

# Assignment 4

August 17, 2017

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You are currently looking at **version 1.1** of this notebook. To download notebooks and datafiles, as well as get help on Jupyter notebooks in the Coursera platform, visit the [Jupyter Notebook FAQ](#) course resource.

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```
In [2]: import pandas as pd
import numpy as np
from scipy.stats import ttest_ind
```

## 1 Assignment 4 - Hypothesis Testing

This assignment requires more individual learning than previous assignments - you are encouraged to check out the [pandas documentation](#) to find functions or methods you might not have used yet, or ask questions on [Stack Overflow](#) and tag them as pandas and python related. And of course, the discussion forums are open for interaction with your peers and the course staff.

Definitions: \* A *quarter* is a specific three month period, Q1 is January through March, Q2 is April through June, Q3 is July through September, Q4 is October through December. \* A *recession* is defined as starting with two consecutive quarters of GDP decline, and ending with two consecutive quarters of GDP growth. \* A *recession bottom* is the quarter within a recession which had the lowest GDP. \* A *university town* is a city which has a high percentage of university students compared to the total population of the city.

**Hypothesis:** University towns have their mean housing prices less effected by recessions. Run a t-test to compare the ratio of the mean price of houses in university towns the quarter before the recession starts compared to the recession bottom. (price\_ratio=quarter\_before\_recession/recession\_bottom)

The following data files are available for this assignment: \* From the [Zillow research data site](#) there is housing data for the United States. In particular the datafile for [all homes at a city level](#), `City_Zhvi_AllHomes.csv`, has median home sale prices at a fine grained level. \* From the Wikipedia page on college towns is a list of [university towns in the United States](#) which has been copy and pasted into the file `university_towns.txt`. \* From Bureau of Economic Analysis, US Department of Commerce, the [GDP over time](#) of the United States in current dollars (use the chained value in 2009 dollars), in quarterly intervals, in the file `gdplev.xls`. For this assignment, only look at GDP data from the first quarter of 2000 onward.

Each function in this assignment below is worth 10%, with the exception of `run_ttest()`, which is worth 50%.

```
In [3]: # Use this dictionary to map state names to two letter acronyms
states = {'OH': 'Ohio', 'KY': 'Kentucky', 'AS': 'American Samoa', 'NV': 'Ne
```

```
In [4]: def get_list_of_university_towns():
    '''Returns a DataFrame of towns and the states they are in from the
    university_towns.txt list. The format of the DataFrame should be:
    DataFrame( [ ["Michigan", "Ann Arbor"], ["Michigan", "Yipsilanti"] ],
    columns=["State", "RegionName"] )
```

*The following cleaning needs to be done:*

- 1. For "State", removing characters from "[" to the end.*
- 2. For "RegionName", when applicable, removing every character from "*
- 3. Depending on how you read the data, you may need to remove newline c*

```
state = None
town = None
state_town = []
with open('university_towns.txt') as file :
    for line in file:
        line = line[:-1]
        if line[-6:] == '[edit]' :
            state = line[:-6]
            continue # this will return the control to the next iteration
        if '(' in line :
            town = line[(line.index('(')-1)]
            state_town.append([state, town])
        else :
            town = line
            state_town.append([state,town])
df = pd.DataFrame(state_town,columns=['State','RegionName'])
return df
```

```
get_list_of_university_towns ()
```

```
Out[4]:
```

	State	RegionName
0	Alabama	Auburn
1	Alabama	Auburn
2	Alabama	Florence
3	Alabama	Florence
4	Alabama	Jacksonville
5	Alabama	Jacksonville
6	Alabama	Livingston
7	Alabama	Livingston
8	Alabama	Montevallo
9	Alabama	Montevallo
10	Alabama	Troy
11	Alabama	Troy

12	Alabama	Tuscaloosa
13	Alabama	Tuscaloosa
14	Alabama	Tuskegee
15	Alabama	Tuskegee
16	Alaska	Fairbanks
17	Alaska	Fairbanks
18	Arizona	Flagstaff
19	Arizona	Flagstaff
20	Arizona	Tempe
21	Arizona	Tempe
22	Arizona	Tucson
23	Arizona	Tucson
24	Arkansas	Arkadelphia
25	Arkansas	Arkadelphia
26	Arkansas	Conway
27	Arkansas	Conway
28	Arkansas	Fayetteville
29	Arkansas	Fayetteville
...	...	...
1000	West Virginia	West Liberty
1001	West Virginia	West Liberty
1002	Wisconsin	Appleton
1003	Wisconsin	Appleton
1004	Wisconsin	Eau Claire
1005	Wisconsin	Eau Claire
1006	Wisconsin	Green Bay
1007	Wisconsin	Green Bay
1008	Wisconsin	La Crosse
1009	Wisconsin	La Crosse
1010	Wisconsin	Madison
1011	Wisconsin	Madison
1012	Wisconsin	Menomonie
1013	Wisconsin	Menomonie
1014	Wisconsin	Milwaukee
1015	Wisconsin	Milwaukee
1016	Wisconsin	Oshkosh
1017	Wisconsin	Oshkosh
1018	Wisconsin	Platteville
1019	Wisconsin	Platteville
1020	Wisconsin	River Falls
1021	Wisconsin	River Falls
1022	Wisconsin	Stevens Point
1023	Wisconsin	Stevens Point
1024	Wisconsin	Waukesha
1025	Wisconsin	Waukesha
1026	Wisconsin	Whitewater
1027	Wisconsin	Whitewater
1028	Wyoming	Laramie

1029 Wyoming Laramie

[1030 rows x 2 columns]

```
In [5]: def get_recession_start():
        '''Returns the year and quarter of the recession start time as a
        string value in a format such as 2005q3'''
        gdp_qtr = pd.read_excel(open('gdplev.xls','rb'), sheetname=0, skiprows=
        gdp_qtr.drop([0,1,2,3,7],axis=1,inplace=True)
        for i in range(len(gdp_qtr)-2):
            if int(gdp_qtr.iloc[i][4][:4]) < 2000 :
                continue
            if (gdp_qtr.iloc[i][6] > gdp_qtr.iloc[i+1][6]) and (gdp_qtr.iloc[i+1]
                return gdp_qtr.iloc[i+1][4]

        get_recession_start()
```

Out[5]: '2008q3'

