THE LIVE-WORK-PLAY DISTRICT: FROM VISION TO IMPLEMENTATION

by

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ABSTRACT

The concept of Live-Work-Play has grown in popularity in the field of planning, as various strands of the planning literature increasingly have highlighted the potential benefits of providing places to live, work, and play in close proximity. This study explores the theoretical foundations of the Live-Work-Play concept and discusses its effectiveness as a strategy for creating vibrant urban areas by reforming the spatial arrangement of the built environments. More specifically, the present study empirically examines how the segregation or the mixture of places to live, work, and play may create differences in terms of growth, inequality, education, the built environment, and transportation by analyzing the Boston metropolitan region as an example. The empirical analysis with the use of census tract level socio-economic data shows that the Live-Work-Play mixes can encourage more desirable travel patterns, while the mixes may not significantly promote growth in small areas. However, the analysis also revealed racial and income inequalities exist in the provision of the mixes in the Boston region. These findings suggest planners carefully should consider the equity issues when adopting the Live-Work-Play concept and providing its potential benefits.

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CHAPTER 1 | INTRODUCTION

Cities began segregating different land uses more intensely near the beginning of the 20th century (Grant 2004). While separation often occurs through the market mechanism, uses were largely segregated by regulations, particularly traditional zoning ordinances, designed to minimize negative externalities among incompatible land uses (Fischel 1987, Kim 2011). Planners used spatial buffers between incompatible uses to enhance efficiency or safety. However, this separation of uses created a variety of unanticipated effects (Grant 2002).

In 1961, Jane Jacobs wrote a famous book, entitled The Death and Life of Great American Cities, in which she argued many ideal community plans fail because they do not address how cities actually work. Jacobs (1961) contended many of the interactions and synergies within cities produced environments conducive to the creation of a great city. She attributed many of these interactions and synergies to the mix of uses and the diversity of urban character. Mixed-use developments have since become more infused in the planning profession. Modern planning theory also has begun to unearth the comparative advantages of mixed uses over traditional separation practices in organizing the built environment.

In recent years, planners, cities, developers, and residents alike increasingly have embraced the idea of mixed-use, although separated urban activities still are the norm in most American cities. In particular, when describing the mix of uses, the terms live, work, and play often have served as a tagline to attract attention (Cohen 2009). The Columbus Chamber (Columbus Region 2012), Denver Regional Council of Governments (Denver Regional COG 2011), and a design firm in Boston (Hacin+Associations 2010) all recently have used the terms Live, Work, and Play (LWP) to present their visions for creating more vibrant places by reforming the traditional

approaches to organizing built environments. It appears the LWP terms may represent a new wave of planning that addresses many chronic urban problems, such as spatial mismatches (Kain 1968, 1992, Ihlanfeldt 1994), jobs-housing imbalances (Cervero 1989, Levine 1998), and the associated long distance commuting, and eventually may create a more complete realization of urban development.

Research Objectives & Approaches.

The fundamental objective of this study is to understand the Live-Work-Play idea that recently has gained growing popularity in the field of planning. More specifically, the present study explores the theoretical foundations of the LWP concept through a review of the relevant literature and examines various implications of the LWP mixes in urban areas through an empirical analysis. By doing this, the study intends to provide useful information about the LWP idea and meaningful lessons for city planners who seek to improve the spatial arrangement and function of their cities. Furthermore, the study attempts to provide an intriguing perspective, through the lens of the LWP concept, on the relationship between built environments and a broad range of urban activities.

As for empirical analysis, this study sets three functional objectives in order to better analyze and understand the implications of the LWP mixes. These objectives are: (1) to identify key areas that utilize the LWP concept in a region, (2) to explore these areas and determine their characteristics that pertain to the LWP concept, and (3) to examine if the characteristics of the mixed areas support or contradict the theoretical benefits of the LWP mixes. In order to accomplish these objectives, the study set forth a research question to guide the analysis of the LWP districts. The question reads as follows:

Do substantial differences actually exist between segregated and mixed districts? And if so, how do these differences support or contradict the theoretical benefits ascribed to areas that provide places to live, work, and play?

In this study, the guiding research question was answered mainly by an empirical examination of the Boston metropolitan area that consisted of two levels of analysis:

- Regional analysis, designed to identify the relationships between LWP mixes and a variety of urban indicators through a set of correlation analyses.
- District-level analysis, designed to validate the findings of the regional analysis through a close investigation of selected key districts in the study area.

The study accomplished these analyses with the extensive use of secondary data, collected from decennial censuses of population and housing and the Census Transportation Planning Packages.

Report Organization.

The remainder of this report is structured as follows. The second chapter (The Live Work Play District: A Literature Review) reviews previous literature related or ancillary to the subject of the Live-Work-Play concept. In the literature review, the report examines the history of the LWP concept, its theoretical benefits, and the praxis of the LWP idea. The analysis section details the methods utilized to analyze the data. More specifically, it provides an in-depth explanation of the methods used to delineate the study area and the districts, to create the data sets, and to analyze the data. The analysis chapter also presents the final results from the regional and district analyses. The concluding section discusses and recommends how the findings and results can be applied to cities and urban planning.

CHAPTER 2 | THE LIVE WORK PLAY DISTRICT: A LITERATURE REVIEW

Is the segregation or the mix of Live-Work-Play critical? Do planners need to promote more mixed development? Why? What benefits can be accrued from the LWP mixes? In order to provide background information, the study conducted a literature review using the lens of the LWP concept. The literature review first discusses the theoretical basis and the history of the concept. The second section reviews the potential benefits of providing places to live, work, and play in close proximity. The third section discusses the praxis of mixed-use development as it relates to the LWP concept.

Theoretical Foundations.

Recently, the use of Live-Work-Play as a tagline to attract residents has gained popularity throughout America (Cohen 2009). Planners, cities, developers, and residents alike have embraced this recent fascination with the concept. The tagline describes developments that provide places to live, work, and play all together. However, at its core, LWP is about providing basic human necessities. Many scholars throughout history have tried to define what humans need. In 1954, American psychologist Abraham Maslow formed one of the most famous theories. In his book Motivation and Personality, Maslow (1954) argued every human has five basic needs, and contended these needs have a hierarchical order. In order of the most fundamental to the highest, the five basic needs are as follows:

- Physiological – Everyone has certain needs necessary to survival.
- Safety – Everyone needs to feel physically, financially, and emotionally secure.
- Love/Belonging – Everyone needs to feel accepted.
- Esteem – Everyone needs to have self-respect or self-value.

- Self-Actualization – Everyone needs to become what he or she is capable of becoming by realizing and meeting his or her full potential.

The LWP concept can well represent Maslow's hierarchy of needs. Live corresponds with physiological and safety needs. Shelter is one of the basic physiological human needs. Furthermore, it is a safe space that provides a feeling of security. A place to live can satisfy both physiological and safety needs for basic human lives. Second, the place to work can connect to esteem and self-actualization. People need to have self-worth or self-value, which many find through their professional work and contribution to the society. In addition, people may actualize their potential through their career. Moreover, the earnings obtained by work meet many physiological needs and provide financially safety. Finally, the place to play can connect to the need for love or belonging. Recreational places can help people find social acceptance and connections with others. The need for places to live, work, and play are fundamental for every human being.

In fact, numerous scholars in several fields of study have theorized the LWP concept in a variety of forms. In 1855, Le Play categorized life into three sectors, which were "Lieu, Travail, et Famille," – Place, Work, and Family. Le Play studied families and their lifestyles and budgets. He theorized families depend on work for subsistence, but the nature of their surroundings largely influences the character of work they undertake (Holt-Jensen 1999). In 1879, Geddes applied Le Play's theory to the study of cities and regions and entitled this form of city research a regional survey. To encourage the application of this framework to regional planning, Geddes did change the third aspect in Le Play's theory from Family to Folk (Holt-Jensen 1999). In 1914, Cabot developed a model outlining the reasons why men desire to live. Cabot argued men lived in order to work, play, love, and worship. Cabot provided a psychological perspective to the basic concept of Live-Work-Play. According to Mumford (2000), in 1933 at the fourth meeting for the Congrès

Internationaux d'Architecture Moderne (CIAM), Le Corbusier emphasized the four essential roles of a functional city. He stated a city is functional if it provides dwelling, work, recreation, and circulation to its people. Le Corbusier was an architect and an urbanist who provided yet another variation on the basic concept of LWP (Mumford 2000).

More recently, in 1989, Oldenburg created a theory resembling the basic LWP concept. Oldenburg researched the concept of third places in his book The Great Good Place. In this book, Oldenburg (1989) defined a third place as an informal public gathering place that is neither home nor work. He argued life needs three components in order to be "relaxing and fulfilling." He contended life must be domestic, productive, and sociable. In other words, in order to live a full life, there must be a home life, a fulfilling occupation, and interaction within a community. He contended that third places – spaces that encourage social interaction – have fallen as the automobile suburb has risen. Oldenburg advocated for the third places, as he believed they are necessary to living a relaxing and fulfilling life (Oldenburg 1989). Oldenburg's theory is based on three aspects of life that are very comparable to the LWP concept. Current fascination with the concept also is attributable to Florida (2011) and his website, which is subtitled "the source on how we live, work, and play." Florida has credited the origin of the phrase Live-Work-Play to a graduate student he taught at Carnegie Mellon University. The student used the phrase when they were debating on how to retain young adults after graduation (Cohen 2009).

Benefits of Live-Work-Play Mix.

The provision of places to live, work, and play is critical, as it determines the organization of the basic human needs across space. As mentioned earlier, in many cities the three types of spaces tend to be separated. Although the separation is necessary to some extent to avoid conflicts among incompatible land uses, it also is attributable to obsolete approaches to land use

management and/or the lack of appreciation of the potential benefits from mixed development. There may be valid reasons to proactively provide places to live, work, and play rather than to follow the status quo of separation. The following sections discuss these potential benefits.

From Live Perspective.

Nelson (2011) suggested a growing number of people want to live in close proximity to work and play opportunities. He observed decreasing trends in the percentage of households more likely to own detached homes, which are households with children. He also found increasing trends in the number of people desiring walkable, accessible, diverse, and dense neighborhoods. Denser neighborhoods are less likely to have detached homes than traditional suburban development. Through empirical analysis, he projected a deficit of walkable, accessible, diverse, and dense neighborhoods in the future. Furthermore, Davis and Diegel (2011) determined the percentage of workers commuting less than fifteen minutes nearly doubled from 15.9 percent in 1990 to 28.6 percent in 2009. This translates into an increase in the number of people who chose to live in close proximity to where they work. In other words, they either desire to live in a place where they also can work or to work in a place they also can live. One can assume that unless current trends change, America will have a shortage of places with great LWP mixes. These studies indicate people may be realizing the benefits of living and working in close proximity.

In addition, LWP districts can provide substantial benefits to residents. In 1961, Jane Jacobs wrote a book entitled The Death and Life of Great American Cities. In her book, she argued a mixture of uses provides safety, one of Maslow's (1954) hierarchical needs. She stated the mixture of uses creates an environment that encourages people to use the city at varying times. She posited when people occupy the street at different times they provide constant surveillance, which is a crime deterrent. Additionally, Jacobs argued stable neighborhoods retain the charac-

ter of a neighborhood and are more resilient to physical change. She stated neighborhoods are more stable if they retain their residents. She acknowledged that occupation, income, family size, friends, and interests of each resident changes over time and if an area has one single use, as many suburbs do, people are more likely to frequently move, as they seek a neighborhood more suitable to their living styles at that particular moment. In contrast, providing a variety of opportunities may encourage neighborhood stability. In other words, diversity of uses and living arrangements is more suitable to a variety of lifestyles and therefore contributes to realizing more secure and stable communities.

From Work Perspective.

According to Marshall (1890), knowledge spillovers occur when firms (i.e. businesses) are in close proximity and within the same industry, or as he entitled it, an Industrial District. He assumed knowledge is industry-specific and has a limited geographic extent from where knowledge spillovers can be drawn. Moreover, he argued knowledge spillovers create innovations within an industry, typically through the sharing of tacit knowledge, or undocumented knowledge. However, Marshall did not theorize that places of work must be agglomerated with places to live and play to achieve knowledge spillovers. Conversely, Feldman and Audretsch (1996) theorized tacit knowledge is most easily shared through social interactions, which are subject to geographical constraints. In other words, social interaction may occur at a higher level when people live and play as well as work in close proximity to one another. Increased social interaction can lead to higher rates of innovation, which in turn improves the performance of the economy.

The study of the Italian Industrial District also advanced understanding of the impacts of proximity and social interaction on innovation. Italian scholars (Beccatini 1979, Beccatini and Pyke 1992) studied the impacts of social interaction on economies composed of small-scale firms in

upper Italy and discovered these Italian Industrial Districts comprised of small firms with a complex relationship between the firms and the local community showed higher performance (Tappi 2005). According to Beccatini and Pyke (1992), businesses within Italian Industrial Districts have an incentive to belong to their districts because the surrounding population treats each business as if they were responsible for it or as if it belonged to them. This increase in social interaction between businesses and the surrounding population could translate into competitive advantages, which are essential for long-term vitality of the economy (Bellandi 2002).

The benefits discovered in the Italian Industrial District suggest LWP districts may produce economic benefits. First, if people have all their needs to live, work, and play met in one district, they most likely will feel more responsible for the district as if it belonged to them. Secondly, complex and friendlier relationships may arise between businesses and the surrounding community because of the sense of belonging and responsibility to the district. These relationships increase social interaction and capital, allowing the economy to thrive. Finally, as argued by Marshall (1890) and later by Feldman and Audretsch (1996), this increase in social interaction and capital may result in higher rates of innovation and subsequently increased economic growth.

The LWP mixes also can promote consumers' local investment and expenditures, and thus induce multiplier effects. When a consumer buys goods from a producer, the producer is provided an income. The producer subsequently will spend that income to purchase goods from a different producer. Producers become consumers and create a multiplying effect that ripples throughout the economy (Quesnay and Mirabeau 1766, Keynes 1936, Leontief 1966). If a greater portion of the profit is spent locally, the multiplier effect becomes more intense for that location. This can induce an increase in money spent within a place, which consequently will strengthen the local

or regional economy. If all consumer needs are met locally, the multiplier effect likely will increase since residents must spend less money on goods produced outside the region.

From Play Perspective.

In 1989, Ray Oldenburg argued that third places, or places to play, are a necessary component of a full life. Similar to the LWP concept, Oldenburg contended that in order to live a full life, there must be a home life, a fulfilling occupation, and interaction within a community. Although third places are crucial to the social interaction within a community, the number of third places has fallen as the automobile-oriented suburb has risen. Oldenburg (1989) found this has led to the decline of community bonds.

