meanings; something that quantitative methods alone perhaps would not be able to account for. Another benefit of triangulation approach is that the results of one part could feed the research design of the other. The analysis of interviews might reveal factors that participants have reported as significant (for example, increased rent, or presence of homeless population with disturbing behavioral patterns from the customers' perspectives), that could be further incorporated in the survival model if such data are available.

The business owners that are in the focus of this research are essentially humans. As much as statistical analyses are a useful tool to identify the general survival/exit trends of retail establishments in transit neighborhoods, they are powerless in explaining the perception of changes by their very own victims or beneficiaries. The analysis of survival trends in this study showed that business survival trends are similar both in transit and non-non transit neighborhood with high significance of business characteristics, such as age and size compared to the neighborhood characteristics, such as household income and type of neighborhood (transit/non-transit). This might beg for conclusion that perhaps the location in transit neighborhood does not pay a significant role in determining business success or failure and other characteristics appear to be important in driving these relationships. Relatively high survival rates (40% survival of establishments in transit

neighborhood over the course 8 years since the light rail opening) might point at generally positive survival trends for retail business in transit neighborhoods. High survival trends however have been challenged by business owners with roughly a third of participants reporting difficulties for their business operation encountered in transit neighborhoods that in some cases resulted in unwilling relocation. Of course, due to disproportionate sample sides in all parts of this research, these trends cannot be compared directly with each other, but they can provide context.

Looking at the trends in all three cities together (for research objective # 1 and research objective # 2) instead of just one allows for more in depth understanding of commercial development trends in transit neighborhoods. While the cities share similar population growth as discussed earlier in the dissertation, the way transit development in those three cities takes place is slightly different. When talking about retail concentration around transit stations, Seattle and Phoenix generally have more highly concentrated retail subsectors (LQ > 1.25 compared to Charlotte), with Charlotte retail development more evenly distributed and with more diversified retail environment around transit stations. Charlotte also has fewest small retail establishments around transit stations. However, Charlotte business owners have reported more challenges associated with their operation in transit neighborhoods (28) compared with Phoenix (9) and Seattle (14). It is possible to conclude that while all three lines have relatively similar opening timelines, the development patterns could vary.

Commercial development around transit stations is highly location specific, so future research might need to include a wider selection of cities to explore trends. Future research might further investigate the role of business and non-business-related

characteristics that would further explore the diversity of outcomes for business establishments located near light rail stations. It also would need to investigate the role of local business supporting organization and incentives in business survival. Finally, further research would need to examine to what extent the extrapolation of framework adopted in this study could be empirically supported by studies of similar settings in other cities in the US.

CHAPTER 7: LIMITATIONS

This dissertation has contributed to knowledge gaps on retail dynamics in new transit neighborhoods using a mixed quantitative and qualitative research design. Nonetheless, there are several limitations of this work and areas for future research as discussed below.

One of the most significant limitations of the dissertation is that small businesses are pressured by the ongoing e-commercialization of retail. A most significant byproduct of these trends is that many mortar and brick stores struggle to adapt to the new reality and are at higher risks of bankruptcy. Locations in a transit neighborhood would likely make the survival of struggling retail establishments even more challenging when burdened by the increased rents, construction and operation impacts, change of property ownership, and other inconveniences discussed earlier.

Another overarching limitation that applies to all three parts of the dissertation is that a quarter of a mile buffer around each transit station was selected as the study area, though that might not always be the way TOD zoning regulations are applied. While ¼ mile area selection is common among similar research efforts, some studies suggest that the impacts might spread even further (Ray, 2017). The interpretation of results around TOD stations should also be carried out with caution as in most cases TOD stations are located within the central business districts as seen in Figure 2. Related to that, in some instances, light rail lines run through the parts of town that either have protective ordinances in place designed to preserve the neighborhood character (like Pike Place neighborhood in Seattle), or run-in proximity to the shopping malls and/or airport that often

have their own regulations in place that could impact the development trends on a local level.

Another limitation of this research is how "Retail" is defined. Retail is defined by the categories compiled by NAICS falling under the category "Retail Trade" with 44-45 NAICS codes. In many studies examining retail however, retail is defined as a much broader category that includes services (Meltzer & Capperis, 2016) including food services such as restaurants. Future studies looking at similar patterns might benefit from the inclusion of other categories, such as coffee shops, breweries, and other establishments that are associated with the neighborhood transformation (Zukin et al., 2009).

