A Comparison of Downtown and Suburban Office Markets

by

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Submitted to the Department of Urban Studies & Planning in Partial Fulfillment of the Requirements for the Degree of

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at the

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Abstract

There have been many studies about office demand with relation to employment focused at the MSA level. This paper investigates the relationship between office demand and office employment between downtown and suburban markets. The paper provides an analysis of office demand and employment across 43 downtown markets and 52 suburban markets for the years 1998 and 2006. Correlation and multi-variable regression analysis are used to determine the relationship between office demand, employment, and rent as well as the relationship between downtown and suburban markets.

The analysis is divided into three parts. The first part focuses on levels of office employment against levels of office demand in each market for each year separately. The second section investigates the change in office demand against the change in employment and rents for each market over the two years. Finally, the third part analyzes the relationship of office demand, employment and rent between downtown and suburban markets.

The paper uses employment data categorized by industry using the North American Industry Classification System (NAICS). Employee counts are estimated from the establishment data available by zip code from the U.S. Census Bureau. By using employment data at the zip code level, the study is able to split the MSA into downtown and suburban markets. The study focuses on six industries thought to use the majority of office space.

Thesis Supervisor: William Wheaton
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Chapter 1: Introduction

The demand for office space is primarily driven by employment growth. Specifically, it is employment in certain sectors such as Finance, Insurance, Real Estate, Information, Professional, Scientific, Technical, Administrative and Support, Management and Headquarters, that tends to drive office demand.[1] The purpose of this study is twofold. First, it will investigate if the relationship between the aforementioned sectors of employment and demand for office space is similar between downtown and suburban markets. It will focus on gaining an understanding of whether different employment sectors impact demand and growth of office space differently in the downtown and suburban markets. Second, the paper will investigate the relationship, if any, between demand for office space in the downtown market and demand in the suburban market. Over the last half-century, the total percentage of office space located in the suburbs for most MSAs has been increasing.[2] The paper will analyze whether the growth of suburban office markets substitutes or complements the downtown office market. The paper will look for associations between office demand and employment and rent through the regressions and correlations; It will not attempt to demonstrate causality between the variables. No assumptions are made about the amount of space occupied per worker by industry as this can vary widely.

This paper will use the Torto Wheaton approach to demand, which consists of tracking employment in two major categories – Professional, Technical, and Business Services and Finance and Insurance.[3] In addition, it will also add several additional industries thought to use office space. Employment data for different locales is available from the U.S. Census and is categorized by the North American Industry

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[1] Shilton and Webb, *Office Employment Growth and the Changing Function of Cities*, 1991.

[2] *An Age of Transformation: Valencia and Willingboro*, The Economist. 29 May 2008

[3] Burns and McDonald, *Who are Your Future Tenants? Office Employment in the United States 2004-2014*, 2007

Classification System (NAICS). The study will analyze data for 43 Metropolitan Statistical Areas (MSAs) in the downtown markets as well as 52 MSAs in the suburban markets (some suburban office markets do not have a downtown counterpart). Appendices A & B provide a list of all the MSAs included in the study. Office space demand data in each MSA for 1996 and 2007 will be analyzed against employment data in each MSA for 1998 and 2006. The years chosen for study are a result of limitations in the employment data provided by the U.S. Census Bureau.

The intent of this study is to provide further insight into office demand and its relationship with office employment growth in the downtown and suburban markets. The information could have potential use to developers or investment managers that are assessing development or investment opportunities in a particular city by better enabling them to determine how employment in particular sectors might drive the demand for office space within an MSA submarket.

Chapter 2: Literature Review

There have been a number of papers written on forecasting office demand over the last forty years. While the initial studies used population ratios to forecast office demand, the methodology has since been refined to a more comprehensive model that uses additional variables. [4] The newer forecasting models use variables such as employment, population, supply, vacancy, and rent. A common element in all the studies is the use of employment growth for forecasting office demand.

The 1984 Technical Note by Schloss in the Monthly Labor Review demonstrates how employment data can be used to estimate demand for office space in a Standard Metropolitan Statistical Area (SMSA).[5] In it, the author uses employment data by industry published by the Bureau of Labor Statistics to provide estimations for office demand for the Chicago SMSA. In addition to the number of office employees, other variables used include used for this method include amount of commercial space available, the amount of occupied space, and the market equilibrium occupancy level.

Rabianski and Gibler provide a comprehensive literature review of office demand analyses from the last four decades.[6] The paper follows the progression of office demand analysis and forecasting techniques since 1965 with detailed analysis of studies by Jennings, Kelly, Clapp, Detoy and Rabin, Bible and Whaley, and Kimball and Bloomberg. From these studies, Rabianski and Gibler conclude that an accurate office employment forecast is the basis for estimating office space demand but they recognize that rents will also impact space allocation in office demand studies. Rabianski and Gibler favor using office

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[4] Rabianski and Gibler, *Office Market Demand Analysis and Estimation Techniques: A Literature Review, Synthesis and Commentary*, 2007.

[5] Schloss. *Technical Note: Use of employment data to estimate office space demand*, 1984.

[6] Rabianski and Gibler, *Office Market Demand Analysis and Estimation Techniques: A Literature Review, Synthesis and Commentary*, 2007.

occupations as opposed to the industries thought to use office to calculate employment figures.

Shilton and Webb's 1991 paper examines office employment and its impact on cities. It groups office employment by Standard Industrial Classification (SIC) category in order to estimate office space growth as a percent of total employment in the city. The study was conducted for forty five cities over a time series including 3 years, 1976, 1982, and 1985. The authors' main intent was to determine if the amount of office employment or certain combinations of office employment sectors created a central place function that would foster additional office growth. They found that while the total percentage of office employment didn't have an impact on office growth, certain clusters of office categories were associated with office employment growth.[7]

The 1996 study by Hakfoort and Lie analyzes the amount of office space occupied per worker from survey data of four European office markets. They study whether office space per worker differed by industry, occupation, building size, cost of city, time period, the internal layout of building, age of building, and the location in the MSA (downtown or suburb).[8] Their findings suggest that it is hard to forecast space per worker uniformly across different markets as there are many different variables as stated earlier. However, they conclude that different industries and occupations occupy different amounts of office space.

The report by Burns and McDonald sets out to provide a methodology to predict future tenants for office buildings might be from 2004 – 2014. They begin with the premise that demand for office space is primarily driven by two variables, office employment and rent. To calculate office demand, this study enumerates office occupations rather than

[7] Shilton and Webb, *Office Employment Growth and the Changing Function of Cities*, 1991.

[8] Hakfoort and Lie, *Office Space per Worker: Evidence from Four European Markets*, 1996.

looking at the list of industries that are thought to comprise the majority of office demand. The paper relies on Rabianski and Gibler's literature review to argue for this method by discussing the economy's increasing reliance on 'ghost workers' and the lack of inclusion of these independent workers in traditional (industry) employment statistics.[9] In order to forecast future employment trends, Burns and McDonald surveyed a number of real estate experts to gauge sentiment for the future. While Burns and McDonald use office occupations as the employment amounts, our study calculates employment from the other method; that is by looking at the industries that are thought to comprise office demand because data by office occupation available by MSA, but not by zip code so it was not possible to separate downtown from suburban using office occupations.

Although there have been many papers published on the subject of office demand, there has been little focus on investigating differences between downtown and suburban markets. Most studies have analyzed office demand at the broader MSA level. This study will focus on analyzing office demand between downtown and suburb separately. It will first focus on investigating whether the employment drivers in downtown office demand are similar to those of suburban office demand. The paper will then analyze the correlation between downtown and suburban markets and try to answer whether growth is mutually exclusive or complementary to each other.

[9] Burns and McDonald, *Who are Your Future Tenants? Office Employment in the United States 2004-2014*, 2007

Chapter 3: Data and Methodology

Data:

Data for 43 cities in the downtown markets as well as 52 cities in the suburban markets were acquired from Torto Wheaton Research and the U.S. Census Bureau. Refer to Appendices A & B for a list of all MSAs analyzed for this study.

Data provided by Torto Wheaton Research included Net Rentable Area (NRA), Vacancy Rate, and average rent per square foot for both downtown and suburban markets in each MSA for both 1996 and 2007. All data provided was for Class A and Class B office buildings in the MSA. In addition, a list comprising each MSA and its respective zip codes broken into downtown and suburb was also provided in order to match up the employment data by zip code.

Zip Code Business Pattern data was downloaded from the U.S. Census website. Data acquired included the number of establishments (businesses) by establishment size, zip code and NAICS. Since only the number of establishments was available, this data was used to estimate the number of employees in each zip code. An explanation of the estimation process is provided below.

Employment Category Selection:

As previously mentioned, this study will use the Torto Wheaton approach to office demand, which consists of tracking employment by industry category. The U.S. Census Bureau provides employment data classified by industry known as North American Industry Classification System (NAICS). NAICS was introduced in 1997 to replace the U.S. Standard Industrial Classification (SIC) system which was originally introduced in the 1930s. The NAICS system breaks employment into more than two thousand different codes. Only the industry codes using office space were relevant for this study. Most office workers are

classified into the NAICS codes, 51 – 56, as shown in Table 3.1 below. While the Torto Wheaton approach focuses primarily on categories 52 and 54, this paper will include several additional categories thought to occupy office space. It should be noted that there are other industries with occupations that occupy office space but these jobs cannot be tracked using the Torto Wheaton method.

Table 3.1 – NAICS Categories for Office Workers

NAICS Code	NAICS Title
51xxxx	Information
52xxxx	Finance and Insurance
53xxxx	Real Estate, Rental and Leasing
54xxxx	Professional, Scientific, and Technical Services
55xxxx	Management of Companies and Enterprise
5611xx – 5615xx	Administrative and Support

This study will not include government office workers. While NAICS does have a code for public administration (92xxxx) to classify government workers, the census does not provide employment data by this code as it is difficult to identify separate establishment detail for many government agencies.[10] To that end, it should be noted that only private sector office workers are included in this study. Lastly, the NAICS system was updated in 2002 from its introduction in 1997, but there were no changes to the NAICS categories outlined above.

Date Selection:

The purpose of this study was to analyze occupied office space and employment over time. Taking data constraints into account, the years selected for the time series were 1998 and 2006. Data for 2006 was the most recent available as the U.S. Census Bureau releases data with a two year lag. 1998 is the first year selected in the time series as

[10] United States, Census Bureau, *2002 NAICS Definitions,* 2006.

this is the first year that the Census started classifying employment data using the NAICS system instead of the older SIC system.

According to the Census website, while two thirds of the NAICS codes can be linked to the old SIC codes, the other codes were changed more profoundly leading to breaks in the availability of data.[11] A major change impacting office categories was the new NAICS category, '55---', for Management of Companies and Headquarters. In SIC, these workers were included in the industry that the company did business in. For example, if it was a headquarters of a mining company, the workers working in the headquarters would be classified in mining industry and not office workers. By selecting dates so that the data in both years are classified by NAICS categories, the study remains focused its primary objective – the relationship between office demand and employment categories – and not concerned about potential gaps in data which would inadvertently lead to a skew in the employment totals between SIC and NAICS.

