FIT5145 Introduction to Data Science

Assignment 1
Tutorial: Tuesday, 2:00 pm

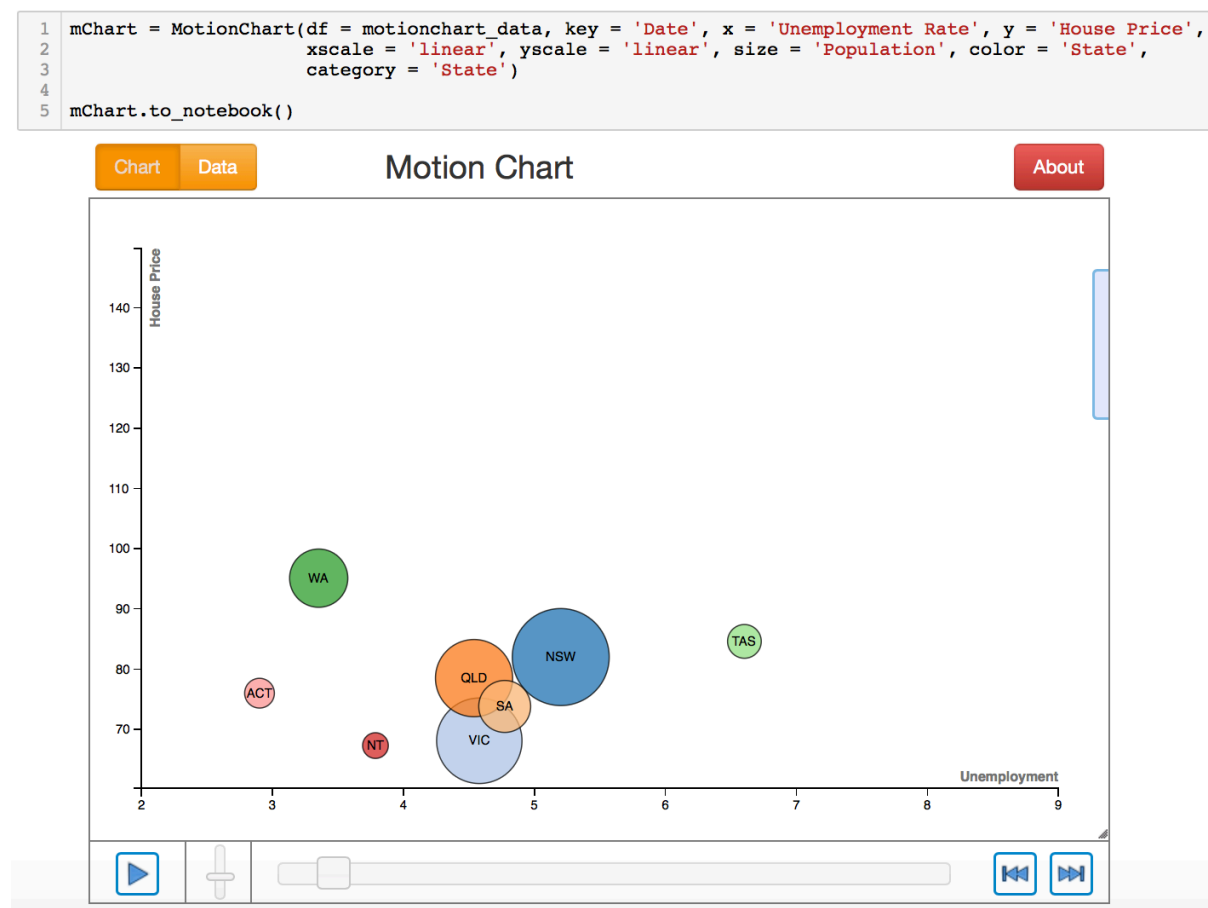**Student ID: 26389126**
Student Name: Moon Byeong Kim

Introduction

This report elucidates to visualize analysis of Task 1 and Task 2 questions of the Assignment 1. Task 1 used three data files that "ERP_by state and gender.csv", "SA4 Time Series – October 2016.xls" and "House Price Index.csv". Task 2 used data file that "fig-16-water-consumption-in-aus-hh-by-state-and-terr.csv" and "fig-14-manuf-water-cons.csv".
All the questions are answered in this report, with appropriate figures and data calculation. More details can be found in Jupyter NoteBook file.

