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Transformation of San Francisco Bay Area downtowns

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TRANSFORMATION OF
SAN FRANCISCO BAY AREA DOWNTOWNS

A Thesis

Presented to

The Faculty of the Department of Geography

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Joseph Hasty

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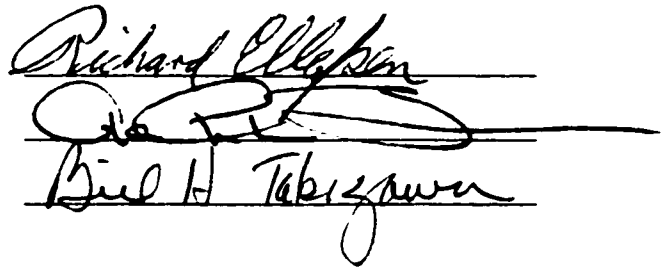
APPROVED FOR THE DEPARTMENT OF GEOGRAPHY



APPROVED FOR THE COLLEGE GRADUATE COMMITTEE

ABSTRACT

TRANSFORMATION OF SAN FRANCISCO BAY AREA DOWNTOWNS

by Joseph Mark Hasty

The purpose of this study is to measure, document and analyze the transformation of San Francisco Bay Area downtowns from providers of low-end goods and services to centers for high-end, regional shops.

The design of this study was threefold. First, the composition of downtown shops was recorded at several windows from 1949 to 1998. Second, the change was calculated and analyzed on an individual city basis. Last, cities were grouped together in order to find spatial patterns of change.

The results showed that all study cities experienced varied levels of change toward high-end growth. Analysis of the amount and rate of change over the time period revealed geographic factors that influenced the development of these downtowns. Analysis of the transformation processes of grouped cities showed distinctive spatial patterns in the development of the region, reflecting the unique physical environment and history of the San Francisco Bay Area.

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Chapter 1: Introduction

Evidence of Transformation on the Landscape

Casual visitors to the downtown areas of small cities in the San Francisco Bay Area are immediately made aware that these commercial areas appear to have a large number of establishments offering "high-end" goods and services and only a relatively small number of "ordinary" level goods and services shops. Perhaps, the visitor would wonder that the plethora of these "high-end" shops is greater than the local populace can support and that these shops draw upon a broader, regional customer base.

Further questions come to the mind of the urban geographer. Did the current mix of high-end and ordinary businesses always exist? Or, did these towns at one time have a balance that reflected the common range of goods and services that usually fall along the traditional threshold and range continuum? Such a continuum would have a base of low level goods and services – such as a dry cleaners, a hair salon, or a bakery – and only those higher end stores (following the principals set forth by Lösch, 8) that could be supported by the local populace, e.g., an appliance store or a men's shoe store? If an examination of the historical record of dowtown land uses revealed that a normal mix once existed and that today's mix differs significantly, then a major transformation has taken place.

This thesis focuses on measuring the change between a downtown's past and current composition. The question of transformation will be examined. The assumption that transformation has taken place in the Bay Area is supported by the general awareness that urban growth and change at the broadest level has occurred. As small Bay Area

towns that once were isolated nuclei separated by non-urban land uses have become surrounded by contiguous urban development – stretching almost continuously from Gilroy to Healdsburg on US 101 and out to the far peripheries of the eastern counties that comprise the Bay Area. Moreover, the downtowns that were once the only centers for commercial land uses – in addition to the major cities of San Francisco, Oakland, and San Jose – are today competing with commercial ribbons located in an ordered way throughout the area lying outside the original downtowns. Also, the level of disposable income has risen sharply in the Bay Area with the advent of high-tech industry, therefore further enhancing the support for high-end goods and services.

Thus, the following questions are posed. Have all of these developments contributed to a changed downtown, one no longer interested solely in providing the ordinary range of goods and services to its townsfolk, farmers, and others in the surrounding rural area? Have these towns possibly been transformed into commercial centers offering high-end goods and services to a broader regional market while retaining just enough goods and services at the lower end of the traditional threshold and range continuum to serve the local inhabitants? Have these old downtowns had to change to compete with the planned commercial shopping areas?

Procedures for measurement of past and present, described in detail in the next chapter, focus on noting land uses along the main streets of these downtowns, the original commercial cores. The thesis shows type and amount of change historically.

Composition of Downtown Commercial Land Use

For this study, downtown land use is placed into two major categories: high end goods and services and low end goods and services. Every downtown consists of different percentages of these two categories which, when added together, equal 100%. The traditional threshold and range continuum, discussed in detail in the next section, can be used to categorize these shops. There are two factors of the continuum, frequency of visits (threshold) and distance traveled by the consumer (range). These factors can be used to categorize each shop as either high end or low end.

Low end goods and services are shops that customers visit often by (high frequency) and fall into the class of convenience stores, where propinquity is key. These shops mostly serve local inhabitants (limited range) and do not draw customers from long distances. Frequently, they are service-oriented shops, such as bakeries and locksmiths. The time between visits can vary, but the clientele is often very loyal and does not feel the need to "shop" for the best deal. Convenience is often the customer's most important factor when selecting a store. Shops in this category are referred to by a variety of terms in this paper, including low end goods and services, service, high-frequency, and convenience shops.

High end goods and services are shops that are visited much less-often (low frequency) and are often considered specialty stores. These shops generally serve a much broader regional base (large range), as there is not as much demand for their products. These specialty shops usually provide higher priced goods, such as antiques and jewelry. The clientele is willing to travel much greater distances to try to minimize their

expenditure or a get a product that is unique. Convenience is not of much concern to these customers because they do not visit often. In this study, shops in this category are also referred to by a variety of terms including high end goods and services, specialty, retail, and low frequency shops. A list of some of major shop types and the categories into which they fall is provided in Table 1.

Table 1: Types of Service and Retail Shops

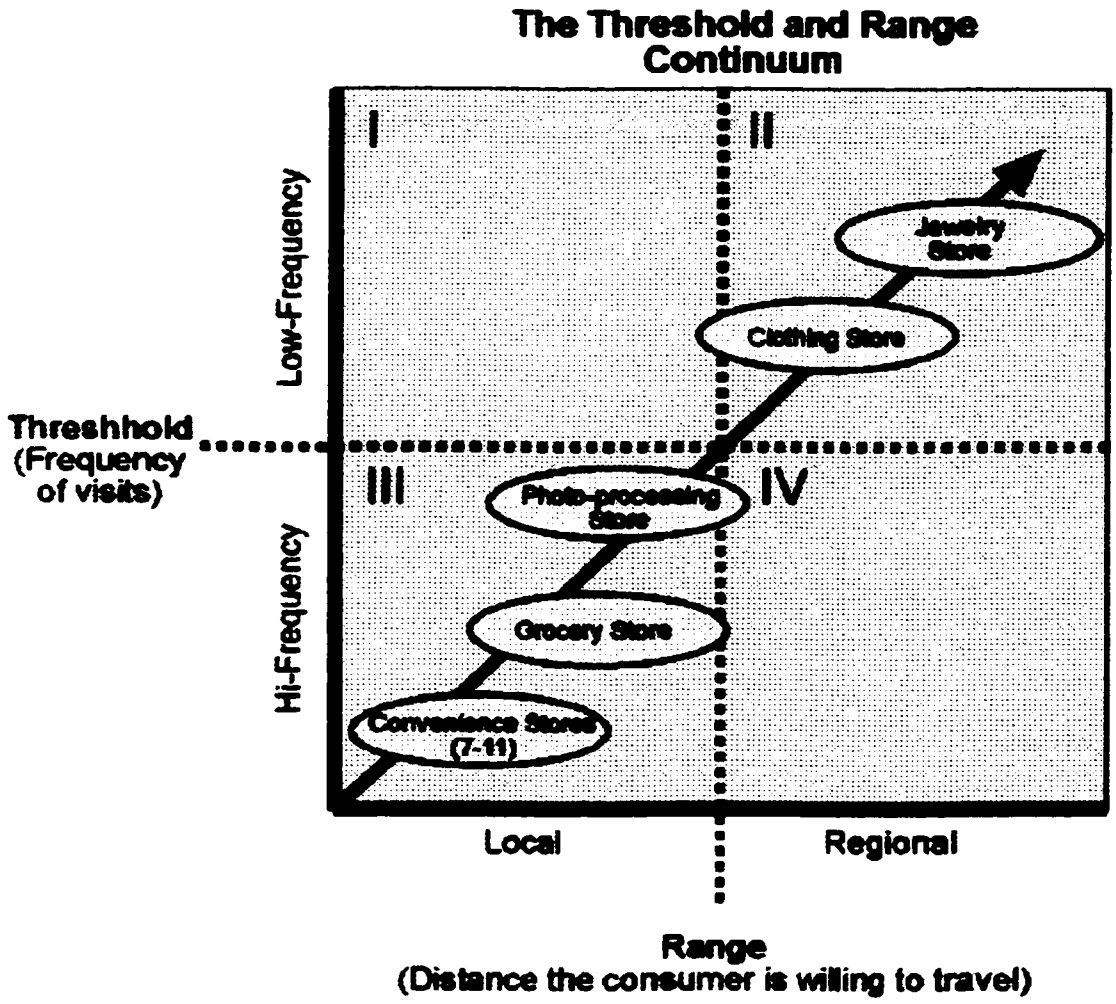
Low end	High end
Convenience/Liquor store	Coin/Stamp shop
Bakery	Shoe store
Deli/Meat market	Toy Store
Grocery (not supermarkets)	Art Gallery
Florist	Furniture store
Drug store/Pharmacy	Restaurant
Banks	Appliance store
Stationery store	Jewelry
Hardware store	Antique store
Men's clothing/Tailor	Women's clothing
Barber/Beauty shop	Sporting Goods

Threshold and Range Continuum

A variation on the threshold and range continuum (Figure 1) displays different shop types with reference to the frequency of visits (threshold) and the distance traveled (range). All types of shops are represented. The horizontal axis represents the customer travel distance, with distance increasing to the right. The dotted line found midway through this axis represents the barrier between a local and regional customer base. The vertical axis represents the frequency of visits for the average customer. The frequency

of visits decreases as one moves higher on the axis. The dotted line halfway up the axis represents the barrier between high and low frequency shops.

Figure 1: Threshold and Range Continuum



The two dotted lines create four quadrants. Every shop falls into one of these four categories, depending on the average customer's distance traveled and the frequency of visits. Quadrant I (top, left) is composed of shops that have an average customer base

made up of local residents who visit the shops infrequently. This quadrant is nearly devoid of shops because they often cannot survive financially in this situation. Quadrant II (top, right) has a customer base that is infrequent and travels long distances. Quadrant III (bottom, left), is composed of shops that have a local customer base that travels short distances. Quadrant IV (bottom, right) consists of shops that have an average customer that travels long distances frequently. Like Quadrant I, very few shops are found in this situation simply because convenience shops are generally located in close proximity to each customer's residence.

Most shops fall into either quadrant II or III. The distance that a consumer is willing to travel is directly related to the frequency of visits. The blue arrow on the graph depicts this trend. Most shops cluster near this curve. Shops in quadrant III are local, high frequency locations, while shops in quadrant II are regional, and low frequency locations. Stores in quadrant III range from ultra convenience (e.g., 7-11s) to other services that are not frequented as much (e.g., photo-processing stores). Shops in quadrant II range from somewhat regularly visited specialty shops (e.g., clothing stores) to highly specialized shops (e.g., jewelry stores).

Rarely do shops do fall into quadrants I and IV. The combination of serving a local population that visits infrequently (quadrant I) is not very common. With the advent of on-line banking, banks are starting to fall into this trend. Quadrant IV, with a customer base that travels far and visits often is not quite as rare, however is still not a common occurrence. Coffee shops or restaurants in business parks fall into this category. Shops that fall into these categories are so rare, especially when dealing with downtowns,

that they are not considered in this study. In this study, all shops are categorized into quadrants II or III.

Bay Area Influences

For this study the metropolis of the Bay Area is defined by the nine counties outside the city and county of San Francisco. These counties include Marin, Sonoma, Napa and Solano to the north and northeast, Contra Costa and Alameda to the east, and San Mateo, Santa Clara and Santa Cruz to the south. This entire area has a wide variety of both physical and cultural environments.

The most prominent feature of this region is the bay itself. One of the most notable in the world, San Francisco Bay dominates the landscape and played a vital role in the transportation, trade, climate, settlement patterns, and overall history of the region. Another important feature is the mountain ranges. North-south linear ranges and valleys were created as a result of the tumultuous boundary of the Pacific and North American Plates. In fact, if it were not for the gap in the Coast Range, which is now spanned by the Golden Gate Bridge, the San Francisco Bay would be just a northern extension of the Santa Clara Valley. These ranges and valleys have also played a very important role in the cultural features of the region, including agriculture, transportation structure and settlement patterns. The last major physical feature that affected the development of the Bay Area is the climate, the rare Cs category according to the Köeppen system. Wet winters and dry summers characterize this class, referred to as Mediterranean Climate. Argued by many as the most suitable climate for human existence, the Bay Area has

often been cited for its pleasant weather. However, generalizations about Bay Area weather and climate are hard to make. This is due to the many microclimates found in the area. On any given day, the atmospheric conditions can range dramatically from one location to another. Climate, therefore, has had a dramatic impact on the land use and settlement patterns of the Bay Area (Vance, Geography, 44; Benet, 112; Carroll, Chapin, and Hyman, 59).

Historical patterns of the San Francisco Bay Area also differ from many urban centers of the United States. The first notable growth period for this region after the establishment of the Spanish missions was the gold rush of the late 1840s and early 1850s. This high growth period impacted the city of San Francisco, which became the warehouse and supply center for the miners in the foothills of the Sierra Nevada. Due to the extensive use of ferries as transportation, this region felt its first pulls of urban sprawl before most cities in the United States. Bedroom communities developed in Marin county and the east bay counties before the turn of the century. Most cities across the country had to wait until the advent of the trolley car after 1900 to make the working class mobile. Instead of the large body of water inhibiting urban sprawl, it actually encouraged it (Vance, Geography, 45; Benet, 112; Carroll, Chapin, and Hyman, 63).

In many aspects, the Bay Area remained connected to San Francisco. Specialty towns developed to serve San Francisco (e.g., Pittsburg for steel, Richmond for refining, and peninsula cities for recreation). San Francisco began to show signs of isolation with the increased use of the railroad. While increasing the access between cities within different regions of the Bay Area, San Francisco remained relatively isolated due to the

lack of bridges. This allowed regions to become more self-sufficient and break their ties with San Francisco (Vance, Geography, 76; Benet, 86; Carroll, Chapin, and Hyman, 89).

World War II accentuated this process with an increase in specialized industry, including electronics, missiles, and research and development. This, along with increased use of the automobile, created a non-centric metropolis for the first time in the Bay Area (Vance, Geography, 56). More people were traveling from one outlying area to another for work rather than traveling from an outlying area to the center city. The boom development of the Silicon Valley continued this process by shifting still more influence away from San Francisco to the periphery.

The San Francisco Bay Area has a physical and cultural uniqueness all its own. These influences have given the area its reputations, and have allowed it to develop in a unique urban pattern.

Literature Review

Although very little work has been done that is similar to this project, there are several sources of information that relate to this study. The following is a limited review of the more helpful sources of previous work, from the macro to the micro level.

At the macro-level, there are many works that deal with the development process of cities in general. Most of these are focused on major metropolitan areas and were of help in providing the broad theories and histories of the development process. Some of the resources that were used in this study were *The North American City,* by Maurice Yeates and *The Continuing City: Urban Morphology in Western Civilization,* by James E.

Maurice Yeates; *Fundamentals of Urban Geography*, by Richard Ellefsen; and *The Continuing City: Urban Morphology in Western Civilization*, by James E. Vance, Jr. The author of the latter book, James E. Vance, Jr., has contributed a great amount to the literature regarding urban morphology.

On a smaller scale, the textbook, *Urban Design Downtown: Patterns and Politics of Form*, by Anastesia Loukaitou and Sideris Tridab, focuses on downtown areas of major metropolitan areas. This work provided an excellent source of information on downtown transformations.

The work that had the greatest impact on this study was *Geography and Urban Evolution in the San Francisco Bay Area*, by James E. Vance, Jr. Here, Vance explores the physical geography, history and urban transformation of the study area. It proved invaluable not only in background information regarding the different areas of the Bay Area, but also in the theoretical variations of development patterns that the Bay Area experienced that differed from the rest of the country.

There are also several guide books that helped tremendously in the description, both physically and historically, of many of the communities and regions of the San Francisco Bay Area. There are two notable sources of this type used in this study. The first, *The Suburbs of San Francisco*, by Jonathan Carroll, William Chapin and Alvin D. Hyman, is a good account of the communities organized at a regional level. This book also has a strong emphasis on the suburban qualities of each location, when compared to San Francisco. The other, *Guide to San Francisco and the Bay Region*, by James Benet, is another good source that covers a larger portion of the area of study.

Although it is focused on the tourist audience, it is full of valuable geographic information.

Chapter 2: Methodology

Field Work

The first step in the methodology was to establish criteria in order for a city to qualify for the study. The first criterion was location. The city had to be located in one of the nine counties (outside San Francisco County) constituting the Bay Area (Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and Santa Cruz). The second requirement was that a city had to have a distinguishable downtown area where walking was the dominant mode of transportation. The third qualification was that the city had to have been well established by the beginning year of the study period, which was 1949. Lastly, a qualifying city required a data stream extending from 1949 to the present. The most desirable set of data would consist of six dates; one in 1949 and one in 1998 with the other four spaced out at ten-year increments near the turn of each decade.

Once the criteria were established, a preliminary selection of possible cities was made. This was done with a combination of map work and *a priori* knowledge. A list of cities from the nine study counties was generated. The cities were then ranked according to their importance to the area. The first order always consisted of the largest and most important city of the county. Each consecutive order consisted of more cities than the previous order. Then, with *a priori* knowledge, cities at the two extremes were omitted. The cities at the bottom of the list were omitted for a variety of reasons. Some of the reasons include, but are not limited to; a lack of a distinguishable downtown; a

predominately residential area; or an area that was founded after 1949. The first order cities of San Francisco, Oakland, and San Jose, were not considered in this study because from their origins they were central cities and not satellites. Lastly, any cities with other special circumstances causing them to develop in a non-conformative way were also omitted.

The data used in this study came from a resource known as crisscross directories. These directories act as a phone book. However, the addresses in these directories are listed by street with the name of the shop, type of shop, and phone number following. The directories serve mapping purposes well by listing the shops sequentially with the numbers along the street. Several companies publish these directories. The Polk Directories are the oldest and encompass the longest time span; some cities have Polk Directories that date back to the 19th century. Information, however, is spotty. Data focuses mostly on the bigger towns, sometimes omitting the lesser order towns. Another problem with these directories is that not all dates are available. Haynes is another company that publishes crisscross directories. These directories were a much more helpful publication for this study for two reasons. First, they are county-based and are all-encompassing in their addresses. Second, almost all the dates from when the company started producing the reference are available. There are, however, two problems with these directories. First, they go back only to the early to middle 1970s. Second, the address listings are not as descriptive as those listed in Polk's. More interpretation needs to be utilized in order to determine the type of store found at each address. The pros and cons of these directories contributed to the pattern of data used for

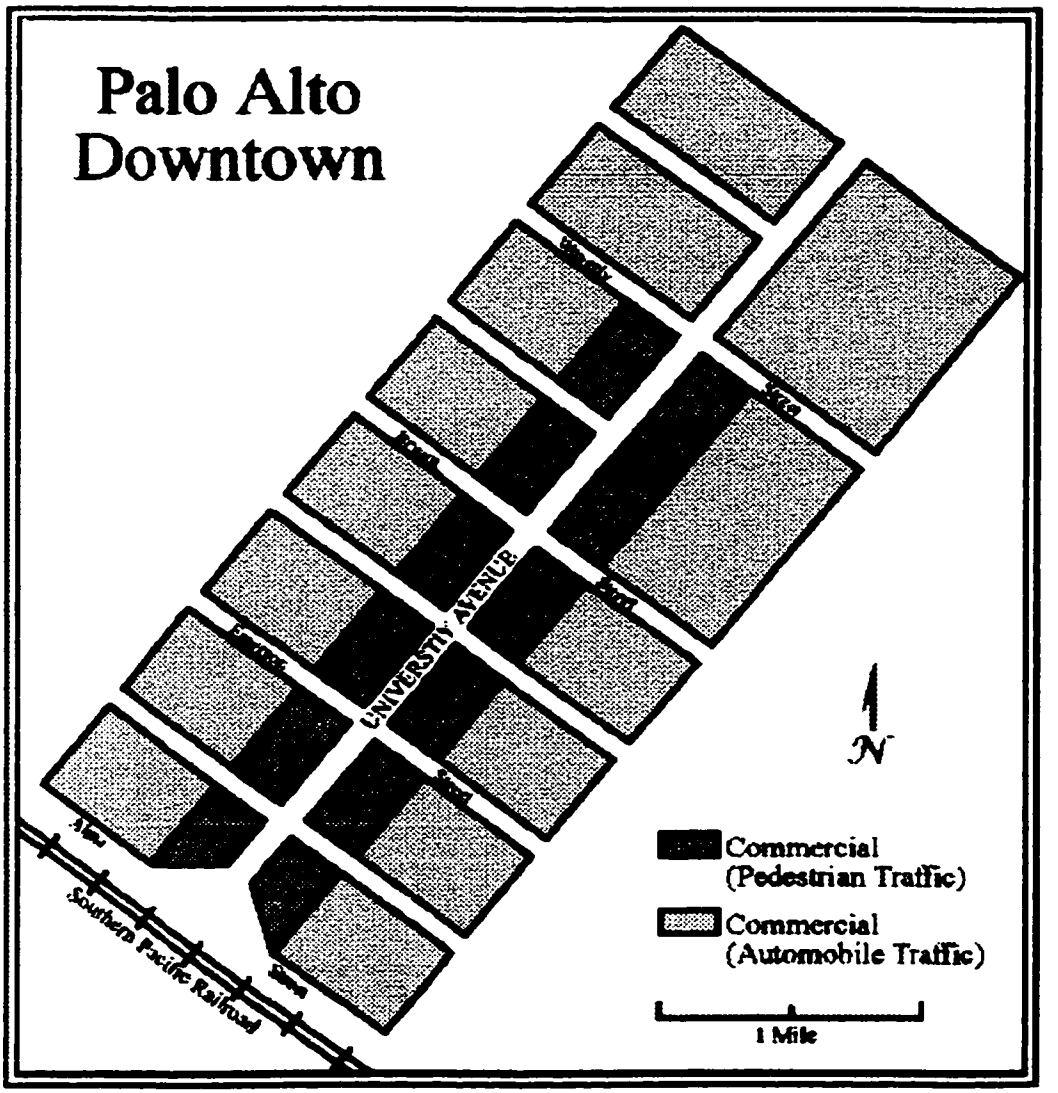
each city: Polk directories before 1975 and Haynes directories after this date. In order for a city to be included in the study, the Polk directory must have existing data of that city prior to 1975. At times, Pac Bell's crisscross directories were used when both Polk and Haynes directories were unavailable. These crisscross directories are available mainly in the reference section of libraries.

The next step was to go into the field to find the directories. For organizational purposes, this process was done county by county, beginning with the libraries of first order cities. Whether municipal or county-run, libraries in these larger cities serve as regional libraries for a large area. Often, these libraries carry crisscross directories for several communities. This was an initial check to see which dates were available for which cities. After checking the availability of Polk directories, the preliminary list of cities was then modified according to the available data.

The next step was to go to the communities on the list, specifically the downtown. To qualify, a city had to have a distinguishable downtown dominated by pedestrian traffic. These areas were usually relatively easy to delineate. Some characteristics of the downtown areas are streets faced by continuous "walls" of stores with no setback and often wider, more decorated sidewalks. Frequently, streets are decorated with banners denoting a historic downtown. The downtown can also be found by reading characteristic street signs, e.g., Main, First, A or B Street. The borders of downtowns often lie at street intersections where a noticeable change in land use marks each side (Figure 2). The next step was to note the addresses of the beginning and end of the study

area. Usually, the downtown spans three or four blocks on one street. Sometimes, more than one street was involved, but to simplify the study, usually

Figure 2: Downtown Palo Alto



only the most distinguishable street was used. Once the addresses were recorded, then the historical directories were consulted.

The oldest date was first analyzed to see if the delineated downtown existed at that date. If it did, then it was cross-referenced with the address range of the present downtown to see if they are the same. Once this was established, the necessary documents were photocopied for later data entry.

The last step was one last field check in the downtown. The last date was checked against the actual addresses of the downtown. Usually, there were no discrepancies. However, there were enough mistakes and changes in land use to warrant this last check for all the cities. Most changes were due to recent transactions, but there were some differences. These discrepancies were rectified by noting the changes and updating the records.

In addition to using resources at the regional library, crisscross directories were found at smaller libraries, museums, and historical societies. Usually, these locations did not have anything unique from the larger libraries, however some did shelve difficult-to-find volumes of the directories. In the end, thirty-five cities (Table 2) were eligible for the study.

Table 2: Cities That Qualified for the Study

City	County	Distance from San Francisco *
Hayward	Alameda	18.8
Livermore	Alameda	35.2
San Leandro	Alameda	14.8
Antioch	Contra Costa	35.6
Concord	Contra Costa	24.4
Pittsburg	Contra Costa	32.4
Richmond	Contra Costa	11.6
Walnut Creek	Contra Costa	20.8
Fairfax	Marin	17.5
San Anselmo	Marin	16
San Rafael	Marin	14.4
Calistoga	Napa	55
Napa	Napa	34
Saint Helena	Napa	49
Burlingame (#1)	San Mateo	12.4
Burlingame (#2)	San Mateo	13.4
Redwood City	San Mateo	21.2
San Bruno	San Mateo	10.1
San Carlos	San Mateo	20
San Mateo	San Mateo	14.4
Gilroy	Santa Clara	71
Los Gatos	Santa Clara	42
Morgan Hill	Santa Clara	61
Mountain View	Santa Clara	29.2
Palo Alto	Santa Clara	25.6
Sunnyvale	Santa Clara	33.2
Willow Glen	Santa Clara	40
Aptos	Santa Cruz	61
Capitola	Santa Cruz	60
Santa Cruz	Santa Cruz	57.4
Soquel	Santa Cruz	58
Watsonville	Santa Cruz	79
Vallejo	Solano	22.8
Petaluma	Sonoma	33
Santa Rosa	Sonoma	48

*Distance denoted in miles

Data Processing

Data processing followed collection. Organization at the county level was continued. The first step was to categorize the individual addresses. The addresses were placed into one of the two categories: high-end or low-end. This step took a relatively long time due to the amount of data and the amount of time spent on classification. This was especially true from the middle 1970s due to the lack of description of the shops in the Haynes directories which left much to be interpreted.

The next step was to calculate the percentage of service shops for each city at each date. This was done by simply dividing the number of service shops by the total number of addresses for each date.

The data then were entered into a spreadsheet in Microsoft Excel 97. The original spreadsheet was designed with dates in the columns across the top and the individual cities in the rows along the side. Other columns of information - county, region and linear distance from San Francisco - were inserted before the years to help sort and organize the data. The years start with 1947 and end with 1999. The columns were created with one for each year to accommodate the range of dates. The same year in each decade was not always available. The format allowed any year to be entered at its correct location.

Once all the percentages for each city were entered, the dates in between the existing data were inferred. This makes the graph easier to read because there are continuous lines for each city, rather than single x,y plots whose dates do not correspond. By plotting entire lines of change for each city, different dates or ranges of dates could be

compared to find a better relationship. (This process was done rather simply in Excel using the series fill option under the edit pull-down menu.) Evenly proportioned steps were created between the dates that had data. Next, a row was added to the bottom where an average was generated from all the data for each date, thus creating a final curve. These data were then graphed using the line graph option on Excel.

Data Analysis

The rate of change over time was an important factor. The cities needed to have the same beginning and ending dates; all the cities were measured from a set starting point of 1949. While the majority of the cities met this starting point, some did not have data until after 1949, which forced the data to be inferred without a beginning year. This is dangerous because there is no grounding for the data on one end. However, because of the small number of cities involved, this process was deemed acceptable. The method used employed the rate of change for the first two hard data dates with projection of change to 1949.

Two slightly different statistical processes were used to normalize the data. The first took the percentage of low-end shops at each date and subtracted it from the percentage at 1949. This new number at each date is a change in percent. This proved very useful, but it was felt that it allowed the cities that started with a high percentage to outweigh the ones that started with a lower percent. Straight change in percent was not quite useful. To normalize the data even more, a second step was added at the end. The new percent was divided by the original percentage in 1949. This new number at each

date is a percent change. This proved more useful because it allows the cities with varying percentages to have their change better represented. Although both of these processes had very similar results, the percent change was the more useful for this study (Table 3).

City Grouping

Besides individual city patterns of development, similarities between cities are helpful in understanding the morphology of a metropolitan area. This can be found by grouping data from study cities into geographically logical categories. Cities were first grouped according to (1) regions and (2) linear distance from San Francisco. There are six groupings in total; three regional and three linear distance groupings. Map 1 shows the distribution of the thirty-five cities.

The first regional grouping was by county. In this grouping, there are nine classes, one for each county in the study. The other two regional groupings are both based on grouping two or more adjacent counties with similar geographical settings. Three classes comprise the first multiple county grouping:(1) the North Bay Area consisting of Marin, Sonoma, Napa and Solano counties; (2) the East Bay Area consisting of Contra Costa and Alameda counties; and (3) the South Bay Area consisting of San Mateo, Santa Clara and Santa Cruz counties (Map 2). The second multiple-county grouping creates four rather than three classes by grouping counties together that have similar histories or development patterns (Map 3). The four classes are:(1) Marin and

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

City	1949	1950	1951	1952	1953	1954	1955	1956	1957
Hayward	0.000	-0.007	-0.013	-0.020	-0.026	-0.033	-0.040	-0.046	-0.053
Livermore	0.000	-0.006	-0.012	-0.019	-0.025	-0.031	-0.037	-0.044	-0.050
San Leandro	0.000	-0.007	-0.014	-0.021	-0.027	-0.034	-0.041	-0.048	-0.055
Antioch	0.000	-0.022	-0.044	-0.066	-0.088	-0.110	-0.132	-0.154	-0.176
Concord	0.000	-0.017	-0.034	-0.050	-0.067	-0.084	-0.101	-0.118	-0.135
Pittsburg	0.000	-0.035	-0.070	-0.105	-0.140	-0.176	-0.211	-0.246	-0.281
Richmond	0.000	-0.021	-0.043	-0.064	-0.086	-0.107	-0.129	-0.150	-0.172
Walnut Creek	0.000	-0.022	-0.043	-0.065	-0.087	-0.108	-0.130	-0.152	-0.173
Fairfax	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
San Anselmo	0.000	-0.006	-0.013	-0.019	-0.026	-0.032	-0.039	-0.045	-0.052
San Rafael	0.000	0.020	0.040	0.060	0.081	0.101	0.121	0.141	0.161
Calistoga	0.000	-0.029	-0.059	-0.088	-0.118	-0.147	-0.177	-0.206	-0.235
Napa	0.000	-0.020	-0.039	-0.078	-0.117	-0.156	-0.195	-0.234	-0.273
Saint Helena	0.000	-0.012	-0.024	-0.036	-0.047	-0.059	-0.071	-0.083	-0.095
Burlingame (#1)	0.000	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005
Burlingame (#2)	0.000	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008
Redwood City	0.000	-0.039	-0.077	-0.116	-0.154	-0.193	-0.231	-0.270	-0.308
San Bruno	0.000	-0.023	-0.046	-0.093	-0.139	-0.186	-0.232	-0.241	-0.250
San Carlos	0.000	-0.002	-0.004	-0.006	-0.008	-0.011	-0.013	-0.015	-0.017
San Mateo	0.000	0.005	0.010	0.015	0.020	0.026	0.031	0.036	0.041
Gilroy	0.000	0.017	0.033	0.050	0.067	0.083	0.100	0.117	0.134
Los Gatos	0.000	-0.010	-0.020	-0.030	-0.040	-0.051	-0.061	-0.071	-0.081
Morgan Hill	0.000	-0.011	-0.023	-0.034	-0.045	-0.057	-0.068	-0.079	-0.091
Mountain View	0.000	-0.011	-0.023	-0.034	-0.046	-0.057	-0.068	-0.080	-0.091
Palo Alto	0.000	-0.022	-0.044	-0.066	-0.088	-0.109	-0.131	-0.153	-0.175
Sunnyvale	0.000	-0.002	-0.004	-0.007	-0.009	-0.011	-0.017	-0.023	-0.029
Willow Glen	0.000	-0.032	-0.063	-0.095	-0.126	-0.157	-0.189	-0.220	-0.251
Aptos	0.000	-0.007	-0.015	-0.022	-0.030	-0.037	-0.045	-0.052	-0.060
Capitola	0.000	-0.039	-0.077	-0.116	-0.155	-0.193	-0.232	-0.271	-0.309
Santa Cruz	0.000	-0.014	-0.028	-0.041	-0.055	-0.069	-0.083	-0.097	-0.110
Soquel	0.000	-0.019	-0.038	-0.058	-0.077	-0.096	-0.115	-0.134	-0.154
Watsonville	0.000	-0.018	-0.035	-0.053	-0.070	-0.088	-0.106	-0.123	-0.141
Vallejo	0.000	-0.008	-0.017	-0.025	-0.034	-0.042	-0.050	-0.059	-0.067
Petaluma	0.000	-0.031	-0.061	-0.092	-0.122	-0.153	-0.183	-0.214	-0.244
Santa Rosa	0.000	-0.005	-0.009	-0.014	-0.019	-0.024	-0.028	-0.033	-0.038
Average	0.000	-0.013	-0.026	-0.040	-0.053	-0.066	-0.079	-0.092	-0.106

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

City	1958	1959	1960	1961	1962	1963	1964	1965	1966
Hayward	-0.059	-0.066	-0.069	-0.071	-0.074	-0.076	-0.079	-0.081	-0.084
Livermore	-0.056	-0.062	-0.068	-0.074	-0.079	-0.085	-0.090	-0.096	-0.102
San Leandro	-0.062	-0.069	-0.076	-0.082	-0.089	-0.096	-0.103	-0.110	-0.117
Antioch	-0.183	-0.190	-0.197	-0.203	-0.210	-0.217	-0.224	-0.231	-0.238
Concord	-0.152	-0.168	-0.185	-0.202	-0.219	-0.236	-0.253	-0.269	-0.286
Pittsburg	-0.279	-0.277	-0.276	-0.274	-0.272	-0.270	-0.268	-0.266	-0.265
Richmond	-0.193	-0.215	-0.247	-0.279	-0.310	-0.342	-0.374	-0.381	-0.387
Walnut Creek	-0.195	-0.217	-0.238	-0.260	-0.282	-0.303	-0.325	-0.347	-0.369
Fairfax	-0.002	-0.002	-0.002	-0.019	-0.035	-0.052	-0.069	-0.085	-0.102
San Anselmo	-0.058	-0.065	-0.071	-0.087	-0.103	-0.119	-0.135	-0.151	-0.167
San Rafael	0.182	0.202	0.222	0.208	0.194	0.179	0.165	0.151	0.137
Calistoga	-0.264	-0.282	-0.299	-0.317	-0.334	-0.352	-0.369	-0.387	-0.404
Napa	-0.312	-0.336	-0.361	-0.385	-0.409	-0.433	-0.458	-0.482	-0.506
Saint Helena	-0.107	-0.119	-0.131	-0.143	-0.155	-0.166	-0.178	-0.190	-0.202
Burlingame (#1)	0.005	0.006	0.006	0.007	0.007	0.008	0.008	0.009	0.009
Burlingame (#2)	-0.010	-0.011	-0.012	-0.013	-0.014	-0.015	-0.016	-0.017	-0.018
Redwood City	-0.347	-0.385	-0.361	-0.338	-0.314	-0.290	-0.267	-0.243	-0.236
San Bruno	-0.259	-0.268	-0.277	-0.286	-0.295	-0.304	-0.313	-0.322	-0.331
San Carlos	-0.019	-0.021	-0.023	-0.025	-0.027	-0.029	-0.031	-0.032	-0.034
San Mateo	0.046	0.051	0.039	0.027	0.015	0.003	-0.009	-0.020	-0.032
Gilroy	0.150	0.167	0.184	0.200	0.217	0.234	0.250	0.267	0.284
Los Gatos	-0.091	-0.099	-0.108	-0.116	-0.124	-0.133	-0.141	-0.149	-0.158
Morgan Hill	-0.102	-0.113	-0.125	-0.136	-0.147	-0.159	-0.170	-0.181	-0.193
Mountain View	-0.102	-0.113	-0.125	-0.136	-0.147	-0.166	-0.184	-0.203	-0.222
Palo Alto	-0.197	-0.219	-0.216	-0.213	-0.210	-0.207	-0.203	-0.200	-0.197
Sunnyvale	-0.035	-0.042	-0.048	-0.054	-0.060	-0.066	-0.072	-0.068	-0.063
Willow Glen	-0.283	-0.314	-0.324	-0.334	-0.345	-0.355	-0.365	-0.375	-0.385
Aptos	-0.067	-0.075	-0.082	-0.090	-0.097	-0.105	-0.112	-0.137	-0.162
Capitola	-0.348	-0.387	-0.425	-0.464	-0.503	-0.542	-0.580	-0.619	-0.658
Santa Cruz	-0.124	-0.138	-0.143	-0.148	-0.153	-0.158	-0.163	-0.168	-0.173
Soquel	-0.173	-0.192	-0.211	-0.230	-0.250	-0.269	-0.288	-0.307	-0.326
Watsonville	-0.158	-0.176	-0.173	-0.170	-0.167	-0.164	-0.161	-0.158	-0.155
Vallejo	-0.076	-0.084	-0.099	-0.114	-0.129	-0.144	-0.159	-0.174	-0.189
Petaluma	-0.275	-0.305	-0.291	-0.277	-0.263	-0.249	-0.235	-0.221	-0.207
Santa Rosa	-0.042	-0.047	-0.031	-0.014	0.002	0.019	0.035	0.051	0.068
Average	-0.119	-0.132	-0.140	-0.148	-0.156	-0.164	-0.172	-0.179	-0.187

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

City	1967	1968	1969	1970	1971	1972	1973	1974	1975
Hayward	-0.086	-0.089	-0.091	-0.094	-0.096	-0.099	-0.102	-0.104	-0.107
Livermore	-0.107	-0.113	-0.118	-0.124	-0.130	-0.135	-0.141	-0.146	-0.152
San Leandro	-0.124	-0.131	-0.138	-0.145	-0.182	-0.220	-0.257	-0.294	-0.332
Antioch	-0.244	-0.251	-0.258	-0.286	-0.313	-0.341	-0.368	-0.396	-0.423
Concord	-0.303	-0.320	-0.337	-0.354	-0.370	-0.387	-0.404	-0.421	-0.438
Pittsburg	-0.263	-0.261	-0.259	-0.314	-0.369	-0.424	-0.479	-0.534	-0.589
Richmond	-0.394	-0.401	-0.407	-0.414	-0.421	-0.427	-0.434	-0.441	-0.447
Walnut Creek	-0.390	-0.412	-0.415	-0.418	-0.420	-0.423	-0.426	-0.429	-0.431
Fairfax	-0.118	-0.135	-0.162	-0.190	-0.217	-0.244	-0.272	-0.299	-0.327
San Anselmo	-0.183	-0.199	-0.221	-0.244	-0.266	-0.289	-0.311	-0.334	-0.356
San Rafael	0.122	0.108	0.075	0.042	0.010	-0.023	-0.056	-0.089	-0.122
Calistoga	-0.422	-0.439	-0.444	-0.450	-0.455	-0.460	-0.466	-0.471	-0.477
Napa	-0.530	-0.555	-0.579	-0.569	-0.559	-0.550	-0.540	-0.530	-0.520
Saint Helena	-0.214	-0.226	-0.238	-0.256	-0.273	-0.291	-0.309	-0.327	-0.344
Burlingame (#1)	0.010	0.010	0.011	0.011	0.012	0.012	0.013	0.013	0.014
Burlingame (#2)	-0.019	-0.020	-0.021	-0.022	-0.023	-0.025	-0.026	-0.027	-0.028
Redwood City	-0.229	-0.223	-0.216	-0.209	-0.202	-0.196	-0.189	-0.182	-0.175
San Bruno	-0.341	-0.350	-0.359	-0.368	-0.377	-0.386	-0.395	-0.404	-0.413
San Carlos	-0.036	-0.038	-0.040	-0.042	-0.044	-0.046	-0.048	-0.050	-0.051
San Mateo	-0.044	-0.056	-0.068	-0.064	-0.061	-0.057	-0.053	-0.050	-0.046
Gilroy	0.300	0.317	0.333	0.350	0.286	0.223	0.159	0.096	0.032
Los Gatos	-0.166	-0.190	-0.214	-0.238	-0.262	-0.286	-0.310	-0.334	-0.357
Morgan Hill	-0.204	-0.215	-0.227	-0.238	-0.251	-0.263	-0.276	-0.289	-0.301
Mountain View	-0.240	-0.259	-0.277	-0.295	-0.312	-0.330	-0.348	-0.366	-0.383
Palo Alto	-0.194	-0.191	-0.188	-0.203	-0.219	-0.234	-0.249	-0.264	-0.280
Sunnyvale	-0.059	-0.054	-0.100	-0.146	-0.192	-0.239	-0.285	-0.331	-0.377
Willow Glen	-0.396	-0.406	-0.416	-0.421	-0.425	-0.430	-0.434	-0.439	-0.444
Aptos	-0.187	-0.212	-0.237	-0.265	-0.292	-0.320	-0.347	-0.375	-0.403
Capitola	-0.697	-0.735	-0.774	-0.789	-0.804	-0.820	-0.835	-0.850	-0.865
Santa Cruz	-0.178	-0.183	-0.188	-0.208	-0.229	-0.249	-0.270	-0.290	-0.310
Soquel	-0.346	-0.365	-0.384	-0.401	-0.417	-0.434	-0.450	-0.467	-0.483
Watsonville	-0.152	-0.149	-0.146	-0.161	-0.176	-0.191	-0.206	-0.221	-0.236
Vallejo	-0.204	-0.219	-0.233	-0.248	-0.262	-0.277	-0.291	-0.306	-0.320
Petaluma	-0.193	-0.179	-0.165	-0.151	-0.175	-0.199	-0.223	-0.247	-0.271
Santa Rosa	0.084	0.101	0.117	0.068	0.019	-0.030	-0.079	-0.129	-0.178
Average	-0.195	-0.203	-0.211	-0.228	-0.246	-0.263	-0.280	-0.298	-0.315

