Public transport and downtown improvement: a Phoenix case-study

Foeke Boersma
s2756188

University of Groningen, Faculty of Spatial Sciences
MSc Economic Geography – MSc Thesis
July 10, 2019

Supervisor: Paul Van Steen

Abstract

More and more American cities are implementing a transit system with the expectations to impact economic activity in a positive way. This research identifies causes for the increasing popularity of implementing public transit systems. The goal of this research is to examine the spatial-economic effects of light rail in Phoenix, Arizona. Areas which are impacted by light rail are compared to areas that are not influenced by light rail. Three time periods are examined: one period before implementation; a second period after the opening in 2008 that also is influenced by the economic recession of 2008 and a second operating period which consists of 2012-2015. It is argued that light rail functions as a complementary instrument next to for instance the implementation of a stadium, convention center or university campus. Therefore, effects of light rail are hard to separately identify from other effects. Also, trends such as a changing demography and housing market influence Phoenix local economy, with or without light rail. Quantitative data shows that many businesses struggle during (and due to) light rail construction. Moreover, many areas are not operating better in terms of economic activity after the opening of light rail, both in total jobs and retail. The recession-effects influences and limits effects of light rail. Experts however argue that quality is (also) important in determining light rail success. This quality translates into the attraction of certain (high value) businesses, retail and residency (mixed use) creating high density areas. High density- and mixed use areas should be promoted in order to let light rail effects become more apparent. Experts argue that clear effects still take time to unfold, some argue it will take decades. Areas that are not impacted by light rail will continue to grow since land is cheap and abundant.

Contents

Chapter 1: Backgrounds and organization of the research

1.1 Introduction

American cities have undergone drastic changes in the last century. Whereas cities were first compact and clear, they now have become systems of urban sprawl and complexity. This transformation from clear to complex had several causes and has several consequences.

Economic development first happened mainly in the downtown. The process of suburbanization led people, (retail-)services and thus jobs to move away from the downtown to centers elsewhere in the periphery. Today, economic development happens at many places within a city, or better defined, metropolitan area. Another important process was the increasing popularity of the automobile and the politics associated with it. This suburbanization along with the transport evolution caused downtowns to lose value and becoming less attractive, leading downtowns to become places that people avoided. The status of the downtown is described by Jane Jacobs (1961) as follows: “Civic centers that are avoided by everyone but bums, who have fewer choices of loitering place than others. Commercial centers that are lackluster imitations of standardized suburban chain-store shopping. Promenades that go from no place to nowhere and have no promenaders. Expressways that eviscerate great cities. This is not the rebuilding of cities. This is the sacking of cities.” (Jacobs, 1961, p4).

As a result (local) governments reacted to this downfall of the CBD, which was (and arguably still is) the heart of a metropolitan area (Carey, 1988). One of the main aims of these policies is to revitalize the downtown. To revitalize this downtown, economic development should be offset by different policy implementations. One of the policy implementations is to encourage the use of public transport. Whereas the street car system was removed and replaced by car-friendly infrastructure, more and more American cities are implementing public transport systems (again) in order to trigger economic development in places where it is (mostly) needed. Phoenix is one of those American cities. It is also one of the more recent cities in the United States to implement such a public transport system, the Valley Metro Rail.

Phoenix can be considered to be a more recent “mega-city”. To illustrate, the population of Phoenix increased from 107,000 in 1950; 790,000 in 1980 to 1,446,000 by 2010 (figure 1) (Heim, 2001; Phoenix, 2012).

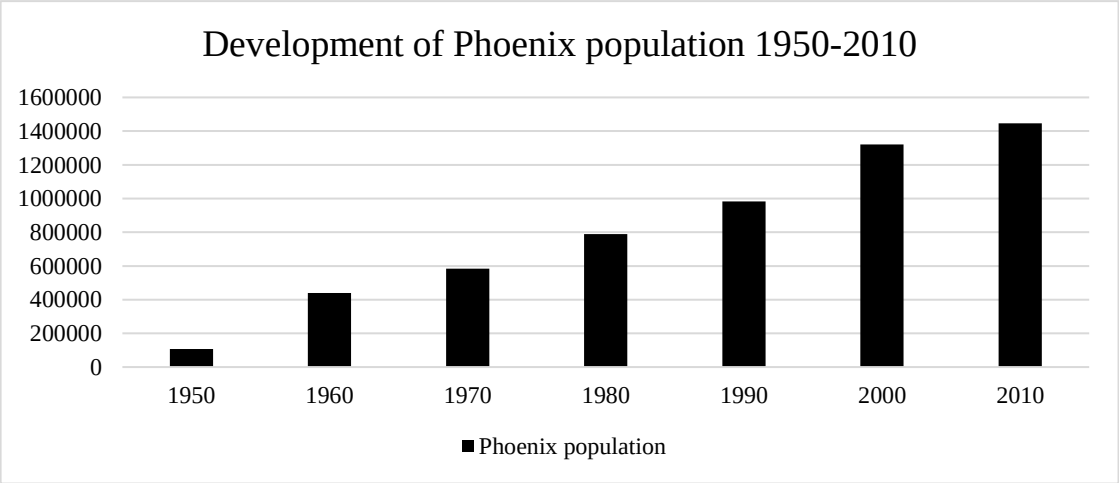

Figure 1: The development of Phoenix-population (Heim 2001; Phoenix, 2012)

Credit (2018) argues that Phoenix is one of the key representatives of the American Sunbelt. This American Sunbelt can be classified as a system of cities in the south west which experience the largest gains in population since the Second World War but often without investment in fixed transit infrastructure. Rather, these cities rely heavily on sprawling and automobile-orientated development patterns (Economist, 2017 in Credit, 2018). The downtown did not grow in line with the population of the city as one of the local goals is to "..support revitalization of center city and downtown districts..", indicating the downtown of Phoenix (Maricopa Association of Governments 2000, p. 164-165; in Heim, 2001). With the entrance of light rail in 2008, economic development should be set off in areas that are directly served by light rail (Knowles & Ferbrache, 2016; Valley Metro, 2018b). According to Knowles & Frebrache (2016), transport plays a critical role in facilitating the regions competitiveness whereby locations with poor quality transport are at a competitive disadvantage.

1.2 Research Problem

Given the (economic) development goal of investing in light rail (expansion), that can be found in the literature and can be heard by many city governments, the goal of this research is to analyze the spatial-economic effects of the Valley Metro Rail on downtown Phoenix, Arizona. The economic effect will be measured in terms of number of jobs and retail activity.

Thereby, the main question is: "Does the Valley Metro Rail in downtown Phoenix, Arizona have positive economic effects? And where, in downtown, can these effects be observed and to what degree can they be attributed to the Valley Metro Rail?"

which consists of the following sub questions:

1.a. What was the economic performance of the downtown area of Phoenix in terms of total jobs and retail activity prior to the implementation of the light rail system?

1.b. Was the economic performance of the downtown area different between the area where the light rail stations were to be built and the area that was not to be directly serviced by the light rail stations?

2. What was the economic performance of both parts in downtown at the time of the opening of the light rail stations?

3.a. Is the economic performance today of the downtown area adjacent to the light rail stations different from the economic performance of the area not directly serviced by light rail?

3.b. To what degree can this difference, if existing at all, be attributed to light rail?

4. Which recommendations for light rail induced economic development can be deduced from this analysis of downtown Phoenix Arizona for other comparable cities?

1.3 Structure

Theories about the evolution of the downtown and the uprising of (public transport) policies will be further discussed in chapter 2; the research design is elaborated in chapter 3; results are presented in chapter 4 for both total jobs and retail activity; chapter 5 summarizes the study on public transport and downtown improvement. Moreover, chapter 5 evaluates on the research, thereby giving implications for further research.

Chapter 2. Theoretical background

2.1 The evolution of the downtown

Downtowns are considered to be very important for the economy and performance, as well as the image of a city. It may even be that downtowns are the success factor for the overall identity of a city. Unlike suburban shopping malls or office complexes, American downtown districts were not created in a particular era. Rather, downtowns evolved gradually over time, and this evolution was influenced by changing technologies and socioeconomic patterns (Robertson, 1995).

The American downtown experienced a flourishing period in the beginning of its existence. In the beginning of the twentieth century, downtowns were shaped by pedestrian traffic and mass transit, especially the electric streetcar (Muller 1980; Robertson, 1995). The streetcar systems helped the downtown with making it the most accessible part of the city. This was done by focusing the streetcar network on the downtown. As a result, thousands of shoppers, workers and visitors used the streetcar as a transport mode for accessing the downtown district. The downtown or central core was high in its density. Destinations within the downtown were almost always easy to walk to except for some already large cities such as New York or Chicago. In the 1920s, downtowns could thus be defined as centers of concentrated activity, good accessibility, high land values and hosting the full spectrum of economic activities (Robertson, 1995). The main economic activities of this period in this area consisted of retailing, offices/finance and entertainment. Retailing became the dominant component in the metropolitan areas with major department stores and many specialized shops in the downtown district. Office/financial activity developed early as well. This was due to an expanding industry which needed more space for management functions; locations near support offices (e.g. printing, banking etc.) and competing or complimentary businesses became in demand. Thereby, the search for impressive buildings at prestigious business addresses started off. It was no wonder that skyscrapers emerged and were more and more defining the downtowns (Gottmann 1966; Robertson, 1995). Entertainment was also one of the functions that flourished in the downtown at the beginning of the twentieth century. The entertainment industry such as movie houses, theaters, sports arenas, restaurants, bars and museums were drawn by the volume of potential customers.

The flourishing period of the 1920s would come to an end as the downtown, halfway the 20th century would steadily decline. Downtowns turned into old areas during the postwar period. Due to the Great Depression in the 1930s, investments in (downtown) real estate did not or barely happen. The second world war stymied subsequent building activity. Downtowns also dealt with downturns in property taxes which cut services (Birch, 2009).
Housing developers foresaw the demand and need to accommodate new family formations. At the same time, amenities suited for these new family formations were offered at these new locations that were outside the downtown (Carey, 1988). Continuous decentralization caused downtown functions to relocate to surrounding suburbs which was particularly the case since World War II. The development of the automobile allowed activities, that previously had been exclusive in downtowns (e.g. department stores, movie theatres, business offices, hotels) to follow middle-class residents to suburbia. To illustrate, downtown retail sales still accounted for nearly 20 percent of the nationwide metropolitan total in 1954. In 1977 however, this percentage was reduced to 4 (Robertson, 1983; Robertson, 1995). Just like the retail industry that followed the flight to the suburbs during the late 1950s and 1960s, employment centers shifted from the historical downtown to the suburban office campuses (Carey, 1988). Carey (1988) states that the retail sector in many cases represents less than

15 per cent of a city's commercial space. A substantial part of the downtown's image is however derived from it. Carey further explains that the department and specialist stores that left the downtown locations created vacant storefronts which can be considered as an early indication of the decay of American cities. A domino effect took place where potential office or housing developers avoided locating at places that were characterized by a high percentage out of businesses (Carey, 1988).

During the late 1970s and for most of the 1980s, US downtowns were struggling economically and socially. Department stores were closing, while out-of-town malls were opening and expanding, leading to downtowns becoming 'redundant spaces', in the words of Anderson et al. (1983).
That the erosion of many American city-centre districts is continuing in the 1970s and 1980s, is further illustrated via a survey that was conducted by Grubb & Ellis in 1985. With this survey, sales in the downtown of Dallas, Texas were measured that accounted for 31 per cent of the total metropolitan area in 1970 whereas this percentage was taken back to just over 3 in 1985.
Another result was that downtowns became less pedestrian-friendly. The distance between activities within the downtown increased making them less walkable; streets for automobiles widened (for more capacity) which caused sidewalks to narrow; walking became less of a pleasure due to less activities on street (e.g. other pedestrians, shops etc.) and it became more dangerous due to heavy traffic and an increase in criminal activities in downtowns (Robertson, 1995). As a result, downtowns became more and more characterized by "dead spaces". These "dead spaces" can be defined as uninteresting parking lots, ramps, blank-walled office buildings and vacant buildings. These vacant buildings could have indirect effects as Robertson (1995) points out that vacant and underused buildings have a negative effect on the areas around them. As a result, other downtown activities diminished. Moreover, fewer people made use of mass transit as both the number of jobs and the retail sector in downtowns declined (if not in absolute terms, than definitely in relative terms). This caused the influence of mass transit to fade. Carey (1988) argues that it has taken less than three decades to destroy the heartbeat of many American cities while at the same time it takes a century to repair the damage.

It is not easy to give a clear view on the current state of the North American downtown. This may be worrisome, given the opinion of Ford (2003) that the downtown has the most potential for the creation of truly unique and exciting places. Even though edge cities have been formed that can function on their own, successful downtowns have more to offer in terms of variety than the largest mega malls and theme parks that can be found more in the edge cities. As Ford puts it: "downtowns tell us who we are, where we have been, where we are going, and at what speed".

2.2 The evolution of the Valley Area

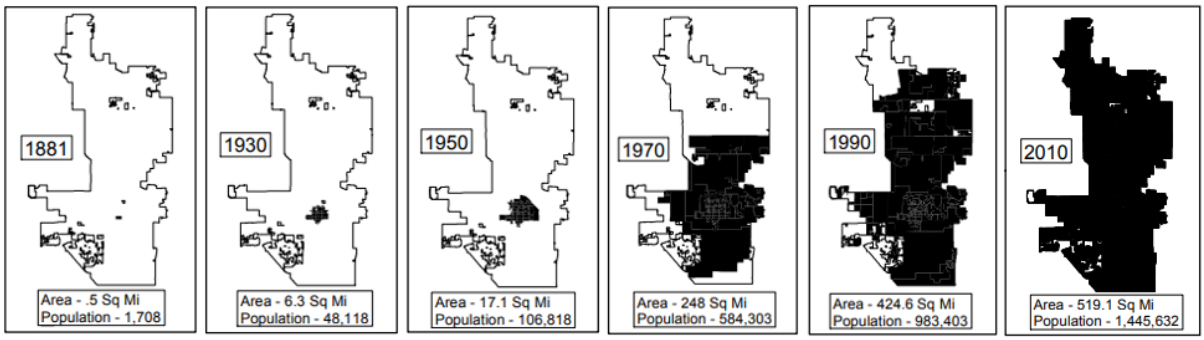

Figure 2: Evolution of Phoenix area in terms of area surface and population (Phoenix, 2012)

The evolution of the Phoenix-downtown follows similar developments as the national standards throughout most of the 20th century (Kane et al., 2014; AZ Central, 2018A). The downtown of Phoenix became a term in the early 1890s. In the next two decades, businesses quadrupled which stimulated a cluster of small businesses and a pattern of specialized land that can be defined as the "central business district" (Van Der Meer, 2010). The downtown emerged to a compact form until the 1950s. Hereby, insurance, real estate and finance grew numerous and became more clustered. Retail sales were the highest per capita of any city that has a comparable size within the United States (Van Der Meer, 2010). Figure 2 shows the expanding boundaries (i.e. suburbanization) of Phoenix that had its effects on the downtown.

First, the downtown district functioned as a vibrant and accessible public space during the 1930s and 1940s. Here, people from different social and economic classes came together and engaged in different commercial and noncommercial activities. Although they were not skyscrapers, the Phoenicians perceived the substantial structures that were built in the 1920s as new, different and a virtual connection to a larger, grander public world (Van Der Meer, 2010). Public buildings were not intended to only be functional, but also create a sense of public presence. The streets and sidewalks were places where people talk, look, walk and meet. Another important aspect of the downtown in this era was the access to the new consumer commercial culture which people could attain by streetcar, automobile or walking. There was a big increase in consumer goods and a large variety of styles and prices that were offered by for example department-, shoe- and clothing stores. Next to purchasing goods, people could eat at one of the many lunch counters, bars and/or restaurants. The entertainment sector was also present with a movie theater for instance. The combination of the public places with an expanding consumer economy resulted in a downtown that was a place for people to be, where they went expecting to see others and to be seen (Van Der Meer, 2010). Phoenicians, as the people from Phoenix are called, share the common view that "every American city, large and small, had to have a downtown" and that "a prosperous downtown was as vital to the well-being of a city as a strong heart was to the well-being of a person" as was described by historian Robert Fogelson. The expectations and goals were tied to this view for the following decades while the specific historical conditions that created this downtown structure would not persist past the 1960s (Van Der Meer, 2010).

A new period arose after World War II that was characterized with a rising prosperity, growth and social change. Some of the growing population moved to cities but a dominant share went to the suburbs (Van Der Meer, 2010). This urban sprawl became criticized as an unregulated process of noncontiguous growth, wasteful land use, dependence on cars and a weak connection with other built areas, mainly city centers. There were several consequences such as the decentralization and the decline of the downtown and the increasing dependency on cars which in its turn increased gasoline consumption and pollution while at the same time diminished both pedestrian and public transportation (AZ Central, 2018A; Van Der Meer, 2010).

Another trend at this time was the expanding variety of other types of commerce and greater spending in suburban malls (figure 3). As an example, suburban downtowns offered 629 stores with 830,000 square feet of shopping in total in 1961. Another important event happened in 1957: the opening of Park Central Mall. This event initiated a massive construction of malls. Seven malls had opened in north central Phoenix by 1963. These malls together offered four times the commercial space available in downtown Phoenix (Van Der Meer, 2010) (see figure 3 & 4).

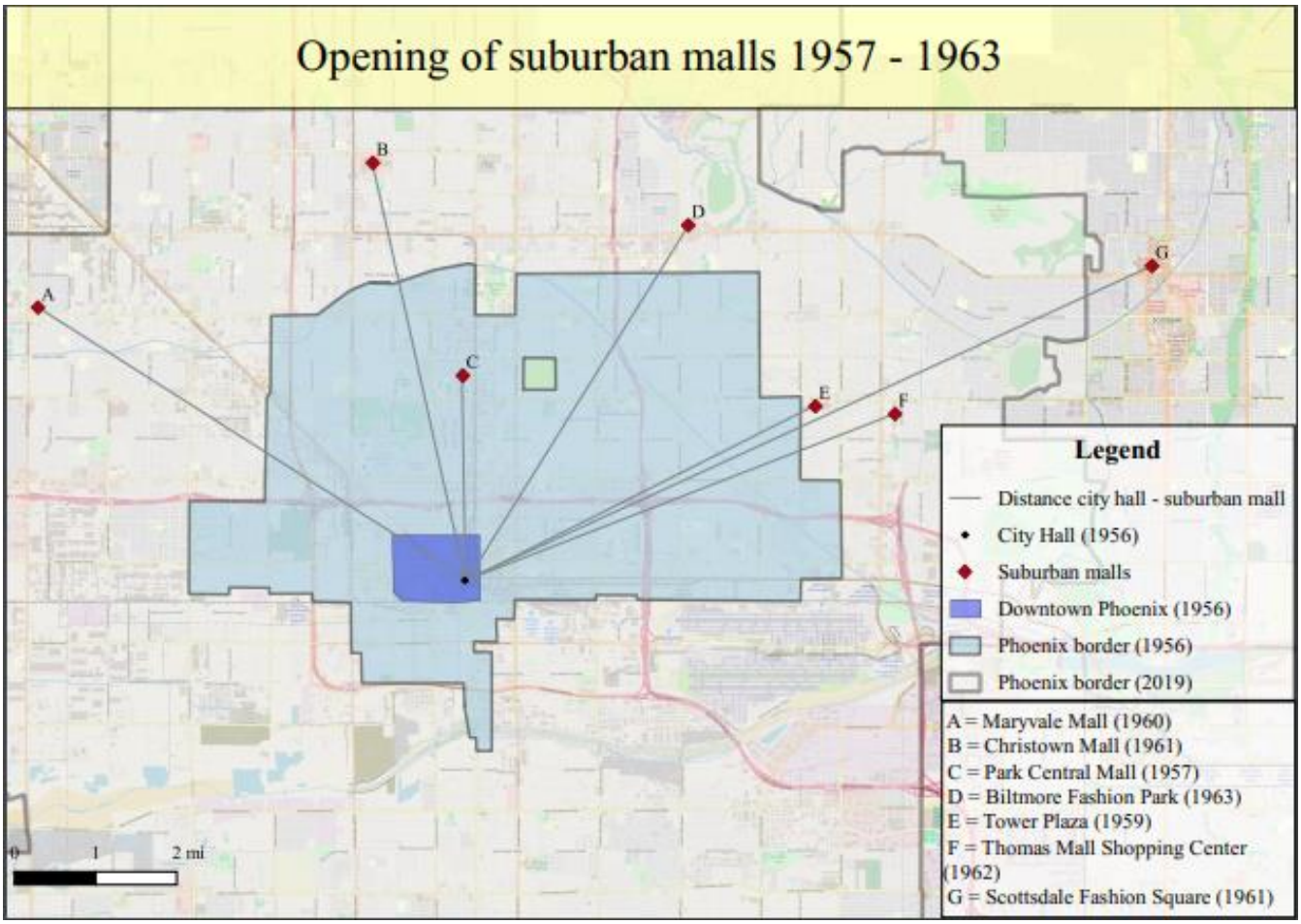

Figure 3: The opening of seven suburban malls, north of downtown Phoenix in the period of 1957-1963 (Van Der Meer, 2010; Wikipedia, 2019)

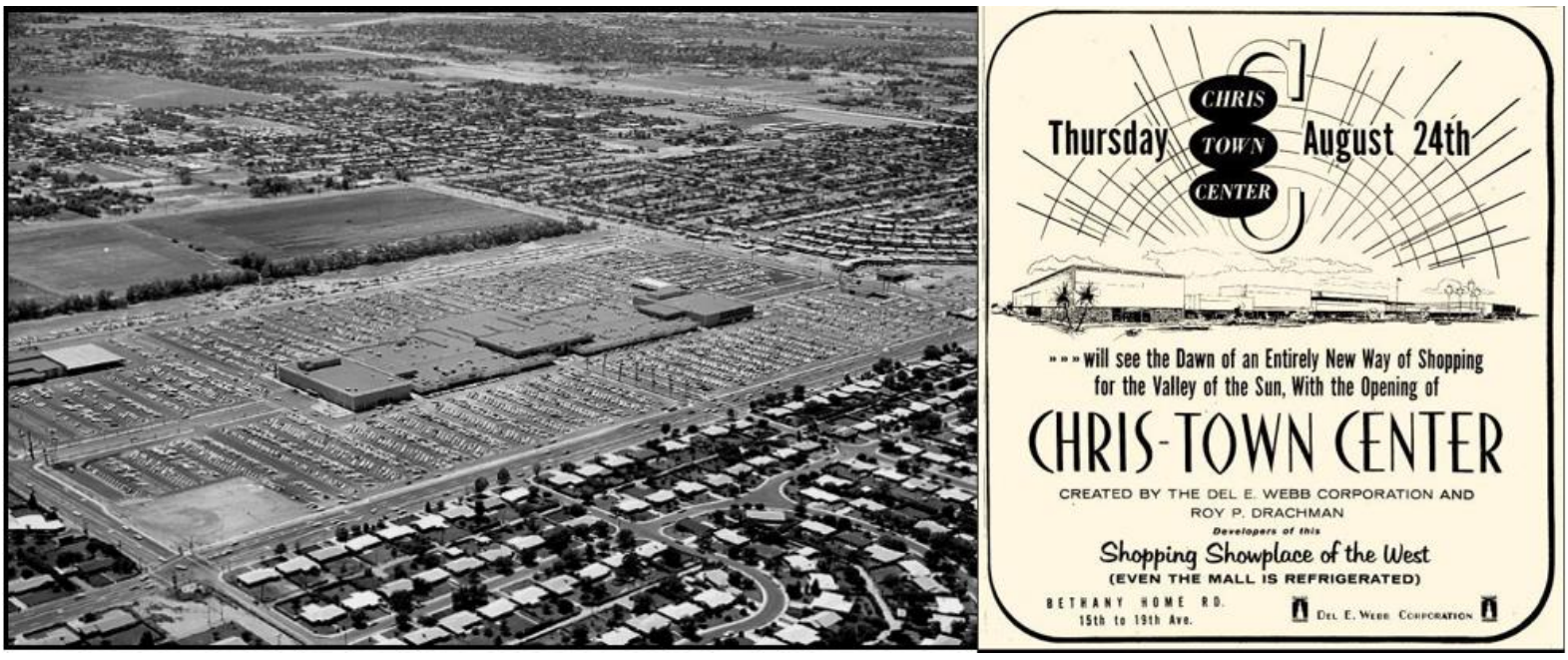

Figure 4: Christown opened its doors for the first time at 10:00am on August 24, 1961. An estimated 130,000 visitors arrived in the 11 hours between opening and closing that day. (http://www.chris-town.com/)

The malls were envisioned as being a sort of "suburban downtown". The decline of the downtown, relative to other places in the metropolitan area is supported by data: From 1948 to 1963, the downtown of Phoenix saw its share of retail sales drop from 35% to 7.7% (Luckingham, 1989; Kane et al., 2014). Also, land use types in the downtown core changed due to the suburbanization forces. Phoenix's downtown could be seen as a ghost town at night and on weekends in the early 1990s as AZ Central (2018a) writes that "workers in the area jumped in their cars and left at quitting time. There were few places to live in Phoenix's core and little shopping or restaurants to keep people around after work". The Phoenix downtown also had the cheapest parking of any major city in the US in that time. This was due to the many vacant dirt lots in the area (AZ Central, 2018a).

Gammage (2003) states that the emergence of the automobile along with malls and suburban strip developments removed the need for Phoenix's CBD to continue its consumer-retail function. Now, there are other centers that have emerged such as several municipal downtowns, a diversified "metrocenter" northwards of the CBD and a cluster of activity around the region's airport, Sky Harbor (Gammage, 2003). In Phoenix, population, urbanized area and vehicle miles travelled have increased rapidly in the past 50 years (Atkinson-Palombo, 2010).

While the downtown of Phoenix has seen a decline in vitality in the past decades, it is changing to a more attractive place again, despite the suburbanization, according to several experts and literature. Today, the downtown of Phoenix is nearly unrecognizable from the downtown 25 years ago. Large investments have been done that caused "a revolution within the downtown" as Jon Talton – a Phoenix historian and former Arizona Republic columnist – puts it (AZ Central, 2018a).

2.3 Failing governance that facilitated decay

Suburbanization and the increasing importance of the car were important factors that created room for the decay of the downtown. Next to these two, governance also played an important role in the decay of the downtown by overestimating the independence of the downtown, focusing on the automobile in facilitating the downtown and failing attempts to improve the downtown (figure 5). Each cause will be further elaborated in this section.

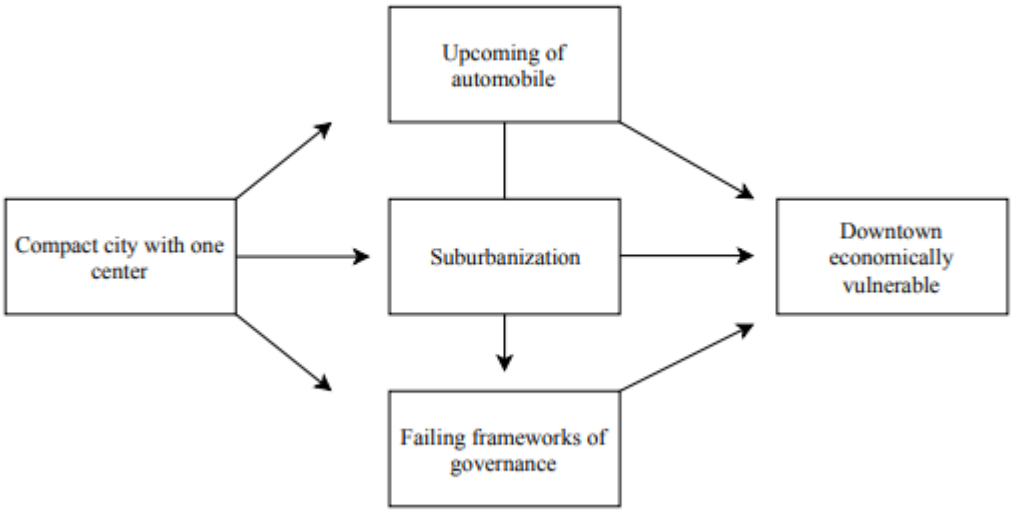

Figure 5: process of the downtown from being a compact and livable center to being a vulnerable center with the forces that influenced this transition (Abbott, 1993).

Local governments reacted slowly to the decay of the downtown. Abbott (1993) predicates that there still was an assumption that everybody wanted to go to the downtown between 1945 and 1955. Based on this assumption, the focus of planning activity was on improving access and circulation with regard to the city centre. The downtown was taken as a given – as a unique and essential element within a metropolitan structure. As a result, plenty of American cities offered broadly inclusive programs for capital investment with little special targeting for the downtown in their postwar development plans. In the 40s and 50s, it was not assumed that the downtown would be a place that could cause trouble for planners. This was demonstrated by sociologist Donald Foley who concluded that there was little to no substance of notion that suburban dispersion was threatening the existence of central business districts. Further literature and experts stated that the downtowns were the "only focus" and "only cites" for essential urban activities (Abbott, 1993). No explicit attention was given to the CBD.

Another factor that led to the decay of the downtown was a focus on the wrong instrument for facilitating downtown development: the automobile. Scott (1971) addresses that using the car as an instrument for reshaping the city, has the most potential for crippling central business districts and up building outlying shopping areas. Still, the automobile was important in the creation of city-plans. In the 1920s, city governments adapted downtowns in such a way that automobiles and trucks were accommodated. Famous architects such as Le Corbusier and Frank Lloyd Wright emphasized the automobile in their designs. They created frameworks – with an emphasis on the automobile - that were adapted by several decision makers (Mitchell and Rapkin, 1954; Birch, 2009). Explicit attention was given to the opening of circumferential highways that closely bordered the downtown so that access could improve and surrounding residential areas could foster. Successful combat of traffic congestion and parking facilities were of great importance in facilitating the "already successful operating inner cores of the city" (Abbott, 1993). In case the downtown longed attention, improving accessibility through peripheral freeways was seen as the solution. New or improved roads were considered to be the boundaries for an expanded business core. Planning Commissions proposed plans for creating inner highway loops for cities such as Washington and Fort Worth (Abbott, 1993).

It was during the mid-1950s that an understanding emerged about the downtown being an area of declining activity and failing real estate markets. The 1958 Census of Business and the 1960 Census of Population had a large influence in the documentation of the suburbanization process. The 1958 Census of Business demonstrated that retail and personal services moved towards the periphery of a city. The 1960 Census of Population administrated the additional shock by revealing that many cities could not meet their expected population numbers. City planners began to realize that downtowns could not be seen as something fixed and could potentially lose their logical and organic predominance. A framework shifted from building automobile infrastructure in order to increase downtown accessibility to urban renewal which should strengthen the competitiveness of the downtown (Abbott, 1993). City governments applied urban renewal attempts whereby parts of downtowns where demolished, sometimes up to 80% which was the case in Richmond, California. In many cases, just like Richmond, downtowns (partly) vanished due to the proximity of suburban centers that outcompeted the attempted renewed downtowns (Carey, 1988). These urban renewal practices did not turn out to be successful in general as more reactions turned against the urban renewal plans of the 1950s. A replacing vision arose during the 1960s which increased in popularity as years followed. This vision had to do with splitting the downtown area up into different districts or functions, thereby promoting variety which should be attractive to people (Abbott, 1993).
The governments of American cities turned downtowns in such a way that it should be a collection of opportunities for individual experiences. The inner core of a city was designed in the interest of enjoyment and tourism. The conception of the downtown as a theme park accepted its loss of primacy within the metropolitan community. With this framework came the idea that suburban "outer cities" were emerging as co-equals to the downtown (Abbott, 1993).

2.4 Strategies for improving the quality of the downtown

Robertson (1995) identifies several aspects which are important for implementing in order to create a downtown with a strong identity in the context of the suburbanization. These factors include the creation of a pedestrian-friendly environment, indoor shopping centers, historic preservation, waterfront development, office development and transport enhancement. Many cities use the idea of implementing mass transit in order to improve downtown accessibility. Two common responses relate to transportation when Americans are asked why they avoid the downtown. One of the responses relates to the effort to get around downtown. The other answer relates to the problems in reaching downtown since people experience long travel times, inconvenience, traffic congestion, parking and safety anxieties. Since the downtown is the central hub, it is the most accessible part of most cities. Fewer people made use of transit and ventured downtown however. The mass transit became less prominent. Still, the relative high densities of many downtowns are good conditions for the mass transit to operate in (Robertson, 1995).
The search for alternative modes other than the automobile became more prominent throughout the years (also driven by growing environmental awareness). As an example, public transport subsidies in the USA have increased from $14 billion in 1991 to $32 billion dollar in 2007 (Buehler & Pucher, 2011).

Public transportation networks have been implemented in several cities across the world in the hope to improve the vitality of the downtown. To illustrate, two downtown circulatory systems – the Memphis and the Miami people mover – are intended to stimulate activity in the city centre (Mackett & Edwards, 1998). The Sydney light rail scheme tries to provide access to the new development at

Darling Harbour. In Dallas where the light rail system is implemented, it is intended that companies have the possibility to choose locations that meet legal obligations and so, reduce the number of cars being used by their employees (Mackett & Edwards, 1998).

The stimulation of development via public transport seems to be a global phenomenon since projects have also been implemented in Vienna, Lausanne and Vancouver. In Vienna (Austria), the public transport system has encouraged people to live in the city by improving access to activities that take place in the city. Vienna thus aims to make its city more attractive via the public transport system. Companies have also been locating near the line, thereby developing a certain area. This phenomenon was the case in for instance San Jose and Vancouver (Mackett and Edwards, 1998). In these cases, development and light rail systems would not succeed without each other. Previous literature focus on the impact of public transport on the processes within the downtown in terms of (economic) livability. While BART (Bay Area Rapid Transport) might not have been the decisive factor influencing downtown office and retail construction over the past 20 years in San Francisco, BART's presence was likely a vital and necessary pre-condition for much of the growth that did occur. Evidence suggests that BART has allowed downtown San Francisco to continue to grow and maintain its primacy in the urban hierarchy (Cervero, 1997). Carey (1988) addresses the local light transit system as one of the important factors in the success of Portland's downtown management. Carey argues that Portland implemented light rail transit (LRT) in times where most other American cities discarded such a system.

2.5 Light rail as a way of transportation enhancement

To mitigate the unwanted effects of population growth (e.g. uncontrolled suburbanization), the integration of a rapid rail system is often seen as the best alternative. It is argued that the rail transit is seen as an alternative to the automobile transportation since it reduces the number of drivers on the road and more compact patterns of growth are encouraged by attracting residents close to rail stations (Credit, 2018). Joshi et al. (2007) argue that all rail systems are focused on bringing employees to the downtown. One of these rail transit modes is light rail that has been recently implemented in Phoenix.

Light rail is an alternative for the bus, metro and/or tram. Cervero (1984) cites that light rail transit falls about midway between the bus and/or trolley and rail rapid modes (e.g. metro, heavy rail etc.) in terms of carrying capacity and general operating features. Under ideal circumstances, light rail has three- or four-car trains that operates every two or three minutes and that can carry around 12,000 and 16,000 passengers per hour on a single track (Tennyson, 1982). When compared to the bus and several rail rapid modes, light rail can carry more passengers per hour than the bus (6,000) but less than the rail rapid modes (20,000).

Within the US and Canada, light rail has gained increasing popularity since the late 1970s whereby it shows promising signs for the future. Today, more than 50 American cities use rail transit as a means of regional public transportation (Joshi et al., 2007). As for 2014, billions of tax dollars have been spent on constructing around 650 miles of light rail in 16 regions with a future addition of 150 miles planned or under construction (Credit, 2018). Cervero (1984) states that light rail is a low-cost way to carry commuters along urban corridors where roadway can no longer be expanded and heavy rail cannot be justified. Also, light rail ridership along suburban corridors is encouraged with park-and-ride facilities.

The economic effects of light rail are widely discussed in literature. Knowles & Ferbrache (2016) argue that the implementation of light rail sets off economic activity. This economic activity consists of (1) unlocking previously hard to reach sites for development; (2) triggering fresh growth through elimination of significant transport constraints (e.g. congestion or unreliability); (3) stimulating inward investment; (4) extension of labour market catchment areas; (5) reorganizing or rationalization of production, distribution and land use and (6) land value and property value increase. Some factors need little explaining such as (1) and (2). Considering stimulating inward investment, one of the factors that contribute to the earlier defined economic activity, the implementation of light rail can alter the perception inward investors hold of a city in terms of accessibility, distance, peripherally, disadvantage and attractiveness of an area. Light rail may extend the labour market by creating a scenario where workers can make longer distance travels while costs and time may stay similar to old travel patterns. This is appealing for businesses as well since they gain access to wider markets and availability of skilled labour. To expand on the fifth contributing aspect (being reorganization or rationalization of production, distribution and land use), examples can be derived from the United Kingdom and Denmark. In London a collection of media corporations including the BBC relocated five departments, with their jobs, to the established Salford tram station (MediaCityUK) from its London headquarters in 2010. Another case was in Copenhagen where light rail enabled the Danish Broadcasting Corporation to move 3000 of its employees which were dispersed over 10 separate sites to join at one site at the Ørestad North station (Knowles & Ferbrache, 2016). Light rail thus may also increase the value of land, and of residential and commercial property surrounding its stations due to enhanced accessibility. This is mainly the case for areas that are within a walking distance of Light Rail stations (Knowles & Ferbrache, 2016).

Schuetz (2015) argues that increased pedestrian traffic created by transit riders should increase retail businesses. Bowes & Ihlanfeldt (2001) state that if transit service provides a real economic benefit, the value of that benefit should be capitalized into the price of nearby parcels. Cervero (1984) acknowledges the importance of light rail by stating that it influences urban growth, affects land uses, promotes (re)development and increases nearby property values. Credit (2019) theorizes about public transport investments leading to an in increase in accessibility. This greater accessibility in its turn increase property values which creates extra potential for development in the form of high density residential and commercial development. Next to new growth that tends to cluster around station sites, declining areas can be rejuvenated because of the higher value and profit potential of surrounding land (Cervero, 1984). Topalovic et al. (2012) state that the implementation of a LRT system influences development investments such as the creation of new housing, offices, services, and shops. Cities that successfully implemented a LRT system, reported an increase in shopping commerce generated adjacent to the line, development of new residential and commercial areas and increased employment nodes (Topalovic et al., 2012 ; Crampton, 2003).