Task1. Unemployment Rate and House Prices

Visualizing the Relationship over Time

```
1  mChart = MotionChart(df = motionchart_data, key = 'Date', x = 'Unemployment Rate', y = 'House Price',
2                       xscale = 'linear', yscale = 'linear', size = 'Population', color = 'State',
3                       category = 'State')
4
5  mChart.to_notebook()
```


<figure 1. Motion Chart of Task1>

Above figure 1 is motion chart that shows relationship between unemployment rate and house price index, with population size shown by size of bubble. The timeline for this motion chart is from December 2015 to June 2015. This report uses the above motion chart to answer the following questions to illustrate the relationship between the unemployment rate and house price

The overall statistical data

```
1  motionchart_data.describe()
```

	Population	House Price	Unemployment Rate
count	3.120000e+02	312.000000	312.000000
mean	2.759674e+06	97.020513	4.932110
std	2.462720e+06	13.010538	1.151542
min	2.073850e+05	60.200000	2.517942
25%	4.637628e+05	88.575000	4.127231
50%	1.864265e+06	100.000000	5.002531
75%	4.840351e+06	104.300000	5.655046
max	7.618241e+06	149.800000	8.668320

<figure2. Overall statistical data>

During this period, all Australian the average residential property house price index is 97.02, the highest price is 149.80, the minimum price is 60.20 and the standard deviation is 13.01. Moreover, the average unemployment rate is 4.93%, the highest rate is 8.67%, the minimum rate is 2.52% and the standard deviation is 1.15.

NSW

	Population	House Price	Unemployment Rate
count	3.900000e+01	39.000000	39.000000
mean	7.155957e+06	100.253846	5.306104
std	2.708809e+05	17.277866	0.524191
min	6.718023e+06	80.800000	4.337943
25%	6.931684e+06	86.500000	4.967903
50%	7.162726e+06	99.900000	5.256375
75%	7.371425e+06	104.200000	5.587461
max	7.618241e+06	149.800000	6.690732

VIC

	Population	House Price	Unemployment Rate
count	3.900000e+01	39.000000	39.000000
mean	5.475036e+06	94.256410	5.388681
std	2.742987e+05	15.794633	0.681564
min	5.023203e+06	64.000000	4.247518
25%	5.244688e+06	82.750000	4.848080
50%	5.478710e+06	99.400000	5.400766
75%	5.695674e+06	105.200000	5.777440
max	5.938119e+06	120.800000	6.818976

QLD

	Population	House Price	Unemployment Rate
count	3.900000e+01	39.000000	39.000000
mean	4.406070e+06	99.117949	5.182800
std	2.489515e+05	10.388959	0.941909
min	3.964175e+06	75.000000	3.555443
25%	4.205492e+06	96.750000	4.519583
50%	4.421470e+06	101.300000	5.250055
75%	4.620427e+06	105.300000	6.037014
max	4.779400e+06	113.700000	6.580057

WA

	Population	House Price	Unemployment Rate
count	3.900000e+01	39.000000	39.000000
mean	2.317484e+06	101.451282	4.264687
std	1.813419e+05	9.852488	0.853309
min	2.029936e+06	70.000000	2.736973
25%	2.163626e+06	97.650000	3.505551
50%	2.305415e+06	100.600000	4.288163
75%	2.490276e+06	107.050000	4.874135
max	2.591585e+06	114.800000	6.003158

SA

	Population	House Price	Unemployment Rate
count	3.900000e+01	39.000000	39.000000
mean	1.625878e+06	95.782051	5.614217
std	4.666590e+04	10.953343	0.773760
min	1.544852e+06	71.600000	4.394235
25%	1.586536e+06	93.400000	5.024052
50%	1.630230e+06	99.800000	5.479536
75%	1.664616e+06	103.600000	5.846696
max	1.698594e+06	108.500000	7.906160

ACT

	Population	House Price	Unemployment Rate
count	39.000000	39.000000	39.000000
mean	362724.743590	93.853846	3.537999
std	18004.926774	10.523004	0.624869
min	333505.000000	71.700000	2.524443
25%	347422.500000	86.050000	3.008705
50%	362838.000000	99.500000	3.583104
75%	378957.500000	101.800000	3.944457
max	390757.000000	106.200000	4.850543

NT

	Population	House Price	Unemployment Rate
count	39.000000	39.000000	39.000000
mean	228580.666667	93.817949	4.093356
std	11975.040027	16.718865	0.853768
min	207385.000000	60.200000	2.517942
25%	218893.000000	78.400000	3.625556
50%	230224.000000	98.700000	4.132063
75%	240077.500000	108.700000	4.575477
max	244602.000000	114.700000	6.004577

TAS

	Population	House Price	Unemployment Rate
count	39.000000	39.000000	39.000000
mean	505658.461538	97.630769	6.069034
std	9146.335118	7.492633	1.174708
min	488098.000000	79.100000	3.900126
25%	498060.000000	93.650000	5.231671
50%	509481.000000	99.400000	5.962563
75%	512743.500000	103.650000	6.943991
max	516630.000000	106.600000	8.668320

In Australia over the period of time,
- New South Wales had the highest residential property house price index (149.80);
- Northern Territory had the lowest residential property house price index (60.20);
- Tasmania had the highest unemployment rate (8.67%);
- Northern Territory had the lowest unemployment rate (2.53%);
- NSW, QLD, WA and TAS were above the average house price index (97.02) of the Australia;
- NSW, VIC, QLD, SA, TAS were above the average unemployment rate (4.93%) of the Australia.