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

City	1976	1977	1978	1979	1980	1981	1982	1983	1984
Hayward	-0.109	-0.112	-0.115	-0.117	-0.120	-0.142	-0.165	-0.187	-0.209
Livermore	-0.158	-0.163	-0.169	-0.174	-0.180	-0.154	-0.129	-0.103	-0.078
San Leandro	-0.369	-0.406	-0.443	-0.481	-0.518	-0.530	-0.542	-0.554	-0.566
Antioch	-0.451	-0.478	-0.506	-0.533	-0.561	-0.572	-0.584	-0.595	-0.607
Concord	-0.455	-0.471	-0.488	-0.505	-0.522	-0.550	-0.577	-0.605	-0.633
Pittsburg	-0.644	-0.699	-0.754	-0.809	-0.864	-0.881	-0.898	-0.915	-0.932
Richmond	-0.454	-0.461	-0.467	-0.474	-0.481	-0.487	-0.494	-0.501	-0.507
Walnut Creek	-0.434	-0.437	-0.440	-0.442	-0.445	-0.457	-0.469	-0.481	-0.494
Fairfax	-0.354	-0.381	-0.409	-0.436	-0.445	-0.455	-0.464	-0.473	-0.483
San Anselmo	-0.379	-0.401	-0.424	-0.446	-0.462	-0.477	-0.493	-0.508	-0.524
San Rafael	-0.155	-0.187	-0.220	-0.253	-0.257	-0.260	-0.264	-0.267	-0.271
Calistoga	-0.482	-0.487	-0.493	-0.498	-0.491	-0.483	-0.476	-0.469	-0.462
Napa	-0.511	-0.501	-0.491	-0.511	-0.530	-0.550	-0.570	-0.590	-0.609
Saint Helena	-0.362	-0.380	-0.397	-0.415	-0.414	-0.414	-0.413	-0.413	-0.412
Burlingame (#1)	0.014	0.015	0.015	0.016	0.003	-0.011	-0.025	-0.038	-0.052
Burlingame (#2)	-0.029	-0.030	-0.031	-0.032	-0.052	-0.071	-0.091	-0.110	-0.130
Redwood City	-0.168	-0.162	-0.155	-0.148	-0.161	-0.175	-0.188	-0.201	-0.215
San Bruno	-0.422	-0.431	-0.440	-0.449	-0.445	-0.440	-0.436	-0.431	-0.427
San Carlos	-0.053	-0.055	-0.057	-0.059	-0.054	-0.049	-0.044	-0.039	-0.034
San Mateo	-0.042	-0.038	-0.035	-0.031	-0.031	-0.031	-0.031	-0.031	-0.031
Gilroy	-0.031	-0.095	-0.158	-0.222	-0.285	-0.349	-0.333	-0.318	-0.302
Los Gatos	-0.381	-0.405	-0.429	-0.453	-0.477	-0.501	-0.522	-0.544	-0.565
Morgan Hill	-0.314	-0.326	-0.339	-0.352	-0.364	-0.377	-0.390	-0.403	-0.416
Mountain View	-0.401	-0.419	-0.437	-0.454	-0.472	-0.490	-0.503	-0.517	-0.530
Palo Alto	-0.295	-0.310	-0.325	-0.341	-0.356	-0.371	-0.370	-0.370	-0.369
Sunnyvale	-0.423	-0.469	-0.516	-0.562	-0.608	-0.654	-0.644	-0.635	-0.625
Willow Glen	-0.448	-0.453	-0.457	-0.462	-0.466	-0.471	-0.484	-0.496	-0.509
Aptos	-0.430	-0.458	-0.485	-0.513	-0.505	-0.496	-0.488	-0.479	-0.471
Capitola	-0.880	-0.896	-0.911	-0.926	-0.924	-0.922	-0.920	-0.918	-0.917
Santa Cruz	-0.331	-0.351	-0.372	-0.392	-0.414	-0.436	-0.458	-0.480	-0.502
Soquel	-0.500	-0.516	-0.533	-0.549	-0.553	-0.557	-0.561	-0.565	-0.569
Watsonville	-0.251	-0.266	-0.281	-0.296	-0.292	-0.287	-0.283	-0.278	-0.274
Vallejo	-0.335	-0.349	-0.364	-0.378	-0.373	-0.368	-0.363	-0.358	-0.353
Petaluma	-0.295	-0.319	-0.343	-0.367	-0.374	-0.382	-0.389	-0.396	-0.403
Santa Rosa	-0.227	-0.276	-0.325	-0.374	-0.389	-0.403	-0.418	-0.433	-0.447
Average	-0.332	-0.349	-0.367	-0.384	-0.391	-0.399	-0.406	-0.413	-0.421

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

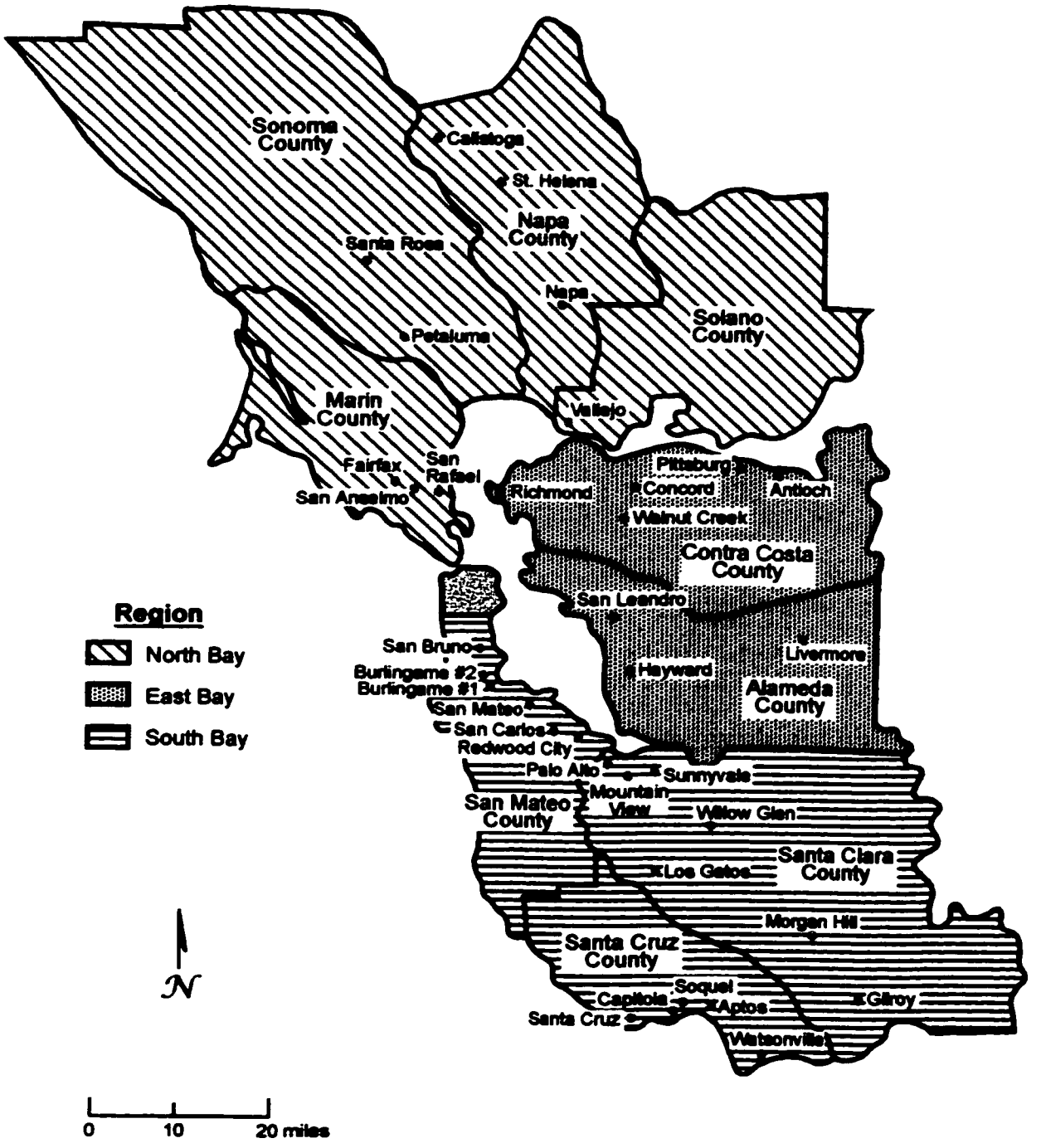
City	1985	1986	1987	1988	1989	1990	1991	1992	1993
Hayward	-0.231	-0.254	-0.276	-0.298	-0.303	-0.308	-0.314	-0.319	-0.324
Livermore	-0.052	-0.026	-0.001	0.025	0.010	-0.006	-0.021	-0.037	-0.052
San Leandro	-0.578	-0.590	-0.602	-0.614	-0.618	-0.621	-0.625	-0.628	-0.632
Antioch	-0.618	-0.629	-0.641	-0.652	-0.656	-0.660	-0.664	-0.668	-0.672
Concord	-0.660	-0.688	-0.715	-0.743	-0.741	-0.739	-0.737	-0.735	-0.734
Pittsburg	-0.949	-0.966	-0.983	-1.000	-0.980	-0.961	-0.941	-0.922	-0.902
Richmond	-0.514	-0.521	-0.527	-0.534	-0.539	-0.544	-0.550	-0.555	-0.560
Walnut Creek	-0.506	-0.518	-0.530	-0.542	-0.550	-0.558	-0.566	-0.574	-0.583
Fairfax	-0.492	-0.501	-0.510	-0.520	-0.529	-0.550	-0.570	-0.591	-0.611
San Anselmo	-0.540	-0.555	-0.571	-0.586	-0.602	-0.600	-0.597	-0.595	-0.593
San Rafael	-0.274	-0.278	-0.281	-0.285	-0.288	-0.297	-0.306	-0.315	-0.324
Calistoga	-0.454	-0.447	-0.450	-0.453	-0.456	-0.458	-0.461	-0.464	-0.467
Napa	-0.629	-0.649	-0.668	-0.688	-0.677	-0.666	-0.655	-0.644	-0.634
Saint Helena	-0.412	-0.411	-0.411	-0.410	-0.410	-0.409	-0.426	-0.443	-0.460
Burlingame (#1)	-0.065	-0.079	-0.092	-0.106	-0.119	-0.132	-0.145	-0.158	-0.171
Burlingame (#2)	-0.150	-0.169	-0.189	-0.208	-0.228	-0.229	-0.230	-0.231	-0.232
Redwood City	-0.228	-0.241	-0.254	-0.268	-0.281	-0.285	-0.290	-0.294	-0.299
San Bruno	-0.422	-0.418	-0.413	-0.409	-0.404	-0.417	-0.430	-0.444	-0.457
San Carlos	-0.029	-0.024	-0.019	-0.014	-0.009	-0.027	-0.045	-0.064	-0.082
San Mateo	-0.031	-0.031	-0.031	-0.031	-0.031	-0.048	-0.065	-0.081	-0.098
Gilroy	-0.287	-0.271	-0.255	-0.240	-0.224	-0.250	-0.275	-0.301	-0.327
Los Gatos	-0.586	-0.607	-0.629	-0.650	-0.671	-0.669	-0.668	-0.666	-0.665
Morgan Hill	-0.429	-0.441	-0.454	-0.467	-0.480	-0.480	-0.480	-0.480	-0.480
Mountain View	-0.543	-0.556	-0.570	-0.583	-0.596	-0.602	-0.608	-0.613	-0.619
Palo Alto	-0.369	-0.368	-0.367	-0.367	-0.366	-0.382	-0.398	-0.415	-0.431
Sunnyvale	-0.616	-0.606	-0.596	-0.587	-0.577	-0.577	-0.577	-0.578	-0.578
Willow Glen	-0.522	-0.534	-0.547	-0.559	-0.572	-0.582	-0.591	-0.601	-0.610
Aptos	-0.463	-0.454	-0.446	-0.437	-0.429	-0.426	-0.423	-0.419	-0.416
Capitola	-0.915	-0.913	-0.911	-0.909	-0.907	-0.912	-0.918	-0.923	-0.929
Santa Cruz	-0.524	-0.546	-0.568	-0.590	-0.612	-0.616	-0.619	-0.623	-0.626
Soquel	-0.572	-0.576	-0.580	-0.584	-0.588	-0.593	-0.597	-0.602	-0.607
Watsonville	-0.269	-0.265	-0.260	-0.256	-0.251	-0.288	-0.326	-0.363	-0.400
Vallejo	-0.348	-0.343	-0.338	-0.333	-0.354	-0.374	-0.395	-0.416	-0.437
Petaluma	-0.411	-0.418	-0.425	-0.432	-0.440	-0.447	-0.449	-0.451	-0.452
Santa Rosa	-0.462	-0.476	-0.491	-0.506	-0.520	-0.535	-0.531	-0.528	-0.524
Average	-0.428	-0.435	-0.442	-0.450	-0.457	-0.464	-0.471	-0.478	-0.485

Table 3: Percent Change from Low-end Goods and Services from 1949 to 1998

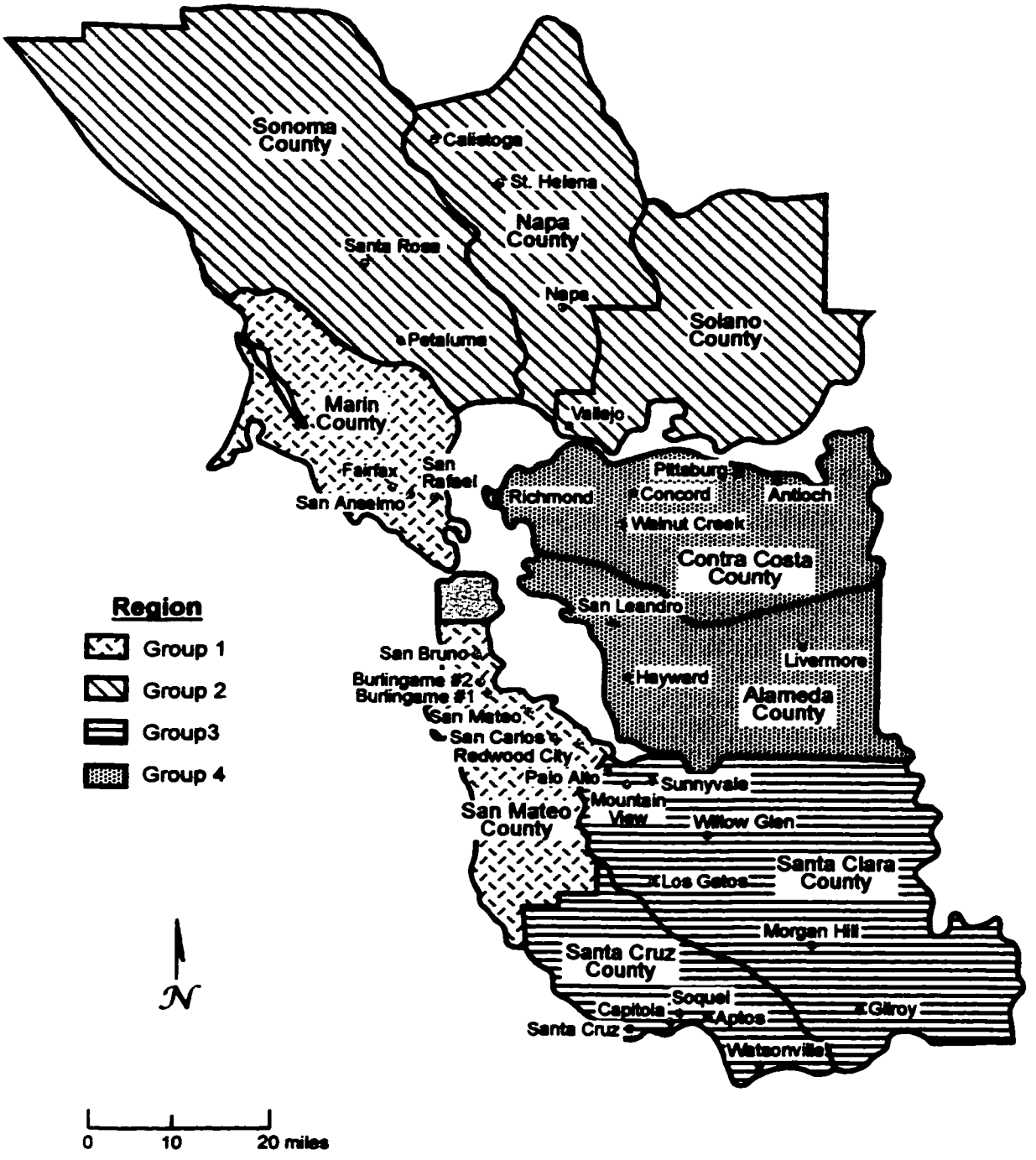
City	1994	1995	1996	1997	1998
Hayward	-0.329	-0.334	-0.340	-0.345	-0.350
Livermore	-0.067	-0.083	-0.098	-0.114	-0.129
San Leandro	-0.635	-0.639	-0.642	-0.646	-0.649
Antioch	-0.676	-0.680	-0.684	-0.688	-0.692
Concord	-0.732	-0.730	-0.728	-0.726	-0.724
Pittsburg	-0.882	-0.863	-0.843	-0.824	-0.804
Richmond	-0.565	-0.570	-0.576	-0.581	-0.586
Walnut Creek	-0.591	-0.599	-0.607	-0.615	-0.623
Fairfax	-0.632	-0.653	-0.673	-0.694	-0.714
San Anselmo	-0.591	-0.588	-0.586	-0.584	-0.581
San Rafael	-0.333	-0.341	-0.350	-0.359	-0.368
Calistoga	-0.470	-0.473	-0.475	-0.478	-0.481
Napa	-0.623	-0.612	-0.601	-0.590	-0.579
Saint Helena	-0.477	-0.493	-0.510	-0.527	-0.544
Burlingame (#1)	-0.185	-0.198	-0.211	-0.224	-0.237
Burlingame (#2)	-0.233	-0.234	-0.235	-0.236	-0.237
Redwood City	-0.303	-0.307	-0.312	-0.316	-0.321
San Bruno	-0.470	-0.483	-0.496	-0.510	-0.523
San Carlos	-0.100	-0.118	-0.136	-0.155	-0.173
San Mateo	-0.115	-0.132	-0.149	-0.165	-0.182
Gilroy	-0.352	-0.378	-0.404	-0.429	-0.455
Los Gatos	-0.663	-0.662	-0.660	-0.659	-0.657
Morgan Hill	-0.480	-0.480	-0.480	-0.480	-0.480
Mountain View	-0.625	-0.631	-0.636	-0.642	-0.648
Palo Alto	-0.447	-0.463	-0.480	-0.496	-0.512
Sunnyvale	-0.578	-0.578	-0.579	-0.579	-0.579
Willow Glen	-0.620	-0.629	-0.639	-0.648	-0.658
Aptos	-0.413	-0.410	-0.406	-0.403	-0.400
Capitola	-0.934	-0.940	-0.945	-0.951	-0.956
Santa Cruz	-0.630	-0.633	-0.637	-0.640	-0.644
Soquel	-0.611	-0.616	-0.621	-0.625	-0.630
Watsonville	-0.438	-0.475	-0.512	-0.550	-0.587
Vallejo	-0.457	-0.478	-0.499	-0.520	-0.540
Petaluma	-0.454	-0.456	-0.458	-0.459	-0.461
Santa Rosa	-0.521	-0.517	-0.513	-0.510	-0.506
Average	-0.492	-0.499	-0.506	-0.513	-0.520

Map 1: Regional Grouping: County

Map 2: Regional Grouping: Multiple County #1



Map 3: Regional Grouping: Multiple County #2



San Mateo counties; (2) Sonoma, Napa, and Solano counties; (3) Santa Clara and Santa Cruz counties; (4) Contra Costa and Alameda counties.

Three different groupings deal with the linear distance from San Francisco. Linear distance was measured in miles from downtown San Francisco to each city. In the first grouping, each class had the same number of cities (Map 4). In this case there seven classes, each containing five cities. The five cities closest to San Francisco are in one group while the five farthest away are in another group. The next grouping uses set distances to group the cities (Map 5). Every ten miles away from San Francisco marks the end of one class and the beginning of the next. This created seven classes of varying size. The last grouping places cites with similar distances together (Map 6). This was done by charting the distances on a histogram and then grouping the cities by natural breaks, which created seven classes.

The appropriateness of each grouping was then measured by comparing the data. To do this, the mean of each grouping was generated. This was done by adding the values of all the cities for each date and then dividing the total value by the number of cities. This created a new string of values, one for each date. Each city was then compared to this average by recording the residual for each date. The residual is the absolute value of the difference between two y values on a graph with the same x value. In other words, the difference in value between the average and each city for each date was recorded. The average residual is then calculated by adding the residuals for each date and dividing by the total number of dates. Last, the average group residual is generated by adding the average residual for each city and dividing by the number of

Map 4: Linear Distance Grouping: Set Size

Map 5: Linear Distance Grouping: Set Distance

Map 6: Linear Distance Grouping: Natural Breaks

cities in the group. The lower the average residual, the more similar the cities are in each group and the better the representation of the transformation process.

Graphing

The last step in the methodology is graphing. Two different types of graphs were created. The first graphs are based on the percent change data. These data can thus be portrayed as a curve with time as the horizontal axis and percent change as the vertical axis. These are typically negative curves that start at zero in 1949 and then drop as the study progresses through time. Two different sets of this type of graph were made. The first set is found in the beginning of Chapter Three, where each of the cities is discussed individually. A different graph exhibiting each city's curve versus the average city curve is located with the discussion of each city. The other set of percentage change graphs are in the grouping section of the Chapter Three. These display the curves of the cities in each grouping.

The next group of graphs that were generated was a series of 100% bar graphs. These are based on the straight percentages of service and retail shops and on the fact that there are a finite number of locations. Each bar is divided into the two categories, high-end or low-end, each shown in a percentage of 100. Only two dates were used for these, 1949 and 1998. These are very useful in showing the total change over the entire time period. They are a necessary supplement to the percent change graphs in the interpretation of the individual cities.

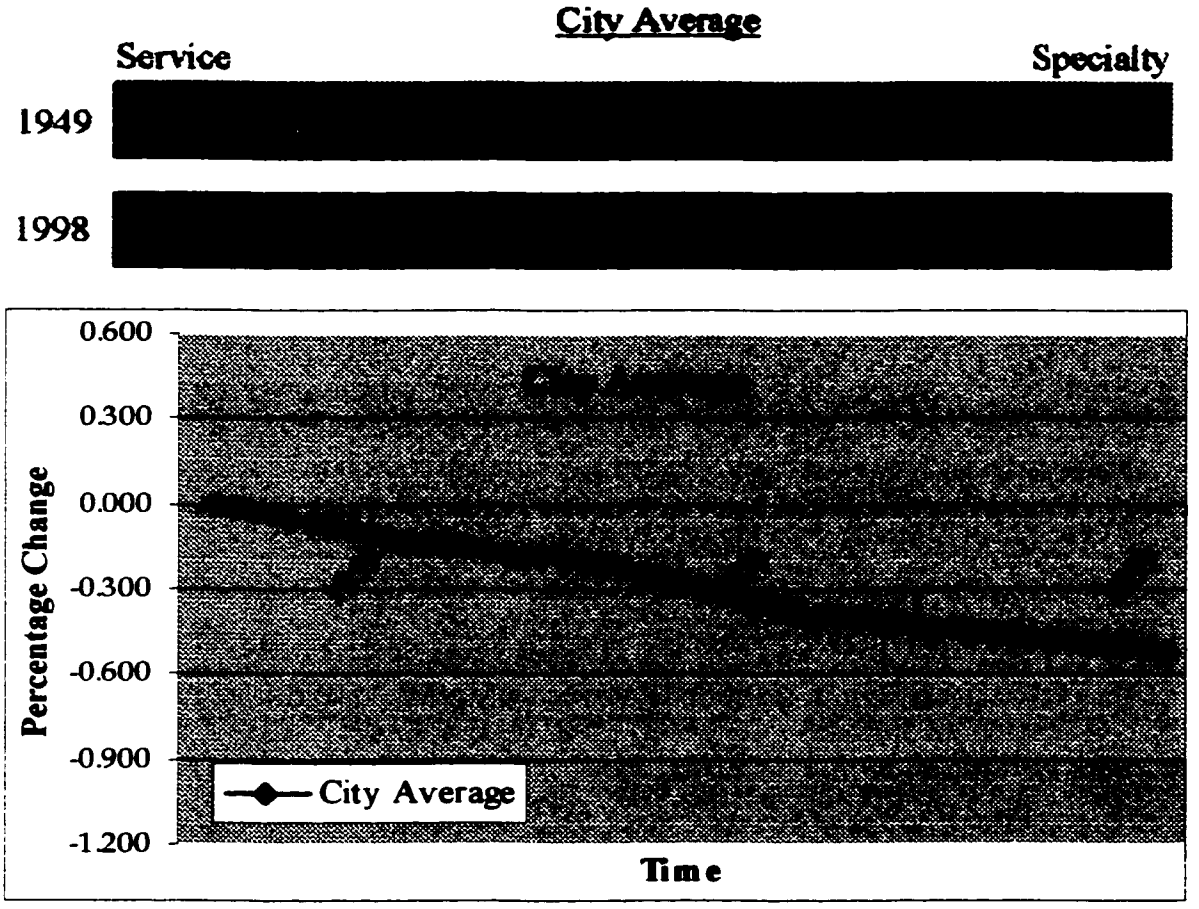
Chapter 3: Analysis

Individual Cities

The study's fundamental measurement produces curves showing the percent change from low-end, service-oriented shops to high-end, specialty shops. In most cases, it is a negative curve that has a negative percent change; a line showing positive change would actually indicate an increase in the percent of service-oriented shops. The city average curve is a curve that represents the aggregate of all the cities in the study. A relatively flat line that remains above the city average portrays a city that has experienced little change during the study time period. This could be the result of either a well-established downtown that has already experienced the change or it could be a city that has not yet transformed. If the line has a steep angle, the city is experiencing a high degree of change. If the curve is below the city average, then it is experiencing more change than most of the cities in the study area at that time period. The 100% bar graphs are an integral part of the analysis of each city transformation because of the ambiguity of the city curve alone. These graphs show the overall percent at the beginning and ending date and shed light on the significance of the city curve

In the aggregate, study city downtowns have been transformed from service centers to regional shopping centers where products of limited appeal, high threshold are offered. The 100% bar graph for the average city shows a decline in service shops from 46.1% in 1949 to 21.5% in 1998. The percentage change curve shows a negative curve over the entire time period of the study with only one relatively steep drop between 1969

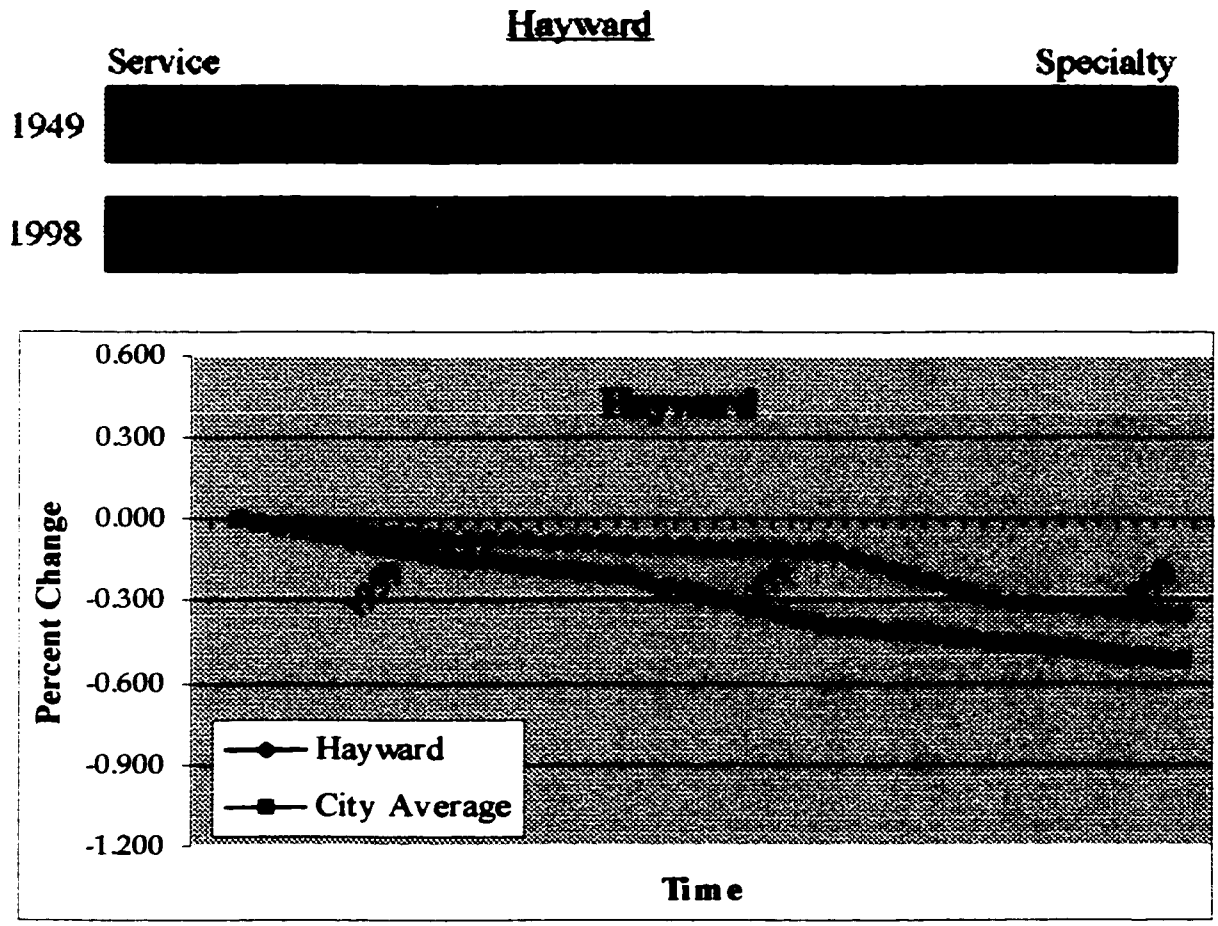
and 1979. Each city in the study exhibits a distinct pattern of change. Individual cases are treated below with regard to the total change and the percentage change curve. While broad generalizations are made with regard to the development of each community, no specific causations are addressed. The cities are organized by county in no particular order.



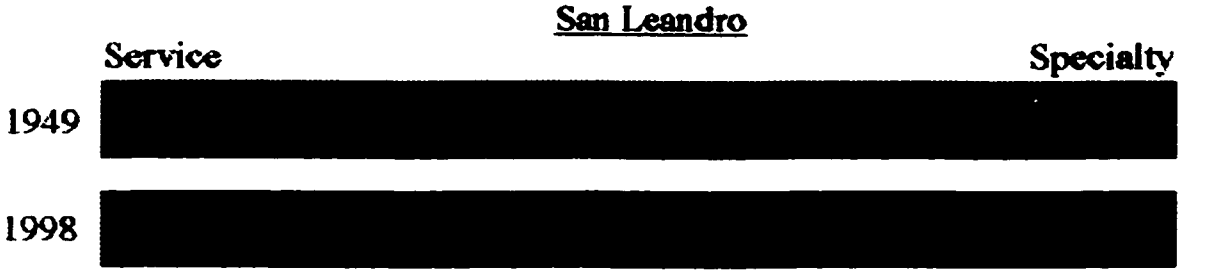
Alameda County

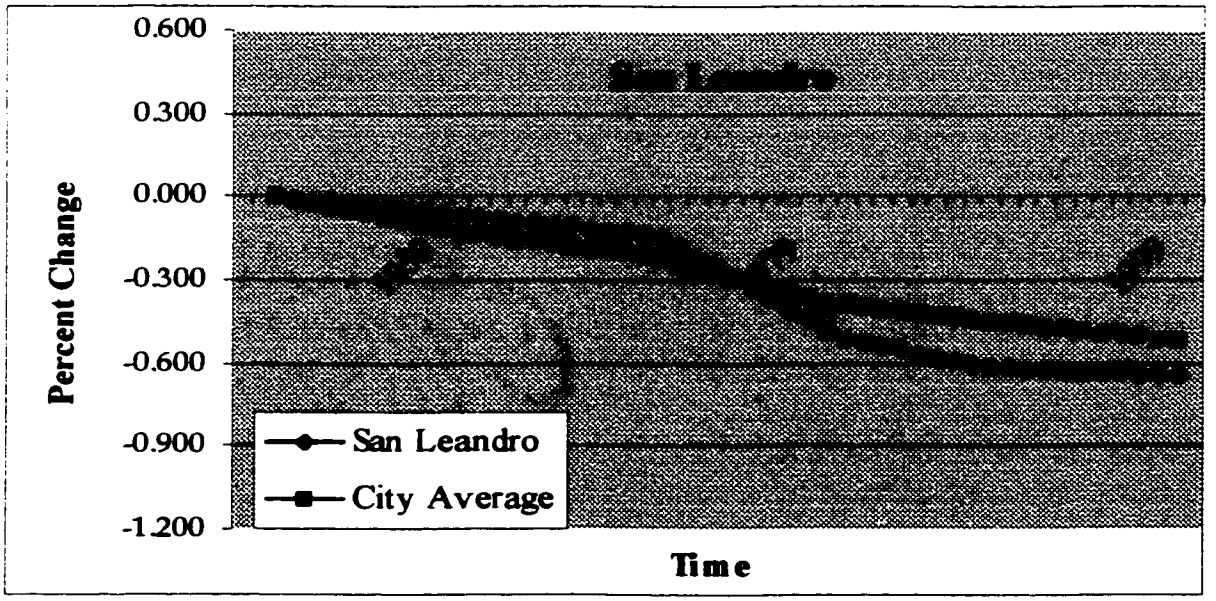
Hayward started the time period with a typical percent of low-end, service-type shops at 43.7%. As time progressed, however, Hayward did not have a very high rate of change. In 1998, it still had 28.6% low-end shops, which is much higher than the

aggregate. Its relatively flat curve, with change less than average, indicates a city that has not gone through the entire transformation yet. This might be due to the fact that Hayward is located in the heart of a string of cities that act as suburbs to Oakland. There is one notable change the 1980s where the services decrease substantially. Hayward should expect to see more change toward high-end goods and services shops during the first part of the next century.

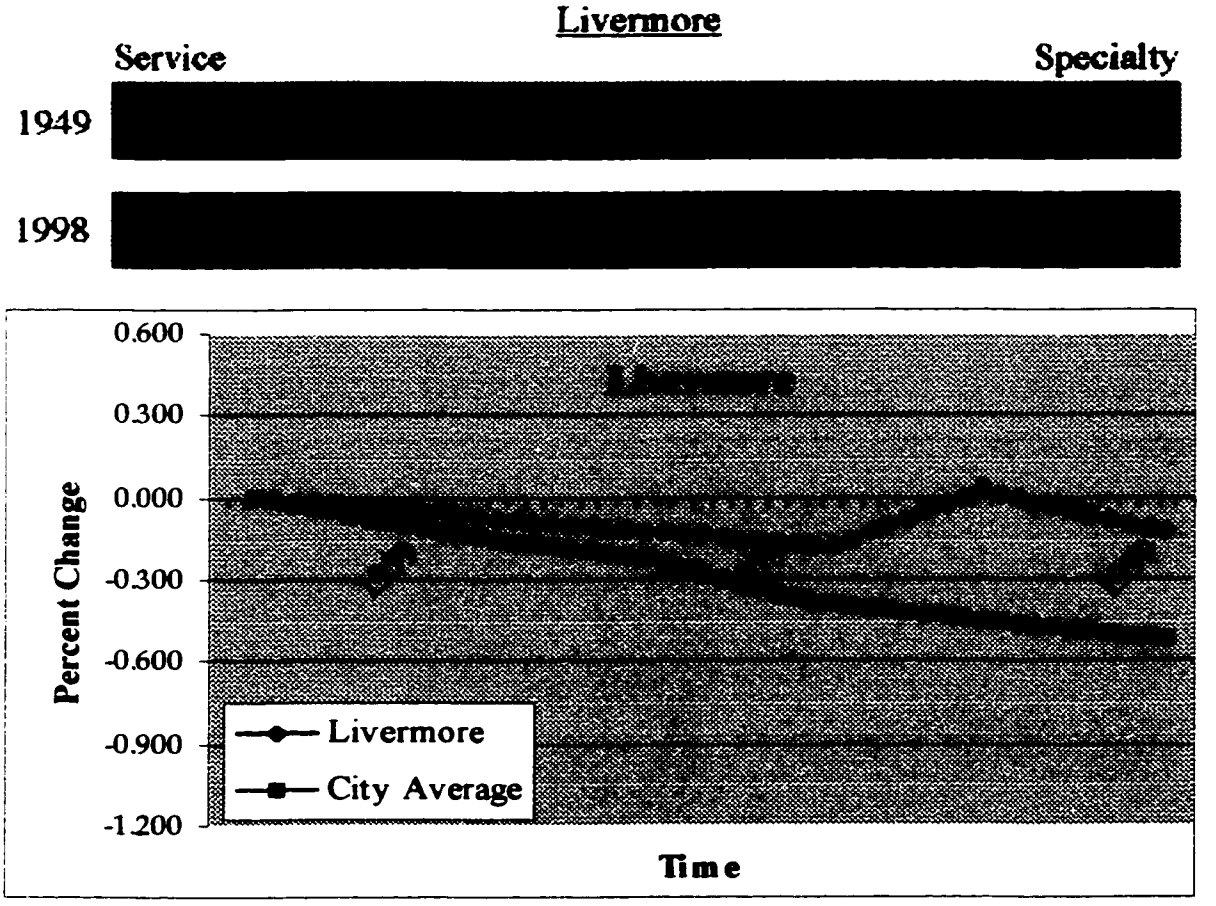


San Leandro, located in the same urban string as Hayward, only closer to Oakland, had a much different transformation. It started at a typical 49.8% low-end in 1949, but experienced a dramatic change throughout the time period. At 17.5% in 1998, it concluded with a lower percentage of low-end shops than the aggregate. This shows a slightly higher than typical degree of change. San Leandro experienced the majority of this change in the late 1970s and early 1980s. This might be attributed to a relatively large (13-block) urban renewal project in the late 1960s (Carroll, Chapin, and Allvin, 102). San Leandro has, for the most part, gone through the transformation and will probably experience little change toward high-end goods and services in the future.



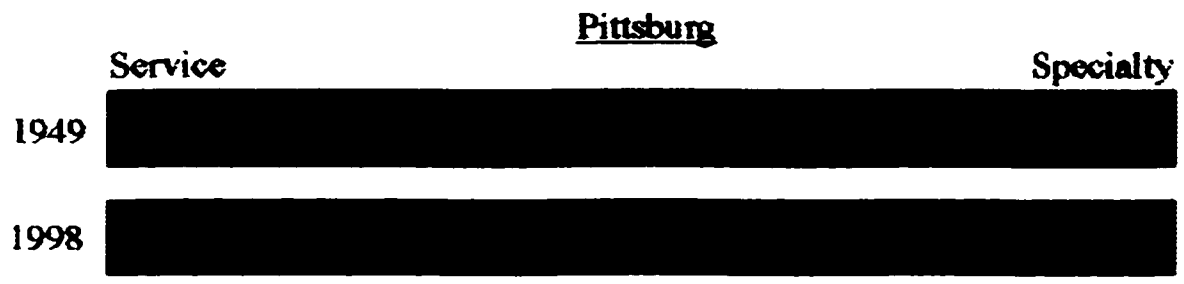


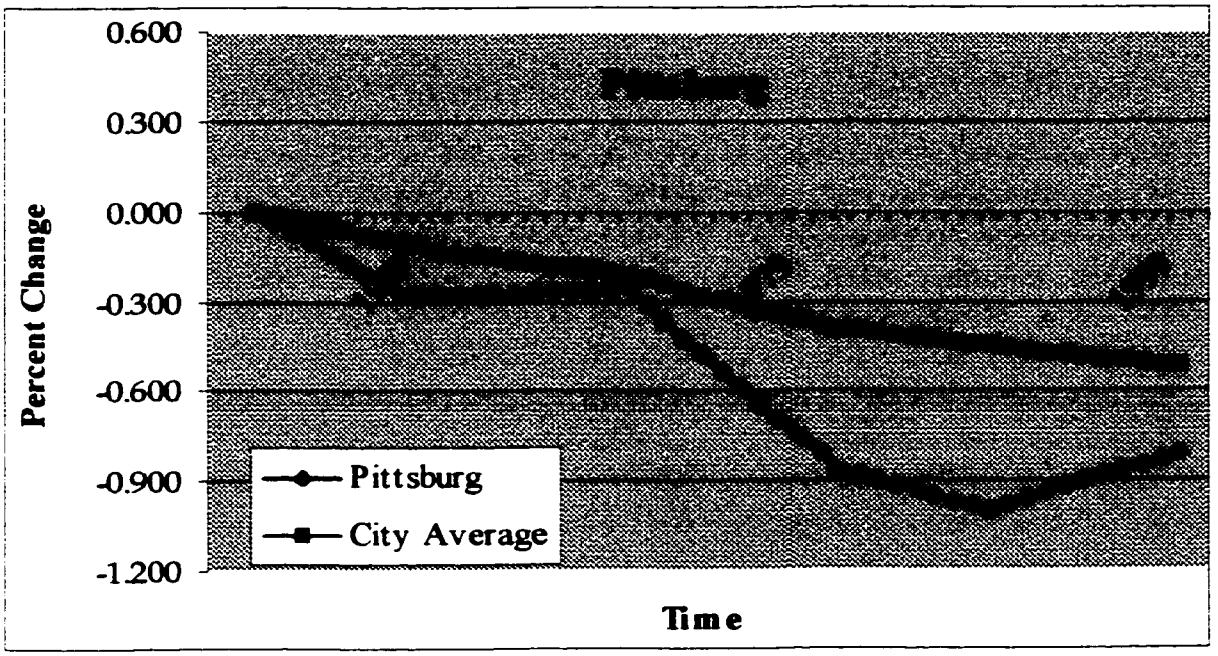
Livermore is located in the eastern half of the county, about 35.2 miles from San Francisco. Livermore went through a similar pattern of transformation as Hayward. It started at a somewhat typical 48.5% service shops. It did not decrease at the same rate as a typical Bay Area city, ending in 1998 with a 42.5% low-end sector. It has a relatively flat percent change curve, with a positive change in low-end shops near 1990. This might be attributed to its role as a suburb to many cities of the Bay Area. Livermore has more recently been the location of relatively cheap housing tracts for the work force of many Bay Area urban centers. As urban sprawl continues to increase at a high rate, it is expected that downtown Livermore will experience a dramatic shift toward high-end goods and services in the near future.