The implementation of light rail created several success stories in American cities. Before the implementation, Portland's inner core was characterized by rising rates of office vacancy and retail centres fading. With the implementation of the Light Rail system, MAX, downtown office vacancy rates declined to levels below those of suburban office parks; rents increased; and the downtown developed an attractive retail hub. Development has been valued for over $2billion surrounding the downtown station areas in Portland. With the implementation of the Light Rail system, Denver's lower downtown has been recognized as one of the most successful new urban neighbourhoods of the United States (Topalovic et al., 2012). Dallas has experienced over $1.3billion in development that can be accounted for the introduction of the Dallas Area Rapid Transit (DART). A side note that Topalovic et al. (2012) make, is that the influence of light rail should not be over-estimated as light rail can serve as

a catalyst for redevelopment in selected areas (rather than being the only aspect responsible for it), or it may simply mean a redistribution of development (rather than a net economic gain for the city). Also, as Golub et al. (2012) point out, light rail transit may have negative or no significant impact. The light rail transit system in Santa Clara had negative impacts on housing prices while impacts were insignificant in parts of San Diego and Sacramento as was concluded by earlier research. Knowles & Ferbrache (2016) state that light rail can have positive impacts but that location is central.

Still, the urban development potential of light rail is expected to be less than heavy rail since the light rail transit has poorer performance characteristics in general (e.g. in terms of regional access, speed etc.) (Cervero, 1984). It might well be that due to technological developments, light rail systems today are more competitive with 'heavy rail' systems. Tennyson (1982) argues that the "sphere of influence" differs between heavy rail and light rail. To illustrate, the heavy rail's sphere of influence might encompass a radius of 2,000 feet – which is approximately three to four blocks – or more, light rail might influence one or two city blocks at most. As a reason for this, light rail has a lower performance which means that fewer land parcels can turn gains in accessibility into higher land values.

2.6 The Valley Metro Rail

While light rail is recently implemented in Phoenix, the high-capacity transit is not new to the Phoenix Metropolitan Area. In the 1880s, trolleys and streetcars operated in the area. This would not last long since all trolleys and street cars were replaced by the automobile. The first attempt to bring back the high-capacity system was made in 1989. The plans did not succeed as the attempt failed by a 3-to-2 margin (Kittrell, 2012). Another two voting rounds would not lead to the wanted outcome for light rail-proponents (AZ Central, 2018a).
It was in 1994 that studies began on the feasibility of light rail transport for the Phoenix Metropolitan Area (ARPA, 2006; City of Phoenix, 2002, 2004; Atkinson-Palombo, 2010). Based on these research results, the city of Phoenix gave the green light in 2000 to fund the majority of the transport system. The system began operating eight years later in December 2008 as the nation's largest modern high-capacity transit system starter line. A total of $1.4 billion dollar was invested in the service whereby 57% was provided by regional and local funds. The light rail system connects the downtown of Phoenix, Tempe and Mesa and 28 stations in a variety of neighbourhoods, commercial districts and an industrial zone, covering a total of 24 miles (Figure 6) (Atkinson-Palombo, 2010; Kittrell; 2012). Along the light rail line are several major attractors such as convention centers, the ASU campus in Tempe and Phoenix downtown and baseball and basketball stadiums (Golub et al., 2012).

Figure 6: The Phoenix light rail. Source: Valley Metro, 2015

Along the so-called Valley Metro light rail route are several park and ride facilities which cover up more than 3,500 parking spaces (Tripsavvy, 2018). It is argued that light rail transport development stimulates and relocates growth in/to places nearby light rail stations, and in this way, develops the downtown of Phoenix and the surrounding neighborhoods (Golub et al., 2012). This is supported by AZ Central (2018a) who states that light rail brings more visitors and eventually development. Also, experts credit the mass transit system with driving development and luring the university to downtown Phoenix (AZ Central, 2018a). A study that was conducted by the Arizona State University, shows that light rail stations in Phoenix had a positive impact on surrounding property values of all three classes of commercial real estate, being industrial, office and retail and service. The same study revealed positive effects on property values was higher for light rail stations than highway exits (AZ Central, 2018a; Golub et al., 2012).

The specific influence of the Valley Metro light rail may be hard to define. To extend on this point, there is no possibility to cleanly differentiate the effect of each downtown project that has occurred over the last decade (Downtown Phoenix, 2018). As another view, a solid economic foundation such as quality transport may allow (private) sector activities to flourish so that economic development can happen (Downtown Phoenix, 2018). Further, the light rail is seen as an instrument to fill up vacant land and building mixed-use developments that can offset economic opportunity. This has an effect that the light rail attracts people and jobs inside the Corridor (Downtown Phoenix, 2018). In the report of Valley Metro (2018b) it is stated that the Phoenix metro acts as a catalyst for several industries via providing transportation options and lifestyle choices for employees, thereby showing the value that Phoenix is willing to invest in itself. Another point that the report makes is that the amount of work-based trips has grown over the entire transit system, predominantly on the light rail. To clarify, the proportion of work-based trips for the light rail grew more than 50 percent in the period of 2011-2015 (Valley Metro, 2018c).

2.7 Conceptual framework

Based on the literature above, a conceptual framework is created which shows the link of downtown decay to certain policies reacting to this process which eventually leads to the implementation of a transit system and its possible effects (figure 7).

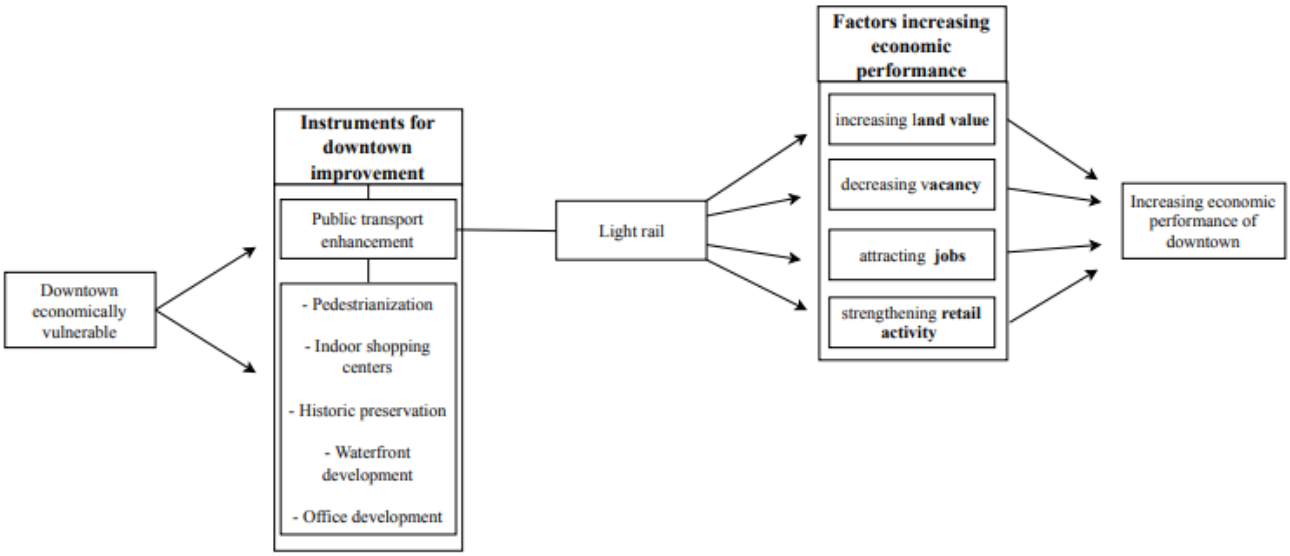

Figure 7: Conceptual framework. Based on Robertson (1995); Joshi et al. (2007); Downtown Phoenix (2018); Valley Metro (2018b)

Chapter 3: Organization of fieldwork

This chapter explains the process of collecting data so that results can be generated. These results are used to answer sub questions and the main question that discusses the spatial-economic effects of public transport.

3.1 Method

Data is collected via several approaches. Quantitative data is provided by "On the map", a system that measures the amount of jobs in total and sectors throughout the United States. The U.S. Census provides the economic data that is visually transformed into heat maps (displayed by On the map), showing the compositions of jobs in every year in the period of 2004-2015. A pro about the use of this survey data is that businesses with less than 5 employees are also taken into account whereas several other sources provide business data with cases that only have 5 employees or more (Valley Metro, 2018). As an example, Valley Metro calculated the increase of tech companies in Phoenix, using employment data from Maricopa Association of Governments (a council of governments that function as the regional planning agency for Phoenix metropolitan area) and the city of Phoenix. The data was based on tech companies with five or more employees located in the CBD (Valley Metro, 2018).
The survey data is used for a GIS-analysis. GIS is also taken as an approach in determining the specific research areas. Several research areas are studied which can be classified as either "light rail-zone" (also classified as "light rail corridor") or "non-light rail-zone". This distinction is needed to better understand the specific influence of light rail. These zones (light rail- and non-light rail) will be split up in more zones to better picture where and to which degree development is (not) happening.

The variables that define the "economic activity" in this research are total jobs and retail activity. Retail activity is part of the total jobs. Therefore, a regression-analysis is conducted via SPSS that shows to which degree the development of retail activity is influenced by the development of total jobs. This is further explained in section 4.3.

Since the aspect of development forms an integral part of the research, a time series analysis/longitudinal approach is conducted.

The qualitative approach is also taken into account. Interviews are held with local experts in the Phoenix metropolitan area so that further information is provided about possible different developments along the light rail corridor and non-light rail areas. Each approach is further elaborated in this chapter.

3.2 Defining the research areas

3.2.1 Defining the sphere of impact

The research areas are thus split up in one segment being the light rail corridor and the other being the non-light rail areas. The light rail corridor is made up of all the light rail stations that were present at that time (being 2018).

In order to determine to which extent – in miles – light rail has an effect on the total jobs and retail activity, it is useful to identify this sphere based on previous literature. According to Mohammed et al. (2013), the extent of influence of light rail in general goes up to 1000m (3281 feet – 0.62 miles) for residential- and 400m (1312 feet – 0.25 miles) for commercial zones. Local experts from Valley Metro argue that effects are not broader than 0,5-mile in the local Phoenix context (Valley Metro, 2018).

GIS is used to determine our impact area based on a 0,5-mile buffer. The number of jobs that are present within this defined area (0,5-mile buffer) are studied. Figure 8 displays the amount of jobs that

are present in one of the light rail buffers (generated from a 0,5-buffer around Glendale light rail station). All the values are aggregated creating a total number of 1348 jobs inside this buffer in the year 2004 (since the job points are related to 2004).

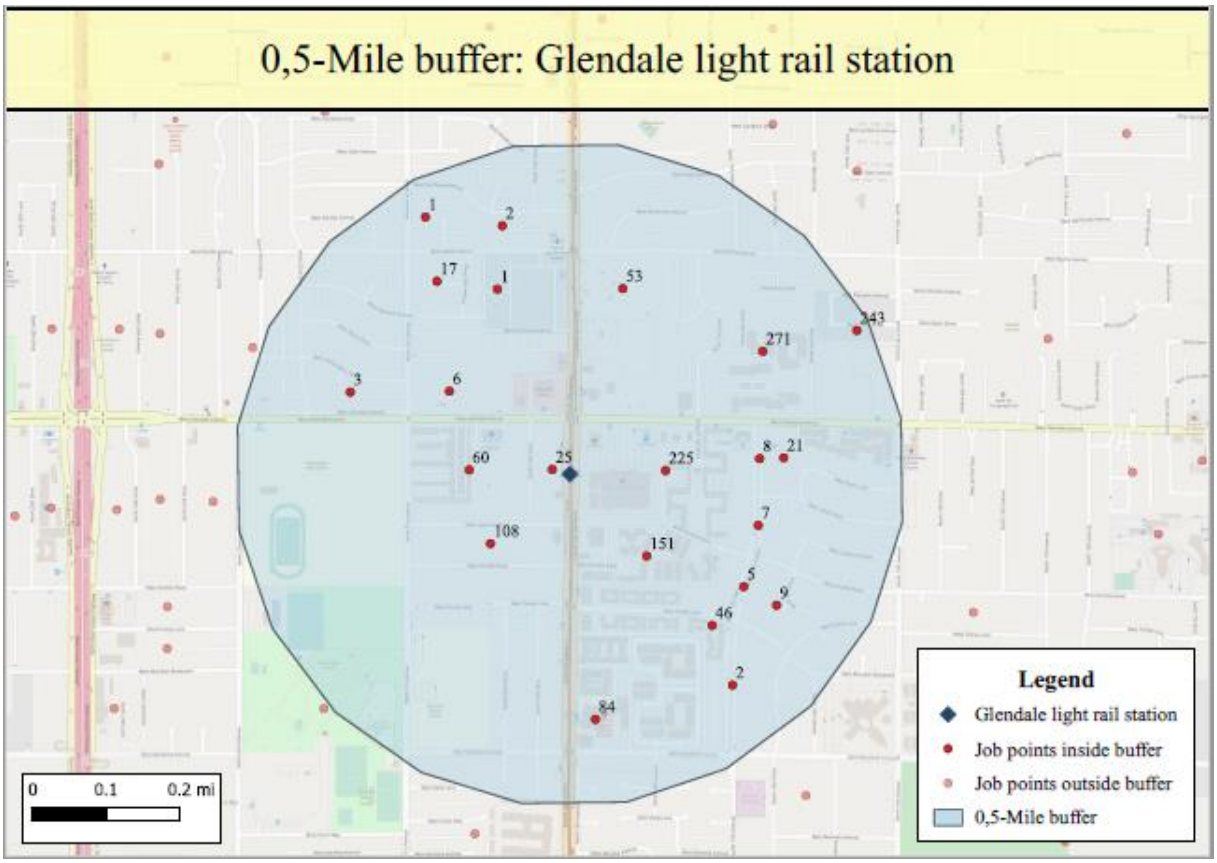

Figure 8: The amount of jobs in the 0,5-mile buffer surrounding the Glendale light rail station in 2004 (QGIS)

3.2.2 Defining the specific research areas

In their light rail research, Joshi et al. (2006) split the light rail corridor into 3 separate zones. They identify "Zone 1" as an area that radiates north from Phoenix downtown, including most of Phoenix Central Business District and the uptown arts district. "Zone 2" is described as a low-density corridor that is adjacent to the commercial airport and includes many industries that have located to take advantage of proximity to the airport. This part is also characterized by low-income neighborhoods and areas with high concentrations of minorities. Their definition of "Zone 3" is an area that is dominated by Arizona State University and activities supporting the university. There is a high concentration of student housing. Also, several ethnic retail establishments are present that cater to a large international student community that are attending the ASU (Joshi et al., 2006).
This research uses the classifications of Joshi et al. (2006) as a starting point for making an alternative and more zoomed-in definition. In order to better understand the developments that have happened in the downtown specifically, it is useful to make the downtown as a separate zone. It is then possible to compare the development in the downtown with developments elsewhere along the corridor.

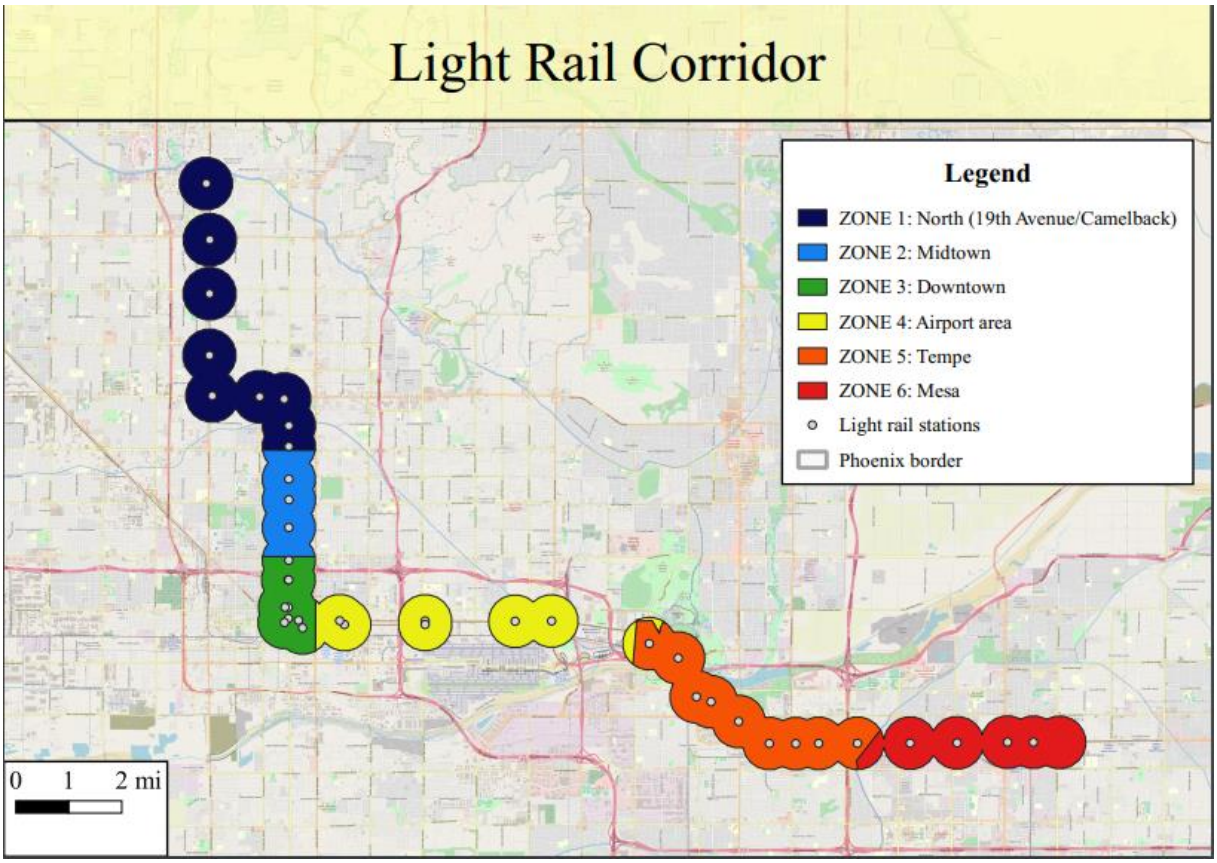

Figure 9: The light rail corridor consisting of six zones (QGIS, 2018)

Eventually, the light rail corridor consists of six "zones" whereby four (Camelback/19th Ave; Midtown; Downtown; Airport Area) are part of Phoenix, one of Tempe and one of Mesa (figure 9). There is a more expanded analysis of the composition of each zone in terms of light rail stations in the appendix (figure 23). Some buffers are merged. Several borders split buffers up, creating a scenario where one 0,5-mile buffer can be part of two zones. The border between zone 4 and zone 5 shows the border of Phoenix splitting the 0,5-buffer in two according to the form of its border. The acres of each area are displayed in table 1. Acres are used instead of square miles since each separate research area is not that big (table 1). The downtown is highlighted in yellow in table 1 since it is the main focus areas.

Table 1: Amount of acres per study area, light rail

Area	Abbreviation	Zone	Acres
Buffers North	NOR	1	3511
Buffers Midtown	MID	2	1203
Buffers Downtown	DT	3	1134
Buffers Airport	AIR	4	2120
Buffers Tempe	TEM	5	3019
Buffers Mesa	MES	6	2196
Total (share of Phoenix-area)	-	-	13183 (3.89%)
Phoenix	-	-	339272

A point of attention here, is that some research areas are considerably bigger than others. For instance, zone 1 is three times as big in it surface than zone 3.

Table 2: Amount of acres per study area, non-light rail

Area	Abbreviation	Acres (rounded)
Camelback Corridor	CC	2297
Desert Ridge/Kierland	DRK	6551
Deer Valley	DV	10443
North Interstate 17	NI17	7221
South Mountain	SM	3880
West-Chandler	WCH	4728
Downtown Scottsdale	SCO	971
Total (share of Phoenix-area)	-	36091 (10.64%)
Phoenix	-	339272

The non-light rail area consists of seven areas (table 2). Leslie (2010) identifies several geographical centers of economic activity within the Phoenix metropolitan area. Many of the geographical centers that Leslie mentions are not related to the light rail corridor. As a result, these non-light rail areas will also be compared with the downtown of Phoenix. The city of Phoenix (2013) also published a report in cooperation with Maricopa Association of Governments (2013) where several major employment centers are outlined (see appendix, figure 22). Furthermore, an area near Loop 202 in Chandler is attractive to classify as a "non-light rail area" since big companies such as Intel opened there recently (Valley Metro, 2019). Four areas are outside the defined Phoenix area, being downtown Scottsdale, Tempe, Mesa and West-Chandler (figure 10). Some areas are bigger than others. The surface of each non-light rail area is displayed in table 2. A geographical visualization of each area can be seen in figure 10. A con of this dispersed research areas, is that economic activity is only measured at some places that in total account for 15% of the Phoenix area. It may therefore be hard to analyze if clustering is happening at certain places since 1) study areas may be quite large so no dynamics within the study areas can be identified and 2) a large part remains unanalyzed. The inability to analyze clustering therefore limits the geographical analysis.

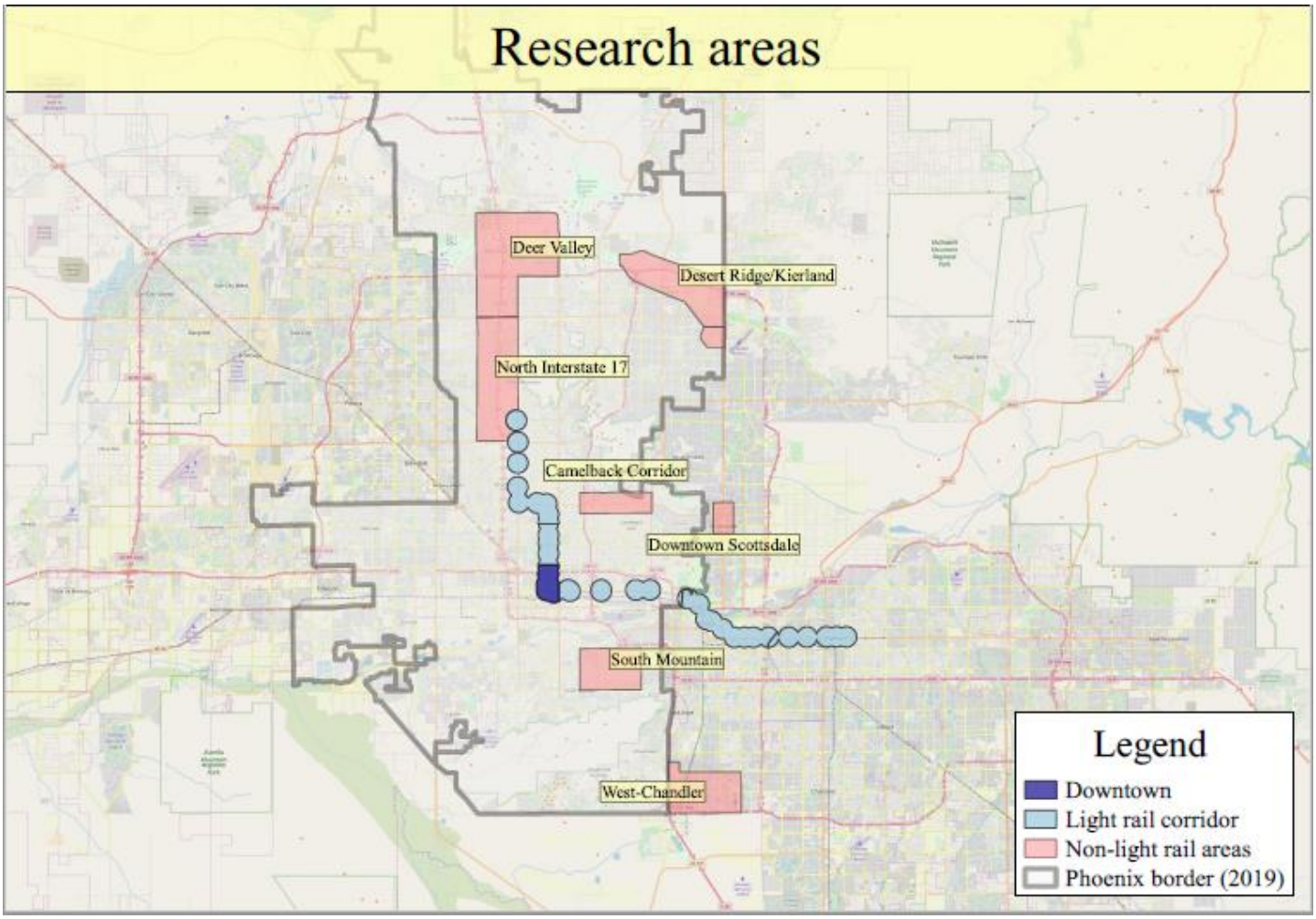

Figure 10: Light rail corridor, non-light rail areas and relative position of downtown

3.3 Longitudinal Approach

To see the effects of the light rail (within the downtown area), the dimension of time must be added. This can be done by looking to the specific areas at three time intervals. Debrezion et al. (2007) take four time periods in order to compare housing price fluctuations over a larger time range where they take into account light rail. They identify a period before any concrete plans for a light rail system, a planning phase for light rail, the construction period and the period when light rail is operating. This research uses a same kind of classification whereby it also looks at a period before and after a specific event, in this case the implementation of light rail. Three periods are used: the pre-implementation period (2004-2008); the first operating period (2008-2012) and the second operating period (2012-2015). These periods can then be divided again in smaller periods. As an example, the 2004-2008 period is broken down in a "2004-2006"-stage and "2006-2008"-stage. This may be of importance as developments can be positive in the first stage while it turns out to be negative in the latter stage. This is the case in certain areas in the research as can be later seen in the results-section.

3.4 Qualitative Approach

Still, the specific influence of the light rail can be hard to define. To give an example, the economic crisis took place at a similar time as the operation of the light rail so it may be difficult to distinguish effects from the light rail and the crisis. Another example are investments that are done without any relation to the implementation of the light rail. The Arizona Center was created in order to be a magnet project to help establish a vital downtown core in Phoenix (Robertson, 1997). The qualitative approach

then seems to be useful since (light rail) effects can be better explained in depth. Local experts can bring more depth in the effects that were specifically caused by the light rail. Local experts may explain more about the "why"-part about the gathered quantitative data. The so called "projection"-method can be used here. This method creates a situation whereby experts are asked about how a group would react or has reacted to a certain event. To clarify, an expert may be asked about how retail activity would react or has reacted to the implementation of the light rail. People may also be asked at location X (near light rail) and Y (without light rail) if the light rail would (have) add(ed) more stores. The local experts are shown in table 3.

Table 3: Function of local experts that contributed to qualitative data gathering

Date of interview	**Company/organization being interviewed**	**Name**	**Function**
20/11/2018	Maricopa Association of Governments	1) Audra Koester Thomas 2) Anubhav Bagley	1) Transportation planning program manager 2) Regional analytics director
14/12/2018	Valley Metro	1) Hannah Quinsey 2) Peter Valenzuela 3) Martin Ziech	1) Planner 2) Planner 3) Planner
21/12/2018	City of Tempe	Maria Laughner	Economic development program manager
29/5/2019	City of Tempe	Maria Laughner	Economic development program manager
5/6/2019	Valley Metro	1) Peter Valenzuela 2) Martin Ziech	1) Planner 2) Planner
6/6/2019	Greater Phoenix Economic Council	Kristen Stephenson	Vice president of research and analytics
13/6/2019	The Midtown Association	Patrick McDaniel	Land use planner

Chapter 4: Results

4.1 Structure of this chapter

The result section of this thesis is divided into three sections, based on the longitudinal data. The first section will be based on the 2004-2008 period; the second section will be based on the 2008-2012 period (also considered as the opening of the light rail-period) and the third section will be based on the 2012-2015 period. In each section, a general view is created that shows to which degree developments have happened in the light rail corridor and non-light rail areas. Remarkable developments within the light rail corridor and non-light rail areas are then mentioned apart that have a big influence on the general developments in both areas. The downtown is an integral part of the research so this will also gain greater attention. As mentioned earlier, light rail can offset many economic effects such as the increase of land value, combating vacancy, creating jobs and promoting retail activity. This research focuses on the last two mentioned aspects since data is available in contrast to the first two mentioned aspects where data is limited. This mentioned structure is first applied on the analysis of the total amount of jobs. The retail activity will be discussed separately in a later part of the result section. The same structure as earlier described will also be applied to the retail activity-section.

To test whether light rail had (significant) positive impacts on economic activity in its serving area, a scenario would be ideal where developments in jobs and retail activity were significantly higher after the implementation compared to before the implementation but also in relation to the non-light rail areas.

4.2 Total amount of jobs

The total jobs are taken apart and analyzed in three segments: the non-light rail area, the light rail area (including the downtown) and the downtown on its own. Figure 11 displays the developments of total jobs in each of the three segments in the three time periods. Phoenix itself is also taken into account to show the more general trend in the region. Interesting is that the dynamics have changed between the pre- and post-implementation. Whereas the biggest increase in total jobs happened in the defined non-light rail area, the downtown came out best in the period 2012-2015 in terms of (positive) total job development while the light rail corridor followed, leaving the non-light rail area last in this period. This change in relations gives the impression that the light rail at least facilitated some economic development. If this happens to be the case, this economic development did not happen immediately after the opening of the light rail since the non-light rail areas did perform better in this period albeit still negative. The more regional trend of Phoenix shows less extremes.

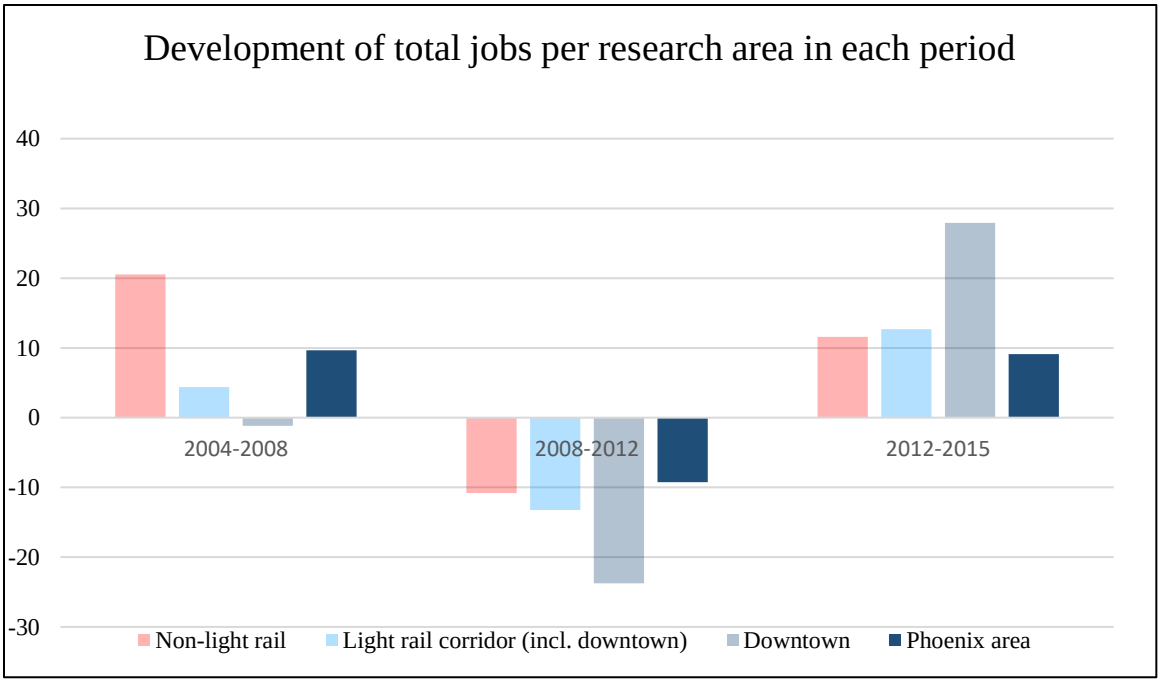

Figure 11: The development (in %) of total jobs in the non-light rail area, light rail corridor (including downtown) and downtown exclusively for the periods of 2004-2008; 2008-2012 and 2012-2015

Since figure 11 only shows relative numbers, it becomes more clear to include absolute numbers. Therefore, figure 12 shows absolute numbers and the share of each area in the total number of jobs. Absolute numbers are - in general - comparable between the non-light rail areas and light rail corridor (including the downtown). The total number of jobs for the whole area of Phoenix are 822,258 (2004); 901,577 (2008); 818,060 (2012); 892,678 (2015) (On the map, 2019).

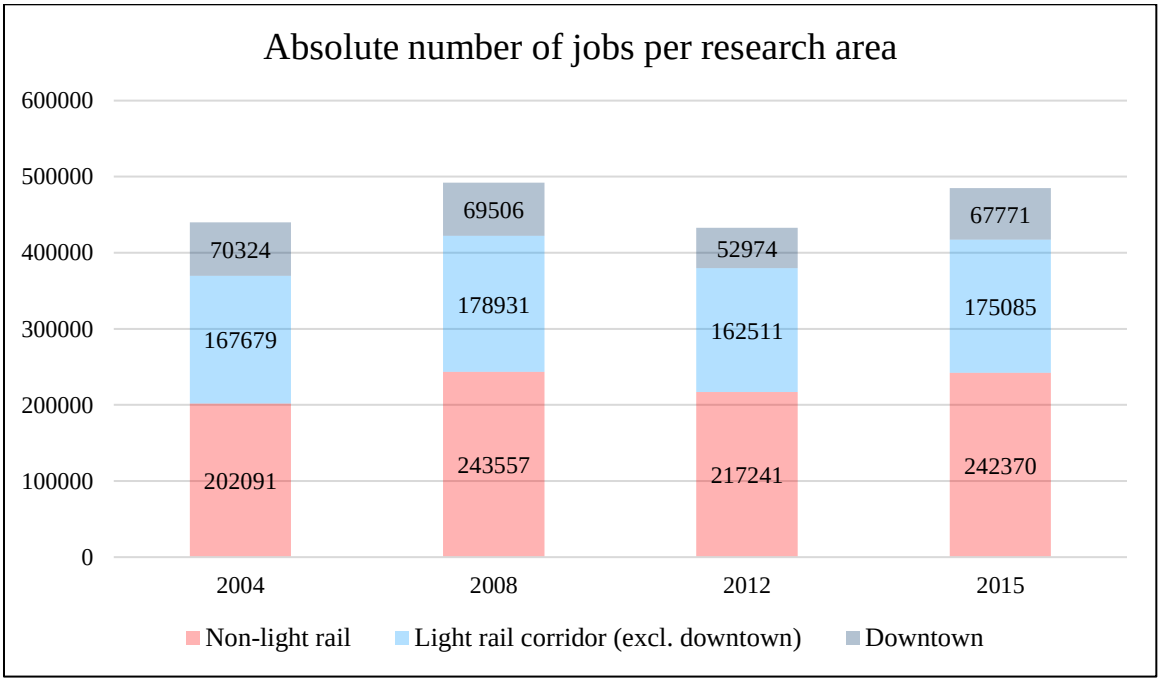

Figure 12: Absolute number of jobs per research area

The use of maps is a helpful addition due to the geographical aspect of the research. In order to show the specific developments in each area, dots are presented that show the degree of development (the bigger the size, the bigger the increase/decrease) and direction of development (green being an

increase of total jobs/retail activity; red being a decrease of total jobs/retail activity). Results would be less clear if points would become too big due to overlapping. Therefore, developments (i.e. percentages) were divided by 3,33 so that points would not become too big. 3,33 is used as a measurement because then, a dot would have a size of "30" with a change of jobs of 100%. Having a maximum point size of "30" (assuming that changes go up to 100% maximum) would prevent situations in which severe overlapping arises thus poor visible results. On the other side, dots may become barely visible due to changes being minor (e.g. -1 or +1%) so this can be important to note. This should not have to be worrisome since minor economic development can be barely visible on its own.

Like earlier mentioned, the inclusion of the downtown forms an integral part of this research. The position of the downtown in each period - relative to the other twelve research areas - is shown in table 4. The main variable for which the areas are compared, is the development of the total amount of jobs. This table will function as a base for the analysis that is further exposed in the result section.

Table 4: Place of downtown compared to all other areas in terms of total jobs development based on total job development

	Place '04-'06	Place '06-'08	**Place '04-'08**	Place '08-'10	Place '10-'12	**Place '08-'12**	Place '12-'14	Place '14-'15	**Place '12-'15**
Total jobs	11/13	9/13	**12/13**	6/13	12/13	**12/13**	2/13	6/13	**2/13**

4.2.1 2004-2008 (prior to the implementation of light rail)

The total jobs in the research areas mainly increased in the period prior to the light rail implementation. Although barely visible (since changes are minor), job loss happened in downtown Phoenix and Mesa (figure 13).

