

# US Median Rent Data (2010 - 2017)

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# Introduction/Analysis Goals

- **Dataset used:** Zillow Rent Index, 2010-Present from Kaggle
- Uncover patterns in the US rental market
- Analyze 4 major states in the 4 regions
- Compare median rent data from the data of years 2010-2017

# Research Questions & Hypotheses:

## Questions:

- How did the median rent price in the states (NY, CA, IL, TX) change across time (2011-2016) compared to the US as a whole?
- Which of the US states (NY, CA, IL, TX) had the greatest change in median rent price?

## Hypotheses:

- **Null hypothesis:** There is no significant statistical difference in rent across US states/regions.
- **Hypothesis:** New York had the most significant difference in rent compared to the rest of the US.



# Limitations

- Not enough data in years 2010 and 2017 to include them
- Limited to 2011-2016 data
- Had to remove NYC from data for NY because it had too much missing data
  - In hindsight we should have excluded it in general since 43% of NY's population lives in NYC
- Prices not adjusted for inflation now, only up to 2017

# Major Findings

|       | 2011    | 2012    | 2013    | 2014   | 2015    | 2016    | Rent Change (%) |
|-------|---------|---------|---------|--------|---------|---------|-----------------|
| State |         |         |         |        |         |         |                 |
| TX    | 1182.50 | 1166.50 | 1200.50 | 1224.5 | 1310.50 | 1336.00 | 12.98           |
| CA    | 1717.75 | 1701.50 | 1759.75 | 1792.0 | 1951.50 | 2098.00 | 22.14           |
| IL    | 1399.50 | 1347.25 | 1363.75 | 1390.0 | 1412.25 | 1414.75 | 1.09            |
| NY    | 1398.00 | 1413.50 | 1408.50 | 1370.5 | 1433.00 | 1388.00 | -0.72           |
| US    | 1215.50 | 1206.00 | 1222.50 | 1233.0 | 1290.50 | 1306.50 | 7.49            |

- The US's median rent prices had an increase of about 7.5% between 2011-2016
- 3 out of the 4 states we selected had an increase in rent between 2011 - 2016.
  - CA had the largest increase and standard deviation in rent between 2011-2016
  - TX also exhibited substantial increase compared to the US but not as high as CA
  - IL experienced tempered rate of escalation
- NY's median rent prices witnessed a decline of .72%

# Dataset

|   | City Code | City         | Metro        | County       | State | Population Rank | November 2010 | December 2010 | January 2011 | February 2011 | ... | April 2016 | May 2016 | June 2016 | July 2016 |
|---|-----------|--------------|--------------|--------------|-------|-----------------|---------------|---------------|--------------|---------------|-----|------------|----------|-----------|-----------|
| 0 | 6181      | New York     | New York     | Queens       | NY    | 1               | NaN           | NaN           | NaN          | NaN           | ... | 2334       | 2339     | 2345      | 2349      |
| 1 | 12447     | Los Angeles  | Los Angeles  | Los Angeles  | CA    | 2               | 2184.0        | 2184.0        | 2183.0       | 2188.0        | ... | 2637       | 2662     | 2687      | 2700      |
| 2 | 17426     | Chicago      | Chicago      | Cook         | IL    | 3               | 1563.0        | 1555.0        | 1547.0       | 1537.0        | ... | 1684       | 1686     | 1687      | 1688      |
| 3 | 39051     | Houston      | Houston      | Harris       | TX    | 4               | 1198.0        | 1199.0        | 1199.0       | 1200.0        | ... | 1444       | 1446     | 1446      | 1447      |
| 4 | 13271     | Philadelphia | Philadelphia | Philadelphia | PA    | 5               | 1092.0        | 1099.0        | 1094.0       | 1087.0        | ... | 1206       | 1211     | 1218      | 1220      |

Initial dataset: Median rental prices spanning various U.S. cities, encompassing the period from November 2010 to January 2017.