```
In [6]: def get_recession_end():
        '''Returns the year and quarter of the recession end time as a
        string value in a format such as 2005q3'''
        start = get_recession_start()
        gdp_qtr = pd.read_excel(open('gdplev.xls','rb'), sheetname=0, skiprows=
        gdp_qtr.drop([0,1,2,3,7],axis=1,inplace=True)
        for i in range(2,len(gdp_qtr)):
            if int(gdp_qtr.iloc[i][4][:4]) < int(start[:4]) :
                continue
            if (gdp_qtr.iloc[i][6] > gdp_qtr.iloc[i-1][6]) and (gdp_qtr.iloc[i-1]
                return gdp_qtr.iloc[i][4]

        get_recession_end()
```

Out[6]: '2009q4'

```
In [7]: def get_recession_bottom():
        '''Returns the year and quarter of the recession bottom time as a
        string value in a format such as 2005q3'''
        gdp_qtr = pd.read_excel(open('gdplev.xls','rb'), sheetname=0, skiprows=
        gdp_qtr.drop([0,1,2,3,7],axis=1,inplace=True)
        start = get_recession_start()
        end = get_recession_end()
        start = gdp_qtr[gdp_qtr[4]==start].index.tolist()[0]
        end = gdp_qtr[gdp_qtr[4]==end].index.tolist()[0]
        new_df = gdp_qtr.iloc[start:(end+1),:]
        result = new_df[6].min()
        result = new_df[new_df[6]==result].index.tolist()[0]
        return gdp_qtr.iloc[result][4]

        get_recession_bottom()
```

Out[7]: '2009q2'

```
In [8]: def convert_housing_data_to_quarters():
        '''Converts the housing data to quarters and returns it as mean
        values in a dataframe. This dataframe should be a dataframe with
        columns for 2000q1 through 2016q3, and should have a multi-index
        in the shape of ["State", "RegionName"].

        Note: Quarters are defined in the assignment description, they are
        not arbitrary three month periods.

        The resulting dataframe should have 67 columns, and 10,730 rows.
        '''
        house_data = pd.read_csv('City_Zhvi_AllHomes.csv')
        for names in house_data.columns:
            if '19' in names :
                house_data.drop([names],axis=1,inplace=True)
        house_data.drop(['RegionID', 'Metro', 'CountyName', 'SizeRank'],axis=1,inplace=True)
        house_data['State'] = house_data['State'].map(states)
        result = pd.DataFrame(house_data[['State', 'RegionName']])
        for year in range(2000,2017):
            result[str(year)+'q1'] = house_data[[str(year)+'-01',str(year)+'-02',str(year)+'-03']
            result[str(year)+'q2'] = house_data[[str(year)+'-04',str(year)+'-05',str(year)+'-06']
            if year != 2016 :
                result[str(year)+'q3'] = house_data[[str(year)+'-07',str(year)+'-08',str(year)+'-09']
                result[str(year)+'q4'] = house_data[[str(year)+'-10',str(year)+'-11',str(year)+'-12']
            else :
                result[str(year)+'q3'] = house_data[[str(year)+'-07',str(year)+'-08',str(year)+'-09']
        result = result.set_index(['State', 'RegionName'])
        return result