The part of the dissertation that estimates survival rates has its own limitations. First, when estimating the survival and business failure based on the data used in this analysis, it is not possible to know if a business has closed for good or if it relocated. It is even harder to know what the circumstances of the relocation were. In other words, retail establishments might have voluntarily relocated elsewhere and continue to operate in other locations but are considered a "failure" for the purpose of this research. Also, the Cox proportional hazard model assumes that the risks are proportional and constant over time, making it unrealistic to account for the temporary events, for example, the construction of buildings next to the business.

Data availability for business establishments is another issue that could be possibly addressed with further research. As data was only available for years post light rail stations opening and not prior (during the announcement and construction period), it is hard to fully evaluate the transit induced transit hypothesis. Exploring the commercial landscape prior

to the light rail stations opening would allow for a broader picture of trends in transit neighborhoods.

Part of the research that examines changes in retail concentration around stations of different types has a set of its own limitations that has to do with the selection of case studies. For the research purpose it was important to pick cities that are as similar as possible in their characteristics, such as population and job growth patterns, as well as percentage of population with a college degree. It was also crucial to compare the light rail lines with the similar timelines, while avoiding negative impacts of 2007/2008 that might misguide the interpretations of the results. While selected cities opened their light rail lines around the same time (2007 in Charlotte, 2008 in Phoenix, and 2009 in Seattle), there is still a few years difference between the light rail starts which could impact the results.

The qualitative part of the study has its own limitations. One of the limitations worth mentioning is the sample size of participants who took part in the interviews. The sample size that was eventually included (35) in the study is much smaller compared to the entire group of qualified participants (over 1000). Such relatively small sample selection might introduce a bias in results interpretations. While the attempts have been made to gain the equal representation of establishments across different business types, some types of establishments are more represented in the study than the others. Future studies might want to incorporate a wider pool of participants to account for the business types and the experiences they might live through located in proximity to light rail stations.

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APPENDICES

Appendix A: Retail Establishment Subsectors

Original categories as they appear in the database (66)	3-digit NAICS (10 represented in total)	Suggested subsectors (9 in total)
New car dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Used car dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Recreational Vehicle dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Motorcycle and All other motor vehicle dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Boat Dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Automotive parts & accessories	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Tire dealers	Motor vehicle and parts dealers (NAICS 441)	Motor vehicle and parts dealers
Furniture stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
Floor covering stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
Window treatment stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
All other home furnishing stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
Household appliances stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
Radio, TV and other Electronics + Computer & Software stores	Furniture and home furnishing stores + Electronics (NAICS 442+443)	Home and garden
Home centers	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden
Paint and Wallpaper	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden

Hardware stores	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden
Other building materials dealers	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden
Outdoor power equipment	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden
Nursery Garden and Farm Supply Stores	Building material and garden equipment and supplies dealers (NAICS 444)	Home and garden
Supermarkets and other grocery stores	Food and beverage stores (NAICS 445)	Food and beverage stores
Convenience stores	Food and beverage stores (NAICS 445)	Food and beverage stores
Meat markets	Food and beverage stores (NAICS 445)	Food and beverage stores
Fish and seafood markets	Food and beverage stores (NAICS 445)	Food and beverage stores
Fruit and vegetable markets	Food and beverage stores (NAICS 445)	Food and beverage stores
Confectionary and nut stores	Food and beverage stores (NAICS 445)	Food and beverage stores
All other specialty food stores	Food and beverage stores (NAICS 445)	Food and beverage stores
Beer wine and liquor stores	Food and beverage stores (NAICS 445)	Food and beverage stores
Pharmacies and drug stores	Health and personal care stores (NAICS 446)	Health and personal care stores
Cosmetic and beauty supply stores	Health and personal care stores (NAICS 446)	Health and personal care stores
Optical good stores	Health and personal care stores (NAICS 446)	Health and personal care stores
Food health supplements stores	Health and personal care stores (NAICS 446)	Health and personal care stores
All other health and personal care stores	Health and personal care stores (NAICS 446)	Health and personal care stores
Other gasoline stations	Gasoline stations (NAICS 447)	Gas stations
Men's clothing stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Women's clothing stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores

Children and infants clothing stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Family clothing stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Clothing accessories stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
All other clothing stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Shoes stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Jewelry stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Luggage and leather goods stores	Clothing and clothing accessories stores (NAICS 448)	Clothing, accessories, and sporting goods stores
Sporting goods stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Clothing, accessories, and sporting goods stores
Hobby toy and game stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
Sewing needlework and piece good stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
Musical Instrument and supplies stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
Book stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
News dealers and news stands	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
Prerecorded tape CD and record stores	Sporting goods, hobby, musical instrument, and bookstores (NAICS 451)	Arts, crafts, music, hobby, second-hand and bookstores
Department stores except discount	General merchandise stores (NAICS 452)	General merchandise stores
Discount department stores	General merchandise stores (NAICS 452)	General merchandise stores

All other general merchandize stores	General merchandise stores (NAICS 452)	General merchandise stores
Florists	Miscellaneous store retailers (NAICS 453)	Home and garden
Office supplies and stationery stores	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Gift Novelty and souvenirs stores	Miscellaneous store retailers (NAICS 453)	Arts, crafts, music, hobby, second-hand and bookstores
Used merchandize stores	Miscellaneous store retailers (NAICS 453)	Arts, crafts, music, hobby, second-hand and bookstores
Pet and pet supplies stores	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Art dealers	Miscellaneous store retailers (NAICS 453)	Arts, crafts, music, hobby, second-hand and bookstores
Manufactures mobile home dealers	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Tobacco stores	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Store retailers not specified elsewhere	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Mail order houses	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Vending machines operators	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Other fuel dealers	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers
Other direct selling establishments	Miscellaneous store retailers (NAICS 453)	Miscellaneous store retailers

Appendix B: List of Variables a) Extracted from LDTB Database; b) Calculated Additionally

Variable	Description
popperch	Percent change in population between 2000 - 2010 (full count)
pernhwht00	Percent of Non-Hispanic white population in 2000 (full count)
pernhwht10	Percent of Non-Hispanic white population in 2010 (full count)
nhwhtperch	Non-Hispanic white population percent change in 2000-2010 (full count)
percol00	Percentage of persons with at least a four-year college degree in 2000 (sample based)
perman00	Percent of employed population engaged in manufacturing in 2000 (sample based)
perh30old00	Percentage of structures built more than 30 years ago in 2000 (sample based)
perh10yrs00	Percentage of household heads moved into unit less than 10 years ago in 2000 (sample based)
perhmulti00	Percentage of housing units in multi-unit structures in 2000 (sample based)
percol10	Percentage of persons with at least a four-year college degree in 2010 (sample based)
perman10	Percent of employed population engaged in manufacturing in 2010 (sample based)
perh30old10	Percentage of structures built more than 30 years ago in 2010 (sample based)
perh10yrs10	Percentage of household heads moved into unit less than 10 years ago in 2010 (sample based)
perhmulti10	Percentage of housing units in multi-unit structures in 2010 (sample based)
hinc00	Median household income in 2000 (sample based)
hinc0a	Median household income in 2010 (sample based)

colperch	Percent change in persons with at least a four-year college degree 2000-2010 (sample based)
manufperch	Percent change in people employed in manufacturing 2000-2010 (sample based)
h30oldperch	Percent change in structure built more than 30 year ago 2000-2010 (sample based)
h10yrsperch	Percent change in household heads moved into unit less than 10 years ago 2000-2010 (sample based)
multiperch	Percent change in housing in multi-family units 2000-2010 (sample based)

Appendix C: LQ of Small Retail Establishments Around Light Rail Stations (in Original Categories)

