Residential Property Values and Neighborhood Retail:
A Comparison of Pedestrian and Automobile Oriented Retail Clusters

by

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ABSTRACT

This study tests the hypothesis that home buyers pay a premium to live within walking distance of pedestrian accessible retail. To answer this question two types of retail clusters are identified in the Boston metropolitan area—pedestrian oriented and automobile oriented—and comparisons are made between their effects on surrounding residential property values. Hedonic regression analysis reveals price gradients which vary depending on retail form, regional location and home type. In particular, walkable centers appear to be more appreciated in inner-suburban locations and among condominium buyers. Interestingly, automobile oriented retail clusters are found to not significantly affect the values of proximate single family homes.

Thesis Supervisor: Lynn Fisher
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INTRODUCTION

> [New Urbanism] holds the promise to reconcile the environmental ethos and the concerns with social equity that have typically been represented by the political left with expansion of choice through the free market that is the central conviction of the political right.
> —Andres Duany and David Brian, *Regulating as if Humans Matter* (2005)[1]

I recently visited the community of Prospect, a decidedly New Urbanist development outside of Longmont, Colorado. Prospect sits at the edge of a satellite city. Its yet complete fabric of streets and homes is unrolling itself onto the Colorado plains along with its more typically suburban neighbors. During my visit I dropped in on a friend who had just moved in with her new husband. Their condominium, on the third floor of a courtyard building, was brand new and they were just getting settled. I, of course, wanted to know everything about Prospect. She was somewhat shy about my wonkish questions, but when another friend asked, "what's your favorite thing about living here," she replied without hesitation: "I can walk to get coffee."

This attitude stands in contrast to a history of zoning and regulations that seek to isolate non-residential uses and buffer them from residential enclaves. This story also contradicts the tenacity with which residents often resist proximate commercial development projects. Knowledge of cities and suburbs and basic intuition suggests that the value of retail uses must depend on a variety of factors. A hypothesis might be that urban residents have less aversion to shops than their suburban counterparts, or one might also speculate that multi-family building residents have different preferences than those seeking single-family home ownership.

New Urbanism has suggested that lack of choice in the current housing market and shifting demographic trends have created a new appreciation for residential environments that provide access to a handful of daily needs on foot. Both anecdotal and empirical research provides evidence of the monetary premium created by projects that espouse New Urbanist principles.[2] Encouraged by this evidence (as well as social and environmental arguments) architects, planners and developers have adopted New Urbanist principles at a variety of scales.

Among the many principles of New Urbanism is the idea that retail, when properly designed, can be integrated into residential communities without detrimental effect. In fact, it has been argued that pedestrian accessible retail amenities actually have the potential to *create value.*

Critics of this proposition, such as Alex Marshal, argue that New Urbanist communities are nothing more than subdivisions masked by a "stage set" of traditional urbanism—actual traditional town centers have no value to Americans. Marshal points out that Celebration (the project by Andres Duany featured in the *Truman Show*) neighbors an old town with "more stores that you can walk to," but the town remains depressed and houses sell at rock bottom prices.

This study extends the observations made by Marshal to the metropolitan Boston region and asks the question, "are home buyers willing to pay more to live in traditional town centers?" More specifically, I focus on clusters of retail located throughout the region and measure their impact on home values.

The study is organized into 3 chapters. In the first, I examine attitudes towards the integration of retail and residential uses in theory and practice. I find that with some exceptions urban design theory has maintained an inclusive attitude toward retail in modern history. The isolation of retail has instead been the result of practical regulation codifying the preferences of homeowners.

In the second chapter I establish a methodology for identifying retail clusters and measuring their impact on home values. Two cluster typologies are defined, "pedestrian oriented" and "automobile oriented," and serve to illuminate my question.

The third chapter presents the findings. Most evident is the preference among home buyers in outer suburban locations to locate over a mile beyond traditional pedestrian oriented clusters.

1 ATTITUDES TOWARDS RETAIL

> We now separate stores and shops from residential areas, although obviously it is the residents who are desirous of buying things. We are consigning structures of cultural and artistic purpose to compounds separated from both residential and retail areas, though obviously it is the people in their role of residents and shoppers who would like to visit these institutions.
> —Victor Gruen, *The Heart of Our Cities* (1964)[3]

There is a distinct sentiment among those wishing to reform the car dominated culture of suburbia that daily functions are disconnected as a result of a modernist infatuation with separation and its manifestation in zoning. A review of major urban theoretical works from this period suggests that this attitude does not actually receive much support in the literature, but instead appears to have emerged as a result of practical needs and popular values.

In Theory

Overcoming the Urban Miasma

Much of contemporary urban policy and thought finds its roots in the industrial city. In the 1845 book *The Condition of the Working Class in England,* factory owner Friedrich Engles compassionately and meticulously documents the hunger, disease and unimaginable conditions encountered by the lower classes of Manchester and the "great towns" of England. In addition to illustrating the class divisions and shortcomings of an industrial economy, he identifies how these issues manifest themselves in the built environment.

In his descriptions he illuminates a street scene in the St. Guiles neighborhood of London as follows:

> A vegetable market is held in the street, baskets with vegetables and fruits, naturally all bad and hardly fit to use, obstruct the sidewalk still further, and from these, as well as from the fish-dealers stalls, arises a horrible smell.[4]

The inclusion of low quality food on an already crowded street is a concern for Engles, however, the bulk of his contempt is reserved for the unsanitary conditions within the buildings. After setting the scene on the street he qualifies, "but all this is nothing in comparison with the dwellings in the narrow courts and alleys between the streets...in which filth and tottering ruin surpass all description."[5] His primary concern is for more direct assaults on human health—overcrowding, raw sewage, piles of garbage, smoke, soot, ash, basement dwellings and miscellaneous "foul liquids." Although he is concerned with the quality of the "adulterated goods" that the poor are forced to buy from small un-established retailers, in the course of the book he spends very little time worrying about the mixing of uses directly.

The only other significant passage that Engles devotes to the discussion of retail is more flattering. He argues that the stores that continuously front the major thoroughfares of Manchester act to "conceal from the eyes of the wealthy men and women of strong

stomachs and weak nerves the misery and grime which form the complement to their wealth."[6] In effect, although his purpose is accusatory, his observation reflects the general impression that the shops of Manchester have a beautifying effect. This stands in contrast to the contemporary American revulsion to the automobile strip—perhaps this is because it does not hide anything, but it correlates with urban designer's obsession with retail to "activate" facades.

In the American city these challenges emerge later. In the 1850s, rapidly growing mill towns are still new and full of hope. "One would swear," Charles Dickens observed on visit to Lowell, "that ever Bakery, Grocery and Bookbindery and every other kind of store took its shutter down for the first time and started in business yesterday."[7] But the woes of the industrial city are soon prevalent in America and the documentarians are not far behind. This time armed with a camera, police reporter Jacob Riis captures the lives and environs of New York City's destitute residents. Again his focus is on the plight of the underfed, the overcrowded, and the homeless—the failure of a system to provide for the most basic needs for its residents. Like Engles, concern for the drifting fumes of incompatible uses is of little concern in his photographs or writing.

Retail in the Streetcar Suburbs

Energy is not afforded to the separation of uses until the transportation revolution takes hold and urban middleclass residents are able to find a place of their own at the fringe. Between 1815 and 1875 the steam ferry, omnibus, commuter railroad, horsecar, trolly, cablecar and elevated railroad began the urban exodus which resulted in the urban-suburban dichotomy we know today.[8] This rapid expansion and decentralization of the city presented urban thinkers with the first possibility of separating uses. Fredrick Law Olmsted, known to most as the designer of Central Park, was also an influential suburban designer who saw clear rational in the segregation of urban uses. He likens the appropriateness of urban segmentation to the functions of a home: "If a house is to be used for many different purposes it must have many rooms and passages of various dimensions variously lighted and furnished, not less must such a metropolis be specifically adapted at different points to different needs."[9]

In Riverside, Illinois, one of the first planned communities on a commuter rail line, Olmsted and his collaborators set aside a small business district surrounding the station. The remaining community was strictly regulated to insure the preservation of a single-use pastoral environment which remains today. This is perhaps the first example of a commercial district being created and preserved in isolation from other uses.

Figure 1. Detail of Riverside, IL plan showing commercial section (1869); Riverside commercial section today.

Olmstead's vision for the suburbs sought to combine the benefits of rural life with the amenities of the city. He writes to his Riverside clients in 1968, "the present outward tendency of town populations…[must not result in]…a sacrifice of urban conveniences, but their combination with the special charms and substantial advantages of rural conditions of life."[10] In this way his opinion correlates with the garden city movement which is outlined in 1898 by Ebenezer Howard's treatise *Tomorrow: A Peaceful Path to Real Reform.* This work provides a more formal proclamation of the beneficial merger of town and country. A crystal palace, which rings a central park, is where most shopping is expected to be carried out, and each ward includes a "store or depot" for the sale of agricultural goods.

In both Howard and Olmstead's work, an inclusive attitude toward retail is combined with an interest in maintaining a sylvan and tranquil environment by separating commerce from domestic life. The uses which serve the residents directly are least offending and are kept within close proximity. This delicate compartmentalization finds company in works that follow after the turn of the century, such as Clarence Perry's full service "neighborhood-unit" which places local shops at the edges of small neighborhoods.[11] There is not push among these influential visionaries to cut off retail from neighborhoods or even buffer it substantially. It must be acknowledged that this is not surprising given the dominant transportation modes of the time.

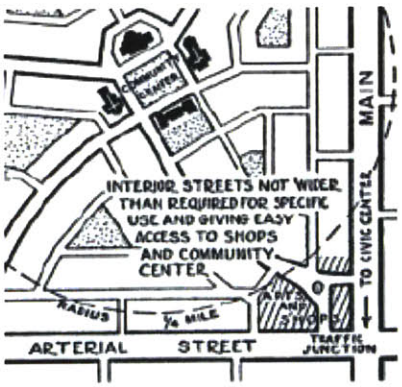


Figure 2. Clarence Perry's Neighborhood Unit (1929)

There is a pervasive tendency in urban literature to ignore the every day shopping needs of urban and suburban habitants. Even in the writings of Olmstead and Howard it is difficult to find relevant reference. Concern for parks, streets, homes and the exclusion of industrial commerce take precedent. It is not clear whether this treatment is the result of a faith in private markets or a utopian hope that private markets can be done away with. When Le Corbusier gets around to talking about suburban retail, it is the latter.

Often the whipping boy of all things separate, Le Corbusier proposed either an intense integration of retail or a conviction that it could be done away with. Like the efforts of today's anti-sprawl advocates, his vision of a "contemporary city" attempted to combat urban residents increasing tendency to spread themselves across the countryside. Together with a seemingly contradictory infatuation with both the wonders of the modern automobile and hyper-dense environments, *The City of Tomorrow and its Planning* enunciates in no uncertain terms how a modern city should be laid out. While many Europeans were using increased mobility to achieve modest environmental gains in a suburban row house (dense by current standards), Le Corbusier sought to overcome urban miasmas and reverse the necessity for this type of growth through modern engineering and building technology. The center of the contemporary city is designed for densities of 1,200 people per acre—over 8 times the density of central Paris at the time[12]. While his Garden Cities clustered on rail lines beyond the cities borders are designed to provide a salubrious environment, while simultaneously exceeding the densities of central London.

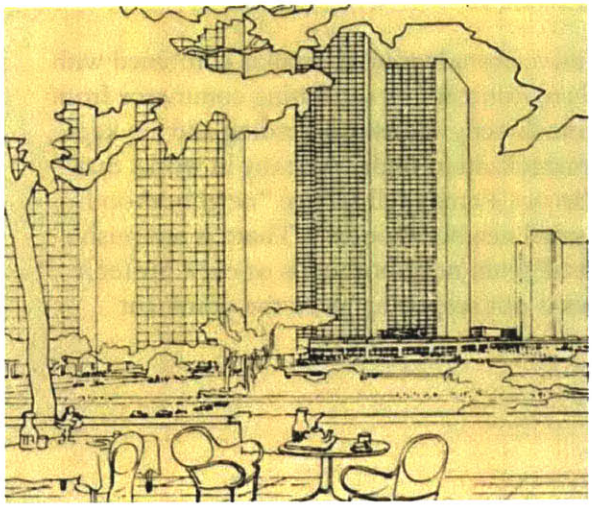


Figure 3. Le Corbusier's towers maintain a prolific Parisian element: the café

Le Corbusier addresses the appropriate place for retail on three different occasions in *The City of To-morrow and its Planning.* The first is at the base of his infamous point towers. This is not a difficult expectation; over 10,000 office workers were programmed for these buildings. In the same urban context, however, he specifies that major boulevards should be lined with low-rise buildings that house shops and restaurants so that "the street would thus be reorganized on a human scale."[13] It is a surprising provision for a designer who most

often appears oblivious to human scale. It is also unrealistic to expect that anyone would have reason to walk along these boulevards given their highway-like width and their redundancy to pedestrian walkways that trace routes between buildings on the interiors of each block. It seems that the inclusion of "human scale" buildings is a response to criticism and not fully thought out: the structures do not exist in any of his perspective drawings and are unclear in plan.

In outlining his design for the suburbs surrounding the core city, retail receives an entirely different treatment. He calls these outlying clusters "cités-jardin" but as exclusively residential enclaves they are more appropriately described as garden suburbs. In the suburbs dense buildings make space for gardens and orchards: "this new type of housing scheme turns the inhabitant of the garden city into an agricultural labourer and *he becomes a producer.*"[14] Aided by a farmer that would be in charge of every 100 plots, families can grow their own fruit and vegetables and store them in communal storehouses for the winter. Other goods and services are provided by an "immense workshop for household economy," at the base of buildings. Managed by a "commissariat" and including "restaurant service, domestic service and laundering," this solution—unencumbered by the filth of the marketplace—follows from a modernist ideal that the functions of urban life can be designed to fulfill every desire without need for change or adaptation.

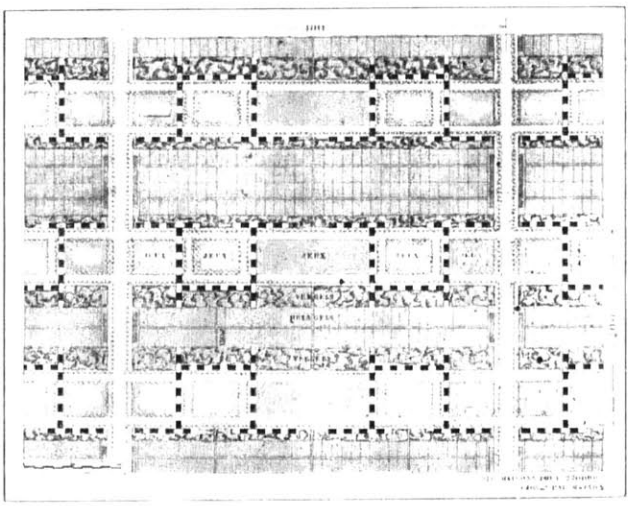


Figure 4. Le Corbusier's drawing for his "cités-jardin." The space between buildings is reserved for agriculture

Despite Le Corbusier's desire to separate transit modes, commercial classifications and household types, he does not suggest that retail should be clustered in some district or kept separate from residential life. We also see in his writing the treatment of retail as a design choice—strung out like gems on the avenue, and supplanted with communal workshops in the suburbs.

Reactions to Modern Retail Forms

Urban designers and planners do not mobilize against a particular retail form until the automobile strip takes hold of the American landscape. The strip was not an entirely new creation; a plan of Dresden in 1833 reveals bits of city protruding into the countryside. And, of course, the shops that extended out the streetcar lines in the later half of the century might be described as strips, although their commercial uses tended to cluster at regular stops and important intersections. But this newest incarnation of the strip was unique: it operated at the automobile scale and thus required bright lights, big signs and a vehicle to get between any two stores.