convert_housing_data_to_quarters()
```

Out[8]:

		2000q1	2000q2	\
State	RegionName			
New York	New York	NaN	NaN	
California	Los Angeles	2.070667e+05	2.144667e+05	
Illinois	Chicago	1.384000e+05	1.436333e+05	
Pennsylvania	Philadelphia	5.300000e+04	5.363333e+04	
Arizona	Phoenix	1.118333e+05	1.143667e+05	
Nevada	Las Vegas	1.326000e+05	1.343667e+05	
California	San Diego	2.229000e+05	2.343667e+05	
Texas	Dallas	8.446667e+04	8.386667e+04	
California	San Jose	3.742667e+05	4.065667e+05	
Florida	Jacksonville	8.860000e+04	8.970000e+04	
California	San Francisco	4.305000e+05	4.644667e+05	
Texas	Austin	1.429667e+05	1.452667e+05	
Michigan	Detroit	6.616667e+04	6.830000e+04	

Ohio	Columbus	9.436667e+04	9.583333e+04
Tennessee	Memphis	7.250000e+04	7.320000e+04
North Carolina	Charlotte	1.269333e+05	1.283667e+05
Texas	El Paso	7.626667e+04	7.686667e+04
Massachusetts	Boston	2.069333e+05	2.191667e+05
Washington	Seattle	2.486000e+05	2.556000e+05
Maryland	Baltimore	5.966667e+04	5.950000e+04
Colorado	Denver	1.622333e+05	1.678333e+05
District of Columbia	Washington	1.377667e+05	1.442000e+05
Tennessee	Nashville	1.138333e+05	1.152667e+05
Wisconsin	Milwaukee	7.803333e+04	7.906667e+04
Arizona	Tucson	1.018333e+05	1.029667e+05
Oregon	Portland	1.528000e+05	1.547667e+05
Oklahoma	Oklahoma City	7.643333e+04	7.750000e+04
Nebraska	Omaha	1.128000e+05	1.141000e+05
New Mexico	Albuquerque	1.258667e+05	1.267000e+05
California	Fresno	9.410000e+04	9.526667e+04
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.556667e+05	1.551667e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.060667e+05	1.043333e+05
Colorado	Bennett	1.329000e+05	1.358333e+05
New Hampshire	East Hampstead	1.618333e+05	1.691000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	5.716667e+04	6.433333e+04
Wisconsin	Oostburg	1.072667e+05	1.081000e+05
California	Twin Peaks	9.736667e+04	1.001667e+05
New York	Upper Brookville	1.230967e+06	1.230967e+06
Hawaii	Volcano	9.870000e+04	1.053667e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.591667e+05	1.613000e+05
Arkansas	Decatur	6.360000e+04	6.440000e+04
Tennessee	Briceville	4.000000e+04	4.173333e+04
Indiana	Edgewood	9.170000e+04	9.186667e+04
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.480667e+05	1.476000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.135333e+05	1.144000e+05
Missouri	Bois D Arc	1.078000e+05	1.069667e+05
Virginia	Henrico	1.285667e+05	1.307667e+05
New Jersey	Diamond Beach	1.739667e+05	1.831000e+05
Tennessee	Gruetli Laager	3.540000e+04	3.546667e+04
Wisconsin	Town of Wrightstown	1.017667e+05	1.054000e+05
New York	Urbana	7.920000e+04	8.166667e+04
Wisconsin	New Denmark	1.145667e+05	1.192667e+05
California	Angels	1.510000e+05	1.559000e+05
Wisconsin	Holland	1.510333e+05	1.505000e+05

State	RegionName	2000q3	2000q4 \
New York	New York	NaN	NaN
California	Los Angeles	2.209667e+05	2.261667e+05
Illinois	Chicago	1.478667e+05	1.521333e+05
Pennsylvania	Philadelphia	5.413333e+04	5.470000e+04
Arizona	Phoenix	1.160000e+05	1.174000e+05
Nevada	Las Vegas	1.354000e+05	1.370000e+05
California	San Diego	2.454333e+05	2.560333e+05
Texas	Dallas	8.486667e+04	8.783333e+04
California	San Jose	4.318667e+05	4.555000e+05
Florida	Jacksonville	9.170000e+04	9.310000e+04
California	San Francisco	4.835333e+05	4.930000e+05
Texas	Austin	1.494667e+05	1.557333e+05
Michigan	Detroit	6.676667e+04	6.703333e+04
Ohio	Columbus	9.713333e+04	9.826667e+04
Tennessee	Memphis	7.386667e+04	7.400000e+04
North Carolina	Charlotte	1.302000e+05	1.315667e+05
Texas	El Paso	7.673333e+04	7.730000e+04
Massachusetts	Boston	2.331000e+05	2.425000e+05
Washington	Seattle	2.625333e+05	2.674000e+05
Maryland	Baltimore	5.883333e+04	5.950000e+04
Colorado	Denver	1.743333e+05	1.803333e+05
District of Columbia	Washington	1.487000e+05	1.477000e+05
Tennessee	Nashville	1.158667e+05	1.169333e+05
Wisconsin	Milwaukee	8.103333e+04	8.233333e+04
Arizona	Tucson	1.044667e+05	1.056667e+05
Oregon	Portland	1.565667e+05	1.574667e+05
Oklahoma	Oklahoma City	7.856667e+04	7.916667e+04
Nebraska	Omaha	1.167333e+05	1.189000e+05
New Mexico	Albuquerque	1.264333e+05	1.267333e+05
California	Fresno	9.646667e+04	9.823333e+04
...	...	...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.584667e+05	1.637000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.019000e+05	1.041667e+05
Colorado	Bennett	1.398000e+05	1.446667e+05
New Hampshire	East Hampstead	1.739667e+05	1.805000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.783333e+04	6.900000e+04
Wisconsin	Oostburg	1.124333e+05	1.155000e+05
California	Twin Peaks	1.013333e+05	1.017000e+05
New York	Upper Brookville	1.237700e+06	1.261567e+06
Hawaii	Volcano	1.146667e+05	1.247667e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.643000e+05	1.662000e+05

Arkansas	Decatur	6.566667e+04	6.673333e+04
Tennessee	Briceville	4.366667e+04	4.490000e+04
Indiana	Edgewood	9.293333e+04	9.490000e+04
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.572333e+05	1.633667e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.141667e+05	1.111333e+05
Missouri	Bois D Arc	1.071000e+05	1.081000e+05
Virginia	Henrico	1.322667e+05	1.332667e+05
New Jersey	Diamond Beach	1.889667e+05	1.931333e+05
Tennessee	Gruetli Laager	3.666667e+04	3.730000e+04
Wisconsin	Town of Wrightstown	1.113667e+05	1.148667e+05
New York	Urbana	9.170000e+04	9.836667e+04
Wisconsin	New Denmark	1.260667e+05	1.319667e+05
California	Angels	1.581000e+05	1.674667e+05
Wisconsin	Holland	1.532333e+05	1.558333e+05

State	RegionName	2001q1	2001q2	\
New York	New York	NaN	NaN	
California	Los Angeles	2.330000e+05	2.391000e+05	
Illinois	Chicago	1.569333e+05	1.618000e+05	
Pennsylvania	Philadelphia	5.533333e+04	5.553333e+04	
Arizona	Phoenix	1.196000e+05	1.215667e+05	
Nevada	Las Vegas	1.395333e+05	1.417333e+05	
California	San Diego	2.672000e+05	2.762667e+05	