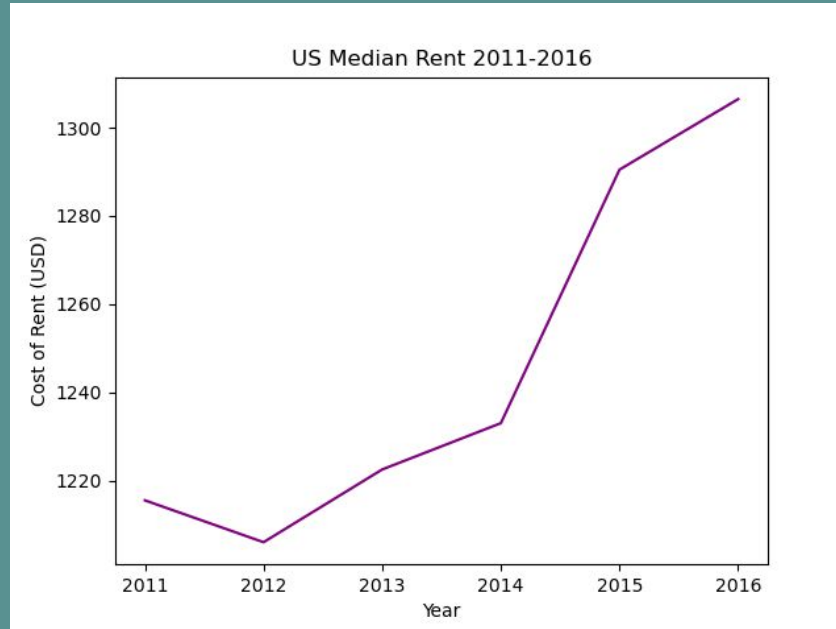


# Data/Method

- Clean data
  - Remove unwanted columns & missing values
- Group and organize into new datasets
  - By state (TX, CA, IL, NY) and year
- Calculation
  - US median rent price dataframe (index)
  - Percent change
- Graphs
  - Line & bar, box plot, histogram, and scatter plots
- Statistical analysis
  - Draw conclusions about the data

|       | 2011    | 2012    | 2013    | 2014   | 2015    | 2016    | Rent Change (%) |
|-------|---------|---------|---------|--------|---------|---------|-----------------|
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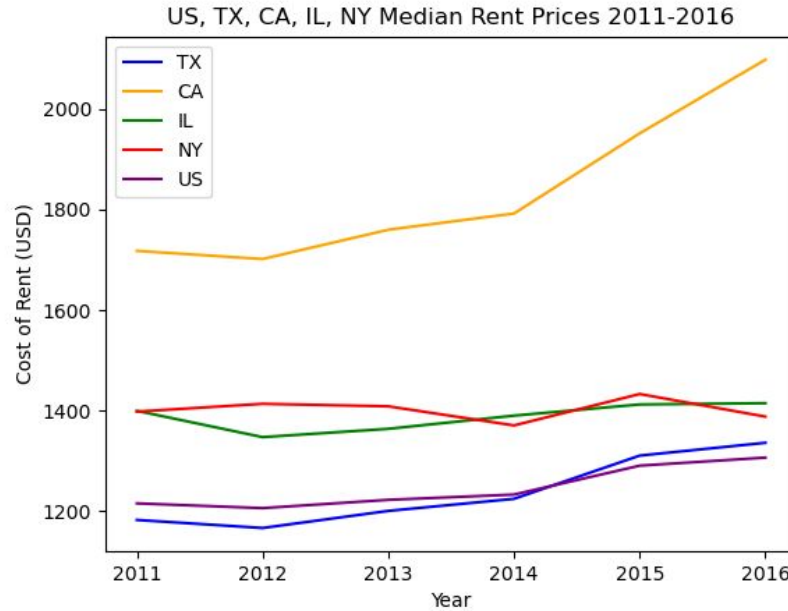
# How US Median Rent Changed



This graphical representation portrays the progressive escalation of rental costs over a span of six years, encompassing the entirety of the United States.