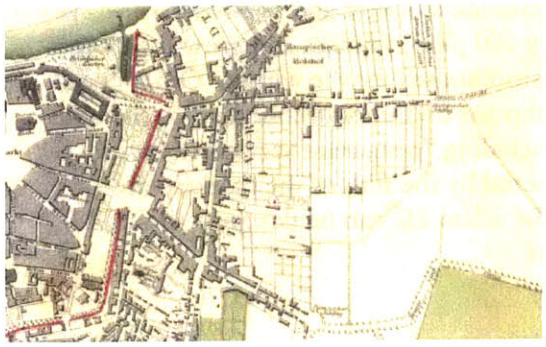


Figure 5. The strip extending out of Dresden (1833)[15]

A Viennese immigrant named Victor Gruen, a chief opponent of the strip, sought to find new ways to centralize civic and commercial functions in vibrant centers similar to those in his home town. His solution to the strip's placeless malaise was the indoor mall. Today anti-sprawl advocates combat the suburban mall in addition to the automobile strip. These activists have many motivations, but are broadly frustrated with land consumption and suburban banality. The group of designers that best represent this broad coalition are the New Urbanists.

Figure 6. The type of strip that inspired Victor Gruen to invent the indoor mall (from *The Heart of our Cities,* 1964)[16]

The New Urbanism seeks to address the entire urban spectrum. Using traditional forms as inspiration, it espouses generally accepted urban planning ideals, such as pedestrian accessibility, legible street systems, compact development and mixed-use places. As a result, its work in the city is unremarkable, but its work in the suburbs is truly unique. The success of the New Urbanism in this regard is in part due to a willingness to account for the needs of the market while promoting dogmatic ideals at the same time. They accomplish this by convincing their clients that their ideals and the needs of the market are one and the same.

One of the founding tenants of New Urbanism relates directly to the relationship between residences and shops. The Charter of the New Urbanism, which is available for download on the Congress for the New Urbanism's website in six languages, states that, "many activities of daily life should occur within walking distance" and "concentrations of civic, institutional, and commercial activity should be embedded in neighborhoods and districts, not isolated in remote, single-use complexes." Their reasoning can be categorized as either in the interest of equality or environmental sustainability. A mix of uses within walking distance and an interconnected street network, the charter argues, "allows independence to those who do not drive, especially the elderly and the young," and "reduce[s] the number and the length of automobile trips, and conserve[s] energy."[17]

Within the charter, no connection is made between its ideals and market feasibility—it serves as an uncompromised vision for the future—but, articles, books and other rhetoric employ this argument readily.[18] Andres Duany, Elizabeth Plater-Zyberk and Jeff Speck, chief advocates for the principles of New Urbanism, accept the notion that, "the suburban aversion to living close to shopping is strong," but they believe, that in many cases, this is the fault of poor design. The difference between the building typologies of a Quick Mart and a corner store is "the volume of the building and its relationship to the street." If designed in a traditional form, they argue, a retail shop can act as a marketing amenity. Moreover, developers are instructed that a corner store, "should not be expected to turn a profit until the neighborhood matures and for that reason the retail space should be provided rent-free by the developer as an amenity; much in the way a conventional developer would construct an elaborate entry feature or a clubhouse."[19]

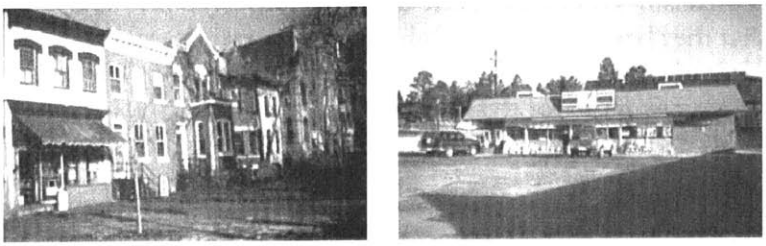


Figure 7. Duany, Plater-Zyberk and Speck argue that the convenience Store on the left "contributes to property values," while the quick mart on the right is considered "blight."

The ability to speak the language of developers and investors has resulted in the implementation of New Urbanist designs by private enterprise at a large scale across the country. Notable examples include Kentlands, Harbor Town, Laguna West, Southern Village, Northwest Landing and Celebration.[20] Kentlands, for example, is over 350 acres.

In developing this argument, architects such as Andres Duany and Peter Calthorpe borrow reasoning developed for the urban environment and apply it to the surburban environment. This reasoning was most forcefully and eloquently cultivated and advocated by Jane Jacobs. It is useful to review her writing to gain some perspective on the foundations of New Urbanism.

In 1961, Jacobs argues that solutions to urban problems are failing because cities require "a most intricate and close-grained diversity of uses that give each other constant mutual support, both economically and socially."[21] This idea gained significant traction in the public discourse and meshed nicely with a generation that was beginning to assign moral priority to things that were complex and diverse. Unlike her New Urbanist decendents, however, she did not attempt to apply her observations to suburban areas. In fact, she includes a cautionary note: "I hope no reader will try to transfer my observations into guides as to what goes on in towns, or little cities, or in suburbs which still are suburban."[22]

She does not suggest by observing the vitality of Hanover Street in the North End of Boston, for example, that such a form would be appropriate at the edge of the city. She only emphasizes that the urban mix-used districts are safer, more vital and more exciting. She makes the following observation of the sidewalk scene on Hudson Street in New York:

> The continuity of this movement (which gives the street its safety) depends on an economic foundation of basic mixed uses. The workers from the laboratories, meat-packing plants, warehouses, plus those from a little industries and offices, give all the eating places and much of the other commerce support at midday. We residents on the street and on its more purely residential tributaries could and would support a modicum of commerce by ourselves, but relatively little. We possess more convenience, liveliness, variety and choice than we "deserve" in our own right.[23]

In making observations such as these she does not reason that residential neighborhoods ought to have nearby retail, but that urban retail is better when it is surrounded by multiple primary uses. The idea that two uses alone—retail and residential for example—would make for a successful urban environment is contradictory to her thesis. This argument does not negate the rhetoric of the New Urbanism—they have made their own observations. It is important to realize, however, that they have pushed beyond their predecessor's assertions in two ways: 1) by proposing that suburban environs should be more urban and 2) by claiming that home buyers will, in some cases, pay more for this way of life.

In Practice

Before embarking on an attempt to test some of the New Urbanist propositions, it is instructive to further examine retail and residential polarization in practice. The previous section reveals that an inclusive attitude toward retail generally prevails in urban theory. At times it is forgotten for more pressing subjects or replaced with communal systems of provision, however, having goods and services near at hand is pursued as the ideal without qualification.

Early Evidence of Retail Separation

Early streetcar suburbs that expanded out from urban agglomerations in the last third of the 19th century included a jumble of uses. On the lines extending from Boston, grocers, hardware stores, carpentry workshops and other commercial establishments clustered at major intersections, and between them walkups, triple-deckers and single-family homes mingled with retail at the edges. Apartments found a place above shops, particularly on the tentacles extending out from the city, such as Washington Street and Huntington Avenue, but in other more affluent or distant locations, such as Coolidge Corner in Brookline and Center Street in Jamaica Plain, a clearer separation of uses begins to emerge. After electrification was established in the 1880s and 1890s, single-story shops begin to appear in these more distant nodes, and are distinct from the residential enclaves that find shelter in the twisting streets behind them. These compressed versions of urban main streets where known as "taxpayer strips." Small enough to be cheap, but large enough to cover taxes, owners expected they would be redeveloped as the area grew. Often, however, they were not rebuilt at higher densities, marking the beginning of an era in use separation.[24]

An advocate for this low density form cannot be found among landscape architects or city officials. The primary civic focus at the end of the 19th century was the provision of water and sewers in order to avoid the periodic plagues and epidemics that had been common in Boston since the 17th century.[25] What did influence the emergence of a-story retail typology was the burgeoning size of the middle class and their increasing ability to reach affordable land for single-family development. While homeownership was not available for a large share of street car dwellers, those with considerable savings or a willingness to endure less frequent service to "pioneer" locations did find the nascent American dream in the suburbs thanks to new modes of transportation. There is a clear correlation between commercial areas that include retail "taxpayer strips" and a preponderance of single-family homes. Although examples of these use-distinct buildings are limited during this period, it does provide evidence that the gradual process of pulling apart retail and residential was well underway before the invention of zoning, the long term mortgage or federal mortgage insurance programs.

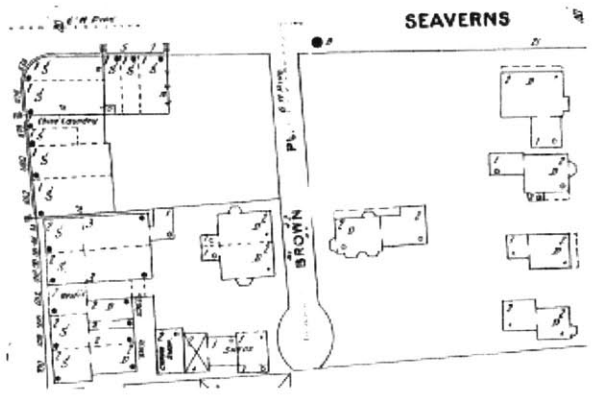


Figure 8. Corner of Center and Seaverns Street (Jamaica Plain, Boston, 1898).
Numbers in top left corners of buildings indicate stories

The Codification of Retail

As illustrated by the preceding discussion, the separation of retail and residential uses was not derived from an intellectual imperative or regulation but instead transportation innovation and the demands of an increasing middle class. It is not until the 1920s that the urge to separate becomes codified into law and supported at the federal level. In the words of Alex Marshall, "zoning just tidies up what would be the basic form of the city anyway."[26] With Herbert Hoover at its helm, the Department of Commerce issued a Standard State Zoning Act in 1926 in order to provide guidance to States in the creation of zoning enabling acts. The influence of this document on the individual zoning laws of municipalities was significant and remains to this day.

The brief nine page template permits local governments to "divide the municipality into districts...and within such districts...regulate and restrict the erecting, construction, reconstruction, alteration, repair or use of buildings, structures or land." More importantly, regulations are instructed to be drafted, "with a view to conserving the value of buildings."[27] The spirit and motivation of this provision was aimed primarily at the most offensive non-residential uses. Indeed, early examples of zoning, such as the first New York City zoning laws in 1916 and the landmark Supreme Court case Euclid, Ohio vs. Amber Realty Co. in 1926, dealt primarily with industrial uses and building bulk. The broad scope of zoning enabling acts, however, provides sufficient authority for the exclusion of retail when the time comes.

The dramatic isolation of retail from residential neighborhoods that we see today is predicated on widespread homeownership and automobile use. This precondition is met after World War II as the homeownership rate climbs toward 60% and car ownership surpasses 25%. As a result, retail generated traffic becomes an increased nuisance and the single-family home cements its status as sacred and untouchable. By the late 1950s, recommendations for the isolation and buffering retail are available from the federal government.[28]

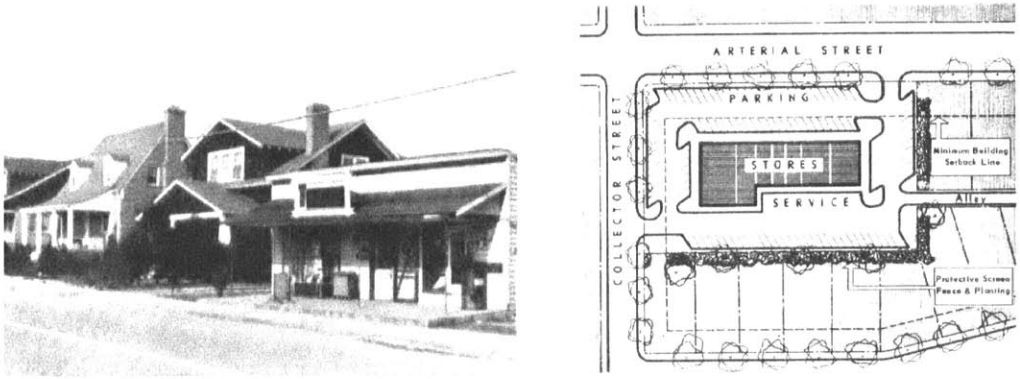


Figure 9. Images from the the Housing and Home Finance Agency's "Suggested Land Subdivision Regulations." The caption for the image at left reads, "covenants should prevent intrusion of business uses which depreciate residential property values"

The Debate

The history of urban thought includes many machine-age impulses to separate the uses of urban life, particularly in Howard and Le Corbusier's utopian cities. These ideas had strong influence on both the growth of new cities and suburbs as well as the redevelopment of existing cities. However, the literature includes no direct assault on retail itself. On the contrary, it is almost always inclusive (if sometimes oblivious to market realities) and since the 1960s the intellectual discourse has been dominated by those seeking the reintegration of multiple uses into the residential fabric of urban communities if not suburban ones as well. Arguments for the isolation of retail only emerge when examining the treatment and valuation of retail in practice. These causes can be described simply as the advent of the automobile (and its preceding innovations) and the growth of the middle class. Together they enabled the attainment of home ownership for a majority of Americans, and an increased desire *and ability* to keep retail, although much needed, at arms length. Resistance to this trend currently finds itself most persuasive in the New Urbanism movement.

From theory and practice a debate emerges about the value of retail in the human environment and the form it should take. On one side, the New Urbanists suggest that pedestrian accessible retail is actually valued in the marketplace for homes. On the other, a common belief pervades that homeowners would much prefer to avoid the traffic and noise associated with retail. Alex Marshal, perhaps an appropriate representative of this viewpoint has argued that real town centers—the places New Urbanists seek to emulate—remain depressed and unappreciated.

In the remaining chapters, I will attempt to test the following hypothesis of the New Urbanism:

> When retail is integrated into neighborhoods using traditional neighborhood design, its presence not only reduces car use and facilitates social interaction; it creates value for residential properties.

This hypothesis implies the following premises:

1. Retail has positive amenity value.
2. Retail generates negative externalities—traffic, noise and smell.
3. Traditional neighborhood design increases the amenity value by improving pedestrian accessibility for those most affected by negative externalities, and decreases the externalities themselves by visually sheltering parking and calming traffic.

Evidence from Empirical Research

The hypothesis that homeowners appreciate a comfortable distance from commercial uses has been tested empirically with mixed results. As early as 1975, econometricians debated the rationale for zoning.[29] Lafferty and Frech's results from 153 towns and cities in eastern Massachusetts "support the conventional position that certain land uses do have an inimical effect on home values."[30] Among these uses is retail which is identified to have a detrimental effect on home values while in one's neighborhood, but a positive effect while in

one's town or city. This crude approximation of distance becomes more sophisticated in later research as computational abilities increase.

In 1980, Li and Brown more precisely investigate the effect of non-residential uses on home values. Using data from 26 towns in the southeastern sector of the Boston metropolitan area, they measure the impact of proximity to oceans, rivers, on-ramps, conservations, recreational areas, schools, industry, commercial uses and highways. Their findings "suggest that proximity to certain non-residential land uses have a positive value for accessibility and negative value for external diseconomies."[31] The variable most relevant to the inquiry in this paper is not defined but described vaguely as "commercial." It appears to represent nodes of retail and jobs; summary statistics indicate that every house in the study is within just over 2 miles of these locations. Their results, illustrated graphically in **figure 10**, are somewhat surprising. In their estimates, the accessibility value dominates the externality effect across the distance spectrum. Moreover, price is expected to actually *accelerate* when approaching commercial uses within 100 meters. While somewhat promising for proponents of mixed-use communities, it is inappropriate to draw connections between this finding and retail proximity specifically. More recent studies have convincingly shown that job accessibility, not simply distance to a cities central business district as controlled for by Li and Brown, has a profound effect on home prices.[32] Because they do not accurately distinguish between retail and employment proximity, the meaning of their results, for our purposes, is obscured.