Texas	Dallas	8.973333e+04	8.930000e+04	
California	San Jose	4.706667e+05	4.702000e+05	
Florida	Jacksonville	9.440000e+04	9.560000e+04	
California	San Francisco	4.940667e+05	4.961333e+05	
Texas	Austin	1.612333e+05	1.607333e+05	
Michigan	Detroit	6.750000e+04	6.836667e+04	
Ohio	Columbus	9.940000e+04	1.002667e+05	
Tennessee	Memphis	7.416667e+04	7.493333e+04	
North Carolina	Charlotte	1.329333e+05	1.332000e+05	
Texas	El Paso	7.823333e+04	7.830000e+04	
Massachusetts	Boston	2.496000e+05	2.570667e+05	
Washington	Seattle	2.710000e+05	2.724333e+05	
Maryland	Baltimore	5.956667e+04	6.013333e+04	
Colorado	Denver	1.865000e+05	1.925333e+05	
District of Columbia	Washington	1.497667e+05	1.551333e+05	
Tennessee	Nashville	1.180333e+05	1.191667e+05	
Wisconsin	Milwaukee	8.403333e+04	8.556667e+04	
Arizona	Tucson	1.072000e+05	1.087667e+05	
Oregon	Portland	1.599000e+05	1.618000e+05	
Oklahoma	Oklahoma City	7.983333e+04	8.040000e+04	
Nebraska	Omaha	1.208667e+05	1.197667e+05	
New Mexico	Albuquerque	1.271000e+05	1.277333e+05	



California	Fresno	1.005667e+05	1.035667e+05
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.634000e+05	1.648333e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.061667e+05	1.083667e+05
Colorado	Bennett	1.483000e+05	1.521000e+05
New Hampshire	East Hampstead	1.909000e+05	1.950667e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.866667e+04	6.386667e+04
Wisconsin	Oostburg	1.191000e+05	1.204333e+05
California	Twin Peaks	1.040000e+05	1.076667e+05
New York	Upper Brookville	1.295167e+06	1.340033e+06
Hawaii	Volcano	1.181333e+05	1.194000e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.664333e+05	1.686333e+05
Arkansas	Decatur	6.720000e+04	6.770000e+04
Tennessee	Briceville	4.480000e+04	4.530000e+04
Indiana	Edgewood	9.893333e+04	1.000667e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.642333e+05	1.682000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.134333e+05	1.130000e+05
Missouri	Bois D Arc	1.107000e+05	1.136667e+05
Virginia	Henrico	1.352333e+05	1.367333e+05
New Jersey	Diamond Beach	1.944000e+05	2.102667e+05
Tennessee	Gruetli Laager	3.773333e+04	3.790000e+04
Wisconsin	Town of Wrightstown	1.259667e+05	1.299000e+05
New York	Urbana	9.486667e+04	9.853333e+04
Wisconsin	New Denmark	1.438000e+05	1.469667e+05
California	Angels	1.768333e+05	1.837667e+05
Wisconsin	Holland	1.618667e+05	1.657333e+05

		2001q3	2001q4	\
State	RegionName			
New York	New York	NaN	NaN	
California	Los Angeles	2.450667e+05	2.530333e+05	
Illinois	Chicago	1.664000e+05	1.704333e+05	
Pennsylvania	Philadelphia	5.626667e+04	5.753333e+04	
Arizona	Phoenix	1.227000e+05	1.243000e+05	
Nevada	Las Vegas	1.433667e+05	1.461333e+05	
California	San Diego	2.845000e+05	2.919333e+05	
Texas	Dallas	8.906667e+04	9.090000e+04	
California	San Jose	4.568000e+05	4.455667e+05	
Florida	Jacksonville	9.706667e+04	9.906667e+04	
California	San Francisco	5.041000e+05	5.134000e+05	
Texas	Austin	1.595333e+05	1.600333e+05	
Michigan	Detroit	6.926667e+04	6.996667e+04	

Ohio	Columbus	1.010667e+05	1.022000e+05
Tennessee	Memphis	7.550000e+04	7.606667e+04
North Carolina	Charlotte	1.328000e+05	1.331000e+05
Texas	El Paso	7.743333e+04	7.680000e+04
Massachusetts	Boston	2.669333e+05	2.749667e+05
Washington	Seattle	2.741667e+05	2.781667e+05
Maryland	Baltimore	6.210000e+04	6.340000e+04
Colorado	Denver	1.964000e+05	1.991000e+05
District of Columbia	Washington	1.646333e+05	1.725333e+05
Tennessee	Nashville	1.201000e+05	1.208000e+05
Wisconsin	Milwaukee	8.706667e+04	8.840000e+04
Arizona	Tucson	1.105667e+05	1.128000e+05
Oregon	Portland	1.642667e+05	1.677667e+05
Oklahoma	Oklahoma City	8.113333e+04	8.173333e+04
Nebraska	Omaha	1.178667e+05	1.174000e+05
New Mexico	Albuquerque	1.285667e+05	1.299000e+05
California	Fresno	1.072333e+05	1.103000e+05
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.647000e+05	1.679000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.110333e+05	1.112333e+05
Colorado	Bennett	1.542333e+05	1.562000e+05
New Hampshire	East Hampstead	1.992667e+05	2.074000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.376667e+04	6.546667e+04
Wisconsin	Oostburg	1.203667e+05	1.196333e+05
California	Twin Peaks	1.098333e+05	1.111333e+05
New York	Upper Brookville	1.403667e+06	1.481933e+06
Hawaii	Volcano	1.232667e+05	1.211667e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.716667e+05	1.750333e+05
Arkansas	Decatur	6.650000e+04	6.540000e+04
Tennessee	Briceville	4.463333e+04	4.370000e+04
Indiana	Edgewood	1.008333e+05	1.010000e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.665000e+05	1.653333e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.130333e+05	1.151667e+05
Missouri	Bois D Arc	1.126333e+05	1.127333e+05
Virginia	Henrico	1.386000e+05	1.413333e+05
New Jersey	Diamond Beach	2.302667e+05	2.486667e+05
Tennessee	Gruetli Laager	3.936667e+04	4.040000e+04
Wisconsin	Town of Wrightstown	1.299000e+05	1.294333e+05
New York	Urbana	1.029667e+05	9.803333e+04
Wisconsin	New Denmark	1.483667e+05	1.491667e+05
California	Angels	1.902333e+05	1.845667e+05
Wisconsin	Holland	1.680333e+05	1.674000e+05

		2002q1	2002q2 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.619667e+05	2.727000e+05
Illinois	Chicago	1.755000e+05	1.775667e+05
Pennsylvania	Philadelphia	5.913333e+04	6.073333e+04
Arizona	Phoenix	1.265333e+05	1.283667e+05
Nevada	Las Vegas	1.493333e+05	1.509333e+05
California	San Diego	3.012333e+05	3.128667e+05
Texas	Dallas	9.256667e+04	9.380000e+04
California	San Jose	4.414333e+05	4.577667e+05
Florida	Jacksonville	1.012333e+05	1.034333e+05
California	San Francisco	5.204333e+05	5.381667e+05
Texas	Austin	1.589667e+05	1.575000e+05
Michigan	Detroit	7.100000e+04	7.233333e+04
Ohio	Columbus	1.034000e+05	1.048000e+05
Tennessee	Memphis	7.633333e+04	7.676667e+04
North Carolina	Charlotte	1.343667e+05	1.353667e+05
