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PPD 631
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Map Projection Group Report

Selection for Ideal Commercial Real Estate Investment in California

Introduction

This project is aimed to use GIS as a tool to select ideal location for investing commercial real estate properties. The analysis specifically focuses on the costs and returns for office building investment and the market potential of 25 major cities in California State. The 25 cities are respectively Los Angeles, San Bernardino, Richmond, Berkeley, Fresno, Oakland, Palm Springs, Palo Alto, Pasadena, Sacramento, Salinas, San Diego, San Francisco, San Jose, San Luis Obispo, San Mateo, San Rafael, Santa Ana, Santa Barbara, Santa Cruz, Santa Rosa, Stockton, Vallejo, and Modesto. Location drives the real estate industry, and GIS is a great tool to conduct the real estate analysis. Location is the origin of geographic data and high accuracy of location increases the value of data (Magotta, 2014). GIS visually shows the location and provides the foundation to conduct further analysis such as researching on common features of the top performing cities in real estate investments. Lots of literatures can be found about the relationship between demographic factors and residential real estate investing, but there are fewer researches on office building investment. This project will provide investors a comprehensive review of an ideal location for office building investments.

Data and Methodology

- Rationale for data collection

To evaluate the investment return of an office building in the target city, we need data of total costs, rent gained after completion of construction, and the relevant demographic factors. More specifically, total costs of constructing an office building include the land cost and construction

cost. Instead of simply analyzing the cost and return of investing an office building for a location, we include the influence of the demographic factors on real estate market as an indicator of potential performance evaluation.

Although cost and return analysis can lead to an explicit result of the best city to invest for constructing an office building, demographic factors play an important role in predicting real estate market. For example, job growth is regarded widely as one of the biggest factors for the investors to consider (Devagno, 2017). If companies in this area are not hiring, there may suffer a high unemployment rate and therefore has a low need for renting office building. It is wise to consider the income trend and employment rate before office investment. Additionally, in the U.S., real estate prices are positively correlated with the total number of population and negatively correlated to the old age dependency ratio in the region (Saita, Shimizu, & Watanabe, 2016). Population growth results partially from other favorable factors such as low unemployment rate, entrepreneurship, affordable living cost, and access to a wide range of industries (Devagno, 2017). These demographic factors impact the rent demand in a region, and high tenant demand may force rents to increase. Thus, we select 7 demographic factors as discussed above that have great impact on office investment to discuss in this project, including average family income, total numbers of employees, white collar employment rate, numbers of establishments, total population, population density, and percentage of education above high school.

- Data Source

We use the basemap provided in the ArcMap as the first layer. All the place shapefiles of California State are imported from the United States Census Bureau (<https://www.census.gov>) to the ArcMap as a second layer. We select the 25 target cities in the attribute table of the place

shapefiles and export the data as a new layer. The original place shapefiles layer is removed. The demographic data is collected from *SimplyAnalytics* and exported to Excel for further processing.

To acquire land cost data, we use *Redfin* (www.redfin.com). *Redfin* provides the actual land cost per square foot which is currently on sale at the open market in each city researched. The construction cost per square foot is collected from the *RSMMeans Data Online*. *RSMMeans* has a comprehensive database in the real estate industry that can provide the latest predictive cost data for selected location. The construction cost is an estimated average cost for each city. *LoopNet* (www.loopnet.com) serves as a good source for us to find the rent per square per year by looking up zip code. All the costs are estimated based on constructing a 11 to 20 floors office building.

- Data Cleaning

To make the costs and rent data usable to create maps, we converted it into the value of cap rate in Excel. Cap rate is a real estate valuation measure, it is calculated as the ratio between the net operating income (NOI) produced by a property and its current market value. The formula for NOI is:

$$\text{NOI} = \text{potential gross rent} - \text{the vacancy allowance} - \text{the operating expenses.}$$