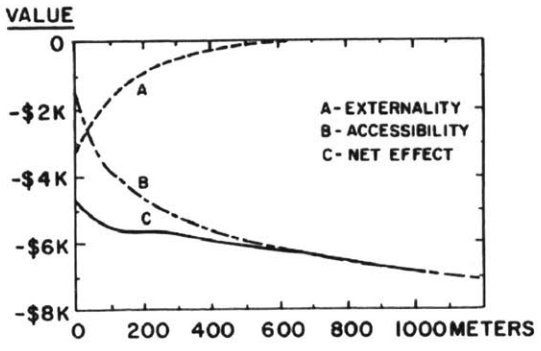


Figure 10. The effect of commercial activity on home values as measured by Li and Brown in 1980

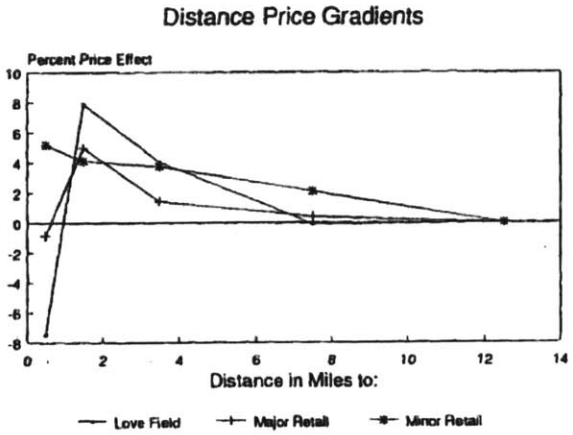


Figure 11. The effect of retail on home values as measured by Wadell et al. in 1993

In a 1993 study of homes in Dallas, Wadell, Berry and Hoch identify a price gradient surrounding major retail malls and minor shopping strips. Major retail centers, they find, have a small but negative effect on property values when within half of a mile, which quickly becomes a 5% premium when beyond a mile and diminishes with increasing distances (see **figure 11**). "Minor shopping strips," which are not clearly defined, do not have a negative proximity effect and register a 5% premium when within half a mile. This finding brings into question the justification for zoning and design standards that isolate retail from homeowners. However, it may in fact reflect the *success* of single-use development standards (keep in mind this is a study of Dallas). Also, the study does not attempt to model the gradient within half of a mile.

2 METHODOLOGY

> Real-estate values are the ultimate reality check. They reveal at a glance what society values, versus what it says it values or thinks it values.
> —Alex Marshall, *How Cities Work* (2000)[33]

In order to test the hypothesis identified in the previous chapter, Boston's suburbs, towns and satellite cities serve as a evidence. The region is ideal for this inquiry because it includes many traditional town centers that allow for pedestrian connectivity, as well as typical suburbs that tend to block expeditious pedestrian traffic. This analysis examines 58 "pedestrian oriented" retail clusters and 33 "automobile oriented" pedestrian clusters in the Boston metropolitan area. The residential neighborhoods that surround these places are used to test the relationship between proximity to retail clusters and property values. This chapter outlines the methodology for identifying retail clusters, measures their relationship to residences and specifies a hedonic model which provides insight to the New Urbanist hypothesis.

Datasets

The retail dataset used identifies the location and industrial classification of every business in the Boston metropolitan area (excluding Boston). From this immense group of over 70,000 points, the data is truncated to just under 19,000 "high-frequency/convenience" locations (see appendix D). This is done in order to focus on those places that serve the everyday needs of a community's residents. It would not be appropriate to identify places that are destination oriented and low-frequency because they serve a larger market and provide less benefit to the immediately surrounding area.

The residential property dataset used includes 45,000 transactions for both single-family and condominium residences in the towns surrounding Boston from 2005. The Warren Group collected the transaction data and combined it with town information that includes property characteristics such as lot size and number of bedrooms. In addition, a number of town level variables were appended by the Housing Affordability Initiative at the MIT Center for Real Estate. Towns neighboring downtown Boston—Brookline, Somerville and Cambridge—are excluded from the study because neighboring amenity clusters in Boston are not accounted for.

Model Specification

To measure the impact of retail clusters on property values, the study uses a semi-log hedonic model. In order to control for the most influential differences in town variation, employment accessibility and school quality are included. Experiments with a town level fixed-effect suggest that it is generally inappropriate for this analysis. The fixed-effect model can be powerful because it captures an array of town characteristics without relying on actual measures of the underlying town characteristics and amenities. It appears, however, that it

explains too much of this variation and obscures retail proximity effects (see Appendix E for town level fixed-effect results).

The semi-log, a typical choice for this type of analysis, was selected because it fits the data well and allows for a simple interpretation of the results. Coefficients represent the percentage change in price associated with a 1 unit change in the independent variable.

Using only the site and building characteristics provided by the Warren Group and the town level characteristics described above, this model explains over 50% of the variation in condominium and single-family home prices. Much of the variation remains unexplained. Important building characteristics such as storage space (attics, basements, and garages) and construction quality are not accounted for. Additionally, intra-town spatial characteristics are not included. The inquiry in this study requires intra-town spatial characteristics, to measure both proximity to retail and to control for correlated spatial factors.

The model, therefore, expects residential values to be a function of a set of *site and building characteristics*, a set of *town control variables,* a set of *spatial control variables,* and *retail proximity.*

LN of Price = F(site and building characteristics, town controls, spatial controls, retail proximity)

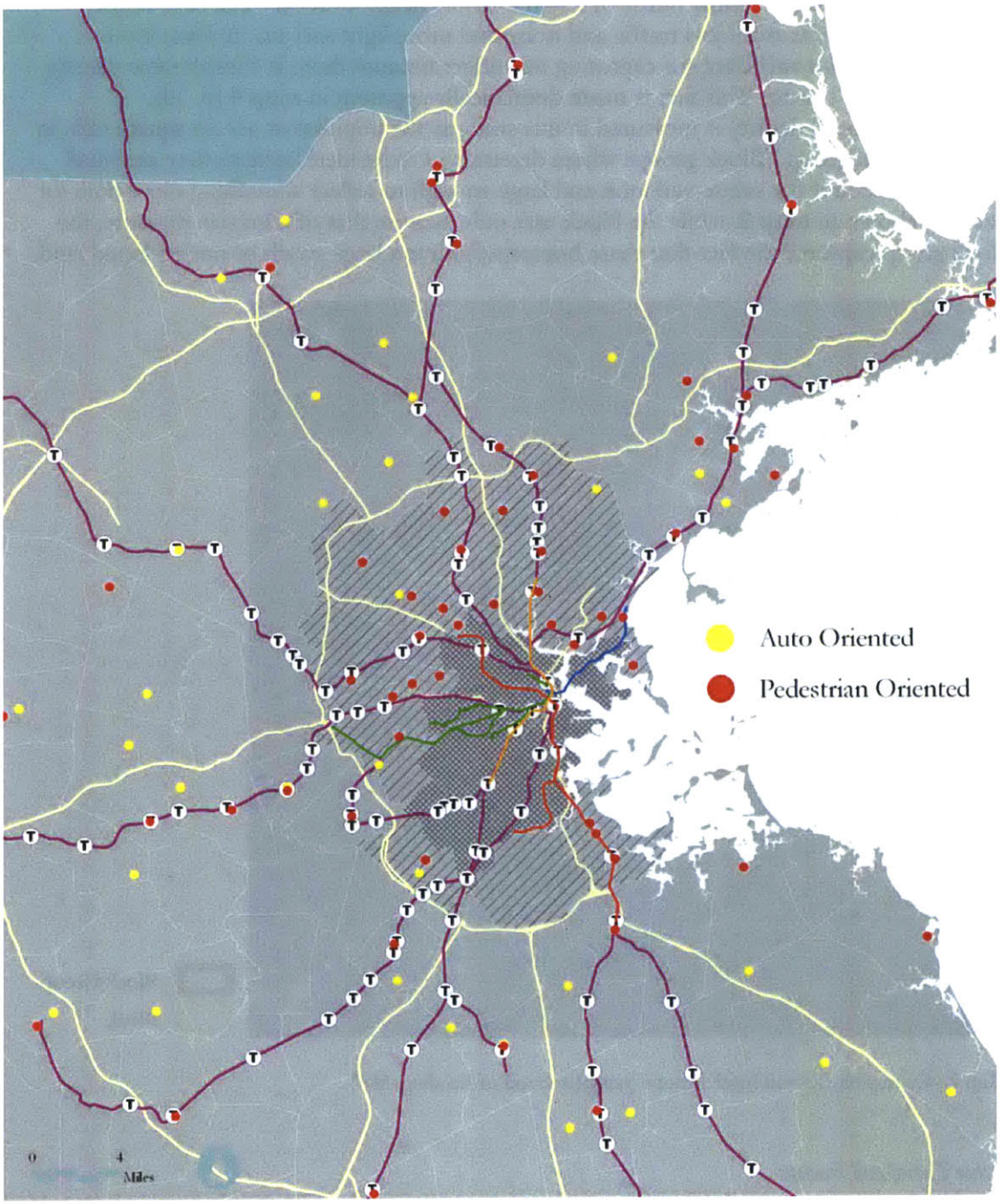
In order to measure how the retail clusters impact home prices in their communities, the sample is reduced to include only the neighborhoods within a reasonable distance of each cluster. Including other communities clouds the analysis with observations in places that have a host of unknown spatial qualities. Experimenting with different distances reveals that 2 miles is an appropriate radius outside route 128 and ¾ of a mile is an appropriate radius inside route 128.

Spatial Control Factors

Proximity variables can easily result in spurious findings if correlated characteristics are omitted. Variables that measure the proximity of transit stations and neighborhood density are added to the model in order to control for these spatially correlated factors.

Rail Transit

An immediate concern when seeking to understand the value of a pedestrian friendly shopping environment is the tendency to find a transit station in these locations. Of course, the pedestrian traffic created by train stations also generates business and maintains the pedestrian orientation in these locations. Former studies, such as Chen, have identified positive transit station effects; therefore any study that wishes to isolate the effects of retail must separate out the benefit created by transit access.[34] To do so, a variable that measures the distance to the nearest commuter rail or mass transit station is created. Of the 58 pedestrian retail clusters identified, 36 are located near train stations (see **map 1**). Only 2 of the automobile oriented clusters are near rail stations.



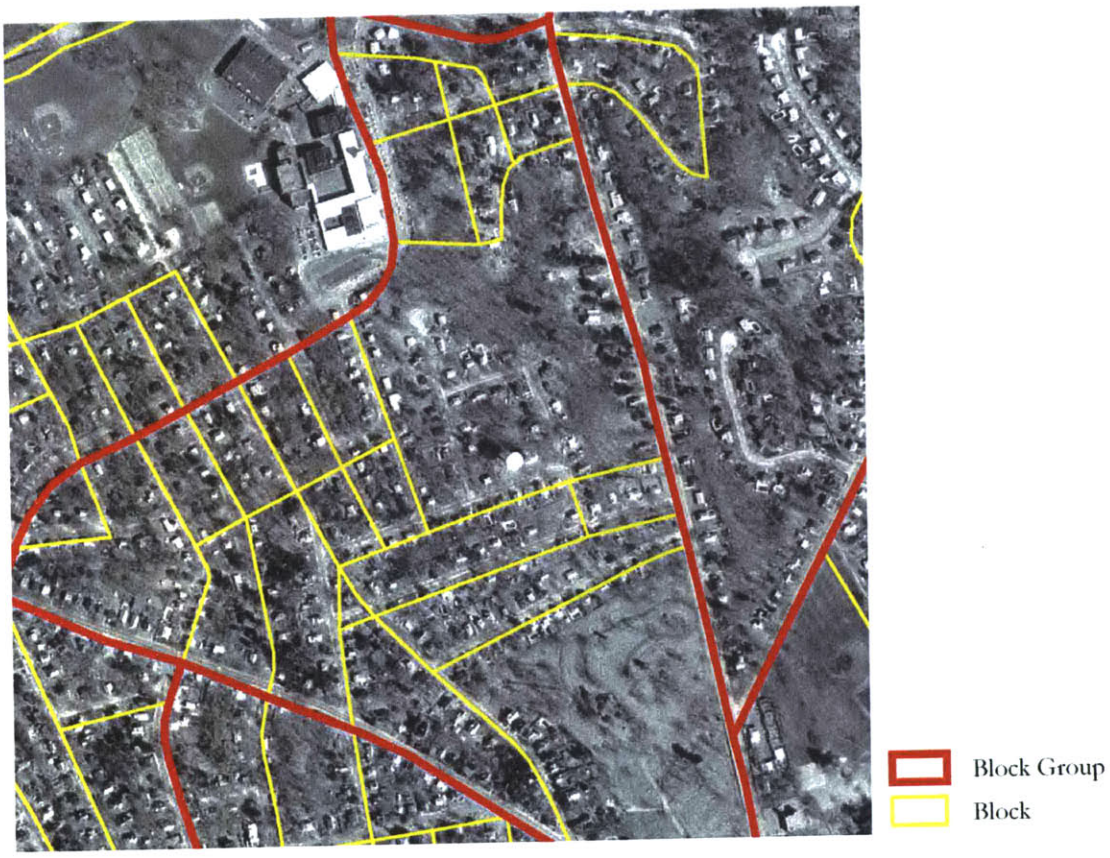
Map 1. Retail clusters and transit stations

Neighborhood Density

Real estate economics clearly identifies an inverse relationship between neighborhood density and price.[35] This effect exists independent of site density which is accounted for by the lot size measure. For example, a single-family house in a multi-family neighborhood will

be less valuable than the same house in a single-family neighborhood. The later house theoretically benefits from less traffic and noise and more light and air. A town level measure is also not sufficient for capturing this effect because there is considerable density variation within towns. This fact is made dramatically apparent in **map 4** (p. 30).

Neighborhood density is measured in this study as the population per *dry* square mile in a census block group. Block groups where determined to be ideal because they are small enough to account for subtle variation and large enough to reflect something more than lot size. As shown in **map 2**, while the block unit only mirrors that of a lot size measure, the block group captures the fact that these homes neighbor a large swath of undeveloped land.



Map 2. Census blocks and block groups (neighborhood of Reading, MA)

Other Correlated Factors

Most major retail exists on high traffic roads. These roads with their requisite cars, trucks and buses are the source of significant negative externalities—noise, smoke and congestion. This fact is never forgotten in the permitting process of retail developments and is often the argument for "traffic mitigation" requirements, "impact fees" or simply permit rejection. This correlated variable, however, is not a concern for this study. If one wished to identify the impact of retail versus no retail, an ability to disentangle these two effects would be necessary. However, because this research is interested in the net effect of retail, and traffic

is a prerequisite for any retail agglomeration, the traffic should be considered an inextricably linked externality.

The exception made in this study is highway on-ramps. While a retail cluster of any kind requires traffic, highway on-ramps serve a much higher level of traffic and are likely to have a disproportionate number of noxious uses that serve cars and trucks specifically. Additionally, the highway itself emits noise and pollution from cars that have no relationship to the retail itself. While a measure of on-ramp proximity may have accounted for this, the choice was made to simply exclude those clusters that were immediately adjacent to on-ramps.

Spatially Uncorrelated Factors

As one moves away from any retail center, residential properties are not the only uses encountered. Random elements both good and bad inevitably emerge (schools, bodies of water, highways, railways, industrial properties, hills, valleys and sometimes more retail). What maintains the legitimacy of this study is that by pooling together multiple clusters these elements are random. Statistically speaking these factors remain in the error term and do not compromise the coefficients.

Retail Clusters

Retail clusters are identified by examining retail density. Pedestrian oriented centers are identified as those places that have 15 or more stores with a density of 30 stores per ¼ mile radius. The identification of automobile oriented centers requires a broader definition due to their low density. Clusters that have 10 or more stores with a density of 20 stores per ¼ mile are candidates for automobile oriented designation. Satellite imagery is then reviewed in order to determine whether the potential clusters qualify as pedestrian oriented or automobile oriented. The clusters and their typology are listed in **table 1** and **2.** They are defined as follows:

> *Pedestrian Oriented.* A traditional town or city center that has a core of well defined streets and parking that is isolated behind buildings. The surrounding residential neighborhood and other uses are connected to the retail by a network of streets.
>
> *Automobile Oriented.* A cluster of retail whose buildings are generously setback to provide for parking. The surrounding residential neighborhood and other uses are disconnected from the retail due to the prevalence of feeder roads and cul-de-sacs.

Those places that show evidence of a traditional past but whose core has been hollowed out over the years to accommodate vehicular traffic are not included in the study because they exhibit characteristics of both categories. Any cluster that is near an on-ramp to a limited access highway is also excluded because of its unique and perhaps overwhelming impact on the surrounding environment.