Although the dates for the Torto Wheaton data are for years 1996 and 2007 while the dates for the employment pattern data are 1998 and 2006, it will not cause material impact to the study as we are interested in the overall cumulative change over time.

Methodology:

As previously mentioned, this paper aims to determine the relationship between occupied office space and employment by category in both the downtown and suburban markets. This was done by conducting both multi-variable regression and correlation analysis between occupied space and number of employees for all NAICS categories in each market separately (downtown and suburb). Additional correlation calculations were run to determine any relationship between suburban and downtown

[11] United States, Census Bureau, *How NAICS Will Affect Data Users*, 1998.

markets. Each regression in this study has been run with occupied square feet as the dependent variable (Y_{SF}) and employment for categories (51, 52, 53, 54, 55, 56) and change in rent as the independent variables (x_{51}, x_{52}, x_{53}, x_{54}, x_{55}, x_{56}, x_{RENT}). All of the variables used in the study are described in more detail below as well as how these variables were calculated.

Occupied Space – The demand for office space can be thought of as the total number of occupied square feet within a market. It can be calculated with the net rentable area (NRA) and vacancy rate data provided by Torto Wheaton Research. The formula used to calculate occupied square feet is defined below:

- Occupied SF = NRA x (1 – Vacancy Rate)

Occupied SF was calculated for each year and each MSA in downtown and suburban data. As previously mentioned, occupied space (Y_{SF}) will be the dependent variable when running the multi-linear regressions.

Rent – Rent represents the average annual rent per square foot for the occupied space in a particular market. It was provided in the Torto Wheaton data and did not need any additional calculations. Rent (x_{RENT}) is one of the independent variables in the regression analysis.

Employment – The employment categories are the main independent variables for this study. As previously mentioned, the Zip Code Business Patterns Data available provides the number of establishments in each zip code by NAICS codes and company size. An example of how the number of employees was estimated from the establishment data is provided below. In Table 3.2, the number of establishments for one zip code (02139) and one NAICS code (54) is provided. The first row of data provides the total number of establishments while each of the rows below provides the number of businesses by establishment size.

Table 3.2 – Sample Zip Code Business Pattern Data

Geographic Area Name	2002 NAICS code	Meaning of 2002 NAICS code	Meaning of Employment size of establishments	Number of establishments
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	All establishments	253
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 1 to 4 employees	133
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 5 to 9 employees	37
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 10 to 19 employees	23
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 20 to 49 employees	31
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 50 to 99 employees	13
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 100 to 249 employees	8
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 250 to 499 employees	2
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 500 to 999 employees	3
ZIP 02139 (CAMBRIDGE,MA)	54	Professional, scientific, & technical services	Establishments with 1,000 employees or more	3

For each establishment size, the midpoint of the employee count was used as estimation. For the last category, establishments with 1,000 or more employees, an estimation of 2,500 employees was used. The establishment data in Table 3.2 was combined with the midpoints data displayed in Table 3.3 to calculate the total number of employees for this zip code and NAICS. For each establishment size, the number of establishments was multiplied by the midpoint number of employees. In the example shown, the total number of professional, scientific, & technical employees (NAICS code 54) in the 02139 zip code is equal to 14,830 from the following calculation:

14,830 = [(133 x 2)+(37 x 7)+(23 x 15)+(31 x 35)+(13 x 75)+(8 x 175)+(2 x 375)+(3 x 750)+(3 x 2,500)]

Table 3.3 – Estimated Employee Methodology

Name	Description	Midpoint Number of Employees
N1_4	1 to 4 Employees	2
N5_9	5 to 9 Employees	7
N10_19	10 to 19 Employees	15
N20_49	20 to 49 Employees	35
N50_99	50 to 99 Employees	75
N100_249	100 to 249 Employees	175
N250_499	250 to 499 Employees	375
N500_999	500 to 999 Employees	750
N1000	1,000 or More Employees	2500

Employee counts were calculated using the aforementioned method for every zip code and each relevant NAICS category. These estimations were used for downtown and suburban markets for 1998 and 2006. Although this is by no means an exact approach, it is intended to provide a ballpark estimate and a consistent approach by applying the same process to data in both 1998 and 2006 for both downtown and suburban markets.

Data Aggregation – Using the MSA/Zip Code data from Torto Wheaton, the employment data calculated for each zip code was aggregated and totaled to the MSA level and split between downtown and suburban markets.

Cumulative Percent Change – The size of each MSA used in this analysis varies in both office space and employees to each other. For example, Albuquerque had approximately 9 million square feet of suburban office space and 3 million square feet of downtown space in 2007. On the other hand, New York City had 71.6 million square feet of suburban office space and 362 million square feet of downtown space. Similar wide ranges exist for employment. In order to minimize the distortion effect that the differences of MSA size would create, part of the

analysis will be conducted using variables that represent the cumulative percent change between the two time periods. The process that was used to calculate the percentage change is explained below.

After aggregating the data by MSA, the cumulative percent change was calculated over the two points in the time series for all variables including NRA, occupied space, rent, and number of employees in each NAICS category. To calculate the percent change, the following formula was used:

- $([d_{2006}] / [d_{1998}]) - 1$; where d_t denotes the data point for time t.

A positive number reflects an increase in change from 1998 while a negative number reflects a decrease in change from 1998.

Chapter 4: Regressions for 1998 and 2006 Levels

The first analysis compares office demand against employment and rent for downtown and suburbs separately for each year in the time series. Regressions were run with occupied space as the dependent variable while the independent variables were rent, total employment across all categories, and employment in each category as a proportion to total employment. The results are displayed in Exhibit 4.1 for downtown and Exhibit 4.2 for suburb.

Looking at the coefficient for 'All Sectors' in the 1998 downtown regression results, it suggests that each worker occupied, on average 301 square feet. Moreover, in 1998, x_{54} and x_{52} were the most dominant sectors respectively as the coefficients are the highest. Similarly, in 2006, each worker occupied approximately 287 square feet. While x_{54} and x_{52} are still the most dominant sectors, their order is reversed. The results from the downtown analysis suggest that workers from our industry categories make up the bulk of the jobs that occupy office space.

On the other hand, in the suburbs, the results suggest that each worker occupied a mere 120 square feet in 1998 and a slightly larger 135 square feet in 2006. These weaker results possibly suggest two things; That there were other industries other than the six studied in this paper occupying office space in the suburbs and that jobs in the NAICS 51-56 categories are not using as much office space as anticipated. Similar to the downtown market, x_{54} seemed to be the most dominant occupier of space of the categories studied in both 1998 and 2006.

One last thing worth noting here is that the rent coefficients in the downtown regression results are positive and significantly higher than those in the suburbs. Intuitively, we expect rent to have a negative

impact to office demand. A possible explanation for the high positive coefficients in the downtown markets is that as rents rise, additional supply of office space comes to market when employment is held constant.

Exhibit 4.1 – Regressions of Downtown Levels

SUMMARY OUTPUT - DOWNTOWN 1998 LEVEL

Regression Statistics	
Multiple R	0.993426843
R Square	0.986896892
Adjusted R Square	0.98427627
Standard Error	6189.690454
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.00996E+11	1.4428E+10	376.588854	5.36252E-31
Residual	35	1340929377	38312267.9		
Total	42	1.02337E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-39096.78335	18932.95442	-2.06501228	0.0463913	-77532.72398	-660.842725
51 / (ALL: 51 to 56)	34588.90974	28019.14845	1.23447398	0.22525066	-22292.98531	91470.80479
52 / (ALL: 51 to 56)	13736.22185	20331.02634	0.67562855	0.50371635	-27537.95566	55010.39936
53 / (ALL: 51 to 56)	-2834.378235	57350.76015	-0.04942181	0.96086411	-119262.6104	113593.8539
54 / (ALL: 51 to 56)	53499.51918	18996.78094	2.81624131	0.00793033	14934.00382	92065.03454
55 / (ALL: 51 to 56)	29589.18768	24881.66299	1.18919655	0.24236786	-20923.2733	80101.64866
All Sectors	0.300659834	0.00871211	34.5105659	1.2749E-28	0.282973311	0.318346357
tw_rent	428.1948448	332.5575928	1.28758102	0.206341	-246.9329567	1103.322646

SUMMARY OUTPUT - DOWNTOWN 2006 LEVEL

Regression Statistics	
Multiple R	0.994766072
R Square	0.989559537
Adjusted R Square	0.987471445
Standard Error	6111.306147
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	1.23896E+11	1.7699E+10	473.905971	1.01316E-32
Residual	35	1307182199	37348062.8		
Total	42	1.25203E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-41328.61019	21341.19763	-1.93656471	0.06090546	-84653.54442	1996.324046
51 / (ALL: 51 to 56)	50547.30117	31227.9023	1.61865823	0.1144985	-12848.71047	113943.3128
52 / (ALL: 51 to 56)	25185.85536	22420.32746	1.12334913	0.26893573	-20329.82888	70701.5396
53 / (ALL: 51 to 56)	-63637.84589	68128.69278	-0.93408288	0.35666107	-201946.4444	74670.75259
54 / (ALL: 51 to 56)	38202.42119	21922.22365	1.74263441	0.09017898	-6302.05858	82706.90095
55 / (ALL: 51 to 56)	6203.046231	25998.06651	0.23859644	0.81281003	-46575.83439	58981.92685
All Sectors	0.287339194	0.013067314	21.9891543	4.507E-22	0.260811136	0.313867253
tw_rent	768.5109045	224.7725552	3.41906023	0.00161133	312.198361	1224.823448

Exhibit 4.2 – Regressions of Suburb Levels

SUMMARY OUTPUT - SUBURBAN 1998 LEVEL

Regression Statistics	
Multiple R	0.937513637
R Square	0.87893182
Adjusted R Square	0.859670973
Standard Error	9342.059041
Observations	52

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	27878093098	3982584728	45.6330828	4.07586E-18
Residual	44	3840058953	87274067.1		
Total	51	31718152051			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-43676.17451	19163.0456	-2.27918753	0.02756175	-82296.75472	-5055.594309
51 / (ALL: 51 to 56)	-2416.111517	50255.13816	-0.04807691	0.96187252	-103698.686	98866.46299
52 / (ALL: 51 to 56)	21735.38653	30117.18524	0.72169382	0.47430065	-38961.8112	82432.58426
53 / (ALL: 51 to 56)	53902.41197	80826.22645	0.6668926	0.50832304	-108992.1418	216796.9657
54 / (ALL: 51 to 56)	106721.9462	34621.06281	3.08257279	0.0035361	36947.77975	176496.1126
55 / (ALL: 51 to 56)	34263.76355	33958.08326	1.00900169	0.31849061	-34174.2554	102701.7825
All Sectors	0.119800636	0.008356554	14.3361291	3.4462E-18	0.102959108	0.136642163
rent	128.7586378	352.2582159	0.36552345	0.71647211	-581.1711386	838.6884142