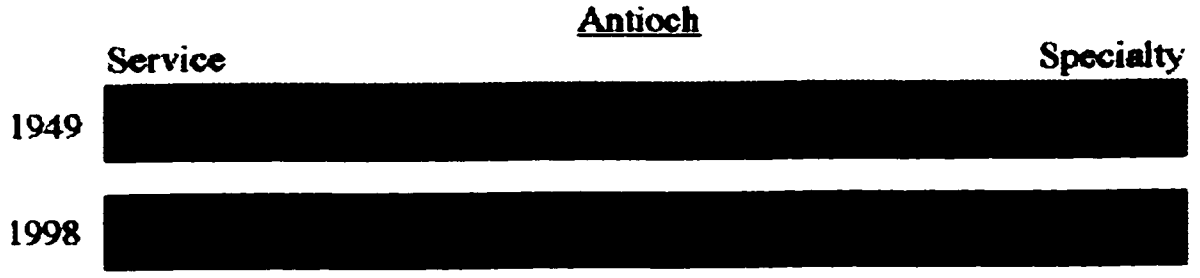
Contra Costa County

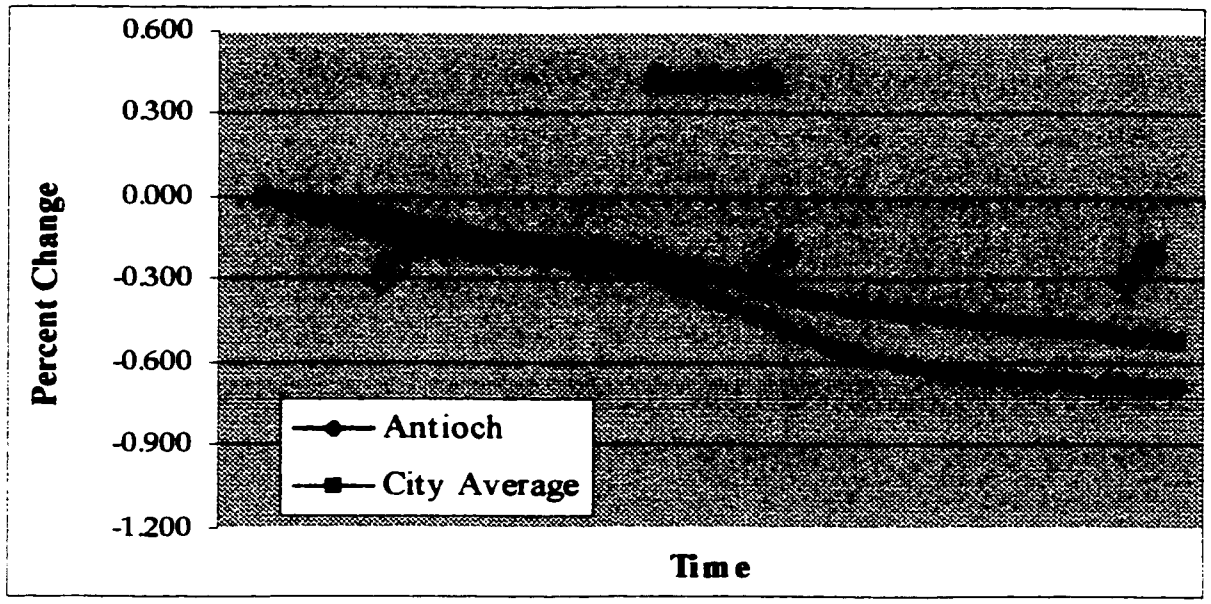
Pittsburg, located on the northern edge of Contra Costa County at the junction of the Sacramento and San Joaquin rivers, is 32.4 miles from San Francisco. It started the time period with a low percentage of low-end services at 41.3% and ended very low at 8.1%. Pittsburg is a special case that was affected more by depression than by any other factor. This can be seen in the percent change curve, which was somewhat normal until 1972, when it dropped dramatically and actually reached a 0% low-end sector in 1989. This was different from most other Bay Area cities due to a high degree of vacancy and economic decline rather than to prosperity. This economic decline can be attributed to the community's strong reliance on one industry, steel. When this industry declined, so did the entire community, which has not yet recovered. In the future, it is expected that the service sector will increase at a relatively high rate before it starts to transform as most other Bay Area cities.



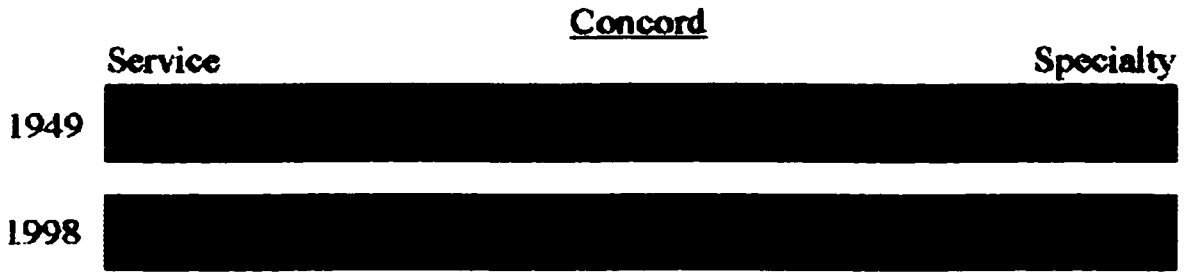


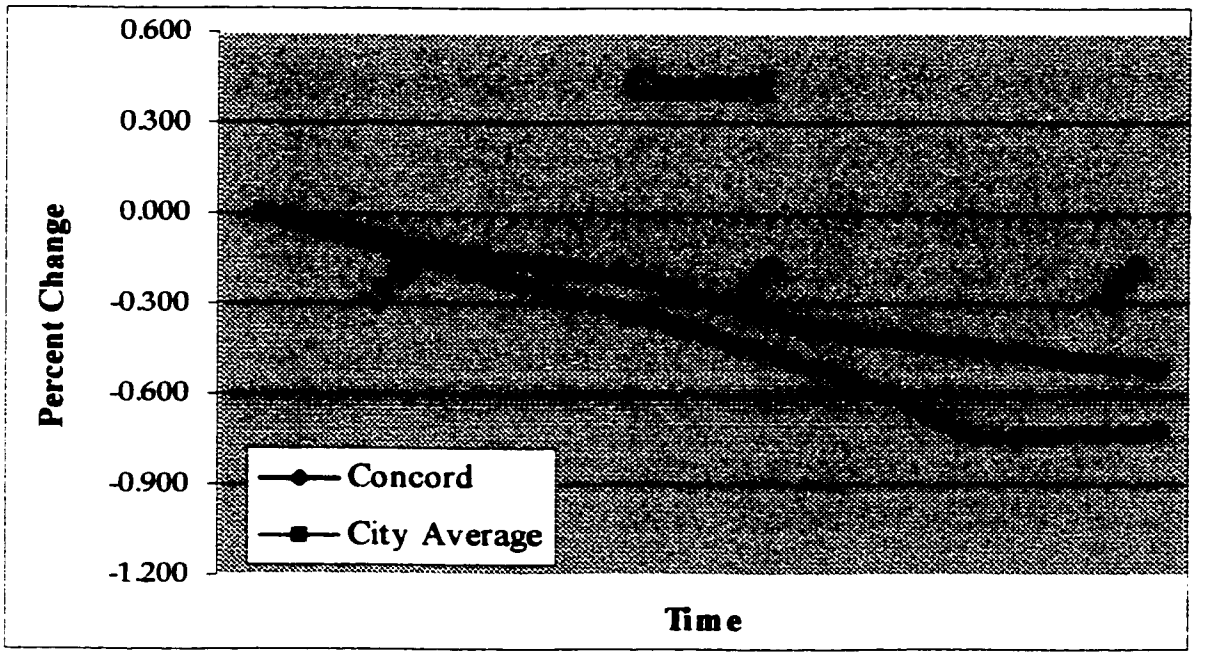
Antioch, located just a couple of miles to the east of Pittsburg, has a similar history, yet a much different transformation outcome. Antioch started out at a very normal 44.2% service sector. Much like Pittsburg, it transformed at a normal rate until the early 1970s, when it experienced a large drop in services, although not to the same degree. The large dip associated with the end of the steel industry was not as prominent as it was in Pittsburg. Antioch, at 13.6%, still had a lower percentage of service than normal and is expected to rise in the service sector before it decreases again.



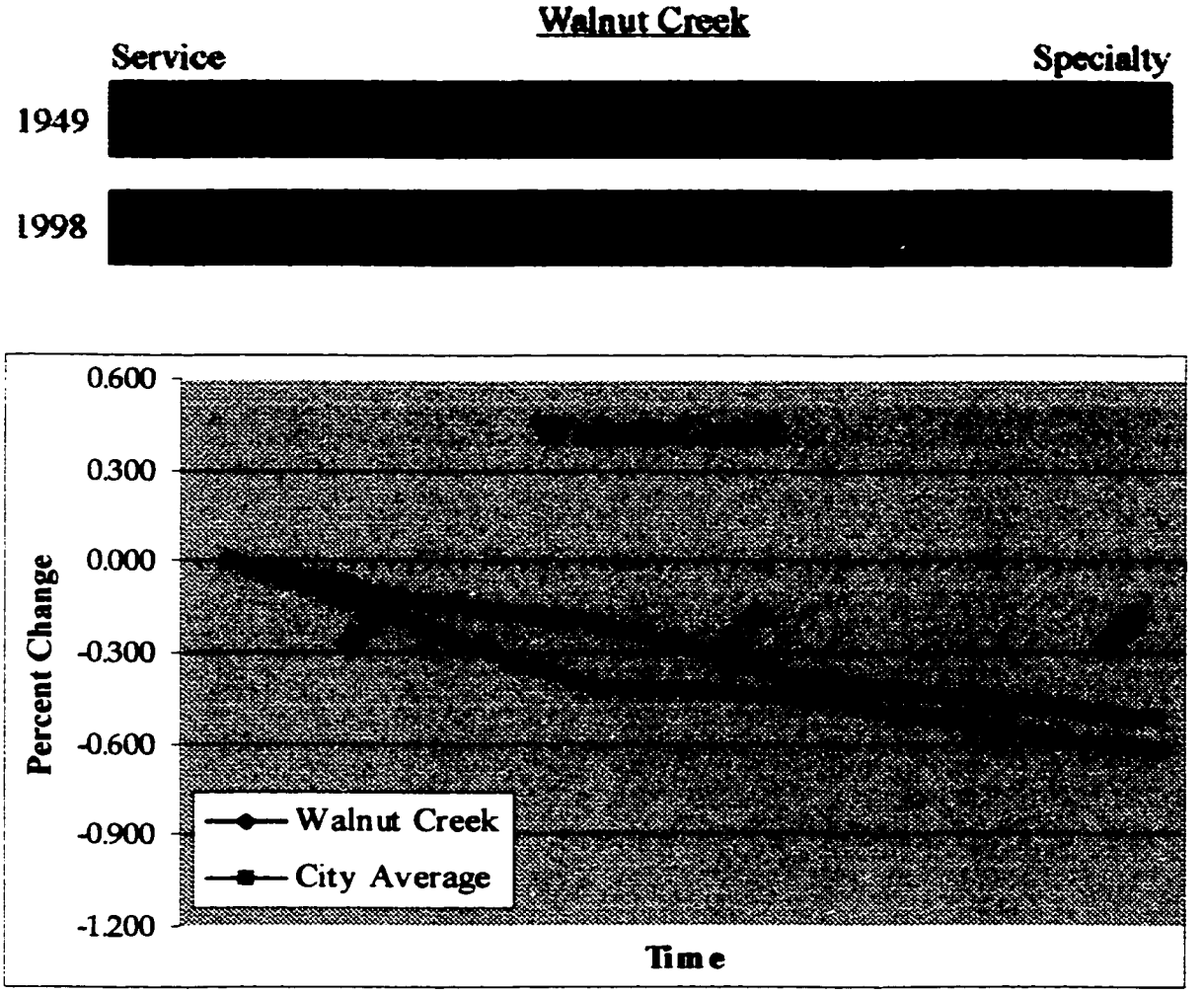


Concord started out at a higher than average 51.3% low-end service sector. It went through a rather typical pattern of change with a high rate during the late 1980s. It finished the study at 19.2%, which is typical for Bay Area cities. The opening of the Sun Valley Mall in the middle 1970s had a profound affect on the entire community (Carroll, Chapin, and Allvin, 98), but was not reflected by any large change in the composition of shops in the downtown. The percentage of service in 1998 and the flat curve during the last decade indicate that Concord has finished the majority of its transformation process and that it is expected to have little increase of the retail sector in the future.



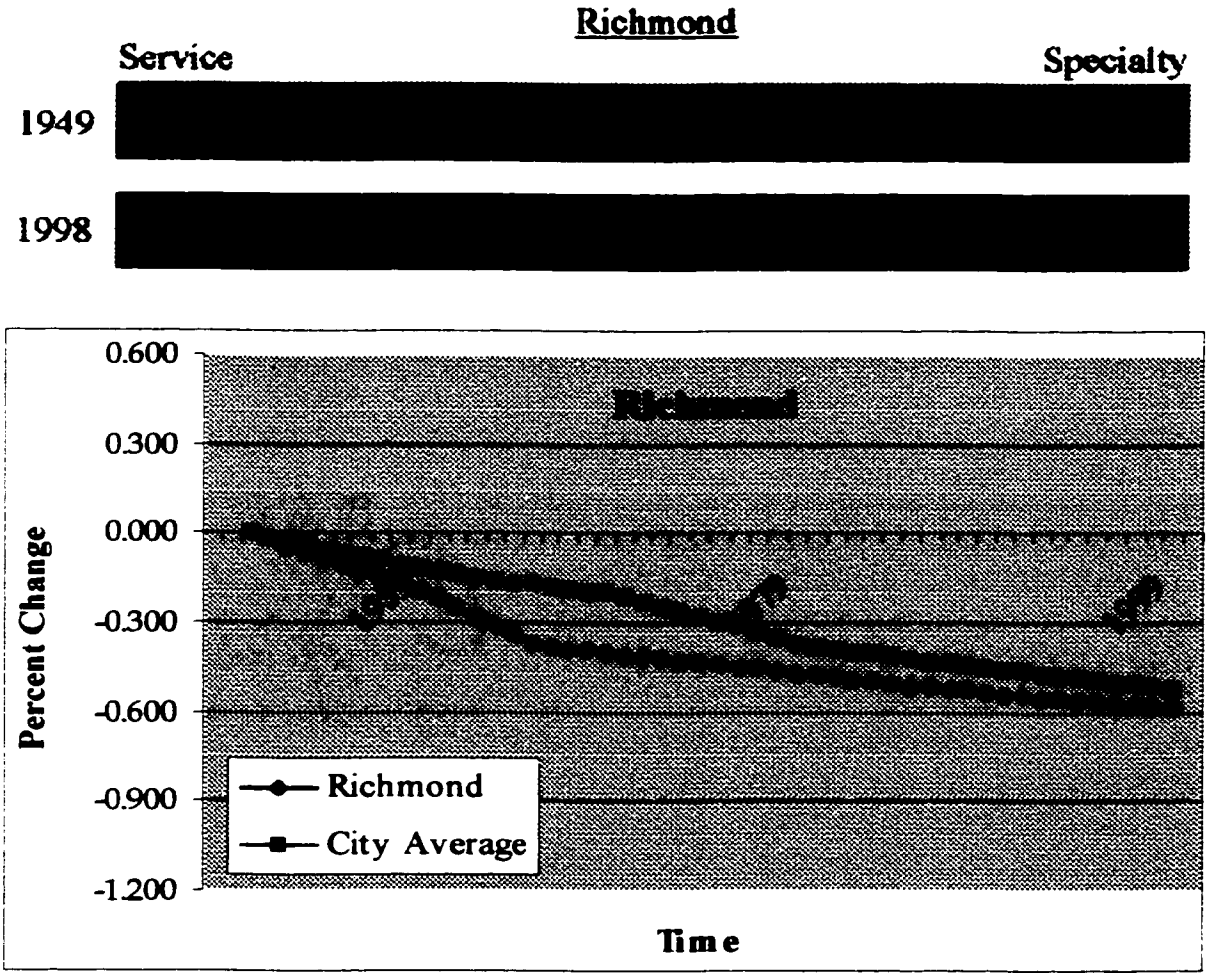


Walnut Creek is located a few miles south from Concord along the I-680 corridor. It is a very good representation of the typical Bay Area transformation process. Walnut Creek started in 1949 very close to the aggregate at 47.5% service. It had a relatively high rate of change until 1969, when its transformation curve leveled off and finally ended with a slightly low service percentage of 17.4%. Walnut Creek was a true suburb community that was dramatically affected by the introduction of the railroad and the automobile. Both of these opened up the eastern part of the East Bay with Walnut Creek at a key juncture, allowing it to become one of the fastest growing bedroom communities in the Bay Area (Vance, Geography, 44; Banet, 157; Carroll, Chapin, and Allvin, 116). Walnut Creek has finished the majority of its transformation process and is expected that it will not see much increase in high-end retail store percentages in the future.



Richmond, located on the western side of the county along the bay, is identified by oil refining. The low percentage of services, 33.8% at the beginning of the study, can be attributed to the city's early development. This well-established city was already far into the transformation process. Much like Pittsburg, the reason for the low percentage of 14.5% in 1998 was due to economic depression. Vacancies started to become a common site during the second half of the study. Today, the downtown is still marked by

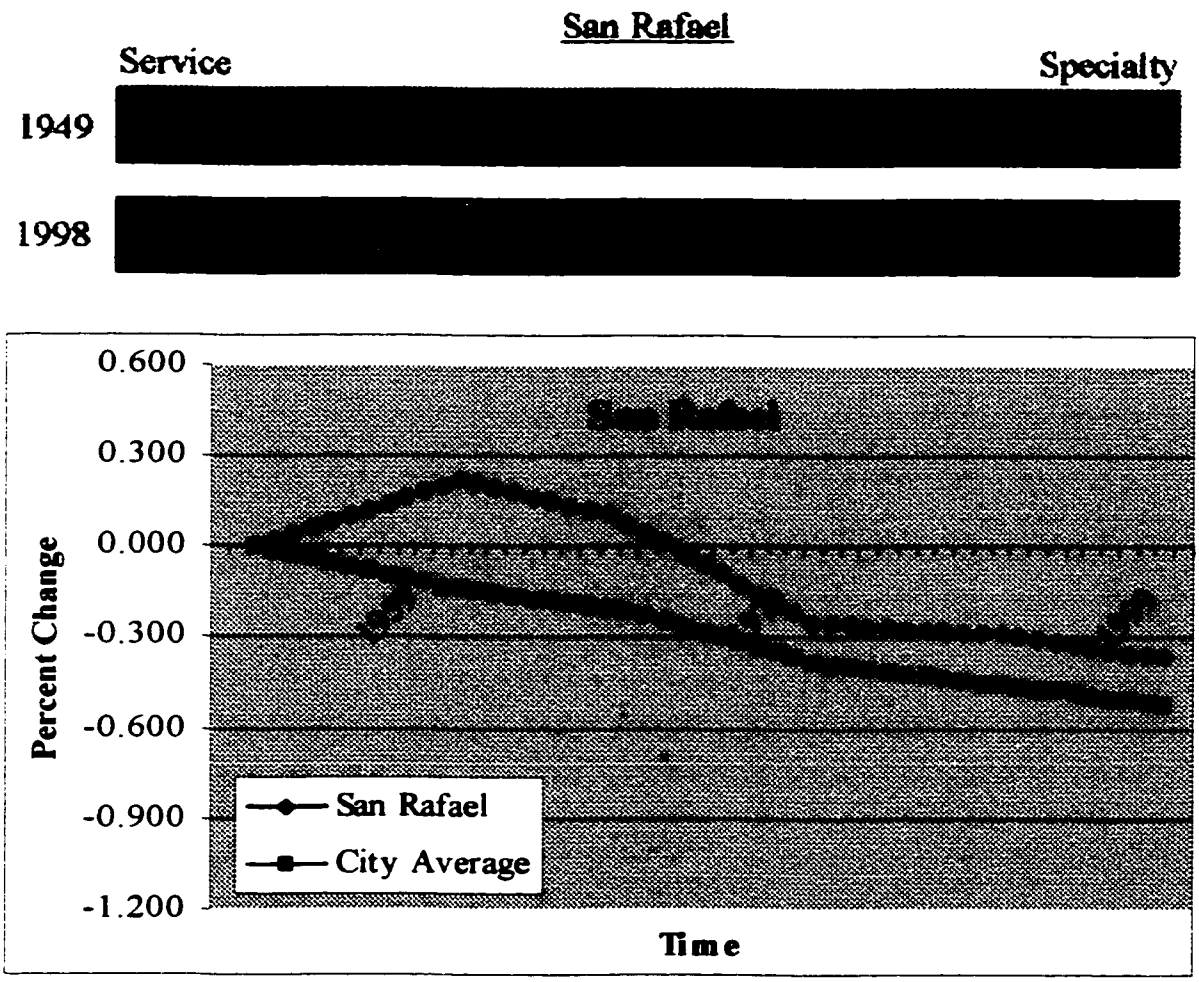
depression. If there is an increase in the economy, it is expected that a larger service sector will develop before a subsequent decrease can take place.



Marin County

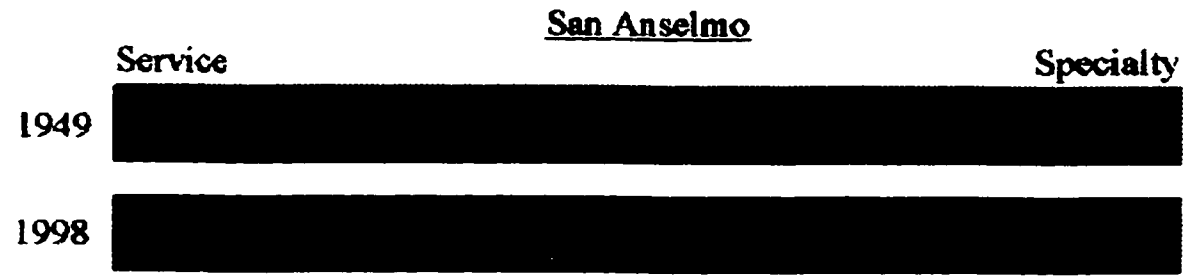
San Rafael is the largest city in the county and is the county seat of government. It has a long history dating back to the establishment of a mission by the Spanish settlers in 1817. This long history, along with economic prosperity, is depicted in its transformation process, which started with a low percentage of 31.6% in 1949, and ended with an average 20.0% in 1998. Its percentage change curve actually showed an increase

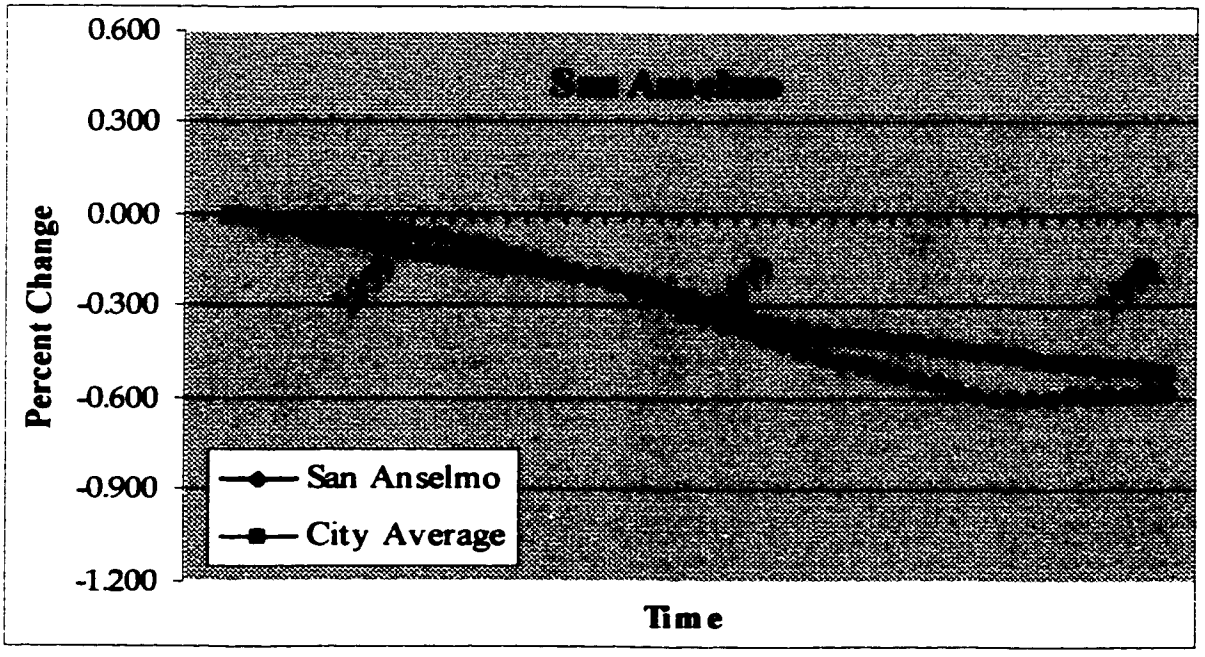
in service until the middle 1970s. San Rafael's long history and location as a gateway to many Marin County communities has forced it to go through the transformation process sooner than most Bay Area cities. It is not expected to decrease the service sector by much in the future.



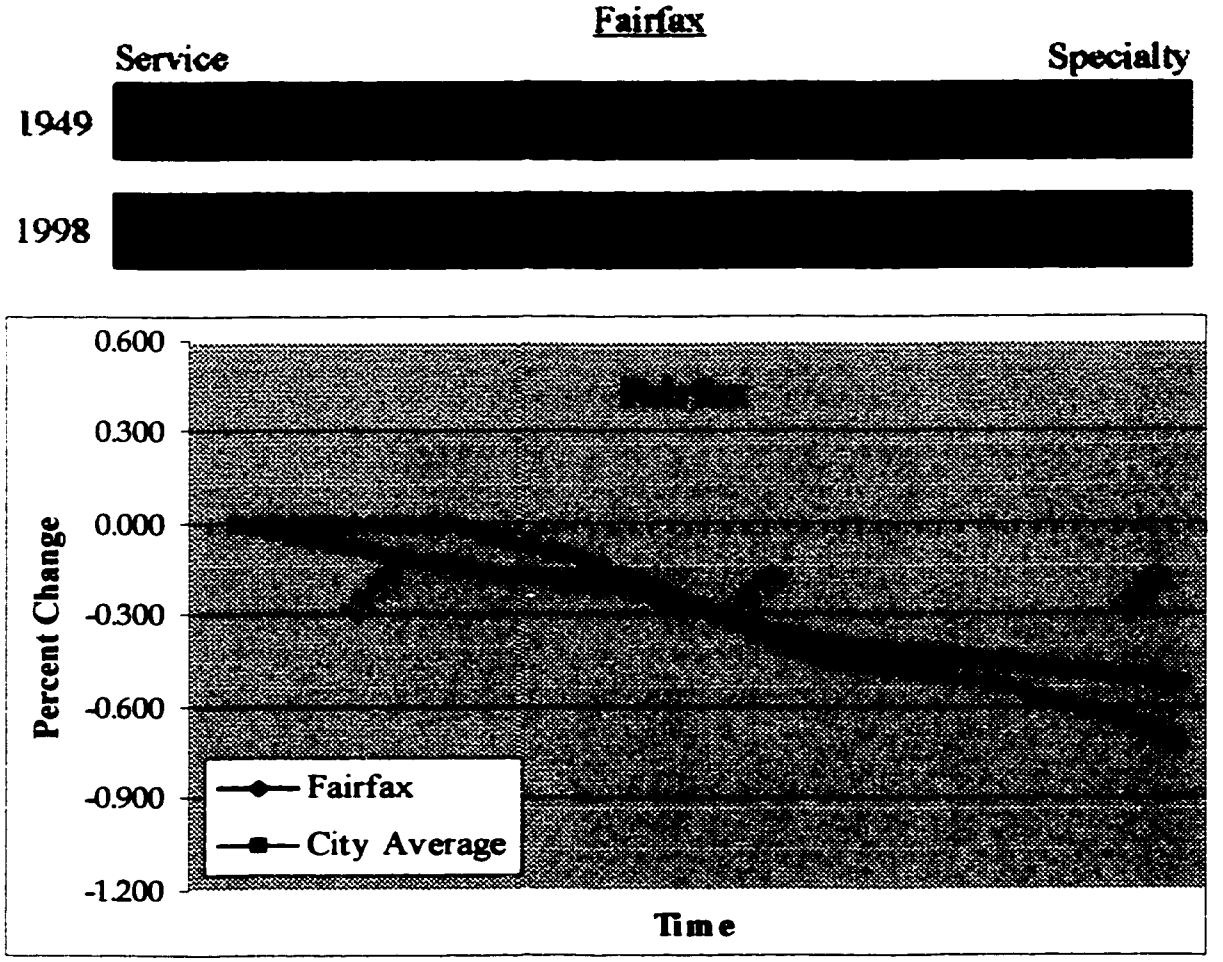
San Anselmo, located a short distance to the west of San Rafael, has a much smaller population and has served as a suburb to San Rafael. This is not reflected by its transformation data. It started the time period with a low percentage of 39.7%, much

lower than expected. It also ended lower than average at 16.6%. Again, this number was expected to be higher. Its overall curve followed the city average rather closely. This unexpected transformation process might be attributable to the community's strong sense of identity and high income level of its residents. It serves as a suburb community for the affluent workers of San Francisco. The high level of disposable income created a prematurely developed downtown with less connection to San Rafael than was expected. It is expected that San Anselmo will experience very little change in its percentages of service and retail shops in the future.



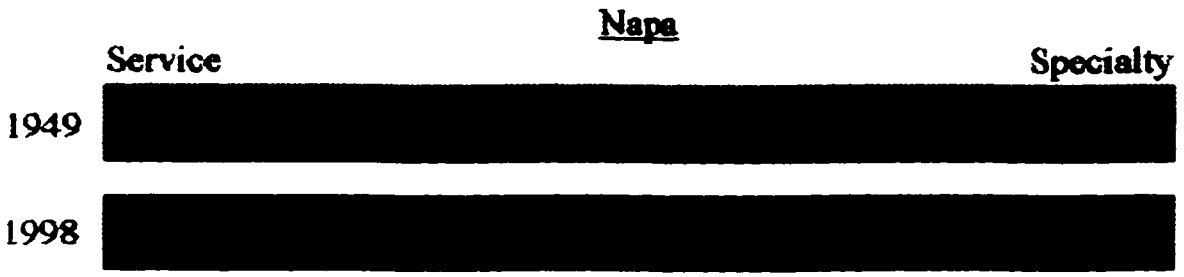


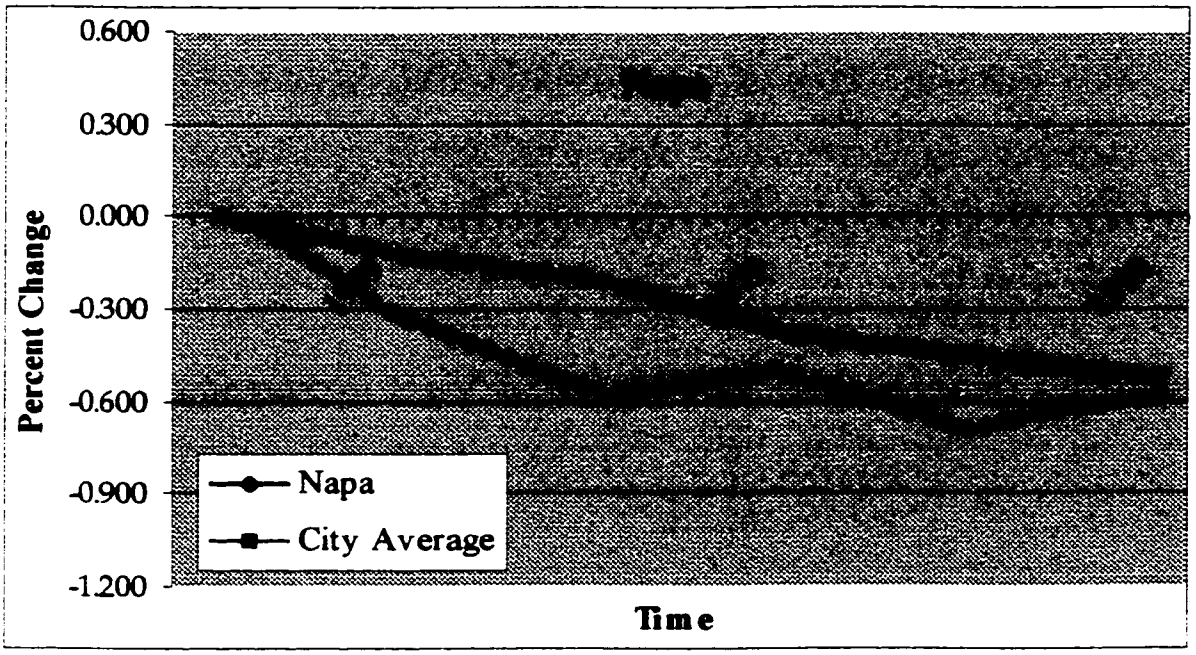
Fairfax, located in close proximity to San Anselmo, exhibited a much different experience. Starting with a higher than normal percentage of 54.8%, it decreased at a typical rate, ending lower than average at 15.6%. It experienced a large amount of change, with slightly more occurring during the second half of the study. The difference between Fairfax and San Anselmo can probably be attributed to the diffusion of affluent commuter residents from San Anselmo to Fairfax after the availability of housing decreased. Fairfax has probably reached its minimum level of low-end goods and services. Due to its semi-isolated location, this level is already very low and if there is any change at all, it will probably be an increase in service shops.



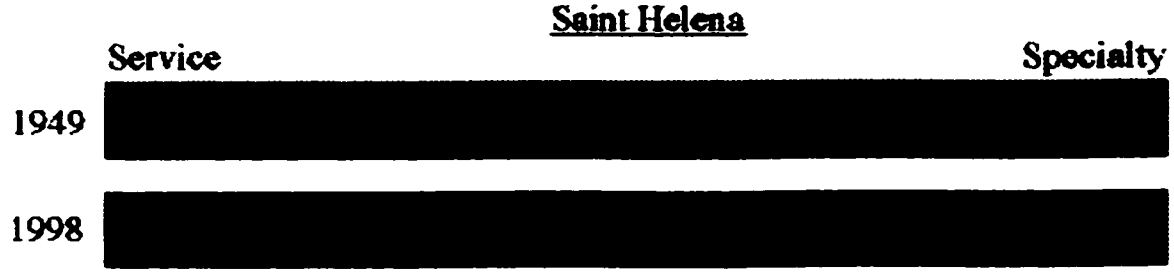
Napa County

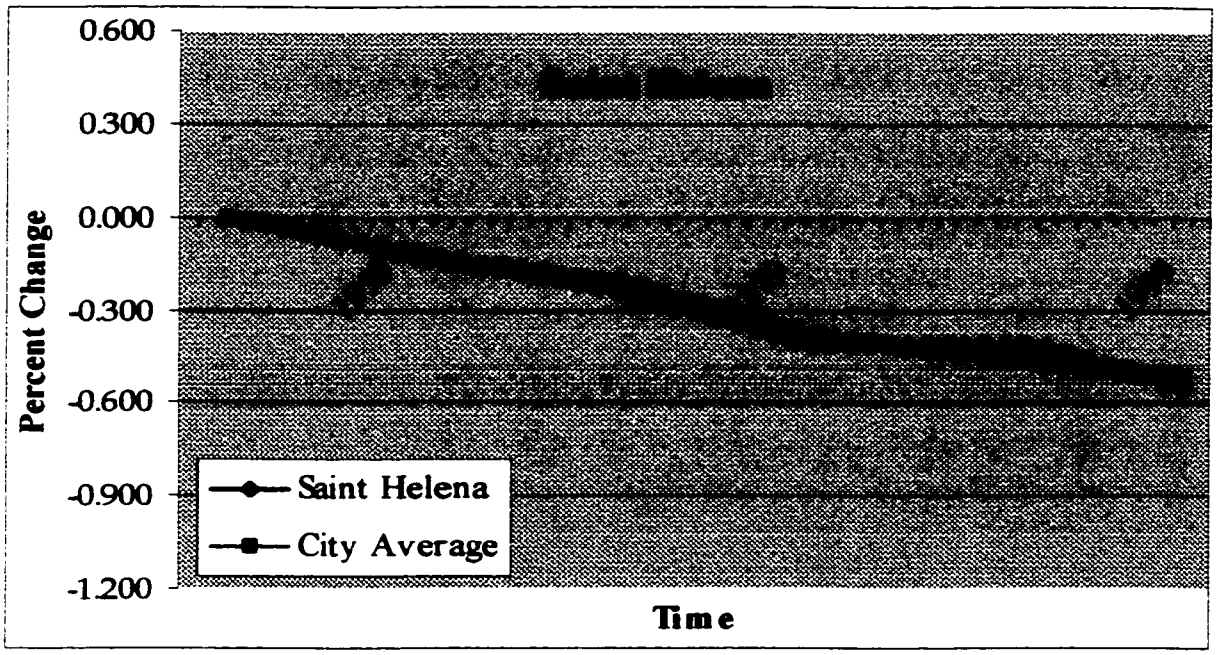
The city of Napa is the county seat of government, as well as the largest and most developed city in the county. Its development pattern is very similar to Richmond's. It started with a low percentage of 35.2% and ended with a low percentage of 14.3%. Napa entered the study period well developed with a strong economy. During the time period, it experienced depression, which made percentages of both service and retail drop. Today, the economy is still trying to recover and the downtown is marked by many vacancies. Napa's percentage change curve is steeper than the city aggregate with a noticeable drop from 1949 to 1970. After that, it fluctuated below the average rate. In the near future, this same unpredictable pattern is expected to continue until the economy can recover.



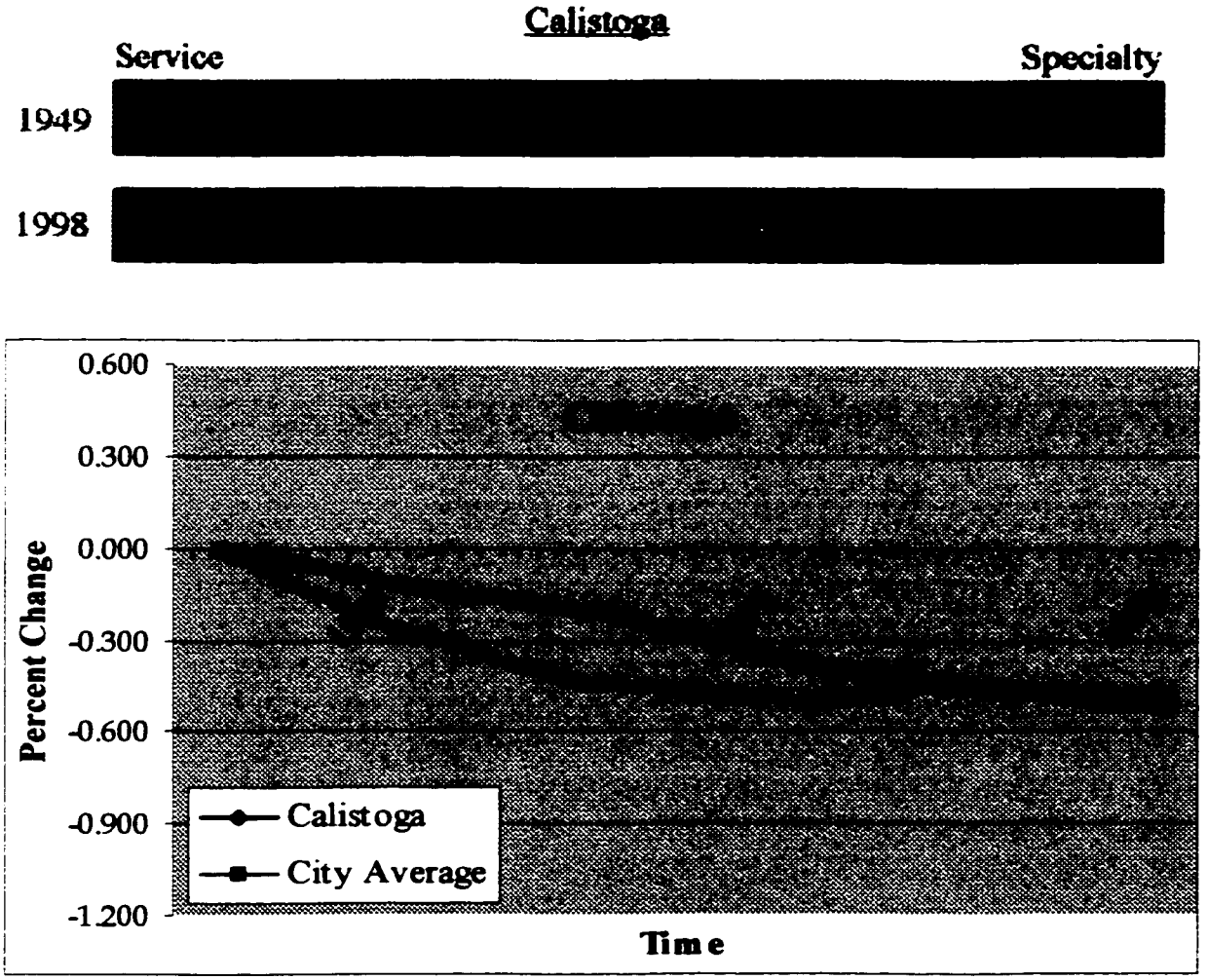


Saint Helena, to the north of Napa, is much smaller. It is one of the cities that best represents the transformation process for the Bay Area. Saint Helena had a higher than normal service percentage in 1949 at 52.5%. Its rate of change curve followed the aggregate very closely and ended with 23.9% service in 1998. In the future, the curve of Saint Helena is expected to continue to follow the aggregate, which should level off even more and show slight change toward retail shops. In all probability, its relative isolation, however, will not allow it to become as specialized as many Bay Area downtowns.





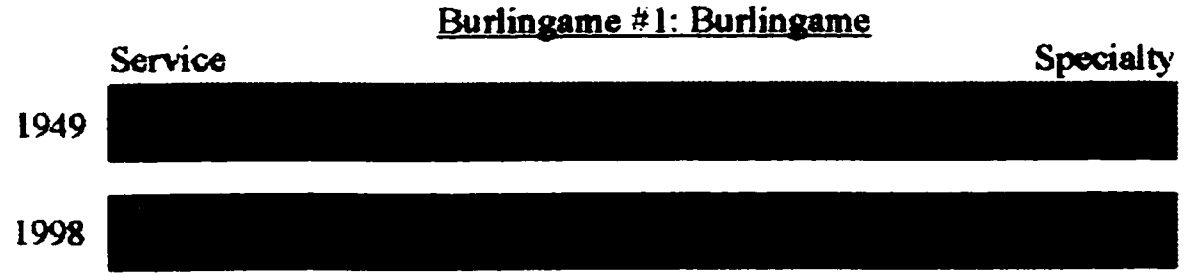
The last city and located farthest north in the county is Calistoga. Its change is typical for its location and role in the region. It started at a high level of service shops, 63.0%. This is normal for a community in a rural setting that has to serve its outlying area. It went through the transformation process and ended with a higher than normal service percentage of 32.7%. This high percentage is expected due to the lack of surrounding communities in the area to supply services to the area. Calistoga had a high rate of change until the late 1970s, when its curve leveled off. The high rate of change is probably due to the increase in tourism in the area. It is expected that its role as a service provider to the surrounding rural area will not allow the percentage of services to ever drop very low.