To measure proximity, each home's distance to the nearest store *that is part of a retail cluster* is calculated in meters. For homes that are outside of the commercial area this represents the distance to the edge of the district. For those residences that are inside the

TABLE 1: RETAIL CLUSTERS OUTSIDE ROUTE 128

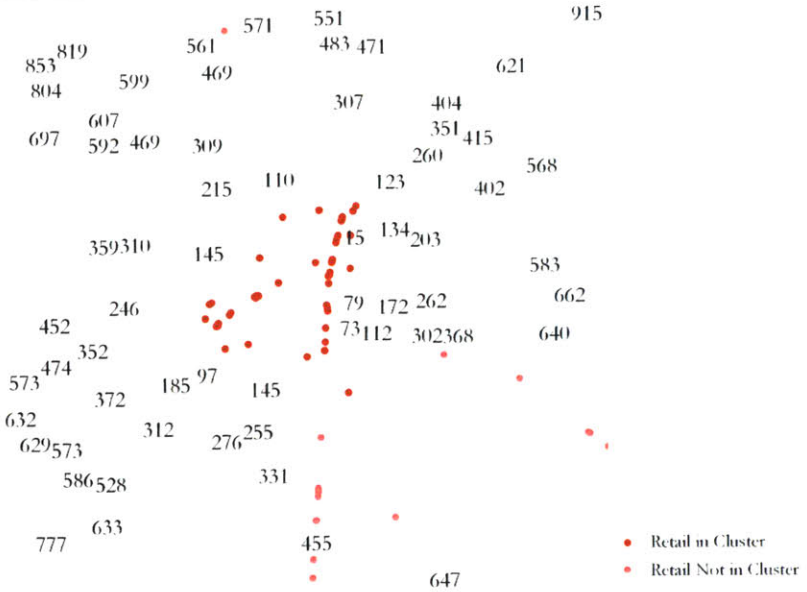
Pedestrian Oriented		Automobile Oriented	
Cluster Name	Square Feet	Cluster Name	Square Feet
Amesbury (Sparhawk)	161,731	Ashland (Pond St)	107,740
Andover (Main St)	376,214	Bedford (Great Rd)	173,737
Beverly (Park St)	445,706	Billerica (Boston Rd)	189,990
Braintree (Hancock St)	181,484	Brockton (Belmont St)	254,986
Brockton (Main St)	178,225	Brockton (Crescant St)	124,741
Danvers (High St)	322,223	Burlington (Murray Ave)	165,738
Framingham (Downtown Framingham)	180,976	Canton (Washington St)	324,732
Franklin (Central and Main)	83,237	Concord (Commonwealth Ave)	128,238
Gloucester (Main St)	474,956	Dracut (Broadway)	80,993
Haverhill (Water St)	285,217	Framingham (Edgell Rd)	134,489
Hingham (Hingham Village)	235,728	Framingham (Rt 9)	1,149,415
Ipswich (Central St)	164,480	Hanover (Columbia Rd)	152,489
Lawrence (Essex and Broadway)	492,439	Hudson (Hudson Rd)	159,740
Lawrence (South Broadway)	28,993	Lowell (Middlesex St)	170,989
Lowell (Merrimack and Gorham)	624,932	Marlboro (Boston Post Road W)	61,494
Mansfield (N Main St)	159,487	Marlboro (E Main St)	98,740
Marblehead (Atlantic Ave)	423,210	Marshfield (Ocean St)	162,988
Marlborough (Weed St)	199,977	Medway (Rt 109)	136,237
Maynard (Main St)	224,231	Middleton (S Main St)	196,988
Milford (Main St)	147,230	Milford (Medway St)	417,975
Natick (Main St)	223,231	Norwell (Washington Street)	226,485
Needham (Needham Center)	286,473	Norwood (Boston Providence R)	134,742
Newburyport (Merrimac St)	508,455	Plainville (Taunton St)	154,987
Norwood (Washington St)	449,205	Randolf (N Main St)	368,724
Peabody (Peabody Sq)	318,218	Salem (Highland Ave)	107,994
Reading (Main St)	305,224	Stoneham (Main St)	139,244
Salem (Washington and Essex)	503,196	Stoughton (Washington St)	304,728
Scituate (Front St)	218,232	Sudbury (Boston Post Rd)	157,736
Stoughton (Pearl St)	146,483	Swampscott (Paradise Rd)	327,976
Taunton (Broadway)	184,984	Taunton (Winthrop St)	151,491
Wellesley (Central St)	185,981	Tewksbury (Main St)	190,739
		Wellesley (Linden St)	88,245
		Wilmington (Main St)	192,741

commercial area the measure is simply the closest establishment in any direction. A simpler measure which calculates the distance to the center of these areas fails to work well in the model because it does not respect the non-circular nature of clusters which tend to be linear or star like. This pattern and measurement method are illustrated in **map 3.**

In addition, units abutting retail structures are approximately identified as those units that are within 50 meters of any "high frequency/convenience store" as defined earlier. This dummy variable is included in order to ensure quadratic gradient results are accurate.

TABLE 2. RETAIL CLUSTERS INSIDE ROUTE 128

Pedestrian Oriented		Automobile Oriented	
Cluster Name	Square Feet	Cluster Name	Square Feet
Arlington (Mass and Broadway)	260,978	Newton (Needham St)	55,245
Arlington (Mass and Lake St)	116,489	Lexington (Mass and Sow)	74,489
Arlington (Mass and Park Ave)	118,239	Dedham (Providence Hwy)	94,493
Belmont (Center)	146,987	Saugus (Rt. 1)	128,733
Chelsea (Park and Broadway)	287,704		
Dedham (Washington St)	240,227		
Everett (Broadway and Norwood)	132,233		
Lexington (Mass Ave)	311,976		
Lynn (Central Sq)	694,438		
Malden (Pleasant St)	356,207		
Medford (Salem St)	257,232		
Melrose (Main Street)	304,226		
Newton (Newton Center)	259,723		
Newton (Watertown St)	152,733		
Quincy (North Quincy)	217,982		
Quincy (Quincy Center)	794,680		
Quincy (Wollaston)	74,743		
Revere (Broadway)	196,483		
Revere (Revere Beach)	92,985		
Stoneham (Main St)	245,222		
Wakefield (Main St)	294,967		
Waltham (Moody and Main St)	668,430		
Watertown (Mt Auburn)	75,238		
Watertown (Watertown Sq)	246,223		
Winchester (Winchester Center)	264,477		
Winthrop (Woodside Ave)	205,230		
Woburn (Main St)	195,226		



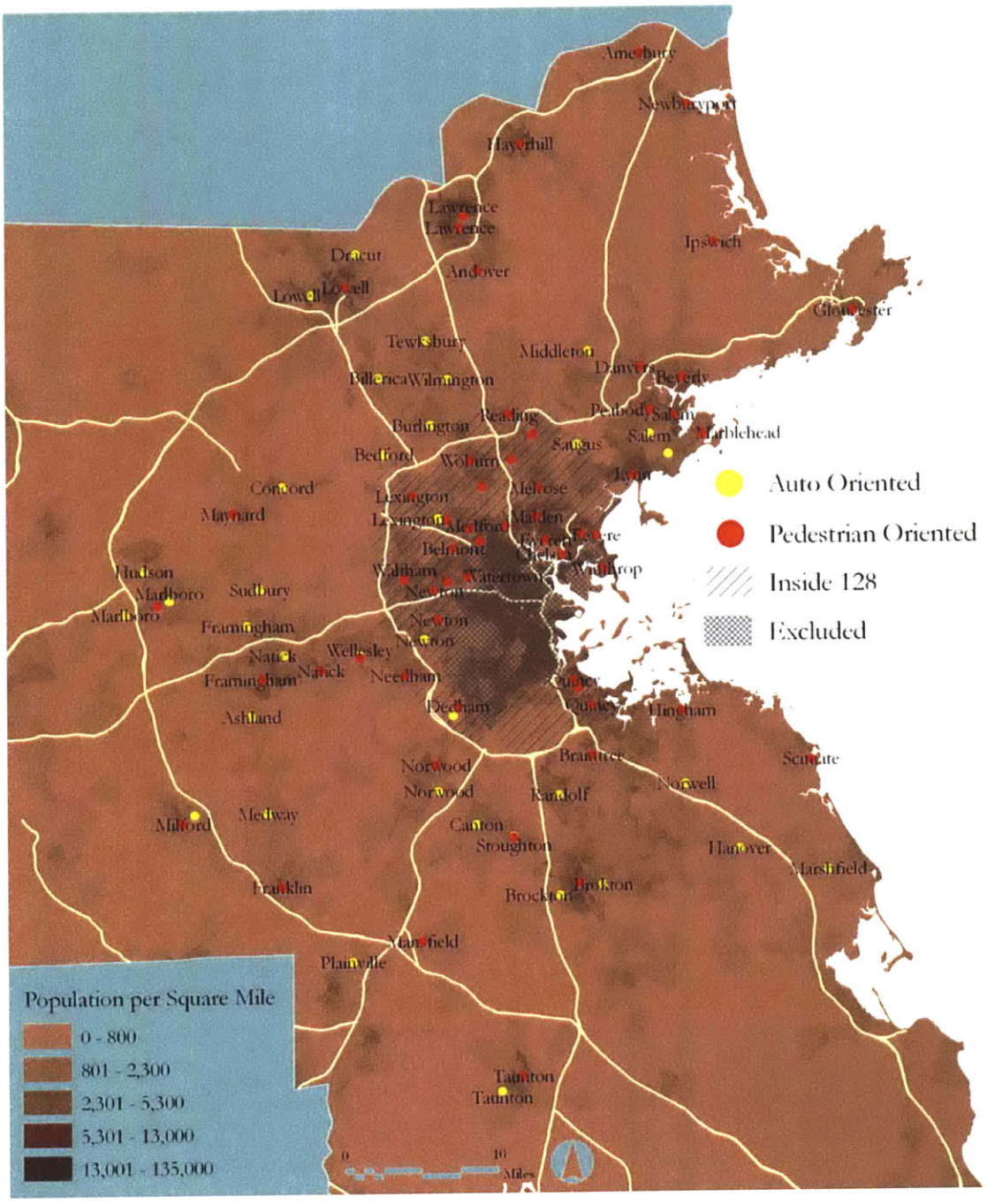
Map 3. Example of pedestrian oriented cluster and distance variable for actual home sales (Reading, MA)

What This Model Does Not Measure

In any analysis it is important to understand what is being analyzed and what is not captured by the scope of the research. This study focuses on the difference between two types of clusters—those traditional in form and those of a more contemporary character. The findings have implications about the economic value of the connected traditional neighborhood centers espoused by the New Urbanists. The following areas, however, are not addressed.

Clusters versus Strip. In reaction to the modern era's innate ability to create an even spread of urbanism or suburbanism across the landscape, many urban critics have advocated for the value of clusters as a solution for environmental, social and mass transit problems. While it may be possible to test for evidence of the social malaise created by what Richard Sennett calls "neutrality," this analysis does not.

Retail versus no Retail. Every urban planner has encountered a community concerned with retail encroachment on a residential community. For these planners and the developers promoting these projects, a general understanding of the impact of individual retail developments on home values would be useful. To study at a regional scale (which is appropriate in order to make accurate observations without bias) it would be necessary to have some measure of road proximity because of its likely impact on home values with or without retail.



Map 4. Retail clusters and population density

3 FINDINGS

America wants to drive cars, right? I have an S.U.V. and I like driving it. I'm sorry!
—Brad Stand, real estate developer in *I Heart Huckabees* (2004)

This analysis finds that single-family home buyers have no interest in being within walking distance of traditional pedestrian-accessible town centers in outer-suburban Boston. It also reveals that Euclidean zoning successfully mitigates the impact of retail on home values. Conversely, inner-suburban residents appear to have a stronger affinity for retail and pay a premium for homes that are just barely within walking distance of retail clusters. Other findings—that condominium buyers prefer pedestrian centers to strip centers—have intuitive appeal but are less robust.

Description of Clusters

The clusters identified using the methodology in the previous chapter have characteristics that provide a strong foundation for design typology comparison. The spatial distribution of the clusters identified and knowledge of the Boston metropolitan area, indicates that this inquiry will be most accurate if clusters outside of Route 128 are compared with each other, and the predominately traditionally defined clusters inside Route 128 are studied separately.

TABLE 1. SUMMARY OF CLUSTER CHARACTERISTICS BY TYPE

	Avg Cluster Density*	Avg Cluster SF	Avg Store SF	Sales per SF
Outside Route 128				
Pedestrian Oriented (31)	47	281,302	4,818	298
Auto Oriented (33)	27	210,250	7,015	263
Inside Route 128				
Pedestrian Oriented (27)	45	267,084	4,902	158
Auto Oriented (4)**	23	88,240	4,253	224

*cluster density is defined as the number of stores within 1/4 mile

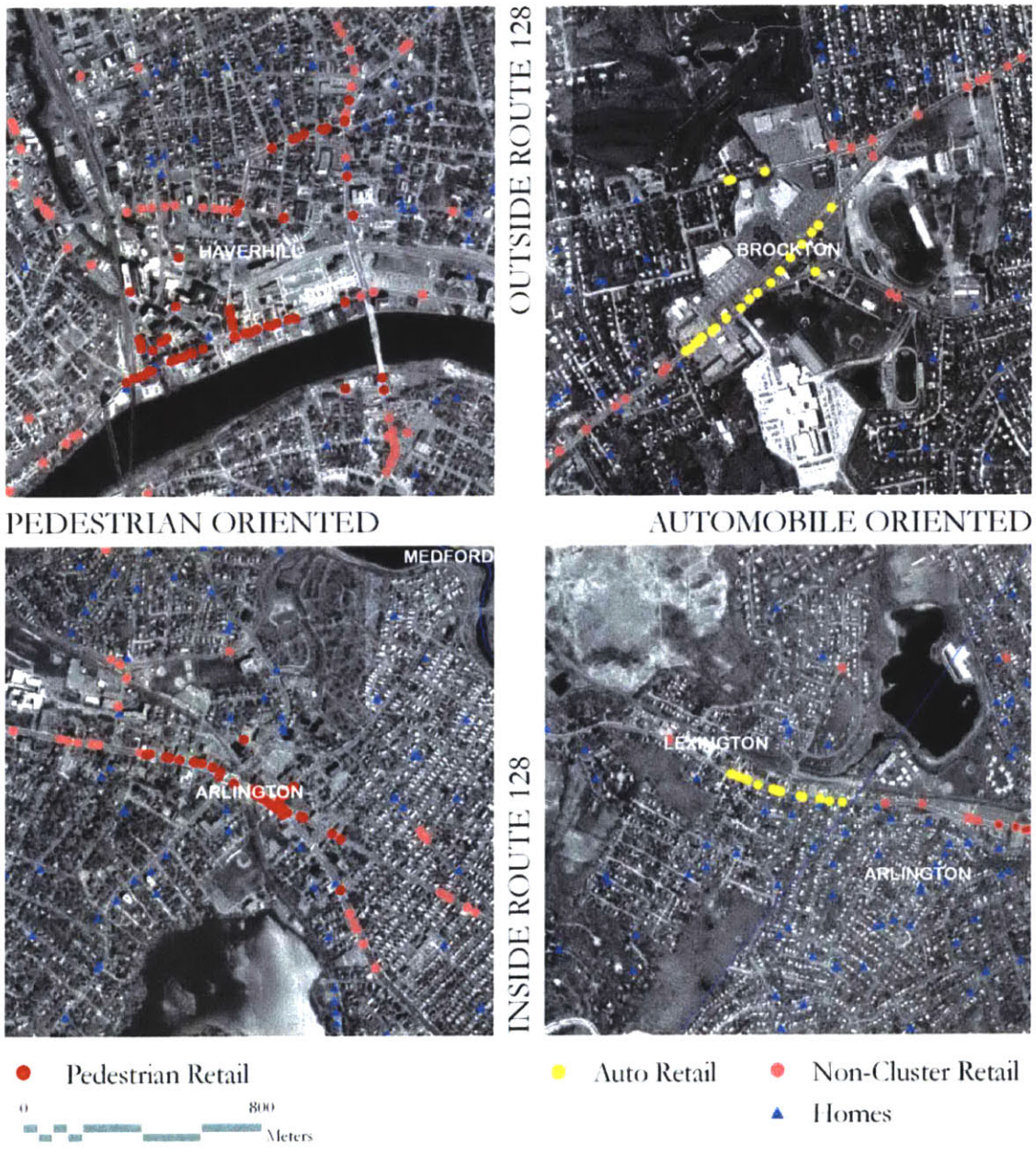
**this group is not included in analysis due to small size and location bias

In aggregate, the clusters outside of Route 128 exhibit characteristics that are appropriately reflective of their typologies (see **table 1**). Beyond Boston's inner belt there are 31 pedestrian oriented places and 33 automobile oriented places. Their size (as measured in square feet and sales per square foot) are similar, on average, which indicates that they are similar in vitality and commercial viability. The higher density of the pedestrian oriented centers, 47 stores per quarter mile, is a direct byproduct of the methodology used to identify their location. Reassuringly this dispersion is made up for by smaller stores in traditional centers, which average about 2,000 square feet less in size than in strip style counterparts.