SUMMARY OUTPUT - SUBURBAN 2006 LEVEL

Regression Statistics	
Multiple R	0.942236965
R Square	0.887810498
Adjusted R Square	0.869962168
Standard Error	11087.39192
Observations	52

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	42803524660	6114789237	49.7419371	7.81416E-19
Residual	44	5408931423	122930260		
Total	51	48212456083			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-25694.41037	32017.13595	-0.80252058	0.42656549	-90220.70711	38831.88637
51 / (ALL: 51 to 56)	-26647.516	67634.20488	-0.39399467	0.69548801	-162955.2976	109660.2656
52 / (ALL: 51 to 56)	7306.095802	44959.84804	0.16250268	0.87165403	-83304.52285	97916.71446
53 / (ALL: 51 to 56)	-16996.77964	103456.6786	-0.16428886	0.87025615	-225500.0121	191506.4529
54 / (ALL: 51 to 56)	84767.8737	39325.78259	2.15552923	0.03663048	5511.967712	164023.7797
55 / (ALL: 51 to 56)	-35845.3714	56886.29068	-0.6301232	0.53187297	-150492.1555	78801.41269
All Sectors	0.134578914	0.00890554	15.1118199	4.9746E-19	0.116630978	0.15252685
rent	229.6277559	433.2531609	0.53000826	0.59877078	-643.5366041	1102.792116

Chapter 5: Analysis of Office Demand Over Time

To better understand the relationship between employment and office demand, correlations between office space, rent, and employment were run for both markets. Exhibit 5.1 shows the results of correlation calculations for change in office square feet (Y_{SF}) with change in employment in each category ($x_{5\#}$) and change in rent (x_{RENT}) for both downtown and suburban markets.

Exhibit 5.1 – Correlations between Dependent and Independent Variables

Downtown Correlations of Percent Change

	Y_{SF}	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	$x_{51\text{-}56}$	x_{RENT}
Y_{SF}	1								
x_{51}	0.0398	1							
x_{52}	0.5477	-0.0911	1						
x_{53}	-0.3459	0.2675	-0.273	1					
x_{54}	0.0570	0.2705	-0.1223	0.2441	1				
x_{55}	-0.1410	-0.1325	-0.0644	0.0758	0.1517	1			
x_{56}	0.3328	0.1125	0.2709	-0.0226	-0.0357	0.2956	1		
$x_{51\text{-}56}$	0.4400	0.285	0.6508	-0.0969	0.3248	0.3289	0.5784	1	
x_{RENT}	0.1723	0.1459	0.101	0.163	0.1335	0.2904	0.2968	0.3825	1

Suburban Correlations of Percent Change

	Y_{SF}	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	$x_{51\text{-}56}$	x_{RENT}
Y_{SF}	1								
x_{51}	0.3126	1							
x_{52}	0.4490	0.3245	1						
x_{53}	0.5936	0.3171	0.3809	1					
x_{54}	0.6383	0.1257	0.2517	0.6463	1				
x_{55}	0.3609	0.1258	0.3989	0.4824	0.4838	1			
x_{56}	0.4606	0.1752	0.1647	0.202	0.2861	0.0033	1		
$x_{51\text{-}56}$	0.7220	0.4434	0.6821	0.6259	0.6341	0.5403	0.657	1	
x_{RENT}	0.0362	0.2123	0.278	0.2314	0.1531	0.3012	0.0529	0.2920	1

The correlation results for downtown markets show that the change in occupied space has a correlation of 0.44 with the change in the number

of office workers over time. Category 52 (Finance and Insurance) has a higher correlation at 0.548 while others such as Categories 53 (Real Estate) and 55 (Management and Headquarters) appear to have negative correlations to office space. Overall, a correlation of 0.44 (R-squared of 19.4%) demonstrates a loose association between change in office space (Y_{SF}) and employment growth (x_{51-56}). There was not a strong correlation between change in rent and the other variables.

The correlation results in the suburban markets show a significantly higher correlation between Y_{SF} and x_{51-56} of 0.722 (R-squared of 52.1%). Correlations between Y_{SF} and individual employment sectors were stronger than in the downtown market. Overall, all the individual employment categories (except x_{52}) showed a stronger correlation with occupied space than in the downtown markets. There were not any negative correlations between Y_{SF} and the other variables. While further analysis is necessary, the demand for suburban office space seems to have a stronger correlation to our employment categories than in the downtown markets.

In addition to the correlation analysis run above, multi-variable regressions were run separately for downtown and suburb markets. First, a regression with all variables was run. After analyzing the results, additional regressions were run that included selective independent variables.

The results of the downtown regressions, shown in Exhibit 5.2, are consistent with the correlations results observed in Exhibit 5.1. The regression run with all variables has an R-squared of 47.15% suggesting that about half of the variation in growth of office demand in downtown markets can be explained by employment growth. Only two of the independent variables, x_{52} and x_{53}, are statistically significant at the 95% confidence level with t-stats of 2.92 and -2.14 respectively. This is consistent with the higher correlations each of these variables had with Y_{SF} in Exhibit 5.1 compared to the other

independent variables. The coefficient for x_{53} is negative suggesting that growth in this sector has a negative impact to overall office demand in downtown markets. Other significant variables are x_{54}, x_{55}, and x_{56} (t-stats of 1.48, -1.69, and 1.78 respectively) although it should be noted that at the 95% confidence level, they are statistically insignificant. When the regression without the variables x_{51} and x_{RENT} was run, then x_{56} was also statistically significant although R-squared decreased to 45.3%.

From the downtown regression results, it appears that Finance and Insurance employment growth is the primary driver of office demand in downtown markets while the Real Estate sector has a dramatic opposite effect with a large negative coefficient. The Administrative sector also impacted downtown office demand with statistical significance. Although it seems that Professional, Scientific, and Technical Services sector could also drive office demand in downtown markets, it cannot be stated with statistical significance. Overall, the coefficients in the downtown regression suggest that these categories do not have a large impact on office demand as they do in the suburban market discussed in the next section.

Exhibit 5.2 – Downtown Regression Results

Downtown - Occupied Space Regression with all Variables

Regression Statistics	
Multiple R	0.686665243
R Square	0.471509157
Adjusted R Square	0.365810988
Standard Error	0.089014978
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	0.247426882	0.035347	4.460902	0.001236002
Residual	35	0.277328319	0.007924		
Total	42	0.524755201			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.119244845	0.027854035	4.281062	0.000137	0.062698148	0.175791542
51----	0.007410338	0.051391816	0.144193	0.886175	-0.096920596	0.111741271
52----	0.106330865	0.036407995	2.920536	0.006078	0.032418706	0.180243024
53----	-0.135544501	0.063101615	-2.148035	0.038713	-0.26364759	-0.007441413
54----	0.099783129	0.06764218	1.475161	0.149109	-0.037537796	0.237104055
55----	-0.026345649	0.015617621	-1.686918	0.100514	-0.058051106	0.005359808
56----	0.079588007	0.044803607	1.776375	0.084365	-0.01136815	0.170544165
Rent	0.066454524	0.06232182	1.066312	0.293583	-0.060065496	0.192974543

Downtown - Occupied Space Regression with Variables x_{52}, x_{53} & x_{RENT}

Regression Statistics	
Multiple R	0.606405137
R Square	0.367727191
Adjusted R Square	0.319090821
Standard Error	0.092235546
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.192966756	0.064322	7.560745	0.000420044
Residual	39	0.331788445	0.008507		
Total	42	0.524755201			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.11339474	0.023746041	4.775311	2.54E-05	0.065363839	0.16142564
52----	0.124414403	0.035936746	3.462039	0.001315	0.051725473	0.197103333
53----	-0.114711622	0.062888229	-1.824056	0.075813	-0.241915072	0.012491827
Rent	0.075920787	0.059848578	1.268548	0.212122	-0.045134388	0.196975962

Downtown - Occupied Space Regression with Variables x_{52}, x_{53}, x_{54}, x_{55} & x_{56}

Regression Statistics	
Multiple R	0.673236655
R Square	0.453247594
Adjusted R Square	0.379362134
Standard Error	0.088058821
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.237844032	0.047569	6.134463	0.000311065
Residual	37	0.286911169	0.007754		
Total	42	0.524755201			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.139223272	0.017365156	8.017393	1.31E-09	0.104038124	0.174408421
52----	0.110250954	0.035630724	3.094266	0.003746	0.03805625	0.182445659
53----	-0.12269154	0.060429887	-2.030312	0.049559	-0.24513412	-0.00024896
54----	0.108497645	0.064441696	1.683656	0.100668	-0.022073633	0.239068923
55----	-0.023523032	0.014510763	-1.621075	0.113494	-0.05292463	0.005878566
56----	0.090719286	0.04253282	2.132924	0.03963	0.004539607	0.176898966

Downtown - Occupied Space Regression with Variables x_{52}, $x_{54, x56}$ & x_{RENT}

Regression Statistics	
Multiple R	0.595456594
R Square	0.354568556
Adjusted R Square	0.288370459
Standard Error	0.093201162
Observations	44

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	0.186104706	0.046526	5.356174	0.001550523
Residual	39	0.338771805	0.008686		
Total	43	0.524876511			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.130052382	0.026859236	4.841999	2.06E-05	0.07572445	0.184380314
52----	0.136110101	0.036136996	3.766503	0.000547	0.063016129	0.209204073
54----	0.060669408	0.066511332	0.912166	0.367285	-0.073862458	0.195201273
56----	0.059133599	0.044098334	1.340949	0.187695	-0.030063701	0.148330898
Rent	0.021371429	0.060754621	0.351766	0.726907	-0.10151639	0.144259248

The regression results for the suburban markets are displayed in Exhibit 4.3. A regression run with all variables has an R-squared of 62.4% which is higher than in the downtown scenario. It suggests that about 62% of the variation in growth of office demand in suburban markets can be explained by employment growth. At the 95% confidence level, there are three statistically significant variables, x_{52}, x_{54}, and x_{56} with t-stats of 2.18, 2.85, and 2.64 respectively. Another important thing observed from the results is that x_{RENT} has a negative coefficient of -0.235 suggesting that the suburban office market demand is more sensitive to rent increases than downtown markets. It should be noted that x_{RENT} is not statistically significant at the 95% confidence level with a t-stat of 1.80 but it is something to consider.