Robert Putnam (2000) also studied the decline of social interaction in America in his book Bowling Alone. In his book, Putnam examined a multitude of variables, ranging from voter turnout to family mealtime to volunteerism, concerning the social capital of America and discovered a surprising decline in social interaction, symbolized by the decreased formation of bowling leagues despite the increase in the number of people bowling. According to Putnam (2000), many Americans are exchanging strong social ties for weaker ones, and this shift away from social constructs could have negative impacts on the social capital of America. He theorized the provision of physical environments where people can interact more efficiently, like LWP districts, could mend lost social ties. Leyden (2003) surveyed six neighborhoods in Ireland, whose form ranged from mixed-use to suburban in nature and found that walkability and mixed-use neighborhoods encourage the development of social capital. The results revealed people in walkable neighborhoods were more likely to feel connected to the community and trust the people in their neighborhoods.

In other words, the provision of a place to play combined with the places to live and work is critical. As suggested by Oldenburg (1989) and Leyden (2003), providing third places mixed

with other uses can improve social interaction and increase the social capital of America. This enhanced social interaction and capital may lead to the viability of cities and economic performance (Jacobs 1961, Feldman and Audretsch 1996). The provision of mixed LWP districts also is essential for offering a broad range of neighborhoods environments (as opposed to typical single-use suburbs) that society increasingly desires (Nelson 2011) and needs (Oldenburg 1989).

Live Work Play in Practice.

According to Grant (2004), mixed-use development has existed throughout history, but more intense segregation of uses began in North America at the turn of the 20th century with the advent of the streetcar, and later and more notably the automobile. As planners and the general public recognized both the problems of the segregation and the potential benefits of integration, mixed-use development implementation has been increasing in the field. However, practitioners sometimes focus on Live and Work (i.e. two zoning terms: residential and commercial-industrial) rather than taking a more holistic approach – namely Live-Work-Play. In practice, adoption of the mixed development strategies serves multiple objectives. As described in the following subsections, through the implementation, planners expect 1) to achieve smart growth, 2) to address contemporary auto-based long distance transportation problems, and 3) to promote economic development.

Mixed-Use and Smart Growth.

Contemporary planning appears to use mixed-use development as an approach that mitigates the negative consequences of sprawl to achieve smarter growth. As discussed by Ewing (1997) and many others, sprawl or the separation of land uses, causes a long list of urban problems, such as increases in vehicle miles traveled, energy consumption, and pollution; loss of resource lands; inefficient provision of infrastructure and public service costs; central city decline;

and many other psychic and social costs. Ewing (1997) proffered two cures for sprawl. First, he argued for utilizing congestion charges and emissions fees to offset the air pollution and traffic congestion caused by suburban travel, in effect making the suburban traveler pay for the external costs they generated. Second, he promoted active planning, as opposed to reactive planning. He contended city planners should be more aggressive in planning for an efficient use of land rather than waiting for property owners to request a rezoning of their land that may have a negative impact on the region as a whole. Ewing implored cities to encourage good development and to reduce bad development. Due to his extensive list on the negative consequences of the separation of land uses, he implied mixed-use development was a good development pattern.

Planning administrations have attempted to combat sprawl with various programs, including mixed development projects, as governments have acknowledged the benefits of mixed-uses and the costs of segregated land uses. According to Grant (2004), mixed-use development is at the core of many smart growth initiatives that attempt to reform the overall arrangement of built environments, including housing and transportation. Grant (2004) further posited mixed development may occur in three different methods: increasing the intensity of a land use, increasing the diversity of land uses, or incorporating segregated uses. Grant argued any of these forms of mixing is a smarter urban strategy than the segregation of land uses. For instance, Grant (2002) detailed the increasing use of mixed-use developments in Canada. She found many planners were concerned about the environmental impacts of the traditional suburban development. By the 1990s, planners across Canada altered their city's plans and regulations in order to discourage the segregation of uses. Many Canadian cities promoted mixed-use development because of its economic, social, and environmental benefits. Toronto and Vancouver used mixed-use development in abandoned urban areas as a strategy to accommodate growth within the city instead

of expanding the urban boundary with suburban development (Grant 2002). Ewing (1997) most likely would classify this mixed-use strategy as good development, or a smarter approach to accommodate growth.

Mixed-Use and Transportation.

Transportation problems are another target of mixed-use development, as they are associated with the separation of land uses. Earlier studies theoretically examined the relationship between land-use mix and transportation. For instance, in 1982, Fujita and Ogawa constructed an economic theory of land consumption based on a linear model of a city, previously used by Stull (1974), and found land uses became less segregated (or more mixed) as commuting costs increased. Reiterated, it is more economically efficient for uses to become progressively more mixed as transportation costs increase.

Since the 1990s, the number of empirical studies focusing on the relationship between urban diversity and transportation has increased, and often suggest mixed development can reduce automobile-based travels, although exceptions do exist. Producing several of these studies, Robert Cervero is one of the leading experts on the nexus between mixed-use and transportation. In 1996, he studied what impact proximity of housing to retail services has on travel patterns. After controlling for residential density and vehicle ownership levels, Cervero (1996) found living within 300 feet of a grocery store or other retail services encouraged non-auto transportation. Furthermore, he discovered living beyond 300 feet but within 1 mile of retail services actually was associated with more automobile-based commuting. According to Cervero, this might occur because trips to commercial stores efficiently could link with the commute to work. From his research, he argued public policies aiming to reduce traffic should encourage more mixed-use development at higher densities. In the following year, Cervero and Kockelman (1997) furthered previous re-

search by studying the relationship between transportation and the three Ds – density, diversity, and design. They examined how the density of population and employment, the diversity of land uses, and the character of design (such as pedestrian or auto-oriented) impacted trip rates and mode choices. They found density, land-use diversity, and pedestrian-oriented design reduced trip rates and increased non-automobile transportation. Several years later, Cervero and Duncan (2006) questioned which type of development reduced travel demand more: jobs-housing balance or retail-housing mix. Using data from the Bay Area Transportation Authority, the authors analyzed the round-trip vehicle miles traveled and vehicle hours traveled for commute-to-work and shopping-services trips. They also used data on the total jobs in the area and the total retail jobs in the area. After controlling for many other factors, they showed the jobs-housing balance reduced travel more than retail-housing mix by a significant margin. Nonetheless, they found both jobs-housing balance and retail-housing mix reduced travel.

McCormack, Rutherford, and Wilkinson (2001) examined the travel patterns of neighborhoods in Seattle, Washington. They collected travel data from respondents in three different neighborhoods. From these data, they had two interesting findings. First, they determined residents from mixed-use neighborhoods traveled 28 percent fewer miles than residents from adjacent areas. Even more, mixed-use neighborhood residents travelled up to 120 percent fewer miles than residents in suburban areas. Even after controlling for socioeconomic variation, these differences were still substantial. Second, they discovered that, regardless of location or socioeconomic status, people traveled approximately 90 minutes per day. From this finding, they concluded people have a budget for the amount of time spent traveling. In sum, the authors discovered the type of development can reduce daily travel distance, but daily travel time may remain constant.

The Institute of Transportation Engineers (ITE) produced the Trip Generation Handbook in 2004. This handbook provided a method to calculate the number of trips generated by different types of development. However, Feldman, Ewing, and Walters (2010) argued the methods used by the ITE underestimated the number of trips captured within a development, or the internal capture rate, for mixed-use development. Therefore, Feldman, Ewing, and Walters (2010) studied 239 mixed-use developments across the United States and showed the traffic impact of mixed-use developments was substantially less than single-use development. Based on this finding, they argued the diversity of uses allowed for linking of destinations within the development, creating a higher internal capture rate. They also produced an alternative method to the ITE's method for calculating the internal capture rate of mixed-use development. Bochner and Sperry (2010) completed a similar study and calculated the internal capture rate for the morning peak-period ranged from 11-15 percent. The internal capture rate for the afternoon peak-period ranged from 33-37 percent. These studies suggested the transportation benefits of mixed-use developments are more substantial than projected by the ITE.

Mixed-Use and Economic Development.

Employment of the idea of mixed development also has increased in the practices of local and regional economic development. Among other changes, recent shifts from traditional to the new Industrial District theory (recognition of the importance of diversity, flexibility, and micro-scale interactions) seem to embrace mixed-use development. The evolution of the theories also has modified local and regional economic development practices. Peddle (1993) found recent plans have incorporated more mixed-uses and less land-intensive developments while traditional Industrial District development projects typically agglomerated firms from a single industry, particularly manufacturing. He also affirmed the term industrial park is perceived as antiquated and

other terms have replaced it in order to encapsulate its application to industries outside manufacturing. The Urban Land Institute changed the title of its Industrial Development Handbook to Business and Industrial Park Development Handbook. Not only has the name changed, but the structure and character of planned commercial-industrial districts also has evolved with inclusion of the places of Live and Play as well as diverse research and production activities.

For example, Boston currently is planning the implementation of the Innovation District, ”a neighborhood where interaction, community, collaboration, and diversity work hand-in-hand to foster a place where innovation can grow” (Hacin+Associations, 2010). The Innovation District promotes diversity, which implies the economy will not be dominated by a couple mass-production firms, but by a variety of smaller scale firms alongside places to live and play. Furthermore, the plan implies the mix of uses will create a more flexible economic environment ready to adapt to market changes because of an enhanced collaboration with the neighborhood. The diverse and innovative nature of current development initiatives illustrates that practical knowledge about the benefits of mixing land uses has increased and today’s economic development practices increasingly have incorporated land use reforms. This shift has occurred over the last few decades and likely will continue in the future as new knowledge and experiences transpire.

Summary.

The LWP concept has occurred in many different forms throughout history. At its core, the concept is about satisfying basic human needs and organizing various human activities in a systematic manner. Districts that provide places to live, work, and play may produce substantial socio-economic benefits and address some contemporary urban problems, such as segregation and auto-based long distance travels. A theoretical understanding of these benefits has existed for quite some time. However, the leap from theory to praxis has been relatively slower. Empirical

studies, testing the benefits in reality, can help planners and the public better understand the desirability of the mixed development. This, in turn, can lead to a more appropriate implementation of the Live-Work-Play concept in the field.

CHAPTER 3 | ANALYSIS OF THE LIVE-WORK-PLAY DISTRICT

As synthesized in the previous section, the literature suggests combining places to live, work, and play may attain many theoretical benefits. For instance, spatial proximity can facilitate social interaction, increase the efficiency in movements, and address a long list of urban problems associated with the separation of Live, Work, and Play. Furthermore, increased social interaction due to spatial proximity may accelerate the innovation process and improve the economy (Becattini 1979, Feldman and Audretsch 1996).

However, does mixed development actually create the benefits in reality, as expected? Do substantial differences really exist between segregated and mixed districts? And if so, how do these differences support or contradict the theoretical benefits ascribed to areas that provide places to live, work, and play? This study conducted an empirical analysis to assess the real implications of the integration of Live, Work, and Play by analyzing the Boston metropolitan area as a case study.

Prior to conducting any analysis, the study area (Boston metropolitan area) needed delineation and the Live-Work-Play concepts needed operationalized. Furthermore, the study needed to collect and integrate vital data sets. Finally, after these preliminary steps, the in-depth analysis began with an appropriate methodology. This section describes the preliminary steps and the subsequent analysis and results utilized to better understand the LWP concept.

Study Area.

The Boston metropolitan area, located in Massachusetts in the northeastern United States, served as a case study for empirical analysis. Two significant factors played into the selection of Boston. First, the Innovation District, a current project, has risen in popularity by promot-

ing new and innovative designs that utilize the Live-Work-Play concept. The people of Boston showed their support by the subsequent surge of mass transit ridership in the area (Grillo 2011). It appears as though Boston has a latent desire for the Live-Work-Play concept; therefore, Boston provided a good area to focus the research of this concept. Second, Boston has a more diverse set of transportation options that could provide a more robust study. Moreover, due to its range of suburban and urban environments, Boston has different levels of dependency on the automobile, mixed-use development, and density. A wide range of environments provides a more vibrant and dynamic study, which makes conclusions easier to extract.

Note the geographic boundary of the study area in this empirical analysis is not identical to the most recent 10-county Boston Metropolitan Statistical Area definition. Instead, it follows more closely with the 1990 Block Group Region for Boston as delineated by RITA (Figure 3.1). The chosen study area was the only area with both 1990 and 2000 commuting data available at a sub-county level. Furthermore, the study excluded sections on the edge of the 1990 Block Group Region if a 2000 census tract boundary overlapped both areas with and without 1990 data.