Within Route 128 there are 27 pedestrian oriented retail centers and only 4 automobile oriented clusters. Of course additional strip retail does exist within 128; however, they do not cluster at levels meeting the requirements of a "cluster" as defined in the methodology section. The ports, villages, town centers and rail suburbs that make up the remaining

clusters are of comparable size to their more suburban counterparts. The shops in these locations sell less per square foot, which is surprising and evades explanation.

While these summary statistics suggest that the typologies divide Boston retail clusters into coherent and distinctive groups, it goes without saying that cities within a given group differ from each other in important ways (appendix D includes more details on each cluster). The images in **map 1** are examples of average clusters from each of the four types.



Map 1. Examples of average clusters in each cluster type:
Haverhill, Brockton, Lexington and Arlington (clockwise from top left)

TABLE 2. REGRESSION RESULTS

	Base		Outside 128 (ped)		Outside 128 (auto)		Inside 128	
	sf	condo	sf	condo	sf	condo	sf	condo
Dependant: Natural Log of Price								
Age (10-30)	-0.036539	-0.112042	0.028307	-0.071084	-0.025855	-0.128304	-0.244082	-0.185140
	(-3.86)	(-10.02)	(1.42)	(-3.93)	(-1.46)	(-6.42)	(-3.66)	(-9.05)
Age (30-50)	-0.059148	-0.253307	-0.002974	-0.208399	-0.062376	-0.245362	-0.163100	-0.231482
	(-6.35)	(-18.86)	(-0.16)	(-10.28)	(-3.84)	(-10.57)	(-2.9)	(-9.94)
Age (50+)	-0.107940	-0.046550	-0.044017	-0.020672	-0.116904	-0.043045	-0.142529	-0.149139
	(-11.62)	(-2.86)	(-2.5)	(-0.93)	(-7.19)	(-1.47)	(-2.73)	(-6.88)
Bathrooms (2)	0.103144	0.151481	0.122932	0.112144	0.091266	0.096053	0.057598	0.105139
	(16.63)	(15.73)	(11.94)	(7.76)	(9.22)	(6.32)	(3.27)	(6.18)
Bathrooms (3+ condo)		0.138874		-0.039640		0.012718		-0.043530
		(5.29)		(-0.87)		(0.27)		(-0.88)
Bathrooms (3 sf)	0.195330		0.258834		0.205935		0.243039	
	(16.34)		(12.14)		(10.19)		(6.52)	
Bathrooms (4+ sf)	0.3509		0.4544		0.4302		0.2753	
	(16.38)		(12.26)		(11.6)		(4.74)	
Bedrooms	0.0347	0.0631	0.0284	0.0593	0.0387	0.0989	0.0371	0.0648
	(9.16)	(9.31)	(4.74)	(6.48)	(6.34)	(9.13)	(3.89)	(6.05)
Internal Square Feet	0.0002	0.0003	0.0002	0.0004	0.0002	0.0004	0.0002	0.0003
	(53.38)	(36.78)	(30.42)	(28.32)	(29.56)	(25.04)	(15.34)	(15.89)
Lot Square Feet	2.93E-07		3.48E-07		6.32E-07		6.49E-06	
	(2.97)		(1.36)		(2.73)		(4.99)	
Townhouse		0.0856		0.0970		0.0895		0.0231
		(8.91)		(6.76)		(5.32)		(1.06)
Employment Access Index	0.1688	0.1561	0.2604	0.1908	0.3420	0.3601	0.3406	0.5331
	(20.75)	(11.11)	(16.66)	(8.85)	(19.69)	(11.54)	(7.18)	(14.42)
School Quality Index	1.2216	0.8301	1.2423	1.0257	1.2697	1.0217	1.1694	0.2709
	(42.03)	(19.54)	(32.55)	(20.48)	(26.67)	(14.56)	(10.33)	(4.02)
Train (<100m)	0.1277	0.0729	0.1300	0.0527	0.1083	-0.1138	0.0725	-0.2082
	(1.25)	(1.26)	(0.89)	(0.85)	(0.86)	(-1.08)	(0.28)	(-2.87)
Train (100-400m)	0.0387	0.0270	0.0226	0.0314	0.0829	0.0105	0.0047	0.0450
	(1.9)	(1.38)	(0.85)	(1.26)	(2.61)	(0.42)	(0.14)	(2.09)
Train (400-800m)	0.0282	0.0326	-0.0106	0.0138	0.0490	0.0372	-0.0017	0.0388
	(2.39)	(2.16)	(-0.72)	(0.79)	(2.84)	(1.8)	(-0.09)	(2.28)
Neighborhood Density	-4.41E-06	-3.43E-06	-5.55E-06	-1.76E-06	-4.15E-06	-7.42E-06	-3.26E-06	-3.98E-06
	(-4.47)	(-2.9)	(-4.46)	(-1.27)	(-2.94)	(-4.54)	(-2.27)	(-3.98)
Abutting Retail (<50m)			-0.0430	0.0238	-0.0489	-0.0011	-0.0872	0.0121
			(-1.76)	(1.27)	(-1.82)	(-0.06)	(-2.71)	(0.7)
Distance to Ped Retail			7.25E-05	2.34E-05			2.07E-04	1.93E-04
			(3.45)	(1)			(2.04)	(2.57)
Distance to Ped Retail ^ 2			-1.99E-08	-1.46E-08			-1.51E-07	-1.27E-07
			(-3.34)	(-2.18)			(-2.01)	(-2.11)
Distance to Auto Retail					-4.96E-06	1.55E-05		
					(-1.03)	(2.57)		
Adjusted R Squared	0.50	0.56	0.53	0.55	0.52	0.59	0.48	0.55
N	24,973	7,433	9,518	3,557	8,594	2,918	2,862	2,196
Distance Descriptive Statistics								
Mean			1,670	1,556	1,860	1,668	692	545
Std. Dev.			855	971	807	947	307	324
Min			7	0	10	5	16	2
Max			3,200	3,198	3,199	3,199	1,200*	1,199*

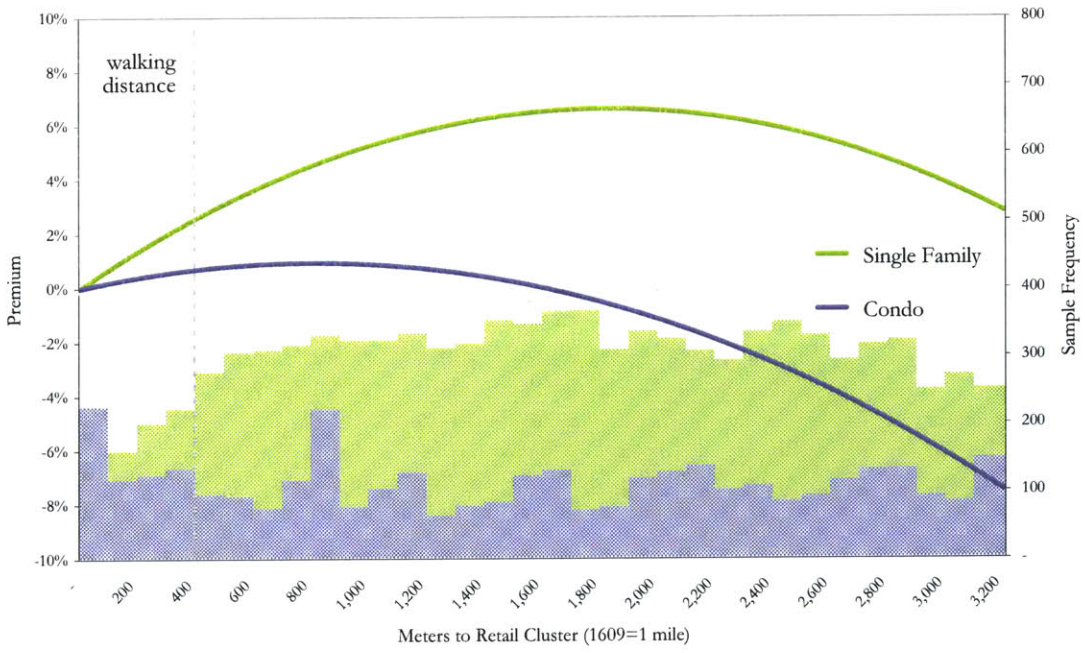
Note: t-scores are shown below coefficients in parentheses
*sample inside 128 is intentionally limited to 1,200 meters

Outside Route 128, Pedestrian Oriented Clusters

Are suburbanites willing to pay more to live within walking distance of traditional town centers? My first look at this question focuses on towns and cities outside Route 128. The green line in **figure 1** illustrates the fairly unequivocal finding that they are not. Up to a point (estimated at 1,800 meters, or little over a mile), houses become more expensive the farther away they are from retail, all else equal. I estimate that the premium for being a mile from retail (compared to being next door) is about 6%. Other models employing level town fixed-effects, alternate train proximity variables and more flexible functional forms all produce similar results, with home prices peaking somewhere just beyond a mile.

The condominium price gradient shown by the blue line in **figure 1** indicates that condominium home buyers prefer to be closer to retail clusters than single-family residents. The positive coefficient that gives the gradient its curvilinear shape is not significant; however, the standard error is about the same as its single-family counterpart and thus warrants inclusion. The results indicate that condo buyers prefer to be about ½ of a mile from traditional retail clusters. This finding is less robust than the previous: using a town fixed-effect model makes the condominium gradient look more like single-family homes.

FIGURE 1. OUTSIDE ROUTE 128 (PEDESTRIAN)

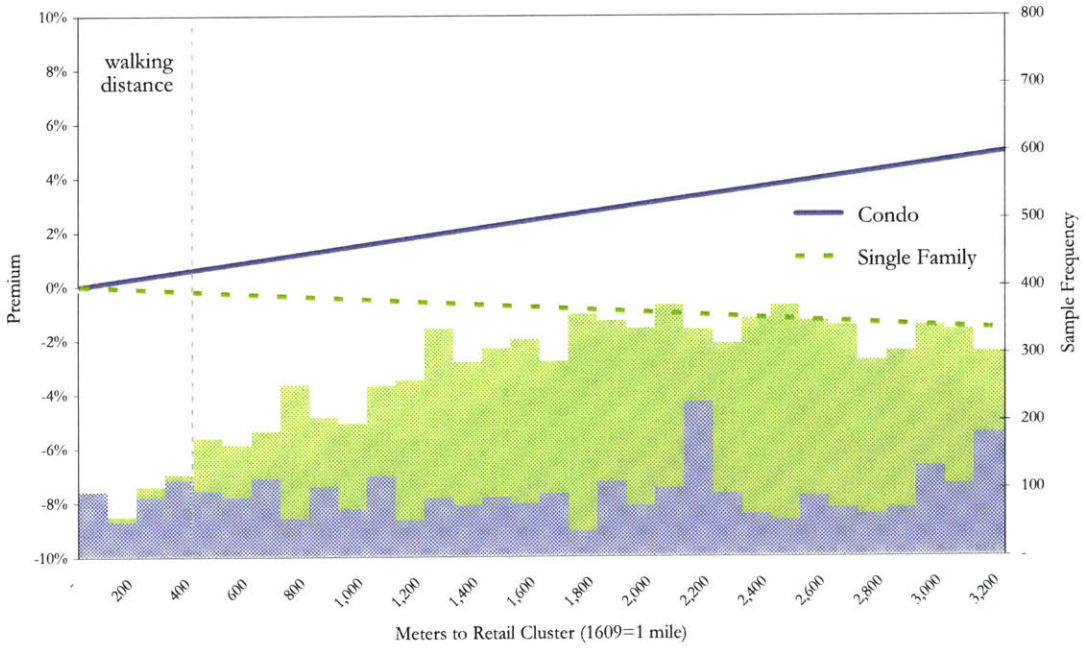


Outside Route 128, Automobile Oriented Clusters

Attempting to model a price gradient surrounding contemporary shopping centers reveals the power of Euclidean zoning. Its purpose—to mitigate the negative external impacts of non-residential uses—is successfully accomplished. Single-family residences are basically indifferent to strip centers. The downward slope of the green line in **figure 2** is statistically insignificant, and the estimated effect is substantively insignificant as well. I found a similarly small price elasticity using a quadratic form.

Condominium buyers, on the other hand, exhibit a determined desire to be further from these clusters. Theoretically, this can be explained by the notion that condominiums benefit little from code standards and buffers because they do not have significant *private* outdoor space that would be protected. At the same time, buyers tend to prefer spectacular *public* space such as a waterway, park, historic district or urban street. These amenities are undoubtedly in the opposite direction of strip centers. Or in other words, inversely spatially correlated.

FIGURE 2. OUTSIDE ROUTE 128 (AUTO)