In this project, due to data limitation, we assume the operating expenses are 0. Therefore, NOI is assumed equal to the gross rent minus the vacancy allowance in this case. Using the cost approach to assess the market value of the property, we get the market value is the sum of the land cost and construction cost. Suppose that the total area for the office building to invest is X

square feet, then Cap rate $= \frac{(\text{rent per sq per yr} - \text{vacancy rate}) * X}{(\text{land cost} + \text{construction cost}) * X} = \frac{\text{rent per sq per yr} - \text{vacancy rate}}{\text{land cost} + \text{construction cost}}$

The vacancy rates for 2017 of these cities are collected by Google search and can be seen in table1. The raw data is converted to the same unit (per square foot) for the purpose of calculation and the results of the cap rates for each city are summarized in table 1.

	cap rate	vacancy rate	land cost per sq	Land cost per acres	construction cost per sq	rent per sq per yr
LOS ANGELES	10.12%	14.40%	132.0550928	534408	189.52	38
SAN BERNARDINO	6.46%	12.90%	21.23549518	85937	180.89	15
RICHMOND	5.86%	9.49%	200.288796	810540	201.47	26
BERKELEY	0.82%	10.00%	3896.293657	15767741	208.99	37.2
FRESNO	11.09%	10.40%	24.36681458	98609	185.66	26
OAKLAND	11.01%	5.00%	180.3869286	730000	207.8	45
OXNARD	6.76%	29.00%	36.27951792	146818	184.38	21
PALM SPRINGS	10.73%	14.90%	94.93492235	384188	182.59	35
PALO ALTO	1.68%	11.20%	3598.621866	14563106	204.02	72
PASADENA	6.59%	13.00%	281.0218308	1137255	181.15	35
SACRAMENTO	7.95%	9.20%	72.67789352	294117	189.96	23
SALINAS	14.97%	7.50%	5.71431195	23125	192	32
SAN DIEGO	14.38%	10.70%	35.00074757	141643	182.3	35
SAN FRANCISCO	19.91%	5.70%	135	8750000	220.18	75
SAN JOSE	18.09%	11.00%	46.6969866	188976	209.07	52
SAN LUIS OBISPO	13.76%	5.38%	8.613599392	34858	183.99	28
SAN MATEO	16.36%	11.90%	69.09190023	279605	205.62	51
SAN RAFAEL	6.62%	11.70%	259.4606507	1050000	207.25	35
SANTA ANA	2.87%	12.00%	491.9643282	1990909	181.64	22
SANTA BARBARA	11.90%	5.80%	117.0661745	473750	183.69	38
SANTA CRUZ	10.02%	6.00%	17.7191856	71707	198.08	23
SANTA ROSA	9.74%	11.70%	23.17774101	93796.99	203.42	25
STOCKTON	10.01%	10.60%	44.76437541	181155	187.4	26
VALLEJO	5.71%	7.80%	29.65264579	120000	196.56	14
MODESTO	11.85%	6.20%	27.23422542	110213	186.54	27

Table 1: Cap rate for 25 cities in California

Additionally, an index number is created for processing demographic data. First, each city will be scored according to the 7 demographic categories respectively by calculating the ratio between its distance to the maximum and the data range. Then the 7 demographic factors are assigned by a weighted proportion to generate a single overall score for each city, which combines all the impact of the 7 factors. The proportion assigned to each category is shown in table 2. The overall score is calculated by adding the proportionally weighted score of individual factor. The result of overall score for each city is shown in figure 1.

Average Family Income	White Collar Employment Rate	Total Employees	Total Establishments	Population Density (per sq. mile)	Education above High School (%)	Total Population
15%	15%	20%	10%	20%	10%	10%