The study area encompasses 6564.82 square kilometers between the Atlantic Ocean (east) to slightly past Interstate 495 (west) to the New Hampshire state border (north) and extends slightly past Plymouth Bay (south). According to the 2000 Census, over 4 million people lived within the study area. Of that population, 589,141 people resided within Boston city proper. Furthermore, roughly 2.27 million people were employed within the area in 2000, with 308,395 employed within Boston city proper. Between 1990 and 2000, the study area experienced a 5.8 percent growth in population, and 4.7 percent growth in employment. Demographically, approximately 82.4 percent of the population was white in race. In 2000, roughly 8.4 percent of the total population lived in poverty, 9.2 percent of all residents in Boston were between the ages 18 and

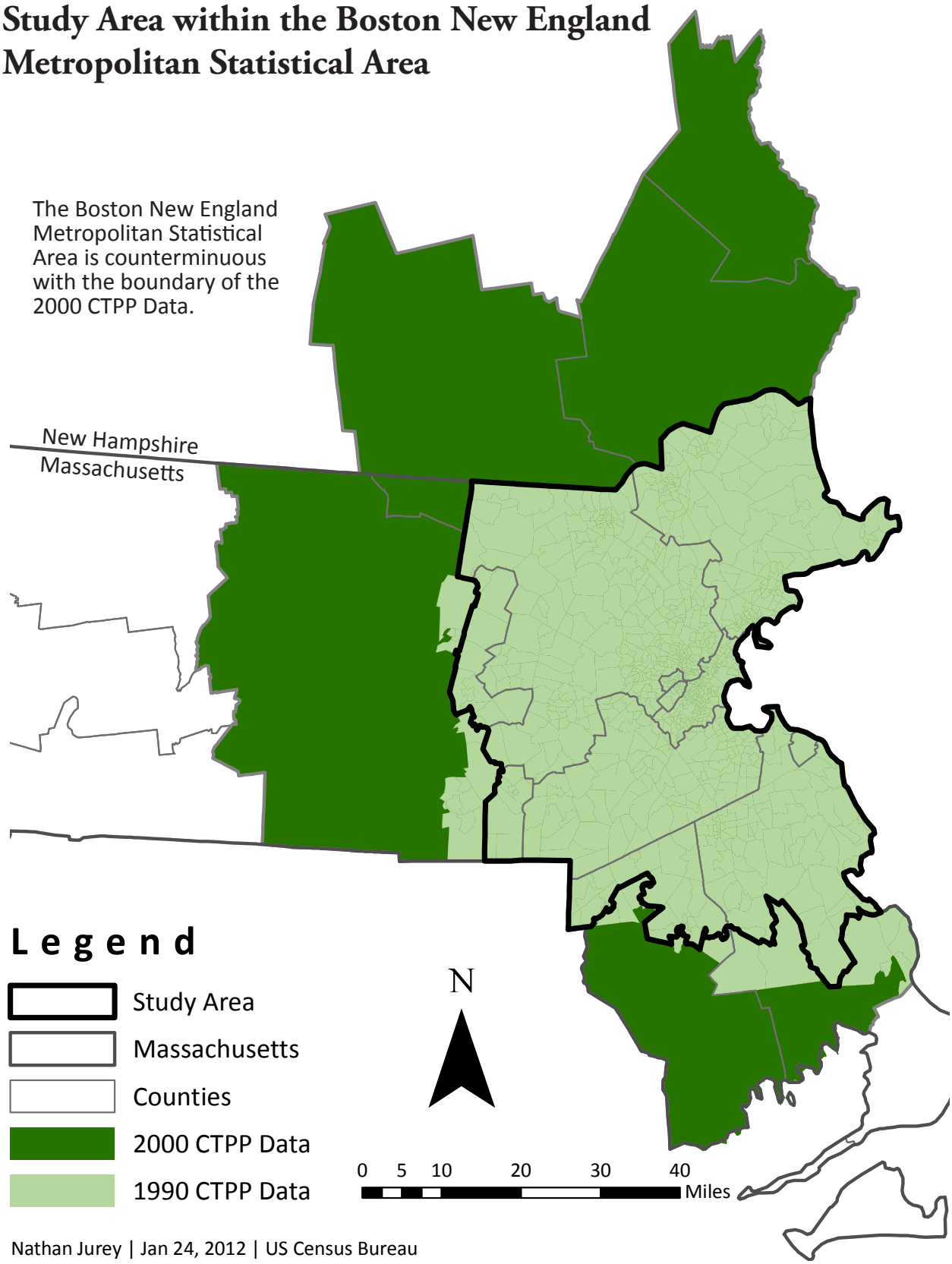

Figure 3.1 | Study Area within the Boston Metropolitan Statistical Area

24, and 44.3 percent of the population above 25 had at least a college degree. As for the built environment in 2000, the Boston study area had a population density of 634 people per square kilometer and an employment density of 346 employees per square kilometer. In terms of transportation, the average commuting time for the study area was 27.5 minutes and 78.9 percent of all commuters traveled by automobile. Furthermore, approximately 14.1 percent of the employed population commuted 10 minutes or less to work.

Variables.

The concepts of Live, Work, and Play and their mixes needed operationalized to conduct an empirical analysis. This study first defined the three key concepts in real terms, as follows:

- Live is the total number of housing units within a geographical unit.
- Work is the total number of employees working within a geographical unit.
- Play is the total number of employees working in the retail trade and the arts, entertainment, and recreation industries within a geographical unit.

From these variables, three ratio variables represented the mixture of Live, Work, and Play – (1) Work/Live, (2) Play/Live, and (3) Play/Work. These three ratio variables indicate the value of the three possible pairs (i.e. mixes) of Live, Work, and Play within a geographical unit. Using the three ratio variables also examines various mix strategies (Live-Work, Live-Play, and Work-Play combinations) and aids understanding of which mix is most critical in praxis.

Although the three ratio variables are useful in measuring the Live-Work-Play mixes, they have some limitations. First, the variables cannot take into account the mixes realized over the boundaries of geographical units (e.g. census tract), as they are computed based upon the Live, Work, and Play values in each zone. For instance, a place to live may be spatially close to a place to

work, but this proximity is not valued if the two places are located in different but adjacent census tracts. Second, the ratio variables only provide data on the spatial proximity of Live-Work-Play rather than considering the utilization of the proximity. Admittedly, spatial proximity does not necessarily translate into more localized human movement and/or enhanced social interaction. For instance, people who live in a district inundated with places to work and play do not necessarily work and play in that same area. For many of the theoretical benefits, it not only matters the extent that a district integrates places to live, work, and play, but also the extent that the people in the district utilize these places. As people increase their utilization of places to live, work, and play in close proximity, some of the theoretical benefits of LWP districts may increase. For these reasons, this analysis employs an additional variable that represents the Level of Utilization (LOU). Hence, the new LOU variable is defined as the percentage of workers in each geographical unit who commute less than 10 minutes to work. These four variables, the three ratio variables and the LOU, are classified as the LWP variables.

In order to examine a broad range of the real implications of the LWP concept (represented by the LWP variables) in the Boston region, the study selected a group of key indicators, as summarized in Table 3.1. Data availability limited the selection of these indicators. Although this list is not exhaustive, the dependent variables cover a variety of urban characteristics such as growth, inequality, education, built environment, and transportation. The study considered some additional variables such as neighborhood design, type of street network, square footage of retail, and access to amenities, but could not include them in this analysis due to a lack of available data.

Table 3.1 | Definition of Variables

CONCEPT VARIABLES	
Live	1990 Total Housing Units
Work	1990 Total Employment
Play	1990 Total Employment in the Retail Trade and Arts, Enter., & Rec. Industries
LWP VARIABLES	
Work-Live	1990 Total Employment / Total Housing Units
Play-Live	1990 Total Retail & Arts, Enter., Rec. Employment / Total Housing Units
Play-Work	1990 Total Retail & Arts, Enter., Rec. Employment / Total Employment
Level of Utilization	1990 Number of Workers with <10-Minute Commute / Total Employment
DEPENDENT VARIABLES	
Growth	
Population Growth	(2000 Total Population – 1990 Total Population) / 1990 Total Population
Economic Growth	(2000 Total Employment – 1990 Total Employment) / 1990 Total Employment
Inequality	
Race *	Non-White Population / Total Population
Change in Race**	2000 Race - 1990 Race
Poverty *	Population Under Poverty Line / Total Population
Change in Poverty**	2000 Poverty - 1990 Poverty
Housing Value	Average Value of Housing (dollars)
Change in Housing Value	(2000 Housing Value - 1990 Housing Value) / 1990 Housing Value
Education	
Educational Level *	1990 Population with Collegiate Degree / Total Population Over 25 Years Old
Change in Educational Level**	2000 Educational Level - 1990 Educational Level
College-Age Population*	1990 Population between Ages 18-24 / Total Population
Change in College-Age Population**	2000 College-Age Population - 1990 College-Age Population
Built Environment	
Population Density	Total Population / Land Area (square kilometers)
Change in Population Density	(2000 Pop. Density - 1990 Pop. Density) / 1990 Pop. Density
Employment Density	Total Employment / Land Area (square kilometers)
Change in Employment Density	(2000 Emp. Density - 1990 Emp. Density) / 1990 Emp. Density
Transportation	
Automobile Commuting*	Number of Residents Commuting by Automobile / Total Employment
Change in Automobile Commuting**	2000 Automobile Commuting - 1990 Automobile Commuting
Walkability*	Number of Commuters Walking or Biking to Work / Total Employment
Change in Walkability**	2000 Walkability - 1990 Walkability
Commute Time	Average Commute Time of Journey to Work for All Workers
Change in Commute Time	(2000 Commute Time - 1990 Commute Time) / 1990 Commute Time

* Dummy Variable between 0 and 1.
**Difference between 1990 Dummy Variable value from 2000 Dummy Variable values.

Data.

This study extensively utilized secondary data. Among many sources of secondary information, the study used a few US Census products to conduct an empirical analysis at a disaggregated geographical scale (i.e. sub-county level). The use of multiple data sources, particularly the use of both 1990 and 2000 information, created data compatibility issues. Therefore, this study involved not only (1) data collection but also (2) data integration that addresses the compatibility issues. The following sections describe these two steps.

Data Collection.

The majority of the secondary data analyzed in the present empirical analysis came from three Census products: (1) the Census Transportation Planning Package (CTPP) provided by the Research and Innovative Technology Administration (RITA), (2) decennial Census (Census 1990 and 2000), and (3) Census geographic boundary and TIGER files for 1990 and 2000. A more detailed description of the data sources is provided in the Appendix. The CTPP provided demographic and socioeconomic information concerning employment and transportation. For the Boston area, the smallest geographical summary level for which the CTPP provided data was the block group level in 1990 and the census tract level in 2000. This data availability dictated which summary level the study collected from the decennial Census, which was more readily available at multiple scales. From the decennial Census data sets (Census 1990 and 2000), the study compiled demographic, socio-economic, and housing information. Given the limited availability of CTPP data at certain geographic scales, the study collected 1990 and 2000 Census information at block group level and census tract level, respectively. Note the study also collected the relevant Census Boundary and TIGER Files, in addition to the above two sources. Utilizing the geographic boundary files spatially represented the data and overcame the data compatibility issues, as discussed in the following section.

Data Integration.

In order to conduct the analysis, the study needed to make the data sets comparable and integrated. However, several obstacles hindered the integration of the data. First, some variables simply were not comparable between the censuses of 1990 and 2000. The proxy for play, for instance, is not comparable between 1990 and 2000 because of the change in the industrial classification system. The 1990 data used the Standard Industrial Code (SIC), whereas the 2000 data is based upon the North American Industrial Classification System (NAICS). Racial composition information also was not comparable between years because of the modifications in the methods the Census determined race. The 1990 Census only allowed the selection of one race per person, whereas the 2000 Census allowed the selection of one or more races. In other words, someone who was White and Pacific Islander may have selected White as their race in 1990, but might be classified into the two or more races category in 2000. Furthermore, housing values are not directly comparable between years because the values given were not adjusted for inflation that occurred between 1990 and 2000.

However, since the entire study area was subjected to the same circumstances, the study assumed every census tracts would be subjected equally. For example, if Boston had a 10 percent inflation rate between 1990 and 2000, the study assumed all housing values across the study area would be subjected to the same inflation rate, making the percent change between 1990 and 2000 housing values comparable. In essence, the study assumed any areas experiencing a change in housing values higher or lower than 10 percent to have other factors contributing to their change. The study applied similar assumptions to the changes in racial and industrial categorization. However, it needed a simple reclassification of the 1990 categories to make the assumption applicable in these cases. The non-white population for both 1990 and 2000 included all who

selected any single race other than white or any combination of races. The Play employment included industries with a two-digit SIC code between 52-59 and 78-79 for 1990 data and industries with a two-digit NAICS code between 44-45 and 71-72 for 2000 data.

A more challenging compatibility issue was the geographical discrepancy between 1990 and 2000 census data. The US Census Bureau changes geographic boundaries over time in order to adjust to the evolving population dynamics. As a result, 1990 block group boundaries do not coincide perfectly within the 2000 block group or tract boundaries. In order to complete the integration and deeper analysis of the data, the study needed to address this obstacle.

Use of four basic steps overcame the geographical discrepancy in the data sets. First, the study overlapped two boundary layers (1990 census block group and 2000 census tract boundary layers), and then disaggregated the newly created overlapping zones. Second, it created a link between 1990 and 2000 data sets in order to make the data sets combined. Third, it constructed a proportionality system to make the 1990 data sets comparable to 2000 data sets using the proportion between the area of the disaggregated zones and the original area in square meters. This system allowed the study to apportion data, such as population, to each disaggregated zone. For example, if 100 people lived in one square kilometer disaggregated into two sections – one of 0.1 square kilometers and the other with 0.9 square kilometers – the population would be apportioned as 10 people to the smaller area and 90 people to the larger one. Last, the study re-aggregated the disaggregated 1990 data values to coincide with the 2000 census tract boundaries. Geographic information systems (GIS) aided in completing these four steps.

Note two items regarding this process of the data integration. First, the process assumes the data has uniform density within each 1990 block group, even though this may not be the case

in reality. Second, this empirical analysis did not include the 2000 census tracts with no or only partial 1990 CTPP information. In other words, the study area excludes many census tracts on the geographic edge of the 1990 data because the 2000 census tract boundaries extended farther than the 1990 CTPP information provided. Figure 3.1 (previous) illustrates the excluded areas and the study area. In order to better explain the process, Table 3.2 provides a description of the four-step process.

Table 3.2 | Data Set Integration Process

1. Overlap two boundary files and disaggregate the overlapping zones
   a. Use Intersect function in GIS – Intersect 1990 block group and 2000 census tract boundary files so only one boundary file exists, composed of boundaries from both years
2. Create a link between 1990 and 2000 data sets
   a. Import database file created in Step 1 into Microsoft Access
   b. Connect 11-digit ID from 1990 with 11-digit ID from 2000 to create a 22-digit ID unique to each disaggregated zone
3. Create a proportionality system
   a. Use Calculate Area function in GIS for 1990 and 2000
   b. Construct proportion system using original and disaggregated areas
4. Adjust 1990 Block Group data to the 2000 Census Tract level
   a. Use link and proportionality system in Microsoft Access
   b. Aggregate to the 2000 census tract level

Methodology.

The study analyzed the integrated data set at two levels: regional and district. First, the study conducted regional analysis with all census tracts in the study area to explore systematic patterns that occurred throughout the entire study area. This consisted of determining the correlations between numerous combinations of variables (i.e. a LWP mix variable and one of the selected indicators), as presented in Table 3.3. The correlation analysis would indicate the direction of the relationship and the statistical significance for every pair of the variables.

Table 3.3 | Regional Analysis Analytical Framework

VARIABLES	COEFFICIENTS OF CORRELATION Work-Live	Play-Live	Play-Work	LOU
Growth				
Population Growth				
Economic Growth				
Inequality				
Race				
Change in Race				
Poverty				
Change in Poverty				
Housing Value				
Change in Housing Value				
Education				
Educational Level				
Change in Educational Level				
College-Age Population				
Change in College-Age Population				
Built Environment				
Population Density				
Change in Population Density				
Employment Density				
Change in Employment Density				
Transportation				
Automobile Commuting				
Change in Automobile Commuting				
Walkability				
Change in Walkability				
Commute Time				
Change in Commute Time				

Then, the study performed a district level analysis to confirm if the overall patterns identified from the regional analysis actually were valid. The study designed the district analysis to select some sample (mixed-use) districts and comparable districts (i.e. a control group), and to examine how the selected mixed-use districts differ from the comparable group and regional averages. The comparison allowed the study to draw conclusions with consideration of the key mixed-

use districts in the study area, as opposed to all census tracts. The district analysis complemented the regional analysis because it focused on selected districts, whereas the regional analysis result could be influenced significantly by a large number of residential census tracts.