From the suburban regression results, it appears that employment growth in Finance & Insurance (x_{52}), Real Estate (x_{53}), Professional, Scientific, & Technical Services (x_{54}), Administrative (x_{56}), and Rent (x_{RENT}) all drive office demand. Professional, Scientific, and Technical Services have the largest coefficient suggesting that this sector drives office demand the most in suburban markets. The coefficients for the other employment sectors are all about half of that of Professional Services.

From the correlation and regression results observed, we try to determine which employment sectors have growth that impacts office demand for the downtown and suburban markets. There is evidence that the office demand in each market do not have the same employment drivers. There seems to be an established tenant base in the suburban markets that doesn't change much and additional growth matches the existing tenant base. Alternatively, in the downtown markets, the size of the tenant base is critical but the additional growth in office demand cannot be explained by the employment growth. The weak downtown regression results marked by the small coefficients and low R-square can be marked as inconclusive. It suggests some sort of

anomaly. Perhaps there were other factors in play during this time period in the downtown markets to alter the relationship between office demand and employment.

As we saw from the previous chapter, the rent coefficients were significantly higher in the downtown markets while the regression analysis in this chapter resulted in a negative rent coefficient for the suburban markets. This suggests that in the downtown markets, rent is a measure of office market supply while in the suburban markets, rent is a measure of office market demand.

Exhibit 5.3 – Suburban Regression Results

Suburb - Occupied Space Regression with all Variables

Regression Statistics	
Multiple R	0.790185632
R Square	0.624393334
Adjusted R Square	0.564637728
Standard Error	0.19608149
Observations	52

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	2.812230028	0.401747	10.44912	1.19801E-07
Residual	44	1.69170984	0.038448		
Total	51	4.503939868			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.018278559	0.07881345	0.231922	0.817674	-0.140559511	0.17711663
51----	0.129962929	0.117415753	1.106861	0.274369	-0.106672969	0.366598826
52----	0.246177622	0.112943165	2.179659	0.034678	0.018555633	0.47379961
53----	0.282268673	0.186733731	1.511611	0.137782	-0.094068427	0.658605774
54----	0.643641976	0.226015357	2.84778	0.006668	0.18813796	1.099145991
55----	0.027807501	0.118320875	0.235018	0.815285	-0.21065255	0.266267553
56----	0.303845977	0.114928295	2.643787	0.011318	0.07222322	0.535468733
Rent	-0.235338111	0.130360343	-1.805289	0.077875	-0.498062116	0.027385893

Suburb - Occupied Space Regression with Variables x_{51}, x_{52}, x_{53}, x_{54}, x_{56} & x_{RENT}

Regression Statistics	
Multiple R	0.789887228
R Square	0.623921833
Adjusted R Square	0.573778078
Standard Error	0.194012225
Observations	52

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	2.81010642	0.468351	12.44266	3.27695E-08
Residual	45	1.693833448	0.037641		
Total	51	4.503939868			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.011998095	0.073362145	0.163546	0.870821	-0.135760847	0.159757037
51----	0.128026278	0.115890187	1.104721	0.275153	-0.105388538	0.361441094
52----	0.253272209	0.107685629	2.351959	0.023111	0.036382221	0.470162197
53----	0.289774767	0.182040549	1.591814	0.118428	-0.076873714	0.656423247
54----	0.659416291	0.213541553	3.088	0.003446	0.229321532	1.08951105
56----	0.298469552	0.111439884	2.678301	0.010294	0.074018107	0.522920996
Rent	-0.229524489	0.126641096	-1.812401	0.076599	-0.484592746	0.025543767

Suburb - Occupied Space Regression with Variables $x_{52,}$ x_{53}, x_{54}, x_{56} & x_{RENT}

Regression Statistics	
Multiple R	0.783404448
R Square	0.61372253
Adjusted R Square	0.571735848
Standard Error	0.194476471
Observations	52

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	2.76416937	0.552834	14.61708	1.41572E-08
Residual	46	1.739770498	0.037821		
Total	51	4.503939868			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.01198469	0.07353769	0.162973	0.871253	-0.136039	0.16000838
52----	0.276852977	0.105801445	2.616722	0.011972	0.063885716	0.489820237
53----	0.336989983	0.177375665	1.899866	0.06373	-0.020048708	0.694028674
54----	0.626260222	0.211927782	2.955064	0.004915	0.199671729	1.052848714
56----	0.314502735	0.110755162	2.839621	0.006704	0.091564159	0.53744131
Rent	-0.214031922	0.12616338	-1.696466	0.096556	-0.467985631	0.039921787

Suburb - Occupied Space Regression with Variables $x_{52,}$ x_{54}, x_{56} & x_{RENT}

Regression Statistics	
Multiple R	0.763814391
R Square	0.583412424
Adjusted R Square	0.547958162
Standard Error	0.199802317
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2.627654476	0.656914	16.45535	1.70105E-08
Residual	47	1.876285392	0.039921		
Total	51	4.503939868			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.005731313	0.074941693	-0.076477	0.939364	-0.15649455	0.145031924
52----	0.329737664	0.104869358	3.144271	0.002884	0.118767732	0.540707596
54----	0.867252022	0.174423591	4.972103	9.24E-06	0.516357024	1.218147021
56----	0.313497992	0.113786957	2.755131	0.00832	0.084588165	0.542407819
Rent	-0.187698443	0.128833818	-1.456904	0.151792	-0.446878651	0.071481765

Chapter 6: Relationship between Downtown and Suburb

This paper has so far looked at the relationship between employment and office demand in downtown and suburban markets separately. In this section, we look at the relationship between downtown and suburban office markets. The primary focus is to determine whether growth in one market substitutes or complements growth in the other market.

Exhibit 6.1 shows the correlation between downtown and suburban markets for each variable. The correlations are of the change over time of the respective variable (Y_{SF}, x_{51}, x_{52}, x_{53}, x_{54}, x_{55}, x_{56}, x_{RENT}). In most sectors, there is a positive correlation between the two suggesting that the gain or loss of employment or office demand in a market is complementary between the two markets. There was a 42.7% correlation between occupied space in downtown markets and suburbs. In other words, if there was a 10% rise in downtown office demand, the correlation implies that a 4.27% rise in suburban office demand could be associated to the rise in downtown demand. Similarly, the 46.8% correlation in the Finance and Insurance sector between downtown and suburbs suggests that for a 10% rise in employment in this sector, there would be an associated growth in employment of 4.68% in the suburbs.

The correlation of rent between downtown and suburbs had the highest correlation at 65.8%. It should be noted that this is a measure of correlation between change in rents over time and not absolute rents. Nonetheless, the high correlation shows that an increase in rent in one market will also see an increase in the other and vice versa.

There were two sectors, Information and Real Estate, which had a slightly negative correlation between downtown and suburbs. In these cases, the numbers suggest a small decline in one market when the

other market experienced growth. Further analysis shows that the correlations of these two sectors are statistically insignificant with t-stats well below the |2| range needed for the 95% confidence level. We can conclude that there is no correlation between downtown and suburb in these two employment sectors. More detailed regression results for each of the correlations in Exhibit 6.1 are provided in Exhibit 6.2.

Exhibit 6.1 – Correlations between Downtown and Suburbs

Correlations of Variables Between Downtown and Suburban Markets

Occupied Office Space

Y_{SF}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.42663273	1

Rent

x_{RENT}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.65776699	1

All Office Employment Sectors

$x_{51\text{-}56}$

	Downtown	*Suburb*
Downtown	1	
Suburb	0.3908957	1

Information Sector

x_{51}

	Downtown	*Suburb*
Downtown	1	
Suburb	-0.05243268	1

Finance & Insurance Sector

x_{52}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.46806269	1

Real Estate

x_{53}

	Downtown	*Suburb*
Downtown	1	
Suburb	-0.05195727	1

Professional, Scientific & Technical

x_{54}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.30866226	1

Mgmt of Companies & Headquarters

x_{55}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.27728778	1

Adminstrative and Support

x_{56}

	Downtown	*Suburb*
Downtown	1	
Suburb	0.37645684	1

Exhibit 6.2 – Regressions of Downtown vs Suburb

Downtown vs Suburb - Y_{SF}

Regression Statistics	
Multiple R	0.4266327
R Square	0.1820155
Adjusted R Square	0.1620646
Standard Error	0.1023196
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.095513574	0.0955136	9.1231984	0.0043318
Residual	41	0.429241627	0.0104693		
Total	42	0.524755201			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.075173	0.025925122	2.8996209	0.0059786	0.0228162	0.127529868
Suburb	0.1518374	0.050269563	3.0204633	0.0043318	0.0503159	0.253358812

Downtown vs Suburb - X_{RENT}

Regression Statistics	
Multiple R	0.657767
R Square	0.4326574
Adjusted R Square	0.4188198
Standard Error	0.1859434
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.081046155	1.0810462	31.266742	1.645E-06
Residual	41	1.417573107	0.034575		
Total	42	2.498619263			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.1610764	0.040069051	4.0199704	0.0002433	0.0801553	0.241997485
Suburb	0.7009451	0.125355291	5.5916672	1.645E-06	0.4477849	0.954105207

Downtown vs Suburb - $X_{51\text{-}56}$

Regression Statistics	
Multiple R	0.3908957
R Square	0.1527994
Adjusted R Square	0.132136
Standard Error	0.1421608
Observations	43

NAICS KEY	
51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.149444166	0.1494442	7.3946803	0.0095483
Residual	41	0.828597117	0.0202097		
Total	42	0.978041283			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.108759	0.035642267	-3.051398	0.0039847	-0.18074	-0.03677772
Suburb	0.4010117	0.147467844	2.7193162	0.0095483	0.1031943	0.698829042

Downtown vs Suburb - X_{51}

Regression Statistics	
Multiple R	0.0524327
R Square	0.0027492
Adjusted R Square	-0.021574
Standard Error	0.3025365
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.010345201	0.0103452	0.1130273	0.7384381
Residual	41	3.752660854	0.0915283		
Total	42	3.763006055			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Downtown	-0.122256	0.049111922	-2.489335	0.0169476	-0.22144	-0.02307251
Suburb	-0.057586	0.171288211	-0.336195	0.7384381	-0.40351	0.28833725

Downtown vs Suburb - x_{52}

Regression Statistics	
Multiple R	0.4680627
R Square	0.2190827
Adjusted R Square	0.2000359
Standard Error	0.3726052
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.596925239	1.5969252	11.502357	0.0015498
Residual	41	5.692218904	0.1388346		
Total	42	7.289144143			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.25205	0.093424909	-2.697885	0.0100842	-0.440725	-0.06337427
Suburb	0.8900346	0.262429983	3.3915125	0.0015498	0.3600465	1.420022667

Downtown vs Suburb - X_{53}

Regression Statistics	
Multiple R	0.0519573
R Square	0.0026996
Adjusted R Square	-0.021625
Standard Error	0.2426314
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.006533477	0.0065335	0.1109815	0.7407271
Residual	41	2.413669486	0.05887		
Total	42	2.420202963			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Downtown	0.0150266	0.061063069	0.246083	0.8068458	-0.108293	0.13834595
Suburb	-0.059847	0.179645282	-0.333139	0.7407271	-0.422648	0.30295419