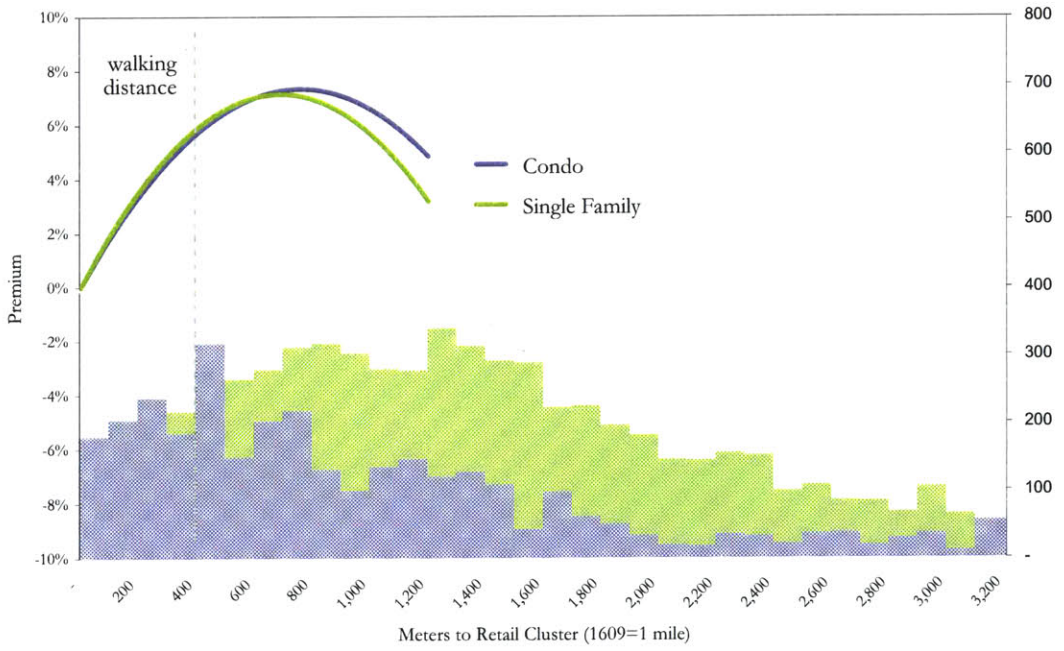


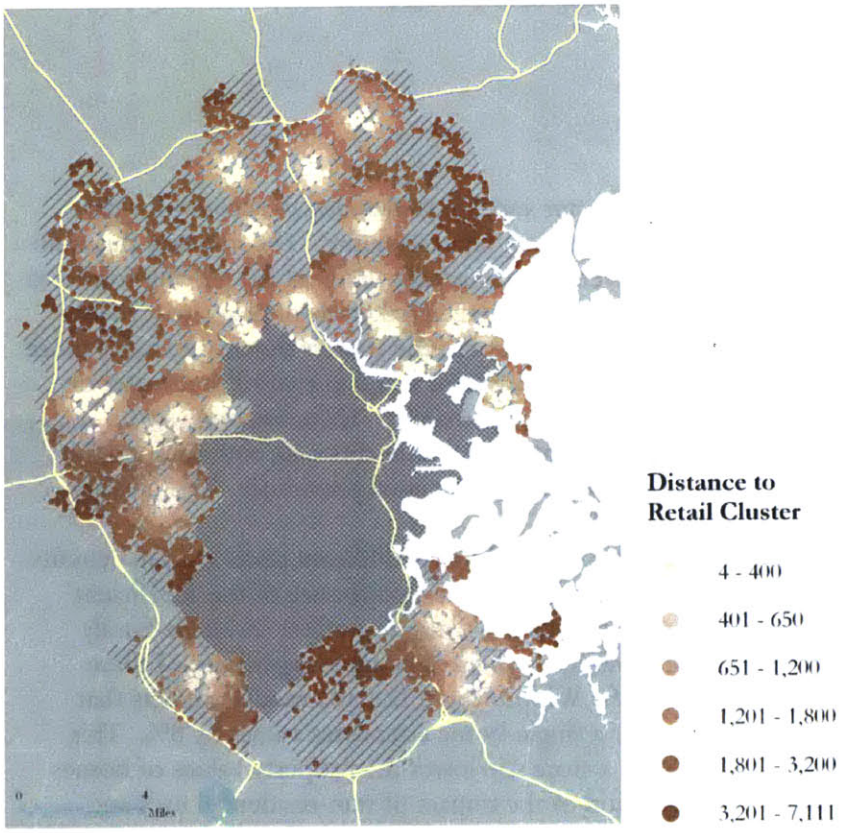
Inside Route 128

Inside 128, home buyers have a much stronger affinity for retail. The results indicate that market participants pay the highest price for houses and condominiums that are about 650 meters from a retail cluster (see **figure 3**). Although a comfortable walking distance is thought to be around 400 meters (1/4 of a mile), 650 meters still provides considerable pedestrian access. Keep in mind that the "distance to retail" variable measures the distance to the closest establishment *in the retail cluster.* Of course, any retail cluster is surrounded by retail that does not qualify as within the cluster. This fact probably puts those buying on the peak of these gradients well within walking distance of a handful of amenities.

Note that these regressions only consider houses within 1,200 meters of a retail cluster (about ¾ of a mile). When this is expanded to a mile or two miles (as in the other models), the significance of these variables disappears. This may be to be due to the fact that observations beyond 1,200 tend to have access to two or more of these centers and are concentrated in a distinct set of towns (see **map 2**). The presence of other unmeasured amenities probably also overwhelms our focus variables. While this in some ways justifies the restriction of the sample, the gradients and their magnitudes would be more convincing if the results could be replicated without restricting the sample beyond two miles.

FIGURE 3. INSIDE ROUTE 128





Map 2. Distance to retail cluster (inside 128)

Pedestrian Oriented vs. Automobile Oriented

While the models presented provide insight to the price gradients around these centers, it does not allow for direct comparison between the two design typologies—pedestrian and automobile oriented. In other words, the question, "would people rather live near a strip mall or near a historic town center," is not answered directly. Attempts to measure both gradients in the same model, such as in Waddell et al., were unsuccessful. This is probably due to the fact that many significant neighborhood characteristics are not controlled for and many retail clusters of smaller size are not included in the study.

It is, however, possible to make some speculative inferences based on the gradients themselves. In respect to those outer suburban places beyond Route 128, condominiums are clearly pulled away from the strip and toward the traditional center. As such, it is reasonable to infer that they prefer an improved pedestrian environment. How much they are willing to pay for that preference is not clear.

The diminishing value for single-family homes beyond 1 1/8th mile (again for suburbs beyond 128), exhibits a distant appreciation for the network of streets and modest urbanity found on the "main streets" of this region. From this evidence we can conclude that although single-family home owners do not want to walk *to* retail, they do appreciate the ability to drive and then walk *around* these places. Whether this preference is significantly

different from the indifference surrounding strip malls, or how this value nets out across the entire price gradient, is not clear.

Retail Abutters

In each of the models described above an abutter variable is included to account for the effect encountered when immediately proximate to a retail structure. Theoretically this is an important variable to include because it prevents the quadratic gradient from being forced to measure abutter effects and could consequently push predicted gradient peaks past their actual location. As described in the methodology chapter, the abutter dummy includes those homes that are within 50 meters of any retail establishment whether part of the cluster or not. As such, it acts as a crude proxy for major road proximity. Experimenting with different definitions (50, 100 and 150 meters from retail within clusters), and omitting the variable completely does not actually affect the results discussed previously. The measure, however, does provide some interesting results.

Single-family and condominium residents appear to have different tastes for the benefits and externalities of neighboring establishments. While the significance of the coefficient estimates varies, abutting commercial uses always have a negative effect on single-family home values and have no effect on condominium values. The most significant of these impacts is on home values within Route 128. Within Route 128, the model predicts that having a retail structure within 50 meters of a single-home attenuates values by 8%. This finding *cannot* be used to infer that building a store will lower the property values of homes within 50 meters. The result is a combination of the impact of non-residential uses and vehicular traffic; no attempt to disentangle the two is made in this study.

Further Research

The findings and their limitations indicate some important possibilities for further research. Addressing the following issues would improve the accuracy of the results, confirm (or deny) the existing findings, and allow additional questions to be answered more completely.

Cluster Identification. Knowledge of the Boston area indicates that significant retail clusters were not identified. Concord Center and a number of villages of Newton, for example, were not included. This indicates that the "cluster" criteria should be relaxed to get a more complete picture of the regions' retail nodes.

Cluster Typologies. The process for distinguishing between those places that are "pedestrian oriented" and "automobile oriented" is methodical but subjective. Objective metrics developed in the urban design and health literature, such as street density and street connectivity have the potential to more subtly measure the design qualities of a retail cluster.[36]

Cluster Scale. The model specified in this section does not account for variation in the scale of the clusters. It is reasonable to expect that the 136 stores in Lowell represent a different value proposition than the 26 stores in Mansfield. Future research should consider modeling sub-samples of size categories to in order to observe price gradient differences.

Cluster Use. Clearly the mix of uses in a cluster matters to the homes around it. A careful analysis of uses in the clusters themselves may indicate use typologies. For example, although all of the clusters provide everyday amenities, a distinct group might be better oriented towards entertainment. In addition, non-retail uses, such as museums and town halls, could be considered in order to identify those places that are true civic centers. Another approach might focus less on high density retail clusters and instead identify locations that provide a defined set of everyday amenities. After all, home buyers probably give more consideration to a simple set of establishments—grocery store, pharmacy, coffee shop, bank and cleaners, for example—than they give to major retail agglomerations.

Distance Measurement. Spatial distances for the transit and retail variables are measured "as the crow flies" and do not account for the actual distance required to walk or drive. It is possible to use mapping technology to identify this distance. This would probably be an improvement, but the implications would need to be understood carefully.

Disaggregate Town Variables. Although the use of town level control variables is common in property value hedonic models, they may have limitations when attempting to model spatial characteristics. Variables that are unrelated to the municipal government directly, such as employment proximity, should be disaggregated to a finer spatial grain when possible. For example, employment accessibility varies across towns and should be reflected as such in the model.

Rental Housing. Previous hedonic research and anecdotal evidence suggest that the share of rental housing in a census tract devalues residential properties. Presumably the clusters of traditional retail tested for here have larger shares of multi-family rental properties than the neighborhood outside of these districts. As such, there ought to be some concern that the retail proximity results are confounded by their presence. The density measure acts as a reasonable proxy, but is not ideal. A variable that measures the proportion of non-owner occupied housing in a location should also be included.

Historic Value. The model used in this study controls for age using four dummy variables (0-10, 10-30, 30-50, 50+). As expected, the results indicate diminishing depreciation over time. However, they do not reflect the historic or renovated value achieved by Victorian and Colonial era homes, or the investment present in the adaptive reuse of old mill buildings. Unfortunately, the data does not allow for a detailed understanding of the resources invested in buildings. However, adding additional dummy variables does begin to capture the tendency for historic buildings to receive renewed attention. Accounting for historic value is important in this analysis because traditional centers are likely to have historic buildings. In addition, consideration should be given to the collective historic value of the neighborhood.

Road Proximity. Developing a measure for major road proximity would increase the sophistication of this analysis. Specifically, it may help answer the question, "will new retail construction lower property values?" Calculating the distance to major roads, can probably be accomplished using mapping software.

CONCLUSION

> Jesus went up to Jerusalem...And found in the temple those that sold oxen and sheep and doves, and the changers of money sitting: And when he had made a scourge of small cords, he drove them all out of the temple, and the sheep, and the oxen; and poured out the changers' money, and overthrew the tables; And said unto them that sold doves, Take these things hence; make not my Father's house an house of merchandise.
> —John 2:14, *King James Bible*

Among proponents of the New Urbanism (and the planning community in general), suburbs are often viewed as a tragedy of good intentions. The prevailing view holds that zoning standards once created to resolve public health issues have since spiraled out of control and now preclude Americans from choosing communities with pedestrian accessible retail. The implication is that if these restricting regulations are eased the marketplace will create a more personal and compact product because that is what home buyers want. Although there may be benefits to reworking these regulations, it does not appear that market forces alone will reintegrate commercial and residential uses substantially, especially in the outer-ring suburbs.

Analysis of single-family and condominium homes surrounding 91 retail clusters in suburban Boston reveals the following:

1. In the outer-suburbs single-family home buyers are not willing to pay a premium to be within walking distance of pedestrian oriented retail. In fact, they pay a 6% premium to be about a mile away.
2. Condominium buyers, on the other hand, appear to have a stronger affinity for retail in outer-suburban locations. Findings suggest that condominiums that are 2 miles away from pedestrian oriented clusters sell for 8% less than those within walking distance.
3. Automobile oriented retail clusters have a less dramatic relevance in buyers' preferences. All else equal, single-family homes sell for about the same price regardless of proximity to automobile oriented retail, while condominium prices are modestly lower when close to these clusters.
4. In inner-suburban locations, which are more urban in character, buyers pay the highest price for homes—both single-family and condominium units—that are just barely within walking distance of retail clusters.

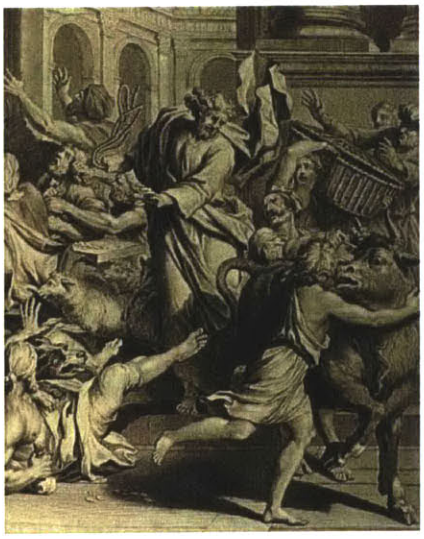
Part of the New Urbanist argument for the marketability of traditional neighborhood design is the need to meet a growing demand for a lifestyle that requires urban-like amenities, such as vibrant streets.[37] Impending demographic shifts, increasing energy costs, and changing preferences make these arguments convincing. At present, however, there is a large supply of existing traditional places and limited demand, meaning that the magnitude of change will have to be significant before it elevates prices around Boston's traditional retail clusters.

This does not necessarily mean that New Urbanist developments cannot be successful in Eastern Massachusetts; New Urbanist town centers differ in many ways from the existing traditional centers surrounding Boston. New Urbanist mixed-use developments attempt to emulate the better qualities of traditional centers while benefiting from modern retailing and housing formats. By doing this, projects such as Mashpee Commons on Cape Cod and the

Pinehills in Plymouth, are offering a more compelling package of amenities than any existing town center—modern buildings, golf courses, bike paths and careful landscaping. This study focuses on existing retail centers with the hope that it gives some indication for the potential of retail to create value in the Boston area. However, any development projects success relies on a host of more complex factors.

Another changing factor is the increasing prevalence of condominiums in the housing market. This trend, enabled by the creation of the condominium form of ownership and the socio-economic trends mentioned above, provides some hope for the increased integration of retail in residential environments. Housing choices often involve a trade-off between the quality of the private environment and the public environment. The findings suggest that the market for condominiums puts more emphasis on the later. If the condominium trend continues it will probably be matched with an increased demand for quality public spaces which may include vibrant retail streets.

In biblical times a single sacred space was sought to provide isolation from the profit seeking motives of the everyday world. For much of America today, the sacred elements of life are contained within a property's lot lines: a tree and yard represent the natural environment, a back patio and grill provide for community interaction, and a television and computer serve an array of other passions. Our sacred place is now the home. The premium placed on isolation from other uses, especially among outer-suburban single-family home buyers, highlights this current cultural preference. However, what defines the home can sometimes exist beyond its lot lines in the public realm. The relative importance of retail for condominium buyers and inner-suburban residents indicates that as the private environment becomes constrained, a useful and perhaps sacred public place becomes more important.