For the district level analysis, the study selected two broad types of districts – one as a representative sample that exemplified the variable in question and the other as a control group from which the study could construct comparisons. When choosing the sample districts, the study delineated areas of a predetermined size as districts if they provided a representation of the variable in question. However, districts could not overlap so as to simplify data processing. Second, the study chose another group of districts in order to provide a control group to compare the first group of districts against. These districts served as a representation of other variables that may have an impact on the variable in question. In summary, the district selection process included two parts: the selection of districts exemplifying the variable in question and the selection of districts representing other significant variables.

More specifically, the study selected twelve districts for the analysis from the study area (Figure 3.2). The study created districts by selecting a central census tract and then selecting all census tracts within a 2,000-foot radius of that central tract, based on the definition of the 10-minute-walk pedestrian shed as defined by Calthorpe (1993). Districts were defined as the agglomerated form of all census tracts within a 2,000-foot radius of the central census tract. Furthermore, the study re-aggregated all census data for all census tracts in each district to the district level.

The twelve selected census tracts fall into three categories, although they originally came from the two-group (sample vs. comparable group) perspective. The first category (the sample

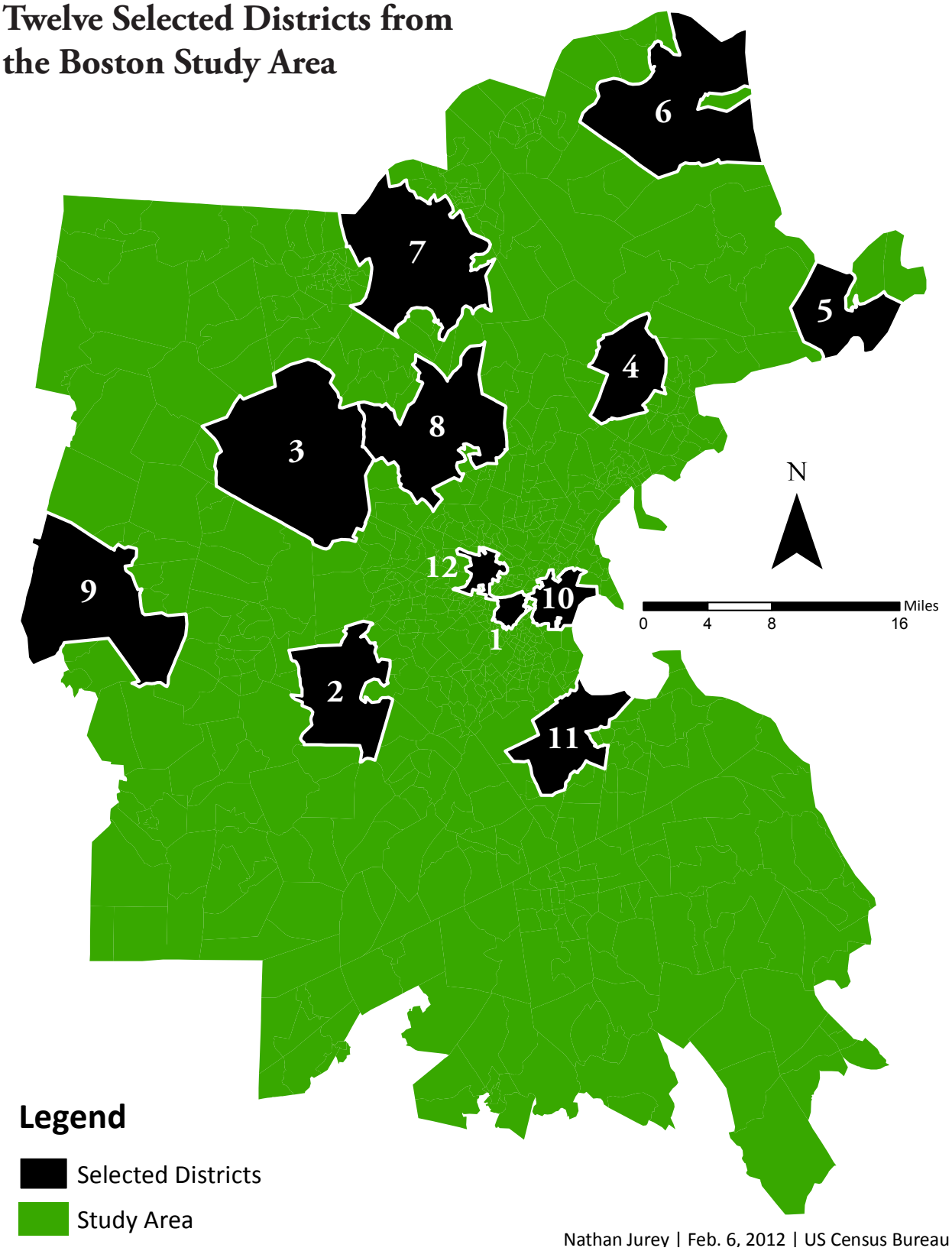

Figure 3.2 | Twelve Selected Districts from the Boston Study Area

group) includes six districts with a high level of utilization (High LOU). The remaining six districts provided a control group or comparables for the six High LOU Districts. The comparable group consisted of six High Employment Districts (the second category) and three Planned Districts (the third category). This adds up to more than twelve districts because one district was in all three groups and another was a High LOU District and a Planned District. Table 3.4 presents the categorization of the Districts.

Table 3.4 | District Categorization

Selected Districts	High LOU Districts	High Employment Districts	Planned Districts
District 1	X	X	X
District 2	X		
District 3	X		X
District 4	X		
District 5	X		
District 6	X		
District 7		X	
District 8		X	
District 9		X	
District 10		X	
District 11		X	
District 12			X

The study selected census tracts with a high LOU in order to provide a representative sample of areas that utilize the LWP concept in reality. If a higher percentage of people live and work in relatively close proximity, that area actually is utilizing a segment of the LWP concept (Live-Work). Therefore, the study selected the High LOU Districts as a representative sample of the LWP concept in actuality. In order for a census tract to qualify as a High LOU District, it had to meet two criteria. First, to reduce the residential areas from selection, the census tract had to have a work-live ratio greater than one. Second, the selected census tract needed to be an area with the local cluster of high LOU values identified through a spatial autocorrelation analysis. This ensured

the selected census tract was not an outlier and the entire district exemplified a high LOU. More than six census tracts met these criteria. However, most of the selectable census tracts were in close proximity. There were six regions in which a larger number of selectable census tracts were located in close proximity. To provide a deeper understanding of the process, Table 3.5 provides a linear explanation of the six steps.

Table 3.5 | High LOU District Selection Process

1. Determine level of utilization for 1990 and 2000
    a. Using Microsoft Access, derive data from Population Census for level of utilization for each census tract
2. Determine Census Tracts from which to select Study Area
    a. Determine Census Tracts with a jobs-housing balance of 1 or greater using Microsoft Access
    b. Create a list of census tracts from which to select
3. Determine areas with spatial autocorrelation
    a. Use Spatial Autocorrelation function in GIS
    b. Find areas that have a concentration of census tracts with high levels of utilization
    c. Using spatial autocorrelation data, create a list of census tracts from which to select
4. Determine geographic regions in which census tracts that meet step 2 and 3 are agglomerated
5. Select the Census Tracts
    a. Must meet criteria determined in Step 2
    b. Must meet criteria determined in Step 3
    c. Select six Census Tracts with highest levels of utilization determined in Step 1, one from each region
6. Create the Districts from the Census Tracts
    a. Use GIS to select all census tracts within a 2,000-foot radius of the six selected census tracts
    b. Export selected census tracts as a GIS shapefile

The study selected High Employment Districts because the comparison of High LOU Districts and High Employment Districts would allow it to draw stronger conclusions about the implications on key indicators. The study based the selection of the High Employment Districts on the number of employees within each geographic unit, selecting census tracts with over 10,000 workers employed in both 1990 and 2000. More than five census tracts fit this description. Like the High LOU Districts, many census tracts with high employment were in close proximity and

subsequently agglomerated into a single district, resulting in six High Employment Districts. However, one area with high employment overlapped a High LOU District. For simplicity, the study used the High LOU District boundary as the district boundary for that specific census tract.

The study selected Planned Districts based on the presence of a strategic development plan involving the LWP concept in some form. Exploratory analysis of the governments of Boston yielded four plans that exemplified some of the characteristics of Live-Work-Play districts mentioned in the literature review. These four plans were the following: Longwood Medical Area Plan, Route 128 Corridor Plan, Harvard Square Development Guidelines, and Kendall Square Master Plan. The Longwood Medical Area Plan and the Route 128 Corridor Plan were created for areas within a High LOU District or within a 2,000-foot radius, therefore utilizing the study's boundaries of the two High LOU Districts. The remaining two plans were written for places in close proximity with each other. Therefore, the study selected a census tract in between the two planned areas and whose 2,000-foot radius encompassed both areas. Figure 3.2 and Table 3.4 present the outcomes of the district selection process.

Analysis Outcomes.

As described in the previous section, the study conducted empirical analysis at two different levels: regional and district. This section presents the results from the analysis at each level.

Regional Analysis.

Regional analysis utilizes data for the entire set of census tracts and explores various implications of the LWP mix by measuring the correlations between LWP variables and the selected dependent variables that represent growth, inequality, education, built environment, and transportation. More specifically, to examine how the mixed uses can influence the dependent vari-

ables through time, the study related LWP variables in 1990 to the changes in the dependent variables between 1990 and 2000, as well as the original 1990 values.

Growth.

Overall, the Boston study area experienced a growth in population (5.9 percent) and employment (4.7 percent) between 1990 and 2000. This growth, however, was not spread evenly over the entire study area. The literature suggested growth may be correlated with the LWP variables; a higher degree of the LWP mixes may generate substantial, positive economic benefits.

According to regional analysis, however, the study found no significant correlations between population or employment growth rates and the four LWP variables (Table 3.6).

Table 3.6 | Regional Analysis: Growth

	COEFFICIENTS OF CORRELATION			
VARIABLES Growth	**Work-Live**	**Play-Live**	**Play-Work**	**LOU**
Population Growth	0.117	0.072	0.037	-0.072
Economic Growth	-0.065	-0.091	-0.015	-0.002

The most significant correlation (0.117) was between the tract-level population growth rate and the Work-Live ratio (Figure 3.3). This may indicate areas with high Work-Live ratios are more attractive to residents, thus more residents moved to those locations, contributing to a higher growth in population. In contrast, for employment growth, the correlations for all four LWP ratios were negative. However, the levels of correlations were very weak and therefore the results suggested the relationships between growth and the LWP variables are generally insignificant.

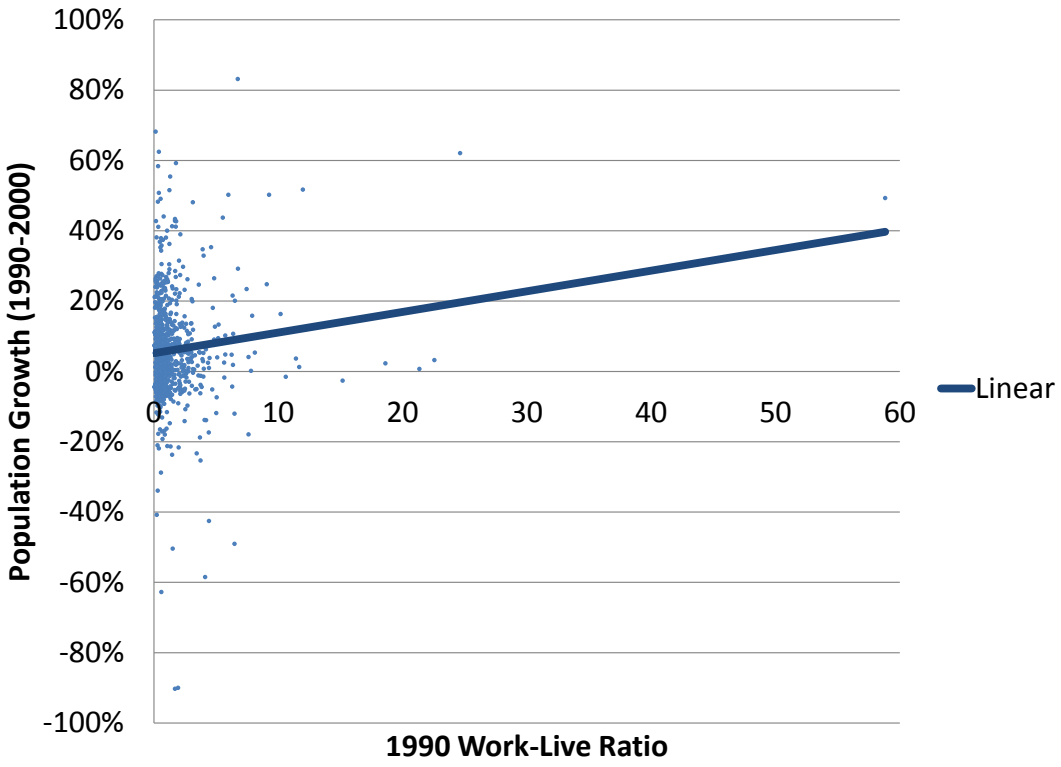

Figure 3.3 | Regional Analysis: Work-Live Ratio and Population Growth

Inequality.

Unlike the case of growth, regional analysis indicated inequalities are somehow associated with the LWP ratios in the Boston region (Table 3.7). In particular, 1990 Race is negatively correlated with the Play-Work ratio (-0.248) and the LOU (-0.290). In other words, the non-white population comprises a smaller percentage of the total population in areas with a high Play-Work ratio and high LOU. This finding may suggest two important findings. First, the negative relationship with the Play-Work ratio may signify the non-white population may have less access to the Play aspect of the LWP concept. Second, the negative correlation between Race and LOU (-0.290) suggests the non-white population is less likely to spend 10 minutes or less commuting to work than the white population. Differences in the transportation network or the access to job opportunities often indicated by the spatial mismatch literature could create this inequality (Kain 1968 and 1992, Ihlanfeldt 1994).