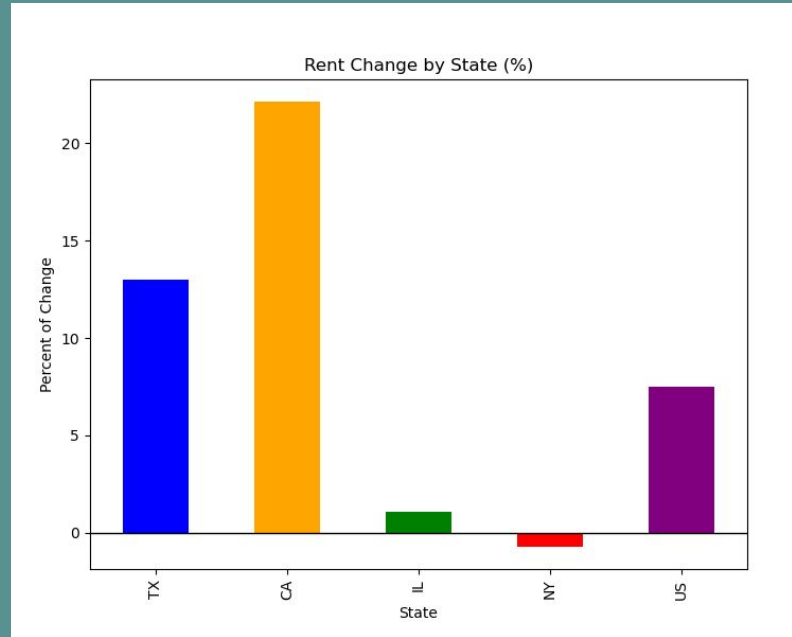


# How Each State's Median Rent Changed



This graph elegantly illustrates the dynamic shift in median rental rates among the specifically chosen states, juxtaposed against the national average. Remarkably, every state exhibited an upward trajectory in rental costs during this period, with the notable exception of New York.

# How Much Did Each State Increase/Decrease



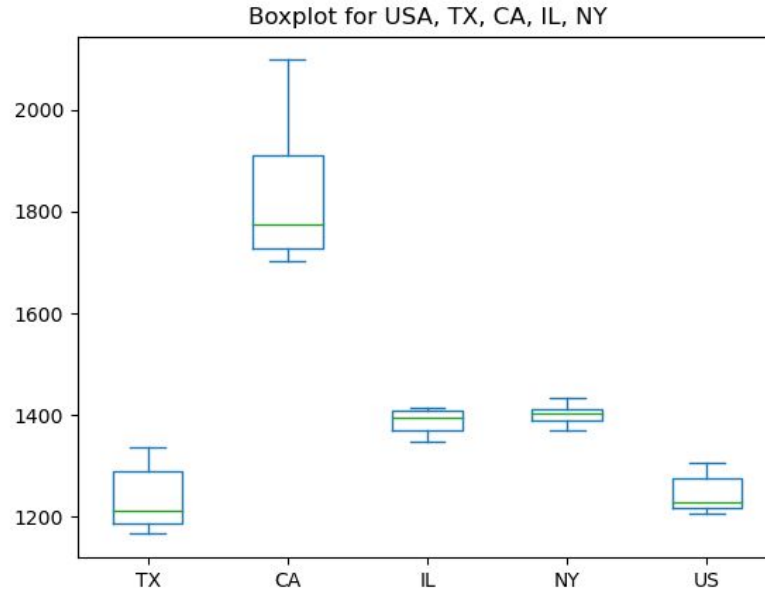
Texas and California exhibited more substantial increase compared to the United States trend. Conversely, Illinois experienced tempered rate of escalation, while New York even witnessed a decline.

# Summary Statistics

- CA has the most expensive rent price
  - Rent varies the most
- TX has the cheapest rent price
  - Most similar price to index
- NY has the most uniform prices