Downtown vs Suburb - X_{54}

Regression Statistics	
Multiple R	0.3086623
R Square	0.0952724
Adjusted R Square	0.0732059
Standard Error	0.2120665
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.194167839	0.1941678	4.3175072	0.044024
Residual	41	1.843860601	0.0449722		
Total	42	2.03802844			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.004639	0.077451171	-0.059895	0.9525302	-0.161055	0.151776864
Suburb	0.3902467	0.187811712	2.0778612	0.044024	0.0109532	0.769540112

Downtown vs Suburb - X_{55}

Regression Statistics	
Multiple R	0.2772878
R Square	0.0768885
Adjusted R Square	0.0543736
Standard Error	0.9769432
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.259341123	3.2593411	3.4150035	0.0718288
Residual	41	39.13114166	0.9544181		
Total	42	42.39048278			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0231869	0.178094812	0.1301943	0.8970494	-0.336483	0.382856698
Suburb	1.0253233	0.554836779	1.8479728	0.0718288	-0.095192	2.145838876

Downtown vs Suburb - X_{56}

Regression Statistics	
Multiple R	0.3764568
R Square	0.1417198
Adjusted R Square	0.1207861
Standard Error	0.3300412
Observations	43

NAICS KEY

51----	Information
52----	Finance & Insurance
53----	Real Estate, Renting, & Leasing
54----	Professional, Scientific, & Technical Services
55----	Management of Companies & Headquarters
56----	Administrative and Support

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.737431004	0.737431	6.7699449	0.0128413
Residual	41	4.466014341	0.1089272		
Total	42	5.203445345			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.139208	0.050367798	-2.763838	0.0085182	-0.240928	-0.03748859
Suburb	0.4942403	0.189952743	2.6019118	0.0128413	0.1106229	0.877857621

Chapter 7: Results Summary

From the results of the regression and correlation analysis, there is reasonable evidence to suggest that office demand in downtown and suburban markets do not have the same employment growth drivers. There were different impacts to the change in occupied space from the employment sectors in each market. The change in office demand in the suburban markets was better explained by the employment growth than in the downtown markets. The analysis results for the downtown market suggest that there was some other factor in play impacting the relationship between office demand and employment.

In the downtown markets, Finance and Insurance (x_{52}) had the highest correlation to occupied space while Real Estate (x_{53}) along with Management and Headquarters (x_{55}) had negative correlations. The regressions run for downtown resulted in an R-squared of 47.15% with only two sectors, x_{52} and x_{53}, with statistically significance. Growth in the Finance and Insurance sector appears to be the strongest driver of office demand in downtown markets of the employment categories studied. The negative coefficient attributed to Real Estate (x_{53}) was unexplainable as one would intuitively expect a positive change in employment in any office category to impact occupied space in the same direction. The regressions run for the levels of employment and occupied office space in both 1998 and 2006 suggested that each worker occupied 301 and 287 square feet respectively with x_{54} having the most impact on office space.

In the suburban markets, the correlations between employment and occupied space were higher than in the downtown markets. An explanation for this is that office demand in suburban markets is more sensitive to employment growth than in the downtown markets. The regressions run for the suburban market resulted in an R-squared of 62.4% with three sectors – x_{52}, x_{54}, and x_{56} – having statistical

significance. These three sectors are the primary drivers of office demand in the suburban markets. Another important observation is the role of the rent variable in the regression results. Change in rent had a negative impact to office demand. A rise in rent would result in a decrease in demand for office space in the suburban markets. The rent variable did not have the same effect in the downtown markets. The regressions run for the levels of employment and occupied office space in both 1998 and 2006 suggested that each worker occupied 120 and 135 square feet respectively with x_{54} having the most impact on office space. The weaker regression results for the levels in the suburban market suggest that there are other workers from industries not studied in this paper occupying space in the suburbs.

The analysis conducted to compare growth between the downtown and suburban markets showed that there was a positive correlation between the two markets in an MSA. The positive correlations between downtown and suburb for each variable suggest that growth in one market is complementary to the other market. This suggests that it is not a zero sum game between the two markets.

Chapter 8: Conclusion

The purpose of this thesis was to study the evolving relationship between employment and office demand in both the suburban and downtown markets as well as the relationship of office demand between downtown and suburban markets. It investigated the relationship of office demand with employment by sector and rent. The study analyzed 43 different downtown markets and 52 different suburban markets. Data for two different years for each market were studied to observe the relationship over time.

Based on the results of the analysis conducted, a strong conclusive argument about the relationship between office demand and the office employment sectors cannot be made. While the results supported an association of growth in employment and growth of employment, the results also uncovered other factors they might play a factor to impact office demand. In the suburban regressions by level, the results suggested that there were jobs from other industries that occupied a high level of office space in the suburbs. The results from the downtown regression results by percent change suggest that there might have been other factors in play that impacted the relationship between office demand and employment. Other lurking variables such as macro-economic factors, local economic factors, or overall demographic changes could have impacted this relationship and could not be uncovered in this paper.

An important observation from this analysis is that the relationship of office demand between downtown and suburbs is positively correlated suggesting a complementary relationship. In other words, one market does not gain at the expense of the other market. Based on the results of the correlation studies, a city that is experiencing strong employment growth should experience office demand in both its downtown and suburban markets. The media often likes to publish articles stating that jobs and as a result office demand are moving to the

suburbs at the detriment of the downtown market. This paper has shown that there is a positive correlation between the two suggesting that a rising tide will lift all boats, albeit not at the same rate.

Another important thing to note is the role of rent in office demand. Based on the regression analysis, office demand in suburban markets is more sensitive to both rents and employment growth. That downtown markets do not seem to be sensitive to rents and less sensitive to employment could be explained by the idea that downtown markets are more robust and there is still a preference to downtown over the suburbs. The tight supply in downtown markets impacts the rent while the looser demand in suburban markets impacts the rents there.

The results of the study showed that were was an association between each of the employment sectors and occupied space in both the downtown and suburban markets. However, the results were not strong enough to provide conclusive evidence to explain the relationship so that forecasts for office demand could be made going forward based solely on the variables studied.

Appendices

Appendix A1 – List of MSAs Used in Study (Downtown)

1.	Albuquerque	23.	Los Angeles
2.	Atlanta	24.	Miami
3.	Austin	25.	Minneapolis
4.	Baltimore	26.	Nashville
5.	Boston	27.	New York
6.	Charlotte	28.	Oakland
7.	Chicago	29.	Orlando
8.	Cincinnati	30.	Philadelphia
9.	Cleveland	31.	Phoenix
10.	Columbus	32.	Portland
11.	Dallas	33.	Sacramento
12.	Denver	34.	Salt Lake City
13.	Detroit	35.	San Diego
14.	Fort Lauderdale	36.	San Francisco
15.	Fort Worth	37.	San Jose
16.	Hartford	38.	Seattle
17.	Honolulu	39.	St. Louis
18.	Houston	40.	Tampa
19.	Indianapolis	41.	Tucson
20.	Jacksonville	42.	Washington, DC
21.	Kansas City	43.	Wilmington
22.	Las Vegas		

Appendix A2 – List of MSAs Used in Study (Suburb)

1.	Albuquerque	27.	Minneapolis
2.	Atlanta	28.	Nashville
3.	Austin	29.	New York
4.	Baltimore	30.	Newark
5.	Boston	31.	Oakland
6.	Charlotte	32.	Orange County
7.	Chicago	33.	Orlando
8.	Cincinnati	34.	Philadelphia
9.	Cleveland	35.	Phoenix
10.	Columbus	36.	Portland
11.	Dallas	37.	Riverside
12.	Denver	38.	Sacramento
13.	Detroit	39.	Salt Lake City
14.	Edison	40.	San Diego
15.	Fort Lauderdale	41.	San Francisco
16.	Fort Worth	42.	San Jose
17.	Hartford	43.	Seattle
18.	Honolulu	44.	St. Louis
19.	Houston	45.	Stamford
20.	Indianapolis	46.	Tampa
21.	Jacksonville	47.	Trenton
22.	Kansas City	48.	Tucson
23.	Las Vegas	49.	Ventura
24.	Long Island	50.	Washington, DC
25.	Los Angeles	51.	West Palm Beach
26.	Miami	52.	Wilmington

Appendix B1 – Torto Wheaton Data (Downtown 1996)

cname	msa_id	sub_type	year	nra	compltns	absorption	vacrate	tw_rent
Albuquerque	ALBUQU	Downtown	1996.4	2891	0	-152	18.7	13.51
Atlanta	ATLANT	Downtown	1996.4	23511	0	-715	17.3	16.3
Austin	AUSTIN	Downtown	1996.4	6855	0	168	14.7	18.47
Baltimore	BALTIM	Downtown	1996.4	11092	0	-94	18.5	16.39
Boston	BOSTON	Downtown	1996.4	58204	0	1028	7.2	24.66
Charlotte	CHRLTE	Downtown	1996.4	9460	0	-24	5.7	17.67
Chicago	CHICAG	Downtown	1996.4	113044	0	230	15.2	18.93
Cincinnati	CINCIN	Downtown	1996.4	12966	0	91	13.3	15.63
Cleveland	CLEVEL	Downtown	1996.4	18892	0	-7	17.1	17.27
Columbus	COLUMB	Downtown	1996.4	9157	0	-25	7.1	19.19
Dallas	DALLAS	Downtown	1996.4	25147	0	213	34.8	12.42
Denver	DENVER	Downtown	1996.4	22802	0	173	11.8	13.08
Detroit	DETROI	Downtown	1996.4	10513	0	375	17.2	12.44
Fort Lauderdale	FORTLA	Downtown	1996.4	4127	0	-49	6.9	24.84
Fort Worth	FORTWO	Downtown	1996.4	6818	0	9	20.6	13.58
Hartford	HARTFO	Downtown	1996.4	7880	0	52	23.5	18.44
Honolulu	HONOLU	Downtown	1996.4	4250	380	408	17.2	21.39
Houston	HOUSTO	Downtown	1996.4	33028	0	113	21	12.16
Indianapolis	INDIAN	Downtown	1996.4	11618	0	76	16.8	12.72
Jacksonville	JACKSO	Downtown	1996.4	7368	0	-4	13.5	15.61
Kansas City	KANSAS	Downtown	1996.4	13739	0	-47	16.3	15.67
Las Vegas	LVEGAS	Downtown	1996.4	1133	0	-16	6.6	22.56
Los Angeles	LANGEL	Downtown	1996.4	32847	0	166	20.8	13.55
Miami	MIAMI	Downtown	1996.4	11051	0	-109	20.1	23.63
Minneapolis	MINNEA	Downtown	1996.4	25881	0	243	8.1	20.73
Nashville	NASHVI	Downtown	1996.4	5956	0	78	13	16.7
New York	NEWYRK	Downtown	1996.4	361200	0	3074	12.5	36.59
Oakland	OAKLAN	Downtown	1996.4	11879	0	133	11.1	15.98
Orlando	ORLAND	Downtown	1996.4	5178	0	10	7	17.12
Philadelphia	PHILAD	Downtown	1996.4	35798	0	89	16.6	14.58
Phoenix	PHOENI	Downtown	1996.4	13033	0	6	12.5	16.52
Portland	PORTLA	Downtown	1996.4	14719	0	283	6	17.54
Sacramento	SACRAM	Downtown	1996.4	7568	0	-163	10.2	18.03
Salt Lake City	SALTLA	Downtown	1996.4	7814	0	-21	7.7	16.91
San Diego	SDIEGO	Downtown	1996.4	8980	0	71	17.9	15.76
San Francisco	SFRANC	Downtown	1996.4	39662	0	579	5.9	18.32
San Jose	SJOSE	Downtown	1996.4	6741	0	129	7.2	20.57
Seattle	SEATTL	Downtown	1996.4	31168	0	207	6.2	18.92
St. Louis	SLOUIS	Downtown	1996.4	11897	0	-90	18	18.86
Tampa	TAMPA	Downtown	1996.4	6812	0	75	19.1	13.19
Tucson	TUCSON	Downtown	1996.4	1213	0	-12	23.7	12.54
Washington, DC	WASHIN	Downtown	1996.4	76785	0	281	10.3	26.92
Wilmington	WILMIN	Downtown	1996.4	5322	0	-168	19.3	15.91
Sum of Markets	SUMMKT	Downtown	1996.4	1135999	380	6664	13.4	24.15