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[2] See Eppli and Tu, *Valuing the New Urbanism* (Washington: ULI, 1999).
[3] Gruen, *Heart of Our Cities: The Urban Crisis Diagnosis and Cure* (New York: Simon and Schuster, 1964), 150.
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[5] *Ibid.,* 71.
[6] *Ibid.,* 86.
[7] Quoted in Eisler, *The Lowell Offering: Writings by New England Mill Women (1840-184)* (New York: Harper & Row, 1977), 18.
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[14] *Ibid.,* 217.
[15] Map of Dresden, (Great Britain: Society for the Diffusion of Useful Knowledge, 1833).
[16] Gruen, *The Heart of Our Cities: The Urban Crisis Diagnosis and Cure* (New York, 1964), 150.
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[18] See Congress for New Urbanism, 'The Coming Demand" (San Francisco, 2001); and Congress for New Urbanism, "Greyfields into Goldfields" (2001); and Eppli and Tu, *Valuing the New Urbanism: The Impact of the New Urbanism on Prices of Single Family Homes* (Washington: ULI, 1999).
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[22] *Ibid.*, 16.
[23] *Ibid.,* 153.
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[26] Marshall, *How Cities Work: Suburbs, Sprawl and the Roads not Taken* (Austin: University of Texas Press, 2000).
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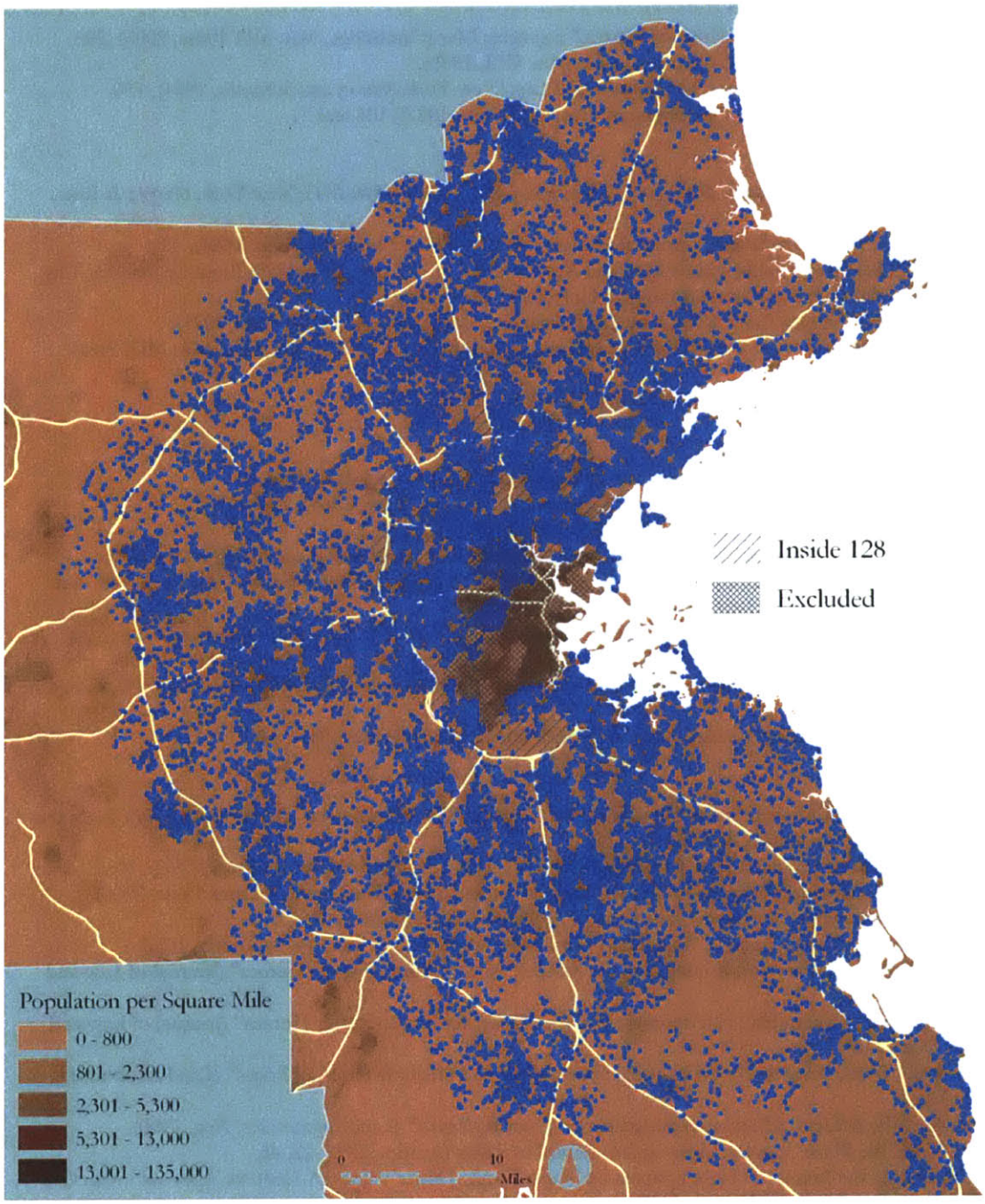
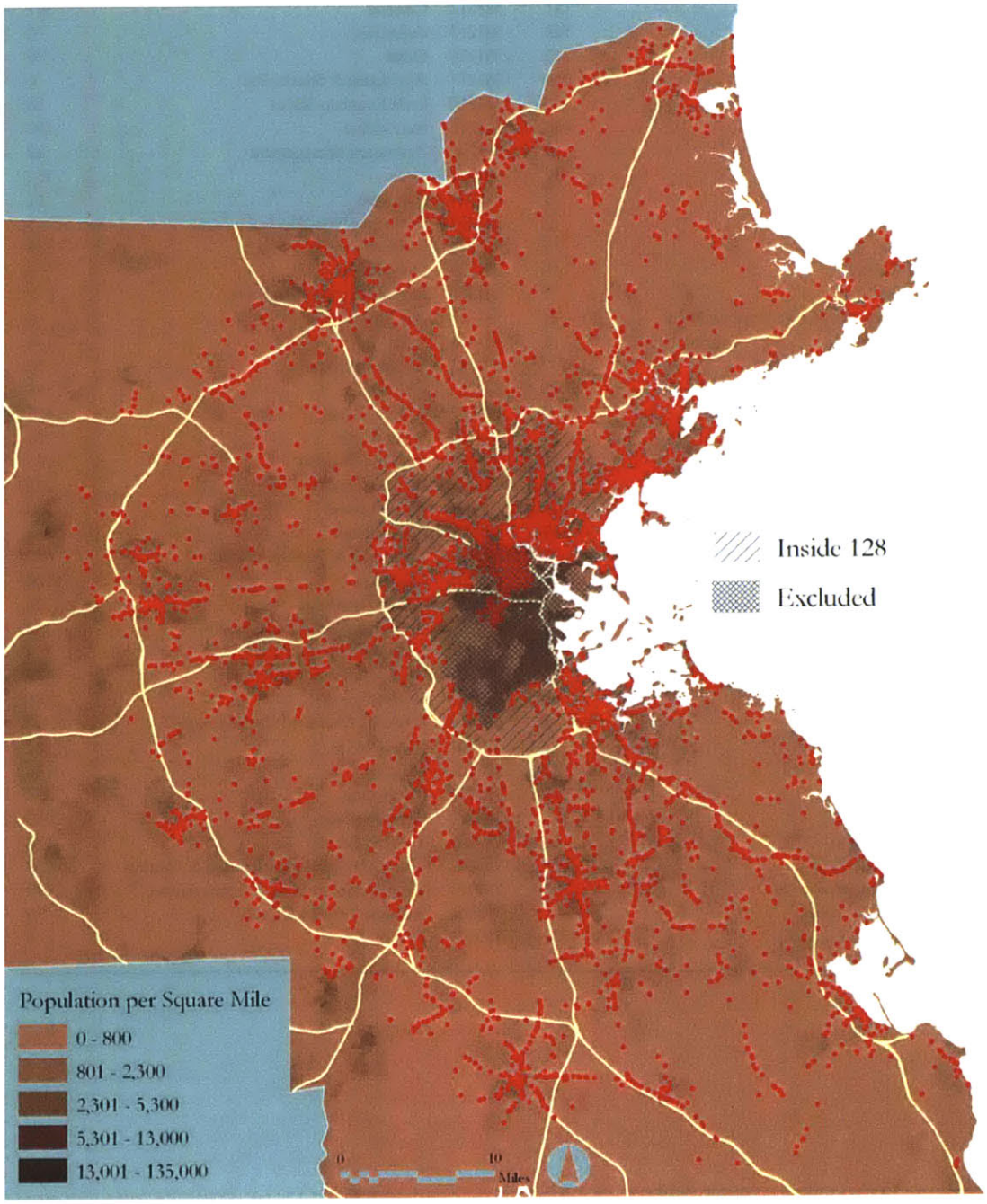
APPENDIX A. SINGLE-FAMILY AND CONDO TRANSACTIONS (2005)



APPENDIX B. HIGH FREQUENCY/CONVENIENCE RETAIL (2005)



APPENDIX C. DEFINITION OF HIGH FREQ/CONVENIENCE RETAIL

SIC	SIC NAME	COUNT	SIC	SIC NAME	COUNT
525104	Hardware-Retail	151	581212	Caterers	311
539901	General Merchandise-Retail	168	581213	Cafeterias	2
541101	Food Markets	262	581214	Cafes	73
541103	Convenience Stores	784	581217	Appetizers & Snacks Etc	1
541104	Food Products-Retail	68	581218	Soda Fountain Shops	16
541105	Grocers-Retail	466	581219	Sandwiches	100
541106	Markets-Kosher	6	581220	Restaurant Management	12
542101	Seafood-Retail	87	581222	Pizza	352
542102	Food Plans	3	581224	Barbecue	11
542103	Frozen Foods-Retail	2	581225	Beverages-Non-Alcoholic-Retail	5
542105	Lobsters	25	581228	Coffee Shops	233
542107	Meat-Retail	43	581229	Deli-Bakery	2
542108	Sausages	2	581230	Restaurants-Food Delivery	1
543101	Fruits & Vegetables & Produce-Retail	75	581236	Tea Rooms	4
543102	Farm Markets	4	581301	Bars	144
543104	Juices-Retail	6	581303	Cocktail Lounges	52
544101	Candy & Confectionery-Retail	109	591205	Pharmacies	533
544103	Popcorn & Popcorn Supplies	1	592102	Liquors-Retail	569
545101	Dairy Products-Retail	15	592103	Wines-Retail	61
545102	Yogurt	12	592104	Beer & Ale-Retail	26
545103	Cheese	17	594141	Bicycles-Dealers	76
546101	Bagels	66	599201	Florists-Retail	540
546102	Bakers-Retail	308	599202	Plants-Retail	3
546104	Pies	1	599992	Cosmetics & Perfumes-Retail	83
546105	Doughnuts	557	602101	Banks	1104
546107	Cookies & Crackers	13	602102	Trust Companies	28
546108	Pretzels-Retail	4	602103	Automated Teller Machines	13
549901	Health & Diet Foods-Retail	93	602201	State Commercial Banks	4
549902	Spices	5	603501	Savings & Loan Associations	18
549904	Vitamins	43	606101	Credit Unions	186
549906	Salt	4	606102	Federally Chartered Credit Unions	13
549907	Poultry-Retail	2	721101	Laundries	87
549913	Herbs	23	721201	Cleaners	770
549915	Coffee & Tea	22	723102	Manicuring	659
549918	Oriental Goods	5	723106	Beauty Salons	2743
549920	Gourmet Shops	40	783201	Theatres-Movie	73
581203	Ice Cream Parlors	217	784102	Video Tapes & Discs-Renting & Leasing	258
581206	Foods-Carry Out	33	799101	Health Clubs Studios & Gymnasiums	419
581207	Foods-Institutional	1	799106	Personal Trainers-Fitness	3
581208	Restaurants	4701	799107	Pilates	8
581209	Delicatessens	169			

APPENDIX D. CLUSTERS BY USE

	Total SF	Cluster Density	Avg Store SF	Sales per SF	Stores	Bank	Bar	Beauty	Coffee	Conv.	Food	Grocery	Gym	Laundry	Movies	Package	Pharmacy
Outside 128, Pedestrian Oriented																	
Amesbury (Sparhawk)	161,731	38	4,256	100	38	4	2	10			2	1	1	1	1	2	1
Andover (Main St)	376,214	65	5,154	159	73	7		32	2	1	3	1	3	2		1	1
Beverly (Park St)	445,706	47	5,065	165	88	3	1	21	4	3	3	1	1	2	1	3	3
Braintree (Hancock St)	181,484	35	5,500	144	33	3		13	1							2	3
Brockton (Main St)	178,225	43	3,565	209	50	5	1	10	3	4	1	2		3		2	1
Danvers (High St)	322,223	54	5,859	231	55	9		16	1	1	2	2		1			3
Framingham (Downtown Framingham)	180,976	41	3,693	132	49	4	1	16	1	2	4					1	1
Franklin (Central and Main)	83,237	30	3,083	116	27	1		10	1		1	1					
Gloucester (Main St)	474,956	59	5,277	381	90	10	2	16	4	2	13	2	2	1		2	3
Haverhill (Water St)	285,217	41	4,257	386	67	6	2	20	2	1	2	1		4			2
Hingham (Traditional)	235,728	36	5,238	219	45	4		7	1		5			1	1	2	
Ipswich (Central St)	164,480	41	4,112	139	40	3		8	1	1	1			1		1	
Lawrence (Essex and Broadway)	492,439	48	3,971	143	124	6	6	26	5	4	14	2		4		4	4
Lawrence (South Broadway)	28,993	33	2,071	122	14			4	1		2					1	
Lowell (Merrimack and Gorham)	624,932	63	4,595	363	136	13	7	28	5		6	4	2	2	1	4	3
Mansfield (N Main St)	159,487	34	6,134	235	26	2		6	2	2	3		2	1		2	
Marblehead (Atlantic Ave)	423,210	68	5,225	1,019	81	9		23	4	1	6	1	3	3		2	2
Marlborough (Weed St)	199,977	40	4,255	382	47	4	1	14	2	1	2					1	1
Maynard (Main St)	224,231	39	5,750	104	39	3	1	8	1	2	4		2		1	2	1
Milford (Main St)	147,230	41	3,681	88	40	4		13	2	1	4		1	2			
Natick (Main St)	223,231	41	5,581	702	40	3		12	2	1	2		1	2		2	1
Needham (Needham Center)	286,473	54	5,305	150	54	9		17		1	3	1	2	3			4
Newburyport (Merrimac St)	508,455	65	5,650	111	90	8		19	5		8	1	2	2	1		2
Norwood (Washington St)	449,205	64	4,883	1,067	92	7	2	23	6	1	2	2		4		2	2
Peabody (Peabody Sq)	318,218	49	4,821	216	66	10	3	16	1	2	7	1	2	1		4	3
Reading (Main St)	305,224	47	5,759	127	53	8		16	3	1	2			3		2	3
Salem (Washington and Essex)	503,196	75	4,575	126	110	11	1	17	8	2	6	3	1	4		1	4
Scituate (Front St)	218,232	36	6,062	268	36	4		4	1	1	2	1	1	2	1	3	2
Stoughton (Pearl St)	146,483	43	4,308	72	34	3		10	2		5				2	1	
Taunton (Broadway)	184,984	38	5,441	89	34	4	2	8	1		1			1		1	1
Wellesley (Central St)	185,981	46	4,769	207	39	5		11	3	1	5			1			1
Total	**281,302**	**47**	**4,818**	**298**	**1810**	**172**	**32**	**454**	**75**	**36**	**121**	**27**	**26**	**51**	**9**	**48**	**52**

APPENDIX D. CLUSTERS BY USE (CONT.)

	Total SF	Cluster Density	Avg Store SF	Sales per SF	Stores	Bank	Bar	Beauty	Coffee	Conv.	Food	Grocery	Gym	Laundry	Movies	Package	Pharmacy
Outside 128, Auto Oriented																	
Ashland (Pond St)	107,740	21	5,387	138	20	2		5			1	1	1	1		1	1
Bedford (Great Rd)	173,737	26	6,682	97	26	3		3	1			1	2	2		1	1
Billerica (Boston Rd)	189,990	23	9,047	303	21	5		1	1	1		1		1	1	3	1
Brockton (Belmont St)	254,986	27	8,793	382	29	3		5		2		2	1	3		1	3
Brockton (Crescant St)	124,741	23	6,565	207	19	2		3	1	1	3		1	1			1
Burlington (Murray Ave)	165,738	24	6,906	111	24			7	1			2	1	2		1	2
Canton (Washington St)	324,732	40	8,546	437	38	4		5	2		4	1	1	1		3	3
Concord (Commonwealth Ave)	128,238	26	5,343	238	24	1		4	1		5	1		2		2	1
Dracut (Broadway)	80,993	22	5,400	122	15	2		3		1	1		1				
Framingham (Edgell Rd)	134,489	22	6,113	105	22	2		3	2	1			1	3		1	1
Framingham (Rt 9)	1,149,415	30	6,644	228	173	13		34	5	2	6	4	4	10	5	6	7
Hanover (Columbia Rd)	152,489	23	6,931	94	22	5		4					3	1			
Hudson (Hudson Rd)	159,740	22	7,607	230	21	2			2		1			1		1	2
Lowell (Middlesex St)	170,989	24	7,434	352	23	2		3	1	1		3		1		1	2
Marlboro (Boston Post Road W)	61,494	20	5,125	256	12	2		1			1						
Marlboro (E Main St)	98,740	25	4,937	412	20	3		5	1			1		2		1	1
Marshfield (Ocean St)	162,988	26	6,520	133	25	3		3	1		3			2		1	3
Medway (Rt 109)	136,237	31	5,240	170	26	2		6	1	1			1	3		2	
Middleton (S Main St)	196,988	26	7,880	329	25	1		4	1	1	1	1	1	3			1
Milford (Medway St)	417,975	52	7,886	285	53	3		10	1		3	2	1	2		3	4
Norwell (Washington Street)	226,485	27	7,078	267	32	5		3	2	1	2	1	1	3		1	1
Norwood (Boston Providence R)	134,742	22	7,926	158	17	1			1		1	1		1			2
Plainville (Taunton St)	154,987	26	5,961	86	26	1		6	2		1		1	1			1
Randolf (N Main St)	368,724	45	6,828	362	54	9	1	13	1	1	1	2	1	1		1	3
Salem (Highland Ave)	107,994	20	9,000	134	12	1		1	1				1				1
Stoneham (Main St)	139,244	22	10,711	432	13	4		1			1	1				1	2
Stoughton (Washington St)	304,728	37	6,772	227	45	5	1	4	3	1	2	1		5		1	3
Sudbury (Boston Post Rd)	157,736	28	5,633	286	28	5		4	3					3		1	2
Swampscott (Paradise Rd)	327,976	25	6,693	166	49	7		10	2	2	2	3	2	3		1	3
Taunton (Winthrop St)	151,491	21	7,575	805	20	1		3	1	2		2				1	1
Tewksbury (Main St)	190,739	24	7,947	348	24	2		4	2			1	1	1		1	1
Wellesley (Linden St)	88,245	41	8,022	87	11	2		2			1		1				1
Wilmington (Main St)	192,741	23	9,637	364	20	4		1	1		1	1		1		1	2
Total	**210,250**	**27**	**7,015**	**263**	**989**	**107**	**2**	**161**	**41**	**18**	**41**	**33**	**27**	**60**	**6**	**37**	**57**

APPENDIX D. CLUSTERS BY USE (CONT.)