Table 3.7 | Regional Analysis: Inequality

VARIABLES	COEFFICIENTS OF CORRELATION			
Inequality	Work-Live	Play-Live	Play-Work	LOU
Race	0.060	-0.036	-0.248	-0.290
Change in Race	-0.107	-0.114	-0.018	-0.144
Poverty	0.079	-0.008	-0.172	-0.138
Change in Poverty	-0.048	-0.017	0.005	0.078
Housing Value	0.138	0.101	-0.093	0.145
Change in Housing Value	-0.021	-0.011	-0.031	-0.126

Furthermore, the change between 1990 and 2000 in racial diversity is negatively correlated with all of the four LWP variables. For instance, Figure 3.4 shows the census tracts with a high LOU were less likely to experience increases in the percentage of the non-white population between 1990 and 2000, while Boston as a whole showed a significant rise in racial diversity for the same time period (the non-white population for the entire study area increased from 12 to 18 percent of the total population between 1990 and 2000). This suggests the existence of social constructs that hinder the non-white population from moving to areas with more balanced LWP variables and/or reduce the provision of the LWP concept to areas with relatively higher percentage of non-white population. Overall, regional analysis suggested racial inequalities, in terms of LWP variables, exist in the Boston region, especially in relation to the LOU.

Regarding the relationship between income inequality and the LWP variables, the analysis outcomes are less conclusive. However, a few notable relationships exist between variables. First, similar to racial inequality, 1990 Poverty is correlated negatively to both the Play-Work ratio and LOU. In other words, areas with a high Play-Work ratio or LOU are more likely to have lower levels of poverty, as Figure 3.5 shows. The discovered correlations, similar to the case of racial inequalities, suggest the population below the poverty line may have less access to the Play aspect of the LWP concept and the lower income residents are less likely to enjoy the benefits of short

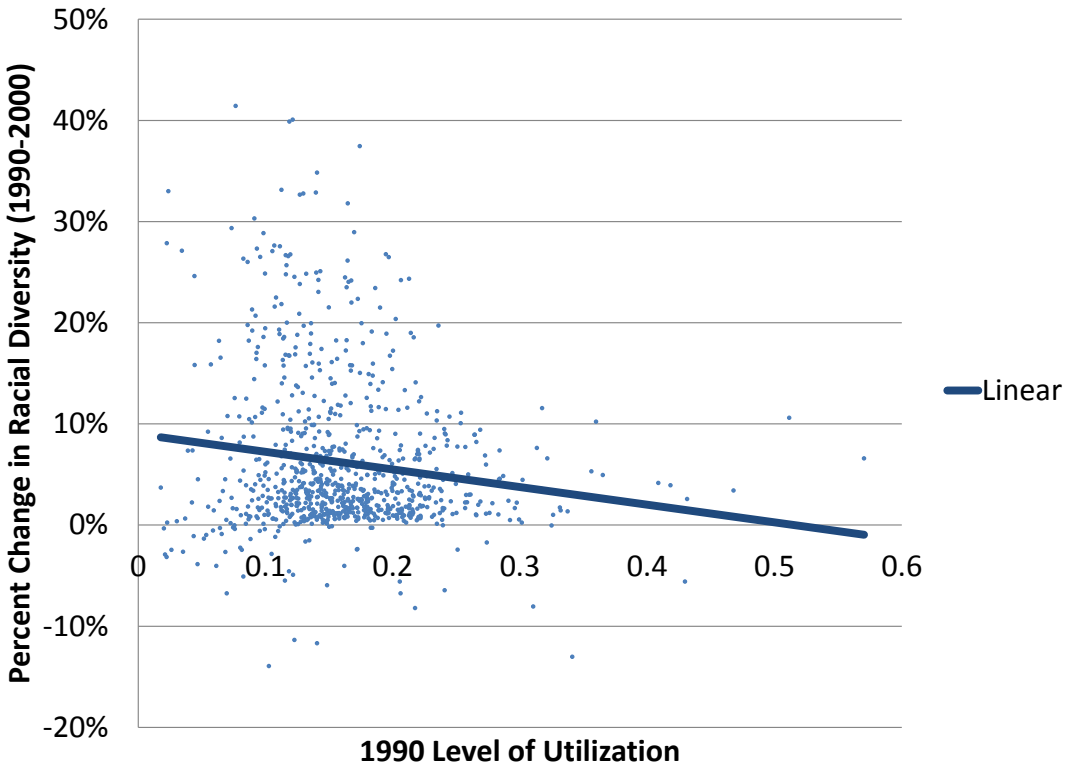

Figure 3.4 | Regional Analysis: Level of Utilization and Percent Change in Race

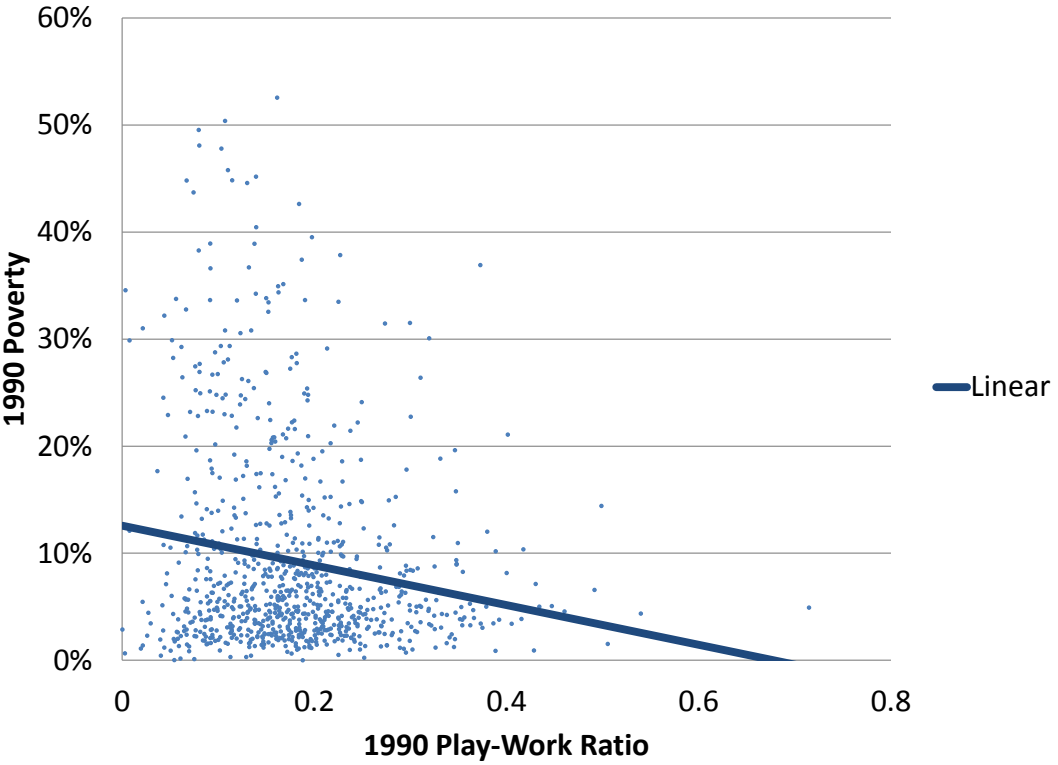

Figure 3.5 | Regional Analysis: Play-Work Ratio and Percent Under Poverty Line

commuting, possibly due to differences in the availability of affordable commuting modes, poorer access to job opportunities, or other unknown relationships.

The correlation analysis outcomes with respect to the relationship between the LWP variables and housing values are ambiguous. On one hand, the Work-Live, Play-Live, and LOU are correlated positively to the 1990 Housing Value. For illustration, Figure 3.6 shows the relationship between the LOU and Housing Values. This suggests people are willing to pay a higher price for housing in the areas with a larger number of available job opportunities and close proximity to work. This is consistent with the expectation that residents' preference for living near their work may translate into higher housing values. On the other hand, the changes in housing values between 1990 and 2000 are correlated negatively with the LWP mix variables. In other words, the housing values in areas with a low LWP level increased more than the housing values in areas with a high degree of LWP mixes in 1990. Due to this contradiction, the overall relationship between housing values and the LWP variables remained inconclusive.

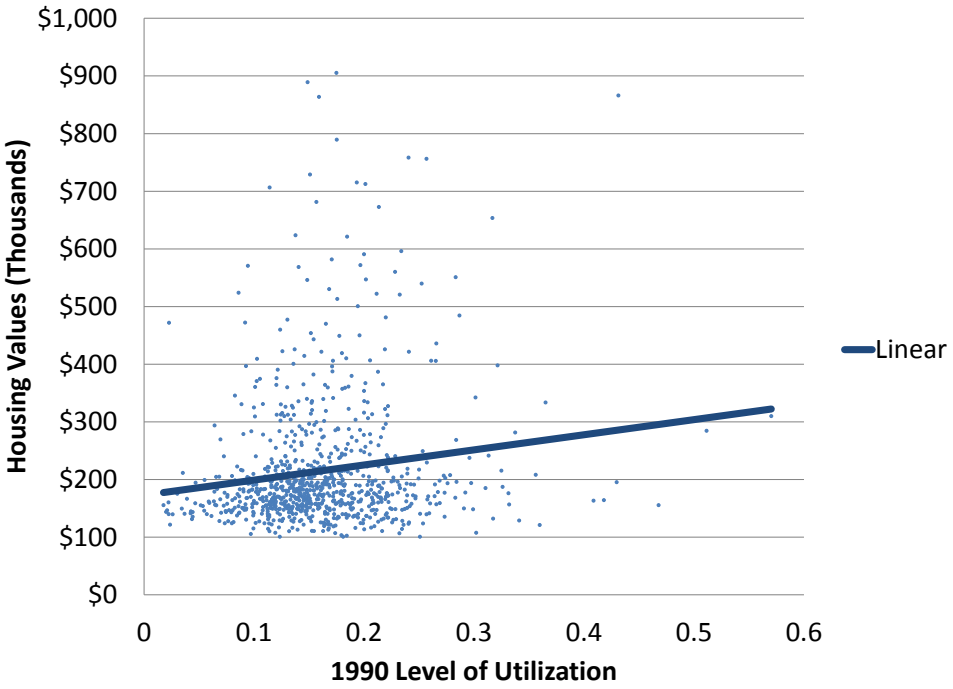

Figure 3.6 | Regional Analysis: Level of Utilization and Housing Value

Education.

In the Boston region, 12 percent of the entire population was college age – between the ages 18 and 24. Furthermore, 38 percent of all residents older than 24 years in 1990 had at least a college degree. Do the residents with such a high level of educational attainment or in the age range for college education tend to prefer the environments with LWP mixes? Table 3.8 presents the relevant analysis outcomes.

Table 3.8 | Regional Analysis: Education

VARIABLES	COEFFICIENTS OF CORRELATION			
Education	Work-Live	Play-Live	Play-Work	LOU
Educational Level	0.083	0.067	-0.053	0.094
Change in Educational Level	0.004	-0.015	-0.061	-0.021
College-Age Population	0.156	0.101	-0.106	0.222
Change in College-Age Population	0.198	0.077	-0.072	-0.057

The study found no significant relationship between educational attainment level and the LWP variables. For instance, the study found a positive relationship between 1990 educational level and LOU, but the correlation (0.094) was weak as Figure 3.7 demonstrates. The other LWP variables (Live-Work, Play-Live, and Play-Work ratios) exhibited weaker relationships with the educational attainment level.

The college-age population ratio showed a little stronger correlation with few LWP variables. More specifically, the 1990 College-Age Population showed a positive relationship with the Work-Live ratio (correlation value of 0.156). This may indicate the college-age cohort was more likely to live in urban areas with commercial-industrial activities than typical suburban residential neighborhoods. Strengthening this relationship, the Work-Live ratio also correlated positively with the change in the college-age population between 1990 and 2000, as Figure 3.8 shows. In other words, areas with a high Work-Live ratio experienced a greater percentage increase in

the college population than those with low Work-Live ratios. This may signify an increase in the preference or the need for high Work-Live ratio areas. Furthermore, a positive correlation (0.222) exists between 1990 College-Age Population and LOU, although LOU does not exhibit a positive correlation with the 1990-2000 change in the college age range.

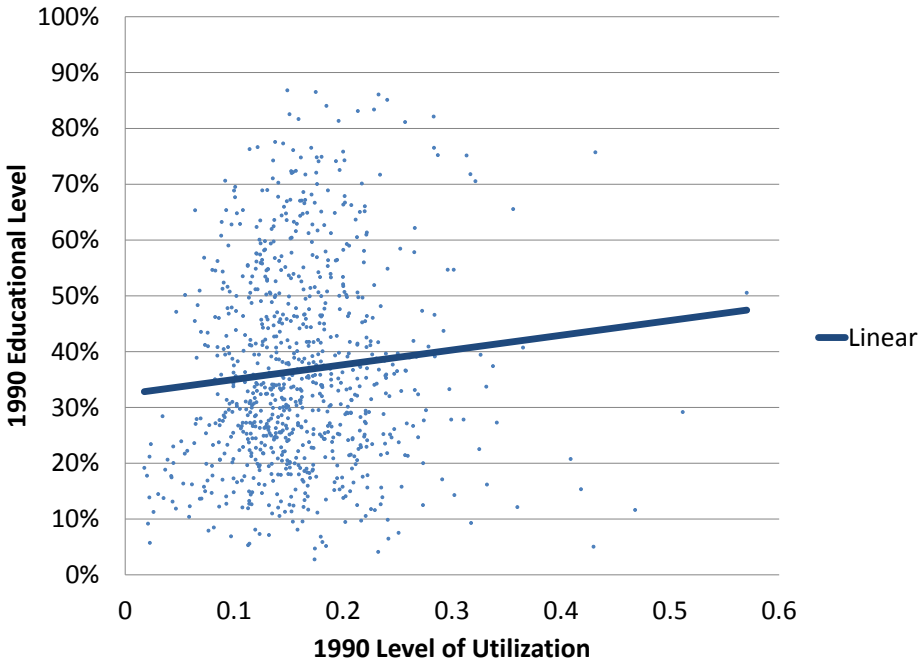

Figure 3.7 | Regional Analysis: Level of Utilization and Educational Level

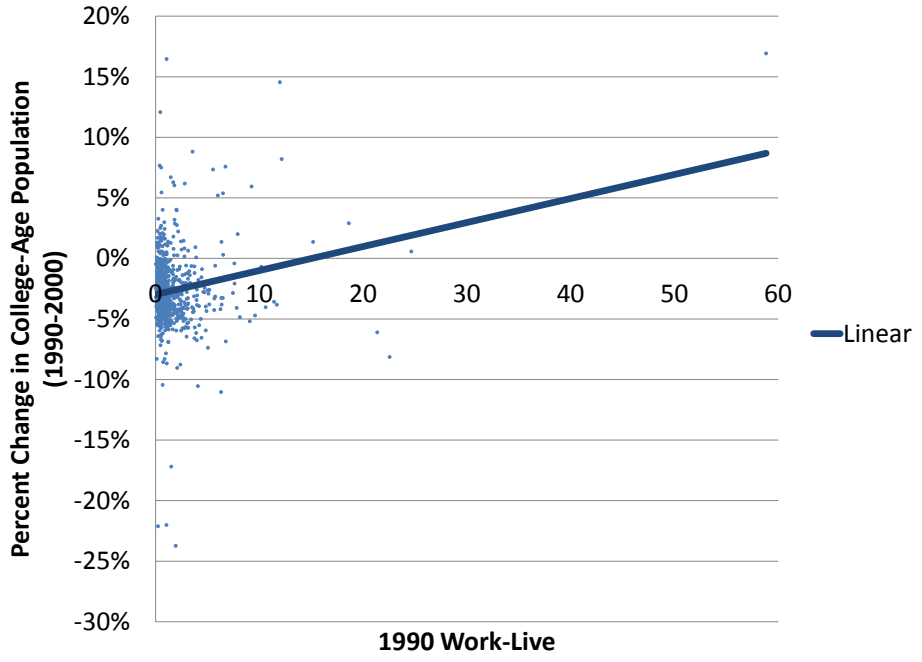

Figure 3.8 | Regional Analysis: Work-Live Ratio and Percent Change in College-Age Population

Built Environment.