The overall Patterns across different states in Australia

Unemployment rate tends to rise slightly over the period of time. Unemployment rate have frequently and gradually gone up and down. During this period, on the average, SA increased considerably, while NT decreased significantly. All states, excluding NT, the unemployment rate rose by about 1%. Moreover, house price index continued to rise steadily throughout Australia during the period. According to figure 2 and 3, all states are above the average of house price index.

```
1  temp1 = motionchart_data[:8]
2  temp1
```

	Date	Population	State	House Price	Unemployment Rate
0	01/12/05	6718023	NSW	81.8	5.293757
1	01/12/05	5023203	VIC	64.0	5.260037
2	01/12/05	3964175	QLD	75.0	4.863610
3	01/12/05	1544852	SA	71.6	4.868181
4	01/12/05	2029936	WA	70.0	4.326411
5	01/12/05	488098	TAS	79.1	5.962563
6	01/12/05	207385	NT	60.2	6.004577
7	01/12/05	333505	ACT	71.7	3.422536

<figure 4. Statistic data on 01/12/05>

```
1  mean1 = temp1.loc[:, 'House Price']
2  count1 = len(mean1)
3  sum = 0
4  for i in mean1:
5      sum += i
6  avg = sum / count
7  avg
```

71.675

```
1  mean2 = temp1.loc[:, 'Unemployment Rate']
2  count2 = len(mean2)
3  sum = 0
4  for i in mean2:
5      sum += i
6  avg = sum / count2
7  avg
```

5.000208912500001

<figure 5. Calculate of mean 01/12/05>

<figure 6. Motion chat on 01/12/05 >
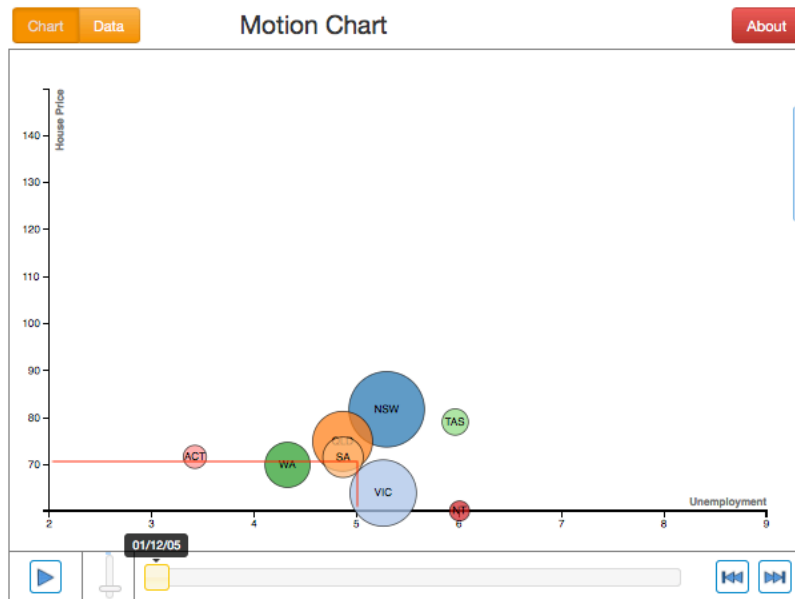
```
1  temp2 = motionchart_data[-8:]
2  temp2
```

	Date	Population	State	House Price	Unemployment Rate
304	01/06/15	7618241	NSW	149.8	5.845268
305	01/06/15	5938119	VIC	120.8	6.055538
306	01/06/15	4779400	QLD	113.7	5.994555
307	01/06/15	1698594	SA	108.5	7.906160
308	01/06/15	2591585	WA	113.4	6.003158
309	01/06/15	516630	TAS	105.7	6.432085
310	01/06/15	244602	NT	112.6	4.484751
311	01/06/15	390757	ACT	106.2	4.540913