Texas	El Paso	7.660000e+04	7.640000e+04
Massachusetts	Boston	2.825000e+05	2.893000e+05
Washington	Seattle	2.805000e+05	2.846000e+05
Maryland	Baltimore	6.366667e+04	6.490000e+04
Colorado	Denver	2.012333e+05	2.024333e+05
District of Columbia	Washington	1.805000e+05	1.933000e+05
Tennessee	Nashville	1.215667e+05	1.226333e+05
Wisconsin	Milwaukee	8.953333e+04	9.136667e+04
Arizona	Tucson	1.150000e+05	1.172000e+05
Oregon	Portland	1.707667e+05	1.741333e+05
Oklahoma	Oklahoma City	8.260000e+04	8.343333e+04
Nebraska	Omaha	1.180667e+05	1.176333e+05
New Mexico	Albuquerque	1.310667e+05	1.321000e+05
California	Fresno	1.140333e+05	1.185333e+05
...	...	...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.782667e+05	1.812000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.141000e+05	1.141667e+05
Colorado	Bennett	1.587333e+05	1.606333e+05
New Hampshire	East Hampstead	2.123000e+05	2.122333e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.533333e+04	6.600000e+04
Wisconsin	Oostburg	1.198667e+05	1.185667e+05
California	Twin Peaks	1.132000e+05	1.166000e+05
New York	Upper Brookville	1.536167e+06	1.562033e+06
Hawaii	Volcano	1.233000e+05	1.169000e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.786667e+05	1.793333e+05

Arkansas	Decatur	6.460000e+04	6.490000e+04
Tennessee	Briceville	4.446667e+04	4.340000e+04
Indiana	Edgewood	1.021667e+05	1.017667e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.673000e+05	1.688000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.187000e+05	1.250667e+05
Missouri	Bois D Arc	1.130667e+05	1.154000e+05
Virginia	Henrico	1.435333e+05	1.461333e+05
New Jersey	Diamond Beach	2.599333e+05	2.656333e+05
Tennessee	Gruetli Laager	4.156667e+04	4.163333e+04
Wisconsin	Town of Wrightstown	1.319000e+05	1.342000e+05
New York	Urbana	9.396667e+04	9.460000e+04
Wisconsin	New Denmark	1.531333e+05	1.567333e+05
California	Angels	1.840333e+05	1.861333e+05
Wisconsin	Holland	1.657667e+05	1.619667e+05

State	RegionName	...	2014q2 \
New York	New York	...	5.154667e+05
California	Los Angeles	...	4.980333e+05
Illinois	Chicago	...	1.926333e+05
Pennsylvania	Philadelphia	...	1.137333e+05
Arizona	Phoenix	...	1.642667e+05
Nevada	Las Vegas	...	1.700667e+05
California	San Diego	...	4.802000e+05
Texas	Dallas	...	1.066333e+05
California	San Jose	...	6.794000e+05
Florida	Jacksonville	...	1.207667e+05
California	San Francisco	...	9.269333e+05
Texas	Austin	...	2.488667e+05
Michigan	Detroit	...	3.730000e+04
Ohio	Columbus	...	1.031333e+05
Tennessee	Memphis	...	6.810000e+04
North Carolina	Charlotte	...	1.494667e+05
Texas	El Paso	...	1.118000e+05
Massachusetts	Boston	...	4.266667e+05
Washington	Seattle	...	4.418000e+05
Maryland	Baltimore	...	1.092333e+05
Colorado	Denver	...	2.708667e+05
District of Columbia	Washington	...	4.469333e+05
Tennessee	Nashville	...	1.607000e+05
Wisconsin	Milwaukee	...	9.216667e+04
Arizona	Tucson	...	1.424667e+05
Oregon	Portland	...	2.822333e+05
Oklahoma	Oklahoma City	...	1.180333e+05
Nebraska	Omaha	...	1.301000e+05
New Mexico	Albuquerque	...	1.632667e+05

California	Fresno	...	1.696333e+05
...		...	...
Texas	Granite Shoals	...	1.169667e+05
Maryland	Piney Point	...	2.964000e+05
Wisconsin	Maribel	...	1.306000e+05
Idaho	Middleton	...	1.443667e+05
Colorado	Bennett	...	1.514667e+05
New Hampshire	East Hampstead	...	2.495000e+05
Missouri	Garden City	...	1.055000e+05
Arkansas	Mountainburg	...	8.160000e+04
Wisconsin	Oostburg	...	1.295667e+05
California	Twin Peaks	...	1.501000e+05
New York	Upper Brookville	...	1.780633e+06
Hawaii	Volcano	...	2.064667e+05
South Carolina	Wedgefield	...	7.436667e+04
Michigan	Williamston	...	1.657000e+05
Arkansas	Decatur	...	8.966667e+04
Tennessee	Briceville	...	5.623333e+04
Indiana	Edgewood	...	9.213333e+04
Tennessee	Palmyra	...	1.227667e+05
Maryland	Saint Inigoes	...	2.822333e+05
Indiana	Marysville	...	1.166000e+05
California	Forest Falls	...	1.653667e+05
Missouri	Bois D Arc	...	1.375667e+05
Virginia	Henrico	...	2.016333e+05
New Jersey	Diamond Beach	...	3.818000e+05
Tennessee	Gruetli Laager	...	5.556667e+04
Wisconsin	Town of Wrightstown	...	1.448667e+05
New York	Urbana	...	1.321333e+05
Wisconsin	New Denmark	...	1.745667e+05
California	Angels	...	2.444667e+05
Wisconsin	Holland	...	2.012667e+05

State	RegionName	2014q3	2014q4 \
New York	New York	5.228000e+05	5.280667e+05
California	Los Angeles	5.090667e+05	5.188667e+05
Illinois	Chicago	1.957667e+05	2.012667e+05
Pennsylvania	Philadelphia	1.153000e+05	1.156667e+05
Arizona	Phoenix	1.653667e+05	1.685000e+05
Nevada	Las Vegas	1.734000e+05	1.754667e+05
California	San Diego	4.890333e+05	4.964333e+05
Texas	Dallas	1.089000e+05	1.115333e+05
California	San Jose	6.970333e+05	7.149333e+05
Florida	Jacksonville	1.217333e+05	1.231667e+05
California	San Francisco	9.545333e+05	9.687667e+05
Texas	Austin	2.528000e+05	2.581333e+05
Michigan	Detroit	3.710000e+04	3.713333e+04

Ohio	Columbus	1.045000e+05	1.064333e+05
Tennessee	Memphis	6.910000e+04	7.116667e+04
North Carolina	Charlotte	1.506333e+05	1.527333e+05
Texas	El Paso	1.117333e+05	1.117667e+05
Massachusetts	Boston	4.314333e+05	4.407333e+05
Washington	Seattle	4.515000e+05	4.591667e+05
Maryland	Baltimore	1.095333e+05	1.073667e+05
Colorado	Denver	2.775000e+05	2.872333e+05
District of Columbia	Washington	4.530000e+05	4.603000e+05
Tennessee	Nashville	1.623000e+05	1.669000e+05
Wisconsin	Milwaukee	9.216667e+04	9.196667e+04
Arizona	Tucson	1.434333e+05	1.442333e+05
Oregon	Portland	2.872667e+05	2.955333e+05
Oklahoma	Oklahoma City	1.189667e+05	1.201000e+05
Nebraska	Omaha	1.303000e+05	1.325000e+05
New Mexico	Albuquerque	1.640000e+05	1.648000e+05
California	Fresno	1.736000e+05	1.781333e+05
...		...	...
Texas	Granite Shoals	1.175333e+05	1.175333e+05
Maryland	Piney Point	3.090000e+05	3.092333e+05
Wisconsin	Maribel	1.289667e+05	1.296333e+05
Idaho	Middleton	1.457000e+05	1.462333e+05