The population and employment densities – the variables representing some built environment characteristics, showed interesting patterns of correlations with the LWP variables. First, as Table 3.9 shows, population density in 1990 exhibited negative correlation with all of the four LWP mix indicators.

Table 3.9 | Regional Analysis: Built Environment

VARIABLES	COEFFICIENTS OF CORRELATION			
Built Environment	Work-Live	Play-Live	Play-Work	LOU
Population Density	-0.082	-0.142	-0.104	-0.247
Change in Population Density	0.117	0.072	0.037	-0.072
Employment Density	0.654	0.457	-0.152	0.082
Change in Employment Density	-0.065	-0.091	-0.015	-0.002

In particular, the LOU has a correlation value of -0.247, which is both negative and relatively substantial. The negative correlations may indicate LWP mixes were realized not only in the populated urban centers but also in the places with low population densities. However, this finding also could be attributed to a caveat of the tract-level analysis that census tracts are much larger in less populated areas, thus tend to have a higher degree of LWP balances. The relationship between the transportation network and density also could cause a substantial negative correlation between the population density and LOU. As density increases, the transportation network becomes more congested, leading to longer commute times, which in turn decreases the LOU. Regarding the change in population density between 1990 and 2000, the positive correlation with the Work-Live ratio is notable (Figure 3.9). This is consistent with the analysis outcome for the relationship population growth rate and Work-Live ratio. As discussed above, this may suggest areas with high Work-Live ratios are more attractive, as they possess a greater number of employment opportunities in close proximity to residential places.

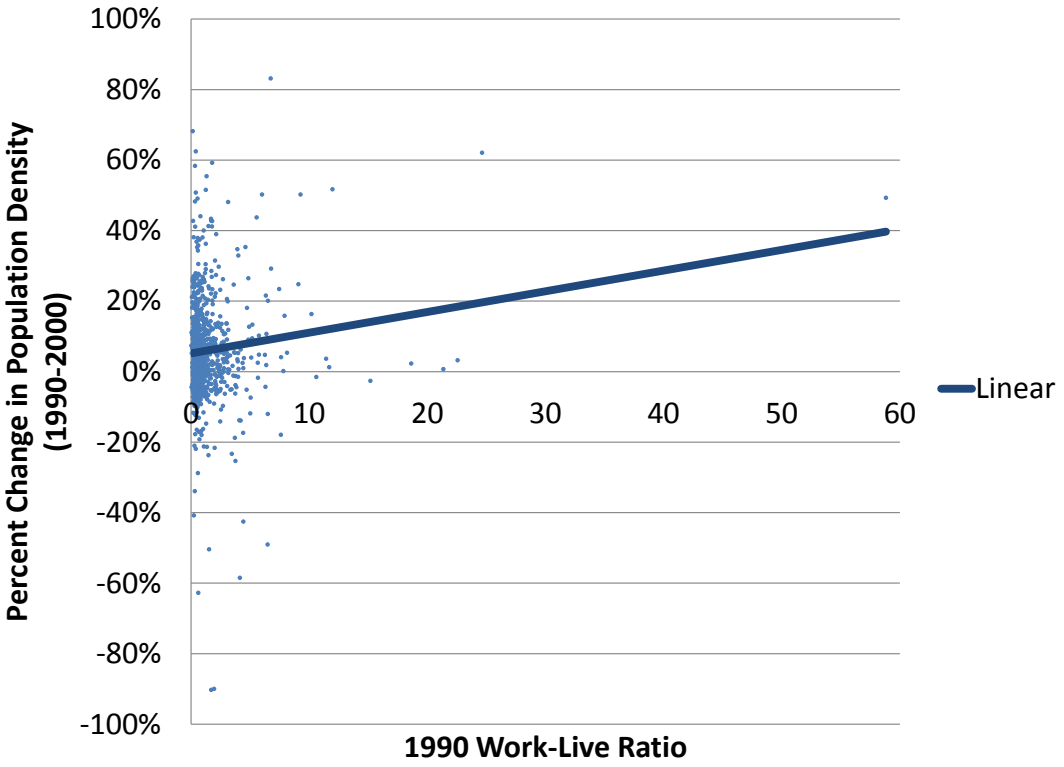

Figure 3.9 | Regional Analysis: Work-Live Ratio and Percent Change in Population Density

Second, the study also found employment density to be highly correlated with the LWP variables. More specifically, 1990 employment density exhibited correlation values of 0.654 and 0.457 with Work-Live and Play-Live ratios, respectively. These substantial magnitudes of the correlations most likely are a result of the direct relationship of the variables Work and Play to employment, and therefore employment density as well. As for the change in employment density between 1990 and 2000, no noteworthy correlations existed in relation to the LWP variables. These findings were inconclusive, suggesting no actual correlation existed between the built environment and the LWP variables.

Transportation.

In the Boston study area, approximately 80 percent of the population commuted to work by automobile, 11 percent by public transit, and 6 percent walked or biked to work in 1990. This

modal choice pattern remained relatively consistent through 2000. The average commute time for the entire region was 23.5 minutes in 1990. The commute time had increased by 17 percent (approximately 4 minutes) between 1990 and 2000. According to the regional analysis, the commuting patterns appeared to have some notable relationships with the LWP variables (Table 3.10).

Table 3.10 | Regional Analysis: Transportation

VARIABLES	COEFFICIENTS OF CORRELATION			
Transportation	Work-Live	Play-Live	Play-Work	LOU
Automobile Commuting	-0.207	-0.088	0.206	0.136
Change in Automobile Commuting	-0.029	-0.029	0.021	0.012
Walkability	0.344	0.220	-0.173	0.226
Change in Walkability	0.001	0.004	0.005	0.104
Commute Time	-0.216	-0.181	0.083	-0.605
Change in Commute Time	-0.064	-0.035	0.036	0.141

The results on the correlation between automobile commuting and the LWP variables were basically inconsistent, but informative. With a correlation value of -0.207, the study found the Work-Live ratio to be related negatively to 1990 Auto Commute (Figure 3.10). The negative correlation suggests areas with less employment per resident tend to have more automobile-oriented commuting patterns. This result may suggest the segregation of places to live away from places to work is associated with the dependence on automobiles, as suspected. However, the relationship between the LOU and 1990 Auto Commute was different (a positive correlation exited between the two variables). The positive relationship suggested that as automobile commuting increases, the number of people who live within a 10-minute commute also increases. This could be a result of the increased accessibility the automobile provides. The automobile can travel a greater distance in less time, which translates into access to more jobs within a 10-minute commute. The relationship between the Play-Work ratio and 1990 Auto Commute also was positive. This correlation may imply the automobile-based commuters tend to have employment located

farther away from their residence, but they still want places to play nearby. As for the change in automobile commuting between 1990 and 2000, no substantial correlations occurred.

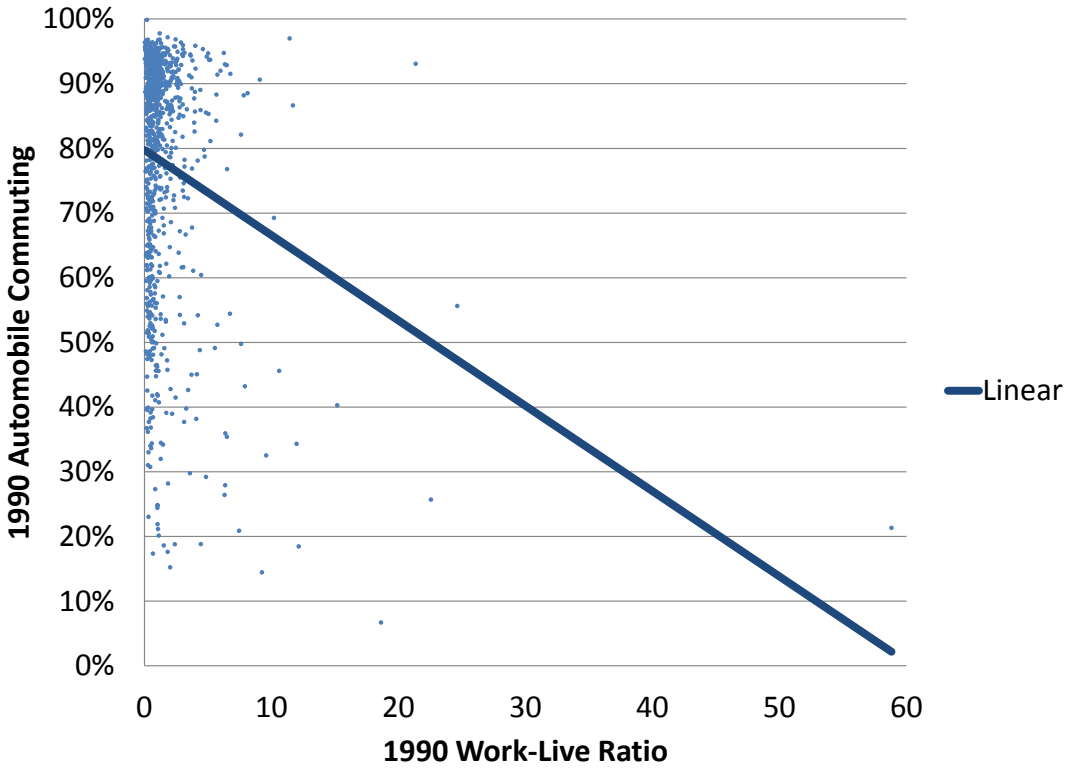

Figure 3.10 | Regional Analysis: Work-Live Ratio and Automobile Commuting

Walkability shows a relatively significant positive correlation with the Work-Live ratio (0.344). This suggests the number of people walking or biking to work may increase as the Work-Live ratio (i.e. jobs-housing balances) rises. Furthermore, the Play-Live ratio and LOU also exhibited positive correlations with 1990 Walkability. As for LOU, the correlation with the Change in Walkability between 1990 and 2000 also was positive, as Figure 3.11 demonstrates. This may suggest a high LOU may actually encourage people to start walking or biking.

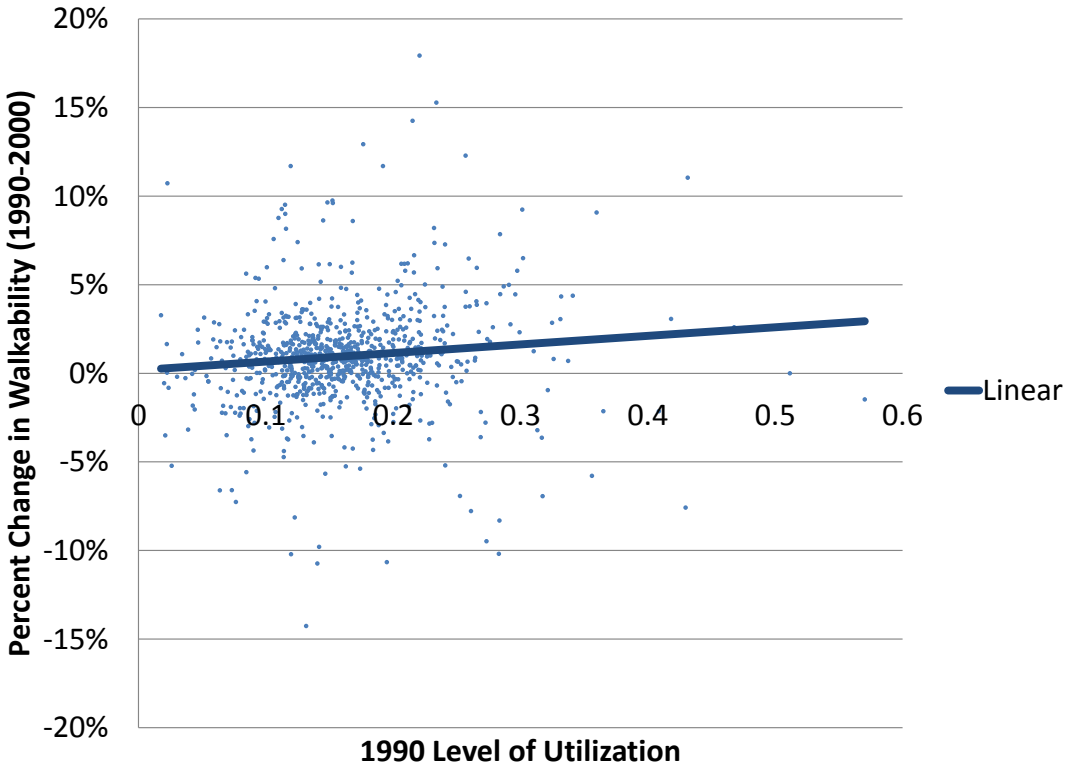

Figure 3.11 | Regional Analysis: Level of Utilization and Percent Change in Walkability

Regarding the average commute time, the Work-Live and Play-Live ratios showed negative relationships. In other words, as the number of nearby employment opportunities per resident increases, the average commute time decreases. The revealed relationships, albeit not strong relationships, may support the validity of Job-Housing balance initiatives. As for the LOU, a substantial relationship exists between 1990 Commute Time and LOU, with a correlation value of -0.605. This substantial relationship is understandable because the LOU used commute time (percentage of workers with a 10-minute commute or less) as a factor in its calculation. However, areas with a high LOU in 1990 experienced a greater increase in their commute times between 1990 and 2000 than areas with a low LOU (Figure 3.12). This finding could be a result of an increasing level of congestions in the high LOU areas.