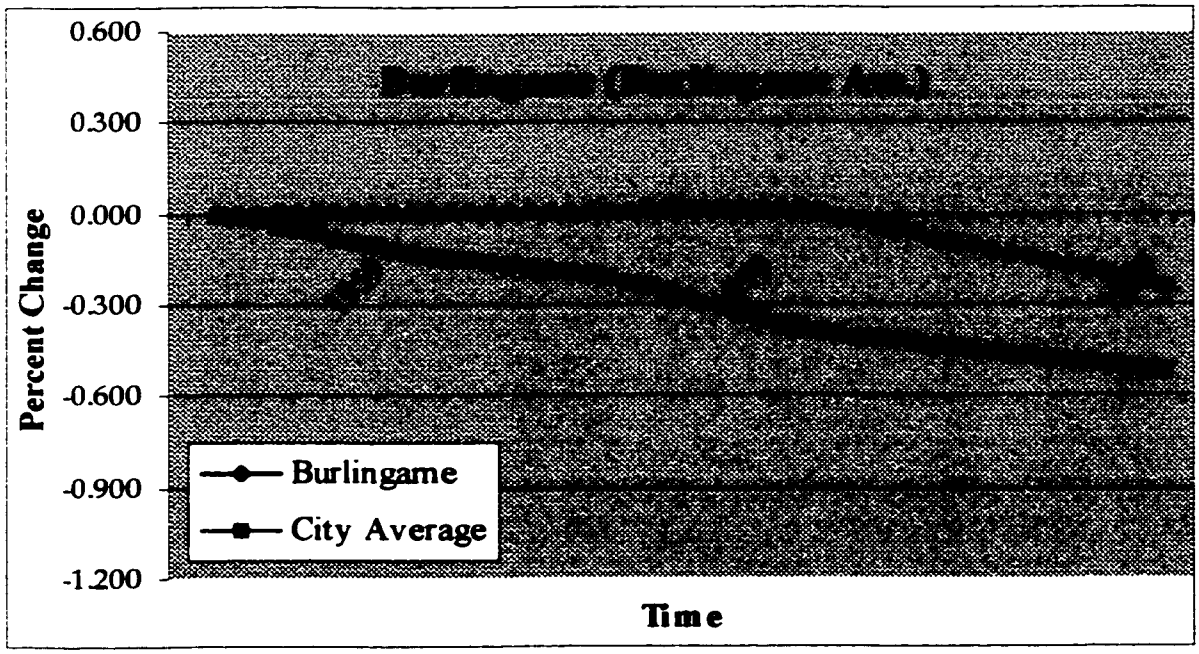


San Mateo County

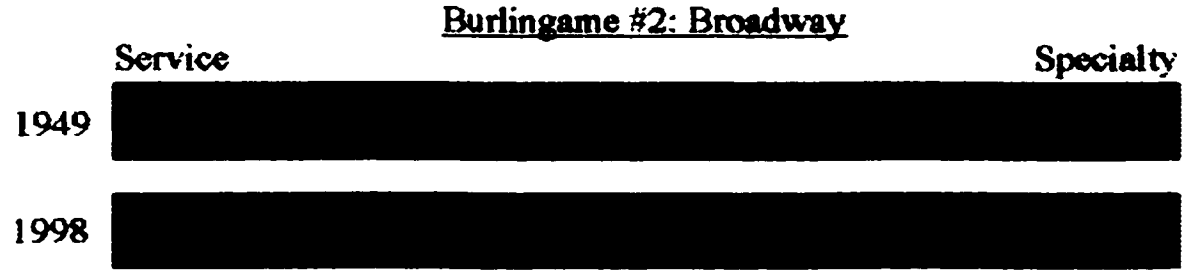
Burlingame is a special case because it is the only sample that has two distinct, well-developed and non-adjacent downtowns. The northern one, located on Burlingame Avenue, started with a low percentage of service at 32.0%. It had a very flat curve that showed almost no change until the middle 1980s, when it dropped. It ended with a close to average service sector at 24.4%. One distinctive feature is that it experienced little

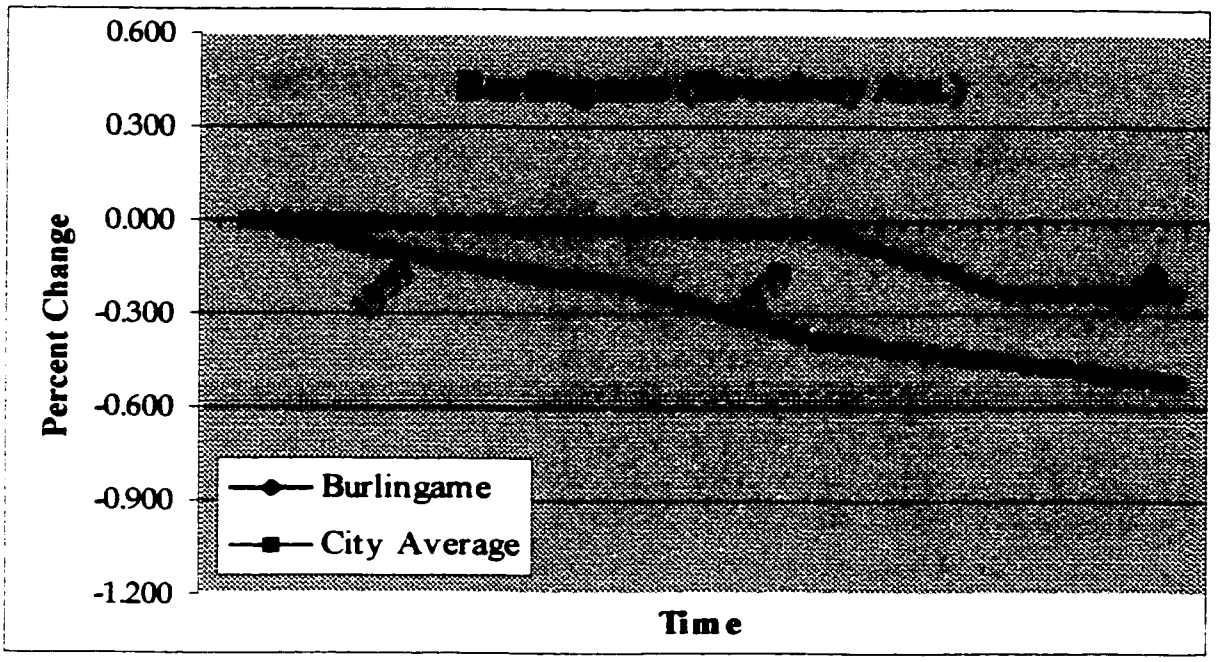
change from 1949 to 1975 and that it plateaued at around 30%. This pattern depicts a community that already reached the minimal level of services that it required by the time the study began. As urban sprawl occurred and the surrounding area became more developed, services became available elsewhere, and the downtown was allowed to reduce its services. This can be seen by the drop in the percentage change curve in the middle 1980s. At 24.4% service in 1998, the town still has some transformation to go through, and because of the location and economy, it could drop as low as 10% service in the near future.



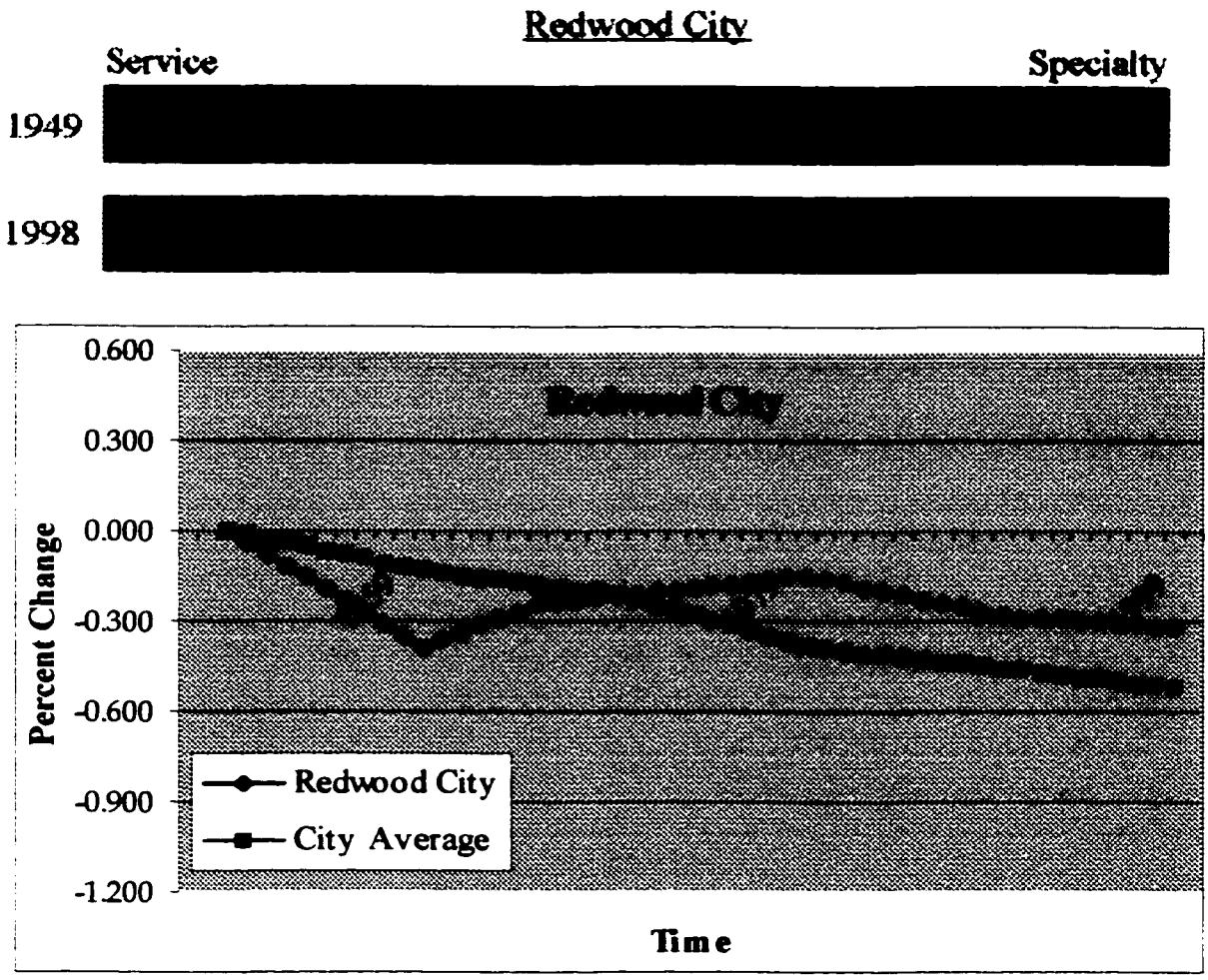


The second downtown in Burlingame, on Broadway, had a much different transformation process. Although it also has a very flat curve like its counterpart, it started at a much higher percentage of service, 49.5%. This is very typical of Bay Area towns. It did not, however, go through the same degree of transformation as other cities. Instead, it had a very low rate of change and ended in 1998 at 37.8% service, which is relatively high. Although both Burlingame downtowns have flat percentage curves, they have fundamentally different development patterns. This can be expected from a city that has two downtowns. They probably could not have coexisted if they developed the same way. They serve two different needs to the same population base. It is expected that Broadway will change dramatically toward retail in the near future, however, it will probably never have as low of a service sector as Burlingame Avenue. This is due to the different niches that each must fill.



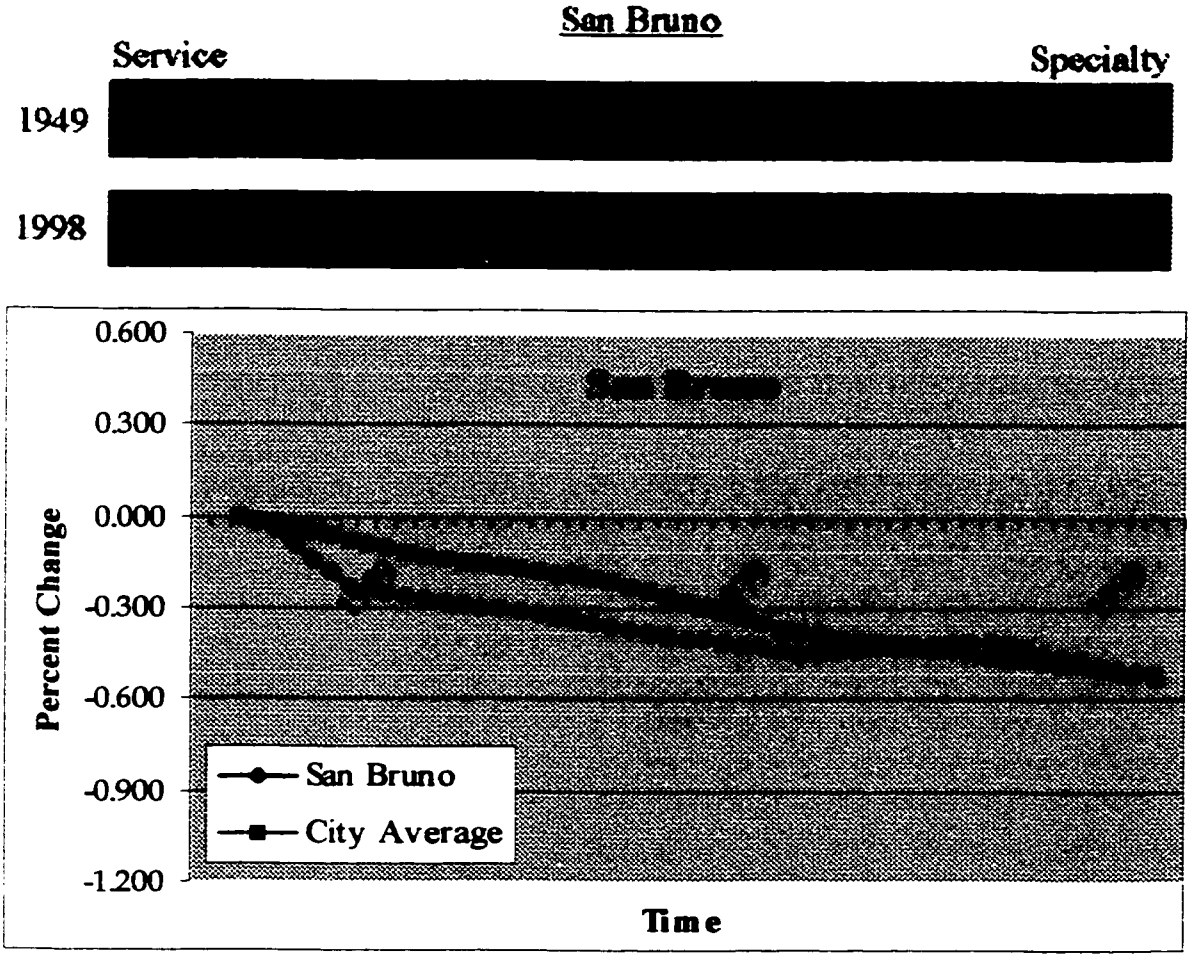


Redwood City, the county seat and the largest city in the county, has a very distinct transformation pattern. It started with a low percentage of service at 32.4% in 1949 and continued to drop very fast until around 1960. At that point, the percentage change curve flattened out, with almost no change again. It ended at a very typical 23.0%. This pattern depicts a city that entered the time period near the tail end of the transformation pattern. It finished during the early 1960s and has seen little change since. It is not expected that there will be much change toward retail in the future besides some minor fluctuations that coincide with the economy.



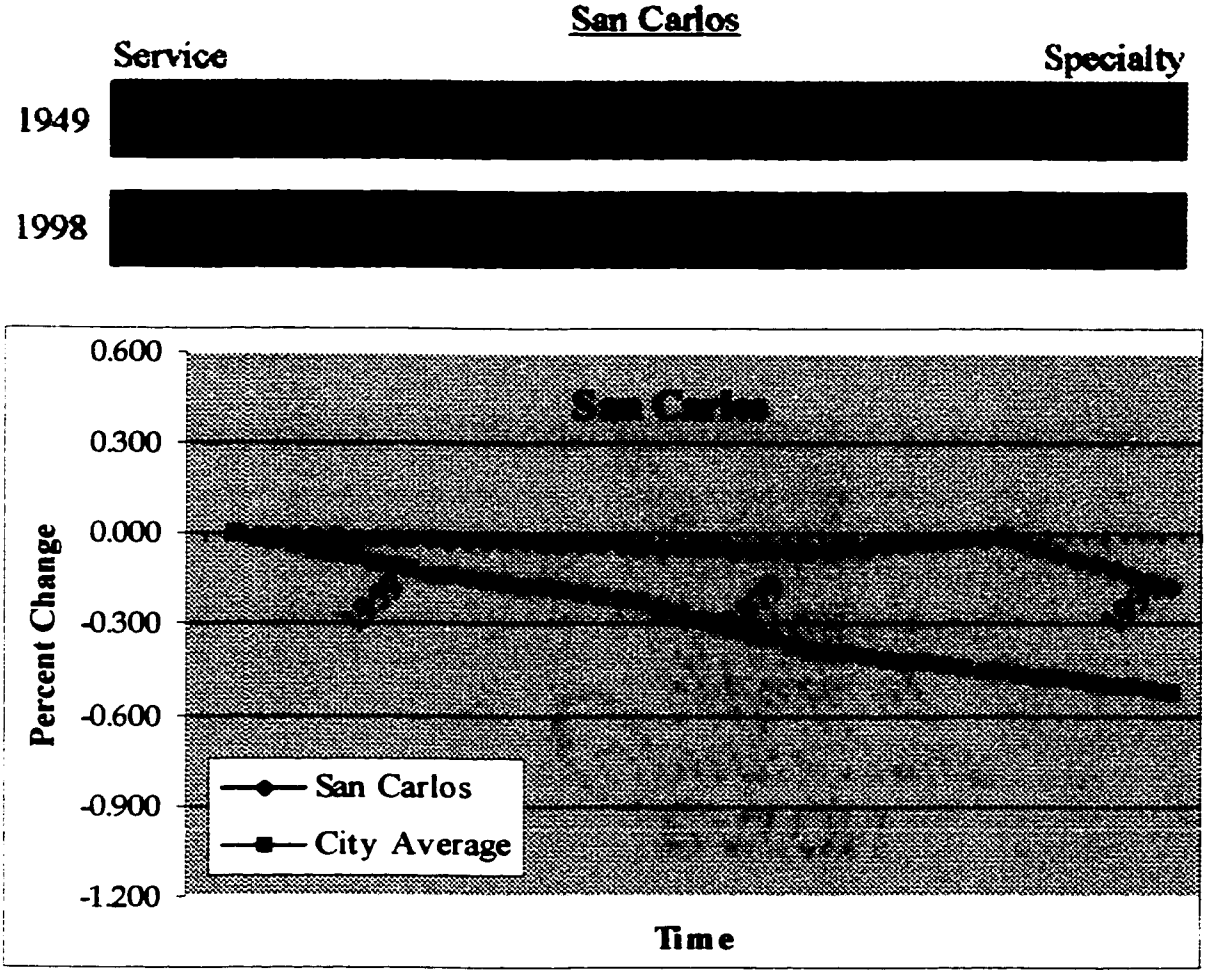
San Bruno is the study city closest to San Francisco. It started with a high percentage of 55.9% service in 1949. Its percentage change curve remains relatively close to the aggregate, with more change during the first half of the study. It ended with a higher than normal percentage at 25.5%. San Bruno's relatively late establishment can account for this pattern. San Bruno was not incorporated until 1914, and this was only due to a large influx of displaced residents from San Francisco after the 1906 earthquake

(Carroll, Chapin, and Allvin, 124). This city is expected to experience a continued high rate of change toward retail until it reaches its minimum service necessary.



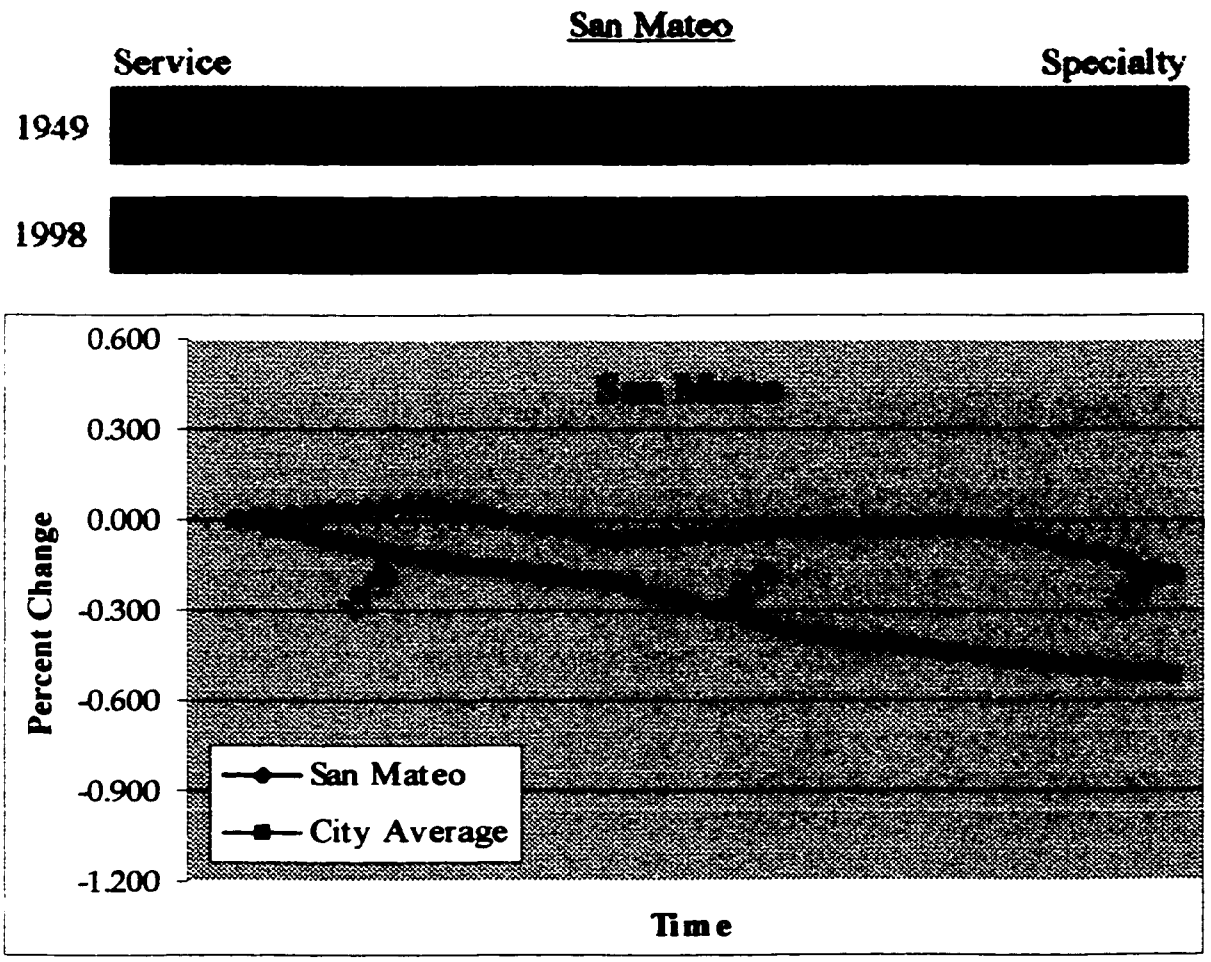
San Carlos, located immediately north of Redwood City, had a much different development than its neighbor to the south. In 1949, it had a relatively low percentage of service at 34.0%. Its percentage change curve is very flat and had very little fluctuation until 1990, when it dropped slightly. It ended with a higher than normal percentage at 28.2%. This is a unique pattern because it shows a leveling at a rather high percentage. One possible reason for this is that it reached its minimal service level as did Burlingame

(Broadway), but has not continued the process to the same degree once the minimum changed. That said, the future of San Carlos is expected to be marked by continued change toward high-end retail.



The city of San Mateo had a very similar pattern as Burlingame Avenue. It started in 1949 with a low percentage of service, 29.4%, and stayed level as it had already experienced the transformation process. Around 1990, the percentage dropped and it ended with a typical 24.0% in 1998. Again, this can be due to a variety of reasons. For most of the cities in this county, the minimum amount of services that a downtown had to

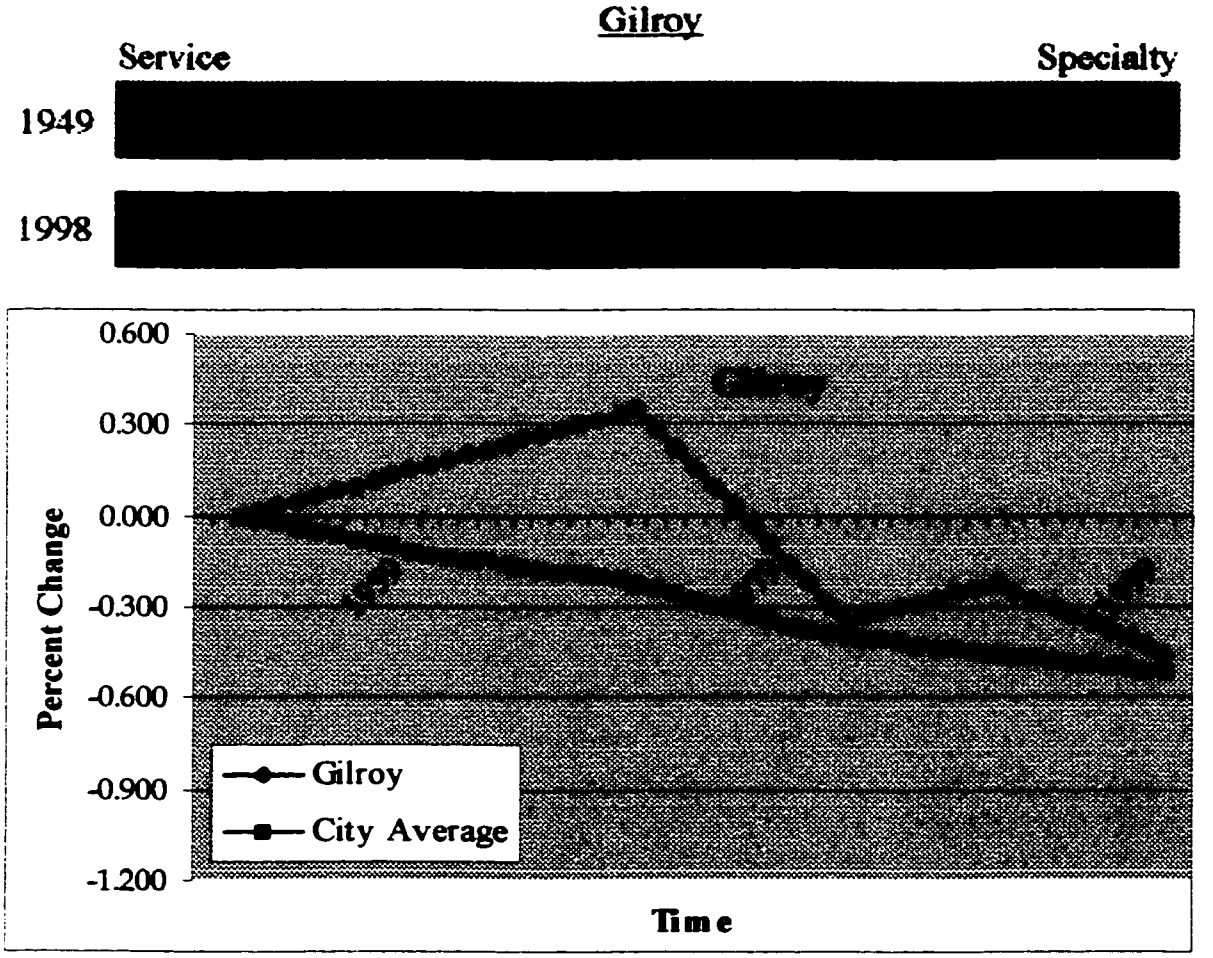
have was around 30% until 1990. After that, they all dropped at similar rates. Again, it is expected that service percentage will drop relatively slowly in the future. San Mateo also has the chance of dropping near 10%.



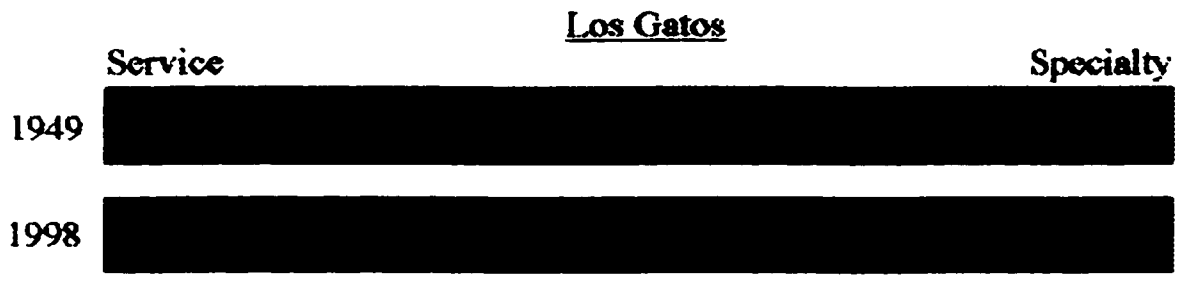
Santa Clara County

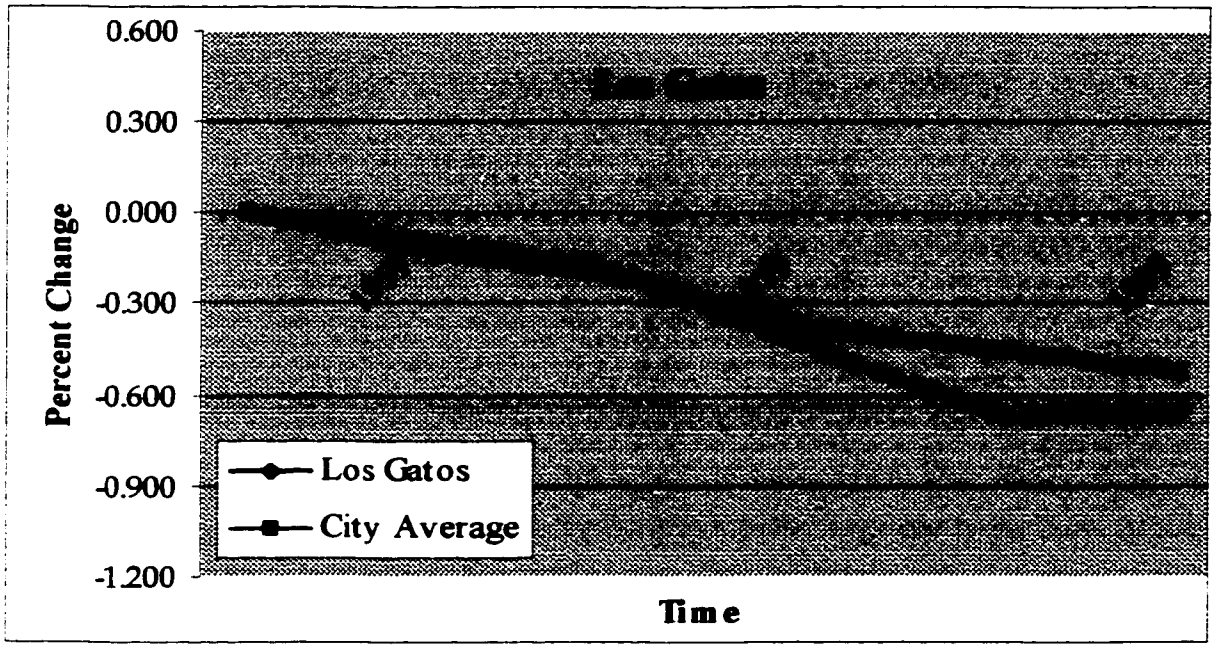
Gilroy, the study city located furthest south in Santa Clara County, started the time period at a low percentage of 33.8% service shops. It had a large increase in services until 1970, when it then dropped significantly until the middle 1980s. From

there, the percentage of service rose and then dropped again before the end of the time period when it finished with a typical 18.4%. This is a similar, yet more sporadic, pattern than that of San Rafael. The high degree of volatility is unexpected from Gilroy. Increasing by 40% in 1970, it had the highest rise in services of all the study cities. This was followed by a huge swing of almost a 70% decrease in services during the next ten years. This was a highly unexpected rate of change from a city with the history and importance of Gilroy. With this pattern it is hard to predict future changes. However, it is expected that the curve will become more consistent with a gradual decrease in services as this portion of the southern Bay Area continues to develop.

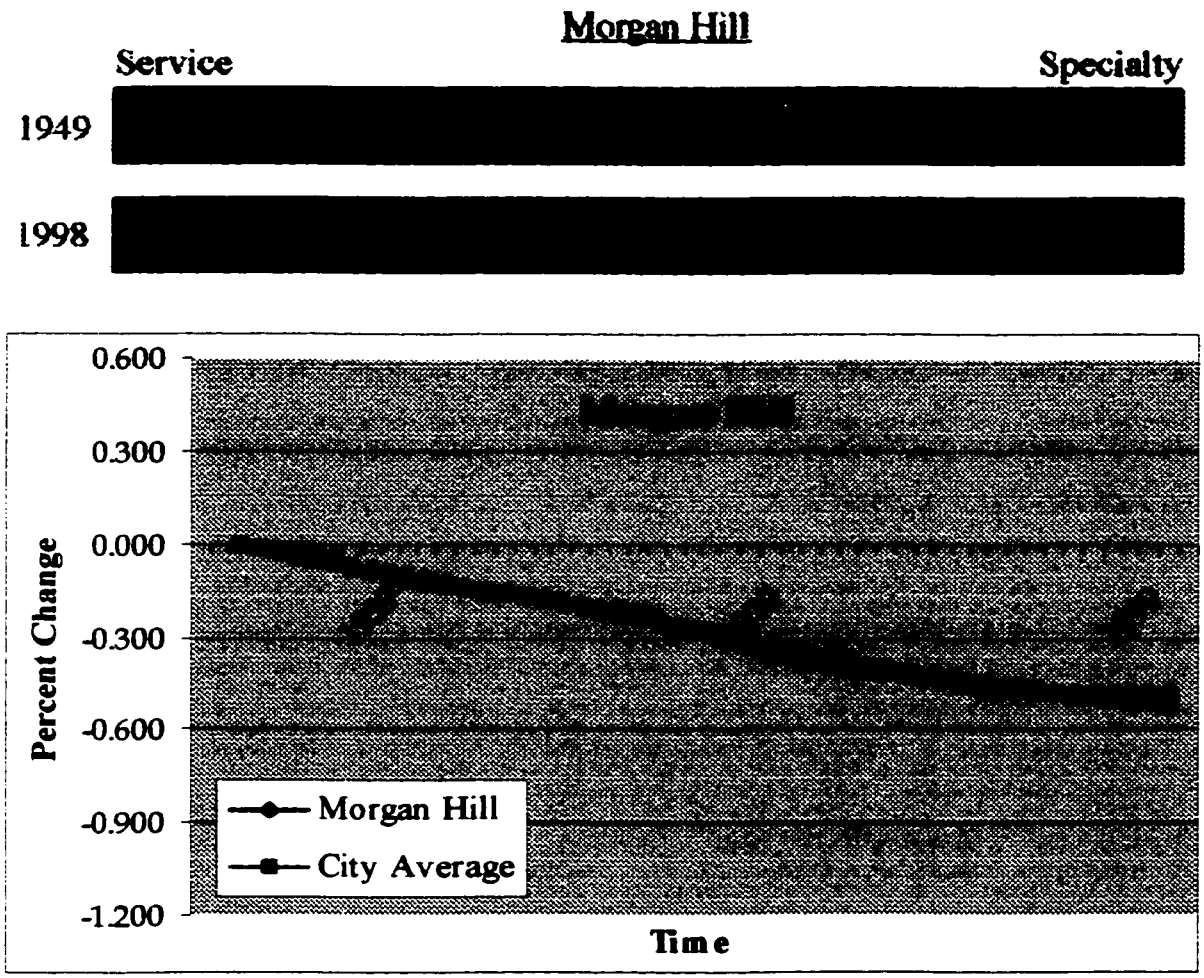


Los Gatos is the study city that best represents the average transformation from service to retail in the Bay Area. The combination of its starting percentage, ending percentage, and rate of change, make it a very good representation of the aggregate. It started slightly higher than average in 1949 with 50.7% service shops. Its rate of change curve followed the aggregate closely for most of the time period, although it had a slightly higher rate of change during the second half of the study. It ended slightly lower than average at 17.4%. This pattern is due to a variety of factors. First, its semi-isolated development allowed it to gain an identity of its own. Then, as urban Silicon Valley developed and urban sprawl connected it to the rest of the metropolis, enough affluence moved into the area to keep its identity. Its location at the major route over the Santa Cruz Mountains also played a large role in its development. Los Gatos, because of its affluence, will continue to shift toward specialized retail. However, because of its relative location in the Bay Area, the low-end retail is not expected to drop below 15%.



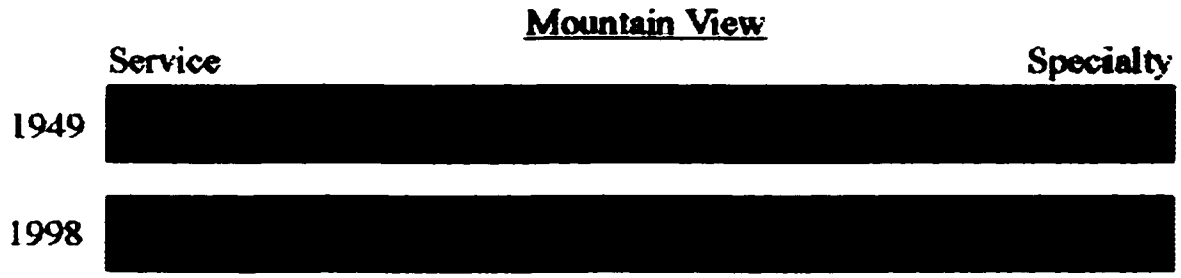


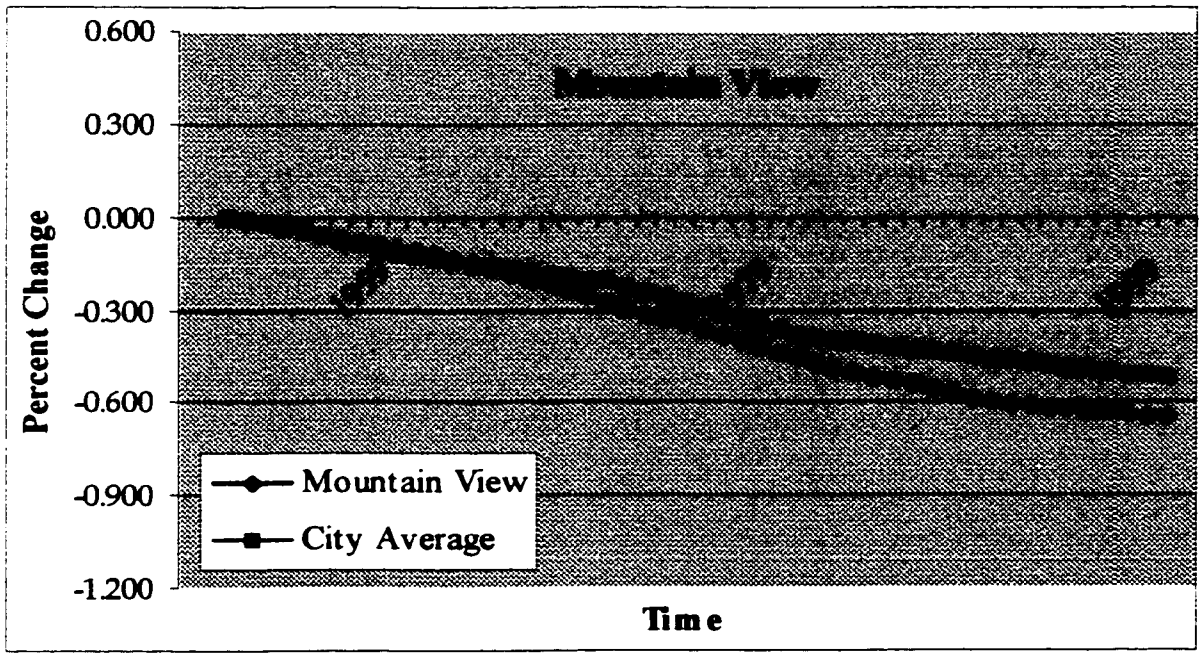
Morgan Hill has a transformation pattern that is indicative of what it is, a city that started out rural and is still in the process of the transformation from service to retail. Starting with a high percentage of 51.3% in 1949, its rate of change mirrored the aggregate, and then ended higher than normal at 26.7%. As development and land use changes continue to occur in this area, Morgan Hill will continue to develop its downtown. One can still expect substantial change toward retail in the future. If there were more cities in close proximity, Morgan Hill could expect to reduce its service sector to nearly 10%.



Mountain View has a somewhat typical transformation. It started out at an average percentage of low-end goods and services at 47.5%. Its percentage curve followed the aggregate rather closely and finished below the average at 16.7%. It had a slightly higher degree of change beginning in 1969, which accounts for the lower percentage at the end date. This can be attributed to the city's relatively late development, mostly associated with the boom of the Silicon Valley in the late 1960s.