Appendix B2 – Torto Wheaton Data (Suburb 1996)

cname	msa_id	sub_type	year	nra	compltns	absorption	vacrate	rent
Albuquerque	ALBUQU	Suburban	1996.4	7060	0	-138	7.8	14.04
Atlanta	ATLANT	Suburban	1996.4	63129	231	688	6.4	18.11
Austin	AUSTIN	Suburban	1996.4	14127	0	-43	6.7	22.08
Baltimore	BALTIM	Suburban	1996.4	23076	184	271	8.1	17.93
Boston	BOSTON	Suburban	1996.4	70812	0	873	7	19.37
Charlotte	CHRLTE	Suburban	1996.4	14202	319	-32	10.9	15.91
Chicago	CHICAG	Suburban	1996.4	73454	51	97	11.1	23.93
Cincinnati	CINCIN	Suburban	1996.4	13628	0	61	10.2	15.94
Cleveland	CLEVEL	Suburban	1996.4	13772	0	103	9.1	16.11
Columbus	COLUMB	Suburban	1996.4	11844	101	17	9	18.3
Dallas	DALLAS	Suburban	1996.4	84169	0	22	11.1	16.63
Denver	DENVER	Suburban	1996.4	45853	0	341	8.6	20.44
Detroit	DETROI	Suburban	1996.4	49878	0	249	9.6	15.47
Edison	EDISON	Suburban	1996.4	32257	0	559	16.7	15.31
Fort Lauderdale	FORTLA	Suburban	1996.4	14401	0	15	10.3	18.49
Fort Worth	FORTWO	Suburban	1996.4	13183	0	13	14.8	13.18
Hartford	HARTFO	Suburban	1996.4	17393	0	139	21.2	17.3
Honolulu	HONOLU	Suburban	1996.4	7346	0	-77	14	24.54
Houston	HOUSTO	Suburban	1996.4	89082	0	659	17.7	11.72
Indianapolis	INDIAN	Suburban	1996.4	12762	79	233	6.9	12.85
Jacksonville	JACKSO	Suburban	1996.4	6830	0	79	8.4	16.49
Kansas City	KANSAS	Suburban	1996.4	25632	0	-79	10.3	16.32
Las Vegas	LVEGAS	Suburban	1996.4	9394	556	378	13.1	20.71
Long Island	LISLAN	Suburban	1996.4	26743	0	55	11.8	20.57
Los Angeles	LANGEL	Suburban	1996.4	126105	0	1810	17.9	17.41
Miami	MIAMI	Suburban	1996.4	20966	171	6	12.2	22.79
Minneapolis	MINNEA	Suburban	1996.4	27412	0	-64	5.8	23.95
Nashville	NASHVI	Suburban	1996.4	15171	245	146	6.3	15.67
New York	NEWYRK	Suburban	1996.4	63534	0	558	15.7	26.9
Newark	NEWARK	Suburban	1996.4	39550	0	-141	14	17.11
Oakland	OAKLAN	Suburban	1996.4	28805	0	98	8	16.09
Orange County	ORANGE	Suburban	1996.4	53308	0	193	11.7	17.81
Orlando	ORLAND	Suburban	1996.4	12344	138	152	10.5	18.27
Philadelphia	PHILAD	Suburban	1996.4	50891	0	447	9.7	16.37
Phoenix	PHOENI	Suburban	1996.4	25002	0	89	7.4	18.79
Portland	PORTLA	Suburban	1996.4	17312	162	168	6.3	17.71
Riverside	RIVERS	Suburban	1996.4	15658	0	112	21.6	14.88
Sacramento	SACRAM	Suburban	1996.4	20786	0	148	11.1	16.8
Salt Lake City	SALTLA	Suburban	1996.4	9873	367	284	4.7	18.49
San Diego	SDIEGO	Suburban	1996.4	28283	0	768	11.2	16.7
San Francisco	SFRANC	Suburban	1996.4	30164	0	62	7.9	19.71
San Jose	SJOSE	Suburban	1996.4	19045	0	383	3	25.61
Seattle	SEATTL	Suburban	1996.4	25496	0	498	9.9	20.71
St. Louis	SLOUIS	Suburban	1996.4	20042	0	13	6.6	21.48
Stamford	STAMFO	Suburban	1996.4	28651	0	155	13.8	17.61
Tampa	TAMPA	Suburban	1996.4	19939	0	346	8.9	14.69
Trenton	TRENTO	Suburban	1996.4	7977	0	17	14	17.63
Tucson	TUCSON	Suburban	1996.4	4838	15	84	6.1	11.78
Ventura	OXNARD	Suburban	1996.4	4176	0	28	13.7	15.61
Washington, DC	WASHIN	Suburban	1996.4	126836	99	730	7.3	19.95
West Palm Beach	WBEACH	Suburban	1996.4	18421	67	156	11.3	18.74
Wilmington	WILMIN	Suburban	1996.4	5366	0	16	9.2	16.56
Sum of Markets	SUMMKT	Suburban	1996.4	1605978	2785	11745	11.1	18.36

Appendix B3 – Torto Wheaton Data (Downtown 2007)

cname	msa_id	sub_type	year	nra	compltns	absorption	vacrate	tw_rent
Albuquerque	ALBUQU	Downtown	2007.4	2921	0	59	17.3	15.43
Atlanta	ATLANT	Downtown	2007.4	29265	0	903	18.8	18.43
Austin	AUSTIN	Downtown	2007.4	8197	0	3	17.3	24.48
Baltimore	BALTIM	Downtown	2007.4	11997	0	3	11.2	22.8
Boston	BOSTON	Downtown	2007.4	65404	300	494	5.9	34.97
Charlotte	CHRLTE	Downtown	2007.4	13858	0	126	2.4	18.54
Chicago	CHICAG	Downtown	2007.4	123335	0	85	11.6	25.45
Cincinnati	CINCIN	Downtown	2007.4	13154	0	16	14.3	17.19
Cleveland	CLEVEL	Downtown	2007.4	18971	0	49	18.5	19.47
Columbus	COLUMB	Downtown	2007.4	11254	0	-5	13.2	20.85
Dallas	DALLAS	Downtown	2007.4	25565	0	-318	26	15.55
Denver	DENVER	Downtown	2007.4	23643	0	-591	12.1	20.18
Detroit	DETROI	Downtown	2007.4	11223	0	-152	25.5	16.25
Fort Lauderdale	FORTLA	Downtown	2007.4	5849	269	47	15.9	28.66
Fort Worth	FORTWO	Downtown	2007.4	7272	0	-23	7.3	19.91
Hartford	HARTFO	Downtown	2007.4	7880	0	61	17	20.54
Honolulu	HONOLU	Downtown	2007.4	4250	0	-27	8.1	23.43
Houston	HOUSTO	Downtown	2007.4	35227	0	-6	10.6	21.21
Indianapolis	INDIAN	Downtown	2007.4	11733	0	-26	12.2	15.89
Jacksonville	JACKSO	Downtown	2007.4	7770	0	-64	19.5	18.4
Kansas City	KANSAS	Downtown	2007.4	15309	0	273	16.4	15.12
Las Vegas	LVEGAS	Downtown	2007.4	1585	30	-56	12.7	31.98
Los Angeles	LANGEL	Downtown	2007.4	33477	0	-120	12.8	22.62
Miami	MIAMI	Downtown	2007.4	12513	31	5	10.7	33.03
Minneapolis	MINNEA	Downtown	2007.4	29159	0	50	17.2	21.07
Nashville	NASHVI	Downtown	2007.4	6555	338	276	10.8	19.26
New York	NEWYRK	Downtown	2007.4	362039	135	341	4.3	75.78
Oakland	OAKLAN	Downtown	2007.4	12959	230	91	12.5	23.32
Orlando	ORLAND	Downtown	2007.4	7235	0	54	10.8	23.95
Philadelphia	PHILAD	Downtown	2007.4	35798	0	-8	8.6	20.24
Phoenix	PHOENI	Downtown	2007.4	14178	0	-31	13	21.59
Portland	PORTLA	Downtown	2007.4	15941	0	10	9.4	22.22
Sacramento	SACRAM	Downtown	2007.4	8338	0	125	9.5	23.1
Salt Lake City	SALTLA	Downtown	2007.4	9574	0	-84	11.4	18.54
San Diego	SDIEGO	Downtown	2007.4	9797	0	46	14.1	29.96
San Francisco	SFRANC	Downtown	2007.4	43199	0	415	8	25.26
San Jose	SJOSE	Downtown	2007.4	7895	0	91	17	21.65
Seattle	SEATTL	Downtown	2007.4	39267	325	-43	8.2	27.04
St. Louis	SLOUIS	Downtown	2007.4	12290	0	59	18.7	16.94
Tampa	TAMPA	Downtown	2007.4	7092	0	-51	15.7	19.28
Tucson	TUCSON	Downtown	2007.4	1232	0	106	3.7	19.42
Washington, DC	WASHIN	Downtown	2007.4	95614	476	167	6.9	43.77
Wilmington	WILMIN	Downtown	2007.4	6168	0	197	20.6	21.19
Sum of Markets	SUMMKT	Downtown	2007.4	1225982	2134	2547	9.6	40.33