<figure 7. Statistic data on 01/06/15>

```
1  mean3 = temp2.loc[:, 'House Price']
2  count3 = len(mean3)
3  sum = 0
4  for i in mean3:
5      sum += i
6  avg = sum / count3
7  avg
```
116.33750000000002

```
1  mean4 = temp2.loc[:, 'Unemployment Rate']
2  count4 = len(mean4)
3  sum = 0
4  for i in mean4:
5      sum += i
6  avg = sum / count4
7  avg
```
5.9078035625

<figure 8. Calculate of mean on 01/12/05>

<figure 9. Motion chart on 01/06/15>
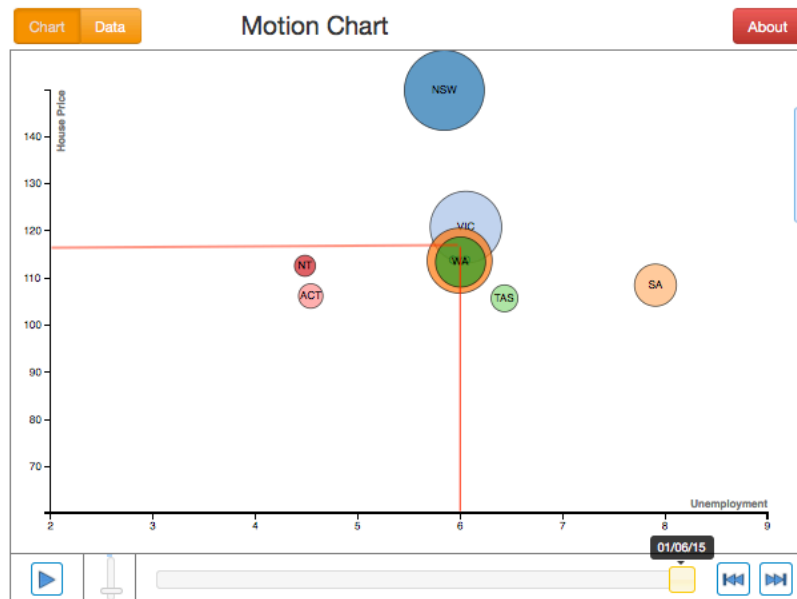
From July 2006 to December 2008, the housing price index rose moderately while the unemployment rate remained steady.
From September to December 2009, NT and ACT had distinct unemployment rate from other states.

<figure 10. Motion chart on 01/09/15>
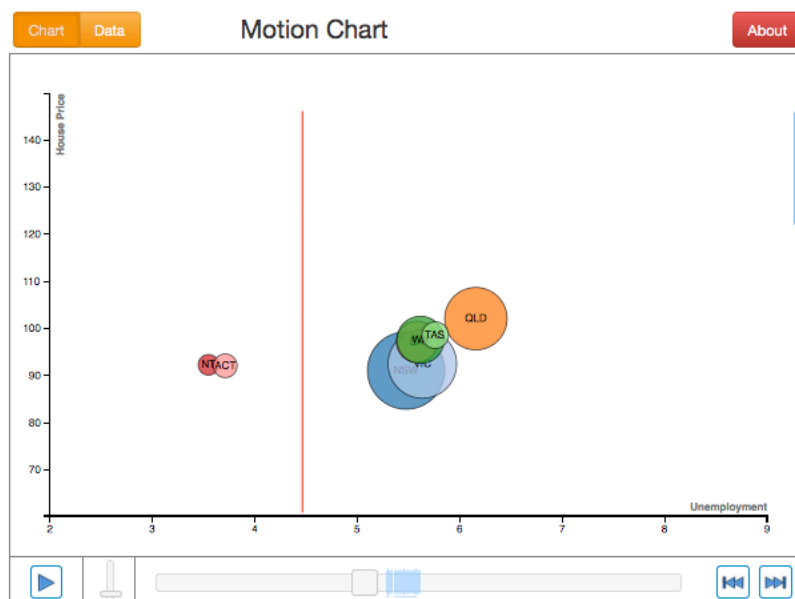
TAS mostly had the highest unemployment rate, but SA passed by December 2014.
According to figure 8, during the first four quarters, WA's house price index rose sharply. From December 2014, the NSW house price index tended to rise significantly, especially in June 2015.