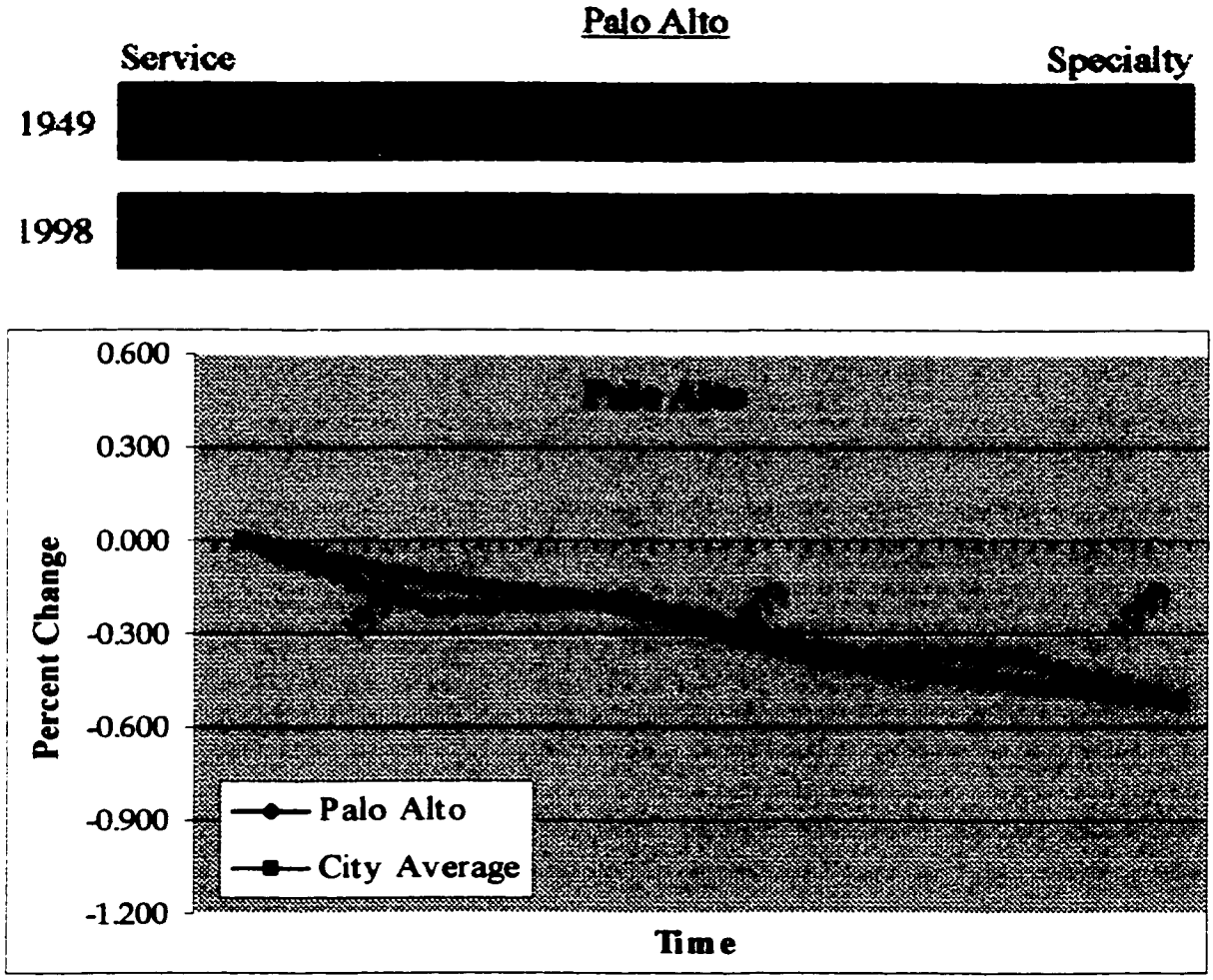
There are no other major jumps in the curve. With a low ending percentage of service shops, little change is expected for Mountain View.





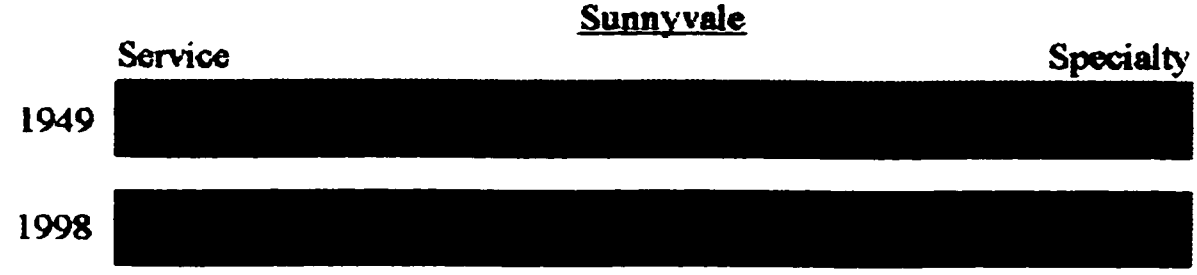
Palo Alto, located just north of Mountain View and at the border of San Mateo County, started with a low percentage of 39.5% in 1949. Its percentage curve is characterized by two periods of relatively high change that really should be connected. The stagnant period of 1959 to 1969 actually had a high rate of change that was masked by the high increase in banks during the period. This can be connected to the high degree

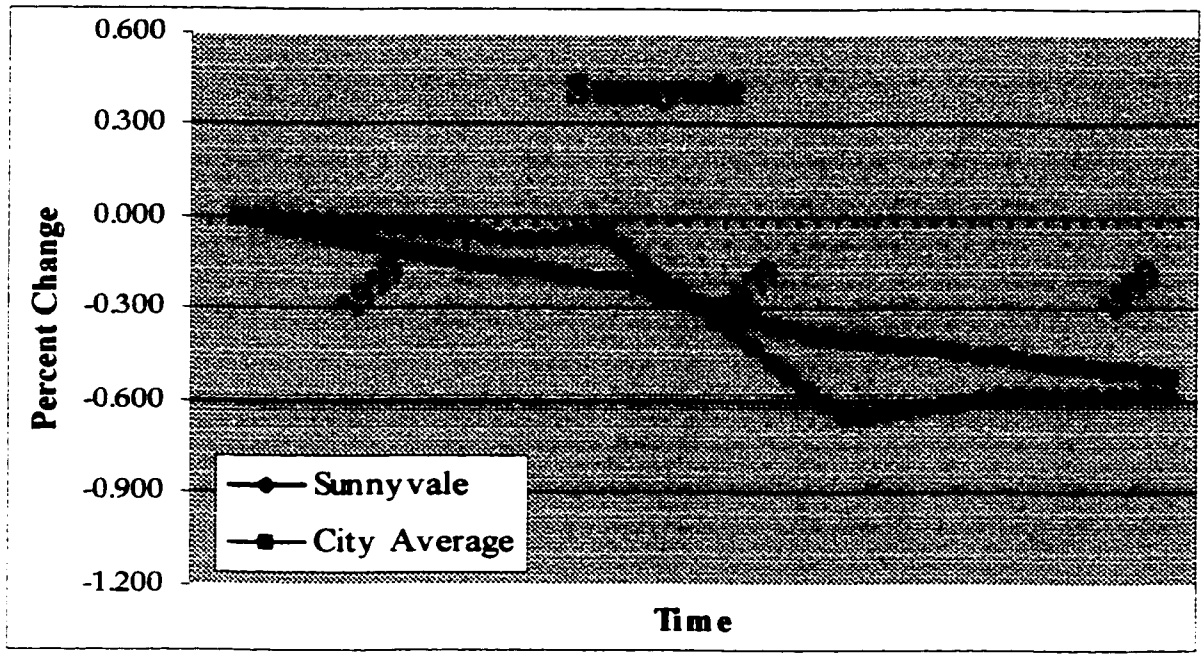
of economic prosperity that the community experienced due to the growth of Silicon Valley. Although the curve does not show it, Palo Alto has experienced a high degree of change from 1949 to 1979. After this, the curve leveled off somewhat and Palo Alto ended in 1998 with an average service percentage of 19.7%. It is expected that the percentage will continue to drop as banks locate elsewhere. The service percentage of Palo Alto has the potential of dropping as low as 10%.



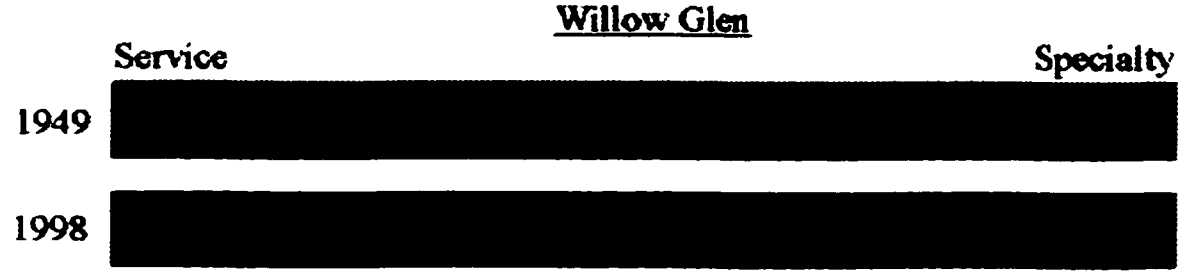
Sunnyvale, located east of Mountain View, is directly south of the bay. It has a very distinct history and transformation pattern. It started higher than average at 51.6%.

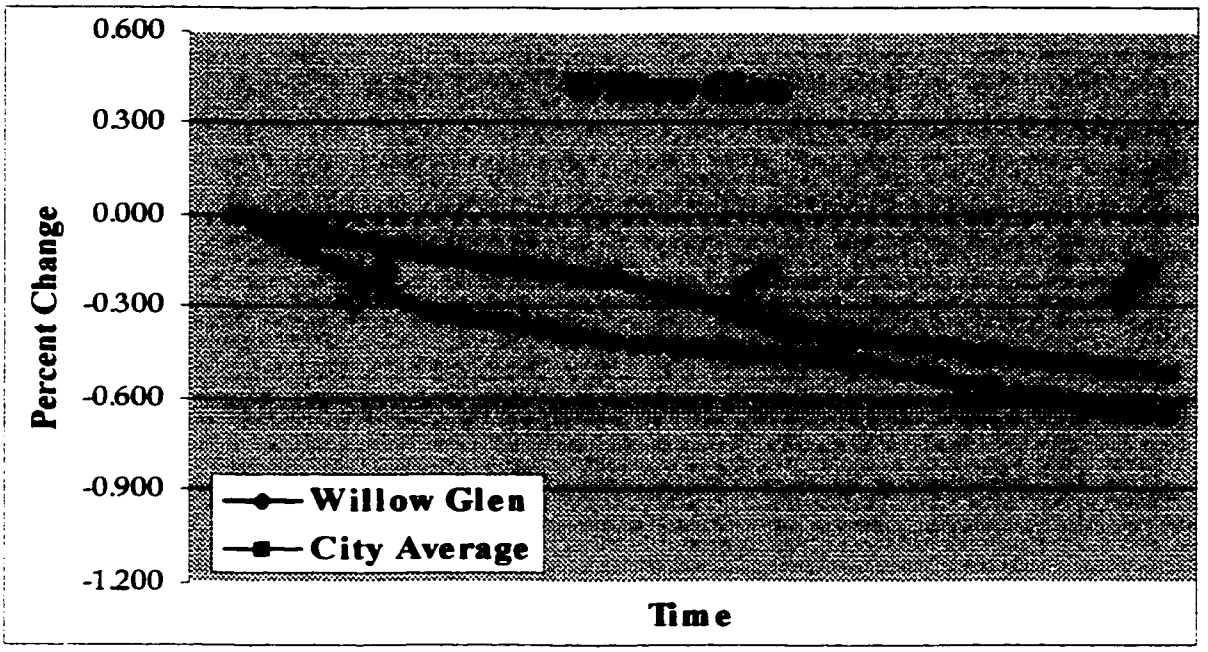
This was followed by a very low rate of change until 1969, when it suddenly dropped about 60% of that percentage in a ten-year period. The curve remained level after that with little change throughout the time period. It ended at a normal 21.3% service in 1998. The sharp drop from 1969 to 1979 was due to the introduction of a mall directly adjacent to the downtown. It not only influenced the type of shops in the sector, but it also severed the direct route to the main artery of the area, El Camino Real. The establishment of the mall sealed the fate of the downtown area by creating a one-block, isolated sector of specialty restaurants and bars rather than a full-functioning downtown. If there is any change at all in the future, it will possibly be an increase in the service sector due to an increase in restaurants.





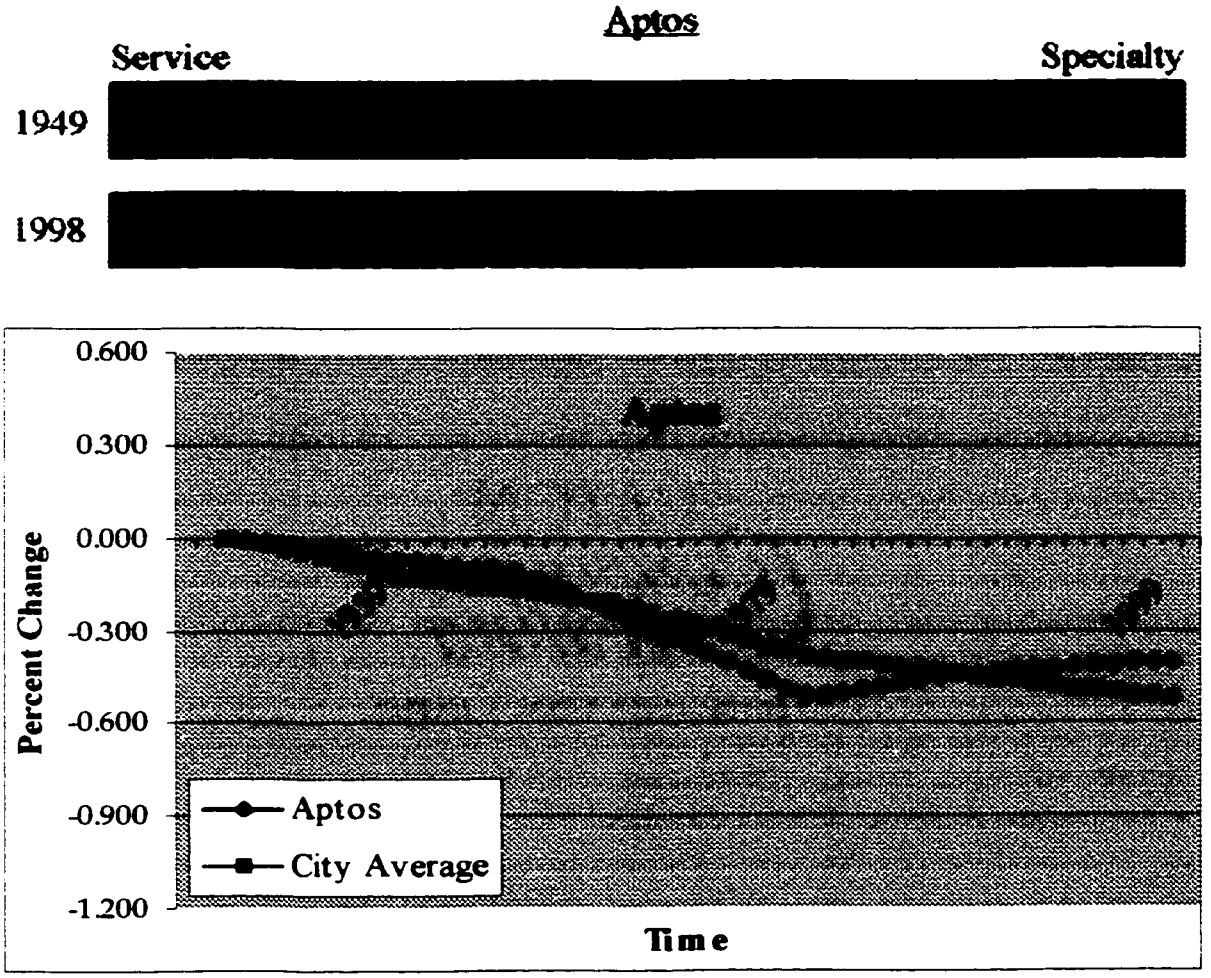
The last study downtown in Santa Clara County is Willow Glen. Directly south of downtown San Jose, Willow Glen is a pleasant oasis in a sea of urban sprawl. Starting with a high percentage of service at 55.8% and ending with a slightly low percentage of 19.1%, Willow Glen had a higher then normal rate of change over the study time period. This high rate occurred mostly in the first decade. The future of Willow Glen is expected to show a gradual shift toward more high-end retail. It has the potential of getting as low as 12% to15% because of the services supplied in the surrounding area.





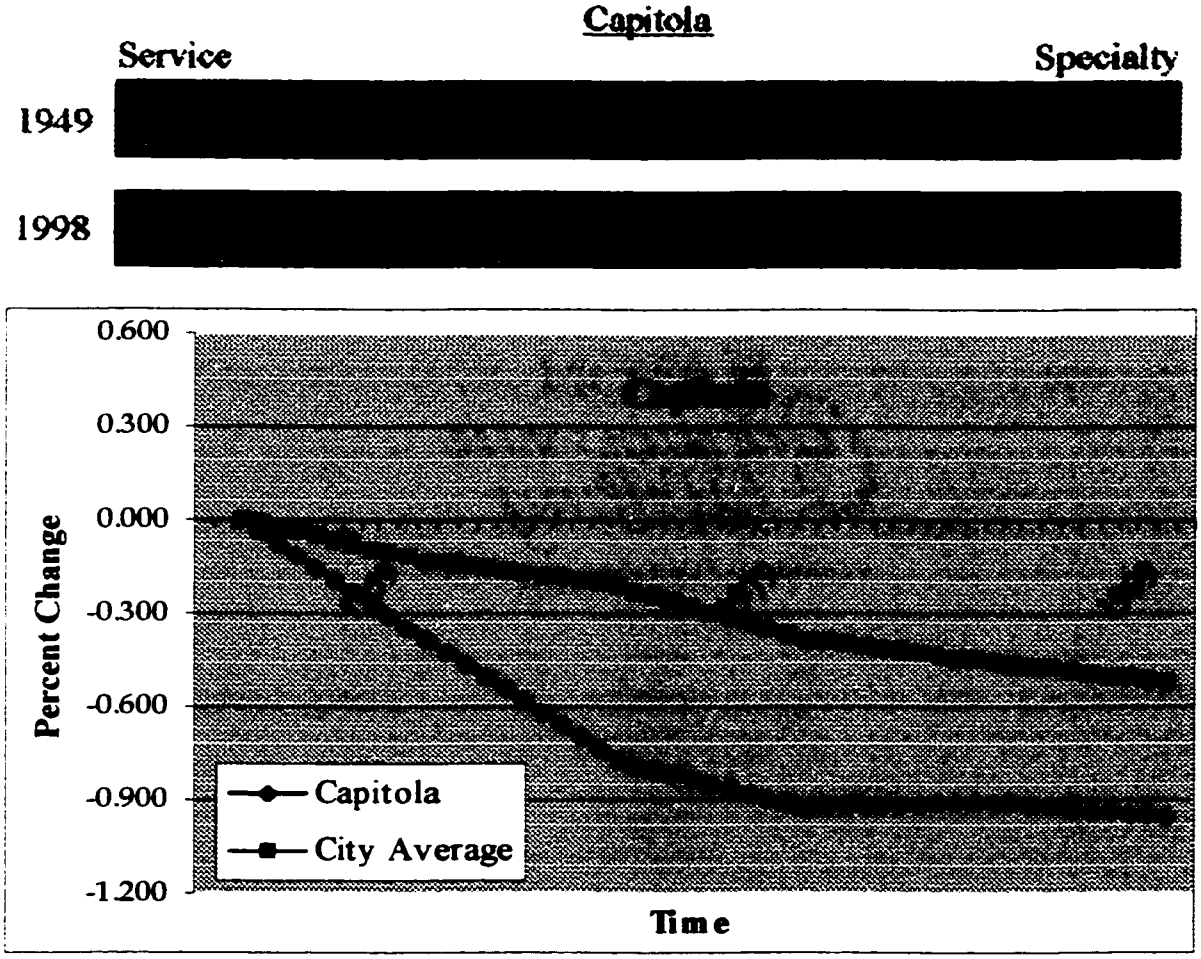
Santa Cruz County

Aptos has an interesting transformation pattern. Starting and ending with high percentages, it is a somewhat isolated town that experienced a period of a high rate of change. In 1949, the service percentage was at a very high 77.0%. It experienced little change until the late 1960s, when it dropped significantly for about a decade. After that, the curve leveled off and showed continuous positive service growth throughout the time period. Without further research, it is not known what accounted for the dramatic change and recovery. Although the trend for the last few decades shows positive service growth, the future of Aptos is hard to predict because the percentage of 46.2% service shops in 1998 remains very high, even for an isolated downtown.



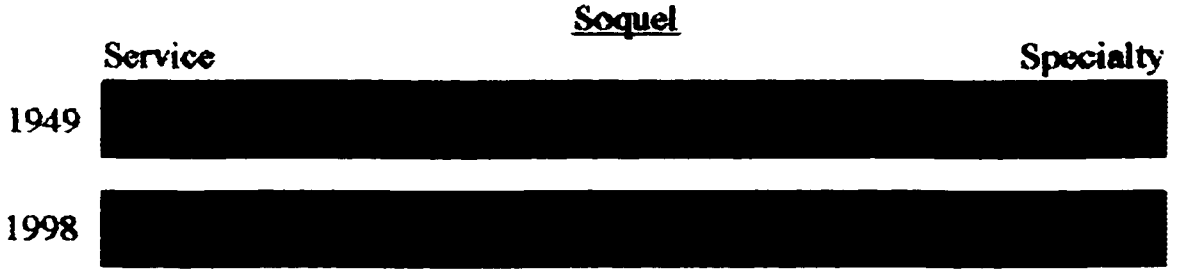
Capitola is a special case due to the fact that it has one of the most distinctive curves in the study. This is possibly a result of its major industry, tourism. In 1949, Capitola had the highest percentage of service in the study at 75.6%. It then experienced an immediate, dramatic drop in percentage until it hit zero near 1980. During the rest of the time period, the curve stayed extremely close to zero, indicating no services. The only other city in the study to reach 100% change is Pittsburg, but that was due to economic depression. Capitola, on the other hand, reached no services through a healthy

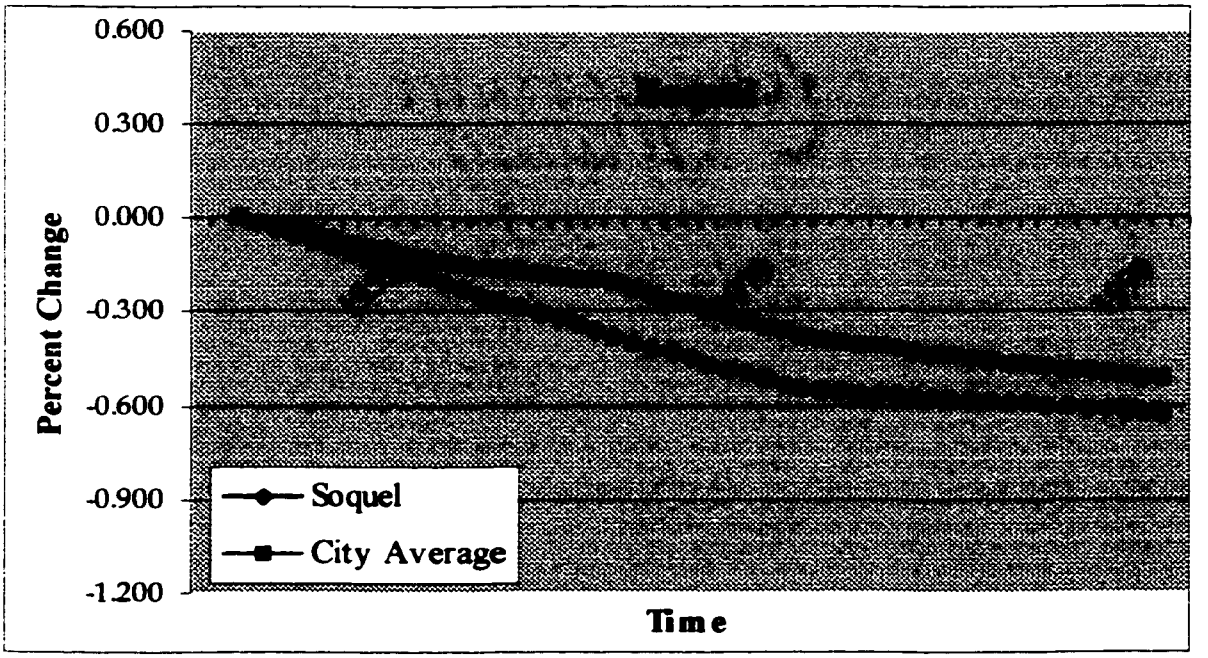
economy driven by tourism. There is little or no need for services in a town dedicated to tourism. Not much change in the percentage service is expected in the future for Capitola. However, if there is change, then the amount of low-end service and retail can only increase.



Soquel, located immediately adjacent to Capitola on the other side of Highway 1, had a completely different transformation process. It started the time period at a very high service percentage of 61.9%. It then experienced a high rate of change until 1979,

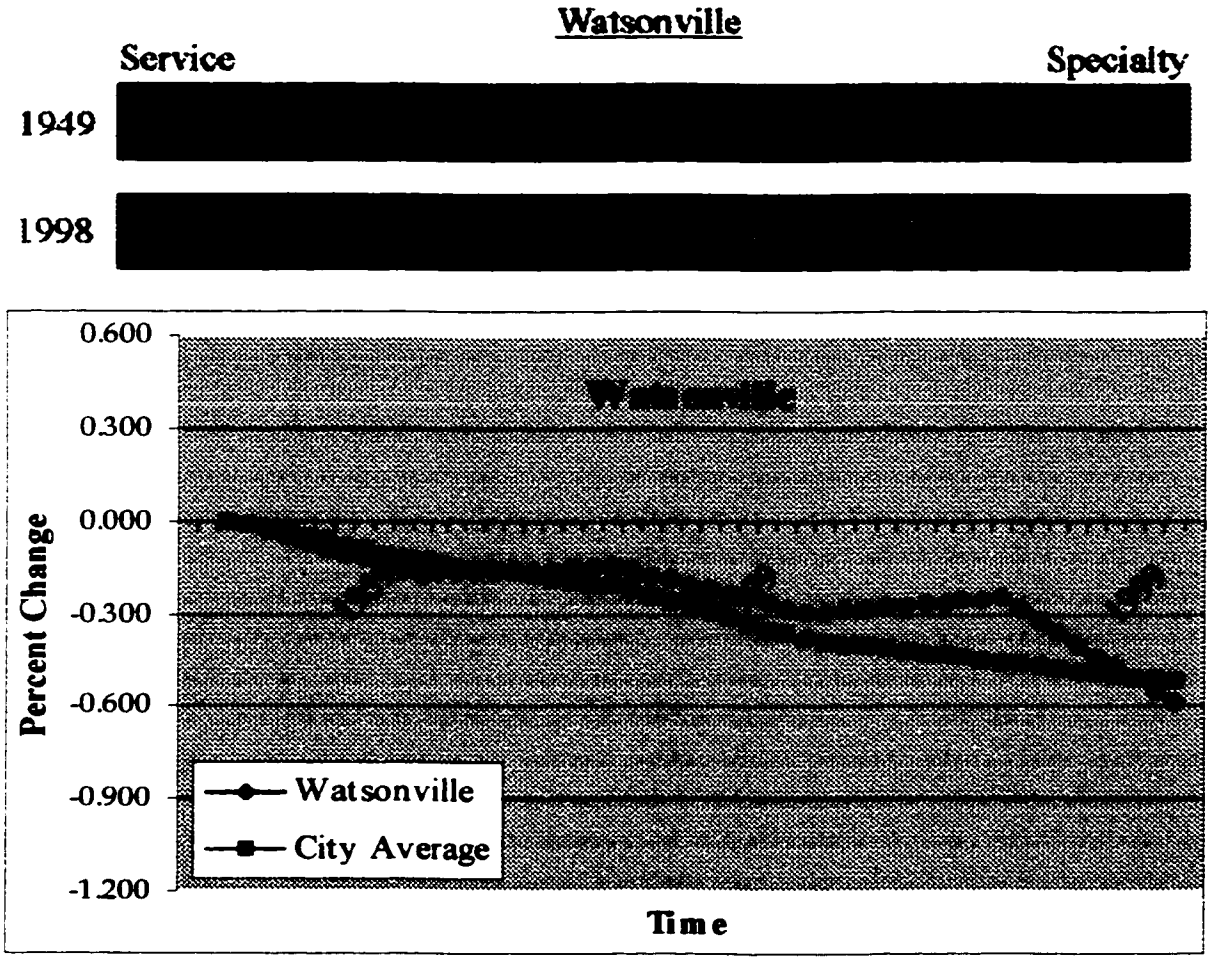
when it leveled off. Its curve never came very close to the aggregate during the entire time period, but it did finish with a close to typical service sector of 22.9%. This pattern has been found in this study to be typical of somewhat isolated cities that have substantial nodes in close proximity. They are able to retain their identity while feeling the effects of economic prosperity. The future for Soquel is expected to be one of consistent change with little deviation from the established curve.



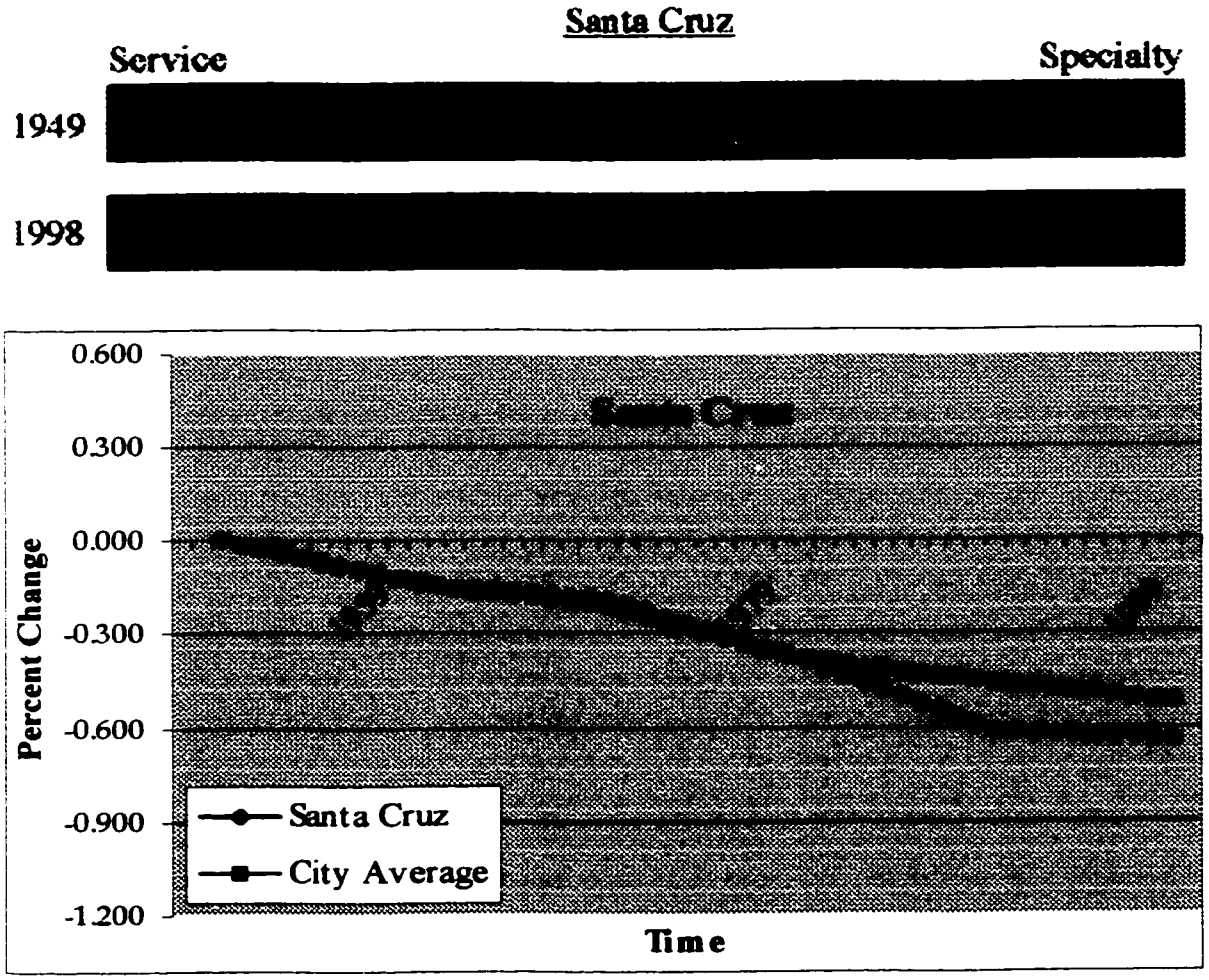


Watsonville, the southern node of a string of development along the coast, has a strong identity. Starting rather low in the service sector at 41.9%, this city's percent

change curve is somewhat sporadic during the entire time period. Watsonville ended in 1998 with a slightly lower than average percentage of 17.6%. This pattern can be attributed to several factors. Its high rate of retail at the beginning of the time period is due to the fact that it served as an economic node for much of the surrounding rural area. It then continued through the process of change toward retail at a slow rate until the last decade, when it experienced a large drop in service. Watsonville, with its unusual combination of surrounding land uses, which are still changing today, and proximity to the Bay Area metropolis, experienced a variety of driving forces behind its transformation process

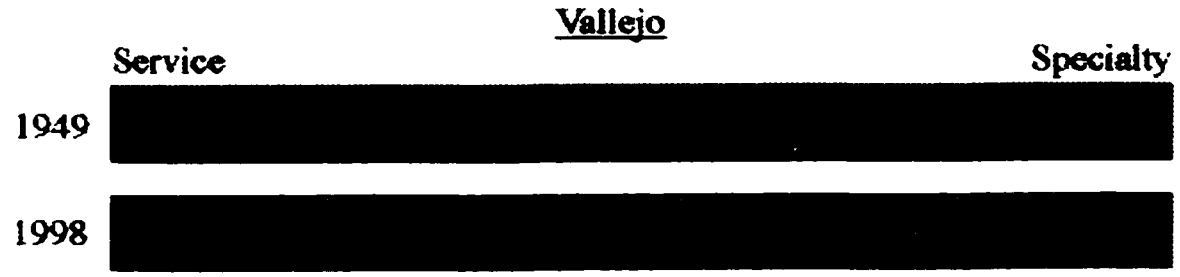


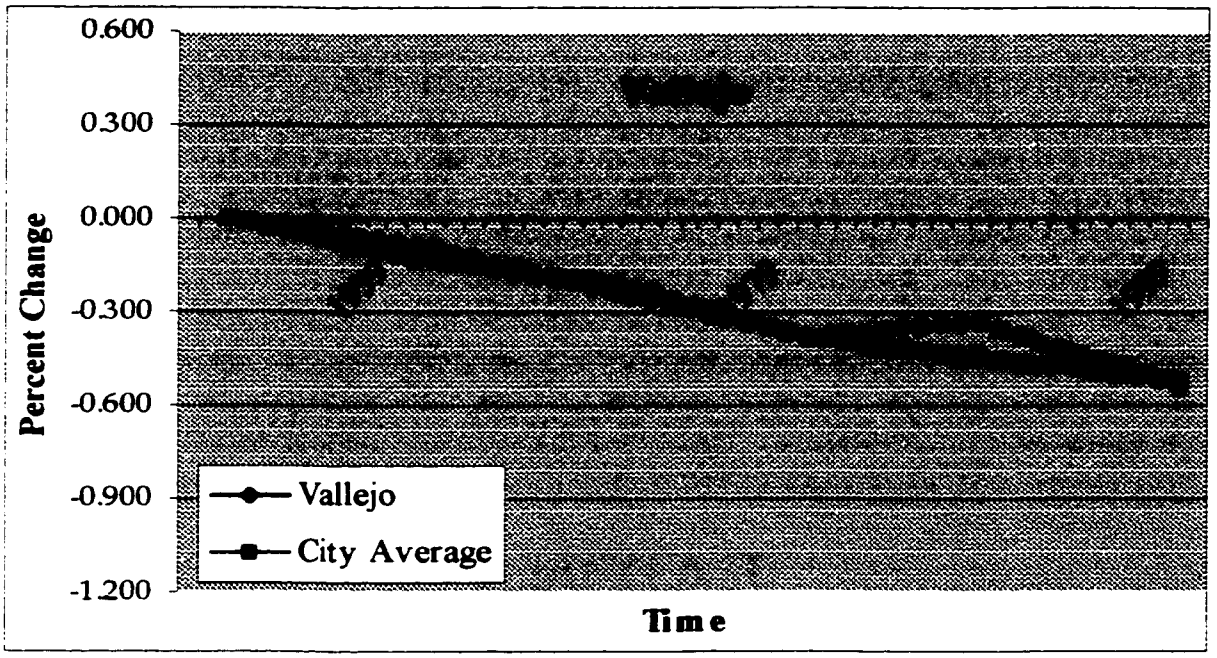
The city of Santa Cruz is a strong economic node that anchors the string of cities opposite Watsonville. Santa Cruz shows a rather typical Bay Area pattern of change. It started in 1949 at an average level of 43.5%. It followed the aggregate percentage change curve for most of the time period. In the early 1980s, Santa Cruz started to experience a higher rate of change than the rest of the Bay Area, resulting in a lower than normal 15.7% service in 1998. In the near future this rate is expected to level off due to the fact that a city of the relative size and importance of Santa Cruz cannot drop much below this percentage.



Solano County

The only study city located in Solano County is Vallejo. In 1949, Vallejo had a service sector of 40.9%, which was lower than the Bay Area average. This was due to the fact that Vallejo experienced a high growth period during World War II, rather than after, like most of the Bay Area. Vallejo is closely linked to the naval yard on adjacent Mare Island. Its percent change curve follows the aggregate rather closely throughout the rest of the time period, ending with a very typical 19.1%. Vallejo did have a somewhat steep drop in services during the last decade. This was due mostly to a decrease in the economy. If the economy grows in the future, Vallejo will probably see an increase in services before a subsequent decrease. If the economy continues to decline, it is expected that services will continue to drop.

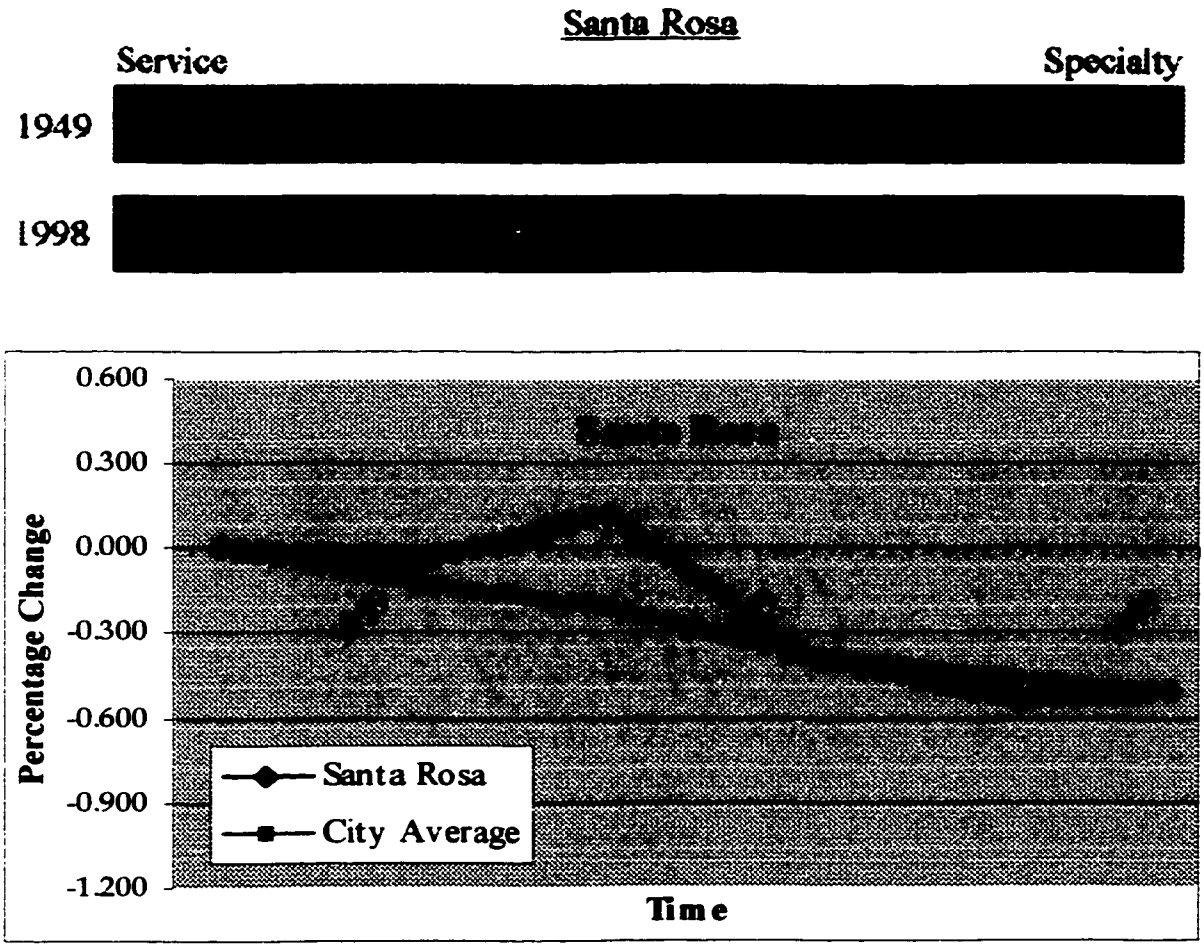




Sonoma County

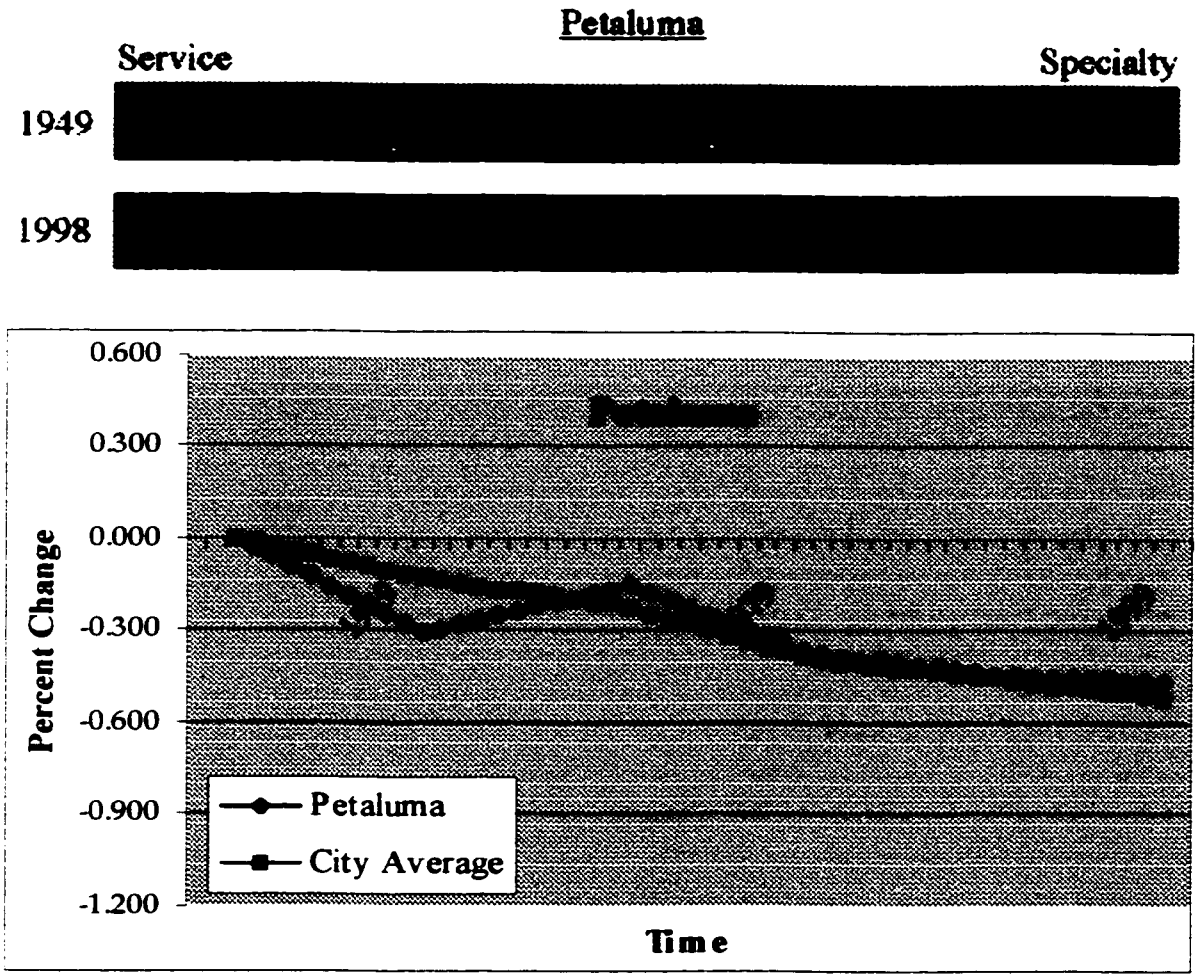
Santa Rosa, located centrally in the county, is the county seat of government. It has a transformation pattern typical of a well-established node in a rural area. Like most major nodes, it started the time period at a low percentage of services, 34.2%. It showed little negative change during the first decade, followed by an increase in services during the second. As the economy increased and urban sprawl began to dominate the countryside in the 1970s, services in the downtown area shifted to the suburbs at a very high rate until they finally leveled off in the 1990s and ended at a lower than normal 16.9%. Like Santa Cruz in its importance to the area, the services of Santa Rosa would not normally expect to drop much lower in the future. However, due to the high degree

of urban sprawl and suburb development in this region, the service sector has the potential to drop much lower.