Appendix B4 – Torto Wheaton Data (Suburb 2007)

cname	msa_id	sub_type	year	nra	compltns	absorption	vacrate	rent
Albuquerque	ALBUQU	Suburban	2007.4	9180	24	49	11	16.36
Atlanta	ATLANT	Suburban	2007.4	99529	834	369	15.8	17.87
Austin	AUSTIN	Suburban	2007.4	25954	521	-109	16	24.27
Baltimore	BALTIM	Suburban	2007.4	39056	451	604	14.1	26.09
Boston	BOSTON	Suburban	2007.4	92229	166	659	14.3	26.44
Charlotte	CHRLTE	Suburban	2007.4	25366	302	420	15.4	15.37
Chicago	CHICAG	Suburban	2007.4	96014	455	1109	19	21.71
Cincinnati	CINCIN	Suburban	2007.4	20794	433	436	20.1	16.28
Cleveland	CLEVEL	Suburban	2007.4	18255	261	296	14	20.77
Columbus	COLUMB	Suburban	2007.4	18986	189	348	16.9	18.92
Dallas	DALLAS	Suburban	2007.4	115721	959	1296	20.7	19.44
Denver	DENVER	Suburban	2007.4	64906	159	227	15.7	17.71
Detroit	DETROI	Suburban	2007.4	60090	441	692	19.5	16.88
Edison	EDISON	Suburban	2007.4	38198	270	-249	20.5	19.06
Fort Lauderdale	FORTLA	Suburban	2007.4	21850	426	241	12.7	23.71
Fort Worth	FORTWO	Suburban	2007.4	16992	75	-49	15.1	17.44
Hartford	HARTFO	Suburban	2007.4	18437	0	224	15.5	18.74
Honolulu	HONOLU	Suburban	2007.4	7346	0	-30	10	25.13
Houston	HOUSTO	Suburban	2007.4	102051	278	725	11.9	18.39
Indianapolis	INDIAN	Suburban	2007.4	19047	142	379	16.3	16.02
Jacksonville	JACKSO	Suburban	2007.4	12597	214	213	16.3	16.85
Kansas City	KANSAS	Suburban	2007.4	31904	400	321	13.9	15.42
Las Vegas	LVEGAS	Suburban	2007.4	27896	747	-120	15.7	28.05
Long Island	LISLAN	Suburban	2007.4	29706	0	136	9.4	23.11
Los Angeles	LANGEL	Suburban	2007.4	141849	1044	513	9.3	28.2
Miami	MIAMI	Suburban	2007.4	28708	819	447	11.2	30.35
Minneapolis	MINNEA	Suburban	2007.4	34735	347	-7	12.8	24.74
Nashville	NASHVI	Suburban	2007.4	22972	291	11	10.7	19.08
New York	NEWYRK	Suburban	2007.4	71684	0	264	12.8	32.81
Newark	NEWARK	Suburban	2007.4	43973	41	152	13.3	22.88
Oakland	OAKLAN	Suburban	2007.4	39444	318	167	17.1	23.96
Orange County	ORANGE	Suburban	2007.4	67039	647	-1445	14.4	29.34
Orlando	ORLAND	Suburban	2007.4	25278	266	-227	12.7	20.87
Philadelphia	PHILAD	Suburban	2007.4	67502	288	287	12.7	21.55
Phoenix	PHOENI	Suburban	2007.4	53753	1163	272	16.7	23.55
Portland	PORTLA	Suburban	2007.4	25754	118	75	14.5	22.23
Riverside	RIVERS	Suburban	2007.4	21682	0	-26	10.2	21.97
Sacramento	SACRAM	Suburban	2007.4	33799	432	264	16.4	22.27
Salt Lake City	SALTLA	Suburban	2007.4	18877	705	467	12.2	18.25
San Diego	SDIEGO	Suburban	2007.4	44995	483	-26	13.4	31.52
San Francisco	SFRANC	Suburban	2007.4	41220	330	254	10.3	25.3
San Jose	SJOSE	Suburban	2007.4	29270	388	522	11	29.97
Seattle	SEATTL	Suburban	2007.4	39854	146	34	11	25.56
St. Louis	SLOUIS	Suburban	2007.4	27232	0	122	13.9	20.92
Stamford	STAMFO	Suburban	2007.4	32518	134	131	10.8	26.53
Tampa	TAMPA	Suburban	2007.4	29680	388	177	14.1	20.29
Trenton	TRENTO	Suburban	2007.4	11124	184	103	15.8	23.75
Tucson	TUCSON	Suburban	2007.4	6808	0	-91	12.1	21.16
Ventura	OXNARD	Suburban	2007.4	5656	33	7	9.4	24.32
Washington, DC	WASHIN	Suburban	2007.4	174871	1172	989	11.8	29.75
West Palm Beach	WBEACH	Suburban	2007.4	24062	177	-292	16	24.04
Wilmington	WILMIN	Suburban	2007.4	6594	0	-32	16.4	17.17
Sum of Markets	SUMMKT	Suburban	2007.4	2183037	17661	11299	14.2	23.37

Appendix C1 – Zip Code Business Pattern Data(Downtown 1998)

cname	51----	52----	53----	54----	55----	56----	Total
Albuquerque	1,059	2,079	187	2,424	128	505	6,382
Atlanta	16,332	17,216	5,390	27,606	9,843	13,100	89,487
Austin	2,643	5,092	966	9,137	702	2,155	20,695
Baltimore	5,029	15,041	3,435	12,775	4,332	7,042	47,654
Boston	23,586	76,700	13,268	58,089	14,954	21,565	208,162
Charlotte	4,253	5,725	1,551	9,360	1,595	1,726	24,210
Chicago	35,219	92,899	27,107	117,817	28,042	43,596	344,680
Cincinnati	13,599	13,421	1,591	15,171	6,461	9,294	59,537
Cleveland	8,479	22,721	2,109	22,927	9,694	10,323	76,253
Columbus	6,536	19,722	3,727	11,812	4,535	5,248	51,580
Dallas	10,575	24,425	3,842	25,725	10,361	7,142	82,070
Denver	22,290	12,011	3,443	21,165	5,590	12,232	76,731
Detroit	6,122	11,330	484	11,132	6,757	4,706	40,531
Fort Lauderdale	4,493	4,993	5,153	9,729	5,061	7,771	37,200
Fort Worth	4,772	4,353	825	4,995	7,411	6,377	28,733
Hartford	2,650	13,827	913	5,823	315	2,928	26,456
Honolulu	3,437	10,294	3,153	8,992	2,002	8,008	35,886
Houston	6,649	17,419	1,865	25,772	14,342	8,488	74,535
Indianapolis	7,367	14,129	2,398	10,291	1,821	7,031	43,037
Jacksonville	10,394	17,945	2,016	7,233	2,598	12,451	52,637
Kansas City	11,664	15,872	1,672	10,917	3,179	2,816	46,120
Las Vegas	512	2,827	1,161	4,345	375	1,923	11,143
Los Angeles	4,384	32,571	6,331	25,918	3,492	6,134	78,830
Miami	3,697	10,626	2,116	12,826	631	5,469	35,365
Minneapolis	12,744	38,943	2,865	28,738	18,163	11,732	113,185
Nashville	8,243	5,731	1,663	7,724	5,142	5,359	33,862
New York	134,995	316,268	61,103	282,439	99,180	126,186	1,020,171
Oakland	6,082	4,956	1,990	8,678	6,429	4,016	32,151
Orlando	5,170	5,454	2,005	10,351	1,676	9,082	33,738
Philadelphia	10,683	32,426	4,702	43,698	7,202	16,805	115,516
Phoenix	12,466	18,077	5,052	18,283	5,127	14,938	73,943
Portland	10,187	17,432	5,379	19,642	5,966	9,445	68,051
Sacramento	1,385	1,778	882	6,102	241	984	11,372
Salt Lake City	8,698	8,807	2,217	9,330	5,805	7,702	42,559
San Diego	2,655	5,503	2,152	10,541	478	2,231	23,560
San Francisco	27,166	72,917	9,116	66,121	14,226	31,727	221,273
San Jose	6,207	7,672	3,484	13,357	1,937	14,671	47,328
Seattle	20,097	24,527	10,088	37,127	11,957	14,792	118,588
St. Louis	10,446	20,903	2,106	13,426	12,989	5,150	65,020
Tampa	7,790	4,032	399	7,038	715	2,514	22,488
Tucson	476	400	146	1,651	84	218	2,975
Washington, DC	25,905	21,818	11,106	81,417	3,613	21,524	165,383
Wilmington	823	15,748	341	4,339	10,167	2,115	33,533
Sum of Markets	527,959	1,086,630	221,499	1,141,983	355,318	509,221	3,842,610

Appendix C2 – Zip Code Business Pattern Data(Downtown 2006)

cname	51----	52----	53----	54----	55----	56----	Total
Albuquerque	689	1,081	235	2,481	482	672	5,640
Atlanta	16,914	17,438	4,863	34,900	10,676	6,284	91,075
Austin	2,472	3,405	1,038	10,280	144	1,064	18,403
Baltimore	3,041	15,761	3,507	13,835	3,065	7,511	46,720
Boston	15,807	80,368	12,531	61,033	20,813	18,182	208,734
Charlotte	3,887	17,767	988	6,891	506	2,605	32,644
Chicago	38,006	109,968	20,079	131,261	23,603	30,627	353,544
Cincinnati	8,031	16,153	1,536	14,021	7,985	4,485	52,211
Cleveland	6,707	19,663	2,246	17,064	9,594	6,404	61,678
Columbus	2,900	6,935	1,976	11,976	1,965	3,312	29,064
Dallas	7,506	18,835	3,870	23,819	8,782	5,413	68,225
Denver	15,202	13,272	4,257	23,908	11,118	8,847	76,604
Detroit	7,965	6,492	548	10,040	5,773	4,079	34,897
Fort Lauderdale	2,561	5,184	3,596	11,303	3,261	5,045	30,950
Fort Worth	4,226	5,569	853	3,885	6,356	3,328	24,217
Hartford	1,171	9,102	762	6,577	431	1,780	19,823
Honolulu	3,478	9,011	2,983	10,927	2,435	3,183	32,017
Houston	7,336	19,408	2,683	34,737	11,595	8,241	84,000
Indianapolis	7,109	15,375	2,251	11,229	3,924	3,992	43,880
Jacksonville	5,563	16,714	2,178	7,484	2,397	7,130	41,466
Kansas City	10,864	13,409	1,636	12,800	2,826	2,787	44,322
Las Vegas	694	2,018	923	4,168	420	3,852	12,075
Los Angeles	6,796	26,579	5,282	29,236	4,504	7,718	80,115
Miami	3,542	9,845	1,934	16,188	1,237	3,376	36,122
Minneapolis	11,893	33,101	3,061	31,636	11,993	8,093	99,777
Nashville	7,004	6,194	1,272	13,685	6,897	3,907	38,959
New York	159,855	311,963	66,119	323,943	82,633	120,843	1,065,356
Oakland	4,191	8,089	2,126	12,543	4,736	4,617	36,302
Orlando	3,913	6,278	1,689	15,643	1,842	6,464	35,829
Philadelphia	9,393	42,385	3,721	42,270	5,900	11,432	115,101
Phoenix	10,192	22,439	4,427	21,626	9,715	13,103	81,502
Portland	9,445	14,852	4,848	20,569	4,716	6,908	61,338
Sacramento	1,230	1,993	1,008	7,186	212	1,627	13,256
Salt Lake City	6,751	7,321	1,830	11,277	3,112	7,049	37,340
San Diego	1,639	6,317	2,202	14,056	3,064	3,519	30,797
San Francisco	25,071	52,564	8,848	72,539	13,078	16,692	188,792
San Jose	6,440	5,136	3,304	17,595	2,609	11,810	46,894
Seattle	20,982	32,870	8,689	50,155	13,179	14,868	140,743
St. Louis	10,600	11,786	3,114	14,949	13,086	4,552	58,087
Tampa	3,059	3,357	559	6,843	454	1,702	15,974
Tucson	99	494	144	1,768	81	288	2,874
Washington, DC	27,726	21,947	11,274	93,783	3,776	20,884	179,390
Wilmington	1,461	10,515	647	7,832	8,489	1,491	30,435
Sum of Markets	503,411	1,058,953	211,637	1,289,941	333,464	409,766	3,807,172