Table 2: Weighted proportion of demographic factors

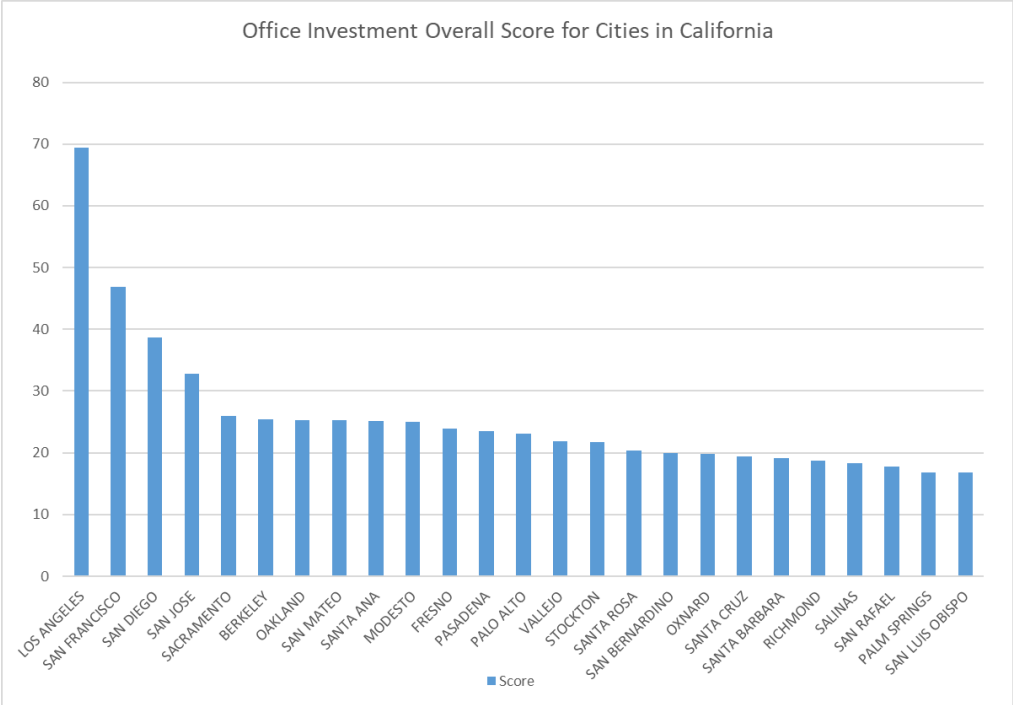


Figure 1: Office investment overall score for cities in California

- Mapping

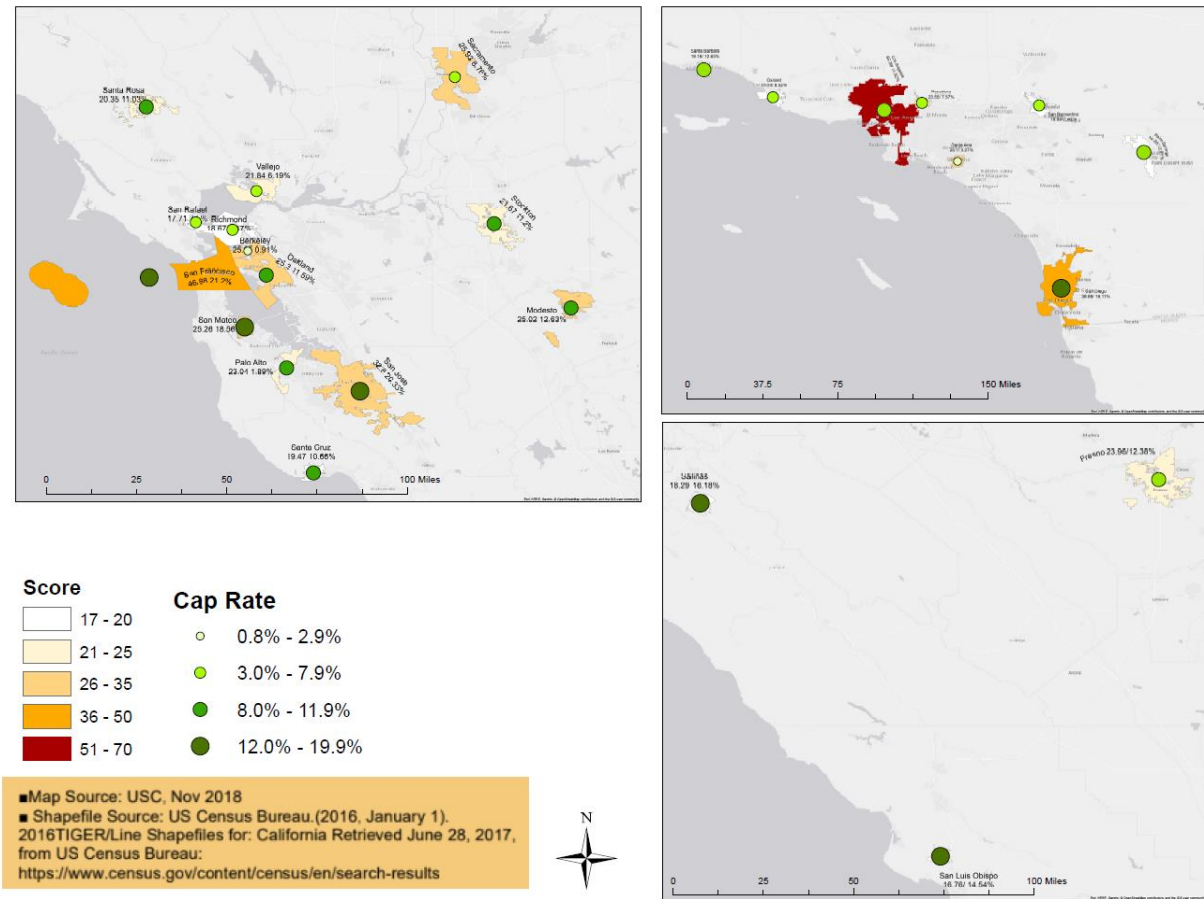
On the shapefiles that have 25 major cities, two fields are added in the attribute table, namely the cap rate and score. Then we join the cleaned data in Excel with the place shapefiles. Having the data in the shapefiles, a thematic map for overall score and cap rate of all the cities is created, using graduated colors based on the score values. The next step is to duplicate the layer so that cap rate value can be presented by graduated symbol on the duplicated layer. To have the two symbology shown on the map, the graduated symbol layer is placed on top of the graduated colors layer.