Colorado	Bennett	1.620667e+05	1.714000e+05
New Hampshire	East Hampstead	2.521000e+05	2.557333e+05
Missouri	Garden City	1.043000e+05	1.047667e+05
Arkansas	Mountainburg	8.506667e+04	8.846667e+04
Wisconsin	Oostburg	1.279333e+05	1.274333e+05
California	Twin Peaks	1.475333e+05	1.460667e+05
New York	Upper Brookville	1.749233e+06	1.729467e+06
Hawaii	Volcano	2.276333e+05	2.332000e+05
South Carolina	Wedgefield	7.026667e+04	7.206667e+04
Michigan	Williamston	1.689333e+05	1.708667e+05
Arkansas	Decatur	9.256667e+04	9.470000e+04
Tennessee	Briceville	5.423333e+04	5.260000e+04
Indiana	Edgewood	9.406667e+04	9.466667e+04
Tennessee	Palmyra	1.269333e+05	1.262333e+05
Maryland	Saint Inigoes	2.884333e+05	2.869667e+05
Indiana	Marysville	1.151000e+05	1.165000e+05
California	Forest Falls	1.675000e+05	1.771000e+05
Missouri	Bois D Arc	1.375667e+05	1.404000e+05
Virginia	Henrico	2.040000e+05	2.059000e+05
New Jersey	Diamond Beach	3.878667e+05	3.876667e+05
Tennessee	Gruetli Laager	5.636667e+04	5.713333e+04
Wisconsin	Town of Wrightstown	1.468667e+05	1.492333e+05
New York	Urbana	1.370333e+05	1.400667e+05
Wisconsin	New Denmark	1.811667e+05	1.861667e+05
California	Angels	2.540667e+05	2.599333e+05
Wisconsin	Holland	2.015667e+05	2.012667e+05

State	RegionName	2015q1	2015q2 \
New York	New York	5.322667e+05	5.408000e+05
California	Los Angeles	5.288000e+05	5.381667e+05
Illinois	Chicago	2.010667e+05	2.060333e+05
Pennsylvania	Philadelphia	1.162000e+05	1.179667e+05
Arizona	Phoenix	1.715333e+05	1.741667e+05
Nevada	Las Vegas	1.775000e+05	1.816000e+05
California	San Diego	5.033667e+05	5.120667e+05
Texas	Dallas	1.137000e+05	1.211333e+05
California	San Jose	7.314333e+05	7.567333e+05
Florida	Jacksonville	1.241667e+05	1.269000e+05
California	San Francisco	1.000733e+06	1.060800e+06
Texas	Austin	2.665000e+05	2.750333e+05
Michigan	Detroit	3.620000e+04	3.583333e+04
Ohio	Columbus	1.078667e+05	1.094333e+05
Tennessee	Memphis	7.053333e+04	6.870000e+04
North Carolina	Charlotte	1.551667e+05	1.579000e+05
Texas	El Paso	1.115000e+05	1.113000e+05
Massachusetts	Boston	4.485000e+05	4.553667e+05
Washington	Seattle	4.679333e+05	4.933667e+05
Maryland	Baltimore	1.080667e+05	1.114333e+05
Colorado	Denver	2.976333e+05	3.103667e+05
District of Columbia	Washington	4.661667e+05	4.810667e+05
Tennessee	Nashville	1.714667e+05	1.762667e+05
Wisconsin	Milwaukee	9.333333e+04	9.410000e+04
Arizona	Tucson	1.441667e+05	1.451333e+05
Oregon	Portland	3.019333e+05	3.119000e+05
Oklahoma	Oklahoma City	1.208000e+05	1.223667e+05
Nebraska	Omaha	1.330667e+05	1.344667e+05
New Mexico	Albuquerque	1.651667e+05	1.659000e+05
California	Fresno	1.804667e+05	1.820333e+05
...		...	...
Texas	Granite Shoals	1.171667e+05	1.191000e+05
Maryland	Piney Point	3.095667e+05	3.017000e+05
Wisconsin	Maribel	1.312667e+05	1.301333e+05
Idaho	Middleton	1.461667e+05	1.477333e+05
Colorado	Bennett	1.780333e+05	1.844333e+05
New Hampshire	East Hampstead	2.587333e+05	2.613667e+05
Missouri	Garden City	1.060333e+05	9.606667e+04
Arkansas	Mountainburg	8.903333e+04	8.556667e+04
Wisconsin	Oostburg	1.270667e+05	1.274000e+05
California	Twin Peaks	1.435000e+05	1.523000e+05
New York	Upper Brookville	1.749867e+06	1.789600e+06
Hawaii	Volcano	2.346333e+05	2.323667e+05
South Carolina	Wedgefield	7.570000e+04	7.206667e+04
Michigan	Williamston	1.744333e+05	1.758667e+05

Arkansas	Decatur	9.350000e+04	9.490000e+04
Tennessee	Briceville	4.963333e+04	4.590000e+04
Indiana	Edgewood	9.586667e+04	9.433333e+04
Tennessee	Palmyra	1.223000e+05	1.204667e+05
Maryland	Saint Inigoes	2.847000e+05	2.807667e+05
Indiana	Marysville	1.118667e+05	1.118000e+05
California	Forest Falls	1.765333e+05	1.818000e+05
Missouri	Bois D Arc	1.450333e+05	1.475667e+05
Virginia	Henrico	2.065667e+05	2.104333e+05
New Jersey	Diamond Beach	3.931667e+05	3.980000e+05
Tennessee	Gruetli Laager	5.890000e+04	6.536667e+04
Wisconsin	Town of Wrightstown	1.486667e+05	1.493333e+05
New York	Urbana	1.417000e+05	1.378667e+05
Wisconsin	New Denmark	1.876000e+05	1.886667e+05
California	Angels	2.601000e+05	2.506333e+05
Wisconsin	Holland	2.060000e+05	2.076000e+05

State	RegionName	2015q3	2015q4	\
New York	New York	5.572000e+05	5.728333e+05	
California	Los Angeles	5.472667e+05	5.577333e+05	
Illinois	Chicago	2.083000e+05	2.079000e+05	
Pennsylvania	Philadelphia	1.212333e+05	1.222000e+05	
Arizona	Phoenix	1.790667e+05	1.838333e+05	
Nevada	Las Vegas	1.867667e+05	1.906333e+05	
California	San Diego	5.197667e+05	5.254667e+05	
Texas	Dallas	1.285667e+05	1.346000e+05	
California	San Jose	7.764000e+05	7.891333e+05	
Florida	Jacksonville	1.301333e+05	1.320000e+05	
California	San Francisco	1.095100e+06	1.105467e+06	
Texas	Austin	2.816333e+05	2.872333e+05	
Michigan	Detroit	3.706667e+04	3.836667e+04	
Ohio	Columbus	1.115667e+05	1.150000e+05	
Tennessee	Memphis	6.866667e+04	6.953333e+04	
North Carolina	Charlotte	1.601667e+05	1.628667e+05	
Texas	El Paso	1.110667e+05	1.102667e+05	
Massachusetts	Boston	4.639667e+05	4.716333e+05	
Washington	Seattle	5.142667e+05	5.334667e+05	
Maryland	Baltimore	1.139667e+05	1.139000e+05	
Colorado	Denver	3.205000e+05	3.301000e+05	
District of Columbia	Washington	4.934000e+05	5.009000e+05	
Tennessee	Nashville	1.818000e+05	1.892000e+05	
Wisconsin	Milwaukee	9.413333e+04	9.456667e+04	
Arizona	Tucson	1.466000e+05	1.481667e+05	
Oregon	Portland	3.257333e+05	3.430667e+05	
Oklahoma	Oklahoma City	1.247000e+05	1.271000e+05	
Nebraska	Omaha	1.367333e+05	1.400667e+05	
New Mexico	Albuquerque	1.665333e+05	1.673333e+05	



California	Fresno	1.857000e+05	1.874667e+05
...		...	...
Texas	Granite Shoals	1.216000e+05	1.280000e+05
Maryland	Piney Point	3.052333e+05	3.099667e+05
Wisconsin	Maribel	1.297333e+05	1.293000e+05
Idaho	Middleton	1.482000e+05	1.511333e+05
Colorado	Bennett	1.916667e+05	1.958000e+05
New Hampshire	East Hampstead	2.616000e+05	2.688000e+05