	Charlotte		Phoenix		Seattle	
Industry type	LQ in 2009	LQ in 2013	LQ in 2009	LQ in 2013	LQ in 2009	LQ in 2013
New car dealers	0.76677947	0.243613243	0	0.635028857	0	0
Used car dealers	0.156841255	0.527222691	1.997932154	1.155936586	0.306826179	0.509076256
Recreational Vehicle dealers	0	0	0.642290091	0.958649332	1.186394558	0
Motorcycle and All other motor vehicle dealers	2.300338409	0.614329048	0.751523099	0.420082292	0.197732426	0.566971203
Boat Dealers	2.300338409	2.354928018	0	0	0.050270956	0.050200575
Automotive parts & accessories	0.600088281	1.041126071	0.321145045	0.243764133	0.25791186	0.665818156
Tire stores	0.905051177	1.412956811	1.042206562	0.448289256	0.296598639	0
Furniture stores	1.662895236	1.458536063	0.38182222	0.406383956	0.839430112	0.717370052
Floor covering stores	0.739394489	0.831151065	0.226380934	0.512155123	1.208364827	0.602406903
Window treatment stores	0.985859318	1.345673153	0.541538704	0	0	0.401604602
All other home furnishing stores	2.611194951	1.461679459	1.104738956	0.89017438	0.753266386	0.639724145
Household appliances stores	2.509460083	1.255961609	0.394549627	1.049468742	0	0
Electronic	1.092247015	1.095315357	1.02582903	1.131436595	0.904877205	1.311569459
Home centers	1.380203046	1.145640657	0	0.519268388	0	0
Paint and Wallpaper	0	0.392488003	0	0.429739356	0	0
Hardware stores	1.623768289	1.046634675	0.642290091	0	0	0.535472803
Other building materials dealers	1.17464089	0.97751729	0.083439498	1.124008236	0.441742655	0.672454217
Outdoor power equipment	0	2.018509729	0	0	0	0.602406903
Nursery Garden and Farm Supply	0	0	0	0.315504843	0.659108088	0.301203451
Supermarkets and other grocery stores	0.775394969	0.878108752	1.288862115	1.335261569	0.741496599	0.822108244
Convenience stores	0.713898127	0.726286211	0.670351308	0.614739258	0.338969874	0.455362698
Meat markets	2.300338409	0.883098007	0.952361169	0.977446378	1.395758303	1.807220708
Fish and Seafood markets	0	0	0	0	0.889795918	0.705256862
Fruit and vegetable markets	2.300338409	1.009254865	4.315386546	2.121266607	2.175056689	1.347757816
Confectionary and nut stores	1.53355894	0.642253096	1.062248996	1.017342148	2.610068027	1.902337588
All other specialty food stores	2.208324873	1.378494449	1.440963855	1.723529118	1.402102659	1.387945504
Beer wine and liquor stores	0.418243347	0.799786874	2.101405622	1.917298664	0.631060935	0.856051915
Pharmacies and drug stores	0.966142132	0.851178802	0.758749283	0.929402403	0.488515406	0.711935431
Cosmetic and beauty supply stores	0.76677947	0.728328253	1.255385177	1.510598947	1.73015873	0.531535502
Optical good stores	0.920135364	0.724593236	1.741705561	1.661658842	1.395758303	1.095285278
Food health supplements stores	0.707796434	1.103872508	1.170274318	0.952543285	0.847424684	0.737641105
All other health and personal care stores	0	0	1.380923695	1.347290953	0.296598639	0.498543644