Limitation

With unlimited time and resources, the analysis could be more accurate. When calculating the net operating income, we assume the operating expenses are 0 for each city because we could not acquire such data for all of the cities. Operating expenses depend largely on the operation of each real estate project. It is difficult to take this factor into account with limited resources. Furthermore, transportation and walkability have large impact on determining real estate value (Willmore, 2011). If the property is located at an area with access to transportation, it is more likely to have higher rent compared to similar properties with inconvenient transportation. Yet in this project, we compare the commercial real estate market among cities. Each city have many submarkets for real estate investment. Real estate prices can be significantly different between submarkets. It may be inaccurate to generalize a situation for all the submarkets for each single city. More specified data is suggested to be collected in the future for better analysis on commercial real estate investment. Last but not least, we developed our own formula when creating the index number due to time limitation, but in order to be more statistically valid, more rigorous approach should be researched.

Analysis and Conclusion

Office Building Investment valuation California



Map 1: Office building investment valuation score and cap rate in California

Cap rate is an assessment of real estate valuation, so higher cap rate value is desirable in this case. Likewise, the scores represent the favorable demographic factors therefore the higher the score is, the better investment outcome is to expect. The results of this study show that the cities with top five cap rate are San Francisco, San Jose, San Mateo, Salinas, and San Diego. As indicated in the Map 1, these five cities have larger and darker green symbols. It can be observed from the map that none of the five cities are scored below 26 (with white or the lightest yellow color). This implicates the potential positive relevance between investment return and demographic factors. Looking at the scores of demographic factors, the top five cities are namely

Los Angeles, San Francisco, San Diego, San Jose, and Sacramento. Among these cities, San Francisco, San Diego, and San Jose all have a cap rate that are over 12.0%. Los Angeles is ranked at the 12th among the 25 cities with a moderate cap rate 10.12%. However, Sacramento has a relatively low cap rate as 7.95%. The divergent ranking of Sacramento between cap rate and demographic score are not expected. By examining the data closely, we think the possible reasons are that Sacramento as state capital gets a relatively high score (25.93) because it has a high white collar employee rates and high education rate but its total population and population density are actually low. Additionally, cities ranking between the 4th and 17th have very close scores, ranging from 20 to 25.93. To be strictly Sacramento are not highly scored.