Missouri	Garden City	9.930000e+04	1.034333e+05
Arkansas	Mountainburg	8.370000e+04	9.043333e+04
Wisconsin	Oostburg	1.303333e+05	1.320333e+05
California	Twin Peaks	1.552667e+05	1.591667e+05
New York	Upper Brookville	1.777267e+06	1.834367e+06
Hawaii	Volcano	2.249667e+05	2.324333e+05
South Carolina	Wedgefield	7.033333e+04	6.903333e+04
Michigan	Williamston	1.794667e+05	1.823000e+05
Arkansas	Decatur	9.543333e+04	9.700000e+04
Tennessee	Briceville	4.793333e+04	4.360000e+04
Indiana	Edgewood	9.663333e+04	9.996667e+04
Tennessee	Palmyra	1.198000e+05	1.258000e+05
Maryland	Saint Inigoes	2.778333e+05	2.768333e+05
Indiana	Marysville	1.156667e+05	1.201667e+05
California	Forest Falls	1.911667e+05	1.987333e+05
Missouri	Bois D Arc	1.463000e+05	1.494333e+05
Virginia	Henrico	2.121000e+05	2.139667e+05
New Jersey	Diamond Beach	3.992333e+05	4.004333e+05
Tennessee	Gruetli Laager	6.950000e+04	7.170000e+04
Wisconsin	Town of Wrightstown	1.498667e+05	1.499333e+05
New York	Urbana	1.364667e+05	1.361667e+05
Wisconsin	New Denmark	1.884333e+05	1.889333e+05
California	Angels	2.635000e+05	2.795000e+05
Wisconsin	Holland	2.128667e+05	2.178333e+05

		2016q1	2016q2	\
State	RegionName			
New York	New York	5.828667e+05	5.916333e+05	
California	Los Angeles	5.660333e+05	5.774667e+05	
Illinois	Chicago	2.060667e+05	2.082000e+05	
Pennsylvania	Philadelphia	1.234333e+05	1.269333e+05	
Arizona	Phoenix	1.879000e+05	1.914333e+05	
Nevada	Las Vegas	1.946000e+05	1.972000e+05	
California	San Diego	5.293333e+05	5.362333e+05	
Texas	Dallas	1.405000e+05	1.446000e+05	
California	San Jose	8.036000e+05	8.189333e+05	
Florida	Jacksonville	1.339667e+05	1.372000e+05	
California	San Francisco	1.121767e+06	1.119267e+06	
Texas	Austin	2.935000e+05	3.014333e+05	
Michigan	Detroit	3.796667e+04	3.746667e+04	

Ohio	Columbus	1.167000e+05	1.182000e+05
Tennessee	Memphis	7.090000e+04	7.416667e+04
North Carolina	Charlotte	1.664667e+05	1.694333e+05
Texas	El Paso	1.106667e+05	1.114667e+05
Massachusetts	Boston	4.826000e+05	4.903667e+05
Washington	Seattle	5.517333e+05	5.755333e+05
Maryland	Baltimore	1.146667e+05	1.147333e+05
Colorado	Denver	3.355667e+05	3.427667e+05
District of Columbia	Washington	5.041000e+05	5.058000e+05
Tennessee	Nashville	1.950667e+05	2.003667e+05
Wisconsin	Milwaukee	9.466667e+04	9.636667e+04
Arizona	Tucson	1.495333e+05	1.511667e+05
Oregon	Portland	3.560000e+05	3.698000e+05
Oklahoma	Oklahoma City	1.279000e+05	1.293000e+05
Nebraska	Omaha	1.416333e+05	1.426667e+05
New Mexico	Albuquerque	1.691000e+05	1.706333e+05
California	Fresno	1.890333e+05	1.927333e+05
...		...	...
Texas	Granite Shoals	1.337667e+05	1.400667e+05
Maryland	Piney Point	3.195000e+05	3.241667e+05
Wisconsin	Maribel	1.278333e+05	1.292667e+05
Idaho	Middleton	1.539000e+05	1.571667e+05
Colorado	Bennett	1.997667e+05	2.074667e+05
New Hampshire	East Hampstead	2.725333e+05	2.778000e+05
Missouri	Garden City	1.062667e+05	1.116667e+05
Arkansas	Mountainburg	9.833333e+04	1.019000e+05
Wisconsin	Oostburg	1.327667e+05	1.341000e+05
California	Twin Peaks	1.641667e+05	1.679667e+05
New York	Upper Brookville	1.904500e+06	1.944067e+06
Hawaii	Volcano	2.420667e+05	2.489667e+05
South Carolina	Wedgefield	6.886667e+04	7.426667e+04
Michigan	Williamston	1.814667e+05	1.824000e+05
Arkansas	Decatur	9.650000e+04	9.663333e+04
Tennessee	Briceville	4.080000e+04	4.180000e+04
Indiana	Edgewood	9.943333e+04	9.996667e+04
Tennessee	Palmyra	1.276667e+05	1.328667e+05
Maryland	Saint Inigoes	2.793333e+05	2.826333e+05
Indiana	Marysville	1.282333e+05	1.232333e+05
California	Forest Falls	1.886333e+05	1.898667e+05
Missouri	Bois D Arc	1.468667e+05	1.437667e+05
Virginia	Henrico	2.160333e+05	2.162000e+05
New Jersey	Diamond Beach	4.045333e+05	4.039000e+05
Tennessee	Gruetli Laager	7.533333e+04	7.646667e+04
Wisconsin	Town of Wrightstown	1.498333e+05	1.512667e+05
New York	Urbana	1.389667e+05	1.442000e+05
Wisconsin	New Denmark	1.910667e+05	1.928333e+05
California	Angels	2.765333e+05	2.716000e+05
Wisconsin	Holland	2.219667e+05	2.280333e+05

State	RegionName	2016q3
New York	New York	587200.0
California	Los Angeles	584050.0
Illinois	Chicago	212000.0
Pennsylvania	Philadelphia	128700.0
Arizona	Phoenix	195200.0
Nevada	Las Vegas	199950.0
California	San Diego	539750.0
Texas	Dallas	149300.0
California	San Jose	822200.0
Florida	Jacksonville	139900.0
California	San Francisco	1106400.0
Texas	Austin	304450.0
Michigan	Detroit	37900.0
Ohio	Columbus	120100.0
Tennessee	Memphis	75900.0
North Carolina	Charlotte	172400.0
Texas	El Paso	112200.0
Massachusetts	Boston	501700.0
Washington	Seattle	589700.0
Maryland	Baltimore	115150.0
Colorado	Denver	351550.0
District of Columbia	Washington	516250.0
Tennessee	Nashville	206100.0
Wisconsin	Milwaukee	98850.0
Arizona	Tucson	152700.0
Oregon	Portland	387050.0
Oklahoma	Oklahoma City	130300.0
Nebraska	Omaha	143450.0
New Mexico	Albuquerque	171900.0
California	Fresno	196450.0
...	...	...
Texas	Granite Shoals	146450.0
Maryland	Piney Point	324600.0
Wisconsin	Maribel	134200.0
Idaho	Middleton	160750.0
Colorado	Bennett	212600.0
New Hampshire	East Hampstead	282450.0
Missouri	Garden City	113600.0
Arkansas	Mountainburg	103400.0
Wisconsin	Oostburg	136350.0
California	Twin Peaks	173500.0
New York	Upper Brookville	1968800.0
Hawaii	Volcano	247850.0
South Carolina	Wedgefield	80700.0
Michigan	Williamston	183000.0

Arkansas	Decatur	96850.0
Tennessee	Briceville	40850.0
Indiana	Edgewood	100950.0
Tennessee	Palmyra	137750.0
Maryland	Saint Inigoes	281400.0
Indiana	Marysville	124200.0
California	Forest Falls	186650.0
Missouri	Bois D Arc	144000.0
Virginia	Henrico	220150.0
New Jersey	Diamond Beach	399000.0
Tennessee	Gruetli Laager	77500.0
Wisconsin	Town of Wrightstown	155000.0
New York	Urbana	143000.0
Wisconsin	New Denmark	197600.0
California	Angels	269950.0
Wisconsin	Holland	234950.0

[10730 rows x 67 columns]