Petaluma is located several miles south of Santa Rosa and closer to San Francisco. It has a somewhat typical overall pattern of change. It started a few points lower than average with 41.1% low-end goods and services in 1949. During the first two decades, the curve fluctuated on either side of the aggregate, but then followed it very closely the rest of the time period. It ended in 1998 with a slightly higher than average service

percentage of 23.5%. Overall, Petaluma has experienced less change than the average Bay Area study city, but is in many ways a good reflection of the transformation process. It is expected that Petaluma will continue to see change toward retail in the future.



City Groupings

Analysis of the overall trends of the transformation curves for each individual city is very important in understanding the different processes that have occurred in the Bay Area. It is also important to study the spatial patterns of this process and how they occur

over the landscape. This is achieved by analyzing the six groupings of the cities described in Chapter Two. The six groupings are divided into two main sections, linear and regional, each consisting of three groupings. Each grouping is addressed with regard to general trends of the transformation curves, the average residuals, and any outliers (cities that do not fit the pattern). All of the same interpretations that were discussed above will apply here as well. In addition, analysis is conducted of residuals, the amount of difference between the transformation curves of the individual cities, and the class average.

Linear Distance Groupings

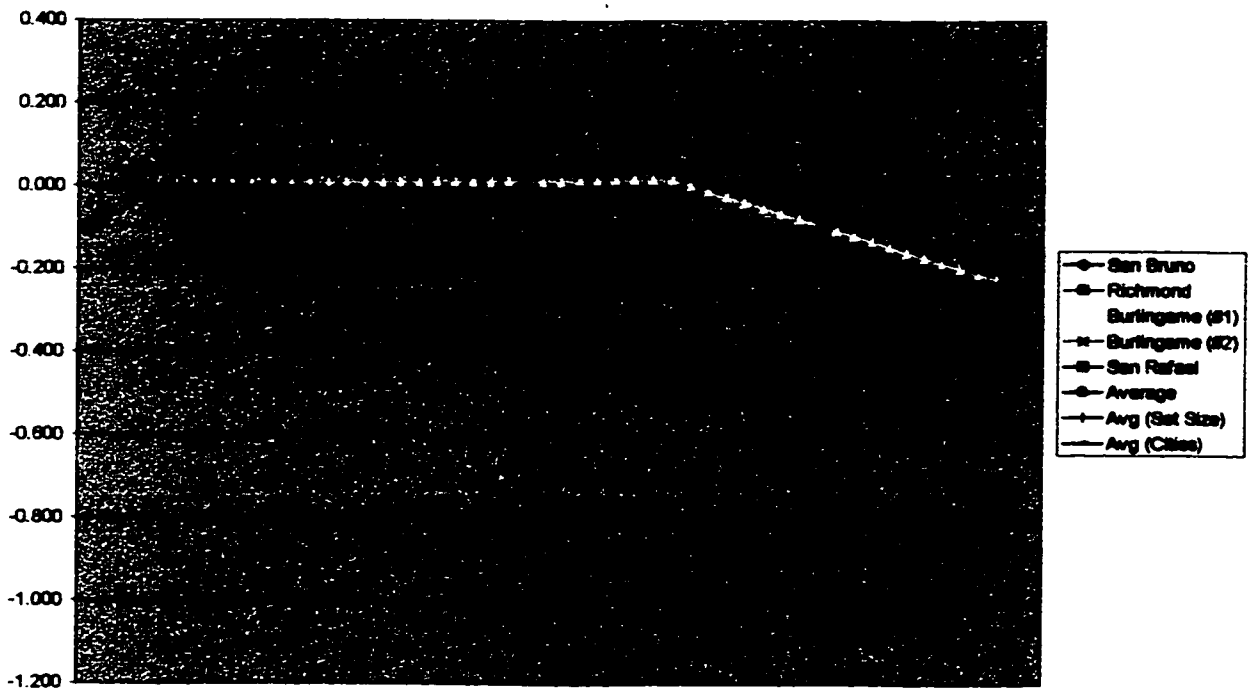
Linear distance is used for the first three groupings. Cities having a similar relationship with regard to distance from a central node are grouped. In this case, San Francisco will always serve as the central node. The three groupings are set size, set distance, and natural breaks.

The first group, set size, divides the cities into seven evenly sized groups, each with five cities (Table 4). The first class (Graph 1), with a high residual of .144, starts with very dispersed city curves that never cluster throughout the entire time period. Generally, the cities have relatively flat curves that are located higher than the city average. This reflects the conceptual view that more mature downtowns are expected to be near the central node.

The next class (Graph 2) has a small average residual at .109. This class shows a tight clustering until 1974. Beyond that, the city curves disperse rather dramatically until

Graphs 1 through 7:
Set Size Grouping

Set Size: 1-5



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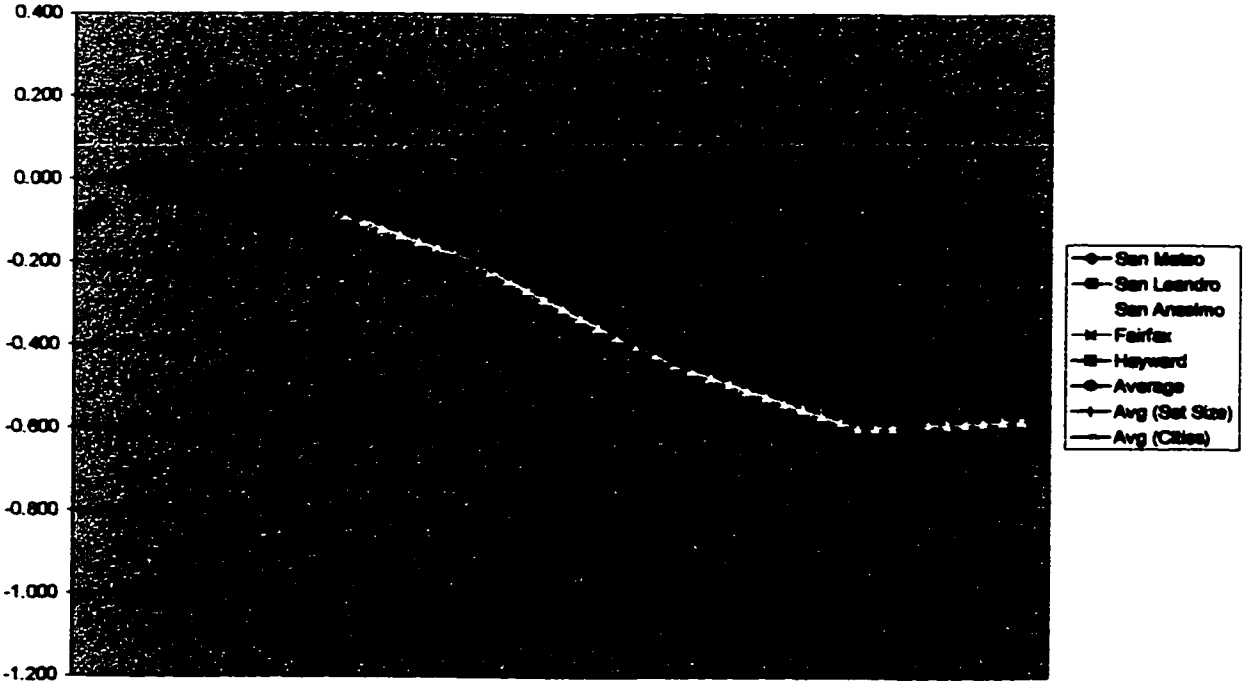

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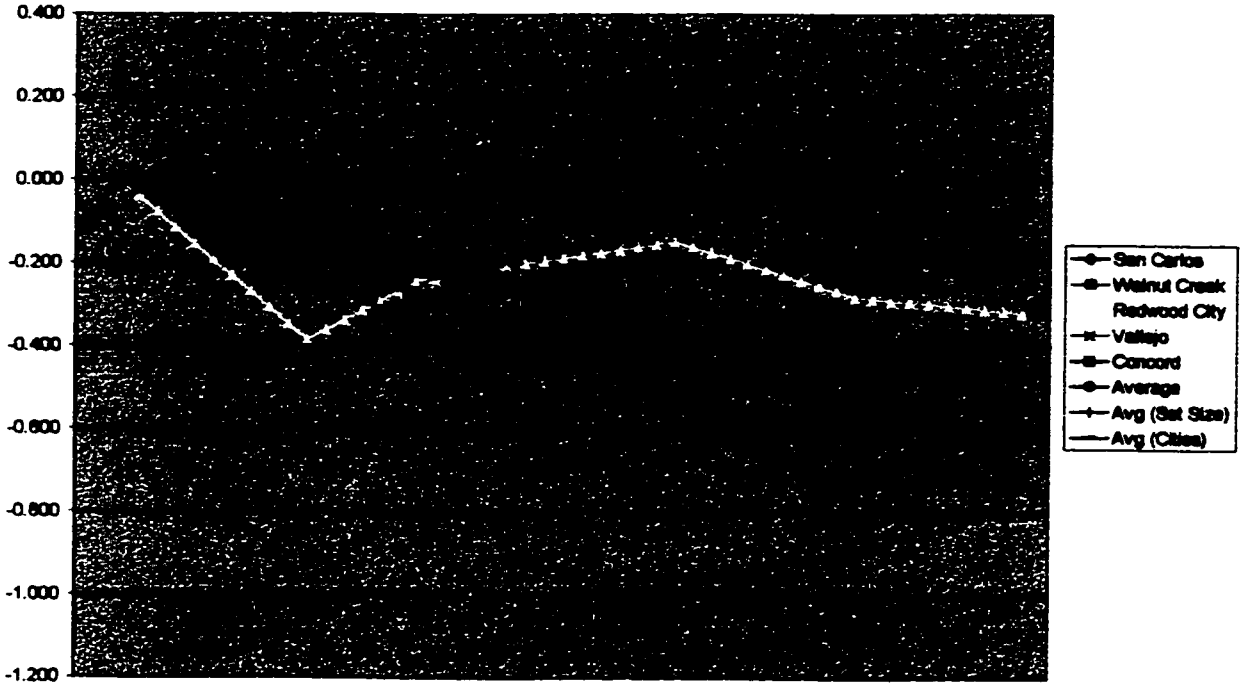
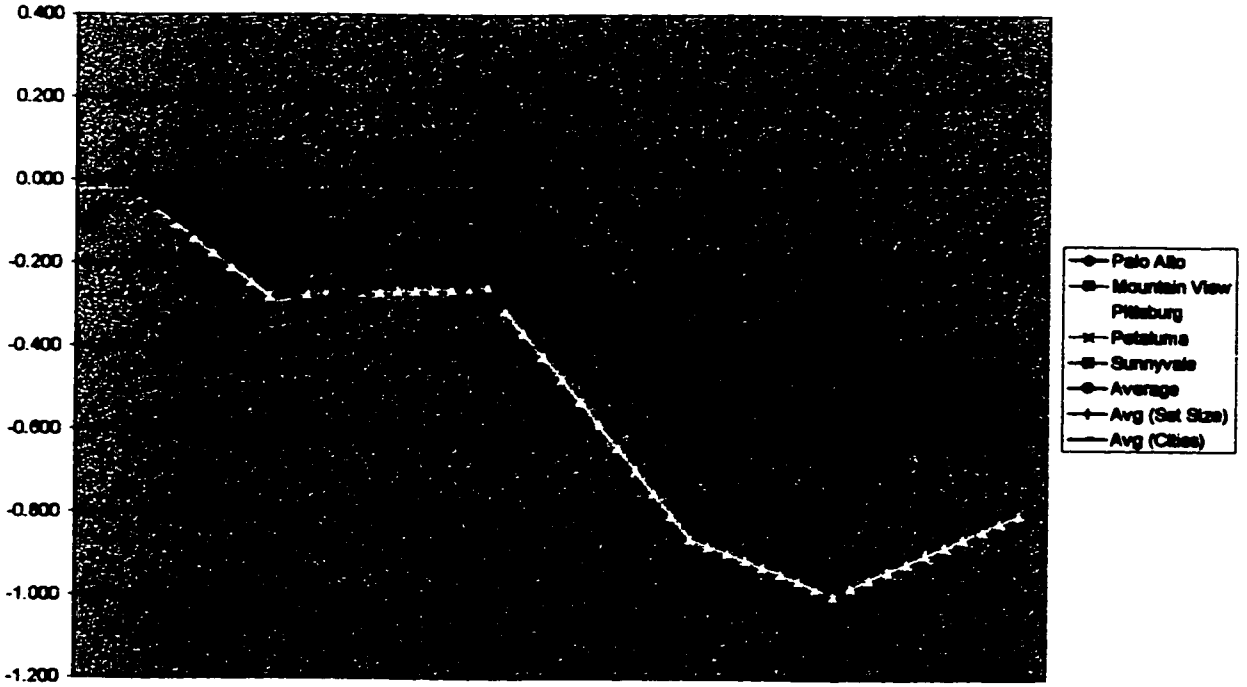
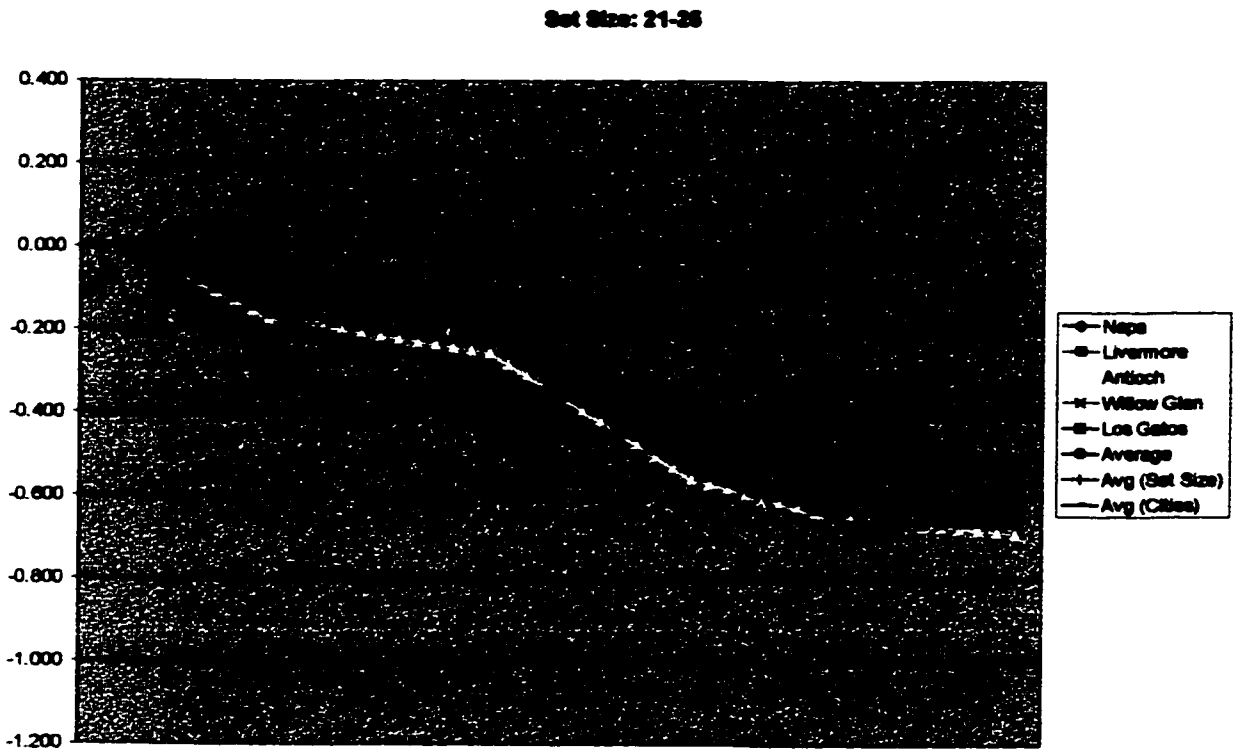
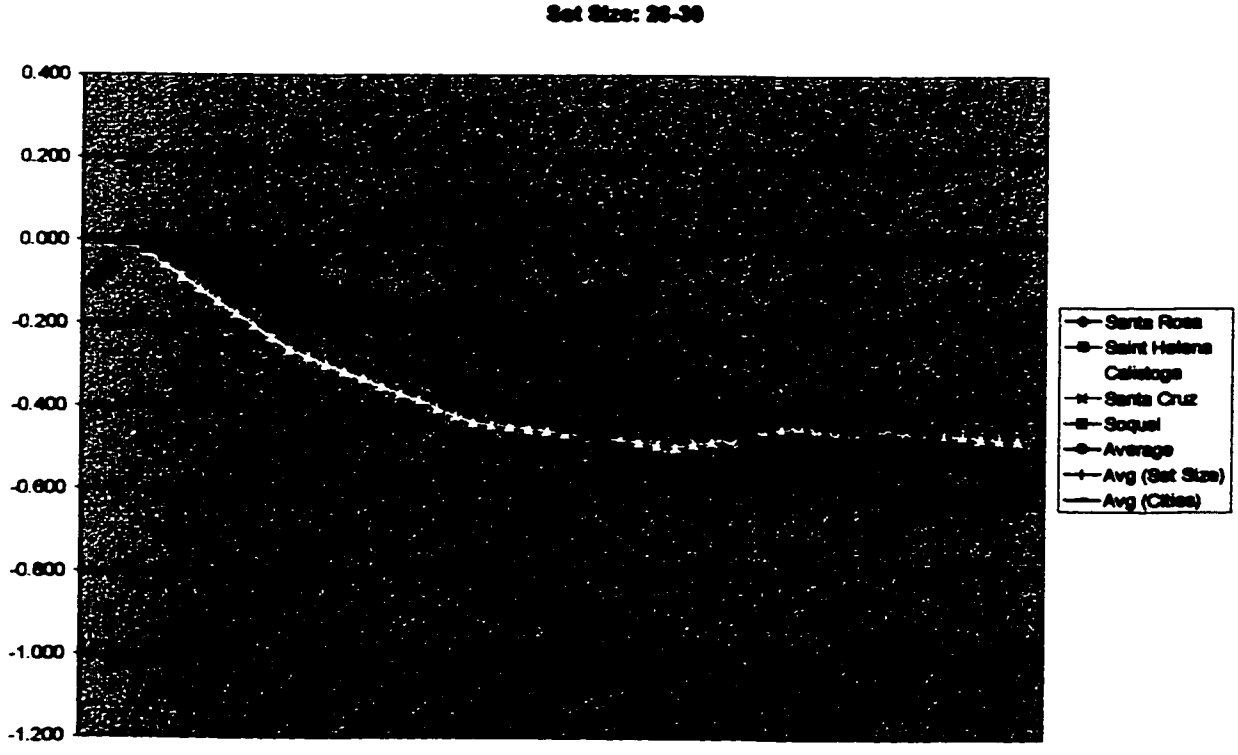
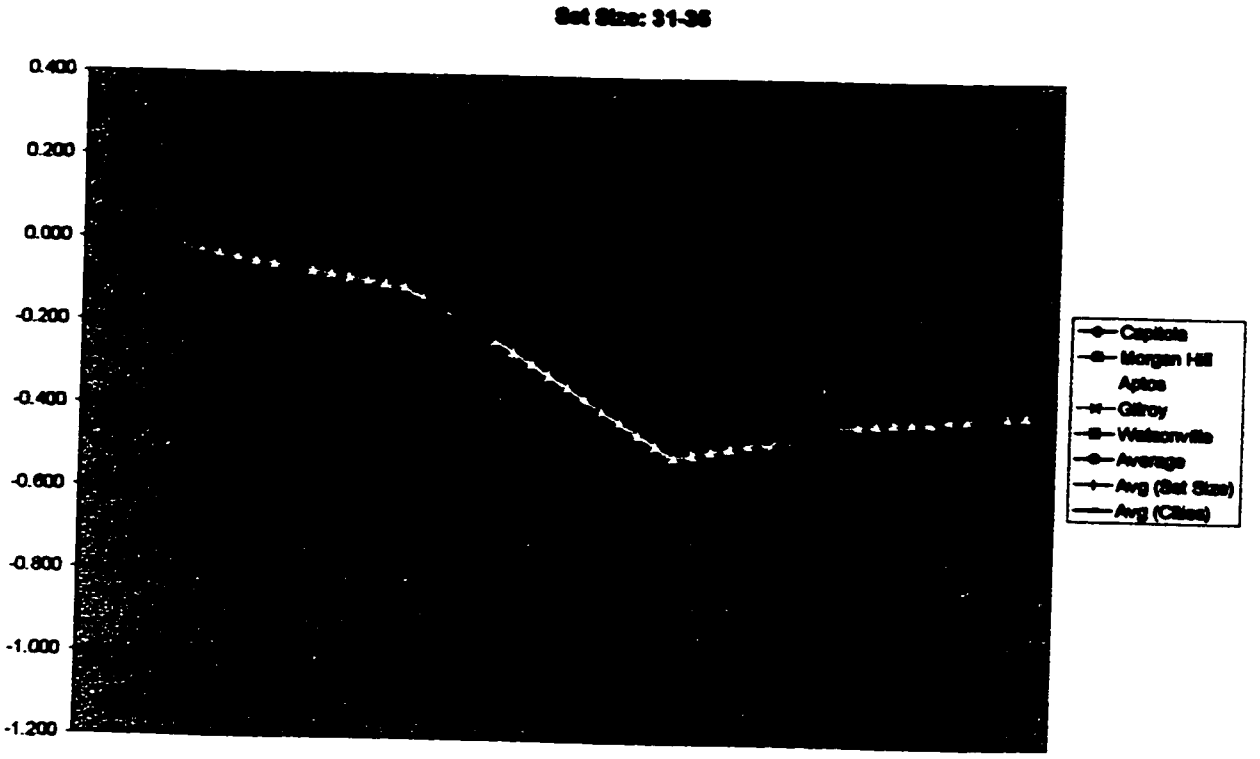


Set Size: 16-20




Set Size: 21-25
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Napa
Livermore
Antioch
Willow Glen
Los Gatos
Average
Avg (Set Size)
Avg (Cities)


Set Size: 26-30
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Santa Rosa
Saint Helena
Calistoga
Santa Cruz
Soquel
Average
Avg (Set Size)
Avg (Cities)


Set Size: 31-36
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Capitola
Morgan Hill
Aptos
Gilroy
Watsonville
Average
Avg (Set Size)
Avg (Cities)

there is a wide spectrum at the end date. The cities are evenly grouped around the city average, showing a good balance of changing and static downtowns. San Mateo, with a rather flat curve throughout the entire time period, is a distinct aberration.

Table 4: Set Size Grouping

City	Distance	Class	City	Distance	Class
San Bruno	10.1	1	Napa	34	5
Richmond	11.6	1	Livermore	35.2	5
Burlingame (#1)	12.4	1	Antioch	35.6	5
Burlingame (#2)	13.4	1	Willow Glen	40	5
San Rafael	14.4	1	Los Gatos	42	5
San Mateo	14.4	2	Santa Rosa	48	6
San Leandro	14.8	2	Saint Helena	49	6
San Anselmo	16	2	Calistoga	55	6
Fairfax	17.5	2	Santa Cruz	57.4	6
Hayward	18.8	2	Soquel	58	6
San Carlos	20	3	Capitola	60	7
Walnut Creek	20.8	3	Morgan Hill	61	7
Redwood City	21.2	3	Aptos	61	7
Vallejo	22.8	3	Gilroy	71	7
Concord	24.4	3	Watsonville	79	7
Palo Alto	25.6	4			
Mountain View	29.2	4			
Pittsburg	32.4	4			
Petaluma	33	4			
Sunnyvale	33.2	4			

*Distances denoted in miles

The third class (Graph 3), with an average residual of .127, is higher than average. This relatively flat-curved grouping of cities is, for the most part, above the city average. There is no tight clustering throughout the curves, making this a poor grouping.

Redwood City, with its heavy drop at the beginning is a slight outlier. San Carlos also has an outlying curve due to its lack of change.

The fourth class (Graph 4), with an average residual of .097, is the second lowest class in this grouping and is well below the average. The curves are all somewhat sporadic with heavy drops near 1970. An interesting phenomenon, however, is that all the cities experience this change. This is a very good grouping, not only because of the low residual rate, but also because of the high volatility of the city curves. They all experience dramatic drops after a period of average change and are located below the city average curve. Pittsburg, with its distinctive drop to zero service-oriented shops in 1989, is the one noticeable outlier and does not fit well in any grouping.

The next class (Graph 5) has a higher than average residual at .124. Although it has a similar residual to class three, its structure is completely different. Instead of being relatively flat, this class is characterized by steep angled curves that are well below the city average. It does, however, show some very good clustering at the beginning of the time period and again near 1979. Livermore is one anomaly in this class with little change and an actual increase in services in 1989. Another anomaly is Napa, that had, until 1969, a distinctively higher rate of change than the rest of the cities.

Class six (Graph 6), with an average residual of .073, is the best class in the grouping. Almost all of the cities are slightly below the city average and follow the curve closely throughout the entire time period. This is a good clustering because it represents a group of cities experiencing the transformation at the same rate. Santa Rosa, with a spike of positive change in 1970, is the one major departure from this class.

The last class (Graph 7) in this grouping is the worst, at .162 average residual. Three of the cities are decently clustered near the city average. Two cities, Gilroy and Capitola, inflate the average residual. Gilroy has very large positive growth at the beginning and is very sporadic after. Capitola experiences a very high rate of negative change from the onset and never comes near to the main cluster.

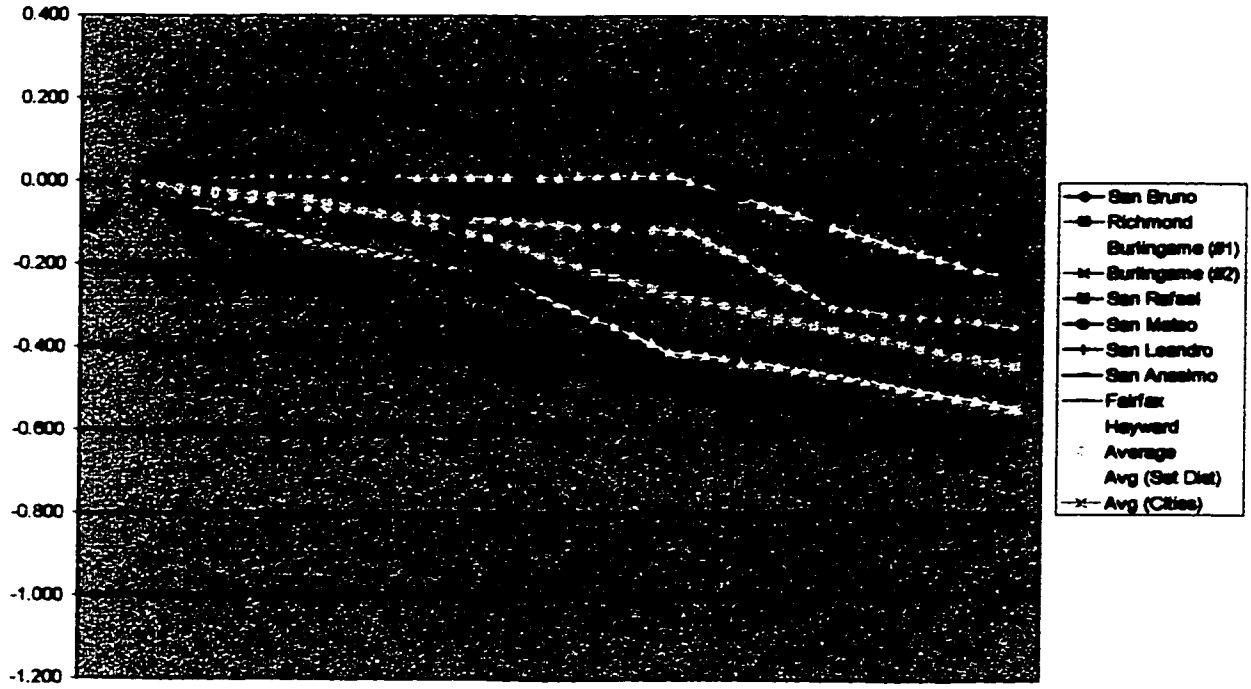
Overall, the grouping of set size is not a very good way to show the transformation process. With an average residual of .119, it is the worst linear grouping and the fifth best overall grouping out of the six. Only classes four and six were good clusters of percent change curves.

The next major grouping is set distance. Again, there are seven groups, however, there is no fixed class size. Rather, the class size depends on set distance classes from San Francisco (Table 5). The first of these classes (Graph 8) is the largest with ten cities. The average residual of this class is .130, making it higher than average and not very useful as an indicator of the transformation process. Similar to the first class of the set size grouping, the city curves in this class are relatively flat and show little change. They are, however, dispersed from the start and never cluster at any time period. San Rafael, with positive growth at the beginning, and San Bruno, with a high rate of negative change at the beginning, are the major outliers in this class.

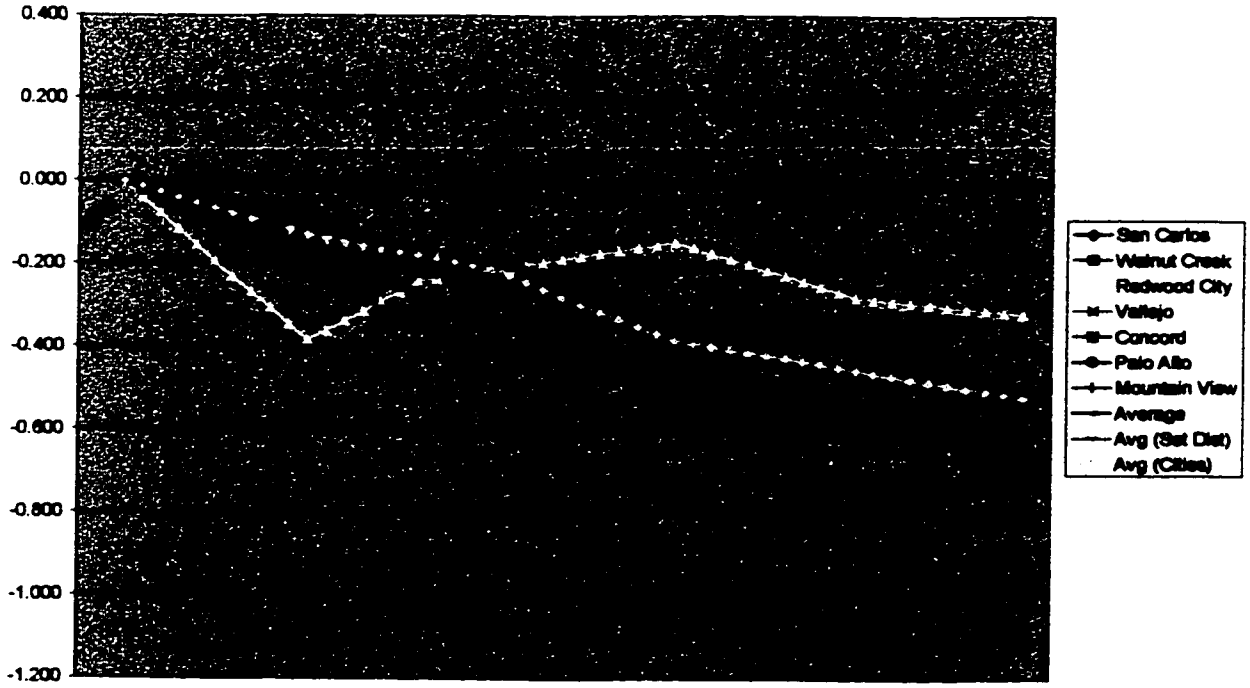
The second class (Graph 9) has a much more respectable average residual of .106. This rather uniform group has notable clusters both at the beginning and near 1979. With relatively steep angles below the city average, these towns indicate a rather high level of change. San Carlos, with its flat curve, is one city that does not follow the pattern. This is

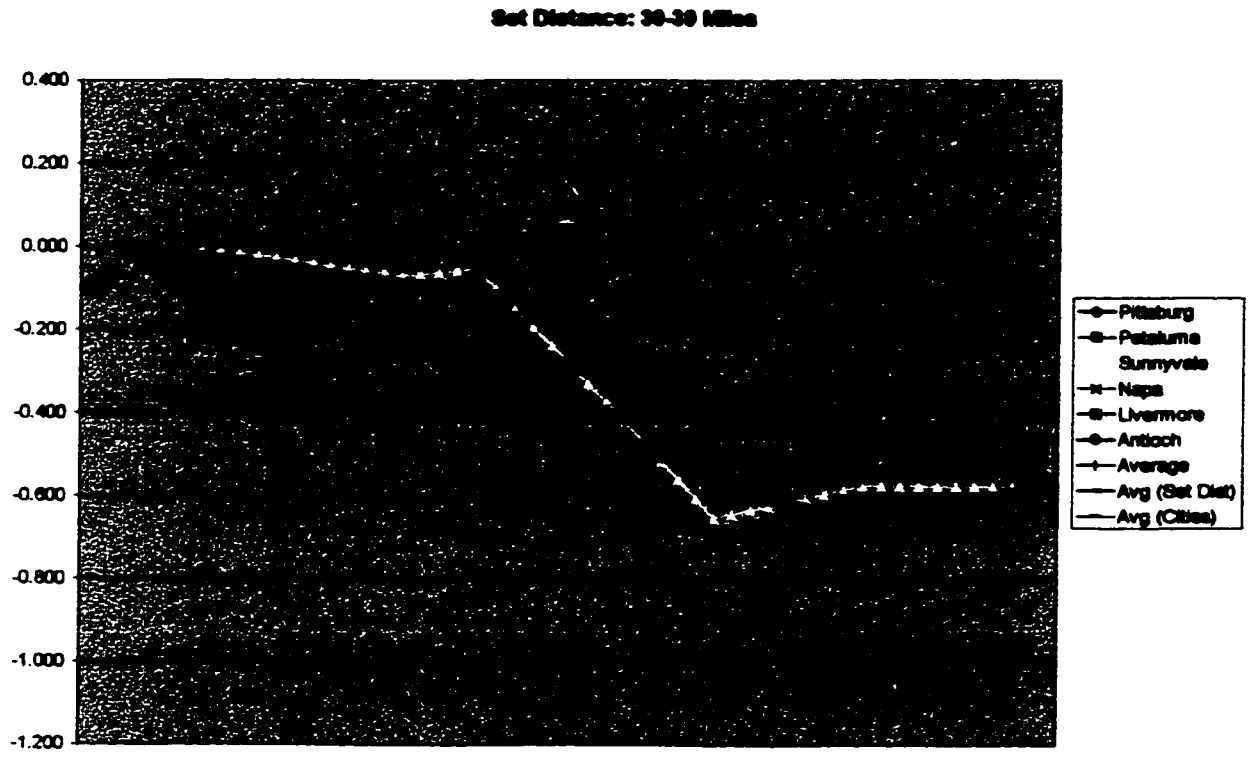
Graphs 8 through 14
Set Distance Grouping