The three common top cities for cap rate and score evaluation are San Francisco, San Jose, and San Diego. San Francisco and San Diego share the features of coastal cities; and both of San Francisco and San Jose are located closely to Silicon Valley, where lots of information technology companies are established. Office-using industries are often information, financial activities and business services companies (Brown, 2018). This supports the conclusion that San Francisco and San Jose are good choices to invest office buildings. It also implicates that the number of information technology establishments can be an indicator for office building investment.

It is surprised that Los Angeles is a common top 3 city in terms of both cap rate and demographic score. It has the highest score and performs well in all of the 7 demographic aspects. Yet the cap rate for office investment is not standing out in Los Angeles. This may be due to the huge divergence of rent in different submarkets. The data for rent we use is based on a current rent for an office building in the market, which is much lower than the rent in San Francisco. This may lead to a much lower cap rate than San Francisco. As mentioned in the

limitation, we get limited access to more specific data so that the analysis result may be affected.

Future researches focusing on submarkets in a region are suggested.

References

Magotta, J. (2014, November 11). How GIS is Being Used in Real Estate. Retrieved November

19, 2018, from <https://www.gislounge.com/gis-used-real-estate/>

DEVAGNO, K. (2017, March 7). 7 Real Estate Demographic Factors That Determine a

Successful Investment. Retrieved November 12, 2018, from <https://locationinc.com>

Yumi Saita, Chihiro Shimizu, Tsutomu Watanabe, (2016) "Aging and real estate prices: evidence

from Japanese and US regional data", International Journal of Housing Markets and

Analysis, Vol. 9 Issue: 1, pp.66-87, <https://doi.org/10.1108/IJHMA-11-2014-0053>

Willmore, D. (2011, August). Determining the Value of Commercial Real Estate. Retrieved

November 11, 2018, from <http://www.sior.com/docs/default-source/membership->

[docs/How to Value Comm Real Estate- Willmore.pdf?sfvrsn=ca4fb7b1_0](http://www.sior.com/docs/default-source/membership-docs/How to Value Comm Real Estate- Willmore.pdf?sfvrsn=ca4fb7b1_0)

Brown, L. (2018, September 04). Coworking Space May Triple From Current Share. Retrieved

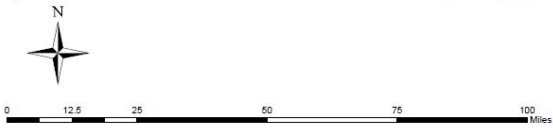
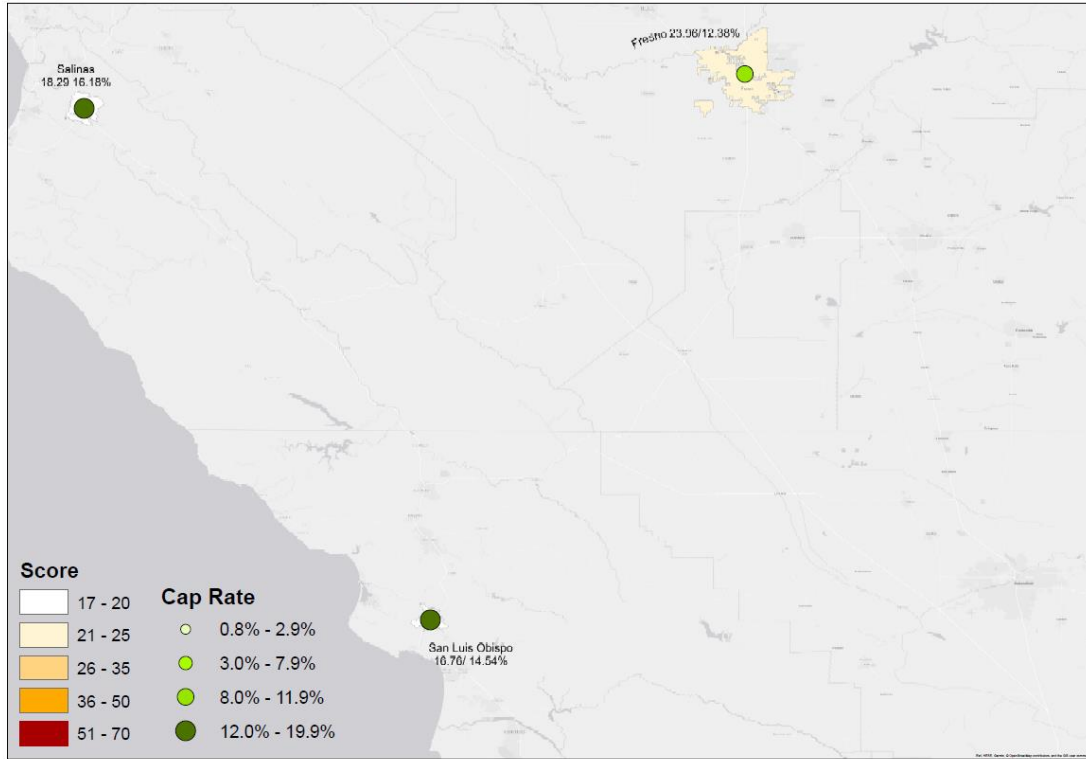
November 10, 2018, from <https://www.globest.com/2018/09/04/coworking-space-may->