<figure 11. Price index of states in Australia>
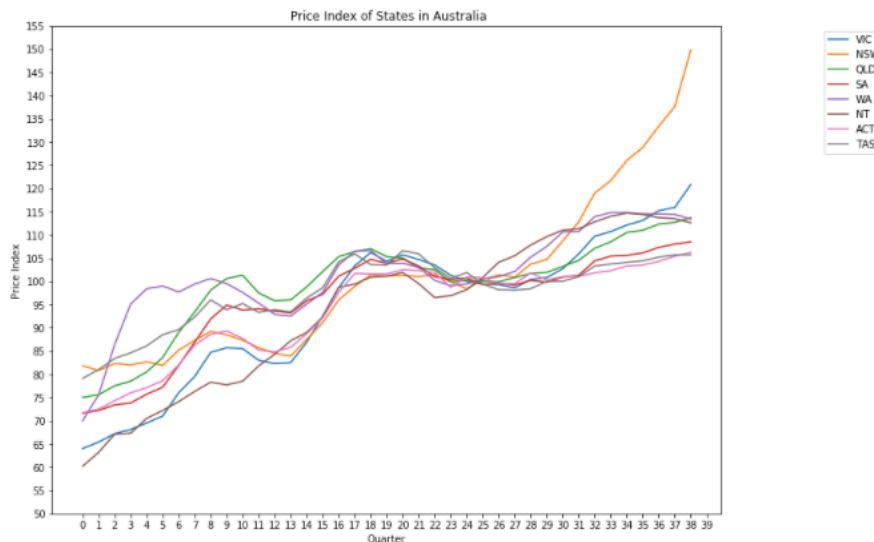
The relationship between unemployment rate and house price index

Unemployment and house price index are non-linear relationship, and two trends can be summarized.

- When the unemployment rate changed, the house price index was basically stable and virtually unchanged.
- When the unemployment rate stabilized or stabilized for a while, the housing price index would change. The unemployment rate and the house price index did not change at the same time.

Thus, when the unemployment rate changed, house price index could change, but not change at the all same time. This means that when the employment rate increased, house price index did not always rise or fall constantly.

The state with the highest unemployment rate and house price index

The highest house price index

According to figure 2 and 3, NSW reached the highest house price index (149.80); however, WA had an average of the highest house price index (101.45).

<figure 12. The highest price index1>
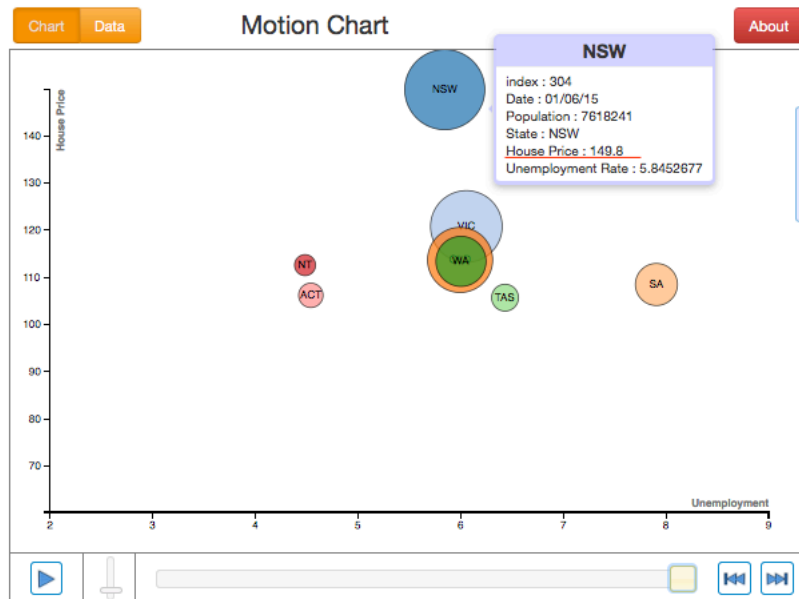
- From June 2006 to December 2007, WA had the highest house price index.
- From March 2008 to September 2010, QLD had the highest house price index.
- From December 2010 to December 2011, TAS had the highest house price index mostly.
- From March 2012 to June 2013, NT had the highest house price index.
- After September 2013, NSW had the highest house price index.

The highest unemployment

According to figure 2 and 3, TAS reached the unemployment rate (8.67%) and had an average of the lowest unemployment rate (6.07%).