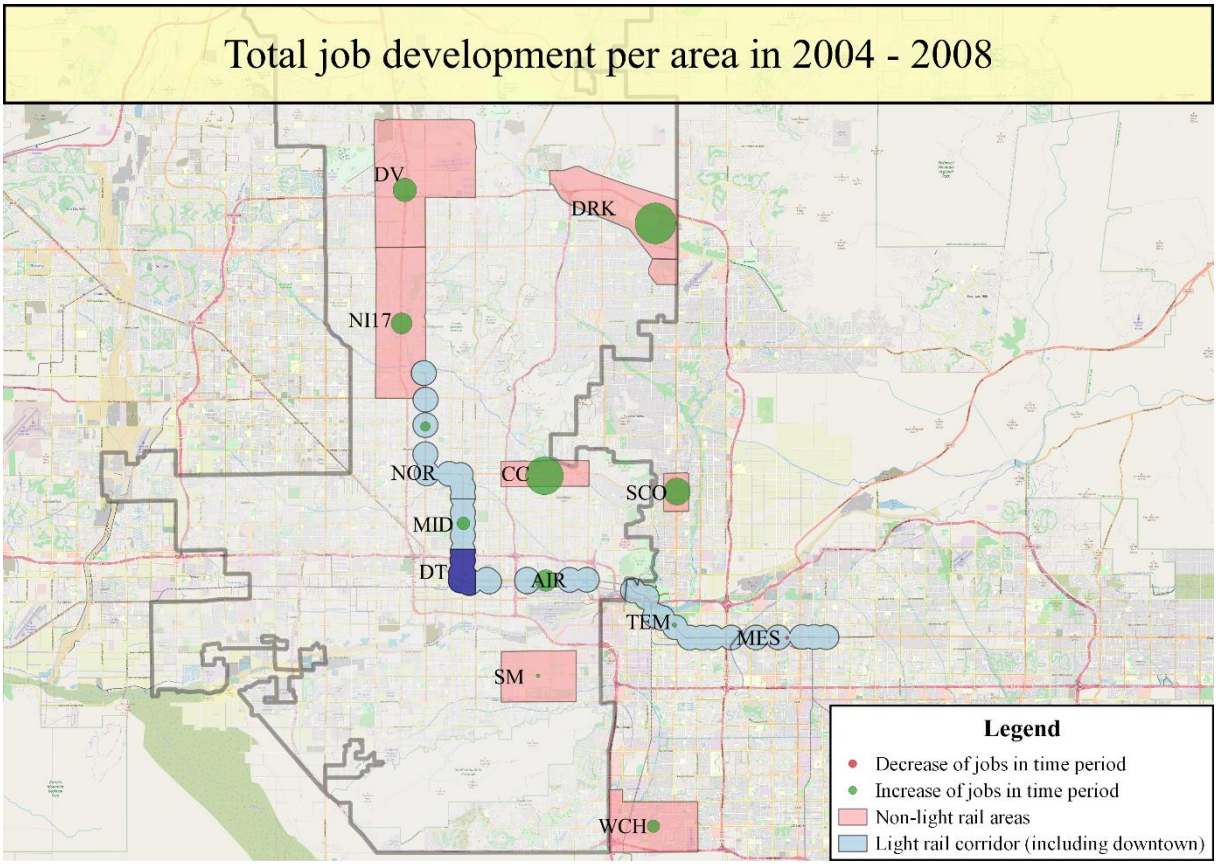

Figure 13: Total job development in 2004-2008 for the research areas

Job development was the strongest in the non-light rail areas with an overall improvement of 21%. The non-light rail areas that performed best were the Camelback Area (CC) and Desert Ridge/Kierland (DRK), respectively with +31% and +33%. Important to note is that while the Camelback Corridor has one of the relative highest increases (+31%), the job development is negative in the latter stage (2006-2008) before the implementation in this area (-1%). So even if developments seem strong and positive, fluctuations can still be strong with periods of negative economic activity. The southern non-light rail areas perform less strong than the middle and northern regions but total jobs still increase. An explanation for (the relative strong) positive changes in North Interstate 17 (NI17), Deer Valley (DV) and Deer Ridge/Kierland, is that two important freeways, Interstate 17 and Loop 101, are going through those study areas. This may give good accessibility which is important for the quality of a certain location (Credit, 2019). Thereby, land is cheaper due to a lower density and land is abundant for companies that need much land, for instance a distribution warehouse. As Tempe city official Laughner (interview 2019) puts it: “We (referring to Tempe) have 800 Amazon jobs at Haiden Faire lake side but we don’t have a distribution warehouse that is a million square feet, that is in Goodyear because land is cheap over there”. Vice president of Greater Phoenix Economic Council, Stephenson (interview 2019), explains that around this time (2004-2008), the state of Arizona sold land to private developers for high invest use, especially in the area of Desert Ridge/Kierland. Large scale development also happened in Scottsdale (SCO). Arizona State University invested in this area resulting in an innovation center known as “Skysong” that opened its first building in 2008. This

realization (and process before) attracted tech companies and office users (interview Stephenson, 2019; Skysong, 2019).

Experts from Valley Metro (interview 2019) argue that it is easy in the mind of the developer to focus on an empty parcel and build offices instead of in the urban environment where land is much more expensive. Those areas (outskirts) are desirable to live, have newer construction and bigger houses in contrast to the core where prices are higher and estates are smaller and older (interview Valley Metro, 2019). Since land is abundant and cheap in suburbs, people were buying land in huge proportion, thereby building heavily. According to Stephenson (interview 2019), the period of 2005-2007 had a peak development in population. Many jobs in construction were generated for the building of these houses in suburbs. So it is important to consider these factors as drivers for development at non-light rail areas that are at the periphery of the Phoenix metropolitan area.

Maricopa Association of Governments (MAG) official Anubhav Bagley (interview 2018) argues that there are areas in the Phoenix metropolitan area without light rail that are booming because major employers moved into those areas. Factors that are considered to be important in attracting employers - next to the factors that were just mentioned - are being at a good place and having prime accessibility to real estate and work force. Another thing that is important in the explanation of the development of total jobs and retail activity, is the massive shift from single family owner occupied housing to multi-family rental occupied housing within the region. Tons of apartments are being created, expecting young people to move in. What younger families are expecting from rental apartment housing, is different from what previous generations wanted. Such apartments have high value which results in the creation of high amenities as well. This is happening not just along the light rail but also along non-light rail areas such as North Interstate 17. Experts are also doubting to which degree this creating of high value apartments is due to light rail as Bagley says that he does not see a connection with light rail but that it is "just due to change in population dynamics" (interview MAG, 2018).

Total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas. As an example, four non-light rail areas (out of seven) gained more jobs than the biggest gainer in the light rail corridor, the Airport Area (+18%). Laughner (interview 2019) and Valley Metro (interview 2019) give an explanation for this occurrence. The lower positive change in the corridor may be the result of light rail construction. This construction of light rail makes the area where it takes place, hard to access. Many of the roads in the corridor are bared. As a result, less people are moving to that area which in its turn makes it harder for businesses to operate (and survive). Another point that is mentioned, is that the public transport concept is relatively new for Arizona. In general, there is not much feeling that light rail is going to be a great addition for businesses. Rather, it is argued by locals that the construction and operation are killing businesses since cars have no access (interview Laughner, 2019).

Several places in the corridor were less developed in the light rail construction. Mesa is negatively affected in 2004-2008. This may be because the construction of light rail was relatively in its beginning phase. Experts argue that construction was only for one mile (out of the now 6 miles) in this time-period (interview Stephenson, 2019; interview Valley Metro, 2019). Experts from Valley Metro (interview 2019) say it as follows: "if you were to interview a business owner in 2005, it was not on his mind to locate at places east of Sycamore/Main Street or north of Montebello (situated in North)", referring to places that still had be constructed.

Although not the strongest decrease (that is Mesa), the downtown loses jobs (-1% i.e. 818 jobs in total) in the period before the running of the light rail whereas most other areas in this light rail corridor experienced growth. The downtown is an area which is relatively poor performing. Out of the 13 research areas, the downtown is placed 12th in development of total jobs (table 4).

In short, non-light rail areas experienced more total job growth than the corridor. Construction was a factor that decreased the economic performance of the corridor. At the same time, cheap and abundant land were important factors that positively impacted non-light rail areas, especially Deer Valley, Scottsdale, Desert Ridge/Kierland and North Interstate 17. Job loss only happened in two areas in this period. These areas are both within the corridor, being Mesa and the downtown. The downtown was the second-worst performing area in 2004-2008.

4.2.2 2008-2012 (first period after the implantation of light rail)

It is important to note that the recession of 2008 had a big influence on the whole economy, especially for Arizona (interview McDaniel, 2019; interview Valley Metro, 2018; Valley Metro, 2018b). Out of the 65 large cities in the US, three Arizona cities (Phoenix 4th; Mesa 3rd; Tucson 1st) are ranked in the 5 worst American cities hit by recession (WalletHub, 2017; Valley Metro, 2018b). Phoenix metropolitan area has been relatively hit hard since one of its strongest industries was real estate. Cheap and abundant land were important components for this real estate-dominant local economy. The bubble of

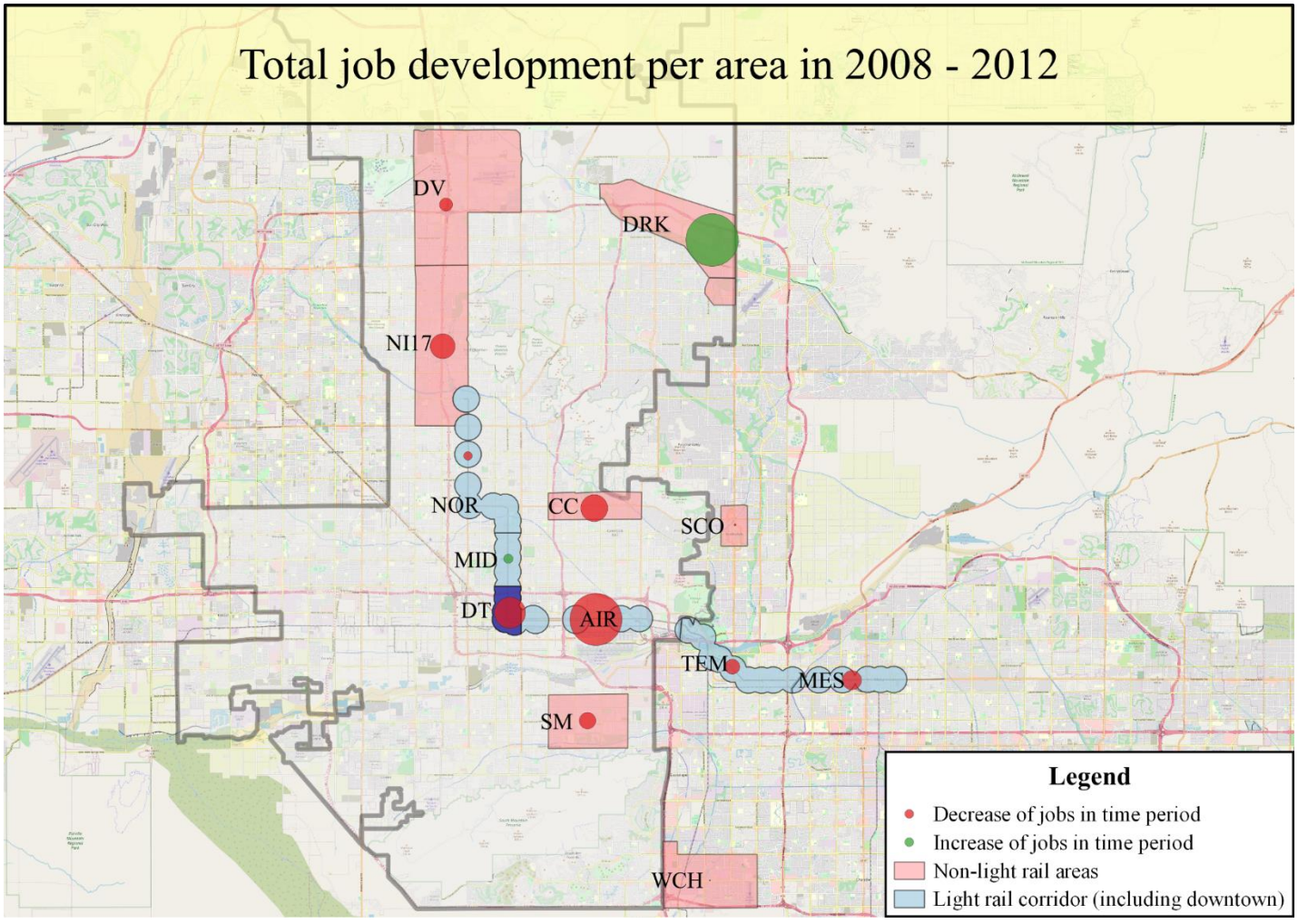

Figure 14: Total job development in 2008-2012 for the research areas

2008 was one characterized by an emphasis on real estate. It is therefore not surprising that cities in Arizona such as Phoenix had been hit so relatively hard (interview Laughner, 2019; interview McDaniel, 2019; interview Valley Metro, 2019). Stephenson (2019) clarifies the recession-effects by stating that over 300,000 jobs had been lost out of the total 2 million jobs. It took until 2016 to fully recover (interview Stephenson, 2019).

Most developments are negative which is expected to be heavily influenced by the recession of 2008. Remarkably is that Desert Ridge/Kierland (DRK) experiences a relative big growth, both in the first and second period of the 2008-2012 period (figure 14; appendix: "Quantitative data: development of total jobs and retail activity per area per period"). Scottsdale (SCO) is another area that is relatively resilient to the recession. Important for this resiliency may be that these communities are wealthy ones (interview Valley Metro, 2019). Total jobs lost with 11% in non-light rail areas which is slightly lower than the corridor (-13%).

The only place that experienced growth within the light rail study area is Midtown (MID), the area north of downtown, with 7%. Unlike Desert Ridge/Kierland, Midtown did not have an increase in both 2008-2010 and 2010-2012. In the first stage (2008-2010), general jobs decreased with 4% while the developments were positive in the latter stage (2010-2012) of this specific time period (+12%). In this period (2008-2012), Saint Joseph hospital extended its institute near Thomas/Central, a light rail station in Midtown. Second, real estate is cheaper in Midtown compared to downtown (interview Laughner, 2019). Two more reasons are added by Stephenson (interview 2019). According to her, Midtown was not a large job booming corridor. She argues that there was less growth in the run up compared to other areas. As a result there was not much to hit. Second, important industries in Midtown such as the healthcare and education, were not hit hard relative to other industries by the 2008-recession. It is said that the healthcare even gained jobs (interview Stephenson, 2019). McDaniel states that Midtown's population has many well-educated professionals that work for themselves (interview McDaniel 2019). He argues that this specific population is less vulnerable to the 2008-recession.

Being the best area in the corridor before light rail implementation, the Airport Area (AIR) now is the biggest loser in 2008-2012 (-40%). Other areas in the corridor thus performed poorly too. McDaniel argues that start-ups were present in large proportion in the corridor. The recession had big impacts on these kind of businesses since start-ups do not have the resources and experience to survive (interview McDaniel, 2019). A reason (besides the recession) for the decrease in jobs in the corridor may be (partly) explained due to socioeconomic reasons. Valley Metro (interview 2018) argues that the ages of workers changed. The proportion of 30 till 54 year olds slightly went up while 29 year olds and younger decreased with 31 percent. For 55 year olds and older, their proportion increased with 48 percent. The job market changed after the recession. The patterns were now characterized by relatively less skilled and low paying jobs ($1,250 per month or less) leaving the corridor while more skilled and higher paying jobs (more than $3,333 per month) replaced them, attracting more established professionals (interview McDaniel, 2019; interview Valley Metro, 2018). So even if the number of jobs decreased, a question may arise whether this is problematic, given the situation that the proportion of high skilled jobs becomes bigger due to the general job losses being tied to a relative big share of low skilled jobs. Maurin & Thesmar (2004) argue that demand is high for high skilled jobs. Experts of Valley Metro (interview 2018; interview 2019) argued that a decrease of jobs in the downtown might be (partly) explained by a large loss of more temporary work such as construction jobs. At the same time, they see tech companies move to the downtown while this number cannot overshadow the number of jobs lost (Valley Metro, interview 2018; interview 2019). Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94). It thus may be viewed that the effect of light rail on total jobs translates into less jobs while salaries increased which points to a scenario where quantity is lost while quality may be improved. A GIS-analysis is also applied to determine whether this is the case for Phoenix. The GIS-analysis could not provide extra evidence since high-skilled jobs did not increase in neither the corridor nor downtown in the measured period. This method is only applied for 2008-2012 because there was an overall job loss. This could of course also be applied to other periods but then the focus will drift away from the research topic.

Looking to the competitiveness of the downtown, it is on a 12th place considering the total job developments of the 13 study areas in 2008-2013 (table 4). The primary factor for its relative poor position, is the relative high rents of the downtown in this period argues Laughner (interview 2019). Experts from Valley Metro (interview 2019) and McDaniel (interview 2019) say government jobs were making up a significant proportion of total jobs in the downtown. Governments may cut budgets easily whatever consequences are in such recession-times. Older employees were encouraged to retire in order to keep certain positions empty (interview Valley Metro, 2019. Employees were also lost since governmental agencies did not get the sufficient amount of property taxes (interview McDaniel, 2019)

The degree to which jobs increase in certain areas may be also dependent upon specific policy measures at those locations (interview MAG, 2018). To extend, Tempe (TEM) has a vision in attracting businesses which tend to make use of public transport. Attracting businesses who think in a sustainable way, correlates with one of Tempe's goals to reduce traffic thus reduction. As an example, Laughner (interview 2018) uses the following statement to clarify Tempe's vision: "…our goal as a city, but when we have developers coming in and say we're going to bring a thousand jobs to downtown Tempe and they need a kind of parking, we are going to say no you can't have that parking" and "…creating culture, in Tempe more so than other places because we attract businesses with a likeminded mindset who think "yeah we don't want that parking space either"". So even if dots are red, this may be since local governments purposely deny access to certain businesses.

To conclude this section, the recession had a large impact on economic activity, especially in Arizona. Two areas that are relatively less impacted are Desert Ridge/Kierland and Scottsdale, both wealthy non-light rail areas. Midtown is the only area in the corridor that experienced growth shortly after the recession. Midtown has a relative large proportion of certain jobs (e.g. jobs in the health sector) and populations (young educated people) that were less vulnerable to the recession. Considering the downtown, it was the second-worst performing area (again) in 2008-2012.

4.2.3 2012-2015 (second period after the implementation)

The last study period is one year shorter than the other two study periods since data continues only until 2015.

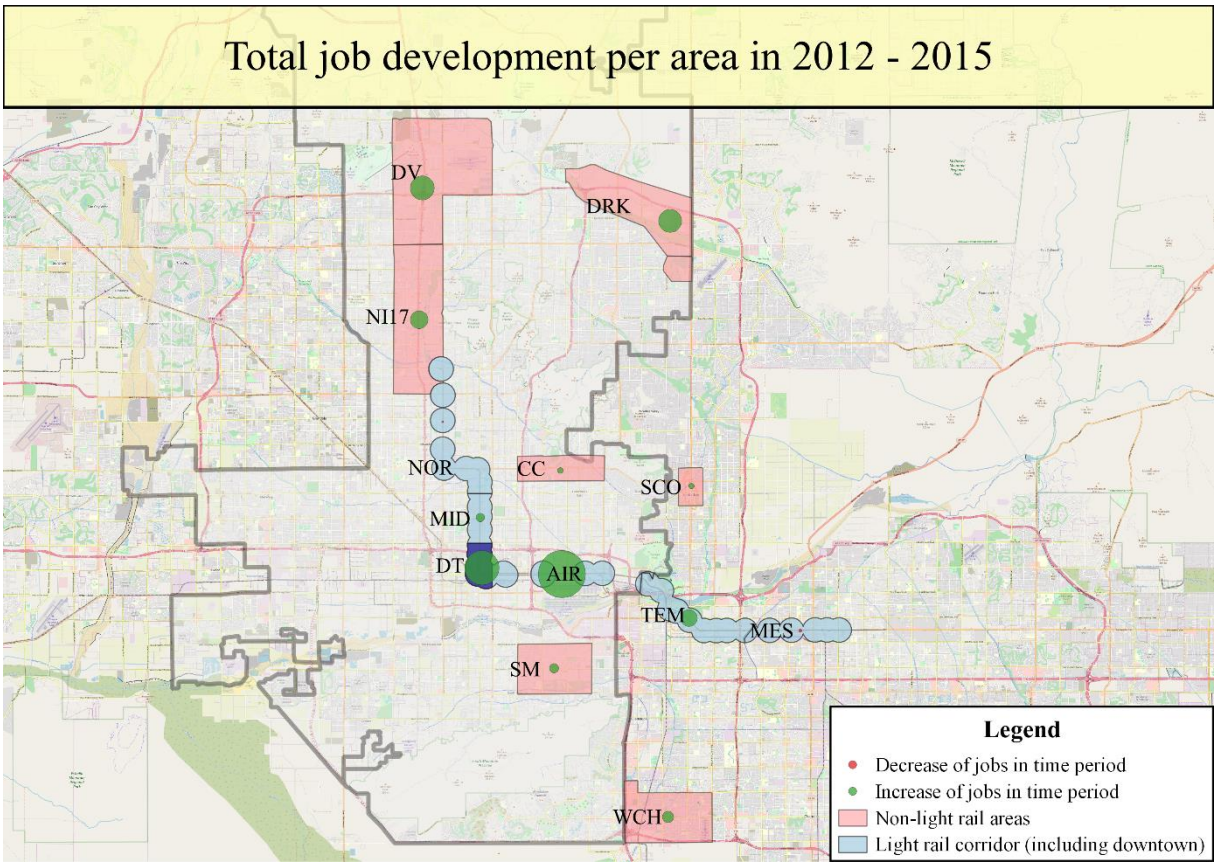

Figure 15: Total job development in 2012-2015 for the research areas

The second operating phase is characterized by an overall growth of total jobs in the research areas. In 2012-2015, the dots in the map are relatively larger in the corridor than in 2004-2008 whereas the dots in non-light rail areas are relatively smaller in 2012-2015 compared to 2004-2008 (figure 13; figure 15). Stronger development of total jobs thus seems to happen in (some places of) the corridor now. Stephenson (interview 2019) stresses the types of jobs in the corridor compared to jobs in the periphery of the metropolitan area. She uses high tech companies as an example. According to her, high tech office users are situated in the corridor which tend to be less vulnerable to recession. Valley Metro (interview 2019) seconds this as they say that "the change in types of jobs make us (referring to the corridor) more resilient".

Regarding the non-light rail areas, an interesting pattern is visible. Positive changes seem to be most significant in the northern study areas. This gives support again for the argument that these non-light rail areas have good accessibility and abundant and cheap land causing an attractive environment for (potential) employers. Minor positive changes are happening in the middle areas while moderate positive changes occur in the southern study areas.

Just like the 2004-2008 period, two out of the thirteen areas experience negative development. These areas are both part of the light rail corridor. Again, Mesa (MES) has a decrease. In all the measured periods, Mesa only has a positive total job change in the first stage of 2004-2008. In 2004-2006, Mesa has an increase of 7%. These results can be considered remarkable, given the fact that Mesa has revitalized a large part of its downtown in the last year(s). Laughner (interview 2018) argues that this revitalization is because of light rail since businesses and a department of ASU moved to downtown Mesa. According to Valley Metro (interview 2019), Mesa is one of the regions that has been hit the hardest and it takes relatively long to recover from the 2008-recession. So even though Mesa's jobs have not been increasing in the study periods, effects may become stronger in the future since revitalization only took place recently.

19th Avenue/Camelback (NOR) is the other area that experiences a decrease (while the downtown was the second area in 2004-2008). Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). The downtown may perform well again due to rents being lowered. In the 2008-2012 period, a growing realization came about rents being too high since landlords lost properties, people moved away, not coming back and vacancy rates grew (interview Laughner, 2019). Moreover, multi-family residency increases in the downtown so it is predicted that amenities will follow and that such developments transform the nine to five culture to a 24/7-one (interview Stephenson, 2019). A third explanation is given by Valley Metro (interview 2019). They argue that (government) jobs that were cut in 2008-2012, are taken back again in order to facilitate the growth in both the downtown and metropolitan area. McDaniel (interview 2019) thinks that specific jobs will increase more in the corridor in relation to non-light rail jobs. He argues that more growth might take place outside the corridor but that high paying jobs will be more present in the corridor.

Just like 2004-2008, the northern non-light rail areas perform relatively strong, being Deer Valley, Desert Ridge/Kierland and North Interstate 17. Two research areas are performing negative, both within the corridor. One of the two is Mesa. North is the other area. Experts argue that these areas had greater difficulty in recovering from the 2008-recession compared to other research areas. Whereas the airport area and downtown were the worst performing areas in 2008-2012, the areas now are the best performing ones. For the downtown, rents are relatively cheaper and jobs that were kept empty in the previous period, are now filled in again.

Desert Ridge/Kierland is an area which experienced growth in all three time periods and is thereby the only area that accomplishes this. Also, it performed more than four times as good as the second best area (table 5). The performance of each area is displayed in table 5 for the period of 2004-2015. The color of the rows determine if the area is a non-light rail area or part of the light rail corridor.

Table 5: The relative positions of each study area and its performance before- and after the implementation of the Light Rail. ***Non-light rail zones (Red)****: CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SM = South Mountain.* ***Light rail zones (blue)****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

	Area	Performance ('04-'15)
1	Desert Ridge/Kierland	+121,97
2	Deer Valley	+28,28
3	Midtown	+26,57
4	Scottsdale	+25,36
5	West-Chandler	+21,77
6	Camelback Corridor	+8,81
7	North Interstate 17	+8,66
8	Tempe	+4,59
9	19th Avenue/Camelback (North)	-0,88
10	Airport Area	-1,98
11	South Mountain	-3,09
12	**Downtown**	-3,63
13	Mesa	-19,44

Area	Performance **before** light rail ('04-'08)
DRK	+ 33,30
CC	+30,77
SCO	+22,03
DV	+19,18
AIR	+17,75
NI17	+17,15
MID	+10,48
WCH	+10,26
NOR	+7,88
TEM	+3,85
SM	+3,05
DT	-1,16
MES	-2,89

Area	Performance **after** light rail ('08-'15)
DRK	+66,52
MID	+14,57
WCH	+10,44
DV	+7,64
SCO	+2,72
TEM	+0,71
DT	-2,50
SM	-5,96
NI17	-7,25
NOR	-8,12
AIR	-16,76
CC	-16,79
MES	-17,05

According to table 5, the relative positions of the light rail areas seem to shift upwards. Whereas the sum of the rankings of light rail areas was 56 (5+7+9+10+12+13) before the implementation of the light rail, the sum after the implementation of light rail decreased to 49 (2+6+7+10+11+12). The light rail corridor gains more (or better put: loses less) total jobs compared to the non-light rail areas since the implementation of the light rail transportation system. Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation. MAG (interview 2018) and Valley Metro (interview 2019) argue that growth can't be expected to take place along the whole corridor since the corridor covers an area of 25-miles. It is also stressed that effects of light rail take place over a longer time, and will be better visible after the measured time period (2008-2015).

To conclude this analysis of total job changes between 2004 and 2015, the downtown did increase in relative position after the transit system had been implemented. Total jobs decreased however although this is the case for ten out of the thirteen study areas. Only West-Chandler (WCH), Midtown (MID) and Desert Ridge/Kierland (DRK) increase relatively more in their number of general jobs after the opening of light rail. Still, Scottsdale (SCO), Deer Valley (DV) and Tempe (TEM) increase as well although this increase is less than the increase before light rail opening, or perhaps more relevant, the 2008-recession. For Tempe, a large proportion of businesses were already present in Tempe before the implementation of light rail. The slight increase of businesses in Tempe after the implementation/recession is corresponding with Laughner's (interview 2018) opinion that businesses are adding but that it is not that noticeable.

4.3 Retail activity

4.3.1 Defining retail activity

Retail activity is measured via classification “NAICS 44-45, Retail Trade”. Retail activity is defined by the United States Census Bureau (2017) as follows: “The Retail Trade sector comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public” (United States Census Bureau, p. 17, 2017).
To elaborate, the retail sector consists of two sectors being “store” and “non-store” retailers. This research focuses on the first category since this category operates from fixed point-of-scale locations (so retail does not move). Thereby store retailers are located and designed to attract a high volume of walk-in customers. Merchandise is generally sold to the general public for personal or household consumption. Next to the general public, businesses and institutional clients are also focus groups. Some store retailers (also) offer alter-sales such as repair and installation. (United States Department of Labor, 2019).

4.3.2 Relation between total jobs and retail activity

The economic activity in this research is thus defined by total jobs and retail activity. Retail activity is however part of total jobs. As an example, out of the 822,258 jobs in Phoenix in 2004, 80,891 (10%) are represented in the retail sector. It is therefore useful to conduct a regression-analysis to determine to which degree the development of total jobs influences the development of retail activity. The regression consists of 39 cases since 13 areas are studied in three separate time periods. Figure 16 shows that the correlation between total job development and retail activity is weak. It is therefore acceptable to say that in many cases, the creation of extra jobs in (a) sector(s) other than retail does not automatically generate jobs in the retail sector. Further information about the correlation can be found in the appendix (figure 24).

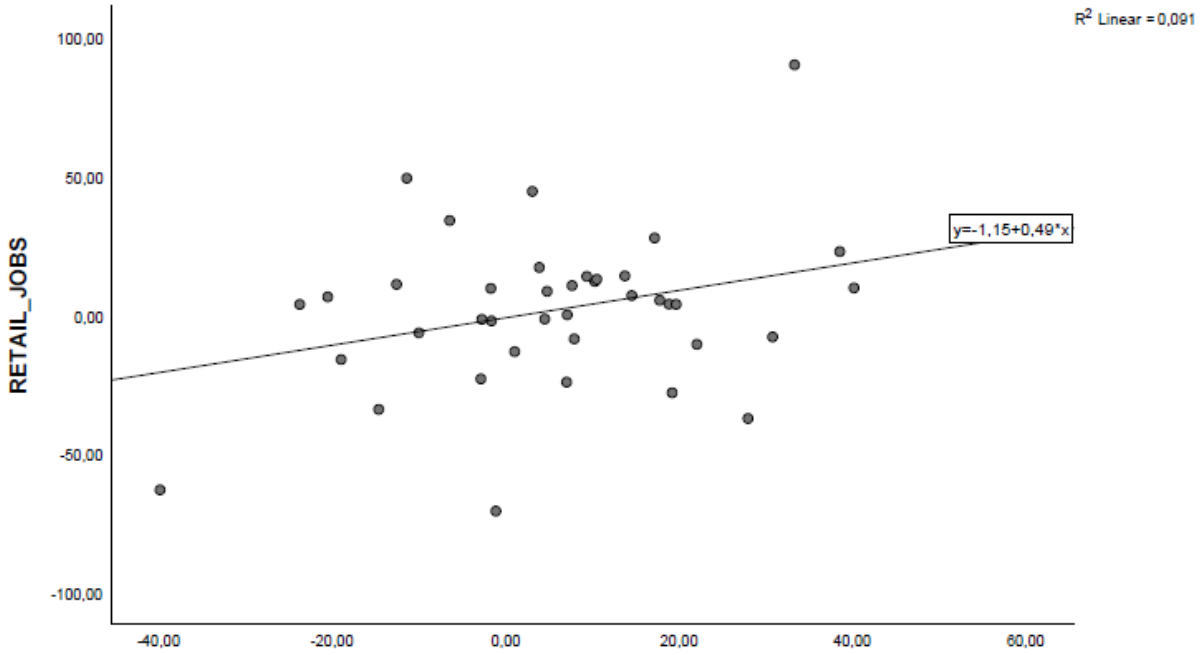

Figure 16: Correlation between jobs in the retail sector and total jobs

4.3.3 General development of retail activity in Phoenix metropolitan area

Compared to the total jobs, retail activity developments are different since areas are less similar in terms of general development (figure 17). Moreover, changes in retail jobs are relatively less extreme to changes in total jobs with exception to the downtown.

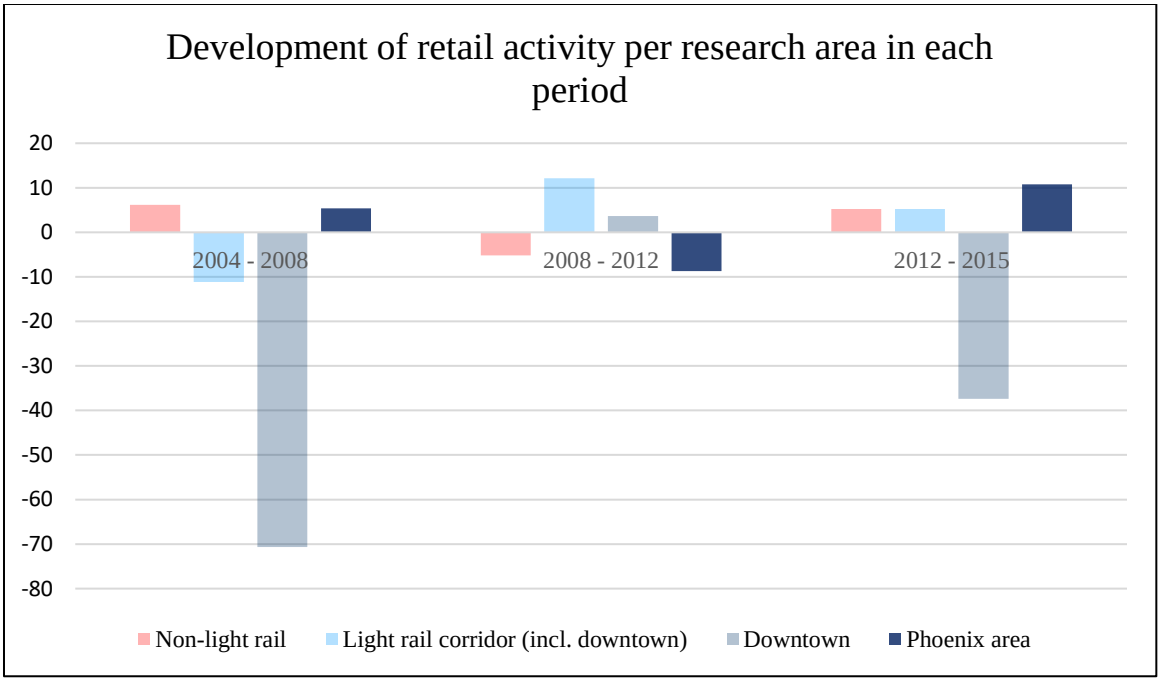

Figure 17: Development (in %) of retail activity per area in each time period. Downtown is also included in the area defined as "light rail corridor"

Considering the non-light rail areas, developments are less extreme. The trends are comparable to the total jobs in Phoenix, given that developments are positive before the recession, negative after the recession and turning positive again in the 2012-2015 period.

The light rail corridor is the only area that has positive changes in the whole period after the implementation of light rail.

The downtown is striking in its negative developments. More than 70% of retail activity is lost in a period of 4 years. After the opening of light rail, it gains less than four percent in jobs. So far, light rail does not seem to steer downtown retail activity in a positive direction. To illustrate, retail activity decreased with more than 35% in the most recent period. The position(s) of the Phoenix-downtown compared to other areas in terms of performance in retail activity are shown in table 6. Further explanations will be given in the sections below.

Phoenix itself shows developments that are similar to the total jobs: a moderate increase followed by a moderate decrease and a moderate increase again in the last time period.

	Place '04-'06	Place '06-'08	**Place '04-'08**	Place '08-'10	Place '10-'12	**Place '08-'12**	Place '12-'14	Place '14-'15	Place '12-'15

Retail	13/13	13/13	**13/13**	2/13	10/13	**6/13**	1/13	11/13	**11/13**

Table 6: Place of downtown compared to all other areas in terms of retail activity development

4.3.4 2004-2008 (Before the implementation of light rail)

Whereas eleven out of thirteen areas experienced positive development in 2004 – 2008 in total jobs, seven out of thirteen areas experienced positive developments for retail activity within the same period. There is a small concentration of negative job changes. Figure 18 displays a corridor of negative retail changes that consists of 19th Avenue/Camelback (NOR) (light rail), the Camelback Corridor (CC) (non-light rail) and downtown Scottsdale (SCO) (non-light rail). The research areas experience different changes in retail activity as some experience large decreases like downtown (- 71%) and Deer Valley (DV) (-28%) while others experience large net increases of retail activity. Examples are Desert Ridge/Kierland, North Interstate 17 (+28%) and South Mountain (SM).

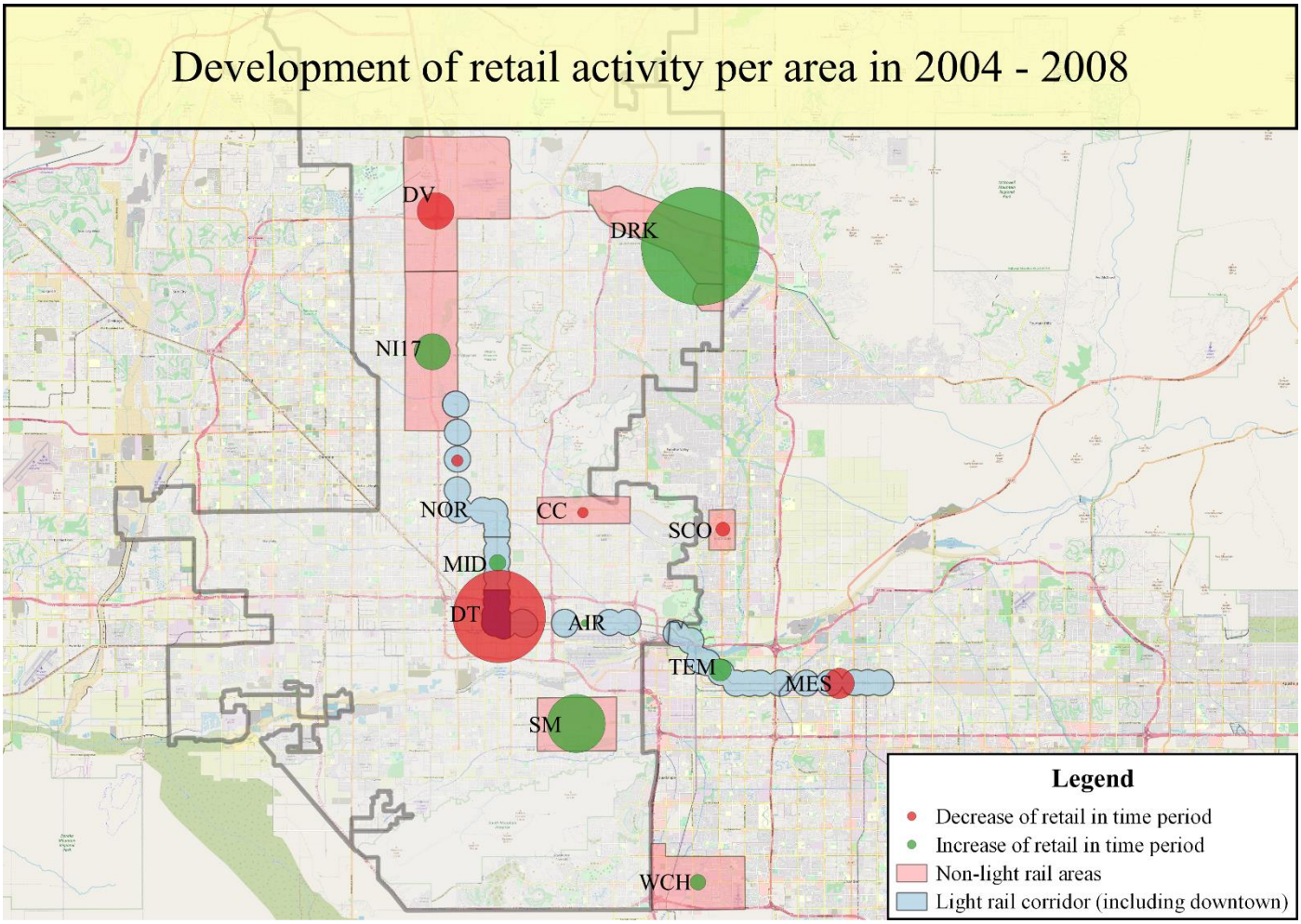

Figure 18: Development of retail activity in 2004-2008 for all the research areas

Considering the non-light rail areas, Desert Ridge/Kierland (DRK) is once more the best performing area. Retail increases with almost 90% in this period. While South Mountain (SM) was quite discrete in the total job-analysis, it stands out next to Desert Ridge/Kierland with a growth of 44%. An explanation could be that Desert Ridge/Kierland and South Mountain are both relatively new , meaning that land is abundant and cheap over there. Whereas downtown is mostly redeveloped, DRK

and SM are areas that experience new development. New development is considered to be more easy to generate than redevelopment. The increasing retail in non-light rail areas can be an effect of the suburbanization that takes place there. With the creation of extra cheap housing comes the provision of extra amenities such as schools and retail businesses (interview Maria Laughner, 2019).