Gasoline stations	0.644954694	0.63078429	1.022906441	1.148612103	0.539270254	0.507290023
Men's clothing stores	0.405942072	1.246726598	0.431538655	0.647399549	2.711758989	2.357244402
Women's clothing stores	1.380203046	1.412956811	0.722051605	0.950525185	1.844394901	1.481696481
Children and infants clothing stores	0	0	0	0.530316652	0.494331066	0.570701276
Family clothing stores	0.265423663	0.751572772	0.789099254	0.434736325	1.847663656	1.704925197
Clothing accessories stores	0.418243347	0.985783821	0.952361169	1.410842413	1.031647442	1.153545133
All other clothing stores	0.896235744	0.432537799	1.878807748	1.450654545	1.330535953	1.239237057
Shoes stores	0.368054146	0.324817658	1.347242629	1.015040469	1.140763998	1.530822247
Jewelry stores	0.673269778	0.49577432	2.312877124	1.379924298	2.11856171	1.776239782
Luggage and leather good stores	0	0	0	0	2.281527996	3.16263624
Sporting good stores	0.920135364	1.123942918	0.638577431	1.258832456	0.523409364	0.295056442
Hobby toy and game stores	0.418243347	1.345673153	0.583488885	0.611653561	0.835489125	1.192393045
Sewing needlework and piece good stores	1.452845311	1.766196013	0.789099254	0.461571901	0.269635127	0.570701276
Musical Instrument and supplies stores	0.76677947	0.565182724	1.200803213	1.947256455	1.078540507	0.637842603
Book stores	2.905690622	1.059717608	2.274462556	2.01413193	0.988662132	1.341442175
News dealers and news stands	6.901015228	4.238870432	0	0	1.694849368	1.606418408
Prerecorded tape CD and record stores	1.061694651	0	2.180405834	0	0.926870748	0
Department stores except discount	1.53355894	0.706478405	0.952361169	2.01007118	2.372789116	1.686739328
Discount department stores	0	0	0.642290091	0.70210937	1.977324263	1.606418408
All other general merchandize stores	1.104162437	0.883098007	1.306279171	1.107772561	1.026687598	0.765411124
Florists	1.932284264	1.895429868	2.008616283	1.557805164	1.412374474	1.15150346
Office supplies and stationery stores	1.104162437	1.367377559	1.255385177	1.068209256	1.977324263	1.642927917
Gift Novelty and souvenirs stores	1.394144491	1.97398378	2.14281263	1.129001652	1.262936142	1.665292381
Used merchandize stores	1.971718637	1.273977452	1.083077408	1.405538494	1.194633409	1.020548165
Pet supplies	2.587880711	0.588732004	0	0	0.282474895	0.481925522
Art dealers	2.587880711	3.163336143	0.673621315	2.020936429	2.432108844	1.786448057
Manufactures mobile home dealers	0	0	0	0	0	0
Tobacco stores	0.920135364	1.177464009	1.290582892	1.175702011	1.355879495	0.937077404
Other Store retailers not specified elsewhere	1.136637802	0.825084269	0.753231106	1.167441809	0.554788822	0.931557066
Mail order houses	0	0	0	0	1.694849368	2.409627611
Vending machines operators	0	0	0	0.44508719	0	1.032697548
Other fuel dealers	0	0	0	0	0	1.807220708
Other direct selling establishments	1.200176561	0.642253096	0.812308056	0	0	0.258174387