<figure 13. The highest unemployment1>
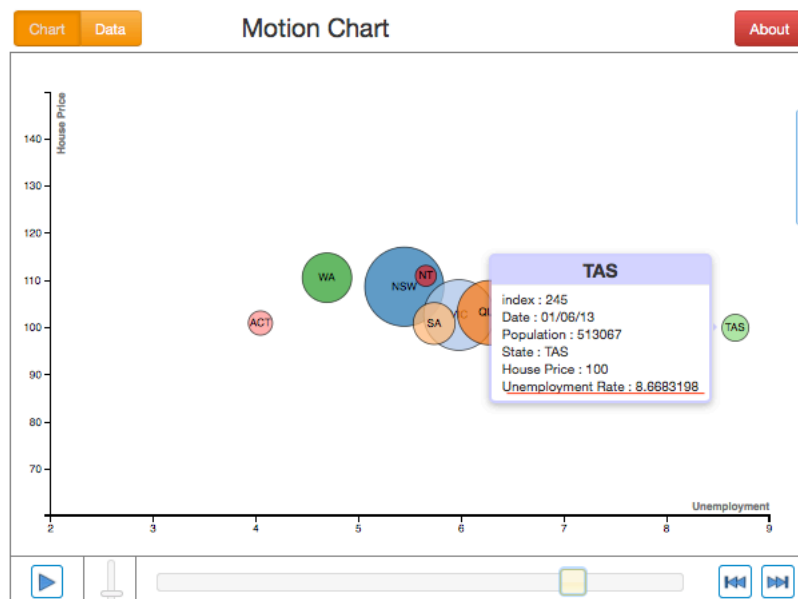
- TAS mostly had the highest unemployment rate, but SA passed by December 2014.
- From December 2011 to September 2013, the unemployment rate of TAS was significantly higher than other states
- From March 2015 to June 2015, the unemployment rate of SA peaked at 8%, which higher than that other regions.

<figure 14. The highest unemployment rate2>
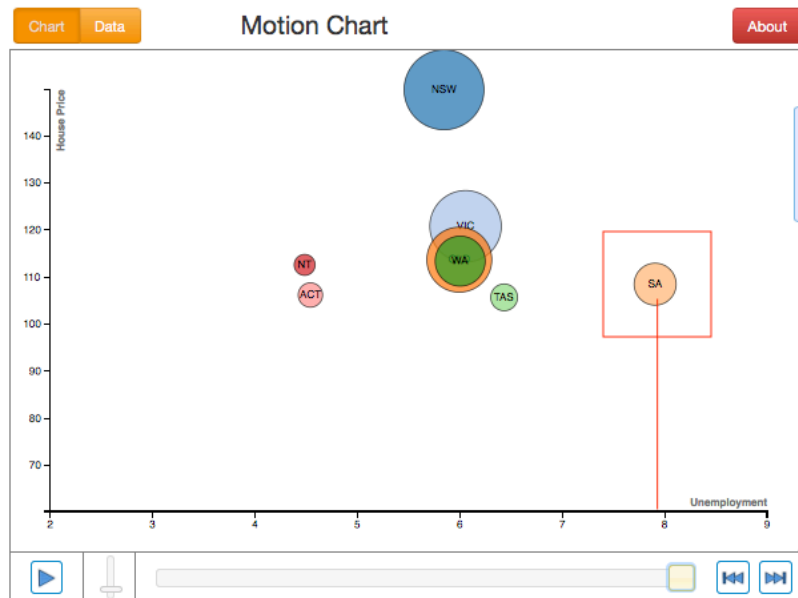
The state with the lowest unemployment rate and house price index

The lowest house price index

According to figure 2 and 3, NT reached both the lowest house price index (60.20) and had an average of the lowest house price index (93.82).

<figure 15. The lowest price index1>

- From December 2015 to December 2011, NT mostly recorded the lowest house price index - the NSW and VIC recorded the lowest for a while in the middle.
- After December 2013, ACT continued to record the lowest house price index.

The lowest employment rates
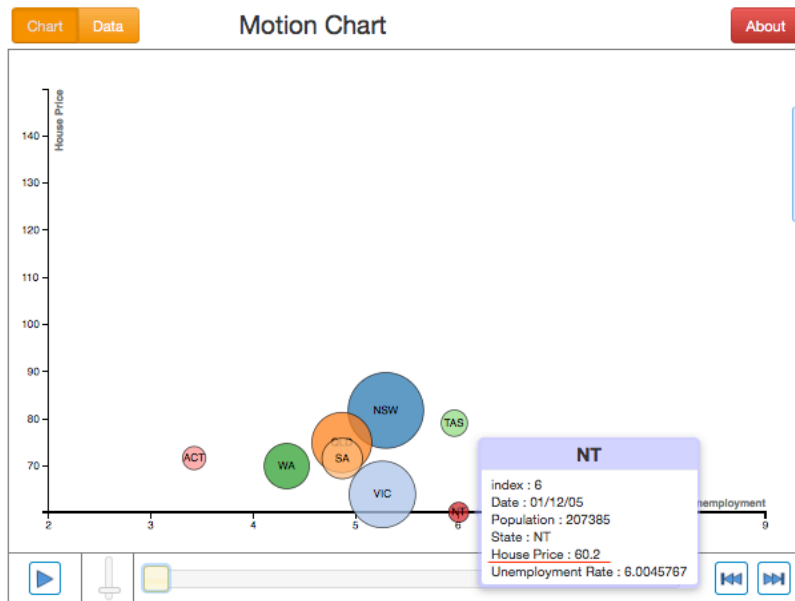
According to figure 2 and 3, NT reached the lowest unemployment rate (2.52%); however, ACT had an average of the lowest unemployment rate (4.93%).