The light rail corridor has smaller dots than the non-light rail areas pointing to less extreme changes in retail activity. Even with the exclusion of the downtown, changes in retail are still considerably more negative than non-light rail areas (respectively -4% and +6%). The construction may be hurtful for retail businesses since these businesses became less accessible for potential customers during the construction. Gilchrist & Allouche (2005) state that large-scale urban construction projects in major urban centers can have measurable fiscal impact on business sales. They further mention that retailers may lose business because (1) accessibility is reduced, (2) annoyances related to construction and (3) detours that are taken.

The retail development is worst in the downtown out of all places. All the other areas surrounding the downtown (being Midtown (MID) north, the Airport Area (AIR) east and South Mountain (SM) south have increasing retail activity values so this may make the situation more striking. There seems to be less effect of retail businesses responding to the still to be implemented light rail. In contrast, experts from Valley Metro (interview 2019) think that many businesses in downtown were not able to survive. The downtown is characterized by many small businesses. These small businesses are relatively vulnerable since there is no corporate backing. They point out that this is not exceptionally due to light rail since businesses tend to struggle a lot with any kind of project which requires construction (interview Valley Metro, 2019). Also, prior to light rail, not much activity was taking place in the CBD. Stephenson (interview 2019) for example says that people “could not find a place to eat after work”. Since there was not much to do besides working, the retail businesses that were there, did not have a lot of customers (interview Stephenson, 2019).

In short, fluctuations are stronger in this period for retail compared to the total jobs in 2004-2008. Again, Desert Ridge/Kierland is performing relatively strong while South Mountain also performs strong despite being discrete in the total jobs-analysis. Both areas experienced new development. Light rail areas experienced an overall negative change in retail activity in 2004-2008 while non-light rail areas experienced an overall positive change in retail activity in the same period. Construction is argued to be an important factor in influencing retail activity in the corridor in a negative way. The downtown is the worst performing area. Experts explain that many small and thus vulnerable businesses operated in downtown. Also, there was not much other (retail) activity that could positively influence retail, prior to light rail implementation.

4.3.5 2008-2012 (first period after the implementation)

In first instance, the performance seems to be better, compared with the performance of total jobs in this period. Less red dots are present for retail activity in 2008-2012 in contrast to the total jobs for the same period (figure 19). Changes in retail activity are quite different per study area.

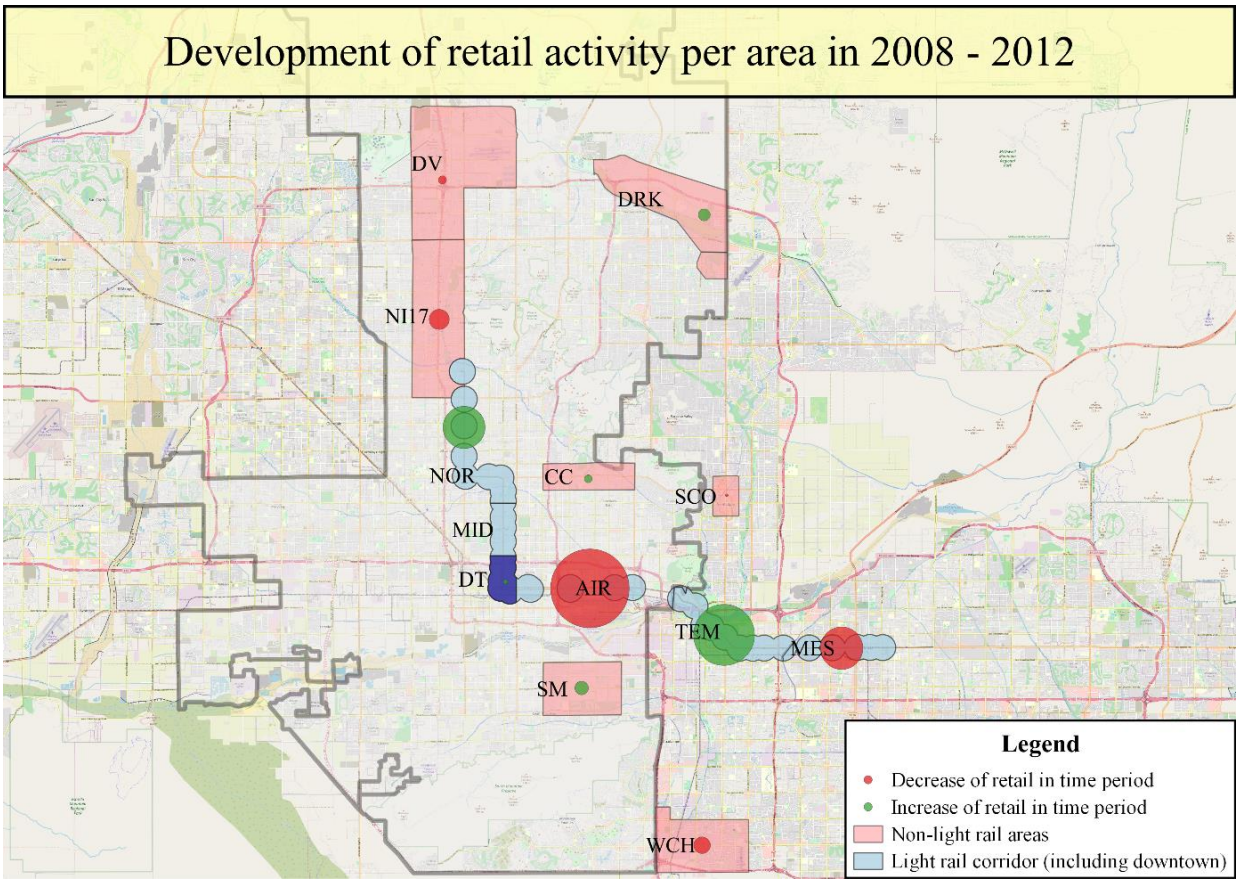

Figure 19: Total retail performance in 2008-2012 for all the research areas

The non-light rail areas have less extreme changes than the corridor. The Desert Ridge/Kierland area is once again one of the best performing with a growth of nearly 10%. South Mountain is performing positive again in retail just like the period prior to the implementation. Here, retail activity increases with 11%.

The light rail corridor (including downtown) is performing (+12%) better than the non-light rail areas (-5%). Tempe (TEM) specifically is doing well with an increase of 49% (although it's total jobs decreased with 11% for the same period). Around this period opened the Tempe Marketplace on a place which had been a garbage dump. Since the place was a garbage dump before, developers got land for free, thereby having no property taxes for the next 40 years (interview Laughner, 2019). Another reason may arguably be that ASU-campus in Tempe creates a constant blow of consumers in the form of students. A thing that may be an issue with this, is that retail is affected by the university as many students tend to go home in holiday-periods (interview McDaniel, 2019; interview Stephenson, 2019; interview Valley Metro, 2019). Development in North (NOR) may be explained by the redevelopment of the Christown Mall area which is next to light rail station 19th Ave/Montebello (See Appendix, figure 23) (interview Stephenson, 2019; interview Valley Metro, 2019).

The downtown has an increase of 4% in the period just after the 2008-recession. This is notable if compared to the other two time periods where the performances of other areas are more positive but the downtown developments are more negative. Translated to total numbers, the development of retail seems a bit less impressive. The increase of 4% translates to an increase of 14 jobs. The 71%-decrease of 2004-2008, translates to a loss of 564 jobs. While the downtown performs worst in both 2004-2008 and 2012-2015, the area is placed 6th in 2008-2012. As a side note, the downtown is 2nd in the first stage of 2008-2012 with a net job increase of 16%. In this stage (2008-2012), nine areas experienced negative changes while the jobs in the downtown increased from 382 to 445 in the retail sector. There may be a small effect of light rail on retail activity and if this happens to be the case, it was not a long lasting effect.

Just after the 2008-recession, the light rail corridor performed positively in general. Non-light rail areas experienced negative change however. Another difference is that fluctuations in retail change were stronger in the corridor than the non-light rail areas. Tempe and North were positive outliers around this time. A reason for this is the opening of Tempe Marketplace and the redevelopment of Christown Mall, respectively in Tempe and North. Downtown was ranked 6/13 in terms of retail performance in 2008-2012.

4.3.6 2012-2015 (second period after the implementation)

2012-2015 is characterized by a period of relative minor changes of jobs in the retail sector. Figure 20 mainly paints a scenario where many dots are small in its size. In other words, most areas perform (relatively) moderate at best in retail activity for this period. Retail seems to have developed less well after the recession compared to total jobs for the non-light rail areas Deer Valley and Desert Ridge/Kierland and light rail areas Midtown and downtown. There is a cluster of small growth in the northern research areas while the Airport Area, Tempe, South Mountain and West-Chandler make a cluster of moderate growth. “Cluster” may be a heavy terminology since there are (non-analyzed) areas in-between the areas of moderate growth which may experience other directions of retail activity.

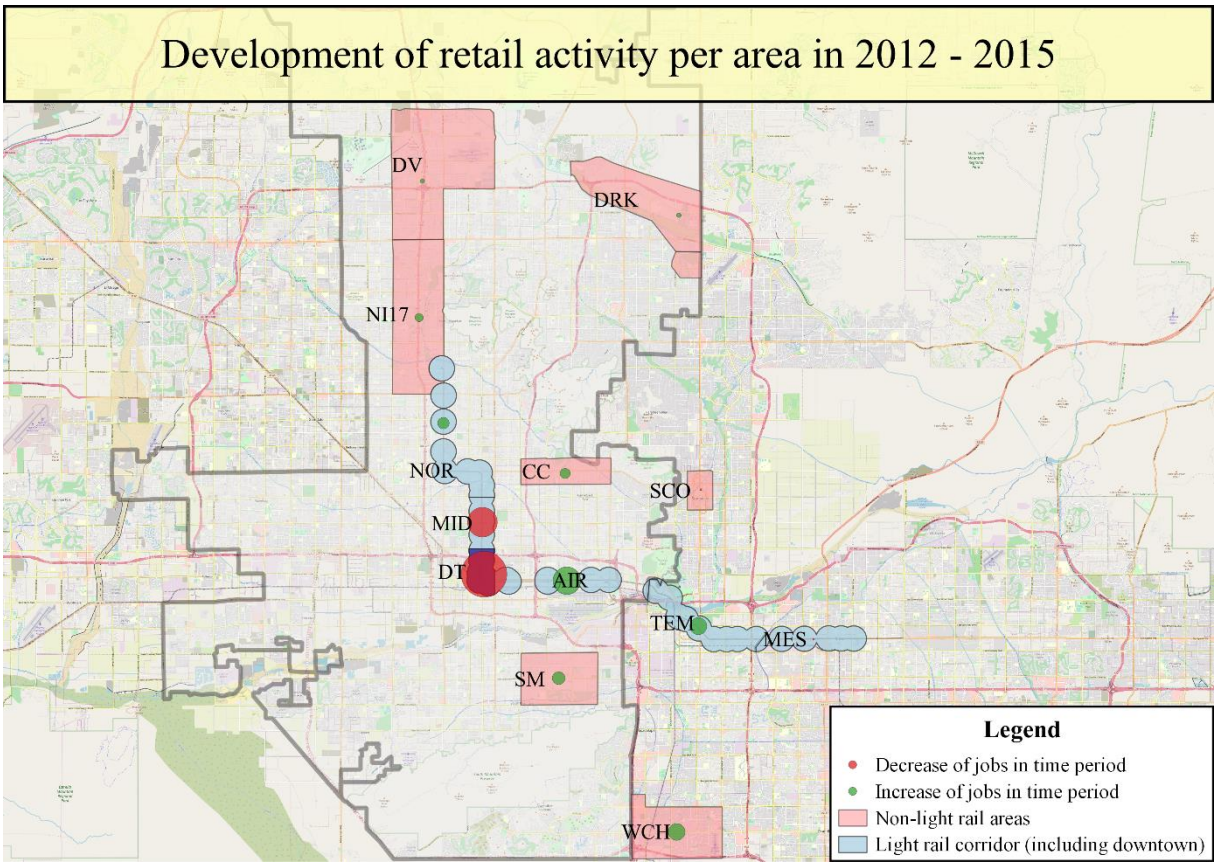

Figure 20: Total retail performance in 2012-2015 for the research areas

There are no significant retail increases in the non-light rail areas. West-Chandler (WCH) is the best performing area with a retail activity development of 14%. South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods. Just like the total jobs, Desert Ridge/Kierland is a place where positive changes happened in all periods. This time, retail rose with nearly for 4% in Desert Ridge/Kierland. Experts from Valley Metro (interview 2019) argue that Desert Ridge/Kierland is performing positive in all periods due to its strategic location. Land is abundant and cheap so the development of retail is a relative low risk investment. Thereby, the Scottsdale-corridor can serve as a potential customer base. Customers within Scottsdale do have money to spend. As an example, many so called “snowbirds” live in this area. “Snowbirds” are considered to be retirees from colder parts of the country or Canada that spend the wintertime in Phoenix (Scottsdale) where they have a house as well. The Scottsdale population can easily access Desert Ridge/Kierland via Loop 101. As a result, developers got cheap land near a wealthy corridor with one of the most affluent populations in the Phoenix metropolitan area. Specific high-end retail stores are created which serve these snowbirds and other high-spending customers as they may “easily pay $200 on dinner on a Tuesday night” (Valley Metro, interview 2019).

The performance of the non-light rail area and light rail corridor is exactly the same. Both the non-light rail area and light rail corridor have a retail increase of 5% which can be considered as remarkable (in the sense that performance is exactly the same). Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods. Next to the earlier mentioned Tempe Marketplace, Laughner (interview 2019) argues that density is an important factor for Tempe’s success. She believes that density will result in a stable costumer-base. McDaniel (interview 2019) further mentions that Tempe has many high retail facilities that were able to locate at high rent places. This high retail services can be more resilient to certain shocks such as (potential future) recessions

The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period. The downtown (currently) lacks a residential aspect says Laughner (interview 2019). The current situation is that many people live in suburbs, do shopping at places close to their home and go to the downtown for other purposes such as work. In order to create more retail activity, it may be necessary to generate residential development as retail creation is strictly tied to it. According to Valley Metro (interview 2019), two full service grocery stores are present in downtown and Midtown. One at McDowell/7th street, the other at 7th Avenue/Osborn. A proportion of retailers need a big box in the suburbs. Valley Metro (interview 2019) does however vision that the downtown is worth to invest since population increases. A proportion of this increasing population is due to students so services such as grocery stores are justified to be set up (interview Valley Metro, 2019). Referring to "new urbanism", McDaniel (interview, 2019) thinks that more educated people will live in the downtown in contrast to the periphery. McDaniel states that the implementation of light rail encourages infill development. This infill development is partly characterized by the creation of residency. This residency attracts high educated professionals out of the suburbs. As a result, braindrain will happen in suburbs while retail activity in downtown is created with the incoming professionals. As a caveat, he mentions that it may take decades to complete this sketched scenario (interview McDaniel, 2019).

In the second operating phase, the retail-development of the corridor and non-light rail areas is equal, both positive. South Mountain has a positive retail change in all three measured periods, similarly to Tempe. Downtown is the worst performing area with a decrease of 38% while total jobs increased with 28% in the same time period. Experts argue that downtown still lacks a significant residential aspect. Some experts however argue that highly educated people increasingly move away from the suburbs to the Phoenix-downtown since the idea of using a car becomes increasingly unattractive.

Table 7 shows the total performance; performance before the implementation and performance after the implementation of light rail.

Table 7: The relative positions of each study area and its retail performance before- and after the implementation of the light rail. ***Non-light rail zones (red)****: CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SM = South Mountain.* ***Light rail zones (blue)****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

	Area	Performance (2004-2015)
1	Desert Ridge/Kierland	+115,90
2	Tempe	+98,55
3	South Mountain	+76.66
4	19th Avenue/Camelback (North)	+33.64
5	North Interstate 17	+14,22
6	West-Chandler	+10,29
7	Camelback Corridor	+5,99
8	Scottsdale	-14,14
9	Midtown	-14,78
10	Deer Valley	-30,39
11	Mesa	-50,23
12	Airport Area	-52,37
13	Downtown	-80,97

Area	Performance **before** light rail ('04-'08)
DRK	+ 89,81
SM	+44,31
NI17	+27,55
TEM	+16,95
MID	+12,70
WCH	+11,90
AIR	+5,14
CC	-8,03
NOR	-8,75
SCO	-10,70
MES	-23,14
DV	-28,11
DT	-70,68

Area	Performance **after** light rail ('08-'15)
TEM	+69,77
NOR	+46,45
SM	+22,42
CC	+15,24
DRK	+13,74
WCH	-1,44
DV	-3,15
SCO	-3,85
NI17	-10,45
MID	-24,38
DT	-35,08
MES	-35,24
AIR	-54,70

Based on table 7, light rail seems to have brought retail activity to Tempe and 19th Avenue/Camelback since performance changes drastically (in a positive way) after the implementation. These regions moved from places four and nine, to places one and two. Using the same approach as by the total jobs, the cumulative relative position of the corridor to the non-light rail areas does not change. Before the implementation, the total sum of all light rail areas rankings was 49 (4+5+7+9+11+13). After the implementation, the sum is 49 as well (1+2+10+11+12+13). The rankings do not change although the compositions do change.

To finalize the retail-analysis, the downtown did increase in relative position after the transit system had been implemented. Still, there is no sign that the implementation of light rail brought significant retail activity to the CBD and if this happens to be the case, it was only for a short amount of time so far.

4.4 The influence of the Valley Metro

Given the quantitative and qualitative analyses, some arguments can be made about the effects of light rail on total jobs and retail activity:

1) *The development of jobs (total jobs, in retail) shows strong spatial and temporal fluctuations*. Some areas have experienced positive change in all three study periods, for both retail and total jobs. Other areas experienced negative change while some areas experienced some positive and some negative change, depending on the aspect of the defined economic activity (retail or total jobs) and time period (2004-2008; 2008-2012; 2012-2015). This is the case between and within the two main areas (non-

light rail and corridor). Since developments in the corridor are heterogeneous, (the degree of) possible light rail effects are different between areas.

2) *Development of economic activity does not depend on only light rail as other trends and/or events stimulated economic activity too*. The different changes in economic performance in different areas over time, may also be attributed to other events than light rail implementation. To clarify, the opening of the ASU-campus or the increase multi-family residency in downtown Phoenix, are also factors that increased total- and retail jobs in Phoenix. Thereby, it is hard to determine whether light rail offset these trends or that light rail was a result of this trends.

3) *The 2008-recession has been an event that overshadowed the (potentially positive) effects of the Valley Metro system.* While the creation of ASU-campuses and multi-family residency created jobs, the 2008-recession had an overall negative impact on total jobs and retail in Phoenix metropolitan area. Important to note is that some sectors were hit worse than others which can be reasons why certain areas perform less poor than others. The 2008-recession was especially apparent in Arizona. In general, the (positive) effects of light rail implementation were not large enough to counter negative effects of the 2008-recession. Laughner (interview 2019) argues that light rail-effects will become more visible in ten years when recession-effects are less apparent so that effects of light rail become more apparent.

4) *It is too early to draw conclusions about effects of light rail implementation.* In their research about light rail and land use change, Higgins et al. (2014) state that several cities such as Los Angeles, Norfolk and Sacramento have completed new light rail lines and system extensions since 2005 but that "the relative immaturity of these systems means it will be some time before researchers are able to decipher their long-term ability to shape urban growth and development (Higgins et al., 2014, p. 106). Chen et al. (2011) state that demand for transit is often not instantaneous. While few literature inquires time-lag effects of light rail implementation, Rose (1986) examines that transit ridership lags 12 to 13 months past changes in transit supply (Rose, 1986 in Chen et al., 2011). Director of the real estate development program at ASU, Mark Stapp, has an opinion that real benefits of light rail will be recognized decades from now as it forms a framework for redevelopment and the urban form of Phoenix metropolitan area (AZ Central, 2018b). 2015 may still be too short to provide a representable argument for light rail success or not. To extend, more companies are coming in the last three years (2016-2019) than ever argues Stephenson (interview 2019). Although public transport seems to be rising in popularity, some experts question it's future continuing influence. While light rail may increase in popularity, experts from Valley Metro (interview 2019) don't think that light rail will become a large network in the Phoenix metropolitan area. It is getting more expensive to expand but they also stress that light rail transit will never be not relevant. Next to the increasing costs associated with light rail, some communities are in large proportion against light rail implementation. Many residents in South Phoenix protest against light rail extension. With their movement "South Phoenix 4 lanes or no train", they argue that light rail will take away two of the four automobile lanes. This change will increase congestion. Car users will take other routes which in its turn affect businesses since they are no longer frequented by this specific group (AZ Central, 2018b).

5) *Non-light rail areas in Phoenix are predicted to continue performing well despite light rail implementation*. While light rail may be considered to be an attractive feature for a good business location, peripheral land will remain in demand for companies. This may be since land is abundant and cheap which are good conditions for future economic development. Stephenson (interview 2019) presumes that development will continue to grow in both the corridor and non-light rail areas. Leslie (2010) states that areas of significant density of both establishments and employment continue to thrive and grow in postmodern urban areas. The low density suburbs will continue to exist whereby experts from Valley Metro (interview 2019) have the following statement about Phoenix metropolitan area: "if you want the sprawl we have it, but we also offer something else"

6) *Mobility behavior will change which could be favorable for light rail*. Laughner (interview 2019) thinks light rail may become more popular over time as generations change. With changing generations comes a change in thinking. Newer generations don't want to drive and deal with parking. Rather, they want to live and work at places which are accessible via bicycle or public transport. Businesses will follow this way of thinking as they try to locate at places where employees are happy (interview Laughner, 2019). Vice chairman Larry Downey, for tenant services by the real estate services company Cushman & Wakefield states that "companies are very interested in being around light rail for their employees and for how it adds to the value of properties" (AZ Central, 2018b). Some companies tend to already experience effects of the shift in mindset by younger generations. As an example, USAA – a large organization for insurance, banking, investment and retirement – recently located in north Phoenix along the interstate 17 and just north of Deer Valley. The site is good for 10,000 jobs. A problem the company faces is that they can't hire software employees because these employees live in Tempe and don't want to drive (such a distance) (interview Laughner, 2019). CEO of DMB development (a real estate development firm business) Brent Herrington argues that light rail is changing the way people live and work and the way development must evolve. Thereby his view is that "many Millennials aren't interested in owning a car or driving to work" (AZ Central, 2018b). This argument is further supported by McDaniel (interview 2019) who states that driver licenses have decreased remarkably (12%) in the last 10 year.

7) *Light rail-construction hindered retail*. Especially small retail businesses experienced loss in jobs during construction. These small retail businesses had no corporate backing. Like said before, this may increase resistance in future light rail trajectories (e.g. South Phoenix) as shop owners are afraid that construction causes harm.

8) *Light rail brought quality instead of quantity*. Valley Metro (interview 2019) says that the implementation can give a new input into the image of Phoenix. To extend, Phoenix and Mesa are recognizing positive press attention and locals and new residents are positively surprised about light rail in Phoenix (interview Valley Metro, 2019). This is supported by Du & Mulley (2007) stating that the existence of metro helps to improve the image of the city, in their case, Sunderland (United Kingdom). This improving image contributes to the growth of property prices in the city (Du & Mulley, 2007). The "light rail"-concept also sells to companies that were before hesitant to moving to the Valley-area (interview Stephenson, 2019). To use as a local example, State Farm picked Tempe for regional headquarters and its company's executive Michael Tipsord mentions light rail as a big reason why (AZ Central, 2018b). Valley Metro (interview 2019) acknowledges the quantitative loss of jobs that happened in the corridor but they add that jobs gained in qualitative sense, bringing more people 24 hours a day. They presume that light rail enhances the quality of life. There are lots of vacant land along light rail that now have reasons to be used. Since people have the increasing demand for living near public transport access, residency is (increasingly) developed along light rail (interview Laughner, 2019; interview Stephenson, 2019; interview Valley Metro, 2019). Vacant land is transformed into walkable land. Whereas people may previously have entered and left the doors of the apartment-complexes with cars, more people now walk through the doors in order to walk to a light rail station. Light rail also changes the mindset of (local) politics: the focus of zoning tends to be more and more replaced by mixed land use around light rail areas.

9) *Effects depend upon land characteristics*. Urban high density-areas are points of focus for local politicians where light rail forms a component in creating this situation. As a result of this high density-thinking, urban sprawl can be paused. Laughner (interview 2019) uses Portland as an example in creating high density in light rail impacted areas. She argues that Portland has urban boundaries which limits available (cheap) land so sprawl is limited. As a result, more businesses are situating near light rail stations so density around stations is high, making the implementation of light rail in Portland seen as a successful one. The situation is different for Phoenix since no urban boundaries are set so economic activity can simply expand in desert areas where land is cheap.

Chapter 5: Conclusion and reflection

5.1 Results

By analyzing total jobs and retail activity over time and between areas, this research examined the potential spatial-economic effects of light rail implementation on (downtown) Phoenix, Arizona. There are no clear signs of positive light rail effects on the downtown of Phoenix in quantitative terms. Effects of light rail become more clear in qualitative terms however.

Before implementation

Right before light rail implementation (2004-2008), the downtown of Phoenix did not perform well. The downtown especially performed poor compared to the other research areas. While the decrease was minor for total jobs, retail decreased heavily in the downtown. Light rail construction was a main factor that negatively influenced retail activity.

Before light rail implementation (2004-2008), non-light rail areas performed better than the downtown in both total jobs and retail activity. Outside downtown, in the more peripheral parts of the Phoenix metropolitan area, land is cheap and abundant which create good conditions for new development. This new development is easier to create than redevelopment in downtown (where land is more scarce and expensive). Although performing less strong compared to non-light rail areas, other places in the corridor performed better than the downtown, especially the areas adjacent to the downtown.

First operating phase

The opening of light rail (2008) happened in recession-times so light rail-effects may therefore be less distinguishable. Remarkable may be that in the downtown, total jobs now decreased while retail increased slightly. Considering total jobs, only one other area in the corridor performed worse than the downtown out of the 13 study areas. Relative high rents (in times of recession) in downtown may be a cause for this relative large job loss. Second, certain sectors are hit harder by the recession. It is argued that these more vulnerable sectors were largely represented in the downtown.

Second operating period

Downtown is the second best performing study area in the second operating period (2012-2015) in terms of total jobs and did thus increase in relative position after LRT had been implemented. Rents have lowered around this time in downtown. Certain functions that were purposely kept empty during the recession-period, were apparently filled in again in order to facilitate the urban growth that was happening in the larger metropolitan area.

In contrast with total jobs, retail activity performed poorly in this period in the downtown. This may be since downtown still functions mainly as a work-center. It is expected that retail will increase since multi-family residency increases in downtown so potential demand can be created for retail in the downtown.

Influence of light rail

Total job and retail activity is not uniform, both between and within the corridor and non-light rail areas. Other events and trends were also of importance for this heterogeneous development. It is however argued that light rail acted as a catalyst for many of these other factors that influenced economic development. This economic development was (and still is) necessary to transform

downtown Phoenix from a dead space to a “24/7”-place where people live, work and entertain themselves.

Unlike other American cities, the light rail system in Phoenix is in its earlier stages so it may be hard to draw concrete conclusions about its impact, especially in comparison to other cities. The unclear light rail effects (in quantitative terms) are also due to recession-effects. Therefore, this research functions more as an explorative study. This research may also create certain hypotheses that further research can use. Experts argue that effects of light rail will become better visible in 10 years, also considering the fact that more companies than ever are coming in in the last three years. Future research could thus examine spatial-economic effects of light rail over 10 years again.

In order to maximize the positive contribution of light rail, high density development along light rail stations should be encouraged. Phoenix used to emphasize on zoning whereby a certain place could only have one certain function. However, experts are now arguing that emphasizing on “mixed use” is important for stimulating positive light rail-effects. This mixed use near light rail stations is needed to facilitate potential future demand that is created by the changing mindset from an auto-oriented society to a public transport one. Therefore, high density development near light rail stations is encouraged to cope with the potential future demand in terms of living, working and shopping (near public transport).

5.2 Reflection

5.2.1 Evaluation

Research area

While this research has defined a clear sphere of influence due to light rail stations, it is also simplistic. The extend of influence of each light rail station might be more complex therefore vary more.

The demarcation, in this study, of the six areas that are influenced by light rail against the seven areas that are not influenced by light rail, has been determined carefully. These areas are however not split up in smaller areas.

Factors such as density may also impact the amount of retail and the changes it experiences. Baum-Snow et at. (2005) find that new transit lines have more success in areas that are more dense. Research could thus explore the relation between denser (light rail) areas within Phoenix and the degree to which these areas experience higher economic performance. Also, several areas can be targeted which potentially can be used for mixed land use.

Retail activity

Although the research discussed retail activity, the data represents little about the actual facts of the retail, for instance on size of retail establishments. Balsas (2014) argues that the Phoenix metropolitan area has some of the newest and most modern shopping formats in the United States. Balsas argues that these formats provide large sales taxes which can then be seen as a source of income for the (local) governments. These formats also lead to more uniform patterns in the urban and suburban landscape. Further research can focus on defining types of retail activity and so, explore if these defining types are also substantially different between the different study areas. Has the light rail corridor experienced more of these increases in “modern shopping formats” compared to the suburban counterparts for instance and if so, what are the effects of this trend. Balsas also points to the local efforts from within the Arizona communities to strengthen local economies through the promotion of locally owned businesses (Balsas, 2014). As locally owned businesses are considered to be important,

policies may want to focus on creating a substantial proportion of locally owned businesses within the corridor.

Time Period

Another thing to discuss is that the definition of certain periods lead to the outcome of certain developments. As an example, the performance of total jobs in the downtown in 2008-2015 is -3%. So a conclusion can be made about the light rail having very limited influence on total jobs in the downtown. Hereby, the downtown is placed 11th out of the 13 areas. If however zoomed in on the 2012-2015 period (which is part of the earlier mentioned 2008-2015 period), the downtown has a total job increase of +28%. In the same period, it performs relatively strong as being the second best performing region. Here, more positive conclusions can be drawn about the light rail having at least some impact on total jobs in the downtown. Periods have to be carefully chosen in order to sketch certain results thus certain conclusions about the influence of the light rail on total- and/or retail jobs in the downtown.

Change in jobs

Literature and experts tend to have contradictory views about whether loss of jobs is something to be considered negative. As it turned out in this case, negative implications in quantitative terms can still be positive in qualitative terms. Therefore, further research may also examine the question whether a decrease in jobs is by definition negative. Thereby, the geographical aspect can be taken into account to examine whether job loss has a different degree of effect between areas, for instance between the corridor and non-light rail areas.

5.2.2 Contribution to literature

Considering the theory of Knowles and Ferbrache (2016) that states that light rail reorganizes production, distribution and land use, results of this research create a caveat. While light rail motivates businesses to locate near a station and land values in the sphere of influence increase, economic development also continues to happen in the periphery. Moreover, the heterogeneity of development is in line with Knowles & Ferbrache (2016) statement in that location is central.

Another point is that light rail acts as a catalyst and therefore needs more factors to let economic activity unfold at places where it is needed. Findings of this research second this by indicating that ASU's presence and the increase of multi-family residency were also important factors in stimulating economic activity in Phoenix. With this observation, another theory is important to note in that it is very difficult to differentiate light rail effects from other effects.

So far, this research does not seem to facilitate the theory of Schuetz (2015) and Topalovic et al. (2012) that light rail increases retail businesses. The statement about Topalovic et al. (2012) about overestimation of light rail effects is seconded however.

Golub et al. (2012) stated that light rail may also have negative effects. Since construction impacted businesses in a negative way in the findings, Golub et al. theory can be supported in this essence.

Moreover, this research contributed in finding theories that can be added to the scarce literature about time-lag effects of light rail since many (interviewed) experts have stressed that light rail effects need decades to clearly unfold, especially when certain shocks such as a recession are taken into account.

Considering studies on travel behavior, this study gives food for thought in the sense that it discovers a trend in which people are increasingly switching from the dependency on the automobile to the usage of public transport.

Sources

Literature

Abbott, Carl. 1993. Five Downtown Strategies: Policy Discourse and Downtown Planning Since 1945. Journal of policy History 5,l: 5-27.

Anderson, J., Duncan, S., and Hudson, R. (1983). Uneven development, redundant spaces?: an introduction. In: Anderson, J., Duncan, S. and Hudson, R. (eds) Redundant spaces in cities and regions. London: Academic Press, pp. 1–16.

Atkinson-Palombo, C., & Kuby, M. J. (2011). The geography of advance transit-oriented development in metropolitan Phoenix, Arizona, 2000–2007. *Journal of Transport Geography*, *19*(2), 189-199.

Balsas, C. J. (2014). Downtown resilience: A review of recent (re) developments in Tempe, Arizona. *Cities*, *36*, 158-169.

Baum-Snow, N., Kahn, M. E., & Voith, R. (2005). Effects of urban rail transit expansions: Evidence from sixteen cities, 1970-2000 [with Comment]. *Brookings-Wharton papers on urban affairs*, 147-206.

Beauregard, R. A. (1993). Representing urban decline: postwar cities as narrative objects. *Urban Affairs Quarterly*, *29*(2), 187-202

Beirão, G., & Cabral, J. S. (2007). Understanding attitudes towards public transport and private car: A qualitative study. *Transport policy*, *14*(6), 478-489

Berry B (1967) Geography of Market Centers and Retail Distribution. Englewood Cliffs, NJ: Prentice Hall.

Birch, E. L. (2009). Downtown in the "new American city". *The annals of the American academy of political and social science*, *626*(1), 134-153.

Brambilla, Roberto, and Gianni Longo. 1977. For Pedestrians Only. New York: Whitney Library of Design.

Buehler, R., & Pucher, J. (2011). Making public transport financially sustainable. *Transport Policy*, *18*(1), 126-138.

Cervero, R. (1984). Journal report: light rail transit and urban development. *Journal of the American Planning Association*, *50*(2), 133-147.

Cervero, R., & Landis, J. (1997). Twenty years of the Bay Area Rapid Transit system: Land use and development impacts. *Transportation Research Part A: Policy and Practice*, *31*(4), 309-333.
Chen, C., Varley, D., & Chen, J. (2011). What affects transit ridership? A dynamic analysis involving multiple factors, lags and asymmetric behaviour. *Urban Studies*, *48*(9), 1893-1908.

Credit, K. (2018). Transit-oriented economic development: The impact of light rail on new business starts in the Phoenix, AZ Region, USA. *Urban Studies*, *55*(13), 2838-2862.

Credit, K. (2019). Accessibility and agglomeration: A theoretical framework for understanding the connection between transportation modes, agglomeration benefits, and types of businesses. *Geography Compass*, *13*(4), e12425.

Du, H., & Mulley, C. (2007). The short-term land value impacts of urban rail transit: Quantitative evidence from Sunderland, UK. *Land Use Policy*, *24*(1), 223-233.

Faulk, D. (2006). The process and practice of downtown revitalization. *Review of Policy Research*, *23*(2), 625-645.

Fischer J and Harrington J (1996) Product variety and firm agglomeration. RAND Journal of Economics 27(2): 281–309.

Ford, L. (2003). *America's New Downtowns: Revitalization Or Reinvention?*. Johns Hopkins University Press

Friedman, D. (2009). An Extraordinary Partnership between Arizona State University and the City of Phoenix. *Journal of Higher Education Outreach and Engagement*, *13*(3), 89-100

Gammage, G. 2003. Phoenix in perspective: Reflections on developing the desert. Tempe, AZ: Herberger Center for Design Excellence, College of Architecture and Environmental Design, Arizona State University.

Gilchrist, A., & Allouche, E. N. (2005). Quantification of social costs associated with construction projects: state-of-the-art review. *Tunnelling and underground space technology*, *20*(1), 89-104.

Golub, A., Guhathakurta, S., & Sollapuram, B. (2012). Spatial and temporal capitalization effects of light rail in Phoenix: From conception, planning, and construction to operation. *Journal of Planning Education and Research*, *32*(4), 415-429.

Gottmann, Jean. 1966. Why the Skyscraper? Geographical Review 56,2: 180-212.

Gruen C. (2010) New Urban Development: Looking Back to See Forward. Piscataway NJ: Rutgers University Press.

Hayes L. R. (2000) Do the poor pay more? An empirical investigation of price dispersion in food retailing. Working paper no. 446. Schuetz 2719 Princeton Department of Economics, Industrial Relations.

Heim, C. E. (2001). Leapfrogging, urban sprawl, and growth management: Phoenix, 1950–2000. *American Journal of Economics and Sociology*, *60*(1), 245-283.

Higgins, C., Ferguson, M., & Kanaroglou, P. (2014). Light rail and land use change: Rail transit's role in reshaping and revitalizing cities. *Journal of Public Transportation*, *17*(2), 5.

Jacobs, J. (1961). The Death and Life of Great American Cities, reprint. *Peregrine Book, London*.

Joshi, H., Guhathakurta, S., Konjevod, G., Crittenden, J., & Li, K. (2006). Simulating the effect of light rail on urban growth in Phoenix: An application of the UrbanSim modeling environment. *Journal of Urban Technology*, *13*(2), 91-111.

Kane, K., Tuccillo, J., York, A. M., Gentile, L., & Ouyang, Y. (2014). A spatio-temporal view of historical growth in Phoenix, Arizona, USA. *Landscape and urban planning*, *121*, 70-80.