Appendix C3 – Zip Code Business Pattern Data (Suburb 1998)

cname	51----	52----	53----	54----	55----	56----	Total
Albuquerque	9,278	12,123	4,924	18,546	8,215	15,516	68,602
Atlanta	78,745	106,470	37,283	145,486	73,057	138,168	579,209
Austin	22,313	22,123	7,221	32,349	5,535	30,485	120,026
Baltimore	21,719	55,691	19,482	75,265	28,248	46,290	246,695
Boston	75,792	87,944	24,584	143,671	56,800	84,851	473,642
Charlotte	16,030	27,424	9,271	30,508	18,210	29,756	131,199
Chicago	70,007	147,725	42,248	162,721	109,462	145,410	677,573
Cincinnati	25,512	42,534	11,106	46,653	29,858	39,913	195,576
Cleveland	14,810	34,457	13,650	32,732	22,964	29,180	147,793
Columbus	22,670	58,147	11,008	36,239	23,713	29,427	181,204
Dallas	88,553	105,067	38,027	121,931	93,736	148,726	596,040
Denver	70,526	76,935	28,020	98,104	33,269	85,331	392,185
Detroit	50,049	76,121	24,946	115,296	63,564	104,331	434,307
Edison	46,616	48,161	8,490	74,309	39,112	39,939	256,627
Fort Lauderdale	14,795	31,397	15,498	31,920	10,040	46,859	150,509
Fort Worth	12,133	27,588	11,667	29,031	14,576	41,920	136,915
Hartford	19,583	47,698	7,617	25,749	10,360	16,883	127,890
Honolulu	7,307	20,067	8,466	15,620	4,691	16,430	72,581
Houston	33,157	61,529	35,456	113,502	67,998	116,184	427,826
Indianapolis	13,717	35,006	10,790	24,688	16,849	27,336	128,386
Jacksonville	17,824	50,833	6,717	21,480	5,622	36,793	139,269
Kansas City	29,305	41,497	12,628	45,910	20,661	30,614	180,615
Las Vegas	7,830	18,973	13,121	21,844	5,697	19,013	86,478
Long Island	24,775	57,415	10,941	51,215	22,256	30,799	197,401
Los Angeles	145,014	150,157	68,822	247,318	71,695	182,380	865,386
Miami	22,328	38,117	19,167	38,827	12,987	46,139	177,565
Minneapolis	26,774	63,825	19,425	63,637	61,754	62,048	297,463
Nashville	15,769	31,255	9,460	24,090	23,494	24,218	128,286
New York	49,732	73,910	24,081	77,818	78,218	49,427	353,186
Newark	26,323	43,542	12,159	70,151	34,393	29,773	216,341
Oakland	36,282	42,693	17,577	55,169	25,545	51,578	228,844
Orange County	35,513	80,442	32,084	92,427	28,318	86,205	354,989
Orlando	22,701	29,538	21,938	41,907	16,106	59,036	191,226
Philadelphia	42,569	97,830	24,719	121,127	59,292	76,725	422,262
Phoenix	34,416	79,924	26,250	80,512	30,203	97,866	349,171
Portland	23,597	37,862	17,305	40,781	29,635	35,591	184,771
Riverside	13,170	18,810	6,841	15,613	10,670	33,899	99,003
Sacramento	27,372	43,253	12,719	33,449	11,577	27,467	155,837
Salt Lake City	13,235	23,273	8,294	20,420	13,072	30,829	109,123
San Diego	40,744	52,515	26,807	82,344	14,284	55,317	272,011
San Francisco	56,338	65,852	22,872	92,158	25,036	45,630	307,886
San Jose	48,571	18,835	13,226	90,721	27,226	58,066	256,645
Seattle	33,675	41,400	23,523	50,676	29,237	42,531	221,042
St. Louis	20,247	42,083	13,846	50,020	29,232	32,410	187,838
Stamford	13,698	36,377	8,591	31,277	23,883	17,059	130,885
Tampa	21,838	54,186	13,819	59,574	20,436	109,297	279,150
Trenton	8,085	7,414	2,043	16,915	7,777	7,037	49,271
Tucson	4,467	7,676	5,963	13,730	1,829	17,844	51,509
Ventura	7,976	10,097	3,403	12,291	2,652	18,036	54,455
Washington, DC	83,083	62,374	38,280	270,557	38,849	78,475	571,618
West Palm Beach	13,536	25,479	10,832	27,962	13,148	40,608	131,565
Wilmington	6,809	19,590	3,422	10,784	5,731	10,836	57,172
Sum of Markets	1,686,908	2,591,234	920,629	3,347,024	1,530,772	2,776,481	12,853,048

Appendix C4 – Zip Code Business Pattern Data (Suburb 2006)

cname	51----	52----	53----	54----	55----	56----	Total
Albuquerque	8,156	16,668	5,603	24,669	9,371	11,424	75,891
Atlanta	90,089	135,058	49,906	192,875	90,407	146,921	705,256
Austin	24,510	29,969	12,256	48,458	7,443	30,949	153,585
Baltimore	23,420	72,016	24,079	97,055	28,631	46,675	291,876
Boston	84,968	106,896	32,642	202,727	75,650	82,820	585,703
Charlotte	17,575	53,390	11,563	37,227	15,177	37,755	172,687
Chicago	70,615	155,715	49,135	194,819	105,553	146,999	722,836
Cincinnati	17,601	60,246	13,041	54,203	33,782	34,596	213,469
Cleveland	13,877	38,515	13,210	46,281	23,640	32,325	167,848
Columbus	24,014	60,840	10,888	46,377	32,962	28,823	203,904
Dallas	87,275	142,201	45,343	150,258	74,206	122,232	621,515
Denver	72,589	82,543	33,986	140,157	45,096	68,675	443,046
Detroit	41,932	75,107	28,002	164,242	76,987	100,278	486,548
Edison	39,214	46,003	11,421	94,487	49,346	42,154	282,625
Fort Lauderdale	20,887	45,272	22,320	44,771	12,414	37,636	183,300
Fort Worth	24,557	40,407	13,772	31,375	16,283	69,503	195,897
Hartford	10,935	50,406	7,393	31,797	12,695	16,110	129,336
Honolulu	8,666	18,701	12,211	20,633	5,516	14,971	80,698
Houston	33,667	80,977	42,094	154,615	78,494	101,372	491,219
Indianapolis	12,667	34,576	13,075	37,041	11,569	38,269	147,197
Jacksonville	14,378	61,197	10,151	36,267	9,842	31,152	162,987
Kansas City	21,570	52,486	14,628	57,381	17,320	32,066	195,451
Las Vegas	10,433	34,662	26,031	43,534	10,800	38,591	164,051
Long Island	26,530	57,570	12,950	65,228	18,229	28,970	209,477
Los Angeles	176,743	175,052	81,809	315,163	71,665	168,966	989,398
Miami	22,293	44,426	26,286	57,972	19,999	35,718	206,694
Minneapolis	24,344	83,549	23,262	77,926	49,145	65,148	323,374
Nashville	19,610	33,307	10,077	39,524	21,036	30,901	154,455
New York	49,745	96,211	28,019	91,389	67,208	57,777	390,349
Newark	25,025	62,322	17,166	85,816	43,204	23,802	257,335
Oakland	33,571	51,684	23,147	77,871	34,142	38,266	258,681
Orange County	40,101	145,008	47,217	132,538	45,338	96,517	506,719
Orlando	29,745	48,704	34,668	69,601	18,349	54,801	255,868
Philadelphia	53,052	125,002	27,598	153,334	54,223	66,980	480,189
Phoenix	41,843	131,666	38,540	105,306	40,729	94,963	453,047
Portland	27,618	43,571	20,954	57,211	36,347	38,536	224,237
Riverside	14,494	27,126	11,589	25,823	10,785	47,474	137,291
Sacramento	30,142	56,653	15,513	49,430	14,300	30,133	196,171
Salt Lake City	19,206	34,249	11,136	33,070	13,338	30,106	141,105
San Diego	38,757	69,235	44,448	134,468	23,961	75,772	386,641
San Francisco	53,909	58,547	24,106	112,289	18,677	28,020	295,548
San Jose	57,447	26,004	18,403	122,701	37,408	38,419	300,382
Seattle	52,206	50,686	24,940	66,018	38,141	49,056	281,047
St. Louis	22,238	50,486	16,366	61,159	35,190	42,595	228,034
Stamford	12,857	53,893	9,383	39,479	17,345	18,809	151,766
Tampa	38,450	80,112	21,681	84,599	23,430	66,364	314,636
Trenton	8,787	16,132	2,465	27,034	14,008	7,069	75,495
Tucson	5,086	10,417	6,861	16,375	3,043	13,025	54,807
Ventura	11,249	22,452	4,894	18,066	4,883	13,575	75,119
Washington, DC	97,438	86,994	50,653	362,246	40,944	83,743	722,018
West Palm Beach	19,204	29,036	18,244	44,233	18,073	29,232	158,022
Wilmington	4,528	23,282	3,780	15,449	7,026	9,866	63,931
Sum of Markets	1,829,813	3,287,227	1,178,905	4,492,567	1,683,350	2,696,899	15,168,761

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