```
In [30]: def run_ttest():
```

```
    '''First creates new data showing the decline or growth of housing prices
    between the recession start and the recession bottom. Then runs a ttest
    comparing the university town values to the non-university towns values
    return whether the alternative hypothesis (that the two groups are the same)
    is true or not as well as the p-value of the confidence.
```

```
    Return the tuple (different, p, better) where different=True if the ttest is
    True at a p<0.01 (we reject the null hypothesis), or different=False if
    otherwise (we cannot reject the null hypothesis). The variable p should
    be equal to the exact p value returned from scipy.stats.ttest_ind(). The
    value for better should be either "university town" or "non-university town"
    depending on which has a lower mean price ratio (which is equivalent to
    reduced market loss).'''
```

```
    start = get_recession_start()
    end = get_recession_end()
    bottom = get_recession_bottom()
    house_qtr = convert_housing_data_to_quarters().copy()
    house_qtr = house_qtr.loc[:,start:bottom]
```

```
    def ratio(row):
        return (row['2008q3'] - row['2009q2'])/row['2008q3']
```

```
    house_qtr['ratio'] = house_qtr.apply(ratio,axis=1)
    house_qtr = house_qtr.reset_index()
    uni_town = get_list_of_university_towns()['RegionName']
    uni_town = set(uni_town)
```

```
    def is_uni_town(row):
```

```

        #check if the town is a university towns or not.
        if row['RegionName'] in uni_town:
            return 1
        else:
            return 0
    house_qtr['is_uni'] = house_qtr.apply(is_uni_town,axis=1)

    not_uni = house_qtr[house_qtr['is_uni']==0].loc[:, 'ratio'].dropna()
    is_uni = house_qtr[house_qtr['is_uni']==1].loc[:, 'ratio'].dropna()

    def better():
        if not_uni.mean() < is_uni.mean():
            return 'non-university town'
        else:
            return 'university town'
    p_val = list(ttest_ind(not_uni, is_uni))[1]
    result = (True,p_val,better())

    return result

run_ttest()

```

```

Out[30]: (True, 0.00036641601595526971, 'university town')

```

```

In [ ]:

```