Keating, W. D., & Krumholz, N. (1991). Downtown plans of the 1980s: The case for more equity in the 1990s. *Journal of the American Planning Association*, *57*(2), 136-152.

Keys, E., Wentz, E. A., & Redman, C. L. (2007). The spatial structure of land use from 1970–2000 in the Phoenix, Arizona, metropolitan area. *The Professional Geographer*, *59*(1), 131-147.

Kittrell, K. (2012). Impacts of vacant land values: Comparison of metro light rail station areas in

Phoenix, Arizona. *Transportation Research Record*, *2276*(1), 138-145.

Knowles, R. D., & Ferbrache, F. (2016). Evaluation of wider economic impacts of light rail investment on cities. *Journal of Transport Geography*, *54*, 430-439

Leslie, T. F. (2010). Identification and differentiation of urban centers in Phoenix through a multi-criteria kernel-density approach. *International Regional Science Review*, *33*(2), 205-235.

Lewis, R. 2002. The changing fortunes of American central-city manufacturing, 1870-1950. Journal of Urban History 28:573-98

Luckingham, B. (1989). Phoenix: The history of a Southwestern Metropolis. Tucson: University of Arizona Press

Mackett, R. L., & Edwards, M. (1998). The impact of new urban public transport systems: will the expectations be met?. *Transportation Research Part A: Policy and Practice*, *32*(4), 231-245.

Maricopa Association of Governments. 2000. Valley Vision 2025. Alternatives, Choices, Solutions. Phoenix: Maricopa Association of Governments.

Maurin, E., & Thesmar, D. (2004). Changes in the Functional Structure of Firms and the Demand for Skill. *Journal of labor economics*, *22*(3), 639-664.

Mieszkowski, P., & Mills, E. S. (1993). The causes of metropolitan suburbanization. *Journal of Economic perspectives*, *7*(3), 135-147.

Mitchell, R. B., & Rapkin, C. (1954). Urban Traffic--A Function of Land Use.

Mohammad, S. I., Graham, D. J., Melo, P. C., & Anderson, R. J. (2013). A meta-analysis of the impact of rail projects on land and property values. *Transportation Research Part A: Policy and Practice*, *50*, 158-170.

Muller, Edward K. 1980. Distinctive Downtown. Geographical Magazine 52,s: 747-55.

Padilla, C., & Eastlick, M. A. (2009). Exploring urban retailing and CBD revitalization strategies. *International Journal of Retail & Distribution Management*, *37*(1), 7-23.

Rex, T. R. (2000). *Development of metropolitan Phoenix: Historical, current and future trends*. Center for Business Research, L. William Seidman Research Institute, College of Business, Arizona State University.

Robertson, Kent A. 1983. Downtown Retail Activity in Large American Cities 1954- 1977. Geographical Review 733 3 14-23.

Robertson, K. A. (1995). Downtown redevelopment strategies in the United States: An end-of-the-century assessment. *Journal of the American Planning Association*, *61*(4), 429-437.

Rose, G. (1986). Transit passenger response: short and long term elasticities using time series analysis. *Transportation*, *13*(2), 131-141.

Ryan, S. (2005). The value of access to highways and light rail transit: evidence for industrial and office firms. *Urban studies*, *42*(4), 751-764.

Scott, M. (1971). *American city planning since 1890: A history commemorating the fiftieth anniversary of the American Institute of Planners* (No. 3). University of California Press.

Schuetz, J. (2015). Do rail transit stations encourage neighbourhood retail activity?. *Urban Studies*, *52*(14), 2699-2723.

Stern N (1972) The optimal size of market areas. Journal of Economic Theory 4(2): 154–173

Tennyson, E. L. 1982. When and where does LRT work? Special Report 295, pp. 46-53. Washgton: Transportation Research Board

Topalovic, P., Carter, J., Topalovic, M., & Krantzberg, G. (2012). Light rail transit in Hamilton: Health, environmental and economic impact analysis. *Social Indicators Research*, *108*(2), 329-350.

Van der Meer, P. (2010). *Desert visions and the making of Phoenix, 1860-2009*. UNM Press.

Ward, K. (2007). Business improvement districts: policy origins, mobile policies and urban liveability. *Geography Compass*, *1*(3), 657-672.

Internet Sources

AZ Central (2018a). *Downtown Phoenix's rebirth has been decades in the making. Here's how they did it*. Consulted on 26-10-2018 via: https://www.azcentral.com/story/news/local/phoenix/2018/10/25/arizona-downtown-phoenix-rebirth-brings-hope-challenges-asu-suns-diamondbacks/1534788002/

AZ Central (2018b). *Development around light rail has changed Phoenix, Tempe and Mesa*. Consulted on 11-6-2019 via: https://eu.azcentral.com/story/news/local/phoenix/2018/12/20/light-rail-has-changed-phoenix-tempe-mesa-development-redevelopment-gentrification-downtown/2266066002/

Big map blog (2011). *Street map of Phoenix, Arizona (1956)*. Consulted on 4-6-2019 via: http://www.bigmapblog.com/2011/us40-12-phoenix-arizona-street-map-1956/

City Of Phoenix (2019). *Major employment centers*. Consulted on 12-3-2019 via: https://www.phoenix.gov/pddsite/Documents/PlanPHX_Major_Emp_Cntrs.pdf

Downtown Phoenix (2018). *The Economic Capture of the Downtown Phoenix Redevelopment Area.* Consulted on 19-3-2019 via: http://dtphx.org/wp-content/uploads/2018/07/DTPHX-IMPACT-REPORT-2018.pdf

DTHPX. *Downtown Phoenix Overview, 2018*. Consulted on 15-10-2018 via: http://dtphx.org/wp-content/uploads/2018/08/DPP-Fact-Sheet_Q3-2018.pdf

DTPHX. *Downtown Phoenix Past, Present & Future*. Consulted on 15-10-2018 via: http://dtphx.org/wp-content/uploads/2018/07/DPI-generic-Q32018.pdf

Google Maps (2018). *Phoenix*. Consulted on 25-10-2018 via: https://www.google.nl/maps/@33.4477199,-112.0854385,13z

Mall hall of fame (2019). *Thomas Mall*. Consulted on 4-6-2019 via: http://mall-hall-of-fame.blogspot.com/2007/09/thomas-mall-east-thomas-road-and-north.html

On The Map (2019). *Phoenix 2004; 2008; 2012; 2015*. Consulted on 25-10-2018 via: https://onthemap.ces.census.gov/

Phoenix (2012). *Phoenix growth*. Consulted on 12-6-2019 via: https://www.phoenix.gov/pddsite/Documents/PZ/pdd_pz_pdf_00178.pdf

Skysong (2019). *Project history*. Consulted on 7-6-2019 via: http://skysong.com/about-skysong/project-history/

Tripsavvy (2018). *Phoenix/Tempe/Mesa Light Rail 101: How to Ride the Train.* Consulted on 25-10-2018 via: https://www.tripsavvy.com/how-to-ride-the-light-rail-2683426

United States Census Bureau. *North American Industry Classification System*. (2017). Consulted on 5-5-2019 via: https://www.census.gov/eos/www/naics/2017NAICS/2017_NAICS_Manual.pdf

United States Department of Labor (2019). *Retail Trade: NAICS 44-45. Consulted on 6-5-2019 via:* https://www.bls.gov/iag/tgs/iag44-45.html

Valley metro (2018b). *Building Communities + enhancing lives. A Quality of Life Report.* Consulted on 19-3-2019 via: https://www.valleymetro.org/sites/default/files/uploads/event-resources/quality_of_life_report_12-3-18_-_final_reduced.pdf

Valley Metro (2018c). *Strategic Plan*. Consulted on 25-4-2019 via: https://www.valleymetro.org/strategic-plan

Wikipedia (2019). *List of shopping malls in the United States: Arizona*. Consulted on 4-6-2019 via: https://en.wikipedia.org/wiki/List_of_shopping_malls_in_the_United_States#Arizona

Source image front page

https://www.tripsavvy.com/valley-metro-rail-system-2683427

Contents

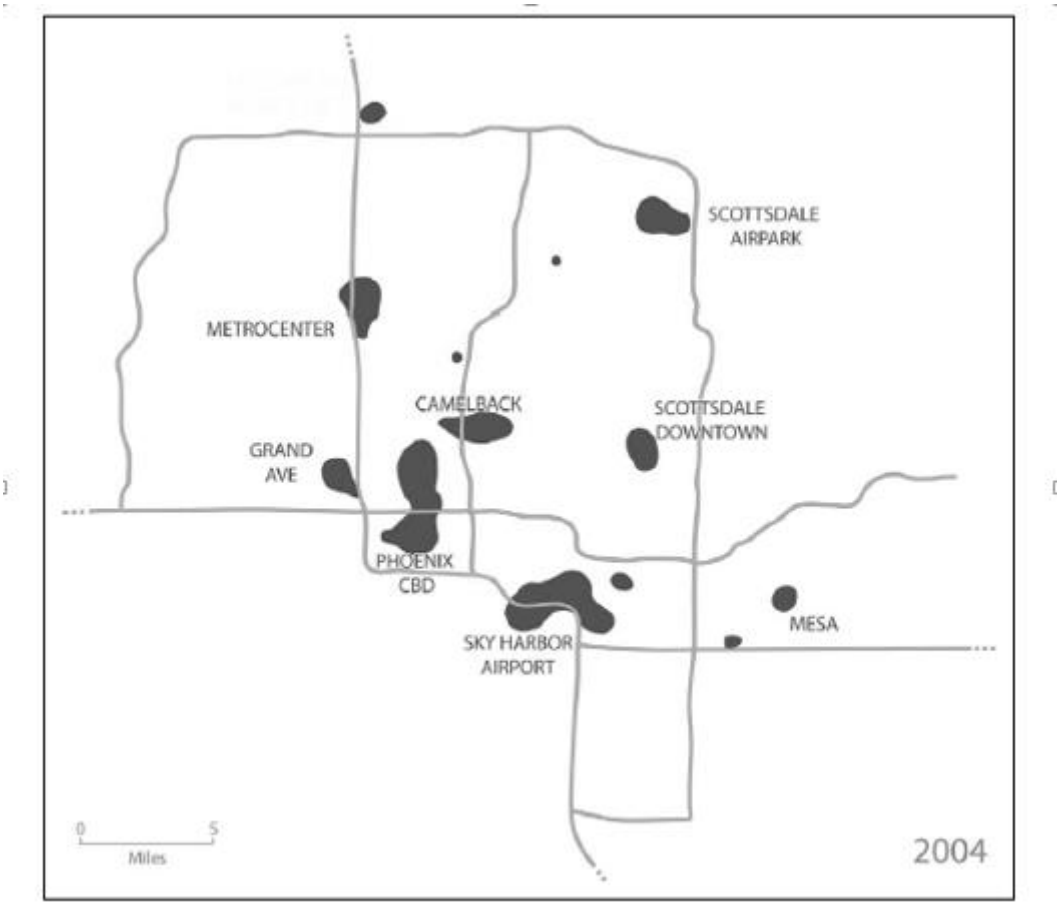

Figure 1: Major employment centers in the Phoenix metropolitan area, defined by Leslie (2010)

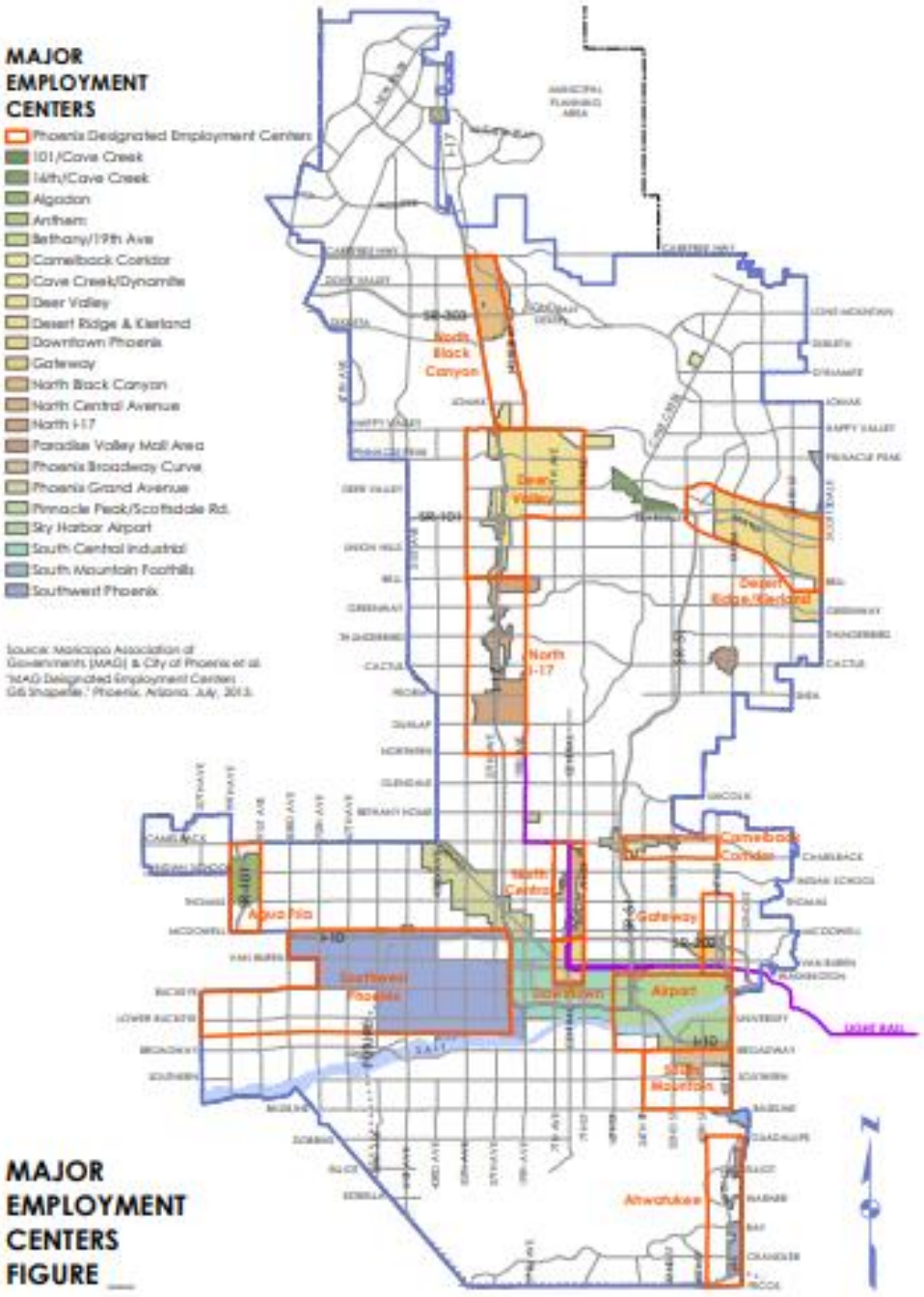

Figure 2: The major employment centers defined by the city of Phoenix and Maricopa Association of Governments (2013). Via: https://www.phoenix.gov/pddsite/Documents/PlanPHX_Major_Emp_Cntrs.pdf

Number	Light Rail Station	Zone
1	19th Ave/Dunlap	1 (North)
2	Northern	1 (North)
3	Glendale	1 (North)
4	19th Ave/Montebello	1 (North)
5	19th Ave/Camelback	1 (North)
6	7th Ave	1 (North)
7	Central Ave/Camelback	1 (North)
8	Campbell	1 (North)
9	Indian School	1 (North)
10	Osborn	2 (Midtown)
11	Thomas	2 (Midtown)
12	Encanto	2 (Midtown)
13	McDowell	3 (Downtown)
14	Roosevelt	3 (Downtown)
15	Van Buren/Central; Van Buren/1st Ave	3 (Downtown)
16	Jefferson/Central; Jefferson/1st Ave	3 (Downtown)
17	3rd Street	3 (Downtown)
18	12th Street	4 (Airport Area)
19	24th Street	4 (Airport Area)
20	38th Street	4 (Airport Area)
21	44th Street	4 (Airport Area)
22	Priest Dr.	5 (Tempe)
23	Center Parkway	5 (Tempe)
24	Mill Ave/3rd Street	5 (Tempe)
25	Tempe Transportation Center	5 (Tempe)
26	University Drive/Rural Road	5 (Tempe)
27	Dorsey Lane	5 (Tempe)
28	McClintock Drive	5 (Tempe)
29	Smith-Martin	5 (Tempe)
30	Price-101	5 (Tempe)
31	Sycamore/Main Street	6 (Mesa)
32	Alma School	6 (Mesa)
33	Country Club	6 (Mesa)
34	Center	6 (Mesa)
35	Mesa Drive	6 (Mesa)

Figure 3: The composition of each Light Rail zone in terms of Light Rail Stations

Correlations

Correlations

		TOTAL_JOBS	RETAIL_JOBS
TOTAL_JOBS	Pearson Correlation	1	,302
	Sig. (2-tailed)		,062
	N	39	39
RETAIL_JOBS	Pearson Correlation	,302	1
	Sig. (2-tailed)	,062	
	N	39	39

Figure 4: Outcome of correlation that shows insignificancy. The development of jobs does not affect retail activity in a significant way.

Quantitative data

Light rail zones

ZONE 1: North (19th Avenue/Camelback)

Year	Total jobs in 0,50 mile-buffer
2004	30360
2006	29535
2008	32753
2010	34398
2012	30626
2014	33270
2015	30092

Table 1: Total jobs in 0,50 mile-buffer, North

Year	Retail jobs 0,50 mile-buffer
2004	3430
2006	3917
2008	3130
2010	3137
2012	4189

2014	4341
2015	4584

Table 2: Retail jobs in 0,50 mile-buffer, North

ZONE 2: Midtown

Year	Total jobs 0,50 mile-buffer
2004	47826
2006	42381
2008	52836
2010	50582
2012	56570
2014	59183
2015	60532

Table 3: Total jobs in 0,50 mile-buffer, Midtown

Year	Retail jobs 0,50 mile-buffer
2004	961
2006	1163
2008	1083
2010	1065
2012	1082
2014	1036
2015	819

Table 4: Retail jobs in 0,50 mile-buffer, Midtown

ZONE 3: Downtown

Year	Total jobs 0,50 mile-buffer
2004	70324
2006	73208
2008	69506
2010	63774
2012	52974
2014	65314
2015	67771

Table 5: Total jobs in 0,50 mile-buffer, Downtown

Year	Retail jobs 0,50 mile-buffer
2004	1303
2006	739
2008	382
2010	445
2012	396
2014	433
2015	248

Table 6: Retail jobs in 0,50 mile-buffer, Downtown

ZONE 4: Phoenix Sky Harbor (Airport area)

Year	Total jobs 0,50 mile-buffer
2004	18842
2006	23491
2008	22186
2010	17253
2012	13332

2014	17156
2015	18468

Table 7: Total jobs in 0,50 mile-buffer, Airport area

Year	Retail jobs 0,50 mile-buffer
2004	739
2006	847
2008	777
2010	519
2012	287
2014	288
2015	352

Table 8: Retail jobs in 0,50 mile-buffer, Airport area

ZONE 5: Tempe

Year	Total jobs 0,50 mile-buffer
2004	37780
2006	41951
2008	39235
2010	38375
2012	34747
2014	37787
2015	39513

Table 9: Total jobs in 0,50 mile-buffer, Tempe

Year	Retail jobs 0,50 mile-buffer
2004	2342
2006	2663
2008	2739
2010	3342
2012	4082
2014	4071
2015	4650

Table 10: Retail jobs in 0,50 mile-buffer, Tempe

ZONE 6: Mesa

Year	Total jobs 0,50 mile-buffer
2004	32871
2006	35041
2008	31921
2010	27836
2012	27236
2014	26973
2015	26480

Table 11: Total jobs in 0,50 mile-buffer, Mesa

Year	Retail jobs 0,50 mile-buffer
2004	2640
2006	2611
2008	2029
2010	1470
2012	1337
2014	1337

2015	1314

Table 12: Retail jobs in 0,50 mile-buffer, Mesa

Non-light rail zones

Camelback Corridor

Year	Total jobs
2004	47491
2006	62654
2008	62102
2010	51462
2012	49331
2014	51398
2015	51675

Table 13: Total jobs in Camelback Corridor

Year	Retail jobs
2004	3375
2006	3511
2008	3104
2010	3107
2012	3301
2014	3371
2015	3577

Table 14: Retail jobs in Camelback Corridor

Deer Valley

Year	Total jobs
2004	43119
2006	52775
2008	51389
2010	45471
2012	46237
2014	52884
2015	55316

Table 15: Total jobs in Deer Valley

Year	Retail jobs
2004	4897
2006	6212
2008	3520
2010	3221
2012	3288
2014	3409
2015	3453

Table 16: Retail jobs in Deer Valley

Desert Ridge/Kierland

Year	Total jobs
2004	8917
2006	11445
2008	11886
2010	12567
2012	16660
2014	18601

2015	19793

Table 17: Total jobs in Desert Ridge/Kierland

Year	Retail jobs
2004	1434
2006	2686
2008	2722
2010	2237
2012	2983
2014	3255
2015	3096

Table 18: Retail jobs in Desert Ridge/Kierland

North Interstate 17

Year	Total jobs
2004	48801
2006	54054
2008	57171
2010	47295
2012	46304
2014	52757
2015	53028

Table 19: Total jobs in North Interstate 17

Year	Retail jobs
2004	6977
2006	7405
2008	8899
2010	6716
2012	7460
2014	7883
2015	7969

Table 20: Retail jobs in North Interstate 17

Scottsdale

Year	Total jobs
2004	23983
2006	26110
2008	29267
2010	29221
2012	28777
2014	30268
2015	30065

Table 21: Total jobs in Scottsdale

Year	Retail jobs

2004	6522
2006	5896
2008	5824
2010	5405
2012	5691
2014	5776
2015	5600

Table 22: Retail jobs in Scottsdale

South Mountain

Year	Total jobs
2004	15169
2006	17544
2008	15632
2010	13692
2012	13659
2014	14429
2015	14701

Table 23: Total jobs in South Mountain

Year	Retail jobs
2004	1187
2006	1596
2008	1713
2010	1947
2012	1899
2014	1921
2015	2097

Table 24: Retail jobs in South Mountain

West-Chandler

Year	Total jobs
2004	14611
2006	16960
2008	16110
2010	14286
2012	16273
2014	16730
2015	17792

Table 25: Total jobs in West-Chandler

Year	Retail jobs
2004	1925
2006	2157
2008	2154
2010	1833
2012	1867
2014	1958
2015	2123

Table 26: Retail jobs in West-Chandler

Development of total jobs and retail activity per area per period

2004-2008

Total jobs, 2004-2008, non-light rail zones

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
1	+ 31.93	+ 28.35	+ 22,39	+ 10,76	+8,87	+ 15,66	16,08	+ 19,52
2	- 0.88	+ 3.85	- 2.63	+ 5,77	+12,09	- 10,90	-5,01	+ 0,83
'04-'08	**+ 30,77**	**+ 33,30**	**+ 19,18**	**+ 17,15**	**+22,03**	**+ 3,05**	**+10,26**	**+20,52**

Table 27: Total jobs change 2004-2008, non-light rail areas. ***Non-light rail zones****: CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SM = South Mountain*

Retail activity in non-light rail areas, 2004-2008

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
1	+ 4,03	+ 87.31	+ 26,85	+ 6,13	- 9,60	+ 34,46	12,05	+11,95
2	- 11.59	+ 1.34	+ 1,34	+ 20,18	-1,22	+ 7,33	-0,14	- 5,18
'04-'08	**- 8,03**	**+ 89,82**	**- 28,12**	**+ 27,55**	**- 10,70**	**+ 44,31**	**+11,90**	**+6,15**

Table 28: Change in retail activity 2004-2008, non-light rail areas.

Light rail areas, 2004-2008

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL
1	- 2,72	- 11,39	+ 4,10	+ 24,67	+ 11,04	+ 6,60	+3,19
2	+ 10,90	+ 24,67	- 5,06	- 5,56	- 6,47	- 8,90	+1,15
'04-'08	**+ 7,88**	**+ 10,48**	**- 1,16**	**+ 17,75**	**+ 3,85**	**- 2,89**	**+ 4,38**

Table 29: Total job change 2004-2008, light rail corridor. ***Light Rail Zones****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

Retail activity in light rail corridor, 2004-2008

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL
1	+ 14,20	+21,02	- 43,28	+ 14,61	+ 13,71	- 1,10	+ 4,6
2	- 20,09	- 6,88	- 48,31	- 8,26	+ 2,85	- 22,29	- 15,08
'04-'08	**- 8,75**	**+ 12,70**	**- 70,68**	**+ 5,14**	**+16,95**	**- 23,14**	**- 11,17**

Table 30: Change in retail activity 2004-2008, light rail corridor.

2008-2012

Total jobs non-light rail area, 2008 - 2012

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
3	- 17,13	+ 5,73	- 11,52	- 17,27	- 0,16	- 12,41	**-11,32**	**- 12,14**
4	- 4,14	+ 32,57	+ 1,68	- 2,10	- 1,52	- 0,24	**+13,91**	**+ 1,52**
'08-'12	- 20,56	+ 40,16	- 10,03	- 19,01	- 1,67	- 12,62	**+1,01**	**- 10,80**

Table 31: Total job change 2008-2012, non-light rail areas.

Retail in the non-light rail area, 2008-2012.

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
3	+ 0,10	- 17,82	- 8,49	- 24,53	- 7,19	+ 13,66	**- 14,90**	**- 12,42**
4	+ 6,24	+ 33,35	+ 2,08	+ 11,08	+ 5,29	- 2,47	**+ 1,85**	**+ 8,27**

'08-'12	+ 6,35	+ 9,59	- 6,59	- 16,17	- 2,28	+ 10,86	**- 13,32**	**- 5,18**

Table 32: Change in retail activity 2008-2012, non-light rail areas.

Light rail corridor, 2008 - 2012

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL
3	**+ 5,02**	-4,26603	-8,24677	-22,2347	-2,19192	-12,7972	**-6,52842**
4	**- 10,97**	11,8382	-16,9348	-22,7265	-9,45407	-2,15548	**-7,20573**
'08-'12	**- 6,49**	7,067151	**-23,785**	-39,9081	-11,4388	-14,6769	**-13,2637**

Table 33: Total job change 2008-2012, light rail corridor.

Retail in the light rail corridor, 2008 - 2012

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL
3	0,223642	-1,66205	16,49215	-33,2046	22,01533	-27,5505	-1,59763
4	33,53522	1,596244	-11,0112	-44,7013	22,14243	-9,04762	13,98076
'08-'12	33,83387	-0,09234	**3,664921**	-63,0631	49,03249	-34,1055	12,15976

Table 34: Change in retail activity 2008-2012, light rail corridor.

2012-2015

Total jobs in non-light rail area 2012- 2015

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
5	4,190063	11,65066	14,37593	13,93616	+ 5,18	5,637309	+ 2,81	+9,13
6	0,538931	6,408258	4,598744	0,513676	- 0,67	1,885093	+ 6,35	+2,24
'12-'15	4,751576	18,80552	19,63579	14,52142	+ 4,48	7,62867	+ 9,33	+11,57

Table 35: Total job change 2012-2015, non-light rail areas.

Retail in the non-light rail zones, 2012-2015

Stage / area	CC	DRK	DV	NI17	SCO	SM	WCH	ALL
5	2,12057	9,118337	3,680049	5,670241	+ 1,49	1,158504	+ 4,87	+4,09
6	6,110946	-4,88479	0	1,090955	- 3,05	9,161895	+ 8,43	+1,08
'12-'15	8,361103	3,788133	3,680049	6,823056	- 1,60	10,42654	+ 13,71	+ 5,22

Table 36: Change in retail activity 2012-2015, non-light rail areas.

Total jobs in light rail area, 2012-2015

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL
5	8,633187	4,619056	23,29445	28,68287	8,748957	-0,96563	11,22955
6	-9,55215	2,279371	3,761827	7,64747	4,567708	-1,82775	1,323832
	-1,74362	7,003712	**27,93257**	38,52385	13,71629	-2,77574	12,70204

Table 37: Total job change 2012-2015, light rail corridor.

Retail in the light rail corridor, 2012 - 2015

Stage/area	NOR	MID	DT	AIR	TEM	MES	ALL

5	3,628551	-4,25139	9,343434	0,348432	-0,26948	0	1,169436
6	5,597789	-20,9459	-42,7252	22,22222	14,22255	-1,72027	4,006605
	9,429458	-24,3068	**-37,3737**	22,64808	13,91475	-1,72027	5,222896

Table 38: Change in retail activity 2012-2015, light rail corridor

Qualitative data

Interviews

Note: some interviews are taken via at a location while others are taken via Skype. Several interviews served as a more orientating case while others are based on results (table 8).

Interview	Date	Location	Status
Maricopa Association of Governments	November 21st 2018	302 North 1st Avenue, Suite #300, Phoenix*	For orientation
Valley Metro	December 14th 2018	101 N. 1st Ave., Suite 1400, Phoenix*	For orientation
City of Tempe	December 18th 2018	31 East 5th Street, Tempe*	For orientation
City of Tempe	May 29th 2019	Vibre	Based on results
Valley Metro	June 5th 2019	Skype	Based on results
GPEC	June 6th 2019	Skype	Based on results
The Midtown Association	June 13th 2019	Skype	Based on results

Table 39: Details of interviews

*= *Addresses are not private*

Interview Maricopa Association of Governments, November 20th 2018

To which degree would you argue that light rail has had influence in Phoenix?

A. K. Thomas: So it is to my understanding the investment to move at least some of initial programs from ASU to downtown hinged whether light rail would be implemented. The ASU downtown campus continued to invest, certainly more than imagined 10 years ago. This investment will continue since there is lots of momentum.

A. K. Thomas: There are lots of interesting factors, both complementary to investment/planned investment to light rail plays big role what we ended up seeing in terms of net benefit. Harder to parcel those out. You can't make case because this was of light rail. Having to tell a more comprehensive story about how light rail is a potential piece of that. Hard time finding defensive sliver of this is what light rail has done for phoenix growth since there are larger trends. As an example, there is the growing density urban centers which has maybe nothing to do with light rail investment. It is just a trend in urban cores across countries. The light rail numbers are better than estimated with initial line investment.

A. Bagley: There are areas in this region without this light rail that are booming just because major employers moved into those areas. That has nothing to do with light rail. It does come down to lot more other factors such as accessibility, being at good place, primarily accessibility to real estate and accessibility to work force. The I17/Deer Valley-area is a big financial center, all kind of employers are moving in there. For instance USAA discover; American express, Signa, State Farm is going in that area, there is no light rail there. There will never be light rail there, at least not in the current plans.

Why? What is driving that?

A. Bagley: There is growth happening in different parts. Phoenix metropolitan area experiences very polycentric employment. There is downtown with 40-45000 jobs. This is small compared for to the whole region. Downtown Denver for instance is 200000 jobs. Whole different story. Having this comprehensively would be best way to look at this rather than causality because of light rail. Again Tempe is light rail but then ASU is booming at same time. There was all kind of investment that happened at Rio Salado. Waterfront property, pre-light rail, fed into the numbers before the light rail. Back to Audra's point, it is a whole bigger story than a piece itself. Other part of that story is that not everywhere where light rail is going, has boomed, or has transformed. If you look at Washington or Jefferson etc., they are still in the same kind of blaze where they were. Still lot of infill lots.

A. K. Thomas: Thereby, you capture transit dependent populations. Riders that have no other venue. So at some areas you are just getting some more catchment. But there are places where economic development (realization on development/redevelopment) is not happening. The area is low density or industrial, e.g. between Tempe and downtown Phoenix.

A. Bagley: Another big thing that has changed in the metropolitan area and across country, is the trend going from single family owner occupied housing to multifamily rental occupied housing. It is a massive shift. Kind of higher density development that you are seeing either on central or all around in this area, Roosevelt, Tempe couple other places, was not something that was a norm. Whole different shift, whether this shift is going to stay is another discussion. But that feeds in all kind of development, not something that was a norm before the housing downturn. Before housing downturn, there was a large proportion of mid-density single family owner occupied housing. That is happening not just here (corridor), but also in for instance North Phoenix or near interstate 17. Tons of apartments are created. Developers are expecting young people to come in, renting and wanting to continue renting rather than buying.

A. K. Thomas: And having those urban cores centers as opposed to regions with dispersed population.

A. Bagley: New apartments, is that due to light rail or is that due to changing housing market? There are a lot more younger families moving in to the city center which creates a different demand. What younger families are expecting from rental apartment housing, is different from what used to be. Now it is high amenity and more expensive. Tons of amenities that are coming due to the new apartments, I don't see the connection with the light rail however. That is just change in population dynamics.

A. Bagley: Light rail's access to jobs is pretty limited, you have downtown Phoenix, downtown Tempe and downtown Mesa which do not have that many jobs. So it is not that light rail access gives you access to many jobs.

What was before light rail, central McDowell/central very different Washington/12th street?

A. K. Thomas: Challenge to tell story why are properties nearest airport that we see in uptown, why are those turning, why are we see value coming to certain locations? If I am 5 minutes away from the airport, why are those properties not turning into value the way properties are 35-40minutes away? For example in qualitative terms, where do these cities want to incentivize redevelopment practices? Phoenix in particular? Why are they making decisions to develop uptown as opposed to some of the industrial core that you see close to the airport. Qualitative policy questions for city councils.

A. Bagley: Data that is from MAG that we can share, we provided access via ASU. If you are using On the map, you don't want to use MAG data, because they don't match.

A. K. Thomas: Light rail followed most transit high capacity locations in this region that is spread out geography. This polycentric development formed the base in that light rail line followed the precise development patterns.

A. Bagley: Hard to find downtown/urban core that has an employment hub along with a residential hub. Most of our activity centers are characteristic driven, entertainment or just employment and there is no residential or a bit of multi-family or only residential. There is no mixed use area.

A. K. Thomas: Desert Ridge, they got some multi stuff, outskirts single family housing. They building retail at the bottom of those condos too.

A. Bagley: Key question: is intrinsically hard to understand why what happened in one area, let alone with another area. Is it possible, having two areas along light rail corridor, one being McDowell, the other one being the airport area and compare them, see what happened on both sides and why what happened. Stuff happened here and did not happen there. What are the factors beyond the light rail? Or even in Tempe and/or Apache. Examine 2 or 3 stations and see how they vent differently.

A. K. Thomas: The public policy aspect is also interesting. As an example, you may have two cities with diversity in how they want to drive land use policy. Why things in Tempe are different in Phoenix because of possible public policy priorities. For Phoenix, it may be a lot of redevelopment and Tempe is a city which is land locked and has no ability to grow. That completely changes dynamics of public policy.

A. Bagley: Light rail is just one of the factors that leads to development, it is not everything. Decision for where light rail went, is where city wanted it to go. Unlike freeway system.

Interview Valley Metro, December 14th 2018

How did you collect data that was used for the Valley Metro-report?

P. Valenzuela: We experienced it as a roadblock, it was a long way to gain data. The system is 10 years old. It is set to record info 10 years, every year. We have to do with what we have. Sometimes it runs back only 5 years. Not a lot of consistency from 2007 to 2018.

H. Quinsey: Yeah, for example, the census data is every 10 year, regarding communities, every year. Able to get for a before year, 2005 beginning of construction. Development (along corridor) really started to happen around construction, not on opening of light rail. So we look at 2005, some of the data, but maybe we couldn't get data until 2015, 2016, depends on dataset and on who is producing it (MAG, LAHD, CENSUS).

P. Valenzuela: It is important to keep in mind that we opened up in the year when the economic crisis took place. Arizona was hit especially hard and recovered relatively slow compared to other states. Took long time to get back. Tracking progress, noted what was happening before, what happened after 2008 and also the climb from 2008 forward. Took a while to get back to prerecession numbers. Time to get back to pre-recession numbers was important focus point. Downtown before? a lot of what we d0, evaluated corridor-wide.

H. Quinsey: Since we are the public industry who run the light rail, we can't just say "all this happened because of us" there are a lot of things that happen when an area is being developed but it is not merely coincidence that development happened around the light rail. This is what is happening around the light rail, we don't directly say it is because of us. It is a little bit too coincidental to be an accident, some of the quotes in the rapport say "we build here specifically because of the light rail that is going to be here". In the case of Apache/Downtown Mesa, development wasn't happening for decades and then all of a sudden the light rail is starting to be constructed and you see all this development, so it was definitely a catalyst for a lot of areas.

Was the downtown a nice place to come and meet?

P. Valenzuela: I am from the downtown and from my experience that is a great shot

H. Quinsey: Cityscape, right in the heart of downtown. This building was this lot. It is still vacant here, and you have development on both sides here.

P. Valenzuela: Downtown was more for if you had to go to work, to court, city hall, then by 5:30 it was cleared out. There wasn't a big presence of restaurants, clubs venues things like that, only the stadium. Not a huge night presence. There wasn't a thing such as "first Friday" (huge art festival at Roosevelt) swarmed with people. The light rail and this event correlate together, the presence wasn't there 10 years ago. A lot of life has come to the downtown area since light rail has been here and before is empty lot, park, wasn't like a playground park, it was just an open area, wasn't much activity there. All the development happened downtown, with the civic center space, all the development brought in a lot more development, especially in evenings and weekends.

H. Quinsey: Central station, that was completely redeveloped when light rail was constructed too. Complete renovation of our bus facility, just bring in more amenities for passengers. All this public spaces in the downtown area were under-utilized or just ageing and needing a new refresher. These public spaces that were really valued became invested and also – in addition to light rail – it was like public amenities, got a huge boost for the public as well. It became a much more inviting place for

people to come and stay after work to spend the evenings to go out to eat. So many restaurants, new bars, Roosevelt row. I don't remember people talking about Roosevelt Row before the light rail but Roosevelt Row is a district, lot of investment. We like to talk about the light rail as an "art-line", that connects to the different museums.

M. Ziech enters

P. Valenzuela: We look at ridership, when people have better access to downtown, there was this huge latent demand to now be in the downtown. We went up to 500% in ridership. That also sparked development. For all these people coming here, we need a destination for them. Worked hand-in-hand. The more people coming in, now we have places for them to go, shot development up in downtown. Also, the campus. You see the correlation to building the campus downtown and having transit access.

What kind of people have more access now?

P. Valenzuela: We have diverse amount of riders, as the 10 years have gone on, it fluctuated a little bit. A lot of student riders coming from Tempe.