[triple-from-current-share/?kw=Coworking Space May Triple From](https://www.globest.com/2018/09/04/coworking-space-may-triple-from-current-share/?kw=Coworking Space May Triple From)

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Appendix

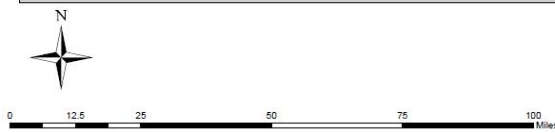
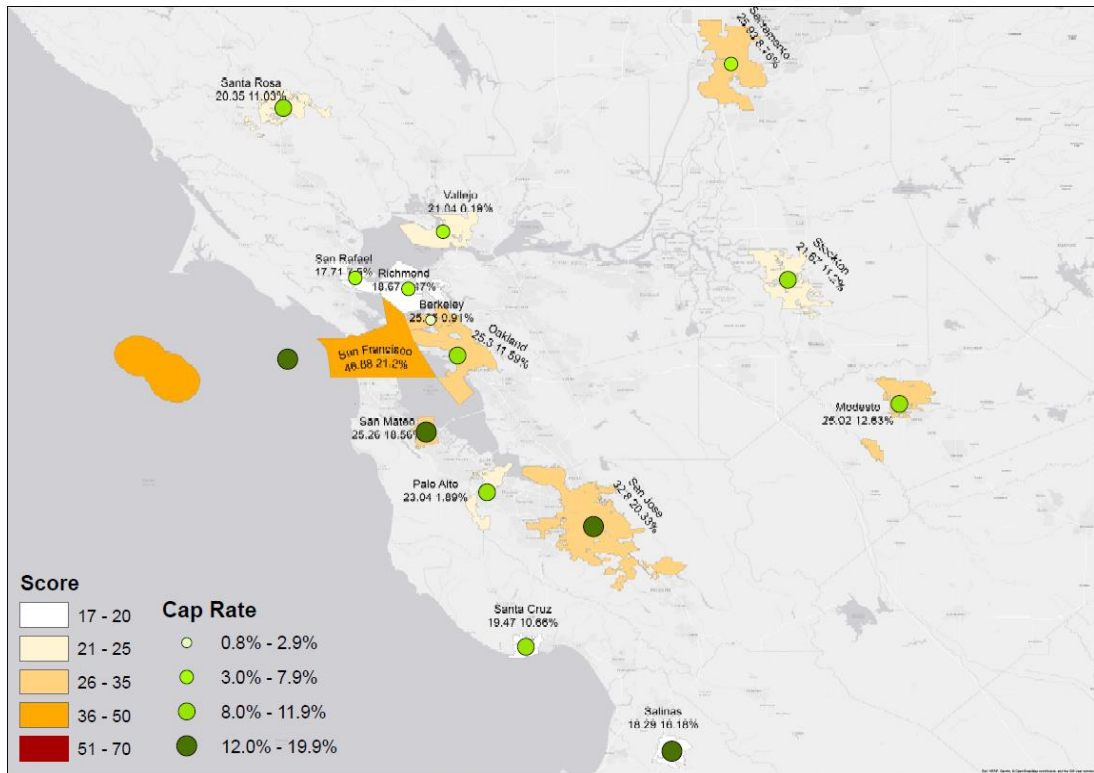
Office Building Investment valuation California