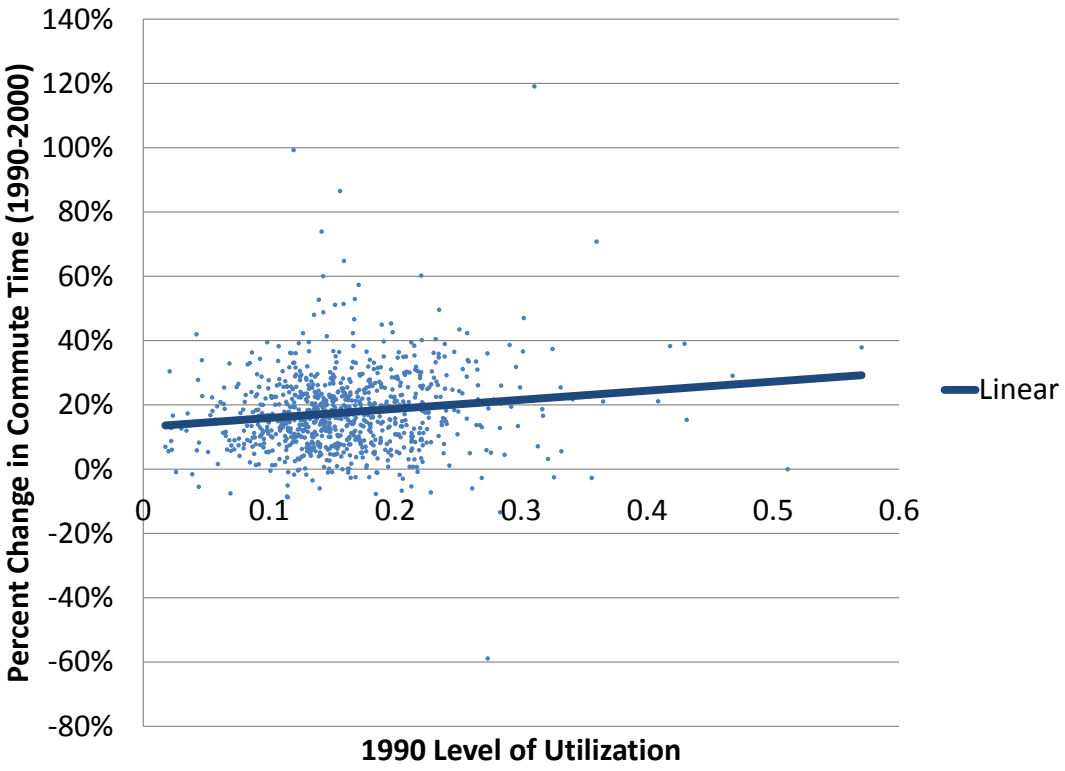

Figure 3.12 | Regional Analysis: LOU and Percent Change in Commute Time

District Analysis.

In order to better understand the implications of the LWP mixes, the study conducted a district-level analysis. As described in the Methodology section, the district analysis identified twelve key districts, falling in three categories (High LOU, High Employment, and Planned Districts), and verified the validity of the regional analysis findings. The study primarily accomplished this through comparison of the average for the category of High LOU Districts (that represent the mixed districts) and the corresponding averages from the other categories (High Employment Districts and Planned Districts) and the entire study area. The study further examined individual High LOU Districts to draw deeper conclusions.

Tables 3.11 and 3.12 provide the averages for each category (category averages) and the study area along with the descriptive statistics for each individual High LOU District. The study de-

termined category averages using an appropriate indicator as the weight, rather than calculating the simple arithmetic means. For instance, the educational level, which is the percentage of the population over 25 with a college degree or above, was weighted by the total population of each district when calculating the category average.

The study used descriptive statistics, including the category averages, to validate the regional analysis findings. More specifically, district analysis focused on the three major findings of the regional analysis: (1) insignificant growth effects, (2) substantial transportation implications, and (3) inequality issues involved in the provision of the LWP mixes. Note the study calculated the difference between the High LOU Districts' category averages and the study area averages for every variable, then correlated them with the LWP variables, and further compared them to the regional analysis results to supplement the analyses. The result of this broader investigation is presented in the Appendix.

Insignificant Growth Effects.

First, regarding the relationship between the LWP mixes and economic growth, the district-level analysis appeared to support the regional analysis finding. The study discovered no significant pattern in the examination of the selected key districts in terms of employment growth. While the category average for employment growth rate in High LOU Districts was almost twice that of the study area, it was similar to the level of growth found in High Employment Districts. This suggests areas with a high LOU did not experience more economic growth than the comparable group, namely High Employment Districts. Furthermore, investigation of each individual High LOU District revealed employment growth varied greatly among the districts. The High LOU Districts ranged from a 14 percent increase to a 6 percent decrease in employment. Three of the six High LOU Districts experienced relatively higher growth, two actually suffered a decline in

Table 3.11 | District Analysis: Study Area and Category Averages

	Study Area	High LOU Districts	High Employment Districts	Planned Districts
LWP Variables				
Live*	1559433.490	112632.422	174052.247	89328.827
Work*	2171626.441	221497.774	534491.615	200791.040
Play*	348852.888	33683.509	67390.608	24742.364
Work-Live	1.393	1.967	3.071	2.248
Play-Live	0.224	0.299	0.387	0.277
Play-Work	0.161	0.152	0.126	0.123
Level of Utilization	0.161	0.209	0.160	0.186
Growth				
Population*	3933176.562	265347.891	414484.814	204248.756
Population Growth	0.059	0.042	0.050	0.013
Employment*	2171626.441	221497.774	534491.615	200791.040
Employment Growth	0.047	0.089	0.077	0.063
Inequality				
Race	0.117	0.142	0.126	0.226
Change in Race	0.059	0.011	0.052	0.025
Poverty Level	0.082	0.096	0.098	0.121
Change in Poverty Level	0.002	0.001	-0.001	0.006
Housing Value	220060.659	333103.938	243335.481	411280.163
Change in Housing Value	0.233	0.224	0.256	0.151
Education				
Educational Level	0.378	0.508	0.393	0.598
Change in Educational Level	0.065	0.080	0.080	0.093
College-Age Population	0.120	0.183	0.154	0.248
Change in College-Age Population	-0.029	-0.022	-0.026	-0.004
Built Environment				
Population Density	599.129	448.269	770.712	893.102
Change in Population Density	0.059	0.042	0.050	0.013
Employment Density	330.797	374.190	993.858	877.983
Change in Employment Density	0.047	0.089	0.077	0.063
Transportation				
Auto Commuting	0.795	0.583	0.608	0.428
Change in Automobile Commuting	-0.006	-0.016	-0.004	-0.026
Walkability	0.061	0.199	0.158	0.274
Change in Walkability	-0.010	-0.010	-0.010	-0.008
Commute Time	23.469	20.839	21.308	20.586
Change in Commute Time	0.173	0.140	0.148	0.130

*Data stated as Totals instead of Averages

Table 3.12 | District Analysis: High LOU Districts

	District 1	District 2	District 3	District 4	District 5	District 6	Average
LWP Variables							
Live*	41957.79	14322.18	17437.24	14362.17	10428.46	14124.57	112632.42
Work*	107500.94	18926.94	34674.70	33192.62	12365.71	14836.86	221497.77
Play*	12205.26	3521.82	4175.05	8350.63	2133.67	3297.07	33683.51
Work-Live	2.56	1.32	1.99	2.31	1.19	1.05	1.97
Play-Live	0.29	0.25	0.24	0.58	0.20	0.23	0.30
Play-Work	0.11	0.19	0.12	0.25	0.17	0.22	0.15
Level of Utilization	0.18	0.21	0.23	0.22	0.34	0.25	0.21
Growth							
Population*	85662.58	40606.15	48224.43	37173.97	22353.92	31326.84	265347.89
Population Growth	0.01	0.04	0.05	0.02	0.08	0.12	0.04
Employment*	107500.94	18926.94	34674.70	33192.62	12365.71	14836.86	221497.77
Employment Growth	0.14	0.05	-0.06	0.12	-0.02	0.13	0.09
Inequality							
Race	0.36	0.05	0.07	0.02	0.01	0.01	0.14
Change in Race	-0.01	0.03	0.04	0.01	0.03	0.01	0.01
Poverty Level	0.21	0.03	0.02	0.04	0.08	0.06	0.10
Change in Poverty Level	0.01	0.00	0.00	-0.01	0.02	0.00	0.00
Housing Value	401920.98	413876.17	383151.04	197943.13	226949.40	200802.73	333103.94
Change in Housing Value	0.19	0.33	0.26	0.16	0.15	0.33	0.22
Education							
Educational Level	0.54	0.65	0.64	0.36	0.27	0.37	0.51
Change in Educational Level	0.08	0.09	0.10	0.04	0.08	0.08	0.08
College-Age Population	0.35	0.15	0.08	0.09	0.09	0.08	0.18
Change in College-Age Population	0.01	-0.04	-0.04	-0.03	-0.03	-0.03	-0.02
Built Environment							
Population Density	10035.48	463.24	233.29	676.44	367.29	180.85	448.27
Change in Population Density	0.01	0.04	0.05	0.02	0.08	0.12	0.04
Employment Density	12593.87	215.92	167.74	603.99	203.18	85.66	374.19
Change in Employment Density	0.14	0.05	-0.06	0.12	-0.02	0.13	0.09
Transportation							
Auto Commuting	0.27	0.79	0.87	0.94	0.85	0.91	0.58
Change in Automobile Commuting	0.00	-0.04	-0.01	0.00	0.00	0.00	-0.02
Walkability	0.36	0.08	0.03	0.03	0.07	0.03	0.20
Change in Walkability	-0.03	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Commute Time	19.84	23.64	22.24	20.56	18.60	23.69	20.84
Change in Commute Time	0.13	0.04	0.19	0.20	0.19	0.13	0.14

*Data stated as Totals instead of Averages in final column

employment, and the last had a growth in employment similar to the study area. This variability further implies the LWP mixes are not significantly associated with economic growth.

Substantial Transportation Implications.

The district-level analysis also seemed to support the regional analysis finding for transportation implications of the LWP mixes. For example, the category average for Walkability was significantly greater in High LOU Districts (0.199) than the study area (0.061). Furthermore, the High LOU Districts showed an average Walkability greater than even the High Employment Districts (0.158). This suggests a balanced mix of the LWP variables may significantly encourage walkability.

A more balanced LWP mix also appears to be associated with lower commute times. The Commute Time category average for the High LOU Districts (20.8 minutes) was lower than that of the study area (23.5 minutes) and the High Employment Districts (21.3 minutes). One could suspect the High LOU Districts should have a lower commute time since that was connected to their selection process. However, a higher LOU level does not necessarily translate to a shorter average commute time. For instance, the study area has a higher LOU value on average than the High Employment Districts, but a longer commute time. In other words, the lower commute times in the High LOU Districts also supports the regional analysis finding that a balanced LWP mix can induce a more desirable travel pattern.

Inequality Issues.

The district-level analysis, similar to regional analysis, suggested the LWP mix may be distributed inequitably in terms of race and income. Although the category average for Race (i.e. the percentage of non-White population) in the High LOU District (0.142) is slightly higher than the

study average (0.117), the 1990-2000 Change in Race in the High LOU District was substantially lower. High LOU Districts experienced an increase of approximately 1.1 percentage points, while the study area and the High Employment District category averages increased by over 5 percentage points between 1990 and 2000. This suggests the High LOU Districts might have racial barriers that prevent non-white population from moving into the area. Examination of the individual High LOU Districts further illustrated the differences in race. Five of the six districts had less than 7 percent of their population as non-white, whereas the study area average was 11.7 percent. The majority of the High LOU Districts showing lower non-white populations indicates racial inequality may exist in the provision of the LWP mixes in Boston.

Note the category average for housing values in High LOU Districts ($333,104) was substantially higher than that of the study area ($220,061) and the High Employment Districts ($243,335). Admittedly, the level of housing value is largely determined by the location and many other conditions in each district. Nonetheless, the high values also may indicate the desirability of the mixed districts as a place of living. The high prices of housing units, however, raise a question about the inclusion of low-income households in the districts. Low-income households may not be able to afford the expensive housing units in the areas, and thus cannot easily obtain the benefits of the high LOU districts.

CHAPTER 4 | SUMMARY AND DISCUSSION

This study explored and discussed various implications of the mixture of places to live, work, and play, which has increased in popularity in contemporary planning. Through the literature review, the present study first synthesized the theoretical benefits, such as increasing social interactions, enhanced knowledge spillovers and innovations, and higher efficiency in transportation, which accrue from mixed development as opposed to the segregation of places to live, work, and play. Then, the study conducted an empirical analysis of the Boston metropolitan area to examine if the Live-Work-Play mixes actually produce substantial benefits as expected. The empirical analysis suggested that:

- LWP mixes are not related significantly to economic growth.
- LWP mixes are associated with more desirable travel patterns, such as less automobile-oriented commuting mode choices and reduced commute times.
- Substantial racial and income inequalities in the provision of LWP mixes exist in the Boston region.

The policy implications for these findings are unmistakable. First, the insignificant relationship between the LWP mixes and economic growth may suggest mixing Live, Work, and Play does not necessarily promote the growth of the small area. However, from this empirical finding, one should not conclude carelessly that LWP mixes do not generate any economic benefits. Although the census tracts with more mixed development did not exhibit a substantial difference in terms of population and employment growth rates, the LWP mixes may contribute to the welfare of the residents. For instance, a shorter commute found in the mixed areas can allow residents to spend more time on other activities such as enjoying nature or playing with their children.

Since an increase in personal time does not always equate to higher financial expenditures, this benefit is invisible to the traditional measurements of the economy. Despite its uncaptured economic benefits, the LWP mixture still may be economically beneficial to society as a whole. The relationship between the economy and the level of utilization may increase in significance if the economic measurements capture a broad range of invisible benefits and the quality of life.

The second finding seems to highlight the real benefits of the mixed development more clearly. Although the empirical analysis only focused on the correlations rather than testing the causality between the LWP variables and transportation indicators, less motorized travel behaviors and shorter commute times found in the mixed areas may indicate the potential of the mixed development as a remedy for serious transportation problems that have long existed in many American cities. This finding also may validate some prior research on the jobs-housing balance and the expectation that mixed development may improve urban transportation more than the separation of Live, Work, and Play.