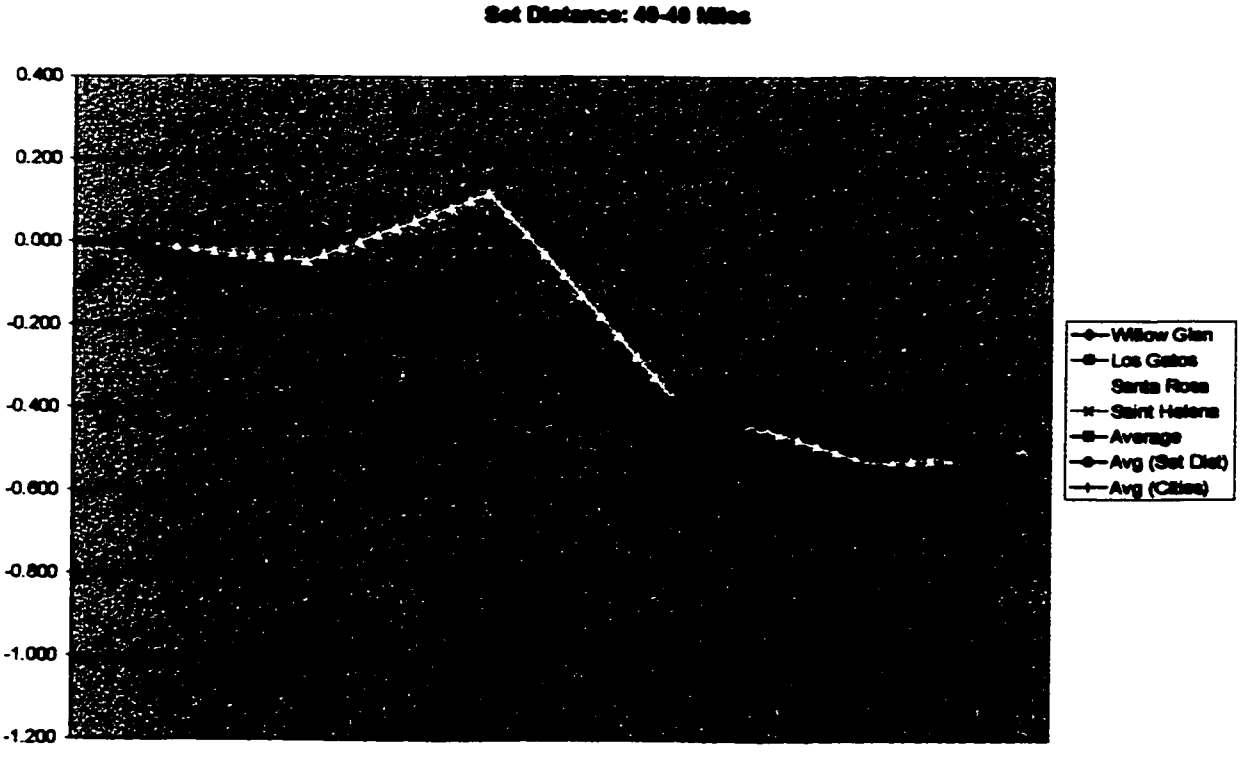
Set Distance: 6-19 Miles

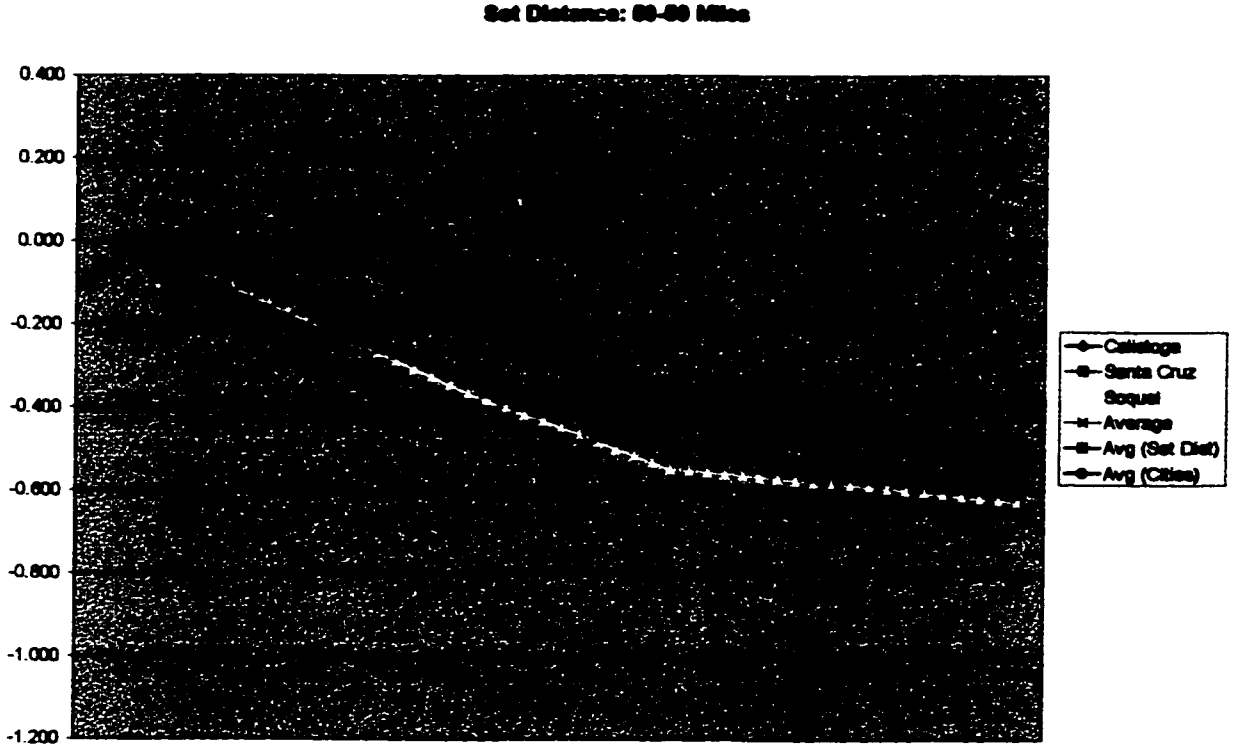


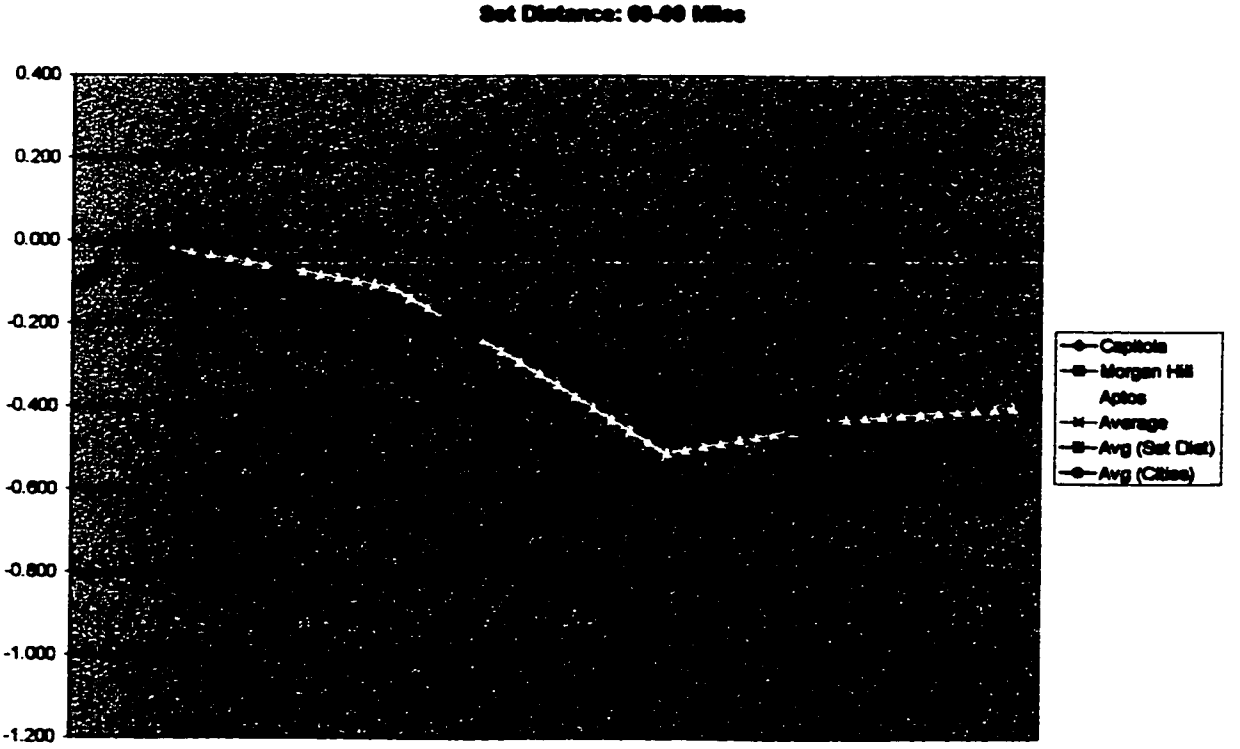
Set Distance: 20-29 Miles

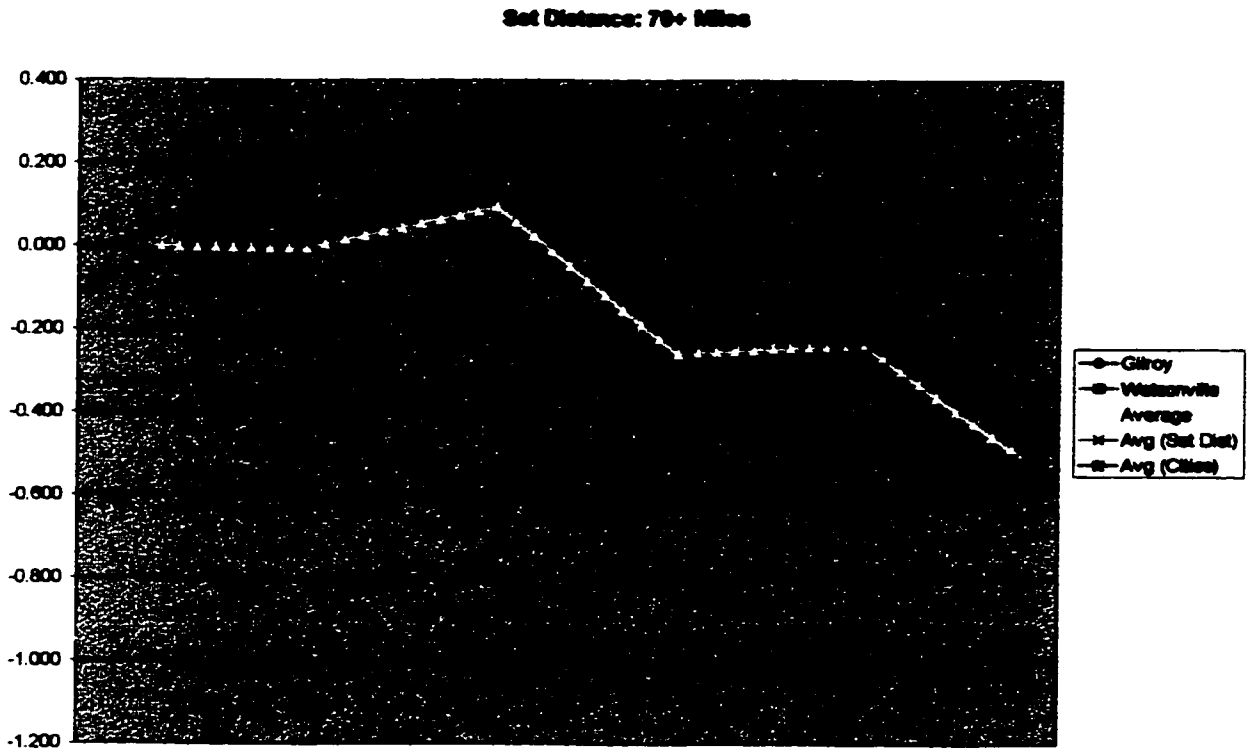



Set Distance: 30-39 Miles
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Pittsburg
Petaluma
Sunnyvale
Napa
Livermore
Antioch
Average
Avg (Set Dist)
Avg (Cities)


Set Distance: 40-49 Miles
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Willow Glen
Los Gatos
Santa Rosa
Saint Helena
Average
Avg (Set Dist)
Avg (Cities)


Set Distance: 60-80 Miles
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Calistoga
Santa Cruz
Soquel
Average
Avg (Set Dist)
Avg (Cities)


Set Distance: 60-80 Miles
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Capitola
Morgan Hill
Aptos
Average
Avg (Set Dist)
Avg (Cities)


Set Distance: 70+ Miles
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Gilroy
Watsonville
Average
Avg (Set Dist)
Avg (Cities)

a good class for Redwood City because its sporadic curve is well-hidden in this spectrum of curves.

Table 5: Set Distance Grouping

City	Distance	Class	City	Distance	Class
San Bruno	10.1	1	Willow Glen	40	4
Richmond	11.6	1	Los Gatos	42	4
Burlingame (#1)	12.4	1	Santa Rosa	48	4
Burlingame (#2)	13.4	1	Saint Helena	49	4
San Rafael	14.4	1			
San Mateo	14.4	1	Calistoga	55	5
San Leandro	14.8	1	Santa Cruz	57.4	5
San Anselmo	16	1	Soquel	58	5
Fairfax	17.5	1			
Hayward	18.8	1	Capitola	60	6
			Morgan Hill	61	6
San Carlos	20	2	Aptos	61	6
Walnut Creek	20.8	2			
Redwood City	21.2	2	Gilroy	71	7
Vallejo	22.8	2	Watsonville	79	7
Concord	24.4	2			
Palo Alto	25.6	2			
Mountain View	29.2	2			
Pittsburg	32.4	3			
Petaluma	33	3			
Sunnyvale	33.2	3			
Napa	34	3			
Livermore	35.2	3			
Antioch	35.6	3			

*Distances denoted in miles

The third class (Graph 10) has a high average residual at .135. Some of the cities in this class are represented well in class four of the set size grouping. The different alignment of cities in this grouping have placed most of the cities in group three, where

they are not very well clustered. The unpredictable change of most of the cities is not represented by the whole. After 1970, there is a lot of change that is not clustered. Most of the cities are below the city average. Pittsburg and Livermore are the major outliers in this class. Livermore's curve is too high at the beginning while Pittsburg's is too low.

The next class, class four (Graph 11), is the second best in this grouping. Although there are only four cities in this group, the average residual of .073 combined with a tight clustering around the city average curve, makes this class a very good representation of the transformation process. If it were not for Santa Rosa's spike and Willow Glen's dip at the beginning of the time period, the residual would be even lower.

The best class in this group is class 5 (Graph 12). With a low .050 average residual, it is one of the tightest clustered classes in the entire study. No cities have any major spikes or drops. Rather, the city curves are all clustered slightly under the city average and follow it closely for the entire time period.

Class six (Graph 13), however, with an average residual of .181, is one of the least indicative in the study. Two of the three cities are very well grouped near the city average. Capitola is the city that inflates the average residual.

Class seven (Graph 14), at a very respectable .104, groups the two farthest outlying cities, Gilroy and Watsonville. Both cities have unusual transformations that are above the city average, and are well represented by being grouped together. It would be hard to fit either of these cities into many other groups without heavily affecting the residual.

Set distance grouping, overall, is a better representation of the transformation process than set size. With an average residual of .115 for the entire group, it is the second best linear grouping and the fourth best overall.

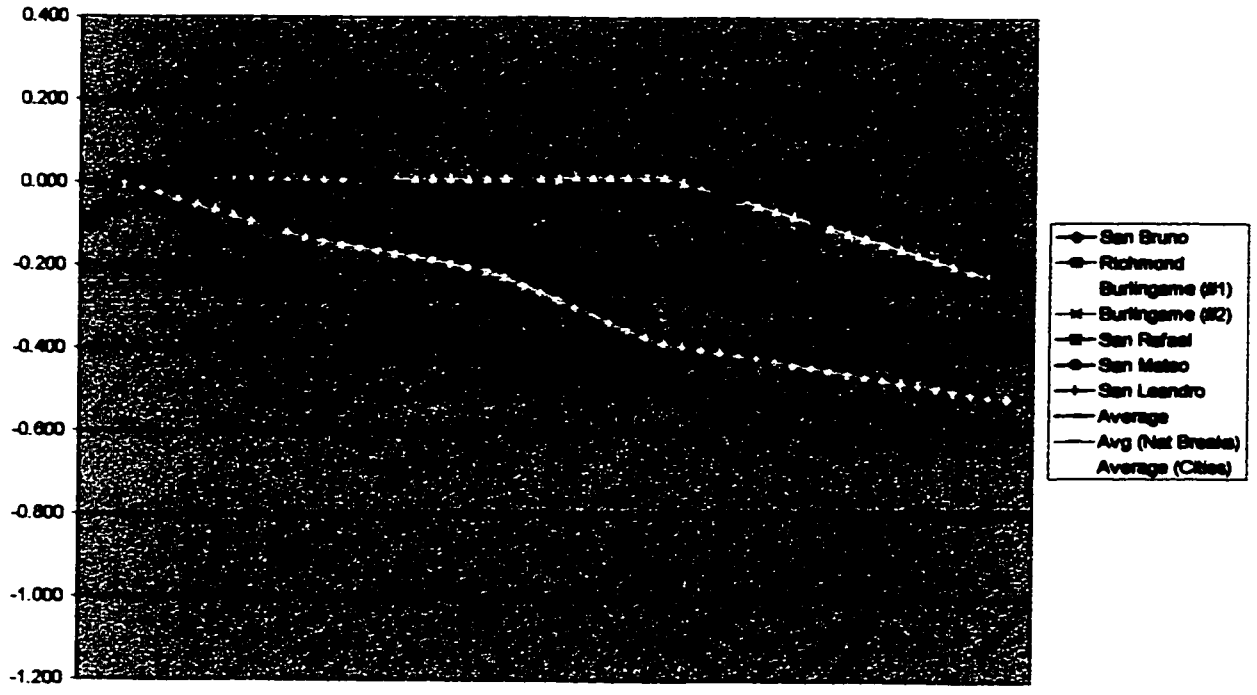
The last linear grouping is natural breaks. With the main component being the distance from San Francisco, class size is dependent on clusters of cities at similar distances from the node. As with set distance grouping, the size of the classes varies (Table 6). The first class of natural breaks (Graph 15) has two fewer cities than the first class of set distance. However, the two cities omitted were not outlying cities, but rather cities that were well grouped. This made the average residual balloon to .144, which is high above the average. The city curves are still relatively flat and above the city average. It also has the same outliers as class one of set distance.

Class two of natural breaks (Graph 16) has a looser clustering than class two of set distance grouping. With an average residual of .126, it is above average. It has a combination of both flat and steep-angled curves. The class average is close to the city average until 1969 where it stays stagnant when compared to the drop of the city average curve. San Carlos has too flat of a curve for this class, while Redwood City's early dip is out of place as well.

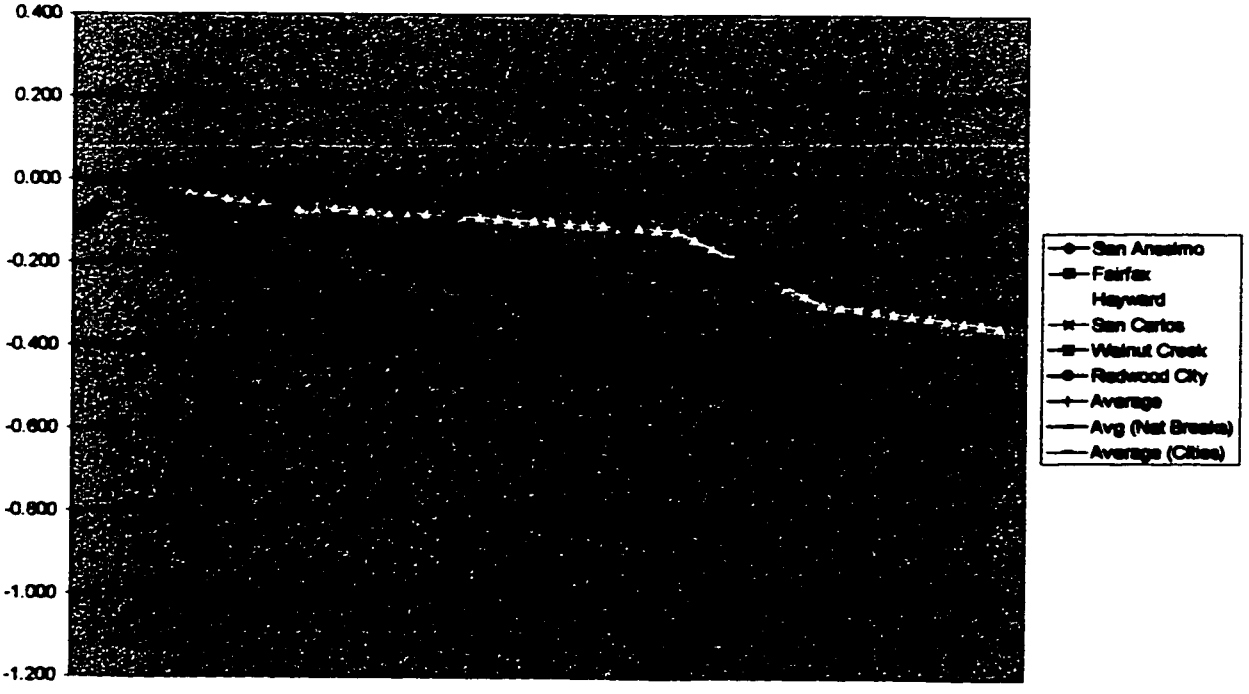
Class three (Graph 17) is the best class in this grouping. With a .067 average residual, it shows very good clustering close to the city average until 1980. From here, there is a slight dispersion, however it is noticeable only because of the abnormally tight clustering before. The class average curve is slightly lower than the city average curve, showing a somewhat higher rate of change than the rest of the Bay Area.

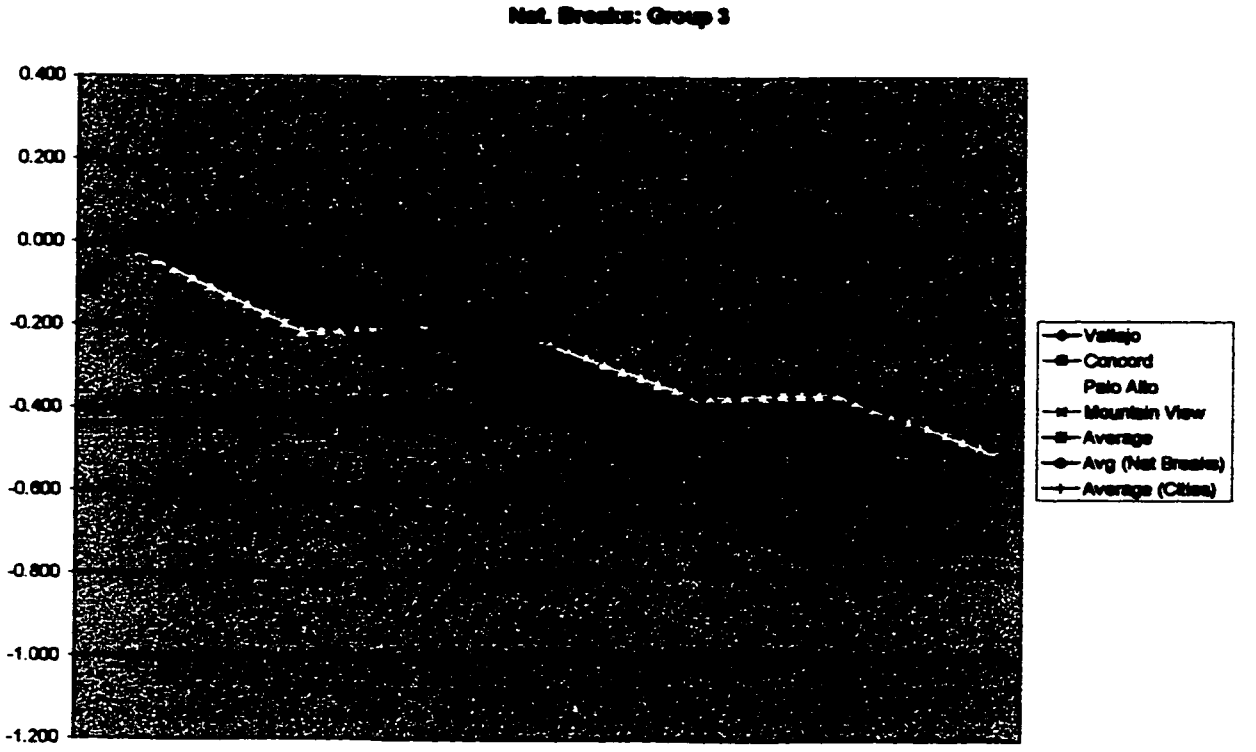
Graphs 15 through 21
Natural Breaks Grouping

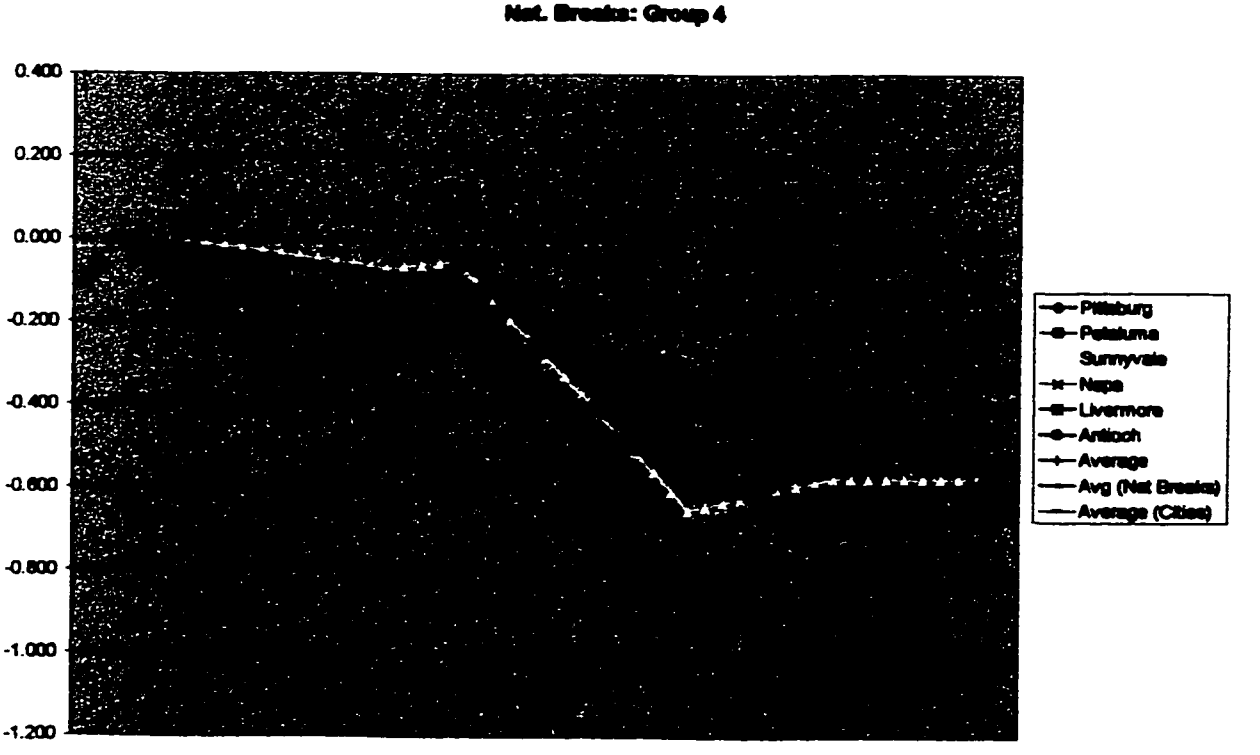
Nat. Breaks: Group 1

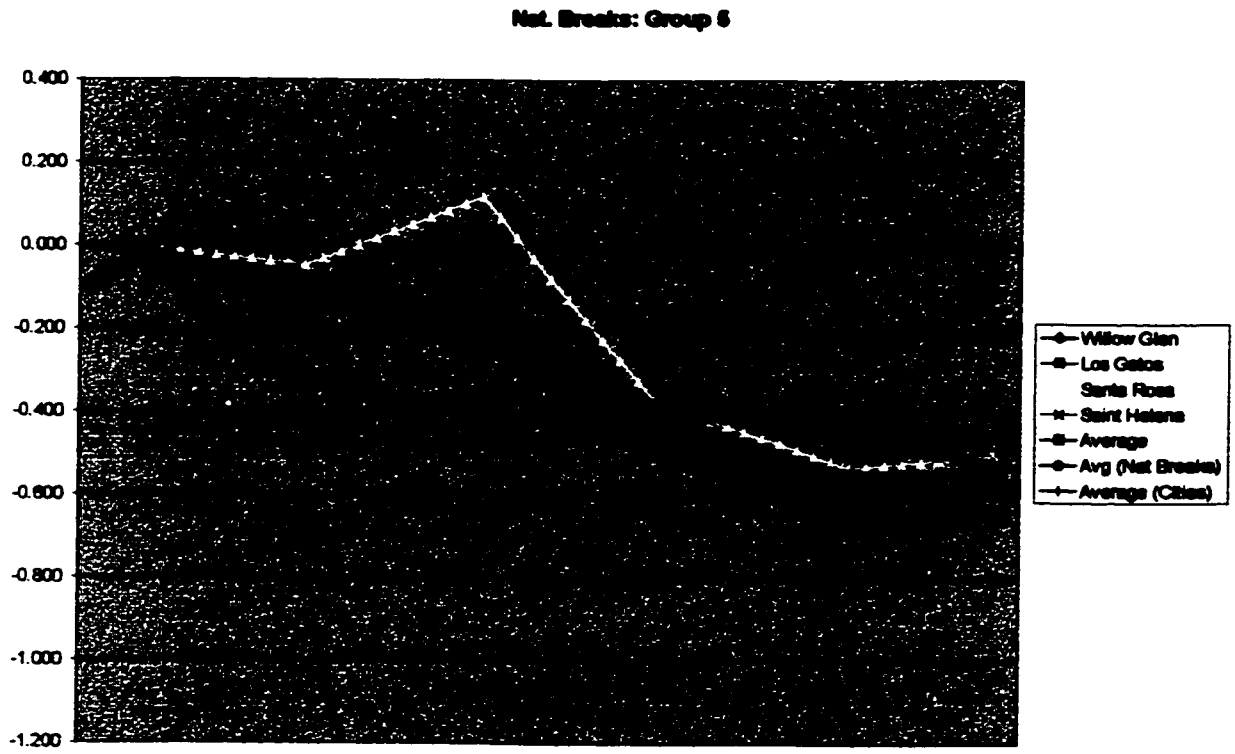


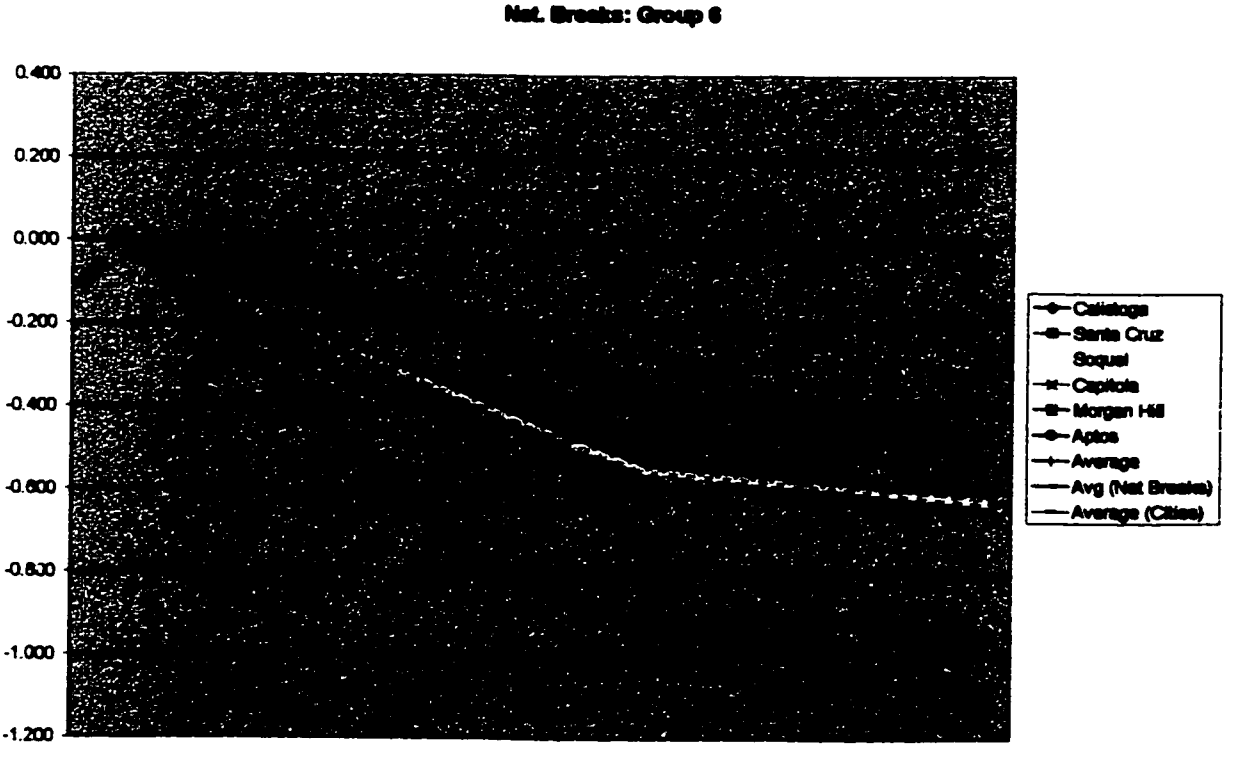
Nat. Breaks: Group 2

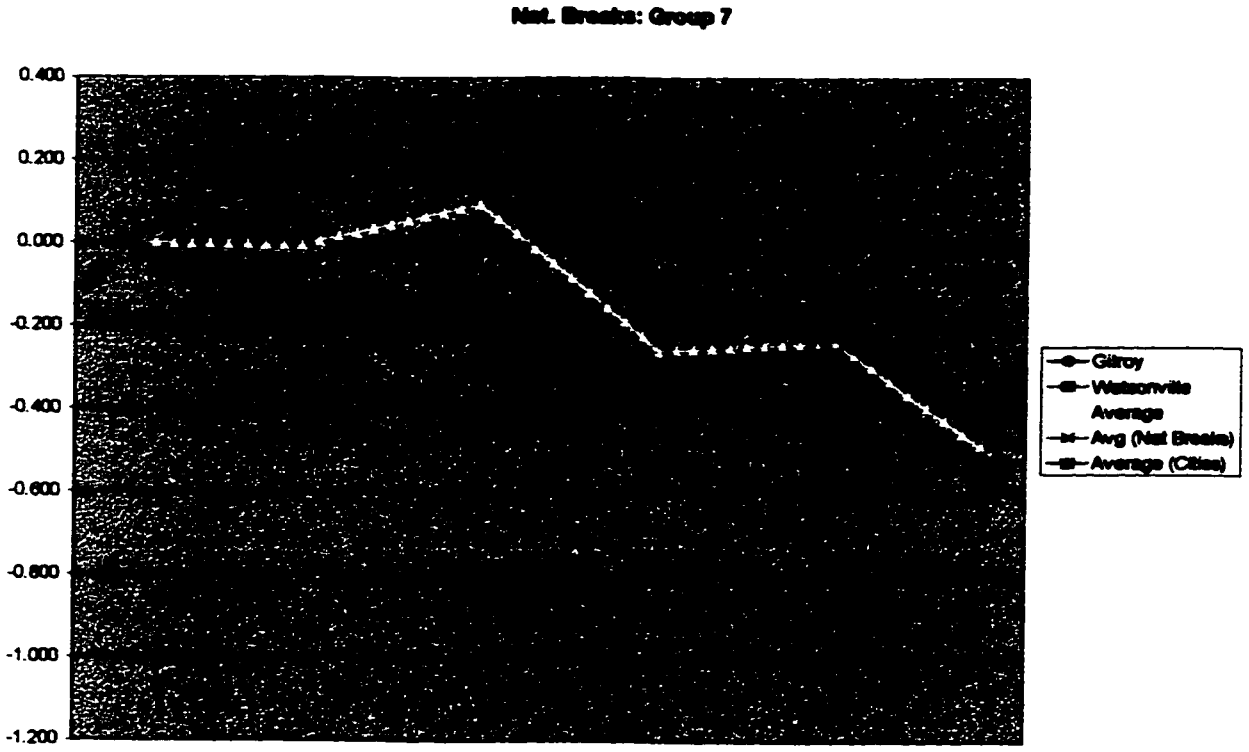



Nat. Breaks: Group 3
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Vallejo
Concord
Palo Alto
Mountain View
Average
Avg (Nat Breaks)
Average (Cities)


Nat. Breaks: Group 4
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Pittsburg
Petaluma
Sunnyvale
Napa
Livermore
Antioch
Average
Avg (Nat Breaks)
Average (Cities)


Nat. Breaks: Group 5
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Willow Glen
Los Gatos
Santa Rosa
Saint Helena
Average
Avg (Nat Breaks)
Average (Cities)


Nat. Breaks: Group 6
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Calistoga
Santa Cruz
Soquel
Capitola
Morgan Hill
Aptos
Average
Avg (Nat Breaks)
Average (Cities)


Nat. Breaks: Group 7
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Gilroy
Watsonville
Average
Avg (Nat Breaks)
Average (Cities)

Class four (Graph 18), with an average residual of .135, is again relatively high. With virtually no clustering aside from a slight grouping in the beginning, the sporadic curves make a residual of .135. 1988 marks the highest discrepancy of curves found in the study. Pittsburg, at a 100% decrease in service-oriented shops, is opposed by Livermore, which has a slight increase. This is a very non-uniform class.

Table 6: Natural Breaks Grouping

City	Distance	Class
San Bruno	10.1	1
Richmond	11.6	1
Burlingame (#1)	12.4	1
Burlingame (#2)	13.4	1
San Rafael	14.4	1
San Mateo	14.4	1
San Leandro	14.8	2
San Anselmo	16	2
Fairfax	17.5	2
Hayward	18.8	2
San Carlos	20	2
Walnut Creek	20.8	2
Redwood City	21.2	2
Vallejo	22.8	3
Concord	24.4	3
Palo Alto	25.6	3
Mountain View	29.2	3
Pittsburg	32.4	4
Petaluma	33	4
Sunnyvale	33.2	4
Napa	34	4
Livermore	35.2	4
Antioch	35.6	4
Willow Glen	40	5
Los Gatos	42	5
Santa Rosa	48	5
Saint Helena	49	5
Calistoga	55	6
Santa Cruz	57.4	6
Soquel	58	6
Capitola	60	6
Morgan Hill	61	6
Aptos	61	6
Gilroy	71	7
Watsonville	79	7

*Distances denoted in miles

The grouping recovers with class five (Graph 19). At .073 average residual, it shows some very good clusters, especially at the end. The class average curve is very close to the city average curve until the latter portion where the towns tend to experience a little more change than average. The two expected offenders of normality in this class are Santa Rosa, with its spike at the beginning, and Willow Glen, with its dip at the beginning.

Class six (Graph 20), with an average residual of .114, is a very average class. It is, for the most part, relatively well clustered with a class average curve considerably below the city average curve during the entire time period. Capitola accentuates this higher rate of change. It is an outlier in all classes because of its distinctive curve.

The last class of natural breaks (Graph 21) is the exact same as the last class in the set distance grouping. With a low residual of .104, it is a good representation for these two distinct cities.

Natural breaks, with the lowest average residual, narrowly edges out the other two linear groupings, thus making it the most accurate linear representation of the transformation process. While natural breaks is the best linear grouping, it is only the third best grouping overall. With residual averages of .115, .116 and .119, small variations of the cities in each class changed the outcome only slightly. Linear distance from San Francisco is not a major factor in the spatial pattern of the transformation of Bay Area downtowns from service oriented centers to regional shopping centers.

Regional Groupings

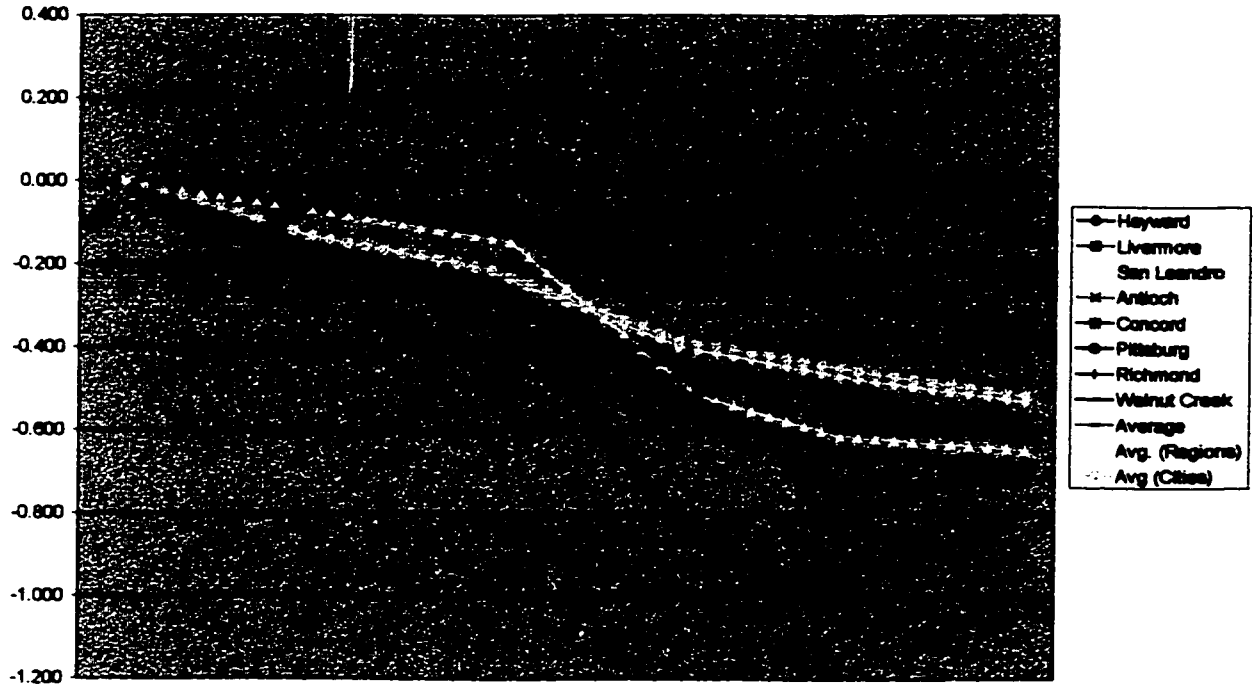
There are three regional groupings. Two are based on combined counties and one is based on the individual county borders.

The first multiple-county grouping has only three classes and is based on major regions of the Bay Area: the East Bay, the North Bay, and the South Bay (Table 7). The first class (Graph 22), the East Bay, consists of Alameda and Contra Costa counties. With an average residual of .122, it is high compared to the entire study, but rather average with regards to this grouping. Most of the curves are characterized by relatively steep angles. All but three of the cities are clustered nicely just below the city average curve for most of the time period. The three abnormal curves inflate the average residual. Livermore and Hayward follow the cluster closely until late in the time period, when they both spike. Pittsburg has just the opposite attributes. It dips toward the latter part of the study.

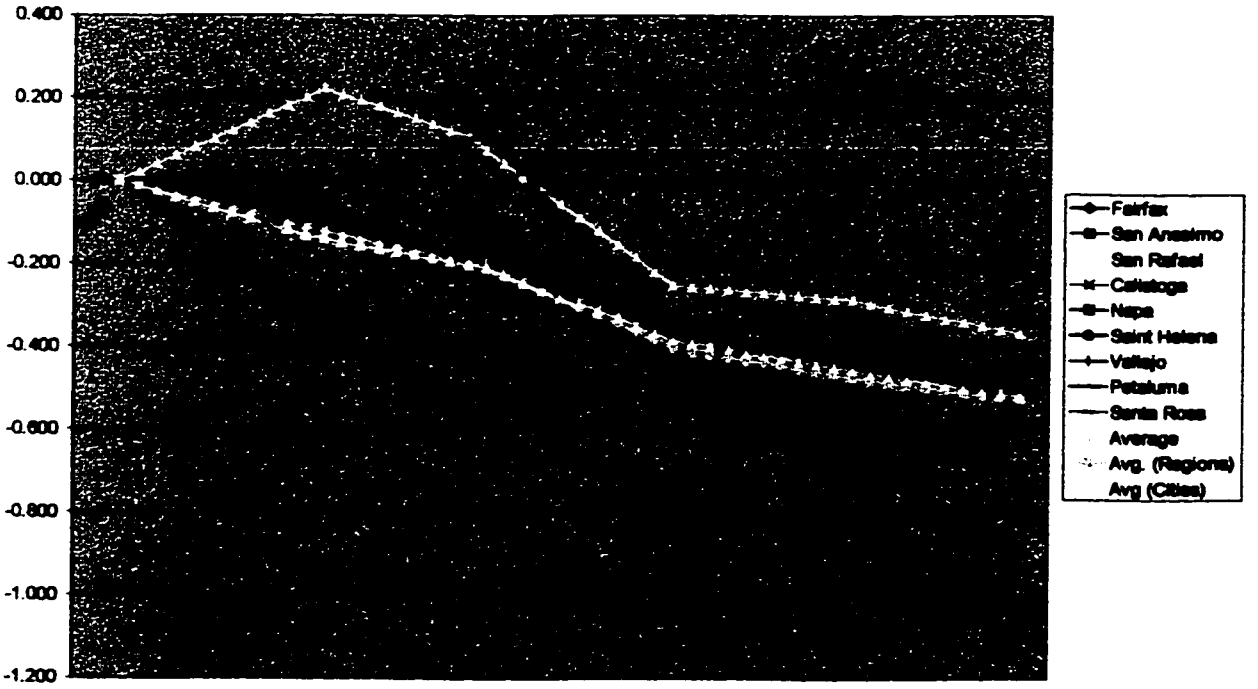
The North Bay (Graph 23) has a very good average residual at .091. The curves are mostly typified by an average rate of change over the entire time period, shown by their tight cluster around the city average. There are, however, some significant outliers. Santa Rosa has a spike in 1969, but then joins the cluster, while San Rafael stays higher than the group the whole time. Cities that change more than the average include Calistoga and Petaluma in the beginning of the time period, and Napa throughout the entire period.