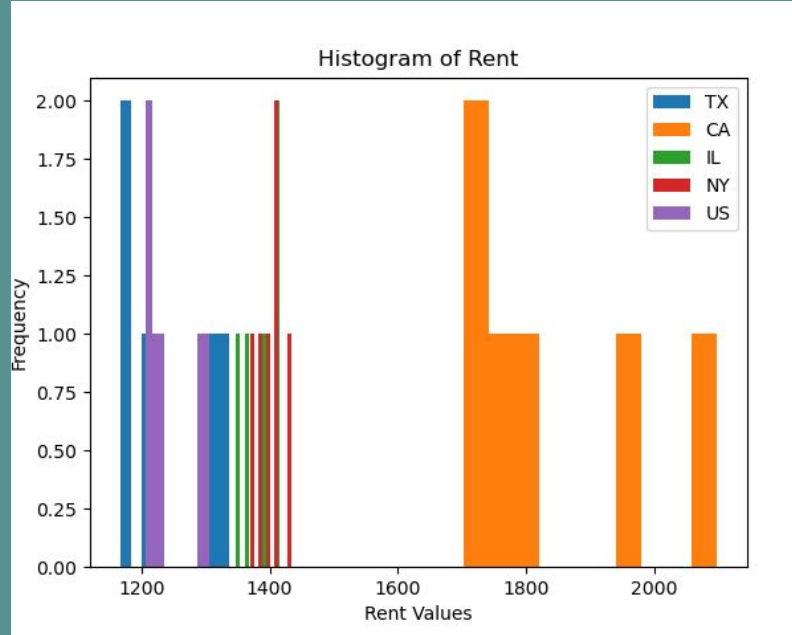
| State | TX         | CA          | IL          | NY          | US          |
|-------|------------|-------------|-------------|-------------|-------------|
| count | 6.00000    | 6.000000    | 6.000000    | 6.000000    | 6.000000    |
| mean  | 1236.75000 | 1836.750000 | 1387.916667 | 1401.916667 | 1245.666667 |
| std   | 70.18814   | 156.079627  | 27.160480   | 21.631959   | 42.169499   |
| min   | 1166.50000 | 1701.500000 | 1347.250000 | 1370.500000 | 1206.000000 |
| 25%   | 1187.00000 | 1728.250000 | 1370.312500 | 1390.500000 | 1217.250000 |
| 50%   | 1212.50000 | 1775.875000 | 1394.750000 | 1403.250000 | 1227.750000 |
| 75%   | 1289.00000 | 1911.625000 | 1409.062500 | 1412.250000 | 1276.125000 |
| max   | 1336.00000 | 2098.000000 | 1414.750000 | 1433.000000 | 1306.500000 |

# How Does the Spread of Rent Look



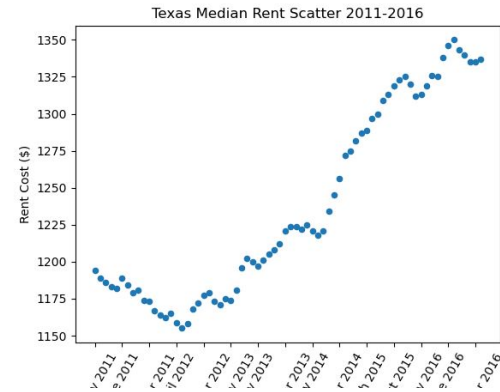
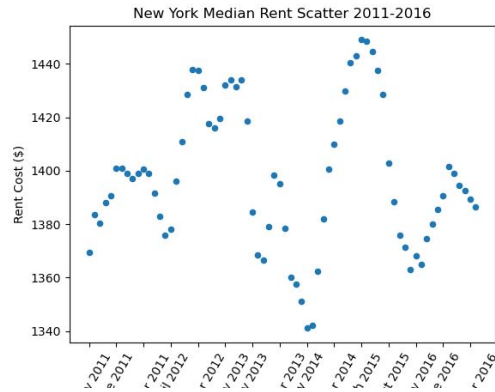
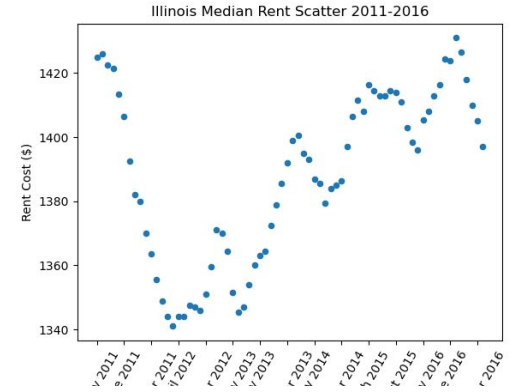
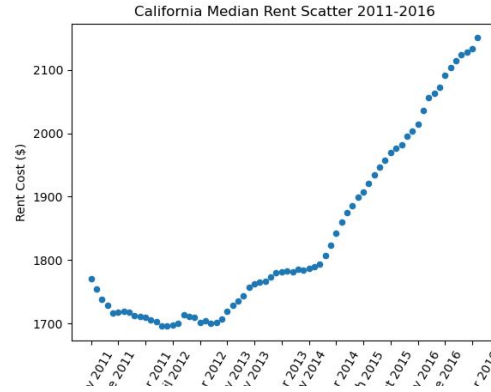
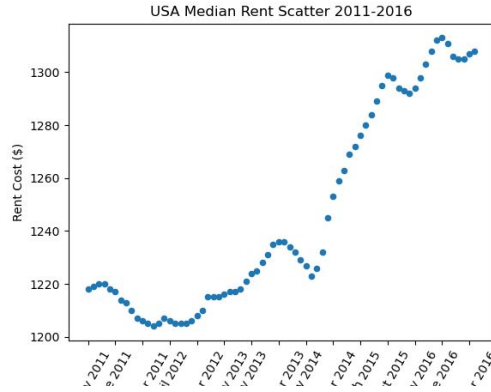
Within this dataset, outliers are conspicuously absent, signifying a notable uniformity in the observations. Additionally, it becomes apparent that California, distinguished by the largest Interquartile Ranges (IQRs) among all states, emerges as a distinctive outlier in terms of data distribution.