The third finding presents some existing challenges in the provision of the LWP mixes. In fact, the planning literature, particularly many studies on spatial mismatch, often suggests racial and income inequalities may exist in the spatial distribution of employment opportunities, and this study confirms this proposition. Furthermore, the correlation analysis outcomes of the present study suggest non-white and lower income households may have less access to Play as well as Work. The reasons for this inequality are uncertain and beyond the scope of the study. However, it is certain planners must make conscious efforts to address this systematically disproportionate pattern of LWP development. Increasing the number of employment opportunities, improving the transportation network in disadvantaged areas, or removing exclusionary land use regulations or discriminatory practices in labor markets can remedy this inequality. In addition, govern-

ments should be more careful in making investment decisions, as they unintentionally may have created this inequality by investing more in white and high-income neighborhoods than in non-white and low-income areas. If Boston is to become a more socially inclusive city, its residents and leaders must fully understand the consequences of spending patterns on equality within the region. When making investment decisions, one cannot listen solely to the wealthiest, most vocal, or the most powerful people, but must seek the opinion of every race and income. The city must plan in a way that does not favor one person at the cost of another. Social inclusivity is paramount to humanity if every person is to realize his or her full potential. Therefore, the equal provision of the benefits of mixed development may be one step in the right direction.

It appears the demand for more mixed development is increasing along with the current changes in housing preferences. Davis and Diegel (2011) recently found the actual percentage of people living within a 15-minute commute to work has nearly doubled from 15.9 percent in 1990 to 28.6 percent in 2009. Likewise, the empirical analysis of the relationship between the LWP mixes and housing values suggested people value the mixed environments. Furthermore, the analysis found that population, particularly the college-age cohort, is more likely to increase in areas with a higher Work-Live ratio. This finding is consistent with Nelson's (2011) assertion that the built environment must become more walkable, accessible, diverse, and dense in order to adapt to the evolving demographics and associated changes in housing demand structure of the nation. If housing preferences truly are changing as explained above, it is imperative that Boston increases its stock of housing in terms of the LWP concept. However, constructing completely new developments based on the LWP concept would not be an effective strategy. Reforming current built environments with the use of existing infrastructure can create LWP districts may prove to be a more efficient and economically viable strategy.

Planners may need to consider how to effectively attain such reforms, accommodate the growing demands for mixed neighborhoods, and maximize the benefits of the LWP mixes. They may target a limited number of strategic locations with great potential by implementing zoning changes or initiating development projects. Given that the college-age population appears to prefer living in close proximity to places to Work and Play, planners' efforts can be more effective in some areas nearby universities and colleges, if the neighborhoods have not fully utilized the LWP balance. However, planners should recognize that focusing on specific areas may exacerbate the inequality issue. Therefore, they must take precaution to ensure built environments are strategically and equitably restructured. Providing the benefits of mixed development to all races and incomes is beneficial to society. For instance, low-income households may benefit the most from living and working in close proximity because commuting costs account for a larger percentage of their limited budget and time than those with higher incomes. However, markets are less likely to ensure equitable provision; it is crucial the government and planners intervene. If they do not take action, the inequalities and gaps between different races and incomes will only widen and further hurt the vitality of the metropolitan region. An inequitable city cannot reach its full potential economically, socially, and culturally.

Planners also must consider the integration of the promotion of LWP balance in economic development initiatives. Although the relationship between the LWP concept and growth was analyzed weakly in this study, the mixed development could support social interaction that can lead to higher rates of innovation, which in turn improves the economy of the entire region (Feldman and Audretsch 1996). Given the economic potential, provision of the LWP mixes and the long-term economic prosperity of the region can be jointly attainable. In the case of Boston, the city's efforts to create an Innovation District systematically can connect to the promotion of the LWP

mixes. Boston's concept of an Innovation District, "a neighborhood where interaction, community, collaboration, and diversity work hand-in-hand to foster a place where innovation can grow" (Hacin+Associations, 2010), overlaps the common urban theories relevant the LWP concept and it recognizes the benefits of mixed development.

This study is not without limitations. Among others, the empirical study used simple correlations to examine the LWP mixes and the selected dependent variables rather than controlling for the effects of many other factors that may have significant influences on the dependent variables. In addition, due to the limited data availability, this study had to focus on population and employment growth rates in testing the economic benefits of the mixed built environments. Admittedly, these measurements do not account for some of the hidden economic benefits or the improvements in real quality of life that mixed development might bring. The use of LOU, as a proxy for the utilization of the LWP balance, also may have some limitations, as it focuses on commuting time as opposed to real spatial proximity. Nevertheless, the present study sheds lights on the theoretical backgrounds and empirical implications of the Live-Work-Play balance, a newly emerging perspective on the spatial arrangement of basic human activities.

While this study is focused on the LWP concept, benefits do exist for the segregation of places to live, work, and play. Segregation may produce more economic growth than a balanced approach because of the benefits of agglomeration. However, complete segregation is not necessary. The regional economy may benefit from an area of high employment, but this does not mean that the local economy cannot benefit from the provision of a few residences in that employment area. The mixture of places to live, work, and play must be provided with account to both regional and local perspectives.

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APPENDIX

Table A.1 | Data Sources

Name	Source	Data	Location
Census Transportation Planning Package (CTPP)	Research and Innovation Technology Administration (RITA)	- Selected 1990 Block Group Data - Selected 2000 Census Tract Data	- 1990 - http://www.transtats.bts.gov/Tables.asp?DB_ID=620 - 2000 - http://www.transtats.bts.gov/Tables.asp?DB_ID=630
Decennial Census	Census Bureau	- Selected 1990 Block Group Data - Selected 2000 Census Tract Data	- 1990 - http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_tabId=DEC2&_submenuId=datasets_1&_lang=en&_ts=340989287317 - 2000 - http://factfinder.census.gov/servlet/DatasetMainPageServlet?_ds_name=DEC_2000_SF1_U&_program=DEC&_lang=en
Census Geographic Boundary Shapefiles	Census Bureau	- 1990 Block Group Boundaries - 2000 Census Tract Boundaries	- Both Years - http://www.census.gov/geo/www/cob/bdy_files.html

Table A.2 depicts the direction of the correlation between the LWP variables and each key indicator in the bottom section of the table. In order to accomplish this, the Study Area average was subtracted from the High LOU District category average for every variable. This produced the direction of the difference. Finally, the direction of the difference for the LWP variables was divided by the direction of the difference for each key indicator, providing the direction of the correlation for every key variable with the LWP variables.

Tables A.3-A.6 provide a synthesis of the direction of correlation and the results from the regional analysis. If the direction of correlation for both regional and district analyses were the same, the direction was correspondingly synthesized. However, if the analyses produced conflicting results it deemed them inconclusive. For the conclusive findings, the outcomes were highlighted in gray if the correlation value from the regional analysis also was substantial.

Table A.2 | District Analysis: Direction of Correlation

			WORK-LIVE	PLAY-LIVE	PLAY-WORK	LOU
		High LOU District	1.967	0.299	0.152	0.209
		Study Area	1.393	0.224	0.161	0.161
		Direction of Difference	+	+	-	+
DISTRICT ANALYSIS	**High LOU District**	**Study Area**	**Direction of Difference**	**WORK-LIVE**	**PLAY-LIVE**	**PLAY-WORK**	**LOU**
Growth							
Population Growth Rate	0.042	0.059	-	-	-	+	-
Employment Growth Rate	0.089	0.047	+	+	+	-	+
Inequality							
Race	0.142	0.117	+	+	+	-	+
Change in Race	0.011	0.059	-	-	-	+	-
Poverty	0.096	0.082	+	+	+	-	+
Change in Poverty	0.001	0.002	-	-	-	+	-
Housing Value	333,103	220,060	+	+	+	-	+
Change in Housing Value	0.224	0.233	-	-	-	+	-
Education							
Educational Level	0.508	0.378	+	+	+	-	+
Change in Education Level	0.080	0.065	+	+	+	-	+
College-Age Population	0.183	0.120	+	+	+	-	+
Change in College-Age Population	-0.022	-0.029	+	+	+	-	+
Built Environment							
Population Density	448.269	599.129	-	-	-	+	-
Change in Population Density	0.042	0.059	-	-	-	+	-
Employment Density	374.190	330.797	+	+	+	-	+
Change in Employment Density	0.089	0.047	+	+	+	-	+
Transportation							
Auto-Commute	0.583	0.795	-	-	-	+	-
Change in Auto-Commute	-0.016	-0.006	-	-	-	+	-
Walkability	0.199	0.061	+	+	+	-	+
Change in Walkability	-0.010	-0.010	~	~	~	~	~
Commute Time	20.839	23.469	-	-	-	+	-
Change in Commute Time	0.140	0.173	-	-	-	+	-

Table A.3 | Synthesis: Work-Live

	WORK-LIVE		SYNTHESIS
	Regional	District	
Growth			
Population Growth	+ 0.117	-	Inconclusive
Economic Growth	- 0.065	+	Inconclusive
Inequality			
Race	+ 0.060	+	**POSITIVE**
Change in Race	- 0.107	-	**NEGATIVE**
Poverty	+ 0.079	+	**POSITIVE**
Change in Poverty	- 0.048	-	**NEGATIVE**
Housing Value	+ 0.138	+	**POSITIVE**
Change in Housing Value	- 0.021	-	**NEGATIVE**
Education			
Educational Level	+ 0.083	+	**POSITIVE**
Change in Educational Level	+ 0.004	+	**POSITIVE**
College-Age Population	+ 0.156	+	**POSITIVE**
Change in College-Age Population	+ 0.198	+	**POSITIVE**
Built Environment			
Population Density	- 0.082	-	**NEGATIVE**
Change in Population Density	+ 0.117	-	Inconclusive
Employment Density	+ 0.654	+	**POSITIVE**
Change in Employment Density	- 0.065	-	**NEGATIVE**
Transportation			
Automobile Commuting	- 0.207	-	**NEGATIVE**
Change in Auto-Commuting	- 0.029	-	**NEGATIVE**
Walkability	+ 0.344	+	**POSITIVE**
Change in Walkability	+ 0.001	~	Inconclusive
Commute Time	- 0.216	-	**NEGATIVE**
Change in Commute Time	- 0.064	-	**NEGATIVE**

Table A.4 | Synthesis: Play-Live

	PLAY-LIVE		SYNTHESIS
	Regional	District	
Growth			
Population Growth	+ 0.072	-	Inconclusive
Economic Growth	- 0.091	+	Inconclusive
Inequality			
Race	- 0.036	+	Inconclusive
Change in Race	- 0.114	-	**NEGATIVE**
Poverty	- 0.008	+	Inconclusive
Change in Poverty	- 0.017	-	**NEGATIVE**
Housing Value	+ 0.101	+	**POSITIVE**
Change in Housing Value	- 0.011	-	**NEGATIVE**
Education			
Educational Level	+ 0.067	+	**POSITIVE**
Change in Educational Level	- 0.015	+	Inconclusive
College-Age Population	+ 0.101	+	**POSITIVE**
Change in College-Age Population	+ 0.077	+	**POSITIVE**
Built Environment			
Population Density	- 0.142	-	**NEGATIVE**
Change in Population Density	+ 0.072	-	Inconclusive
Employment Density	+ 0.457	+	**POSITIVE**
Change in Employment Density	- 0.091	+	Inconclusive
Transportation			
Automobile Commuting	- 0.088	-	**NEGATIVE**
Change in Auto-Commuting	- 0.029	-	**NEGATIVE**
Walkability	+ 0.220	+	**POSITIVE**
Change in Walkability	+ 0.004	~	Inconclusive
Commute Time	- 0.181	-	**NEGATIVE**
Change in Commute Time	- 0.035	-	**NEGATIVE**

Table A.5 | Synthesis: Play-Work

	PLAY-WORK		SYNTHESIS
	Regional	District	
Growth			
Population Growth	+ 0.037	+	**POSITIVE**
Economic Growth	- 0.015	-	Inconclusive
Inequality			
Race	- 0.248	-	**NEGATIVE**
Change in Race	- 0.018	+	Inconclusive
Poverty	- 0.172	-	**NEGATIVE**
Change in Poverty	+ 0.005	+	**POSITIVE**
Housing Value	- 0.093	-	**NEGATIVE**
Change in Housing Value	- 0.031	+	Inconclusive
Education			
Educational Level	- 0.053	-	**NEGATIVE**
Change in Educational Level	- 0.061	-	**NEGATIVE**
College-Age Population	- 0.106	-	**NEGATIVE**
Change in College-Age Population	- 0.072	-	**NEGATIVE**
Built Environment			
Population Density	- 0.104	+	Inconclusive
Change in Population Density	+ 0.037	+	**POSITIVE**
Employment Density	- 0.152	-	**NEGATIVE**
Change in Employment Density	- 0.015	-	**NEGATIVE**
Transportation			
Automobile Commuting	+ 0.206	+	**POSITIVE**
Change in Auto-Commuting	+ 0.021	+	**POSITIVE**
Walkability	- 0.173	-	**NEGATIVE**
Change in Walkability	+ 0.005	~	Inconclusive
Commute Time	+ 0.083	+	**POSITIVE**
Change in Commute Time	+ 0.036	+	**POSITIVE**

Table A.6 | Synthesis: LOU

	LOU		SYNTHESIS
	Regional	District	
Growth			
Population Growth	- 0.072	-	**NEGATIVE**
Economic Growth	- 0.002	+	Inconclusive
Inequality			
Race	- 0.290	+	Inconclusive
Change in Race	- 0.144	-	**NEGATIVE**
Poverty	- 0.138	+	Inconclusive
Change in Poverty	+ 0.078	-	Inconclusive
Housing Value	+ 0.145	+	**POSITIVE**
Change in Housing Value	- 0.126	-	**NEGATIVE**
Education			
Educational Level	+ 0.094	+	**POSITIVE**
Change in Educational Level	- 0.021	+	Inconclusive
College-Age Population	+ 0.021	+	**POSITIVE**
Change in College-Age Population	- 0.057	+	Inconclusive
Built Environment			
Population Density	- 0.247	-	**NEGATIVE**
Change in Population Density	- 0.072	-	**NEGATIVE**
Employment Density	+ 0.082	+	**POSITIVE**
Change in Employment Density	- 0.002	+	Inconclusive
Transportation			
Automobile Commuting	+ 0.136	-	Inconclusive
Change in Auto-Commuting	+ 0.012	-	Inconclusive
Walkability	+ 0.226	+	**POSITIVE**
Change in Walkability	+ 0.104	~	Inconclusive
Commute Time	- 0.605	-	**NEGATIVE**
Change in Commute Time	+ 0.141	-	Inconclusive

List of Acronyms

CIAM – Congres International d'Architecture Moderne

CTPP – Census Transportation Planning Package

GIS – Geographic Information System

ITE – Institute of Transportation Engineers

LOU – Level of Utilization

LWP – Live-Work-Play

NAICS – North American Industrial Classification System

RITA – Research and Innovative Technology Administration

SIC – Standard Industrial Code

TIGER – Topographically Integrated Geographic Encoding and Referencing system