Appendix D: LQ of Small Retail Establishments by Station Type (in Original Categories)

	TOD		TAD		Hybrid	
Industry Type	LQ in 2009	LQ in 2013	LQ in 2009	LQ in 2013	LQ in 2009	LQ in 2013
New car dealers	0	0.205795357	0.637559692	0.461843069	0	0
Used car dealers	0	0.142560057	1.971247552	1.421916843	0.693761765	1.071108162
Recreational Vehicle dealers	0.410865128	0	0	0.550742439	2.402938476	2.074329187
Motorcycle and All other motor vehicle dealers	0.24696811	0.414857307	0.86401532	0.620677987	0.722194624	0
Boat Dealers	0	0	0.236698808	0.201560377	1.582773846	0.759161713
Automotive parts & accessories	0	0.13518626	1.230146294	0.943858594	0.274194224	0.253926504
Tire stores	0.094156592	0.067015411	0.823514602	1.203160405	0.550673401	0
Furniture stores	0.946204174	0.519523142	1.168335987	1.016431382	0.325521222	0.900779035
Floor covering stores	0.974033709	0.399023059	0.681529326	0.895481981	0.569662139	0.562127375
Window treatment stores	0	0.300413912	2.027112867	0.898912947	0	0
All other home furnishing stores	0.774774241	0.738827148	1.581148036	1.105377051	3.020836941	1.040829486
Household appliances stores	0.185226082	0.309301898	0.972017235	1.388262006	1.083291936	0
Electronic	0.983978797	1.444785666	1.246400479	1.117220377	1.587526921	1.006242916
Home centers	0	0	1.838544228	1.564108527	0	0
Paint and Wallpaper	0	0.205795357	0.434381329	0	0	1.159664349
Hardware stores	0	0.399023059	1.540079256	0.596987987	0	0
Other building materials dealers	0.087081241	0.821761062	0.685468802	0.869615554	0.509293319	0.677656621
Outdoor power equipment	0	0	0	1.184930702	0	4.462950675
Nursery Garden and Farm Supply	0.232964763	0.159365917	0.40751238	0.238431178	1.362490888	0.898032758
Supermarkets and other grocery stores	0.666267775	0.734157594	1.262587498	1.263149443	1.948328494	1.654801936
Convenience stores	0.35972996	0.265677361	0.743665864	0.944029924	0.573784151	0.561413109
Meat markets	1.738275541	1.502069561	0.760167325	1.34836942	0	0
Fish and Seafood markets	0.684775213	1.375579493	0	0	0	2.583813548
Fruit and vegetable markets	2.990856446	1.960200777	2.906522125	1.303423773	3.887106358	3.681934307
Confectionary and nut stores	3.766263673	2.158019204	0.658811682	0.717480976	0	0
All other specialty food stores	4.519516408	2.067255057	0.790574018	0.773217492	1.585939394	1.664151099
Beer wine and liquor stores	0.525525164	0.785202028	1.6087262	2.01387364	0.768381489	0.632091726
Pharmacies and drug stores	0.431016551	0.705187463	0.753953423	0.923166922	1.440453582	0.993439273
Cosmetic and beauty supply stores	0.736877675	0.475200188	0.644489689	1.421916843	0	0.892590135
Optical good stores	2.353914796	1.258400499	1.441150554	1.303423773	0.688341751	0.545471749
Food health supplements stores	0.470782959	0.677600269	1.029393253	0.724124318	1.376683502	2.181886996
All other health and personal care stores	0.189895647	0.305684332	0.996521872	0.686012512	1.110601816	2.583813548
Gasoline stations	0.059624227	0.176993298	1.460163094	1.412287609	1.394845553	0.997363695
Men's clothing stores	3.737945901	2.663542457	0	0.498123735	0.993696362	0.938072435
Women's clothing stores	2.74666743	1.672322418	0.982757757	0.857829174	0.365087337	1.884719572
Children and infants clothing stores	0.557964989	0.719339735	0	0.358740488	0	0
Family clothing stores	0.714548049	1.826710402	0.781199623	0.630688922	0.522377929	0
Clothing assessories stores	1.319566834	2.796445553	0.577061327	1.126415606	1.929366659	0.606079721
All other clothing stores	1.775036656	1.346586014	1.194220571	1.098905288	1.597119229	1.034735637
Shoes stores	0.998000469	1.197069177	0.872873522	0.895481981	0.833827231	0.374751583
Jewelry stores	1.992230154	2.034810495	1.593096258	1.082428046	0.332900796	0
Luggage and leather good stores	2.421169504	3.267001295	0	0	0	4.602417883
Sporting good stores	0.581080681	0.638661907	0.790574018	0.735013406	0.755209235	1.38418583
Hobby toy and game stores	0.551160538	1.038516968	0.160685776	1.165312644	0.537242342	0
Sewing needlework and piece good stores	0.297336606	0.675931302	1.040228971	1.34836942	0	0
Musical Instrument and supplies stores	1.164823816	0.998828422	0.40751238	1.494371204	1.362490888	0
Book stores	1.412348877	2.214916132	0.673784675	0.828447313	2.252754821	1.248113324
News dealers and news stands	6.779274611	5.227202073	0	0	0	0
Prerecorded tape CD and record stores	1.633560147	0	2.381247043	0	1.592308628	0
Department stores except discount	3.766263673	1.166786177	4.117573011	2.094788206	5.506734007	2.629953076
Discount department stores	1.434767114	1.089000432	2.509758788	0.814639858	2.097803431	0
All other general merchandize stores	0.575211179	0.456745812	0.718703653	1.44262437	1.441763085	0.85792644
Florists	1.824020075	2.081629144	0.886293742	0.34604171	2.370611949	4.344465258
Office supplies and stationery stores	1.457908519	1.274927335	0.425039795	1.271632949	1.421092647	2.394754021
Gift Novelty and souvenirs stores	1.720392048	1.830372061	1.138686857	0.955278009	1.903562373	2.398654271
Used merchandize stores	0.941565918	0.749419652	0.988217523	1.541684032	0	1.055751772
Pet supplies	0.410865128	0.604300818	0.359351826	0.226027244	1.201469238	0
Art dealers	5.355496321	3.861001531	0.685468802	0.777610773	0.763939978	3.347213006
Manufactures mobile home dealers	0	0	0	0	0	0
Tobacco stores	1.151469148	1.038516968	1.258875825	0.906354279	0.841793734	0.487673418
Other Store retailers not specified elsewhere	0.652637748	0.793045169	0.856217348	1.186493935	1.19279437	0.7771893
Mail order houses	0	2.119135975	1.317623364	0	0	3.980469521
Vending machines operators	0	0.32670013	0	0.488783915	0	0
Other fuel dealers	0	1.633500648	0	0	0	0
Other direct selling establishments	0.322822601	0.242000096	1.129391454	0.362062159	0	0