	Total SF	Cluster Density	Avg Store SF	Sales per SF	Stores	Bank	Bar	Beauty	Coffee	Conv.	Food	Grocery	Gym	Laundry	Movies	Package	Pharmacy
Inside 128, Pedestrian Oriented																	
Arlington (Mass and Broadway)	260,978	41	5,800	142	45	6		9	1	1	3		1	2	1		2
Arlington (Mass and Park Ave)	118,239	31	5,141	88	23			4		1	1		2	2			
Arlington (Mass Ave and Lake St)	116,489	31	5,295	130	22	2		5			3				1		1
Belmont (Leonard)	146,987	30	5,444	150	27	7		4	1		2			2			1
Chelsea (Park and Broadway)	287,704	62	3,127	288	92	4	2	22	5	6	6	9		1		3	1
Dedham (Washington St)	240,227	44	5,222	126	46	7		9	2	1	1		1	4		1	3
Everett (Broadway and Norwood)	132,233	33	3,889	205	34	2		7	2	2	3	1		3		1	1
Lexington (Mass Ave)	311,976	48	6,500	151	48	7		13	5		3		1	2	1		2
Lynn (Central Sq)	694,438	63	5,468	165	127	9	2	23	2	5	8	7	3	2		3	7
Malden (Pleasant St)	356,207	62	4,094	179	87	8		25	2	4	7	1		4		1	2
Medford (Salem St)	257,232	39	6,769	72	38	5		13	3		1		1	2	1		2
Melrose (Main Street)	304,226	48	5,965	213	51	5		14	2		4	1	1	6			2
Newton (Newton Center)	259,723	54	4,722	130	55	3		17	5		3		2	2		1	3
Newton (Watertown St)	152,733	37	4,364	128	35	2		7	1	1	6		1	2		1	1
Quincy (North Quincy)	217,982	36	5,891	316	37	3	1	9		2	2	2	1	1			2
Quincy (Quincy Center)	794,680	68	5,557	97	143	9	5	37	10	5	4	5	5	4	1	2	2
Quincy (Wollaston)	74,743	31	5,339	114	14	3		5	1							1	1
Revere (Broadway)	196,483	35	5,614	122	35	4	1	10	1	5				1		1	2
Revere (Revere Beach)	92,985	38	3,100	373	30	1		5	1	5	2	3		2		1	
Stoneham (Main St)	245,222	43	4,302	213	57	5		17	2	2	2	1	2	3		2	1
Wakefield (Main St)	294,967	63	4,402	100	67	5		22	2	2	2		2	2		2	2
Waltham (Moody and Main St)	668,430	48	4,741	190	141	7	3	30	6	8	6	4	2	7	1	2	4
Watertown (Mt Auburn)	75,238	33	3,010	109	25	1		1		2	6			2			
Watertown (Watertown Sq)	246,223	51	4,477	130	55	6		9	2	2	2	1	1	1		1	1
Winchester (Winchester Center)	264,477	48	5,627	157	47	5		12	2		3		2	3		1	1
Winthrop (Woodside Ave)	205,230	41	5,006	124	41	2		14		1	2		1	1		1	3
Woburn (Main St)	195,226	47	3,984	106	49	3		15	1	2	3		1	1		2	1
Total	**267,084**	**45**	**4,902**	**158**	**1471**	**121**	**14**	**358**	**59**	**57**	**85**	**35**	**30**	**62**	**6**	**27**	**48**
Inside 128, Auto Oriented																	
Dedham (Providence Hwy)	94,493	21	6,300	271	15	2		1	1			1		1		2	1
Lexington (Mass and Sow)	74,489	23	3,386	233	22			3	2	1	1			1		2	
Newton (Needham St)	55,245	22	5,022	226	11	2		3	1					1		1	
Saugus (Rt. 1)	128,733	26	3,678	183	35	1	1	13	2		3			1		2	
Total	**88,240**	**23**	**4,253**	**224**	**83**	**5**	**1**	**20**	**6**	**1**	**4**	**1**	**0**	**4**	**0**	**7**	**1**

APPENDIX E. DETAILED REGRESSION RESULTS

> The conscientious and careful people who make statistics have become what they are through meticulous toil; their minds...[are]...incapable of conceiving any sort of clear and open bold or inspired idea.
> —Le Corbusier

Using Town Level Control Variables (presented results)

Variable	SF	CONDO	SFped	CONDOped	SFauto	CONDOauto	SFin	CONDOin
age_2	-.03653937	-.11204151	.02830673	-.07108398	-.02585478	-.12830367	-.24408192	-.18514025
	.00946605	.01117722	.01998022	.01809726	.01772283	.01999995	.066656	.02045474
	-3.86	-10.02	1.42	-3.93	-1.46	-6.42	-3.66	-9.05
age_3	-.05914797	-.25330706	-.00297386	-.20839902	-.06237639	-.24536178	-.16310007	-.23148173
	.00931827	.01342813	.01832651	.02027581	.01625242	.02320821	.05614479	.02329128
	-6.35	-18.86	-0.16	-10.28	-3.84	-10.57	-2.90	-9.94
age_4	-.10794032	-.04655048	-.04401665	-.02067189	-.11690408	-.04304547	-.14252902	-.14913868
	.00928806	.01626522	.01759628	.02214055	.01626486	.02921669	.05215548	.0216841
	-11.62	-2.86	-2.50	-0.93	-7.19	-1.47	-2.73	-6.88
bathrooms_2	.10314382	.15148111	.12293164	.11214438	.09126589	.09605268	.05759803	.10513887
	.00620396	.00963226	.0102916	.0144595	.00990326	.01520126	.01760334	.0170097
	16.63	15.73	11.94	7.76	9.22	6.32	3.27	6.18
bathrooms_3c		.13887419		-.03963992		.01271806		-.04352956
		.02625111		.04534075		.04749334		.04971136
		5.29		-0.87		0.27		-0.88
bathroom~3sf	.19532987		.25883428		.20593486		.24303888	
	.01195116		.02131839		.02019983		.03727443	
	16.34		12.14		10.19		6.52	
bathroom~4sf	.35087835		.45436043		.43023305		.27525102	
	.02142508		.03706912		.03708831		.05804318	
	16.38		12.26		11.60		4.74	
bedrooms_h	.0346527	.06307879	.028417	.05932825	.03871189	.09892734	.03714586	.06482451
	.00378282	.00677671	.00599991	.00915767	.00610723	.01083533	.00954992	.01070627
	9.16	9.31	4.74	6.48	6.34	9.13	3.89	6.05
intersf	.00024074	.00034258	.00024622	.00038916	.00023106	.0003788	.00024123	.00032838
	4.510e-06	9.315e-06	8.093e-06	.00001374	7.816e-06	.00001513	.00001573	.00002066
	53.38	36.78	30.42	28.32	29.56	25.04	15.34	15.89
lotsize	2.928e-07		3.475e-07		6.321e-07		6.485e-06	
	9.853e-08		2.549e-07		2.315e-07		1.300e-06	
	2.97		1.36		2.73		4.99	
town_house		.08562179		.09698826		.0894542		.02305219
		.00960857		.0143408		.01681112		.02179916
		8.91		6.76		5.32		1.06
* lnaccess15	.16877894	.15612738	.26038071	.19084591	.34196377	.36005784	.34062148	.53309641
	.00813416	.01404806	.01562645	.02157164	.01736807	.03119856	.04743443	.03696323
	20.75	11.11	16.66	8.85	19.69	11.54	7.18	14.42
* lnmcas	1.2215676	.83014988	1.2422931	1.025714	1.269659	1.0216969	1.1693647	.27085254
	.02906579	.04249358	.0381712	.05009506	.04759794	.07019094	.11315092	.06735737
	42.03	19.54	32.55	20.48	26.67	14.56	10.33	4.02
train_1	.12772939	.07286451	.12997195	.05271645	.10827345	-.11384522	.07249064	-.20820398
	.10201485	.05789495	.14569633	.06228479	.12621406	.1050855	.26279485	.07252874
	1.25	1.26	0.89	0.85	0.86	-1.08	0.28	-2.87
train_2	.03870503	.02700896	.02256892	.03141051	.08287704	.01046396	.00471658	.04504355
	.0203519	.01950285	.02660979	.02495982	.03172266	.02505678	.03267061	.02150823
	1.90	1.38	0.85	1.26	2.61	0.42	0.14	2.09
train_3	.02816294	.03259753	-.01058467	.01383211	.04897479	.03722503	-.00173451	.03877179
	.01176077	.0150715	.01477262	.01747224	.01725605	.02069615	.01871784	.01698227
	2.39	2.16	-0.72	0.79	2.84	1.80	-0.09	2.28
density_bg	-4.411e-06	-3.431e-06	-5.551e-06	-1.763e-06	-4.145e-06	-7.415e-06	-3.259e-06	-3.981e-06
	9.860e-07	1.184e-06	1.245e-06	1.393e-06	1.411e-06	1.632e-06	1.437e-06	9.994e-07
	-4.47	-2.90	-4.46	-1.27	-2.94	-4.54	-2.27	-3.98
retailabut			-.04302754	.02377455	-.04887558	-.00106523	-.08718491	.01207448
			.02439555	.01874116	.02683426	.01932401	.03212851	.01720712
			-1.76	1.27	-1.82	-0.06	-2.71	0.70
peddist			.00007245	.00002342			.00020707	.00019319
			.00002103	.00002337			.00010134	.00007528
			3.45	1.00			2.04	2.57
peddist2			-1.989e-08	-1.462e-08			-1.505e-07	-1.274e-07
			5.949e-09	6.702e-09			7.475e-08	6.034e-08
			-3.34	-2.18			-2.01	-2.11
autodist					-4.955e-06	.00001547		
					4.825e-06	6.019e-06		
					-1.03	2.57		
r2_a	.49940902	.55922192	.52628191	.54938173	.5185777	.59345115	.47734752	.54582285
N	24973	7433	9518	3557	8594	2918	2862	2196

legend: b/se/t

Maximum
mSFped = 1821.1183 (6%)
mCONDOped = 800.9367 (1%)
mSFin = 687.98565 (7%)
mCONDOin = 758.01234 (7%)

Using Town Level Fixed-Effect

Variable	SF	CONDO	SFped	CONDOped	SFauto	CONDOauto	SFin	CONDOin
age_2	-.06019275	-.0993429	.01330989	-.05135803	-.04457381	-.10812017	-.20525912	-.1781612
	.00890322	.01165525	.01857026	.01903169	.01657106	.0205196	.06515427	.02140531
	-6.76	-8.52	0.72	-2.70	-2.69	-5.27	-3.15	-8.32
age_3	-.12465839	-.26056763	-.06091012	-.17921307	-.12772373	-.27306189	-.18727483	-.26920042
	.00896925	.01419063	.01724647	.02179183	.0154717	.0261597	.05477961	.02548938
	-13.90	-18.36	-3.53	-8.22	-8.26	-10.44	-3.42	-10.56
age_4	-.20165615	-.10950787	-.12801638	-.05906916	-.21018922	-.11095377	-.16588084	-.19695649
	.00895258	.01679413	.01657275	.02277765	.01545668	.03105887	.05098666	.02398875
	-22.52	-6.52	-7.72	-2.59	-13.60	-3.57	-3.25	-8.21
bathrooms_2	.07361221	.10536229	.08290456	.08582106	.06400467	.04414804	.04302799	.10105902
	.00586286	.00936294	.00956804	.01402422	.00923454	.01539296	.01724219	.01686009
	12.56	11.25	8.66	6.12	6.93	2.87	2.50	5.99
bathrooms_3c		.0687268		-.09040508		-.03683027		-.05493621
		.02534118		.04480995		.04651921		.04939453
		2.71		-2.02		-0.79		-1.11
bathroom~3sf	.11167921		.11563367		.09387277		.17966425	
	.01132942		.02001063		.01905613		.03689077	
	9.86		5.78		4.93		4.87	
bathroom~4sf	.17898449		.19317173		.19574726		.24051896	
	.02054246		.0352771		.03535058		.05751845	
	8.71		5.48		5.54		4.18	
bedrooms_h	.02930012	.08064914	.02727274	.06793021	.027836	.11442973	.03008559	.05580612
	.00357276	.00650074	.00558315	.00874222	.00571544	.0106283	.00935302	.01046609
	8.20	12.41	4.88	7.77	4.87	10.77	3.22	5.33
intersf	.00021722	.00031309	.00022785	.00036184	.00020231	.00032724	.00024405	.00032492
	4.405e-06	9.230e-06	7.767e-06	.0000139	7.571e-06	.00001555	.0000156	.00002032
	49.31	33.92	29.33	26.03	26.72	21.05	15.65	15.99
lotsize	7.403e-07		1.143e-06		1.147e-06		5.960e-06	
	9.990e-08		2.524e-07		2.284e-07		1.311e-06	
	7.41		4.53		5.02		4.55	
town_house		.12966697		.11745224		.03881916		.02514398
		.01230645		.01752121		.0231893		.02541412
		10.54		6.70		1.67		0.99
train_1	.01353168	-.03028925	.06882364	-.00552587	-.02316918	-.12018876	.07424954	-.22884308
	.09525756	.05606799	.13445007	.06247078	.11693752	.10406103	.25572373	.07461762
	0.14	-0.54	0.51	-0.09	-0.20	-1.15	0.29	-3.07
train_2	-.02250596	-.00014012	.00677756	.02750702	.02814723	-.07341901	-.00178625	.02882394
	.0192865	.0204476	.02510768	.02636808	.02999196	.02724505	.0332772	.02371502
	-1.17	-0.01	0.27	1.04	0.94	-2.69	-0.05	1.22
train_3	-.02445128	-.02669078	-.02739891	-.00464547	-.00889064	-.07391638	-.0135328	.05040874
	.01140548	.01656863	.01428151	.0200278	.01659517	.02432604	.01994779	.01880661
	-2.14	-1.61	-1.92	-0.23	-0.54	-3.04	-0.68	2.68
density_bg	-.0000101	-6.980e-06	-6.939e-06	-4.354e-06	-8.848e-06	-.00001017	-4.626e-06	-4.844e-06
	1.004e-06	1.194e-06	1.230e-06	1.426e-06	1.421e-06	1.676e-06	1.509e-06	1.008e-06
	-10.05	-5.84	-5.64	-3.05	-6.22	-6.07	-3.07	-4.81
retailabut			-.02266953	.00826737	-.03330115	-.02038532	-.09213408	.013152
			.02247115	.01839552	.02476012	.01947816	.03145254	.0169614
			-1.01	0.45	-1.34	-1.05	-2.93	0.78
peddist			.0000629	.00009436			.00011347	.0001628
			.00002061	.0000259			.00009925	.0000747
			3.05	3.64			1.14	2.18
peddist2			-1.337e-08	-3.412e-08			-8.386e-08	-1.365e-07
			5.751e-09	7.288e-09			7.306e-08	5.940e-08
			-2.33	-4.68			-1.15	-2.30
autodist					-5.262e-06	.00001372		
					4.936e-06	6.542e-06		
					-1.07	2.10		
r2_a	.56674182	.628101	.60097231	.60727051	.59267192	.64533684	.50787097	.57381644
N	24973	7433	9518	3557	8594	2918	2862	2196

legend: b/se/t

Maximum
mSFped = 2351.8911 (7%)
mCONDOped = 1382.8182 (7%)
mSFin = 676.51304 (4%)
mCONDOin = 596.31717 (5%)

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