Graphs 22 through 24
Multiple County Grouping #1

East Bay Area



North Bay Area



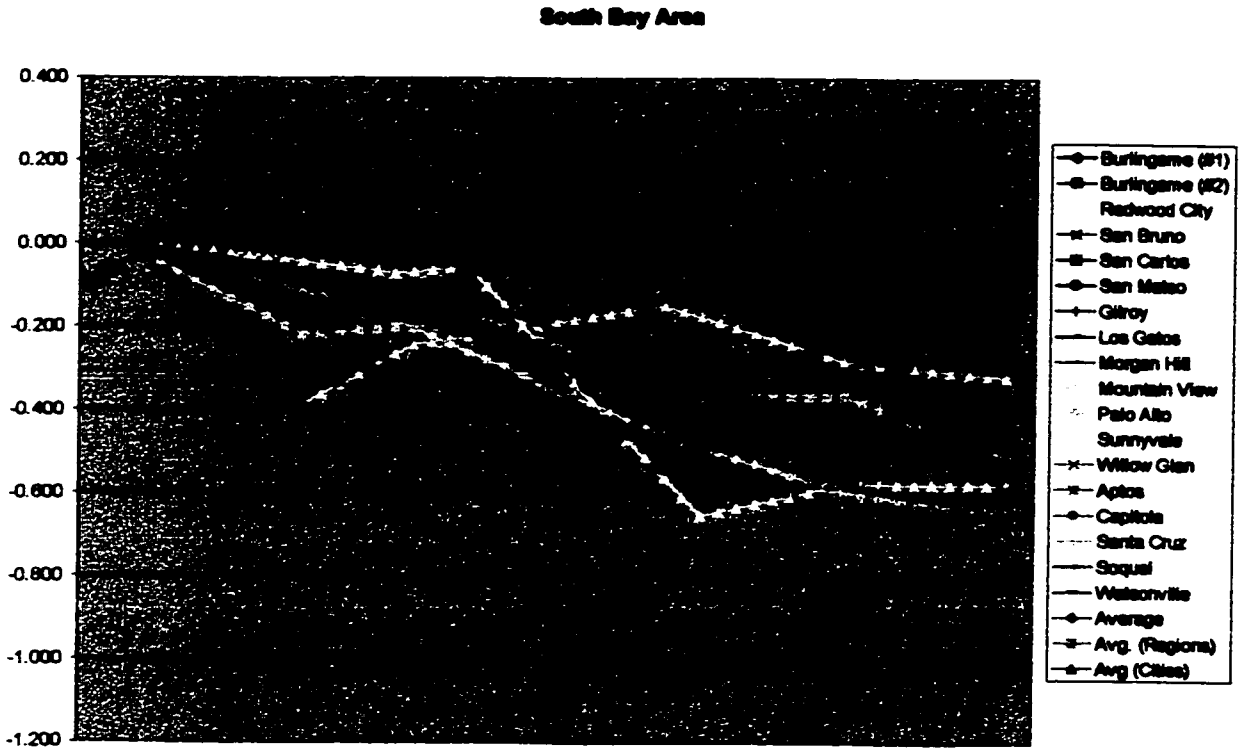

South Bay Area
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Burlingame (#1)
Burlingame (#2)
Redwood City
San Bruno
San Carlos
San Mateo
Gilroy
Los Gatos
Morgan Hill
Mountain View
Palo Alto
Sunnyvale
Willow Glen
Aptos
Capitola
Santa Cruz
Soquel
Watsonville
Average
Avg. (Regions)
Avg (Cities)

Table 7: Multiple County Grouping #1

City	Region	City	Region
Hayward	East Bay	Burlingame (#1)	South Bay
Livermore	East Bay	Burlingame (#2)	South Bay
San Leandro	East Bay	Redwood City	South Bay
Antioch	East Bay	San Bruno	South Bay
Concord	East Bay	San Carlos	South Bay
Pittsburg	East Bay	San Mateo	South Bay
Richmond	East Bay	Gilroy	South Bay
Walnut Creek	East Bay	Los Gatos	South Bay
		Morgan Hill	South Bay
Fairfax	North Bay	Mountain View	South Bay
San Anselmo	North Bay	Palo Alto	South Bay
San Rafael	North Bay	Sunnyvale	South Bay
Calistoga	North Bay	Willow Glen	South Bay
Napa	North Bay	Aptos	South Bay
Saint Helena	North Bay	Capitola	South Bay
Vallejo	North Bay	Santa Cruz	South Bay
Petaluma	North Bay	Soquel	South Bay
Santa Rosa	North Bay	Watsonville	South Bay

The South Bay (Graph 24) has a very poor average residual at .141. The graph of these downtowns shows widely dispersed curves with no distinct clustering. There is a combination of cities with flat curves, cities with steep angles, and cities with varying curves. Even with this wide spectrum, there are still some notable outliers. Gilroy, with its distinctive spike, and Capitola, with its very low overall curve, are in this class. Any others are hard to point out because of the wide variety.

Overall, the first multi-county grouping proved to be the least clustered and the least effective representation of the transformation process. It had an average residual of .124, five points over the fifth best. This proves that the grouping of large regions in the Bay Area based mostly on the physical geography does not portray the transformation of downtowns from service-oriented centers to regional shopping centers very well.

A grouping of regions based on not only physical, but also on historical development, was the basis of the second multi-county grouping (Table 8). The first class (Graph 25) groups the cities from the counties of Napa, Sonoma, and Solano, and has a very low average residual at .083. A good clustering with two bulges, one in 1969 and one in 1989, typifies the curves. The larger bulge in 1969 is solely caused by a spike in Santa Rosa and a dip for Napa. Otherwise, this is a very good class that has a slightly higher rate of change than the rest of the Bay Area.

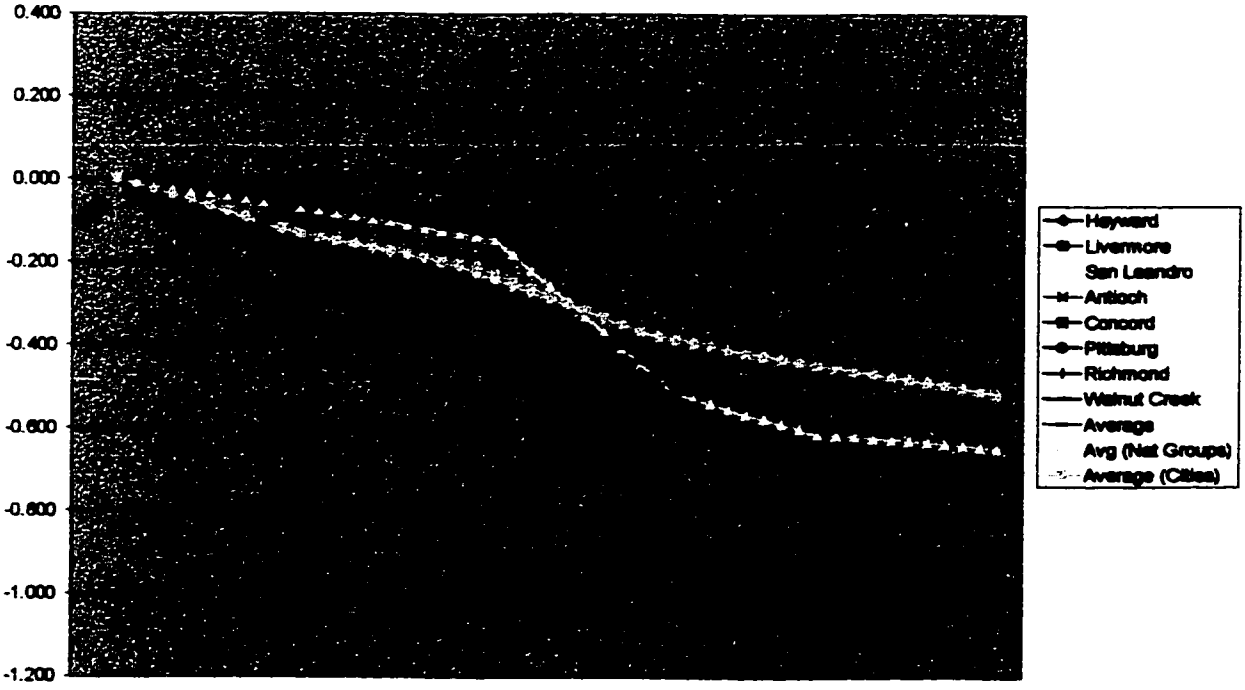
The next class (Graph 26) has a bit higher average residual at .122. This grouping of Contra Costa and Alameda counties is the exact same grouping as the East Bay class in the previous grouping. It has the same features, including a tight clustering at the beginning and a wide dispersal in 1971. The trend is well below the city average. The outliers of Livermore, Hayward and Pittsburg are the same.

The third class (Graph 27), consisting of cities from the counties of Santa Clara and Santa Cruz, has a good average residual of .109. It is a good clustering of cities with a relatively steep angle curve. The class average follows the city average for about half of the time period, but then shows more change when it dives after 1979. The only anomalies are the expected early spike of Gilroy and the extremely low curve of Capitola.

Graphs 25 through 28
Multiple County Grouping #2

Natural Region: AG

Natural Regions: EB



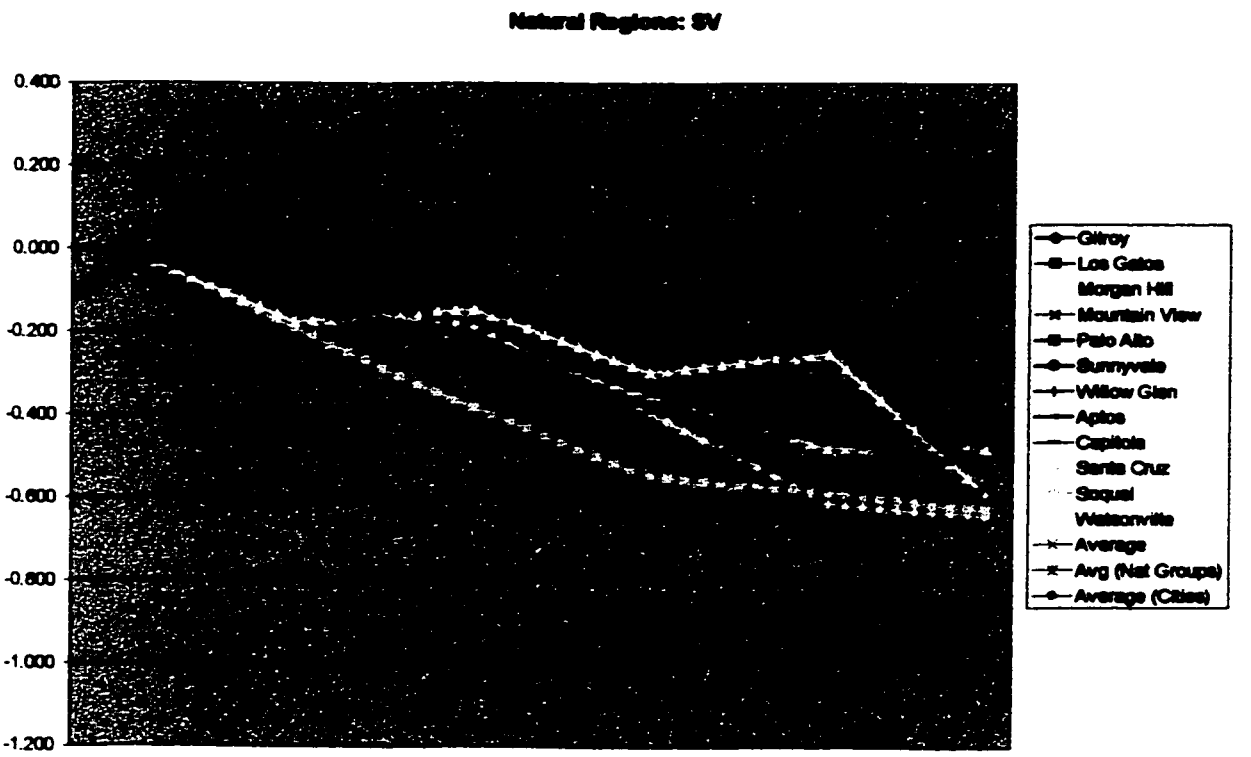

Natural Regions: SV
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Gilroy
Los Gatos
Morgan Hill
Mountain View
Palo Alto
Sunnyvale
Willow Glen
Aptos
Capitola
Santa Cruz
Soquel
Watsonville
Average
Avg (Nat Groups)
Average (Cities)

Table 8: Multiple County Grouping #2

City	County	Class
Calistoga	Napa	1
Napa	Napa	1
Saint Helena	Napa	1
Vallejo	Solano	1
Petaluma	Sonoma	1
Santa Rosa	Sonoma	1
Hayward	Alameda	2
Livermore	Alameda	2
San Leandro	Alameda	2
Antioch	Contra Costa	2
Concord	Contra Costa	2
Pittsburg	Contra Costa	2
Richmond	Contra Costa	2
Walnut Creek	Contra Costa	2
Gilroy	Santa Clara	3
Los Gatos	Santa Clara	3
Morgan Hill	Santa Clara	3
Mountain View	Santa Clara	3
Palo Alto	Santa Clara	3
Sunnyvale	Santa Clara	3
Willow Glen	Santa Clara	3
Aptos	Santa Cruz	3
Capitola	Santa Cruz	3
Santa Cruz	Santa Cruz	3
Soquel	Santa Cruz	3
Watsonville	Santa Cruz	3
Fairfax	Marin	4
San Anselmo	Marin	4
San Rafael	Marin	4
Burlingame (#1)	San Mateo	4
Burlingame (#2)	San Mateo	4
Redwood City	San Mateo	4
San Bruno	San Mateo	4
San Carlos	San Mateo	4
San Mateo	San Mateo	4

The last class (Graph 28) has the worst average residual at .126. At first glance at the graph, a lower residual would be expected. The curves look relatively clustered with a somewhat flat average class curve that is above the city average the entire time period. There are also no major outliers besides a spike by San Rafael and an early dip by Redwood City. The consistent width of the cluster throughout the duration accounts for the high residual.

The second multi-county grouping is much more indicative of the transformation process with an average residual of .112. This is the second lowest with the third best

still three points higher. This proves that the influence of historical development, along with physical features, proved to be more influential than just physical features alone in the transformation process.

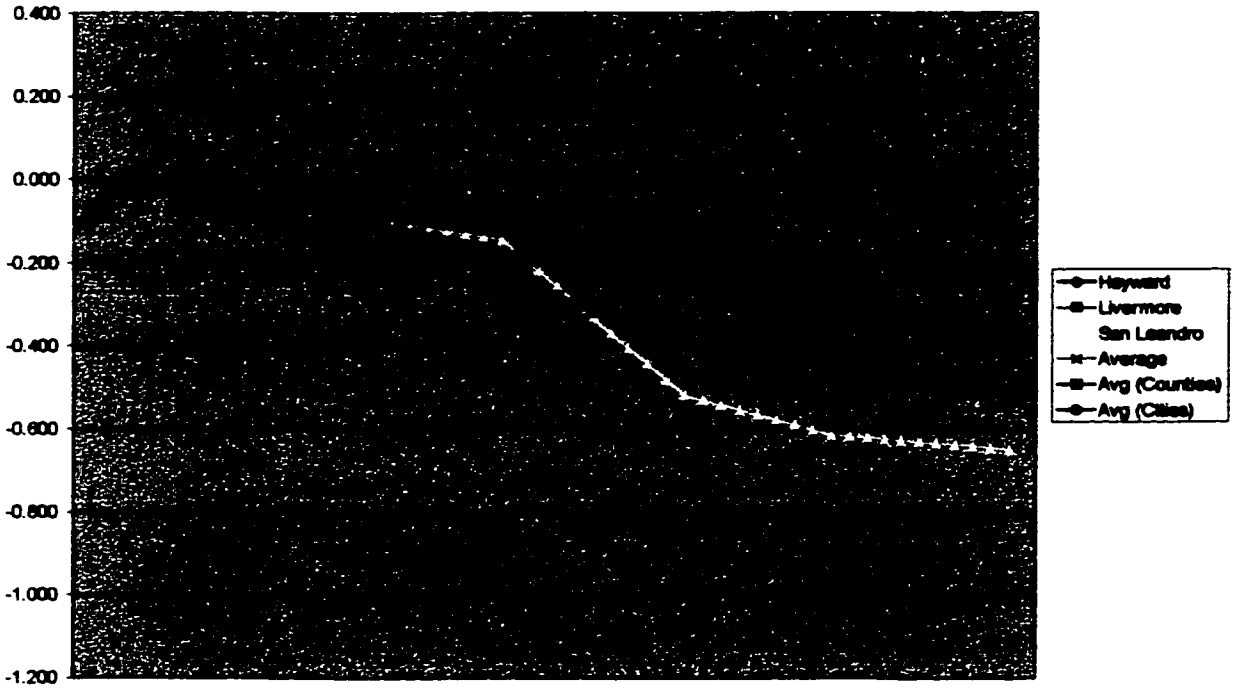
The last regional grouping is by the individual counties. There are nine classes in this grouping, all of varying sizes (Table 9). The first class (Graph 29), Alameda County, has a very good average residual of .097. It starts out clustered tightly, but shows dispersal in 1970. The class average is above the city average the entire time. There is only one major anomaly, a late spike by Livermore.

The next class (Graph 30), Contra Costa County, has an excellent average residual. At .066, it is one of the best. With a tight clustering throughout the study period, every city's curve is below the city average curve. Pittsburg is the one anomaly because it drops too low. This is the best class for it to be in because the class average is so low. Every city in Contra Costa County experienced dramatic change the entire time.

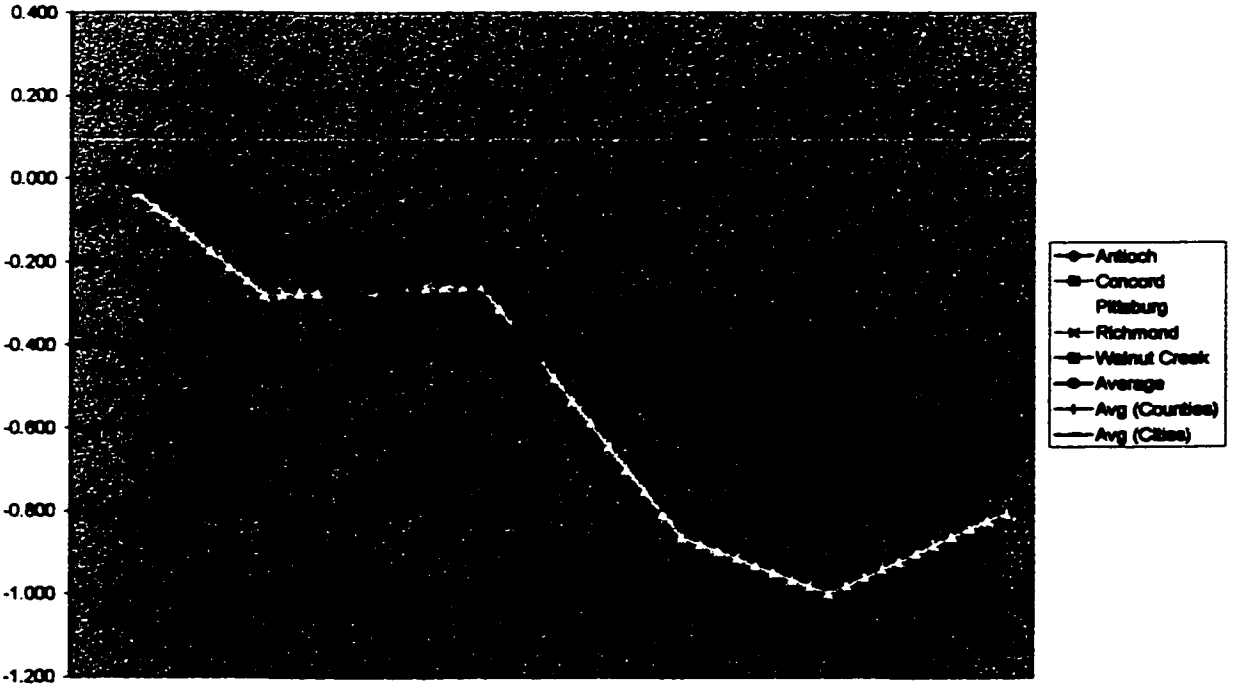
The third class (Graph 31), Marin County, also has a very good residual at .097. Although there is a distinct pattern in this county of low change followed by a period of high change, all the cities follow it, even the outlier. San Rafael's curve, although extreme on the high side, follows the pattern very well. This all contributes to the low residual.

County Grouping
Graphs 29 through 37

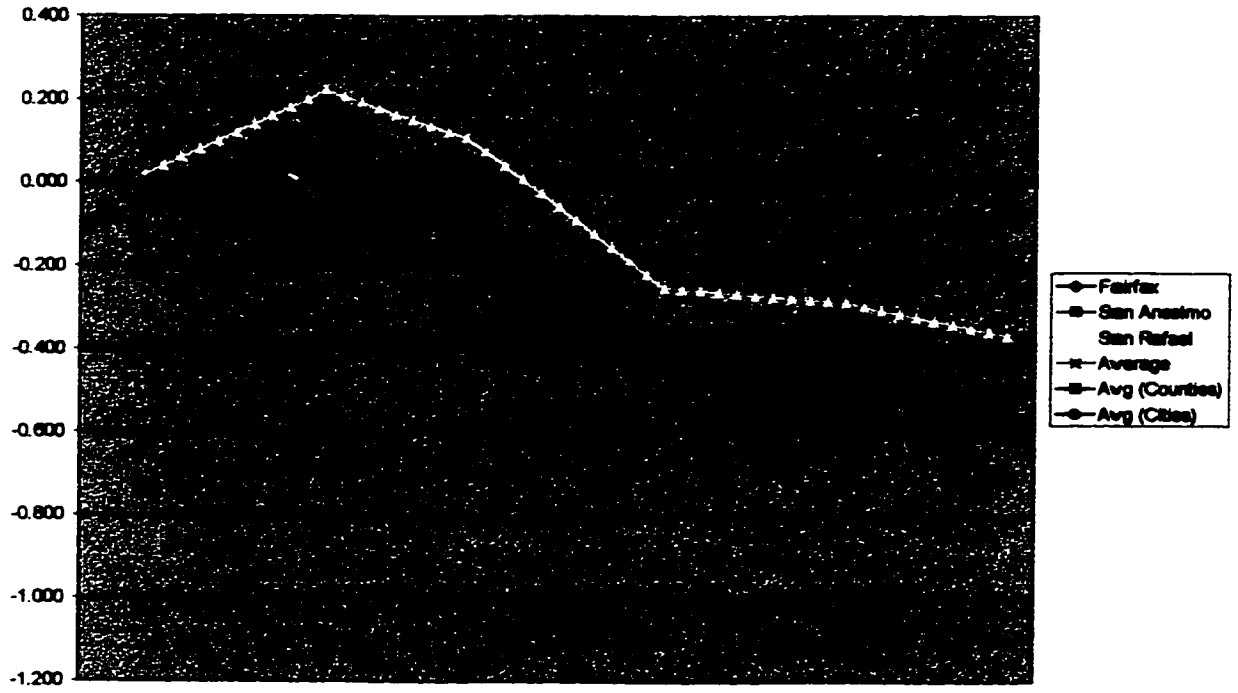
Graph 29: Alameda County



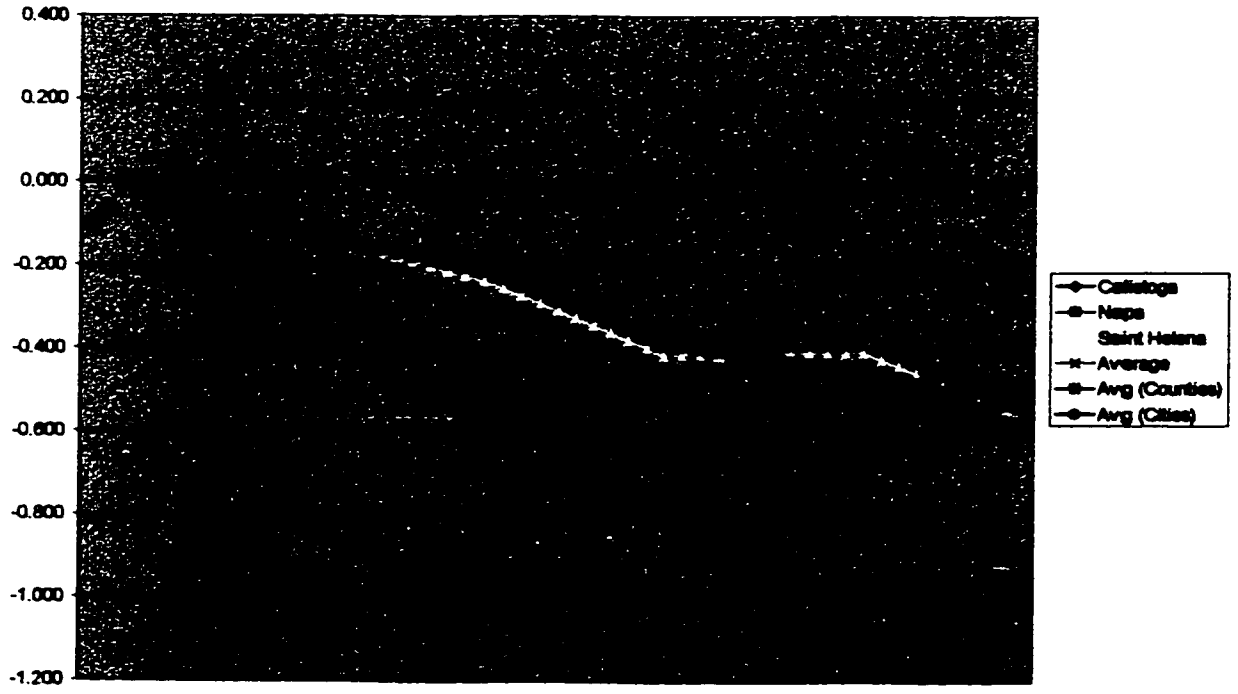
Graph 30: Contra Costa County



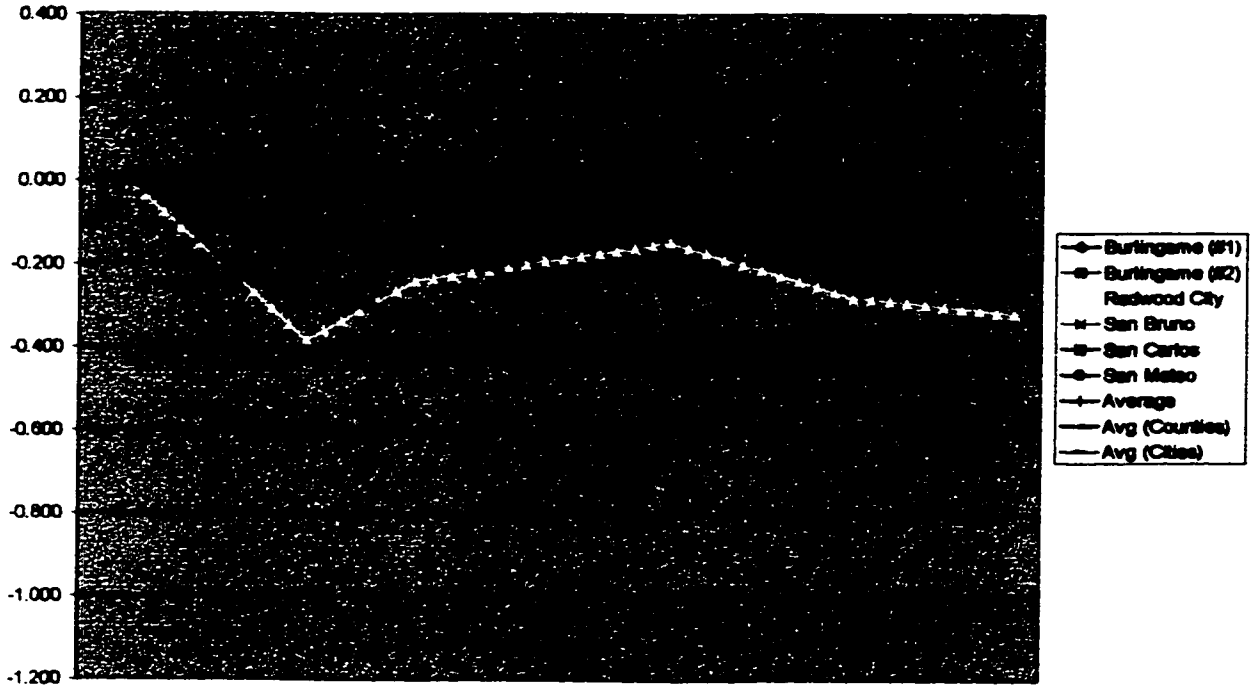
Graph 31: Marin County



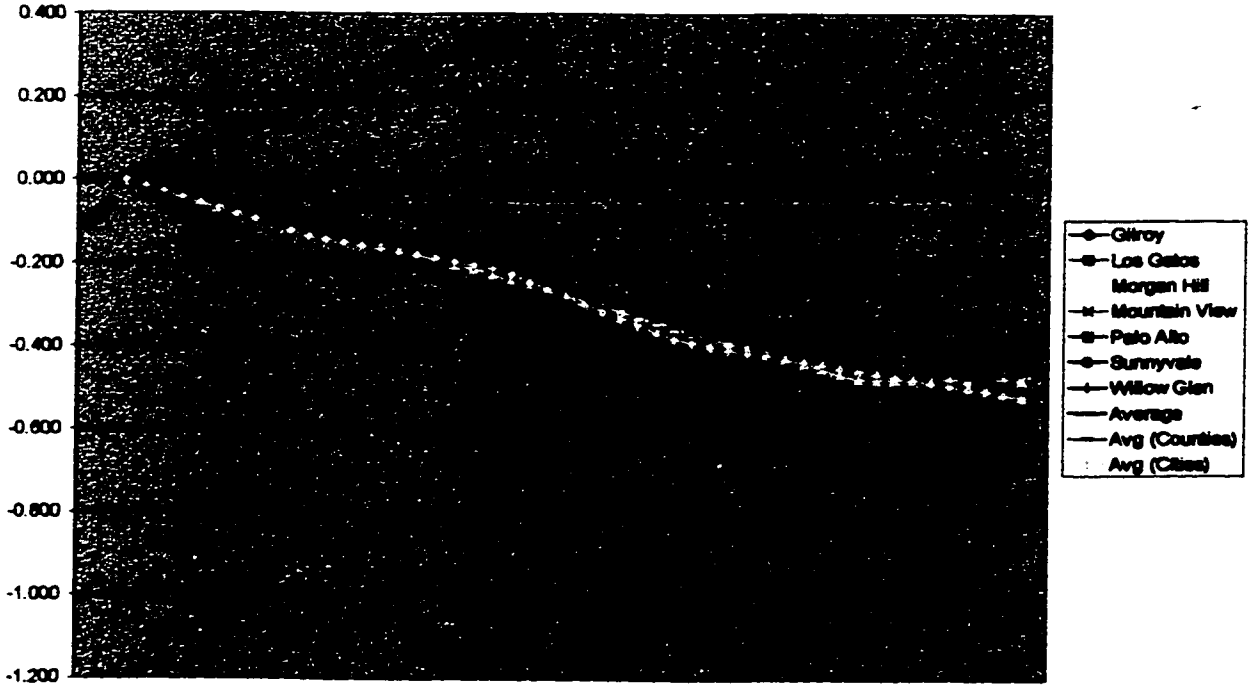
Graph 32: Napa County



Graph 33: San Mateo County

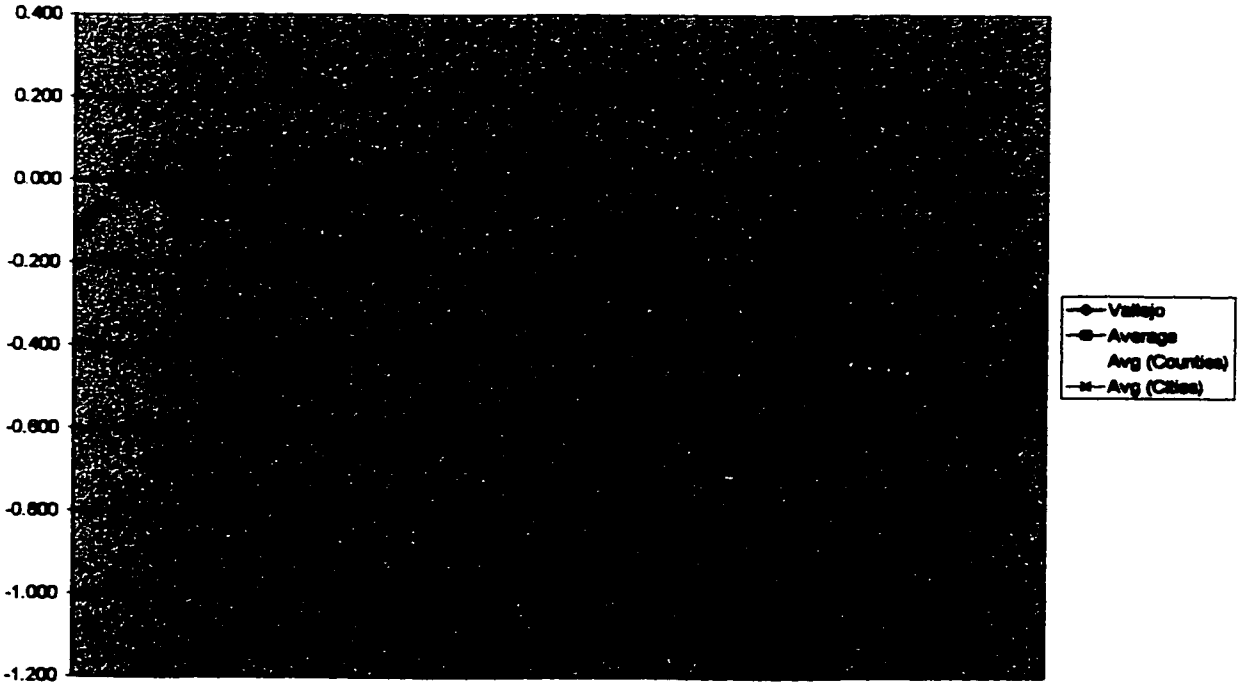


Graph 34: Santa Clara County



Graph 35: Santa Cruz County

Solano



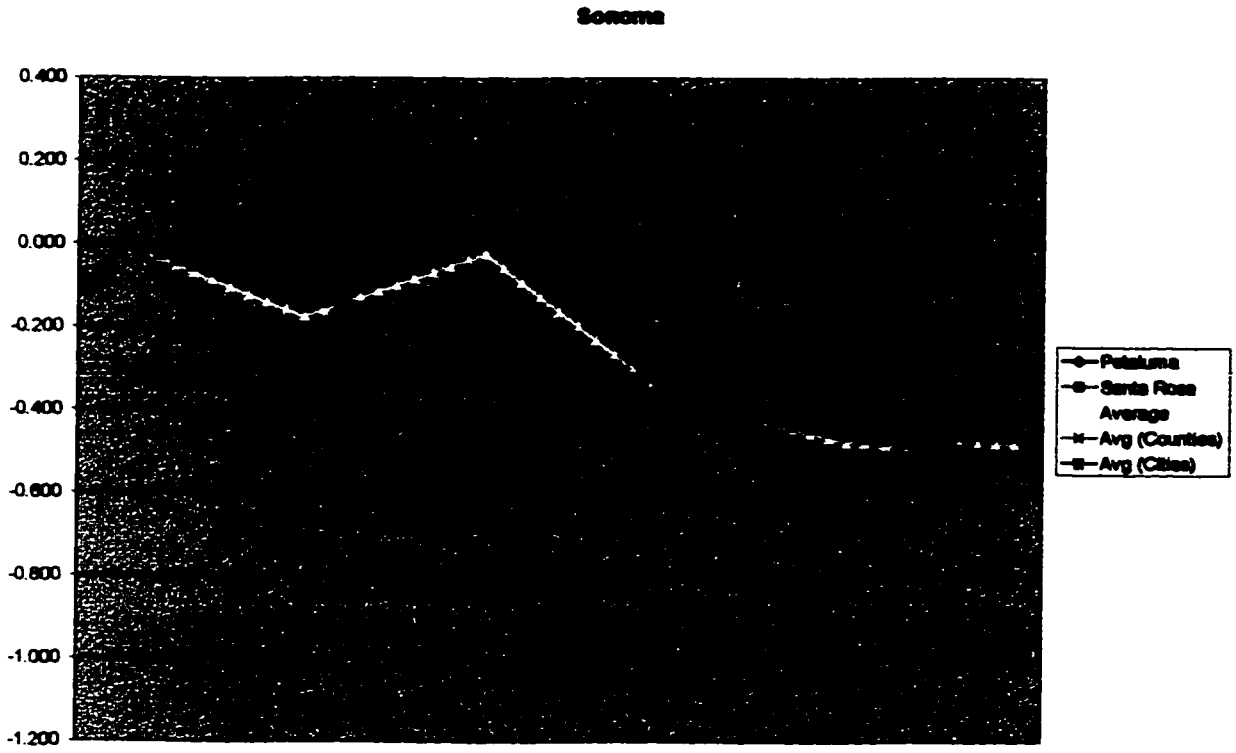

Sonoma
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
Petaluma
Santa Rosa
Average
Avg (Counties)
Avg (Cities)

Table 9: County Grouping

City	County	Class
Hayward	Alameda	1
Livermore	Alameda	1
San Leandro	Alameda	1
Antioch	Contra Costa	2
Concord	Contra Costa	2
Pittsburg	Contra Costa	2
Richmond	Contra Costa	2
Walnut Creek	Contra Costa	2
Fairfax	Marin	3
San Anselmo	Marin	3
San Rafael	Marin	3
Calistoga	Napa	4
Napa	Napa	4
Saint Helena	Napa	4
Burlingame (#1)	San Mateo	5
Burlingame (#2)	San Mateo	5
Redwood City	San Mateo	5
San Bruno	San Mateo	5
San Carlos	San Mateo	5
San Mateo	San Mateo	5
Gilroy	Santa Clara	6
Los Gatos	Santa Clara	6
Morgan Hill	Santa Clara	6
Mountain View	Santa Clara	6
Palo Alto	Santa Clara	6
Sunnyvale	Santa Clara	6
Willow Glen	Santa Clara	6
Aptos	Santa Cruz	7
Capitola	Santa Cruz	7
Santa Cruz	Santa Cruz	7
Soquel	Santa Cruz	7
Watsonville	Santa Cruz	7
Vallejo	Solano	8
Petaluma	Sonoma	9
Santa Rosa	Sonoma	9

Napa County, the next class (Graph 32), is an excellent clustering. At only .073 average residual, it is also one of the best classes in the study. Every city is below the city average curve, showing significant negative change. Also, there are no significant outliers, although Napa flirts with the bottom side of the curves.

San Mateo (Graph 33), with a relatively high average residual for this grouping at .109, is still a good rating for the overall study. There is a good clustering of curves throughout. The class average is significantly above the city average curve. The outliers

stand out because of the distinctive clustering of flat curves near the zero axis. Redwood City dips at the beginning, but groups in with the others in the later half. San Bruno follows the same pattern, but takes longer to recover.

The next class (Graph 34), Santa Clara County, is also a very good representation. The average residual is .096, which is very good for a class that has a steep angle of change. The class average jumps above and below the city average, but never veers very far from it. Sunnyvale fits in very nicely with this class despite its sporadic curve. Gilroy, again, is a problem here because of its high peak.

The next county (Graph 35), Santa Cruz, has a bad average residual for any grouping. In this grouping, most of the cities are under or near .100. A measure of .130, as seen by Santa Cruz, is very high. The county has a very high degree of change with the class curve significantly below the city average. Capitola, again, is a major culprit of the inflated residual.

Solano County (Graph 36), with only one city, has an average residual of .000. Even though Vallejo has an average curve that follows the city average curve closely, it is not factored into the grouping equation for average residuals. A group of one has the same average as itself.

The last class (Graph 37), Sonoma County, has an excellent average residual at only .063. Besides Solano County, it is the best in the grouping. Although there are only two cities in this class, there are some very significant features to point out. Both curves follow a very distinctive pattern of a high rate of negative change followed by a sharp rise toward the positive, followed once again by a sharp negative change. Even though these

curves occurred at different rates, they were very related. Also, in 1979, the curves meet at almost the exact location and then finish the time period in very close proximity to each other. The combination of these factors is what made the average residual so low for this class.

The grouping of cities by county, with an average residual of only .092, proved to be by far the best representation of the transformation process (Table 10). No other grouping even came close, with the second best .020 higher. Regional grouping of cities proves to be a very important spatial factor in the transformation of Bay Area downtowns from low-end service dominated centers to high-end suppliers of goods and services.

Table 10: Average Class and Grouping Residuals

	Set Size	Set Distance	Natural Breaks	Multiple County #1	Multiple County #2	County
Class Averages	0.144	0.130	0.144	0.122	0.083	0.097
	0.109	0.106	0.126	0.091	0.122	0.066
	0.127	0.135	0.067	0.141	0.109	0.097
	0.097	0.073	0.135		0.126	0.073
	0.124	0.050	0.073			0.109
	0.073	0.181	0.114			0.096
	0.162	0.104	0.104			0.130
						0.000
						0.063
Grouping Average	**0.119**	**0.116**	**0.115**	**0.124**	**0.112**	**0.092**

Chapter 4: Conclusion

Overall Analysis

Transformation of San Francisco Bay Area downtowns from centers for local services toward specialty regional retail centers has dramatically changed the landscape of the urbanized communities. Moreover, the spatial patterns of this process throughout the Bay Area are regionally distinct, reflecting the historical and physical diversity of the area.

This phenomenon can be measured by looking at the urban morphology of individual towns and cities in the central node's hinterland. As a city matures, the downtown sector goes through a transformation process from a center for local service-oriented shops to more of a regional shopping center. Cities go through this process at different rates. If similar patterns of this process can link cities in either a linear or regional pattern, then the development pattern for a metropolis can be established.

Study has proven that the San Francisco Bay Area developed in a regional, rather than linear pattern. Thirty-five cities spread over nine counties around the city of San Francisco were categorized into six groupings, three linear and three regional. The average residuals of each city in each grouping were recorded to try to find clusters of similar cities.

The results of this were that cities grouped by county were, by far, the closest representation of the transformation process. The very low average residual of .092 was twenty points lower than the next grouping. The second best grouping was also a

regionally classified group. This grouping was based on similar physical and development patterns. It was only slightly better than the clustering of spatial groupings. Natural breaks, set distance and set size were third through fifth with average residuals of .115, .116 and .119 respectfully. Rounding out the study in sixth place was the last regional grouping at a dismal .124. This last grouping was based solely on physical regions, proving that development patterns were highly influential. Overall, the combination of the large margin of victory by the county grouping and the second place finish of another regional grouping prove that the San Francisco Bay Area developed in a regional manner.

The high performance of the county grouping can probably be attributed to a variety of reasons. First, counties are usually established in order to have a controllable size of territory for governing. The county boundaries are usually established on some sort of physical feature that delineates it from the surrounding area, such as a ridgeline or bay. Often these boundaries are the same features that inhibit or accelerate the growth of an area. Therefore, a county is a very good indicator of a distinct region, both physically and historically, in a lot of cases. Another reason might be that countywide government policies influence the commerce of a county. This can have a great impact on downtowns, usually the most active areas in commerce.

Areas for Future Research

The research presented in this thesis opens areas for further research. First, this same methodology could be applied to other metropolis areas throughout the country and

world to find similar or different development patterns. Other cities with physical or historical uniqueness might experience similar growth patterns.

A second area of further research could be to expand the time period to include the first half of the century as well. Although there would be data for fewer towns in the study, it would give a more encompassing spectrum of change for the Bay Area.

One last area of research opened by this study would be to go into more detail about the reasoning for each distinct curve in the study. More detail on each individual city's history would help to shed more light on the factors involved in the transformation process. Other areas like government policies and financial investing could prove to have a vital impact on downtown development patterns.

Although the methodology and results of this study provide very interesting and important traits to the San Francisco Bay Area development patterns, a lot more research could be conducted to expand and improve the study. Some of these areas include applying the study to other areas, expanding the time period and researching the reasoning for the changes.

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