<figure 16. The lowest unemployment rate2>
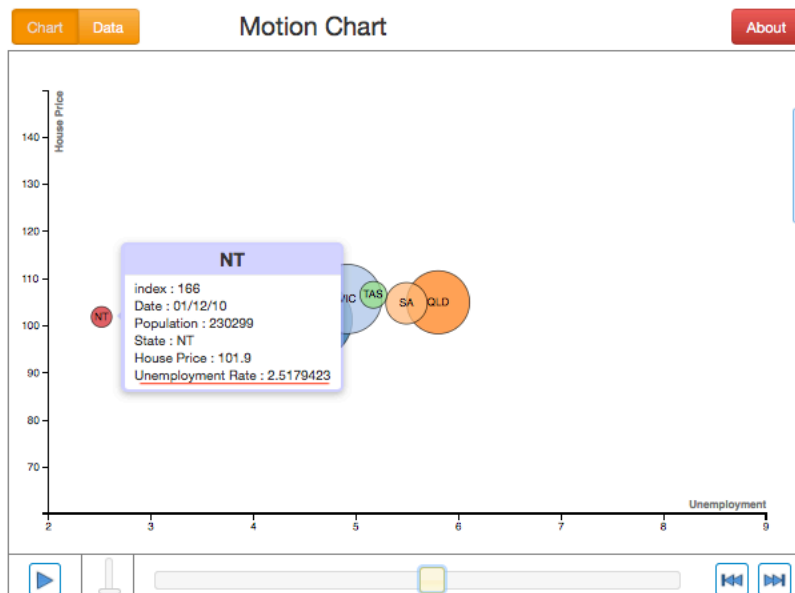
- In general, ACT and TAS maintained the lowest unemployment rate.
- Characteristically, in December 2016 and June 2008, NT rapidly lowered the unemployment rate. In addition, NT was recorded the lowest unemployment rate from March 2011 to June 2011.

The performance of NSW and VIC

<figure 17. Population of NSW and VIC>
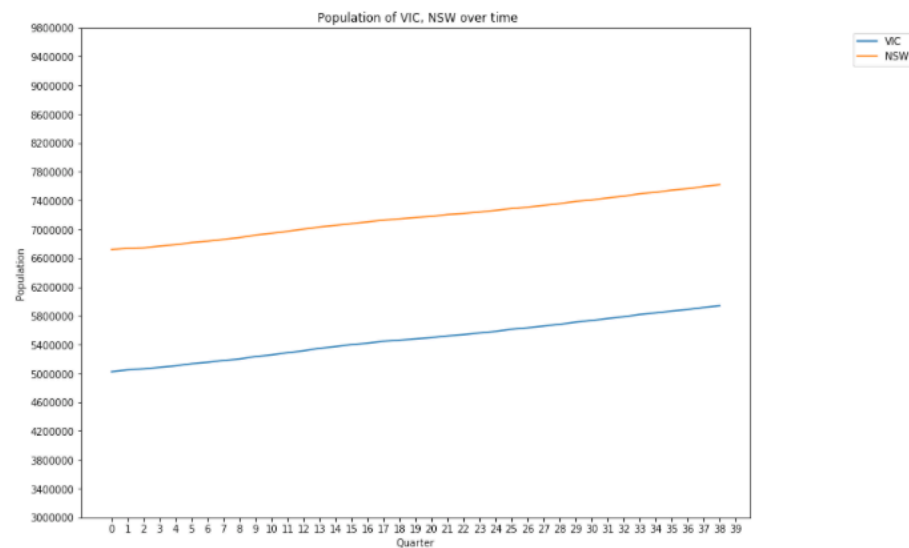
Most populated states like NSW and VIC remained relatively high unemployment rate, and the fluctuation was small. The house price index rose ste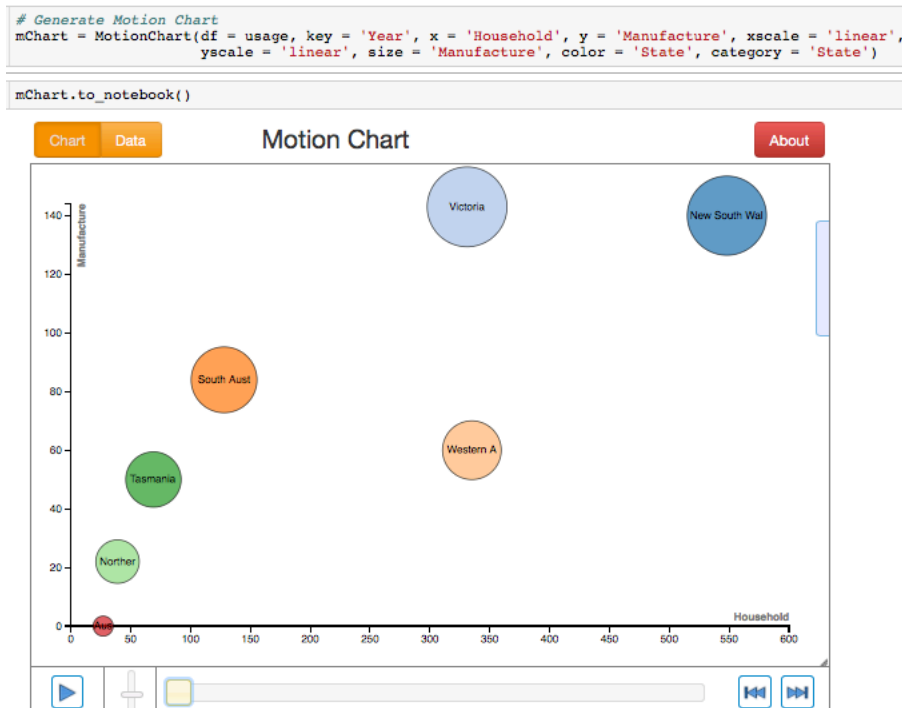adily over the time frame, and it was relatively small compared to other states before June 2013. However, the rate of increase has been particularly strong since June 2014, especially in June 2015.