H. Quinsey: 30% of our riders are students

M. Ziech: When you look at downtown specifically, what we did we looked at commuters share to see how did people use the train versus how were they using the bus prior to it. To the CBD, there is larger proportion of riders that are using it for work, that would say, it is probably most affluent.

H. Quinsey: Ridership went up with 500%, just in the corridor alone, when you compare the red line – the busline – that had very similar routing to what we have on light rail, to what we have today, was almost a 500% increase. The service is better compared to bus, more reliable, more trips, has more capacity, reliable in terms of having dedicated guide ways so you know that your ravel tie is going to be what it is. Driving your car can be more unsure since it is based on the degree of traffic (congestion). Connect buses to light rail to have a better system, all these contribute to increase ridership, reaching more people; its attractive to new riders. You have more people living along the light rail now than you had 10 years ago, new businesses, new places to work.

P. Valenzuela: This goes as well with the economy turn in 2008, the business profile changed in the downtown area. We started to see more tech companies pop up in the downtown area, more white colored jobs pop up in the downtown area. The employment generators started to shift after the economy started to go back up. We noticed that there was different types of jobs downtown that were not there before so that brought different riders as well.

H. Quinsey: Something that we are seeing too, important for some developers, businesses, is to invest along the light rail because they want their employees or their students to have public transport access. Obviously, that has been a huge priority for the ASU in further investing and growing the downtown campus and now, adding a campus in downtown Mesa so that is going to happen. A lot of developers also said that it was important to be along the light rail, you can read that in the rapport. They talk about specifically choosing to be along the light rail in order to have access to high capacity transit

So for many businesses it was important that they were located close to transport access, any idea what the ratio would be about how many would come by transport versus car.

M. Ziech: I think it is still car dominated.

H. Quinsey: It is in the rapport but I would say around 2% so that is very low. But if you look at the corridor, what we did is an analysis – cutline analysis – looked at with and without light rail, comparison, split mode in Phoenix, Tempe, Mesa. Modes that goes with transit is so much higher than it is compared to the region, 10-12%. Mesa: 10%, Tempe: 20% Phoenix 38% on central avenue.

M. Ziech: In the region, one of the things we have noticed it is not an area where you can dictate to the private sector, you can't as a government say to private sector developers/companies, we can't force them to do things. We can provide that option and they can choose to do it, but even in our agency we tell employees you have to take it, we make it easy and convenient to do so but still some people choose the car.

H. Quinsey: We work together business community, we have travel demand management process, subsidized transit passes, we have these partnerships with the businesses in the community. People are more likely to buy a monthly pass if it is affordable and cheaper because employer is subsidizing it. Partnerships.

More tech companies started to come over here? I was wondering about the structure of the jobs and the sectors they are in, if that has changed. I read that a lot of retail went away and the light rail could be a mode in order to get it back. Is this the case for Phoenix?

P. Valenzuela: Companies downtown, warehouses things like that, 10 year span as economy changed, instead of being warehouse downtown, they would have more of the administrative office, flagship building. Changed what kind of buildings they were using. So it wasn't necessarily the warehouse but the office center for the using companies. Tech companies tend to build near each other

M. Ziech: Place to look at would be the warehouse district. Lincoln street. South on Central Ave, cross set of train tracks, set of warehouses that were vacant for decades and now huge growth of more of these kind of startups/tech companies moving in there. Pretty well known companies are based out of here have decided to relocate from suburbs to downtown.

P. Valenzuela: ASU big part of it, they want to have a pool were they can pull creative/educated people away from. Lot of companies that opened up downtown, more companies hiring people with 4, 6, 8 post graduate education, helped with different companies coming downtown.

H. Quinsey: We look at whole corridor, construction/manufacturing biggest industries here, definitely declined in corridor, healthcare/finance/public administration have increased, are bigger industries coming out of the last decades.

Transitioning in structures, how come?

M. Ziech: There is not one thing, light rail was huge investment, many factors, you can see that the land values along the corridor have increased, so certain sectors (e.g. healthcare) are better able to afford renting places in the increased land value places.

H. Quinsey: Decade or 2 ago, construction home building was huge industry then recession hit, one of top 2 hardest hit cities y recession, why? What are industry based in being construction. Coming out of recession, looked at other ways to invest in economic industries here and have schools and educated people here, roam other sectors over the last decade.

P. Valenzuela: Yeah, construction was a big money maker in 2005, 2006, 2007 we were sprawling, we could not built houses fast enough, time was like build build build. Then when market crash, we had

vacant houses everywhere, a lot of that construction to building houses, when market crashed, lot of vacant houses, no need to build more we have to downsize.

H. Quinsey: Lot of infill development, you see it along the corridor too. Type of construction. Redevelopment of existing. Lot of single family homes, that were houses turned into galleries still lot of vacancies. Being transformed in mixed use development, luxury housing, some affordable housing too. 2200 affordable units corridor wide. Filmore/1st avenue, new development being built now by native American connections, affordable housing.

Some sectors require more jobs than other sectors, could it be a bit dramatic as well. Maybe the construction sector provided many jobs whereas in the health sector you have less jobs

M. Ziech: Depends on what you are looking for. With construction there is huge influx of employment, people that could patronize when it is being built, but once it is built out, workers are going to move to another place so that is more temporarily. Whereas if you have a financial firm moving in, then they will stay. Might be a little bit less but more consistent. Not one sector better than another.

P. Valenzuela: We also did a buffer analysis with jobs and one of the things we came across, the way data is collected. What we saw, data with 5 or more employees.

M. Ziech: Few different datasets, census can't use, have employment data listed, based on where they live. From mag we found good data. It was only a dataset with 5 or more employees, so barbers, hotdog cars etc. are not going to be pulled in so you are missing a lot. Majority of companies in this country are less than 5 people. Other one more estimate of model.

P. Valenzuela: We were missing large chunks of employment data, especially in the downtown area where you have a lot more smaller businesses. 30 companies within that building and you have 3 or 4 people per company, you are missing these. You might think that we are losing a lot of employment downtown, why is that? That may be because cases (e.g. <5) are not included.

H. Quinsey: We actually did a lot of analysis on employment in the Phoenix-CBD in particular and then to look at population growth, change in the economy. Comparison, different segments of the corridor to the county as a whole. Mesa as a whole, Tempe etc. to evaluate how jobs developed. 2005 right before test hit, test for are we now on the same level again (as in 2005), have we out-grown, just recovered and breaking even? City-wide/county-wide, gives number that doesn't paint full picture. Phoenix CBD, 2005-2015, so much that happened in two sets of 5 year (2005-2010;2010-2015). Lot of times decline, then really rapid recovery in last 5 years, that is why we use intervals so we can show what was happening in a whole decade. Not only Phoenix downtown but some other areas in the corridor too. Central avenue (midtown e.g.) just boomed. Way beyond pre-recession levels. High job growth in midtown portion in corridor, Phoenix CBD took big hit, coming back but not as In midtown. Huge job growth in Tempe, development exploded. Mesa still recovering, seen lot of investment coming and they haven't seen investment in decades.

M. Ziech: Extension in Mesa inly been open in 2 years, Tempe en Phoenix, 10 years, let everything happen. As overall employment as gone down from 2005 to 2015, what that doesn't factor in is the 11000 ASU students that were not in the CBD in 2005. So overall, the number of people that are active in the CBD, is higher than in 2005 I would argue. Now you have large student population instead of just workers.

H. Quinsey: Corridor wide, young people, retirement age, kind off those ends of spectrum that we see

the growth, 30s early 40s slightly decrease.

M. Ziech: Way economy is around here, public sector, lot of retirements, people hold on till that jobs.

H. Quinsey: Workers in corridor, 50+ increased, 30-54, slight tick, -29 down, large students and not necessarily working.

P. Valenzuela: In correlation with type of jobs that changed in downtown. More established career people who are working downtown. We had to temper our expectations a little bit, 10 years is not a lot of time to have such dramatic change. 10 years not large amount time to measure. And there was recession somewhere in there too.

H. Quinsey: Looking at population in corridor, young population (20-24) and old (54+), end of age distribution lot of growth over lot decade. ASU and new housing, luxury, high end. Lot of retirees, want to have connection with the city, access to events, shows, museums. Instead of moving to the fringe in a more traditional way of retiring in the suburbs. Demographic trend across the US.

P. Valenzuela: If you live in the suburbs, you tend to have family but s kids go away, you don't need that much space.

H. Quinsey: Lifestyle choices are different these days, given big recession, think more need today than ever to have different generations of family helping out with raising children, all sharing day to day life needs. E.g. helping babysit the kids.

M. Ziech: Nationwide, people are working longer.

H. Quinsey: 55+ huge growth in age group because they are still working.

H. Quinsey: High capacity transit has a draw for half a mile. One mile? does the developer wants to be that far away from the amenity that they trying to develop on.

What other light rail stations would be good stations to compare with?

H. Quinsey: What are you trying to compare with? Take all the stations and do an average? What are you looking at comparing here. Think of the different segments on the corridor and what are characteristics of each segment. You can look at downtown Phoenix, Mesa, Tempe, Midtown etc. Look at different segments, perform differently, different profile, develop differently. Give a little overview how each have compared and also compare your five CBD stations to maybe three other.

P. Valenzuela: You have downtown Phoenix, downtown Tempe and this connector in the middle. And it is not really fair, the connection in the middle. You have to connect the 2 hubs somehow and you can't have 100% development along the entirety of the corridor. And if you compare this connection with the downtown, yeah downtown is going to look great. Between downtown Phoenix and downtown Tempe there is some opportunity for development but at the end of the day you have to connect those two and that is for what is really serves at.

M. Ziech: Not look inherently just at new developments, job numbers because all of that because the station that comes to my mind, 24th street, part of town that struggled and continues to struggle. Looking at what the baseline was and what it is now percentage-wise it might be more significant than what you see downtown, other factor that you can look at as well, determining on what land use type, what land use type adjacent to the light rail, drivers benefit from that amenity being there versus

wouldn’t inherently benefit.

H. Quinsey: You can also do comparison of what they do with vacant parcels corridor wide. CBD vs. station areas within other segments. Comparison utilization of vacant parcels in last decade. See that there was. Yes there is this kind of development, but what kind of development is happening at which place. MAG; LAHD census dataset. GPEC (Greater Phoenix Economic Council). SNAP which represents data on grocery stores. Not necessarily job related but for quality of life (grocery stores; education).

H. Quinsey: Segmented approach, drill down into different areas, different analysis.

M. Ziech: 12/24th street is very industrial, more of a macro kind off, macro trend in that region, close to airport, city of Phoenix owns a lot of this land, vacant parcels, that are purposely vacant.

H. Quinsey: What en where you would create this segments. You might be using every single station but subset of stations. In every analysis, corridor wide compared to your CBD, average of stations.

Interview City of Tempe, December 18th 2019

Can you give a short description downtown prior to implementation light rail?

M. Laughner: Downtown Tempe has been like it is now since the interception of light rail, maybe even earlier like 2000. This used to be a bad area. There were bad things happening such prostitution. Since 2000, effort has been put into downtown revitalization. The city ity put effort into revitalizing Mill Ave as Mill Ave is the center point of downtown. This thus happened prior to the light rail opening. Light rail is turning 10 next week. So Tempe only has it for 10 years. City did a lot of things before that happened but downtown was in serious disrepair way before light rail opened. Same thing for downtown Phoenix. I went to high school in downtown Phoenix what is today Arizona center on 3rd street and near Van Buren. Where now the Hooters/Sherrington hotel are, around 3rd street. There is a civic center with conference spaces and the Phoenix city hall 2 blocks north. I was the last graduate in class there, in 1988. Downtown Phoenix would close at 5 o'clock. Office jobs, banks and lawyers would all be closed around that time. When we had just watched a basketball game, there was nothing after the game: no life; no people; no hotels; everything was closed. Restaurants were closed at 3(pm) because they only served breakfast and lunch, no dinner. That is how it was in the 60s-70s-80 and in the 90s. One of the things why my school closed down, is that the city wanted to buy that land and try to revitalize everything. This started in 1988, 20 years before light rail opened. So downtown Phoenix went through this transformation of trying to revitalize itself. They built a convention center; more downtown office space; tore down all the old bad neighborhoods that were characterized with a lot of criminal activity; and a new bus station. Also Valley Metro but in this case its busses. They did all of that in order to prepare for light rail. It is the same for streetcars. It has been on the books for ever but it is really hard to do. The only city that you could say that downtown benefited specifically from the light rail, is Mesa. They have revitalized their entire downtown in the last 4 years because of light rail. They were able to attract a school there because of light rail. Because students have a way to get in and out. They were able to attract more businesses because of light rail. They had a much more direct impact. Phoenix put effort into making something happen in its downtown for a long time and light rail is only an asset that added to it. For Mesa, light rail was everything. Without light rail, there would still be drunkenness and other kinds of (criminal) activity along their main street.

So you would say that a couple of businesses started their business over there, along the light rail, because of the light rail. And why was it in Mesa and why not in Tempe and Phoenix?

M. Laughner: Tempe already had it.

But still it could have added more businesses.

M. Laughner: It is adding but it is not that noticeable. For instance, more noticeable is people being able to access amenities in a different way. So ideally you have your former car-users that will come to Tempe beach park etc. using light rail. So that is our goal with it, we would like to see a reduction in traffic and congestion.

That is one of the main goals for Tempe? And how is that so far?

M. Laughner: Not yet, it will take a generation. People are used to driving. I drive every day everywhere so it is a mindset.

So you think it will change in 30-40 years?

M. Laughner: Oh I think it will be faster than that. Young people are ready.

How about the number of employees that use the light rail to reach their work-destination?

M. Laughner: 30% use light rail in order to get to their work.

How do you think you can increase employees to take light rail?

M. Laughner: There are all kinds of incentives to do it. I have a free light rail pass that is good for ever. When I go to Phoenix downtown, I will use it. We see younger people, were talking to, east of ASU, you know here Tempe market place is? Just south of Tempe marketplace, there is this kind of old run down industrial area. We are looking at revitalizing it, applying adaptive re-use. It means that you use it for x now but you could use it for something else, sometime longer. Changing the building, for instance by offering a second story, a third story on top, offices, a loft spa and residential space in order to diversify the building. Mixed use in essence. Lots of meetings with property owners and some businesses about how this city is encouraging his type of behavior. Here are some ideas for you for in the long term that is going to bring you value. You will hear some older property owners, our employees don't want the streetcar and/ or light rail. They often are 65/70 years old. Your current employees might not, but you're going to hire new and young employees at some point. The older people are not seeing it as an asset but if you talk with a young person they are like "Oh! Great I will take the light rail there".

Saying is something different than doing it.

M. Laughner: Well, that is true.

What would be a good area to research?

M. Laughner: We as a city, were doing an urban core master plan which is talking about exactly where you are talking about. Certain densities. 0.25-mile: 8-12 stories; 0.50-mile: 3-8 and 1 mile only one to two story's. Then there is the parking issue. What we are trying to do, is to get to less parking required. So, that is our goal as a city but when we have developers coming in and say: "were going to bring a thousand jobs to downtown Tempe" and they say "we need a kind of parking" we are going to say "no you can't have that parking". Tell your people to take light rail, tell them to take mass transit. They do it but the employees are still not responding correctly based on traffic reduction measures. What instead of the 8-17 work-times, you have some people work 6-15 and others 10-19 so you have a staggered workday, less traffic and less congestion. We can't make anyone do that, all we can do is say "no you can't get the parking".

So that is one of the main incentives, parking space. A lot of businesses wouldn't agree to come here when their needs are not met which is available parking space.

M. Laughner: That is the juggle right now, because some businesses are very forward looking, progressive. We want to limit our carbon footprint; aim for being carbon neutral; offer flexibility; encourage sustainability and those people are okay with it. That same department head or company would hire people that are likeminded, they are not going to hire someone that wants to drive a hummer. We are creating ac certain culture, in Tempe more so than other places because we attract businesses with a likeminded mindset who think "yeah we don't want that parking space either". We want to be part of the community. Tempe has the image of being open-minded and progressive. That is self-selective. It fits the self-image of businesses, they want to be here as well. Businesses want to be sustainable by locating near light rail. And their client base, if they have clients who also want that.

There was a trend of the downtown being in disrepair, mainly in the second part of the 20th century. How did this translate to Tempe?

M. Laughner: In the 80s, Tempe was a bad place. In the 90s, it was much different. During this time, we would go to Tempe for the nightlife. We had terrible public transportation at that time however.

Why was it then implemented in 2008, considering public transport was bad way before?

M. Laughner: Light rail was part of a bigger plan, it took years and years and years to approve. For numerous years it was on the ballet. There were referendums, but it took years to pass. My dad who was conservative was like "why would we need it, it is dumb". I was like (when I was living in Spain) "yeah we need it, than just cars." And that is when it passed, it was around 2000/2002.

Would you think the downtown of Phoenix and Tempe would be different if it was implemented 10 years earlier?

M. Laughner: Oh can you imagine, everything that we are doing now, would be happening 10 years earlier. When the idea of the light rail became a reality, the city started putting more money in refocusing effort onto the downtown areas. That's when they started bringing housing in, there was nobody living over here. Once you have people living in an area, they can use different types of transportation. You don't need a car. The idea that it was coming, is what helped the revitalization process. It built downtown Phoenix and Tempe, even if they were already in the process it solidifying it.

If we look at the types of sectors, is there a change? Was there a sector that was dominant that has changed? Did those compositions change?

M. Laughner: Yes, the biggest component was always the ASU and then rest of it was all services for ASU. For instance retail, restaurants and shopping needs. The lake was the genesis of it. When we built the lake almost 20 years ago, that's when we started getting more offices uses. Before that, we had ASU and city governments. Thereby, we had Mission Palms (hotel). Now we have a ton of office jobs - 20000 or something - just in Rio Salado. All that is accessible via a form of public transport. The kind of activity is what made it grow. The best way to tell if that is true, is via rents. We have the highest rents in the entire valley, considering rent office space. In fact, I heard from our broker on this other project that is west of the Tempe Center Arts, there is a similar project that is supposed to be – as we call it class A, which is essentially high level office; expensive; beautiful; has full service, an exercise room, café etc. They open class A in downtown Phoenix and they try to rent it for 42 dollars a square foot and it took them one month to realize: "oh we are not Tempe" and they knocked it down to 38, because they can't afford to offer it for 42 dollars. Our concentration here is so pronounced that that has made it attractive. Part of the attractiveness is the high rents. So you have people that want to pay because then they get the best.

So it is a self-full filling prophecy.

M. Laughner: Yes, it is.

How about the retail activity?

M. Laughner: So, retail in downtown has not been the most stable. A reason for that is actually ASU. Fluctuations are happening because of that. These fluctuations hit restaurants and bars hard. So in the summertime, a lot of activity goes down tremendously. If you can't make it through summer, it becomes very hard to survive. So there is a lot of turnover before that.

Is it the same for downtown Phoenix?

Considering downtown Phoenix, ASU has a campus over there that is new. Ten years, maybe a bit longer. 2006. Lot of places that I used to go to are closing. Lot of other activities e.g. a ball-park, where the Suns play. There is a theatre and a convention center. They have a more diversified portfolio. We are still in the situation where downtown is so integrated with ASU. If ASU is out, the downtown is quiet. Some businesses don't go here due to too many students being there. Also, there is too many traffic. It is easier for them to go to Tempe market place or cross over and go to the Northside.

Do you have any ideas to combat that?

M. Laughner: Well, we are hoping that more mass transit will combat that. The streetcar at Rio Salado will help. Scooters are combatting that, you see people in business suits on scooters to go from Rio Salado to down here. Hard for retail, other businesses are fine. Seasonality is bad for retail.

Ridership light rail, has it improved over time?

M. Laughner: That's what Valley Metro say, they target x and they get x+. It is an improving trend. That's why they are building more stops. Phoenix is building one on 50th street and Van Buren and we are exploring adding a stop ourselves. The problem is, you only have one line. If you have one extra stop on that, it will slow down. An alternative may be to create a stop that functions for different lines. So different lines stop at the same station.

Do you think that will be implemented?

M. Laughner: I think they have to, yes. It will be super expensive and it is going to take years, like 50 years. We do the streetcar-implementation which is the exact same concept. There would be two stations were light rail and the streetcar operates. These stations are Mill and Apache whereby the streetcar connects both stations.

When?

M. Laughner: May 2021.

So if this will be implemented in 2021, how do you think it will affect the number of jobs in this area?

M. Laughner: It will go up because of a better connectivity. It will be sexy for businesses to locate where they know their employees can access stuff during the day. It will create a more flexible type of working environment. If I am the boss and I know employees will come, it would be easier for them to go to a certain meeting with light rail or if they need to do something during the day. It would be cheaper for me if they need to run an errand. I don't have to pay for parking and its cool. A really big cool factor. I don't think they think it is cool in New York, it is just part of life, even in London. For us - since it's new here – there is a cool factor.

The best place to see it, is Mesa. Wherever you are looking at Main Street is new, completely renovated. First is was completely vacant. Now if you go down there, it is vibrant and there are students. Because of light rail, ASU located in Mesa. A lot of development is going to happen around light rail.

What will happen to the areas that are not directly impacted by the light rail?

M. Laughner: They will continue to see development because they are cheap and plenty of people live out there. Tempe's largest industry out of ASU is what we call financial- and advanced business services. So anything that is office jobs. You will continue to see those here because they are well paid jobs and they have a certain image that goes along with them. Law firms create a certain image. If you are looking for an amazon distribution warehouse, we are not going to have one. We have amazon jobs, 800 amazon jobs at Haiden faire lake side but we don't have the distribution warehouse that is a million square feet. That is in Goodyear because land is cheap over there. There they can be on the freeway to California. That makes more sense. Why would you pay 10 dollar a foot per land or raw land when you can get it for 50 cents. So those areas will experience that kind of development and they will continue getting cheap housing. One issue that we have here is affordability with housing. If you're looking to buy a new home, you may not be able to afford Tempe. What happened, you get pushed out and that is how the suburbs get build. And then you have the schools and retail for that

kind of housing. But they are going to have a very difficult time attracting our employees. Companies like SAP and Amazon, they are not going to go there for office jobs.

Different kind of development?

M. Laughner: Yes

But then you could say that the light rail can set off more "economic segregation"?

M. Laughner: Absolutely

So that could be a worrisome thing?

M. Laughner: I think it is a natural progression but personally I do think it is worrying yes. Although, you know what, I am saying that because we are looking at the big picture. Tempe actually has one of highest poverty rates in valley, so what does that mean. I think we are at 22%.

How come?

M. Laughner: Maybe because it is easier. Bigger cities do have bigger issues with homeless populations. Poverty is just because. Suburbs have it but they hide it better. Here we do the count, where they go out one night to look in every community. They spend that night from 8 till midnight, walking to neighborhoods finding all the homeless people and count how many there are in the specific neighborhood. We don't have places for them to hide. They have more places to hide in the suburbs. Whether they live in a vacant house, people don't know because they live inside. People drive their car from the garage, go to work and then park car in the garage, afterwards entering the house from the inside. You may not know that your neighbor moved out 3 years ago and there is one guy living there and is actually homeless or they are parked in their car. But on the city street it is clear.

Since next interviews are based on the results, an interview guide has been made that is shown below. Some questions may be unanswered since answers were already given at other questions and/or the respondent could not find any reasons.

Interview guide based on results

1. Results

1.1 structure

The result section of this thesis is divided into three sections, based on the longitudinal data. The first section will be based on the 2004-2008 period; the second section will be based on the 2008-2012 period (also considered as the opening of the light rail-period) and the third section will be based on the 2012-2015 period. In each section, a general view is created that shows to which degree developments have happened in the light rail corridor and non-light rail areas. This mentioned structure is first applied on the analysis of the total amount of jobs. The retail activity will be discussed separately in a later part of the result section. The same structure as earlier described will also be applied to the retail activity-section. The questions are based on figures that specific section (e.g. “1.2.1 total jobs in 2004-2008”). Questions start on page 3.

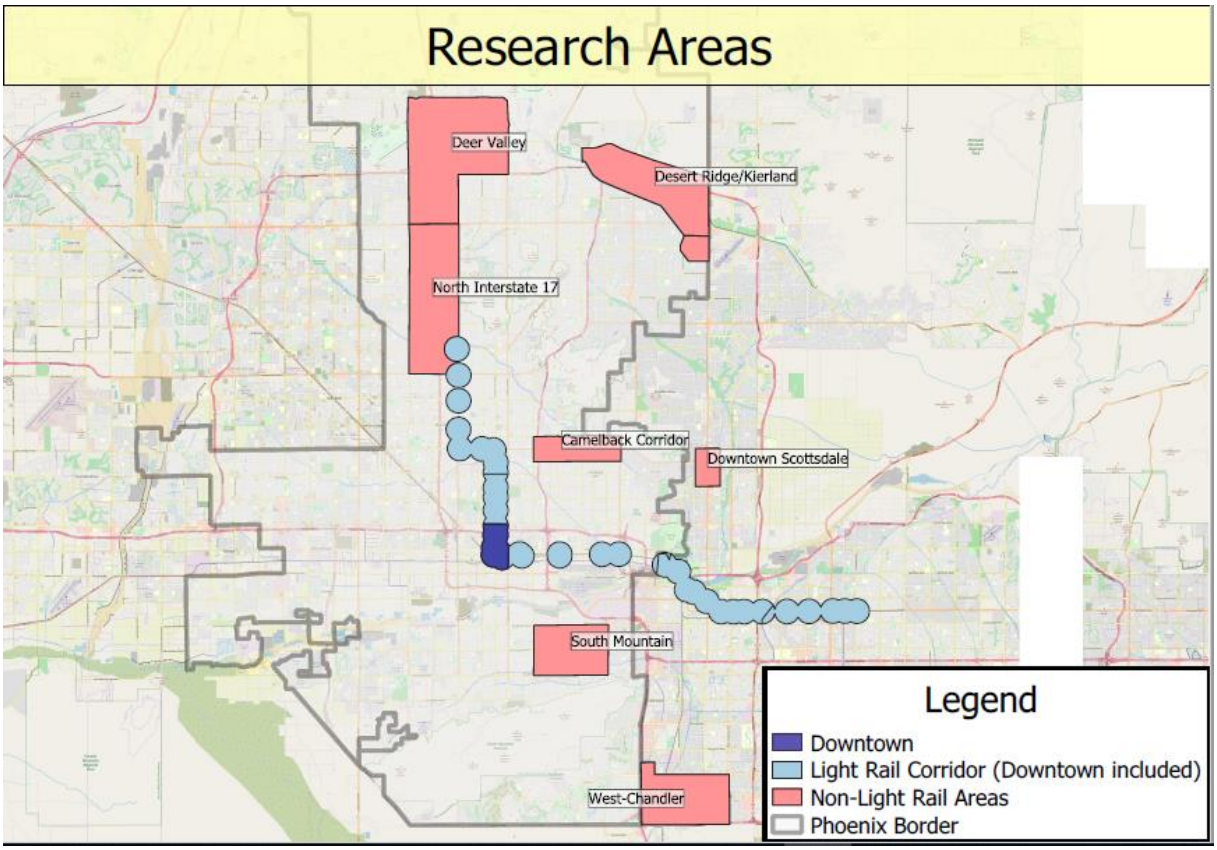

Figure 1: Study areas.

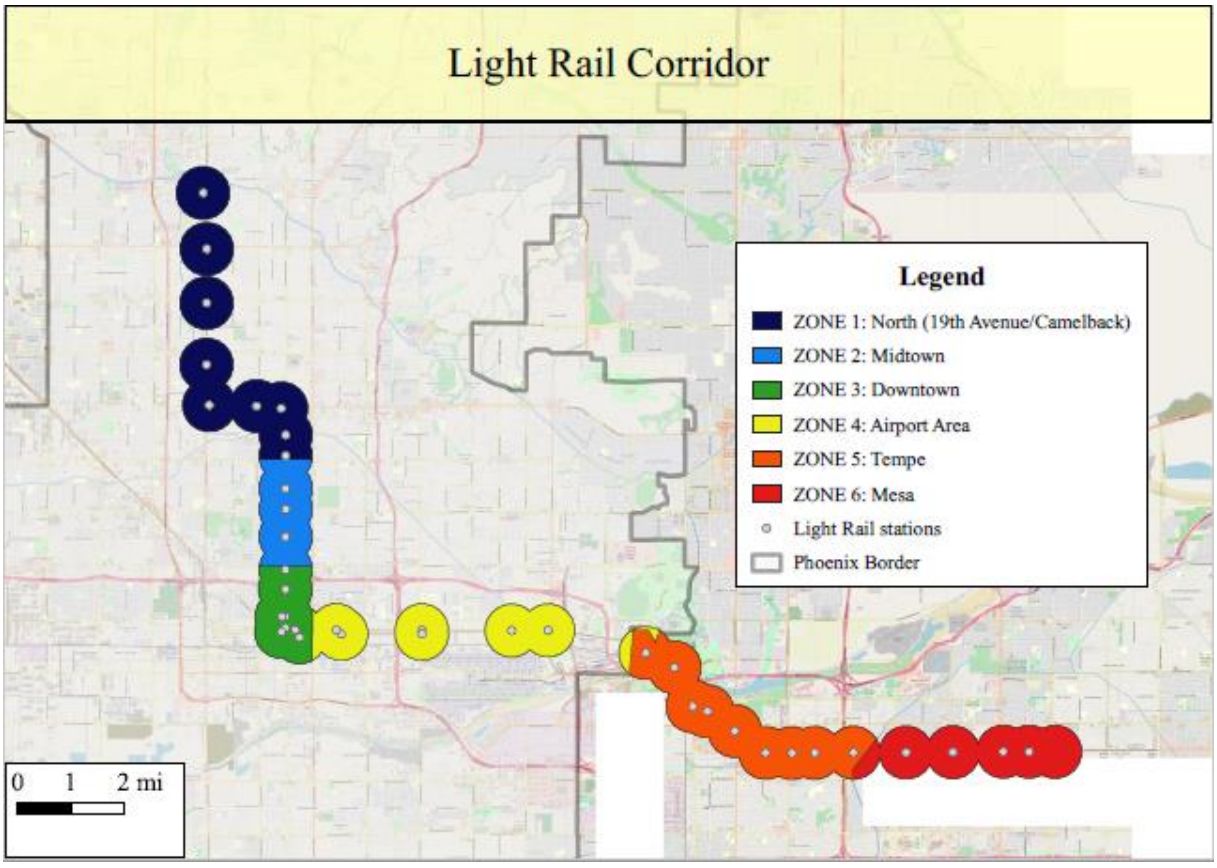

Figure 2: The six study areas in the light rail corridor

1.2 Total jobs

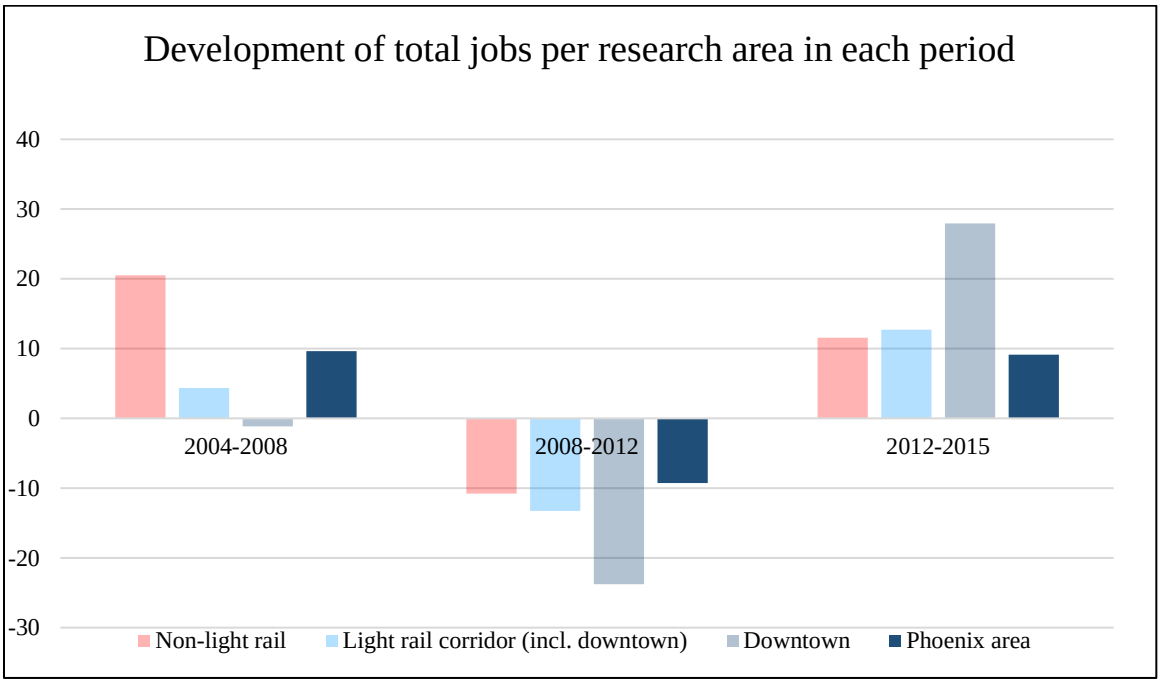

Figure 3: The development of total jobs in the non-light rail areas, light rail corridor (incl. downtown), downtown and Phoenix area

1.2.1 total jobs in 2004-2008

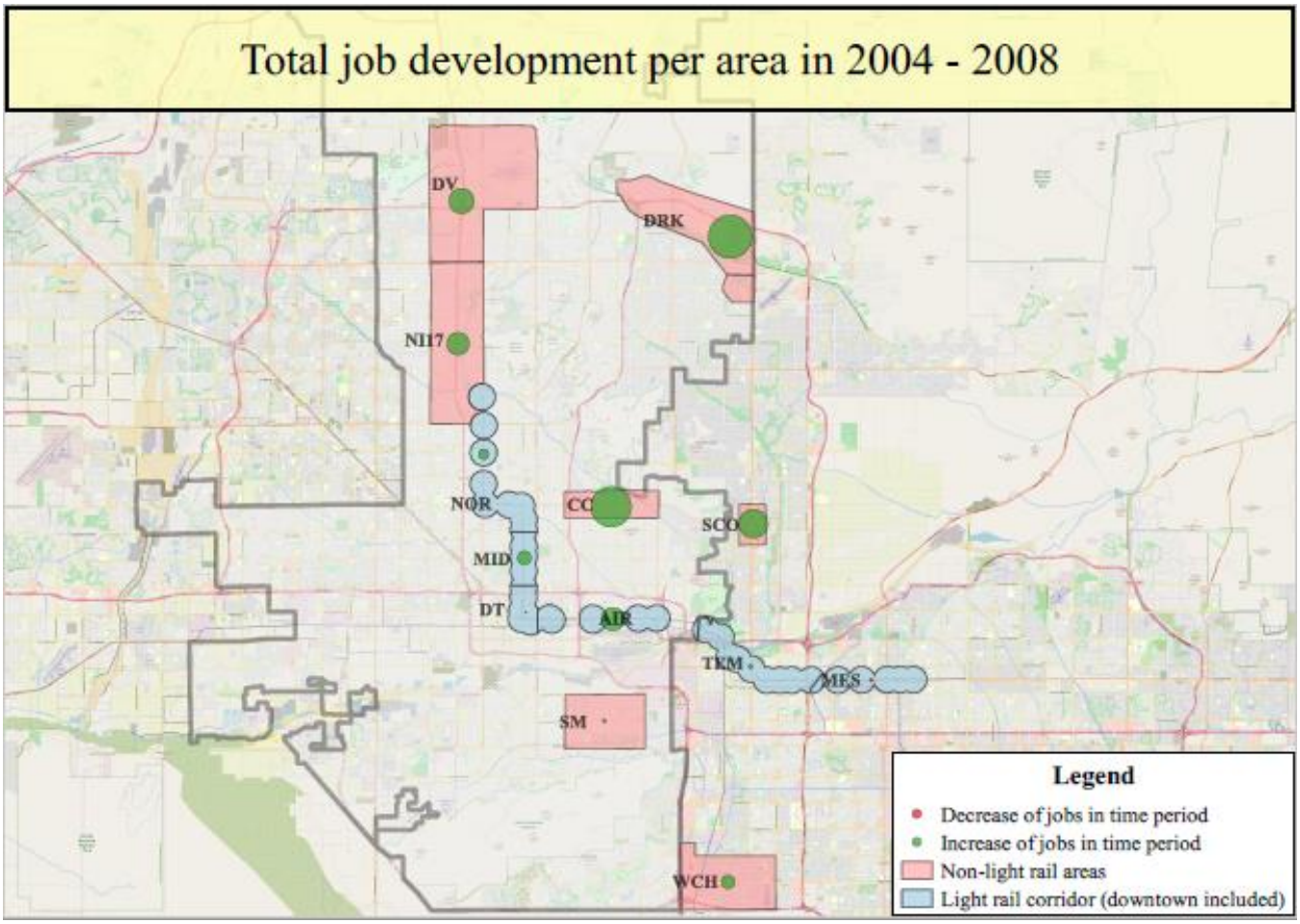

Figure 4: Total job development in non-light rail areas (red) and light rail corridor (blue) in 2004-2008. ***Non-light rail zones (Red)****: CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SCO = Scottsdale; SM = South Mountain; WCH = West-Chandler.* ***Light rail zones (blue)****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

QUESTIONS:

1. Considering 2004-2008, total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas which had an overall increase of 21%. Could you think of possible reasons/dynamics at that time that could explain such a gap?

2. Out of the 13 areas, job loss only happened in downtown and Mesa (figure 4). What is your opinion about that, given that several literature sources state that businesses react prior to the implementation by moving near light rail stations?

3. Considering the spatial patterns, the more northern areas (DV; DRK; NI17; SCO; CC) are performing better before the implementation. Can you think of some reasons?