# How Frequent Rent Prices Are



This histogram represents the data distribution of the data by state and year. It shows how CA has a skewed distribution to the right compared to the rest of the states compared to.

# How Rent and Time Correlate





# Chi-Square Test

Critical Value = 11.07

Chi Sq. Stat = CA: 0.13 , NY: -5.82, IL: -2.92,  
TX: -0.07

P-Values ~ 1.0

|             | 2011    | 2012   | 2013    | 2014   | 2015   | 2016   |
|-------------|---------|--------|---------|--------|--------|--------|
| CA Observed | 1717.75 | 1701.5 | 1759.75 | 1792.0 | 1951.5 | 2098.0 |
| Expected    | 1215.50 | 1206.0 | 1222.50 | 1233.0 | 1290.5 | 1306.5 |

|             | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   |
|-------------|--------|--------|--------|--------|--------|--------|
| NY Observed | 1398.0 | 1413.5 | 1408.5 | 1370.5 | 1433.0 | 1388.0 |
| Expected    | 1215.5 | 1206.0 | 1222.5 | 1233.0 | 1290.5 | 1306.5 |

|             | 2011   | 2012    | 2013    | 2014   | 2015    | 2016    |
|-------------|--------|---------|---------|--------|---------|---------|
| IL Observed | 1399.5 | 1347.25 | 1363.75 | 1390.0 | 1412.25 | 1414.75 |
| Expected    | 1215.5 | 1206.00 | 1222.50 | 1233.0 | 1290.50 | 1306.50 |

|             | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   |
|-------------|--------|--------|--------|--------|--------|--------|
| TX Observed | 1182.5 | 1166.5 | 1200.5 | 1224.5 | 1310.5 | 1336.0 |
| Expected    | 1215.5 | 1206.0 | 1222.5 | 1233.0 | 1290.5 | 1306.5 |



# Conclusions

## Questions:

How did the median rent price in the states (NY, CA, IL, TX) change across time (2011-2016) compared to the US as a whole?

- CA and TX had higher increases
- IL had a small increase
- NY surprisingly had a decrease

Which of the US states (NY, CA, IL, TX) had the greatest change in median rent price?

- CA

## Hypotheses:

**Null hypothesis:** There is no significant statistical difference in rent across US states/regions.

- Rejected.

**Hypothesis:** New York had the most significant difference in rent compared to the rest of the US.

- Disproven with the data used but still unclear due to missing data from NYC.





# Reference Citations

Landup, D. (n.d.) Change Tick Frequency in Matplotlib. StackAbuse.  
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# Acknowledgements

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**Thank you!**