San Luis Obispo & Fresno

Map Source: USC, Nov 2018
Shapefile Source: US Census Bureau, (2016, January 1).
2016TIGER/Line Shapefiles for: California Retrieved June 28, 2017,
from US Census Bureau:
<https://www.census.gov/content/census/en/search-results>

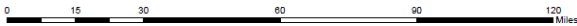
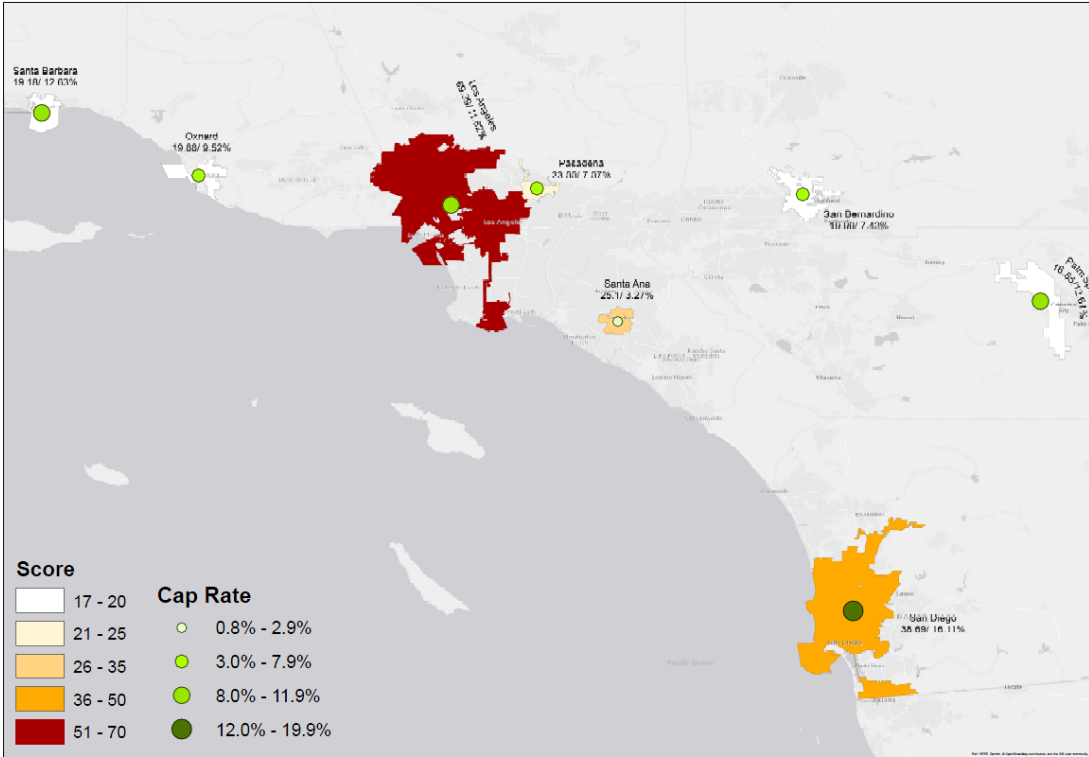
Office Building Investment valuation California



North California

■ Map Source: USC, Nov 2018
 ■ Shapefile Source: US Census Bureau.(2016, January 1).
 2016TIGER/Line Shapefiles for: California Retrieved June 28, 2017,
 from US Census Bureau:
<https://www.census.gov/content/census/en/search-results>

Office Building Investment valuation California



South California

■ Map Source: USC, Nov 2018
 ■ Shapefile Source: US Census Bureau (2016, January 1).
 2016TIGER/Line Shapefiles for California Retrieved June 28, 2017,
 from US Census Bureau:
<https://www.census.gov/content/census/en/search-results>