1.2.2 total jobs in 2008-2012

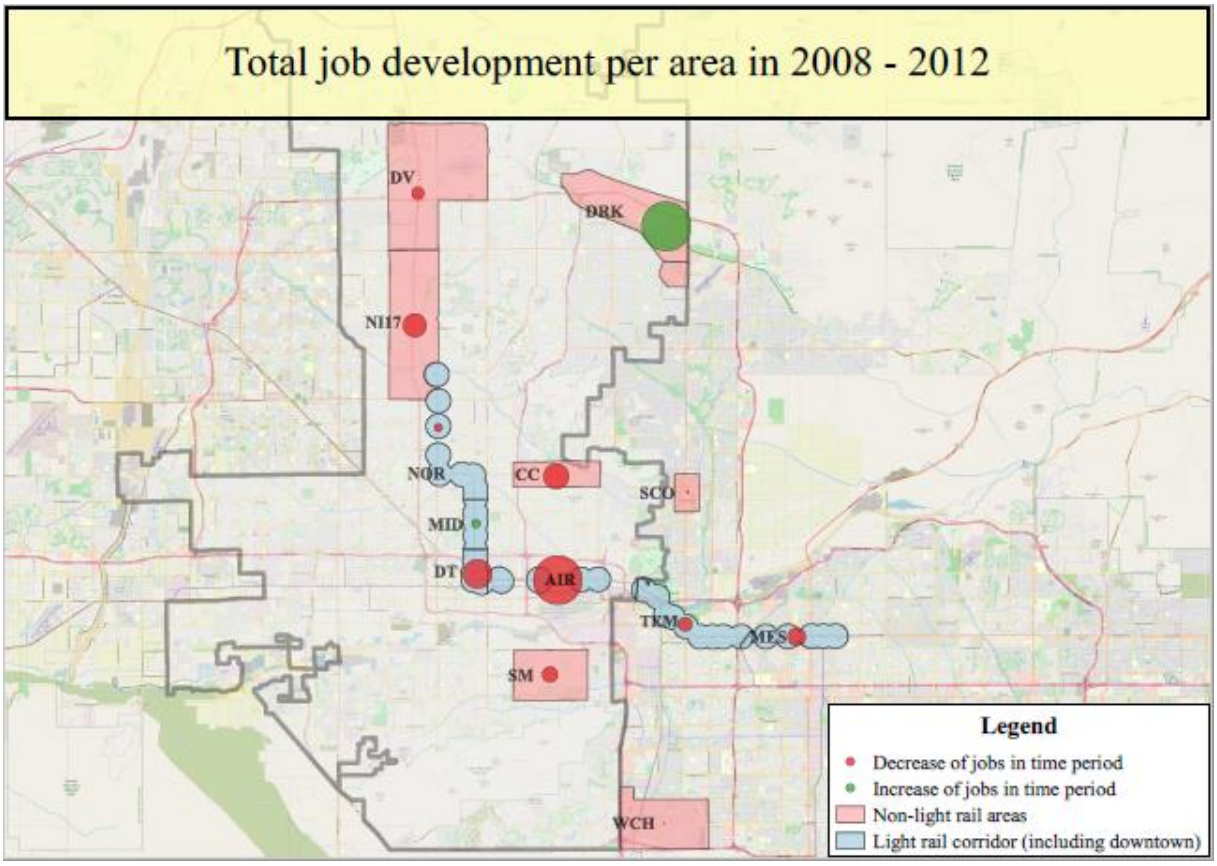

Figure 5: Total job development in non-light rail areas (red) and light rail corridor (blue) in 2008-2012

It is stated within a rapport of Valley Metro that three cities within Arizona are placed within the top 5 of cities hit worst by the 2008-recession

4. How come that Arizona was so vulnerable in comparison to other states?

5. what would you say, could be explanations for the fact that jobs moved away (relatively in the largest numbers) from the downtown in the first operating period?

6. So if we compare the areas that are likely to be influenced by light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of total jobs of the 2008-recession may differ between those two segments? If so, why?

7. Was there anything special happening in Midtown that caused the 2008-recession effects on this place to be limited (Midtown even gains jobs)?

8. To which degree has light rail tempered the impacts of the 2008-recession?

Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94).

9. Do you agree with Joshi et at. in the sense that loss of jobs does not have to be negative and can even considered to be positive?

1.2.3 total jobs in 2012-2015

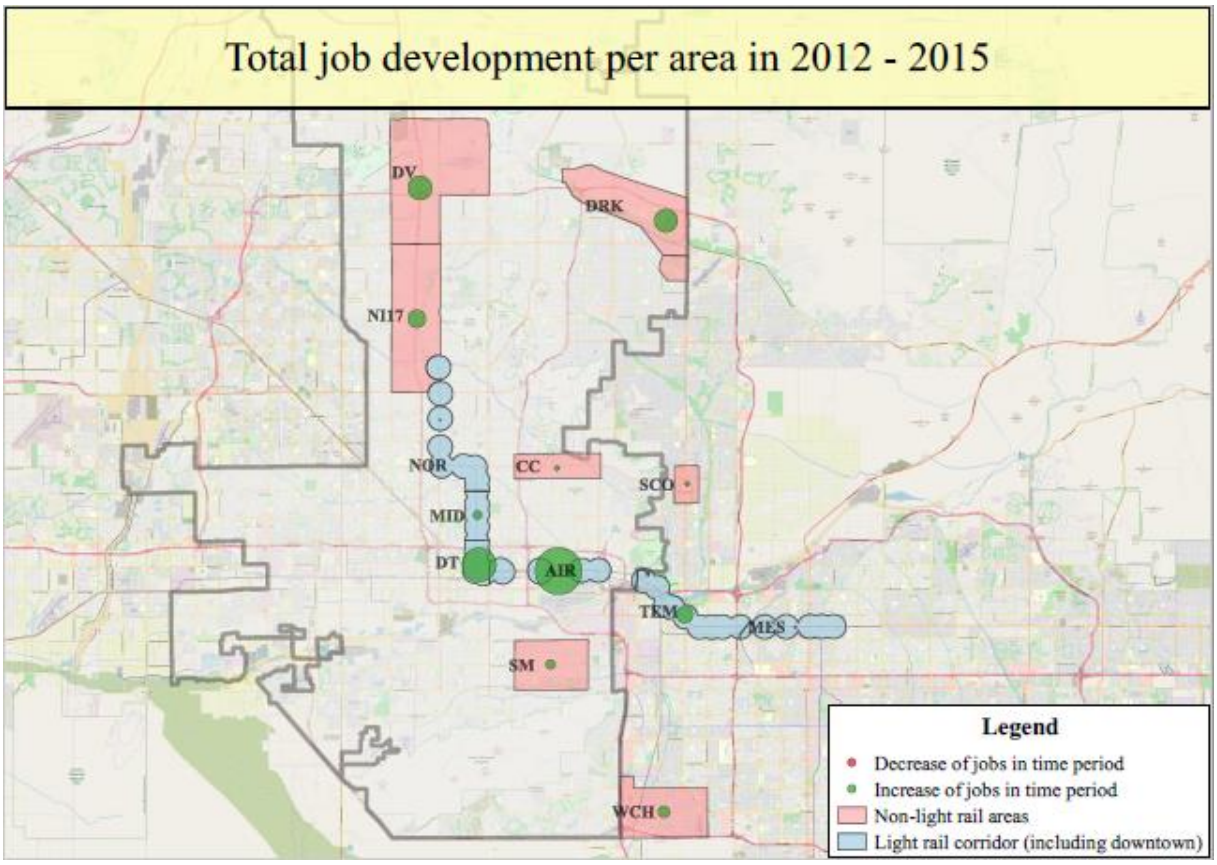

Figure 6: Total job development in non-light rail areas (red) and light rail corridor (blue) in 2012-2015

10. Development of total jobs seems to happen in higher senses in the corridor now. Do you think that light rail areas are less vulnerable to the recession? Why?

11. Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). To which degree would you say that the downtown performing well in 2012-2015, is a result of the downtown performing bad in 2008-2012?

12. in an earlier interview with local experts, it was argued that there are places within the light rail-corridor where economic development is not happening. The area is low density or industrial, for instance between Tempe and downtown Phoenix. Looking at the figure above however, airport area is considered to be the best performing area within the light rail-zone. Given the earlier statement of MAG, how come that the airport area (AIR) has such a strong positive change in jobs?

	Area	Performance
1	Desert Ridge/Kierland	+121,97
2	Deer Valley	+28,28
3	Midtown	+26,57
4	Scottsdale	+25,36
5	West-Chandler	+21,77
6	Camelback Corridor	+8,81
7	North Interstate 17	+8,66
8	Tempe	+4,59
9	19th Avenue/Camelback (North)	-0,88
10	Airport Area	-1,98
11	South Mountain	-3,09
12	**Downtown**	-3,63
13	Mesa	-19,44

Area	Performance **before** light rail ('04-'08)
DRK	+ 33,30
CC	+30,77
SCO	+22,03
DV	+19,18
AIR	+17,75
NI17	+17,15
MID	+10,48
WCH	+10,26
NOR	+7,88
TEM	+3,85
SM	+3,05
DT	-1,16
MES	-2,89

Area	Performance **after** light rail ('08-'15)
DRK	+66,52
MID	+14,57
WCH	+10,44
DV	+7,64
SCO	+2,72
TEM	+0,71
DT	-2,50
SM	-5,96
NI17	-7,25
NOR	-8,12
AIR	-16,76
CC	-16,79
MES	-17,05

Table 1: The relative positions of each study area and its performance before- and after the implementation of the Light Rail. ***Non-light rail zones (Red)****: CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SM = South Mountain.* ***Light rail zones (blue)****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

.

13. "Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation": to which degree to you consider light rail a success so far?

14. How do you expect the corridor to perform in relation to the non-light rail zones in the future in terms of total jobs?

1.3 Retail

1. So we just discussed the impact of light rail on total jobs. Would you argue that this impact will be different for jobs in the retail sector?

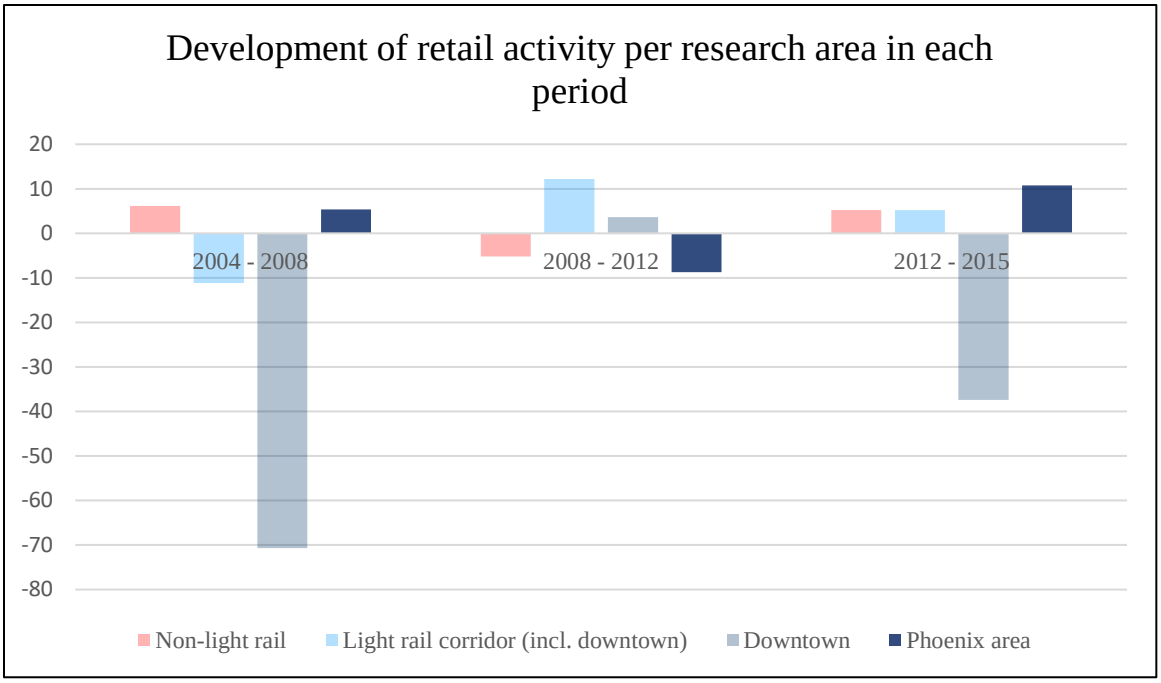

Figure 7: The development of retail activity in the non-light rail areas, light rail corridor (incl. downtown), downtown and Phoenix area

2. When looking at the retail activity of the downtown in the period of 2004-2015, the downtown lost 70% retail activity prior to light rail. To what degree would you think that many retail businesses reacted negatively to the soon to come light rail? And if so, why?

1.3.1 retail in 2004-2008

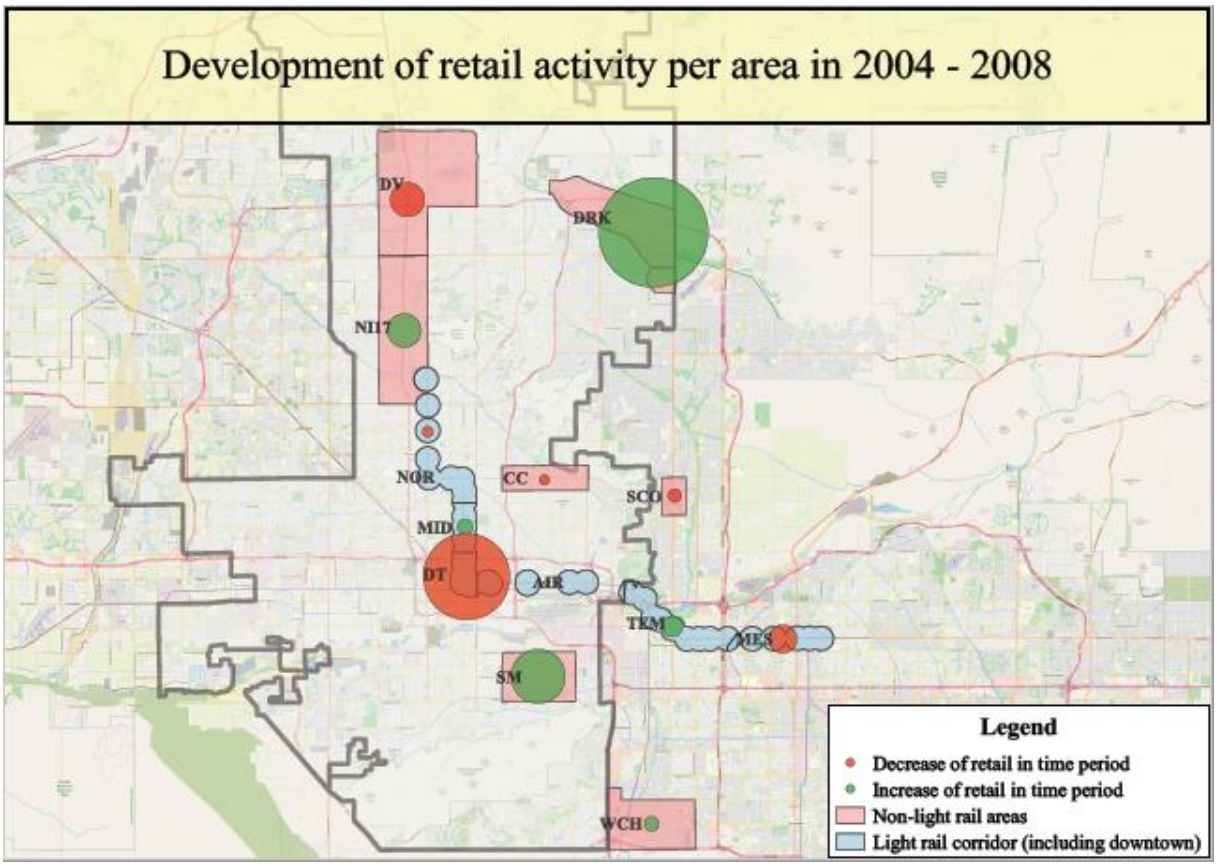

Figure 8: Retail activity development in non-light rail areas (red) and light rail corridor (blue) in 2004-2008

3. There is a major loss of jobs in the downtown. A little further south, in the South Mountain area, there is a large increase. How come, there is such a difference in development between the downtown (the core) and South Mountain - an area which is discrete in the total job development - while the distance between these areas is not big?

1.3.2 retail in 2008-2012

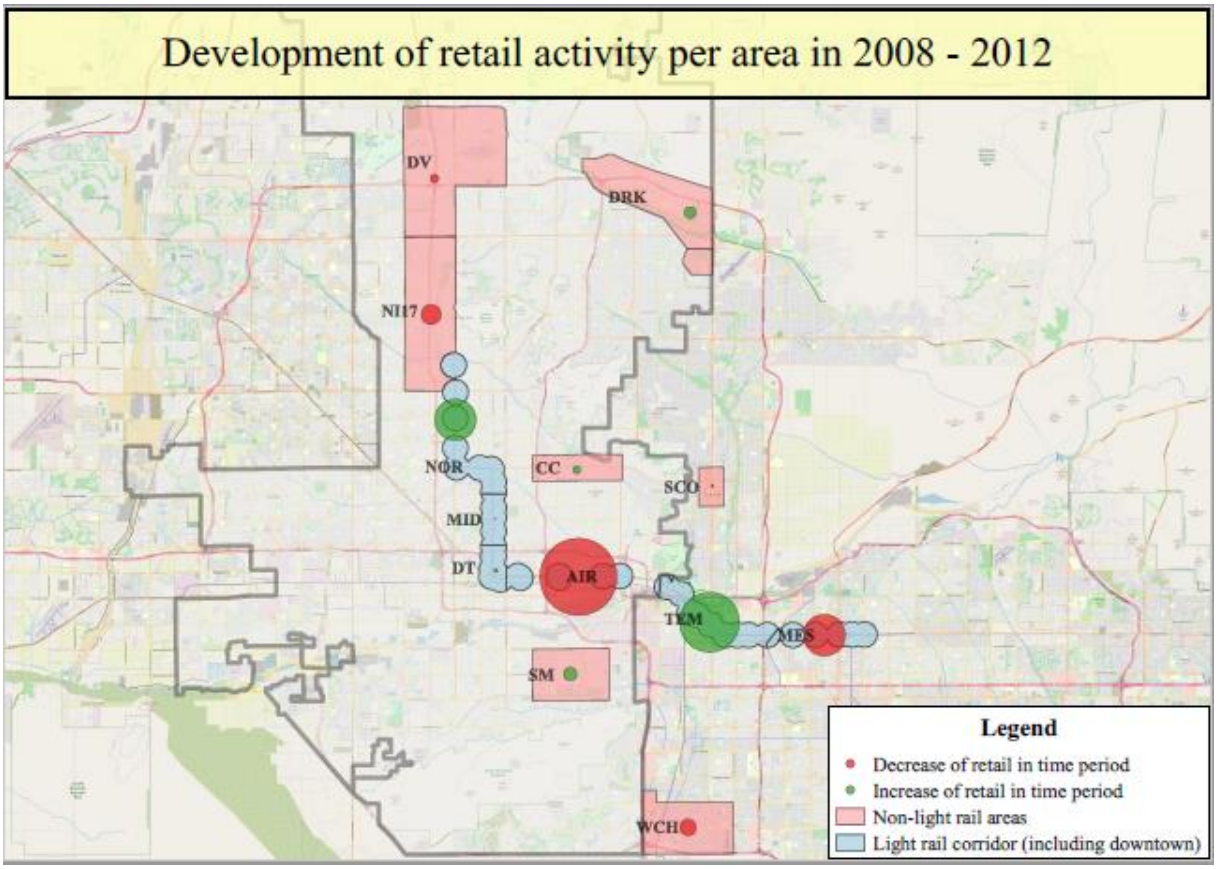

Figure 9: Retail activity development in non-light rail areas (red) and light rail corridor (blue) in 2008-2012

4. So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of retail activity of the 2008-recession may differ between those two segments? If so, why?

5. Tempe and North are two areas that are extreme in positive job change. Most areas are negative and moderate in change. Can you think of reasons why retail activity is performing well in North and Tempe especially?

1.3.3 retail in 2012-2015

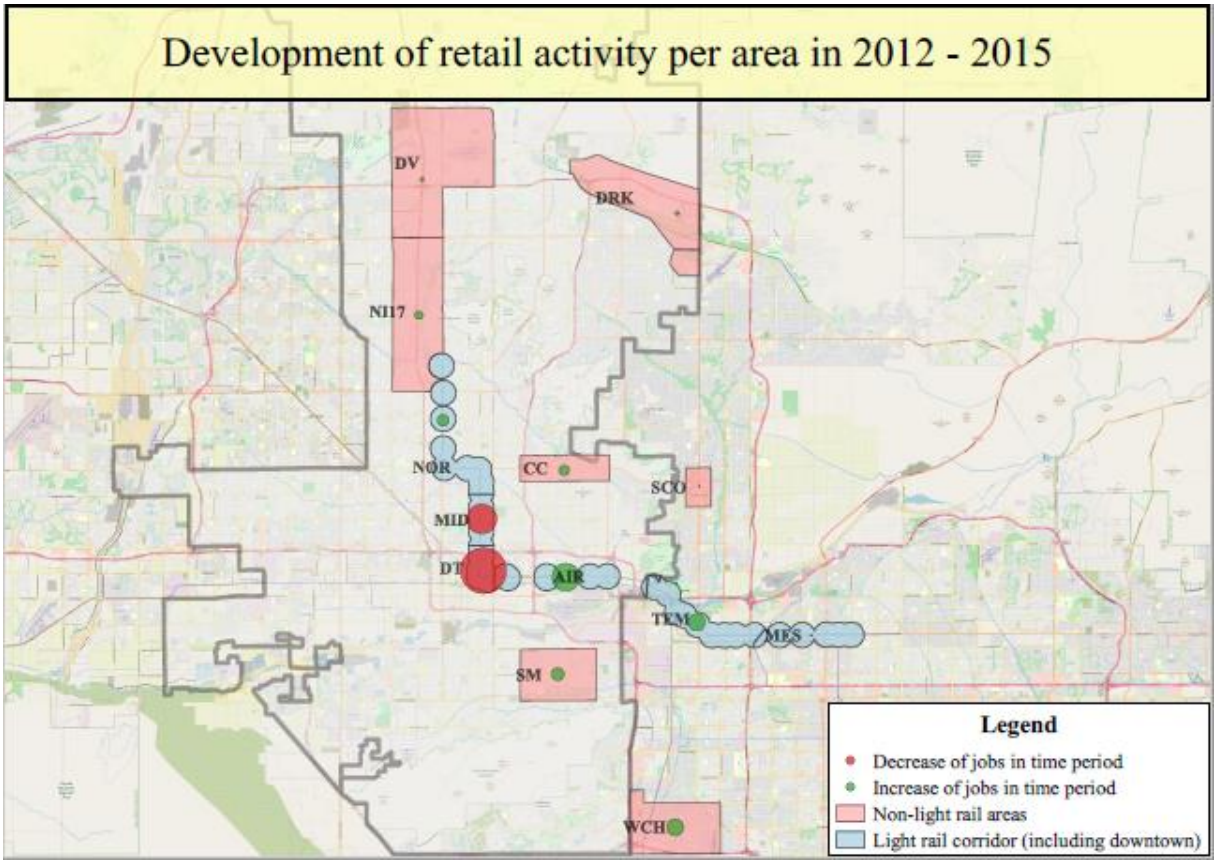

Figure 10: Retail activity development in non-light rail areas (red) and light rail corridor (blue) in 2008-2012

6. "South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods." Can you think of reasons why South Mountain is performing constantly positive in contrast to many other study areas?

7. "Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods". Can you think of a few reasons why Tempe seems to be resilient in retail activity?

8. "The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period.". How come retail is such an outlier in a negative way in the downtown for this period?

	Area	Retail performance (2004-2015)
1	Desert Ridge/Kierland	+115,90
2	Tempe	+98,55
3	South Mountain	+76.66
4	19th Avenue/Camelback (North)	+33.64
5	North Interstate 17	+14,22
6	West-Chandler	+10,29
7	Camelback Corridor	+5,99
8	Scottsdale	-14,14
9	Midtown	-14,78
10	Deer Valley	-30,39
11	Mesa	-50,23
12	Airport Area	-52,37
13	Downtown	-80,97

Area	Retail performance **before** light rail (‘04-’08)
DRK	+ 89,81
SM	+44,31
NI17	+27,55
TEM	+16,95
MID	+12,70
WCH	+11,90
AIR	+5,14
CC	-8,03
NOR	-8,75
SCO	-10,70
MES	-23,14
DV	-28,11
DT	-70,68

Area	Retail performance **after** light rail (’08-’15)
TEM	+69,77
NOR	+46,45
SM	+22,42
CC	+15,24
DRK	+13,74
WCH	-1,44
DV	-3,15
SCO	-3,85
NI17	-10,45
MID	-24,38
DT	-35,08
MES	-35,24
AIR	-54,70

Table 2:: The relative positions of each study area and its performance before- and after the implementation of the Light Rail. Non-light rail zones (Red): CC = Camelback Corridor; DRK = Desert Ridge/Kierland; DV = Deer Valley; NI17 = North Interstate 17; SM = South Mountain. ***Light rail zones (blue)****: NOR = North/Camelback/19th Ave; MID=Midtown; DT=Downtown; AIR=Airport Area; TEM=Tempe; MES=Mesa*

9. Desert Ridge/Kierland is an area which relatively performed very good, both in retail and total jobs in each measured period. Do you have possible explanations for this? And if so, do you think such reasons can be translated into measurements for downtown improvement?

10. It is said that Tempe has the highest rents of whole valley metro. Given the fact that Tempe was one of the better performing areas in retail activity, I was wondering to which degree you agree with the following statement: the high rents attract certain kinds of retail which will be more stable thus are less likely to go bankrupt which in its turn makes up for the strong performing retail activity.

11. Do you think that light rail is an instrument for limiting sprawl in general? How does this apply to the Phoenix-context?

12. Based on the quantitative data, effects of light rail do not seem clear yet. What are your expectations? How long will it last in order to see clear results?

13. Generally speaking, what are some spatial effects that can be attributed to light rail? Do you think suburbs of Phoenix will be impacted in some way by light rail (e.g. businesses relocating thus moving away from the suburbs)?

14. Do you consider negative change in (retail) jobs in a certain area to be problematic? If not, how come?

==========

Thank you very much for taking your time into looking at this document, thereby sharing your knowledge. Information will be processed into the final version of the thesis. The thesis will be send to you as a way of thanking you for partaking in the research. If you have further questions, you are always free to contact me via:
e-mail: [redacted]
phone: [redacted]

Kind Regards,

Foeke Boersma

MSc Economic Geography
University of Groningen (The Netherlands)

Interview City of Tempe, May 29th 2019

1. Considering 2004-2008, total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas which had an overall increase of 21%. Could you think of possible reasons/dynamics at that time that could explain such a gap?

So there are two things. First, construction of light rail had a big impact on businesses in that area. Because of light rail-construction, there was a lack of economic activity. The specific area was hard to access so there were no cars thus people wouldn't go there. Also, don't forget that in Arizona, the local culture is new to public transportation so there is no great feeling that light rail is going to be a great addition for businesses. Rather, locals think that light rail will kill businesses since cars have no access. In the suburbs, land is cheaper. So there was a lot more growth outlining areas. There was more vacant and cheaper land so there was a huge boom construction over there. People were buying land and building like crazy, up until the great recession. There was more vacant land outside the corridor.

2. Out of the 13 areas, job loss only happened in downtown and Mesa (figure 4). What is your opinion about that, given that several literature sources state that businesses react prior to the implementation by moving near light rail stations?

So I am not sure during this period if businesses were moving to light rail-areas. I have more concern about the immediate impact of construction. That caused job loss. The downtown was the most expensive so it probably saw people moving from the downtown corridor out to more suburban areas. Also Mesa had a terrible downtown but it did a lot to fix it. After light rail implementation, there was a natural decay of the downtown core. Apartments in downtown Phoenix were created while there weren't any before light rail implementation.

3. Considering the spatial patterns, the more northern areas (DV; DRK; NI17; SCO; CC) are performing better before the implementation. Can you think of some reasons?

I know that the Desert Ridge Kierland (DRK) area and all of that was brand new development. Huge development occurred there. Single family homes were created on places that used to be desert. Brand new residential retail development mostly. Deer Valley airpark much more economically viable, businesses locating near the airpark. Camelback Corridor has been undergoing redevelopment for a long time. It has always been very busy. Considering Scottsdale, there always has been a lot of activity too e.g. waterfront development. Really big projects are happening there, Scottsdale waterfront as an example. Both residential and retail. Desert Ridge/Kierland now has enormous retail and residential projects. Other parts of city didn't have those projects

1.2.2 total jobs in 2008-2012

It is stated within a rapport of Valley Metro that three cities within Arizona are placed within the top 5 of cities hit worst by the 2008-recession

4. How come that Arizona was so vulnerable in comparison to other states?

So within Arizona and thus also the Phoenix area, the strongest industry has been real estate for some time. The bubble of 2008, was a real estate bubble. Obviously all of those people got hit. Since then, policies try to diversify economy more with more industries. Now it still is mainly real estate. Tempe is in a better position but the rest of the Phoenix metropolitan area is highly real estate dependent.

5. How would you say that businesses within the downtown reacted to the 2008-recession? Would this be different for businesses elsewhere?

Retail was heavily affected. People stopped coming and they closed. People moved back in with families so there was a lot of moving between areas, especially in suburbs. Homes were heavily affected as well. Whole neighborhoods shut down whereby near retail also closed since there was no support anymore.

6. So if we compare the areas that are likely to be influenced by light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of total jobs of the 2008-recession may differ between those two segments? If so, why?

I would say that the periphery is hit harder than the downtown area because of the residential loss. The downtown does not have as many residents as the periphery. People go to the downtown for work. The downtown still has all the government jobs. These didn't go away. Banks, lawyers, they all did fine. Those are stable areas.

7. Was there anything special happening in Midtown that caused the 2008-recession effects on this place to be limited (Midtown even gains jobs)?

That is because during this period, Saint Joseph hospital expanded quite a bit. They built a brand new building. A neurological institute was added to the building. They brought in a medical school, Creighton in Saint Joseph barrows. It is happening now again, with a brand new 20000 square foot location in Thomas and Central, again in midtown. Real estate is cheaper in midtown compared to downtown. Businesses are leaving downtown and going to midtown because of the cheaper rentals, 10 dollar square a foot less.

8. **To which degree has light rail tempered the impacts of the 2008-recession?**

Hard to tell, light rail was implemented in December 2008.

9. **What would you say, could be explanations for the fact that jobs moved away (relatively in the largest numbers) from the downtown in the first operating period?**

Only thing that makes sense and that would be high rents. Since 2012 is has been cheaper.

***Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that* "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94).**

10. Do you agree with Joshi et at. in the sense that loss of jobs does not have to be negative and can even considered to be positive?

Yes because of two different ways: there is a loss of jobs related to recession. The crisis struck. Despite layoffs, jobs relocated to light rail as they took light rail into account for their choice. Layoffs nothing to with light rail. Light rail much to do with businesses locating near light rail for potential in future. Now it is open, construction is over so it is very visible because you see trains running.

1.2.3 total jobs in 2012-2015

10. Development of total jobs seems to happen in higher senses in the corridor now. Do you think that light rail areas are less vulnerable to the recession? Why?

Not sure if they are correlated. It is a good thing that the light rail area has more density meaning more people would rely on light rail to work, school, whatever activity. Purchasing of condos are happening in light rail areas so there are still enough people to be able to keep the corridor vibrant. People losing jobs happens everywhere. This impact purchasing power so you still might see retail shuttering. Less vulnerable because you have higher densities and a greater connectivity.

11. Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). To which degree would you say that the downtown performing well in 2012-2015, is a result of the downtown performing bad in 2008-2012?

Possible that there is correlation: in the 2008-12 period, local governments are still trying to maintain high rents but in 2012-2015 finally decided to lower them since there was a lot of turnoil, landlords losing properties, people leaving and not coming back and a lot of vacancy. So they realized in 2012 that they need to lower rents. That is what you are seeing in that period. The economy is picking up in 2012 more activity because the value of light rail became realized. It is thus all correlated to light rail.

12. **In an earlier interview with MAG, experts argued that there are places within the light rail-corridor where economic development is not happening. The area is low density or industrial, for instance between Tempe and downtown Phoenix. Looking at the figure above however, airport area is considered to be the best performing area within the light rail-zone. Given the earlier statement of MAG, how come that the airport area (AIR) has such a strong positive change in jobs?**

The airport area still requires some attention although it is booming. City of Phoenix just built a transit station at 52 street because they realized the need for an additional stop due to additional (economic) activity.

13. **"Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation": to which degree to you consider light rail a success so far?**

They don't seem to be performing worse. Depends on other things than light rail. For Tempe, light rail is a complete success. We are performing like crazy. There was growth happening in other parts of city, maybe 101. This may be due to the presence of many vacant land there for instance.

14. **How do you expect the corridor to perform in relation to the non-light rail zones in the future in terms of total jobs?**

Non-light rail areas continue to see strong performance. Outside corridor, land is still cheaper. Within the corridor areas, you have to do assembling since there is land with different owners. Requires more brain. Time intensive, lots of people are concerned by the small incremental changes. Downtown area has an older ownership e.g. people that bought it 100 years ago and has since been in the family. Long time owners of small parcels. It takes long to negotiate with different parties whereby generations of same owners are involved over small changes.

1.3 Retail

1. So we just discussed the impact of light rail on total jobs. Would you argue that this impact will be different for jobs in the retail sector?

Probably not, it will follow. Retail was seriously impacted by the recession and also during the construction. Desert Ridge Kierland has very big retail nodes. Scottsdale came thereafter. Those are related to these very large developments. Very large development creating new retail, for instance Tempe market place. Places like Phoenix where you have a great deal of land vacant and a lot of single family homes that will draw a lot of new retail. The downtown is already built out.

2. When looking at the retail activity of the downtown in the period of 2004-2015, the downtown lost 70% retail activity prior to light rail. To what degree would you think that many retail businesses reacted negatively to the soon to come light rail? And if so, why?

Light rail construction was going to hurt business. They were afraid light rail impacted their businesses and were forced to close. Construction was hard for businesses.

1.3.1 retail in 2004-2008

3. There is a major loss of jobs in the downtown. A little further south, in the South Mountain area, there is a large increase. How come, there is such a difference in development between the downtown (the core) and South Mountain - an area which is discrete in the total job development - while the distance between these areas is not big?

Goes back to South Mountain that was a new development area and still is. Lots of building occurs. Again,, this is related to land cheap. New single family homes are created in large proportion. Couple of people I know moved from north to south Phoenix (land was cheaper). New development compared to redevelopment is essential here. New development is more easy.

1.3.2 retail in 2008-2012

4. So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of retail activity of the 2008-recession may differ between those two segments? If so, why?

Only green areas experienced rebirth. One being Tempe Marketplace. This area previously was a garbage dump. Developers got land for free with no property taxes for the following 40 years. The Christown mall was another event that boosted retail in that specific area. The mall got completely redeveloped, with a big Walmart. Lots of retail activity was created as a result. In the downtown, nothing was happening since land was too expensive.

5. Tempe and North are two areas that are extreme in positive job change. Most areas are negative and moderate in change. Can you think of reasons why retail activity is performing well in North and Tempe especially?

1.3.3 retail in 2012-2015

6. **"South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods." Can you think of reasons why South Mountain is performing constantly positive in contrast to many other study areas?**

New development, there is nothing there. You could say it is an entire new city. Very cheap land which triggered development despite fact that south Phoenix is still considered to be poor.

7. "Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods". Can you think of a few reasons why Tempe seems to be resilient in retail activity?

Reason is reason for all of this, is density. Tempe already had the downtown living since it had been built before during the entire research period. When you have density, you have costumers. ASU in Tempe grew during this period. Tempe had more activity overall.

8. **"The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period.". How come retail is such an outlier in a negative way in the downtown for this period?**

Related lack of residency. You have more multi-family apartment and condos coming in but effects – for instance in terms of extra retail jobs – takes time. Also, a lot of people working in the downtown do their shopping and retail at home. If you were going to do this again, you will measure more retail growth simply because more people are living in the downtown which requires more services. Building homes-effects have to wait.

9. **Desert Ridge/Kierland is an area which relatively performed very good, both in retail and total jobs in each measured period. Do you have possible explanations for this? And if so, do you think such reasons can be translated into measurements for downtown improvement?**

10. **It is said that Tempe has the highest rents of whole valley metro. Given the fact that Tempe was one of the better performing areas in retail activity, I was wondering to which degree you agree with the following statement: the high rents attract certain kinds of retail which will be more stable thus are less likely to go bankrupt which in its turn makes up for the strong performing retail activity.**

More stable residential peace created better retail opportunity, not sure if rents have to do with that. If you look at the direct area, you can have higher rent due to more chance of stability. I agree.

11. **Do you think that light rail is an instrument for limiting sprawl in general? How does this apply to the Phoenix-context?**

No, because cheap land will always have buyers. Phoenix metropolitan area has no boundaries whereas in Portland for example, you would see that. Portland has a clear boundary, an urban boundary. As a result, everything is successful in that corridor. They were able to create density due to these urban boundaries. Phoenix will struggle since there is no mechanism like that to prevent sprawl. You may sell light rail so more people will invest in the corridor.

12. **Based on the quantitative data, effects of light rail do not seem clear yet. What are your expectations? How long will it last in order to see clear results?**

I think the problem with this study period is the recession. Give it another 10 years and you will have a clear picture what light rail will do for the corridor.

13. **Generally speaking, what are some spatial effects that can be attributed to light rail? Do you think suburbs of Phoenix will be impacted in some way by light rail (e.g. businesses relocating thus moving away from the suburbs)?**

There is going to be a greater movement towards the corridor as opposed to suburbs. Temper what I am saying that is happening as there is a change in generation. Younger people are more interested in more urban environment than having their own property in the suburbs like my generation. Change in generational thinking. Businesses are locating where the workforce wants to be. Businesses are locating were employees are happy. Millennials don't want to drive. They want to live and work where they can access via bicycle and public transport. They don't want to deal with parking. Shift in mentality. Companies are locating where they know they can get workers. USAA was locating in north Phoenix, along the interstate 17 which is quite far away. The site has potential for 10000 workers. However, USAA can't hire software employees because these employees live in Tempe and don't want to drive. Their decision was based on old thinking.

14. Do you consider negative change in (retail) jobs in a certain area to be problematic? If not, how come?

The thing with retail is, is that retail has changed significantly as well. You have Amazon, internet shopping and generations look different at it. Young people buy more online. Not sure if there is a

direct correlation. Shopping experience more related to experiencing something. That is the new face of retail.

Interview Valley Metro, June 5th 2019

1. Considering 2004-2008, total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas which had an overall increase of 21%. Could you think of possible reasons/dynamics at that time that could explain such a gap?

One thing was that the entire light rail corridor was under construction. As a result, there were not a lot of jobs being developed. It is not like construction at the fringe of city where a highway is being build. At the corridor, they are tearing up all the roads, so it is impossible to use roads. Traffic is much heavier.