Task 2. Water consumption in Australian household vs manufacturing


```
# Generate Motion Chart
mChart = MotionChart(df = usage, key = 'Year', x = 'Household', y = 'Manufacture', xscale = 'linear',
                yscale = 'linear', size = 'Manufacture', color = 'State', category = 'State')

mChart.to_notebook()
```

<figure 18. Motion chart of water usage>

Above motion chart that shows relationship between household water consumption and manufacturing water consumption by Australian states over 2008 to 2015. This chart elucidates how much water is consumed by the states from two major consumers. It helps to analyze the amount of water used by each state. Moreover, through the amount of water used, how much population density and manufacture density of the area is predictable. This chart can be used to predict how much will be consumed annually. In addition, this chart shows the fact that manufactures do not exist in certain areas of Australia and in which areas they are concentrated, so you can think about occupations and employment rates.

<Figure 19. Motion chart of water consumption>
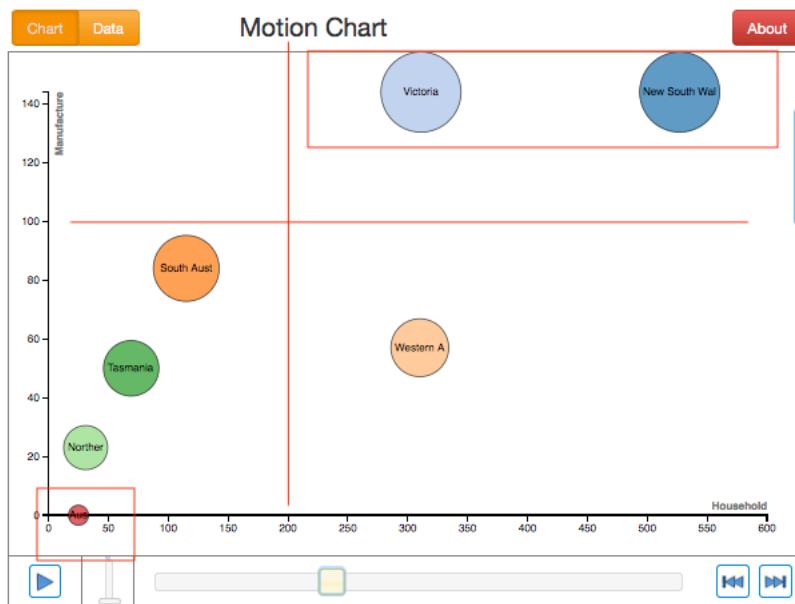
Above motion chart shows that NSW and VIC had high population, and most manufactures are located. Also, there is no manufactures in ACT.