2. Out of the 13 areas, job loss only happened in downtown and Mesa (figure 4). What is your opinion about that, given that several literature sources state that businesses react prior to the implementation by moving near light rail stations?

So this may be contributed to construction. During construction, businesses were not able to survive. Some stores closed. If you are looking at 2004-2008, construction in Mesa only happened for one mile. All the of rest Mesa, being 5 mile, was not affected by light rail. Don't look east at Main Street/Sycamore. Underschool/Country Club/Mesa Drive/Gilbert, these didn't open until 2015. Within Phoenix, don't look north of Montebello. If you interview a business owner in 2005, it was not on his mind to locate at such a place.

3. Considering the spatial patterns, the more northern areas (DV; DRK; NI17; SCO; CC) are performing better before the implementation. Can you think of some reasons?

Sprawling takes place over there. Still growing out so it is easier in the mind of the developer to focus on empty parcels and build office than an urban environment. Land is still cheap. Those areas are pretty desirable to live. Newer construction takes place that create bigger houses as well. Within the core, prices are higher while estates are older and smaller.

1.2.2 total jobs in 2008-2012

It is stated within a rapport of Valley Metro that three cities within Arizona are placed within the top 5 of cities hit worst by the 2008-recession

4. How come that Arizona was so vulnerable in comparison to other states?

There was cheap land available so developers were in love. Our economy heavily tied to the housing bubble. It is Arizona's main component in keeping the economy strong. Phoenix has a heavy reliance on construction and tourism and to a lesser degree healthcare. This determines the rate of growth. Scottsdale for example is more resilient and wealthy. Phoenix is very reliant on a few industries. When it is going well, it will grow faster than other places. But you have the other side of the coin too. Also , Phoenix has a large older population. Land was so cheap, development on that land.

5. What would you say, could be explanations for the fact that jobs moved away (relatively in the largest numbers) from the downtown in the first operating period?

Just when recession at the height in most areas, Arizona was hit so hard. People worked at that time in the downtown were limited to certain sectors. There wasn't a huge market of commerce, shops and restaurants in the downtown. Rather, government jobs were making up a significant proportion of total jobs in downtown. Governments jobs, cut budgets and were happy to do it, whatever consequences were. So there was a high government population, not firing people though, but encouraging people to retire in order to keep positions empty. The choice between sharing a building in downtown or a new building outside, was easily made. Airport neither performed well since there was no tourism. ASU

campus downtown Phoenix was being built at that time. They had 1000 students, now, in 2019, 12000. Facilities were built such as housing etc. Drop in that period absolutely due to recession exacerbated. At the same time, developers saw opportunities. Their way of thinking was: "Hey, we can build very cheap (accommodation for students etc.) now during recession".

6. **So if we compare the areas that are likely to be influenced by light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of total jobs of the 2008-recession may differ between those two segments? If so, why?**

Yes, you have the quality of life-aspect. Different kind of jobs after light rail. Labor forced changed. Downtown corridor experienced more tech jobs now. The effect of overall jobs was less jobs but higher salaries. Now you have this shiny train that people want to use. Midtown was growing I see. Midtown has a large private sector consisting of office parks. Midtown more private businesses than downtown. Midtown more office buildings. Lot of companies moving to Midtown with higher end work. You have the outline areas with level office spaces, call-center spaces etc. The headquarter in the downtown and call centers in outline areas where space is needed.

7. Was there anything special happening in Midtown that caused the 2008-recession effects on this place to be limited (Midtown even gains jobs)?

8. To which degree has light rail tempered the impacts of the 2008-recession?

Rule of thumb is to not say that light rail has created certain economic activity. Recession was turning around anyways. Light rail being in corridor definitely has an effect on the corridor. Recession effect for the entire state. Within the corridor, there is a lot of development and growth. This impacted the urban form. Thereby, it allowed developers to experiment building with more urban styles. They allowed it to be. Now you have your office buildings gaining more urban character. Wasn't that much going on on Central Avenue. Now, quite a few residential towers where before it was commercial. Yes, jobs gone down but light rail brought more balanced development style that we had not seen before. Past segmented, Phoenix had much zoning. Focus was on single family and everything else was a degradation of that ideal. Light rail demands to live close to rail and close to work. The architecture is now more progressive, more pedestrian friendly and more urban. Overall mindset of the city changed.

Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94).

9. **Do you agree with Joshi et at. in the sense that loss of jobs does not have to be negative and can even considered to be positive?**

1.2.3 total jobs in 2012-2015

10. **Development of total jobs seems to happen in higher senses in the corridor now. Do you think that light rail areas are less vulnerable to the recession? Why?**

More resistant how types of jobs have changed. The changing types of jobs does make us more resilient. Easy to build out in north Scottsdale, Deer Valley because there wasn't anything there while the light rail corridor was built out. When the economy was bad, developers chose a cheap project in order to get something done. Now, the economy is performing good, so more building within corridor. Lots of vacant land can be developed in density spots. The airport and downtown got some towers. Tempe is unique in itself. Light rail helped growth there but the university had a bigger impact than light rail.

11. **Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). To which degree would you say that the downtown performing well in 2012-2015, is a result of the downtown performing bad in 2008-2012?**

The downtown performance in 2012-2015 had a lot to do with government jobs. The same way they cut jobs, they now get all those people back again. Attribute to fact jobs that were lost, population growth now and the city is overall growing. These jobs need to be filled again due to growth.

12. **In an earlier interview with local experts, it was argued that there are places within the light rail-corridor where economic development is not happening. The area is low density or industrial, for instance between Tempe and downtown Phoenix. Looking at the figure above however, airport area is considered to be the best performing area within the light rail-zone. Given the earlier statement of MAG, how come that the airport area (AIR) has such a strong positive change in jobs?**

Vacant land, buildings zones for industrial purposes and parking lots were being recycled and used for something else. As an example, you have the station at 38 Street/Washington. They are growing, not necessarily in jobs, but students. South greyhound racing track before was empty. Now it is an extremely popular flee-market. One of reasons they locate is because of the train. That was empty, pretty easy to develop and also easy to access by train. It is however hard to create growth everywhere. Then, you have to create growth for 25 miles. Geographically, industrial jobs were situated not in close proximity to the freeway and/or light rail stations but rather just in-between. There are some small examples of residential development popping up near airport. Apartments for flight attendants but that is relatively small. There was such positive change because it was so bad. Still a long way to go because baseline was so bad. Change looked remarkable, and it was easy to spout very strong numbers when a priori, it was not good.

13. **"Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation": to which degree to you consider light rail a success so far?**

Depends on what you are defining with it. You suddenly have a shock to the city. Suddenly, there is light rail. Took people lot of time to get used to it. Midtown had the capacity to deal with such shocks since it was diversifying both in jobs and uses. Different types of jobs, for example Creighton university nursing school at Thomas and Central avenue. Was a big deal and happened because of light rail. University would never go to the mayor and say: "we want to open near a highway at the outline..". In quantitative terms, yes you are right. In qualitative terms, it is more diversified so that is succeeding in bringing more people 24h a day. Still work in progress. Look at this again with data considering 2015-2020. In these last 5 years downtown would be positive. The downtown and Mesa, they are starting to get a lot of handshake deals now for first time in 20 years. Diversifying, signs that study can be redone with a better performing corridor.

14. **How do you expect the corridor to perform in relation to the non-light rail zones in the future in terms of total jobs?**

We are expecting it to be much better. We can see where development is happening. Especially Tempe outpaces everything. Phoenix and Mesa are also recognizing positive press attention. Reactions are both from locals and new people saying: "I did not know Phoenix was like that". If you want the sprawl we have it, but we also offer something else. Large scale concerts, the super bowl and entertainment now We never heard that before.

1.3 Retail

1. So we just discussed the impact of light rail on total jobs. Would you argue that this impact will be different for jobs in the retail sector?

That is a good question. Anecdotally, I think that there is lot to be said about change in retail. Consumer habits in general, for instance malls closing throughout the whole nation. New amenities are put at places that are popular but at the same time, there are a lot of negative trends. There is a change in the way society is. You have the scenario of what people buy at stores versus Amazon. You have the 19th Avenue corridor and Mesa, past Sycamore until downtown, that are retail corridors. Still, you have the consumers wanting the big box store. These are found more at the outskirts so space certainly plays a role in retail.

2. When looking at the retail activity of the downtown in the period of 2004-2015, the downtown lost 70% retail activity prior to light rail. To what degree would you think that many retail businesses reacted negatively to the soon to come light rail? And if so, why?

The businesses weren't able to survive during construction. Like Circle K, a lot of them struggle that come with any kind of project, especially small retail businesses. There were not a lot of big retail shops in the corridor that were replaced. More retail in suburbs. The city hollowed out. Small retailers more equivalent in downtown. These small retailers are the first to suffer from construction since there is no corporate backing, paired with loss of jobs to cause a negative effect on retail in the downtown.

1.3.1 retail in 2004-2008

3. There is a major loss of jobs in the downtown. A little further south, in the South Mountain area, there is a large increase. How come, there is such a difference in development between the downtown (the core) and South Mountain - an area which is discrete in the total job development - while the distance between these areas is not big?

Prior to 2008, that was mostly undeveloped land. Again, it can be attributed to sprawl because of cheap land. The sprawling is thus moving south as well. More neighborhoods, so more need for grocery stores such as a Target, Walmart and Walgreens.

1.3.2 retail in 2008-2012

4. So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of retail activity of the 2008-recession may differ between those two segments? If so, why?

Land use. Look at areas that really decreased around light rail in 2008-2012, for instance the airpark area that is industrial. Mesa under construction until 2012. University remedy in Tempe. Within the corridor, there is a huge government investment of 2 billion being invested in the corridor. This large

investments of the government create attractive conditions for developers since they know that money will be put into the area.

5. **Tempe and North are two areas that are extreme in positive job change. Most areas are negative and moderate in change. Can you think of reasons why retail activity is performing well in North and Tempe especially?**

New developments and older establishments being redeveloped. Areas with lot of housing, especially dense multi-family that are getting more renovated and/or developed. Much money is put into it.

1.3.3 retail in 2012-2015

6. **"South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods." Can you think of reasons why South Mountain is performing constantly positive in contrast to many other study areas?**

New since there wasn't anything there. South Phoenix has been the poorest with racial discrimination that kept south Phoenix down. It is also near the freeway which situates hotels for people that stay in that area. Also, you don't have to travel far to the stadium. You have many facilities such as Home Depot, Walmart, Target and other grocery stores.

7. **"Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods". Can you think of a few reasons why Tempe seems to be resilient in retail activity?**

Completely due to university. There is a constant blow of consumers in the form of students. Whether the economy is good or not. High proportion of population that are able to consume. Retail is affected by university schedule though.

8. **"The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period.". How come retail is such an outlier in a negative way in the downtown for this period?**

Answered earlier, more developed in suburbs where neighborhoods are new. Suburbs are confined, all activity taking place in neighborhoods while outside, there is not much activity. Downtown and Midtown together have 2 full service groceries stores, one of them at McDowell/7th street; other at7th Avenue/Osborn, half a mile of the light rail station. Downtown has been none, just one now. Pretty hard to talk to major retailer and say "hey you should build in downtown". Such retailers need a big box in the suburbs. Since two or three years ago, the downtown is absolutely worth to invest. There is population grow, mainly due to the growing student population that is probably 30,000 now. That justifies grocery stores.

9. **Desert Ridge/Kierland is an area which relatively performed very good, both in retail and total jobs in each measured period. Do you have possible explanations for this? And if so, do you think such reasons can be translated into measurements for downtown improvement?**

Retail stores in Kierland are associated with being more higher end and aspirational versus retail stores at the North Interstate 17-corridor that are not. Desert Ridge/Kierland is located next to Scottsdale so next to higher end houses. You can get cheap land near the wealthier corridor. Desert Ridge/Kierland attracts people from Scottsdale, they even want a 45 minutes' drive to it. People from Scottsdale are the most affluent of the metropolitan-population so they have money to spend. The region of Scottsdale has many snowbirds which are retirees from Canada moving to Phoenix in the wintertime. Retirees that have a house here and a house somewhere else. This is especially the case in Scottsdale and they easily pay $200 on dinner on a Tuesday night.

10. **It is said that Tempe has the highest rents of whole valley metro. Given the fact that Tempe was one of the better performing areas in retail activity, I was wondering to which degree you agree with the following statement: the high rents attract certain kinds of retail which will be more stable thus are less likely to go bankrupt which in its turn makes up for the strong performing retail activity.**

Not necessarily high rents that attracts certain kind of retail. Retail sees tends to be more local franchises or locations of national and international stores with backing of the parent company. Stability assigned with larger enterprises. Retail at Desert Ridge/Kierland are not modern pop shops but are all large conglomerate organizations. Desert Ridge/Kierland-shopping center has very specific, high end stores.

11. **Do you think that light rail is an instrument for limiting sprawl in general? How does this apply to the Phoenix-context?**

In this region, light rail is a great alternative to the traditional sprawl model. Not big enough to have a huge effect. It covers a small portion of the valley. Light rail encourages a change in mindset of land use. Change in mindset could have a pause-effect on sprawl. Dallas has park and rides situated at every suburb. Our light rail is still in the core. People in Dallas that live in suburbs, use light rail in the suburbs. Here we do have to be able to love light rail in the corridor in order to utilize it. More people are going to live in the urban core however so that gives potential.

12. **Based on the quantitative data, effects of light rail do not seem clear yet. What are your expectations? How long will it last in order to see clear results?**

There are several issues. It is expensive, thereby getting more expensive since the political climate is expensive in order to expand. In the future, I don't know if light rail would be large network system. New technologies and working partnerships are apparent and will continue to flourish so I don't think transit will ever not be relevant. Mindset turns to the true urban core i.e. urban high density multi use mindsets continue to grow in the valley.

13. **Generally speaking, what are some spatial effects that can be attributed to light rail? Do you think suburbs of Phoenix will be impacted in some way by light rail (e.g. businesses relocating thus moving away from the suburbs)?**

The quality of life is improving. Rebuilding the area that is already built. There is lots of vacant land along light rail. Once the train got built in, there is a significant amount of vacant land that is transformed into walkable land with restaurants. People are leaving apartments via the doors instead of driving away via the garage due to light rail. Downtown isn't that big so it will not be the one premier office location like it is in most cities.

14. **Do you consider negative change in (retail) jobs in a certain area to be problematic? If not, how come?**

Although we may lose retail, we turn into a more complete city that better supports retail. There is an increasing population in the downtown. Not that segmented anymore. Now, there is more mixed use with light rail implementation.

Interview Greater Phoenix Economic Council, June 6th 2019

1.2.1 total jobs in 2004-2008

1. Considering 2004-2008, total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas which had an overall increase of 21%. Could you think of possible reasons/dynamics at that time that could explain such a gap?

Lot of that particular segment was right when light rail was being constructed. There wasn't a lot of mass transportation yet. This was the case until December 2008. Lot of it was due to the fact that the area hadn't been constructed which was a driving factor in determining businesses or not. Part of the driving was the large boom in population, housing, etc.. Essentially in 2005-2007, there was peak development. Housing was driving so much of the development at that time. Lot more fringes of the valley got along with housing development.

2. Out of the 13 areas, job loss only happened in downtown and Mesa (figure 4). What is your opinion about that, given that several literature sources state that businesses react prior to the implementation by moving near light rail stations?

Especially with Mesa, as the line was a only mile in 2008. 2008-2012 might be where Mesa started to see impact as construction occurred. Especially downtown Mesa is thriving now. Pivot right at that point and it is expected to have a lot of growth afterwards.

3. Considering the spatial patterns, the more northern areas (DV; DRK; NI17; SCO; CC) are performing better before the implementation. Can you think of some reasons?

Lot of new development occurred. In Deer Valley, there was a lot of new office construction along that, industrial development too. Desert Ridge/Kierland as well. Interesting situation in the state. The state was selling parcels for the highest invest use. Desert Ridge/Kierland invested right around that time frame as land was actually available for private development now. Natural growth captured Deer Valley, North Interstate 17 and DRK-corridor. Scottsdale has seen lot of development in downtown area. Slightly off downtown, there was investment in Scottsdale too as Arizona State University invested right around that time frame on some office buildings there. This then functioned as an economic catalyst. You have the ASU-offices, for example the office of knowledge and enterprise located at Skysong. Therefore, Scottsdale attracted many tech companies and office users in 2004-2008.

1.2.2 total jobs in 2008-2012

It is stated within a rapport of Valley Metro that three cities within Arizona are placed within the top 5 of cities hit worst by the 2008-recession

4. How come that Arizona was so vulnerable in comparison to other states?

Our economy prior to recession consisted of consumption based industries and the housing construction. The housing market crashed and Arizona was susceptible to these effects whereby only Nevada was hit worse within the United States.

5. What would you say, could be explanations for the fact that jobs moved away (relatively in the largest numbers) from the downtown in the first operating period?

The recession-effects were so strong. Over 300,000 jobs out of 2 million were lost. Took us until 2016 to fully recover, valley wide.

6. **So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of total jobs of the 2008-recession may differ between those two segments? If so, why?**

In terms of immediate effects, not really. The whole region and state was hit hard. Every job corridor experienced the impact of it. Pretty equal effect across region, in terms of immediate recession-effects.

7. Was there anything special happening in Midtown that caused the 2008-recession effects on this place to be limited (Midtown even gains jobs)?

Two factors driving. One being that it wasn't really a job booming corridor. There was less growth in the run up so there was not much to hit. The second being the sectors in Midtown. Other industries were hit hard except for two: health care and education. Healthcare jobs may have cost that area not to feel as much of the impact. The healthcare sector actually gained jobs. The Midtown corridor has many healthcare jobs so not much negative effect there (relatively speaking).

8. **To which degree has light rail tempered the impacts of the 2008-recession?**

Light rail definitely helped in terms of mitigating impacts. The corridor opened and so did the ASU downtown campus around the same time. That has driven lot of development in the downtown Phoenix area. Downtown was primarily a 8-17-area whereas now it functions 24 hours a day. One of the main drivers for ASU was light rail with access to transportation. Light rail connects two campuses (ASU downtown Phoenix/ASU Tempe). Both time frames are 2008-2015. A lot of companies are interested in locating near transit. Recession slowed down. This speeded up process of recovery. We are working with companies and finding out what the biggest driving factors are for businesses so we try to offer them something in order to come to greater Phoenix.

***Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that* "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94).**

9. Do you agree with Joshi et at. in the sense that loss of jobs does not have to be negative and can even considered to be positive?

I think it can be positive when you take into consideration what you are losing versus attracting. Losing jobs may translate into jobs that do not provide much economic benefit. Certain jobs (e.g. high educated and/or high paying jobs) seek out the corridor so you may see the long term benefit despite losing jobs now.

1.2.3 total jobs in 2012-2015

10. Development of total jobs seems to happen in higher senses in the corridor now. Do you think that light rail areas are less vulnerable to the recession? Why?

Yes, the types of jobs in the corridor are less susceptible to the recession. High tech office users are coming in and are interested in mass transit. These companies are less vulnerable to the recession. This is the case for other office sectors as well.

11. **Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). To which**

degree would you say that the downtown performing well in 2012-2015, is a result of the downtown performing bad in 2008-2012?

Cumulative investment over time to see if these areas going well. ASU is a big economic driver in the second time frame. Tremendous amounts of new multifamily-residential and office development in downtown. This translates in 24/7 residence, new businesses, the ASU, 24/7-activity, office corridors and new products along light rail. More companies come in. It has taken long enough to realize this, not necessarily due to dip of the economy. Same thing in airport area. In the airport area, there is a continuation of developed along light rail there. It may take a few years to unravel into clear effects.

12. **In an earlier interview with local experts, it was argued that there are places within the light rail-corridor where economic development is not happening. The area is low density or industrial, for instance between Tempe and downtown Phoenix. Looking at the figure above however, airport area is considered to be the best performing area within the light rail-zone. Given the earlier statement of these local experts, how come that the airport area (AIR) has such a strong positive change in jobs?**

I think that to some extent, it is not solely industrial. Employers in that area create new development.

13. **"Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation": to which degree to you consider light rail a success so far?**

Light rail success in terms of ridership numbers above predicted numbers. The 2020 ridership levels where already reached a couple of years ago. The recession-effects took most of them a while to recover. I am surprised by the numbers that it has not recovered all of its jobs. We see more companies coming in last 3 years than ever (2016-2019). We lost almost a decade of economic performance.

14. **How do you expect the corridor to perform in relation to the non-light rail zones in the future in terms of total jobs?**

I do think that non-light rail corridors continue to perform as well. They will attract users that are less mass transit-dependent. Everywhere is space to improve. Via the idea of light rail, we were able to attract companies that were not likely to move otherwise.

1.3 Retail

1. **So we just discussed the impact of light rail on total jobs. Would you argue that this impact will be different for jobs in the retail sector?**

I don't think so, I think retail will benefit from light rail just like total jobs.

2. **When looking at the retail activity of the downtown in the period of 2004-2015, the downtown lost 70% retail activity prior to light rail. To what degree would you think that many retail businesses reacted negatively to the soon to come light rail? And if so, why?**

Lot of that is driven by recession-effects. When light rail was coming, the economy was not good. Prior to light rail, there was not much activity. You couldn't find a place to eat after work. There weren't a lot of people in the downtown area to visit these businesses.

1.3.1 retail in 2004-2008

3. **There is a major loss of jobs in the downtown. A little further south, in the South Mountain area, there is a large increase. How come, there is such a difference in development between the downtown (the core) and South Mountain - an area which is discrete in the total job development - while the distance between these areas is not big?**

The distance is not that big. The accessibility is probably not great which is part of it. Entirely demographics I would argue. The downtown has daytime population thus not much residential. South Mountain did have more of that.

1.3.2 retail in 2008-2012

4. So if we compare the areas that are likely to be influenced by light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of retail activity of the 2008-recession may differ between those two segments? If so, why?

No, there are other factors as well so it is complicated.

5. Tempe and North are two areas that are extreme in positive job change. Most areas are negative and moderate in change. Can you think of reasons why retail activity is performing well in North and Tempe especially?

The Tempe area is primarily ASU. ASU has grown tremendously, driving retail activity for students. Considering North, development is coming in because of park and ride facilities there. Some development is occurring in the mall adjacent to that. Continued construction as light rail spread north of Dunlap. At the time the endpoint (Camelback) expanded a couple of miles north, park and ride (near Camelback) facilities were created adjacent to the mall.

1.3.3 retail in 2012-2015

6. "South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods." Can you think of reasons why South Mountain is performing constantly positive in contrast to many other study areas?

Not sure why. Retail is not something that is the focus I would say.

7. "Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods". Can you think of a few reasons why Tempe seems to be resilient in retail activity?

The Arizona State University continues in this time frame. More development occurred in this area in order to meet the needs of the growing student population.

8. "The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period.". How come retail is such an outlier in a negative way in the downtown for this period?

Findings surprise me on job growth while retail was not.

9. Desert Ridge/Kierland is an area which relatively performed very good, both in retail and total jobs in each measured period. Do you have possible explanations for this? And if so, do you think such reasons can be translated into measurements for downtown improvement?

Because a lot of new development was and is occurring in that area. Started right around beginning of time frame. Thereby, there is lots of residential growth, both in retail as other types of jobs. Employers moved over there. They had and still have positive momentum. There is plenty of land available for development.

10. **It is said that Tempe has the highest rents of whole valley metro. Given the fact that Tempe was one of the better performing areas in retail activity, I was wondering to which degree you agree with the following statement: the high rents attract certain kinds of retail which will be more stable thus are less likely to go bankrupt which in its turn makes up for the strong performing retail activity.**

One of factors is having to do with a lot of people so retailers have solid balance sheets developed in corridor with high rents. This in its turn translates into more stability. Do not oversee ASU with the student population that helps too. People cannot find a job and go study that translates into a larger attendance of ASU which results in larger demand.

11. **Do you think that light rail is an instrument for limiting sprawl in general? How does this apply to the Phoenix-context?**

Yes, because more mass transit options gives more compact development. In Phoenix you still see a lot of growth in the corridor and the outside areas. Phoenix is the fastest growing city in total numbers in the most recent US census data. In terms of %-growth, top growing also in the Phoenix metropolitan area, especially Buckeye. Buckeye sees lots of growth and so does Goodyear. First industrial mainly, now also many warehouses. You can go to Los Angeles and back in one day while this is barely doable east Phoenix. Goodyear has datacenters now and some other developments too.

12. **Based on the quantitative data, effects of light rail do not seem clear yet. What are your expectations? How long will it last in order to see clear results?**

I expect change in light rail to be positive and growing beyond initial line that opened. 20 miles first, now 26. As long as it expands, Phoenix will continue to grow because of that. I suppose for at least another decade. Encompassing more, definitely westward since I think demand is there. The most development is central and east, therefore there needs to be some line heading westbound.

13. **Generally speaking, what are some spatial effects that can be attributed to light rail? Do you think suburbs of Phoenix will be impacted in some way by light rail (e.g. businesses relocating thus moving away from the suburbs)?**

More dense development I would say. Different development in suburbs versus areas light rail areas. Light rail attracts different businesses. Retail and office move more to the light rail corridor while industrial activity is more dominant in the suburban counterparts. The campus style offices are also more located in the suburbs.

14. **Do you consider negative change in (retail) jobs in a certain area to be problematic? If not, how come?**

I do, I don’t want to see any area having negative development area in jobs.

Interview The Midtown Association, June 13th 2019

1. Considering 2004-2008, total jobs in the light rail corridor increased with 4% which is considerably lower than the non-light rail areas which had an overall increase of 21%. Could you think of possible reasons/dynamics at that time that could explain such a gap?

2004-2008 was the time the US great recession took place, causing the economy to fall apart. It was the same timespan as to when the light rail corridor getting on its feet. The recession of 2006 absolutely killed stuff along light rail. Lot of jobs were not developing there. Jobs along light rail, white colored, high tech jobs, were hit hard during the recession. Areas in the not light rail areas are more service related that never go away such as waiters, servers. Non tech related basically. Jobs outside the light rail corridor established. Considering the high tech sector, there were a lot of jobs in startups industries that typically were crushed by the recession. These businesses were just getting started and suddenly went out of business because light rail. No money and experience to survive. Recession moved differently in different areas. The 2004-2006 period really hit the Arizona economy. So much of the Arizona-economy was based upon housing. It was a mortgage bubble. Arizona based on housing, hit hard here first before other areas were hit with the same intensity.

2. Out of the 13 areas, job loss only happened in downtown and Mesa (figure 4). What is your opinion about that, given that several literature sources state that businesses react prior to the implementation by moving near light rail stations?

Mesa was built in the 50s-60s. Mesa for most of the time, did not have a good reputation. A lot of people were moving away from Mesa. Light rail going in Mesa was disaster. Light rail is 10 years old, they didn't have the experience to go in there and draw people/businesses in. A lot of businesses that closed, were impacted by construction. Downtown Phoenix consists of many governmental organizations such as MAG and the City of Phoenix. Part is the income of these agencies is via property taxes. With the recession however, incoming property taxes decreased drastically. They lost many of their employees because they did not have money coming in.

3. Considering the spatial patterns, the more northern areas (DV; DRK; NI17; SCO; CC) are performing better before the implementation. Can you think of some reasons?

Deer Valley; Desert Ridge/Kierland etc. is due to new construction. Recession hit housing stuff, areas that were growing. Almost all of jobs are service related in suburbs, grocery stores etc. Those aren't long lasting great jobs. In the DRK-area, there is a lot of stuff going on, for instance medical industries that will never go away. Couple of these places have headquarters such as America Express, Discover Car. Even during financial though times, medical financial stuff tend to not to go away.

1.2.2 total jobs in 2008-2012

It is stated within a rapport of Valley Metro that three cities within Arizona are placed within the top 5 of cities hit worst by the 2008-recession

4. How come that Arizona was so vulnerable in comparison to other states?

Next to real estate bubble, Americans move around a lot.. Once hard times hit Arizona, many people left. They went home. People didn't have the safety net to stay here. In these tough times, a lot of people moved back to family, cousins. Five C's copper, climate, cattle, citrus, cotton on which Arizona is dependent upon, also were in trouble. Lack of tourism also had a negative impact just as the service related economies.

5. What would you say, could be explanations for the fact that jobs moved away (relatively in the largest numbers) from the downtown in the first operating period?

Hard one. One of things, recession saved Midtown since it did stop on fast rapid unplanned growth. First operating period caused transition in job style. Everyday nonprofessional blue colored jobs (e.g. mechanics, car services etc.) driven out by light rail and the economy was paused. There was a transition taking place from service to professional (tech jobs) sectors. Took time for businesses to catch this transition.

6. **So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of total jobs of the 2008-recession may differ between those two segments? If so, why?**

Phoenix is funny in the sense that you have a lot of bad areas in Phoenix. Poverty problems are out in suburbs. You have huge problem with homeless people 25 miles away from downtown. What is happening, is that the new generation, the professionals move to downtown. High transit dependency rates are increasing in the downtown because people have no cars. Far off places, new generation people moved out there since there is not much to offer e.g. no employable skills. The light rail corridor is far less impacted post-recession. Jobs are bad in suburbs, you couldn't raise family out of it. These are jobs for 18-20 years, but older?

7. Was there anything special happening in Midtown that caused the 2008-recession effects on this place to be limited (Midtown even gains jobs)?

Midtown is an unique part of Phoenix. Midtown has always been full of very educated, professional people. It is not impacted by the recession. It is one of the areas that is extremely aware of how the economy is tied together and how transit oriented development is very helpful. Midtown is a professional place where many people work for themselves. Midtown will always be good, bulletproof. Many people are in their mid-30s with their feed on the ground and well educated.

8. **To which degree has light rail tempered the impacts of the 2008-recession?**

It created jobs, look at every study that has been done, billions into the economy. For every 1 feet on light rail, 14 jobs are created it is said. Jobs are going to happen anyways, with or without recession, light rail helped thereby.

***Joshi et al. (2007) can draw positive conclusions despite negative implications of economic activity in the downtown as they say that* "despite the loss of jobs in the CBD, a significant proportion of new and relocating job centers have sought out rail transit corridors" (Joshi et al., 2007, p.94).**

9. Do you agree with Joshi et at. in the sense that loss of jobs does not have to be negative and can even considered to be positive?

Can be, for instance getting rid of low paying jobs while at the same time considering what is going to come in here.

1.2.3 total jobs in 2012-2015

10. **Development of total jobs seems to happen in higher senses in the corridor now. Do you think that light rail areas are less vulnerable to the recession? Why?**

Due to tech jobs.

11. Remarkable is that the two areas that had the largest decrease in total jobs, being the Airport Area as worst and the downtown as second-worst, now have the largest increases in total jobs. The Airport Area is performing best (+39%), followed by the downtown (+30%). To which degree would you say that the downtown performing well in 2012-2015, is a result of the downtown performing bad in 2008-2012?

Things had to get bad before they got better. After 5pm it was gone, deserted. The mayor put huge effort into attracting people to the downtown. For whatever reason, a lot of property is owned out of state in Phoenix downtown. A lot of people bought properties in the downtown to make money. During the recession, they weren't tied in Phoenix so they just sold it to get rid of it, there was no connection. Owned from outside while caused by the recession, a lot of people from the nside bought it.

12. in an earlier interview with local experts, it was argued that there are places within the light rail-corridor where economic development is not happening. The area is low density or industrial, for instance between Tempe and downtown Phoenix. Looking at the figure above however, airport area is considered to be the best performing area within the light rail-zone. Given the earlier statement of MAG, how come that the airport area (AIR) has such a strong positive change in jobs?

Go on light rail, one of reports I sent you, Valley Metro, there are pockets of development along light rail. Brand new condos are at places which were previously 5 acres of nothing, desert. Development along light rail, hit or miss so it is spotty. Some of that has to do with the tax structure. Taxes increase with the building on the land. Land taxed 5%, very low. No incentive to build something. Knocked down to dirt due to tax lowerage. 90% or lower rate by having nothing there. The rate is very low rate if you only have land. But now with light rail, it may be worth the investment..

13. **"Except for Midtown, every light rail area performs worse after the implementation than prior to the implementation": to which degree to you consider light rail a success so far?**

I consider it success, light rail brought Phoenix back from the dead and it got ASU to the downtown. Large part of the downtown central area Roosevelt is all ASU consisting of students and people that work there. People want to walk to work instead of drive. It just takes time, transforming the entire city/entire economy.

14. **How do you expect the corridor to perform in relation to the non-light rail zones in the future in terms of total jobs?**

Corridor jobs will increase since it are better jobs compared to the outside corridor. Might see more growth outside corridor, but the high paying jobs are in the corridor. Better jobs thus along corridor.

1.3 Retail

1. **So we just discussed the impact of light rail on total jobs. Would you argue that this impact will be different for jobs in the retail sector?**

If you look along light rail and look at the number of liquor licenses before and after implementation, after has more. This is just an example but still, I think it can be a representation of light rail effects on retail

2. **When looking at the retail activity of the downtown in the period of 2004-2015, the downtown lost 70% retail activity prior to light rail. To what degree would you think that many retail businesses reacted negatively to the soon to come light rail? And if so, why?**

Some part of that 70% can be blamed on the recession. The area that lost most would be Mesa because the installation in Mesa was a disaster so it was highly affected. Jobs going away anyways. Downtown dependent on the government: if you lose 20 government workers you lose 3 waiters. People realize they could sell businesses for more now due to land price improvement caused by light rail.

1.3.1 retail in 2004-2008

3. There is a major loss of jobs in the downtown. A little further south, in the South Mountain area, there is a large increase. How come, there is such a difference in development between the downtown (the core) and South Mountain - an area which is discrete in the total job development - while the distance between these areas is not big?

Maybe 6 miles.

1.3.2 retail in 2008-2012

4. So if we compare the areas that are likely to be influenced by the light rail against areas that are more situated in the periphery of Phoenix metropolitan area, would you argue that the effects in terms of retail activity of the 2008-recession may differ between those two segments? If so, why?

In the periphery, a bulk of jobs is going to be there anyways. Especially in Apache Junction where you have 3-store buildings that go on forever. People work at Amazon so you need retail for those people. Periphery will always be strong, it just is. Less area and fewer people are present in the corridor. Population density along corridor is different compared to the periphery.

5. Tempe and North are two areas that are extreme in positive job change. Most areas are negative and moderate in change. Can you think of reasons why retail activity is performing well in North and Tempe especially?

Tempe's positive retail activity is completely tied to ASU. 50% people go to ASU that are not from Arizona. People that have money to spend, for instance from Saudi Arabia or California. North has always been and always will be one of the nastier parts of Phoenix. Highest number of people in prison. Gas stations that has been there for 30 years so I find the positive retail change odd.

1.3.3 retail in 2012-2015

6. "South Mountain is once again positive so this is one of the few study areas that constantly performs well in retail during the study periods." Can you think of reasons why South Mountain is performing constantly positive in contrast to many other study areas?

7. "Tempe is performing well again (+14%) and is the only area within the corridor that experienced positive retail change in all the three periods". Can you think of a few reasons why Tempe seems to be resilient in retail activity?

ASU is a big factor – in terms of attracting and delivering young professionals. These young professionals are for instance 25 with a disposable income. So you have the wealth factor there, people make a lot of money.

8. "The downtown has the worst development of all areas in 2012-2015 (-38%) while its total jobs experienced growth (+28%) and was the second best area in the same time period.". How come retail is such an outlier in a negative way in the downtown for this period?

2015 would be right when downtown gets going and things are picked up. Until 2014-2015, you still have the hangover of the recession. If you look at retail jobs now, I will guarantee you, It has increased tremendously.

9. **Desert Ridge/Kierland is an area which relatively performed very good, both in retail and total jobs in each measured period. Do you have possible explanations for this? And if so, do you think such reasons can be translated into measurements for downtown improvement?**

Desert Ridge/Kierland is a wealthy area. People have money and always will have it over there. They live there and work in the downtown. You could say it is downtown money in the suburbs. A decent amount of people work in banking; finance etc. which are recession-proof.

10. **It is said that Tempe has the highest rents of whole valley metro. Given the fact that Tempe was one of the better performing areas in retail activity, I was wondering to which degree you agree with the following statement: the high rents attract certain kinds of retail which will be more stable thus are less likely to go bankrupt which in its turn makes up for the strong performing retail activity.**

Rents are ridiculous, just like Roosevelt. It goes hand-in-hand. Tempe is a bubble. Some people may have never left this Tempe-bubble, they are attached to that place. They can charge rents, people will still have no incentive to leave. High rents attracts high retail.

11. **Do you think that light rail is an instrument for limiting sprawl in general? How does this apply to the Phoenix-context?**

I do in general. Phoenix is a weird animal when you talk about the Phoenix context. People here are more obsessed with subdivisions, the status with their house and the desert is limitless. Phoenix will limit sprawl but you have to focus on transit oriented development in the downtown. Attract certain kinds of people, young professionals for instance. Not the family that wants a 4000-square house with a pool. You start with nothing since you have desert and whatever you add is valuable. People have that attitude still.

12. **Based on the quantitative data, effects of light rail do not seem clear yet. What are your expectations? How long will it last in order to see clear results?**

People didn't know much, MAG people didn't know lot about impacts. Part of it is due to the census (every 10 years). No, 20 year window yet. Attracting higher quality jobs and educated people in the core corridor is necessary hereby. 2034 supposed way out west. 2045 you have like a really good idea. This long term thinking is against the way many people think.

13. **Generally speaking, what are some spatial effects that can be attributed to light rail? Do you think suburbs of Phoenix will be impacted in some way by light rail (e.g. businesses relocating thus moving away from the suburbs)?**

High density development. For instance the Roosevelt neighborhood, with30 store buildings. You have infill development in light rail areas, 3condos here, 5 apartments there. Land is more valuable. Transit oriented development creates more variety. Downtown Phoenix now has a first real big grocery store. What you'll see is brain drain taking place in the suburbs since a lot of former living in suburbs are working (and starting more and more to live) in the downtown. They don't want to drive an hour. High incomes go from suburbs to the downtown, thereby walking to work. Percentage of Americans of driver's license decreased with 12% in the last 10 years. New urbanism is increasing, meaning more and more people want to live in the downtown.

14. **Do you consider negative change in (retail) jobs in a certain area to be problematic? If not, how come?**

Not that problematic, retail has many low paying jobs. Short term unemployment but you will have the concept of job hopping: people moving from one retail job to another.