Has crime rate reduced in Boroughs of London and areas under control of Metropolitan Police force ?

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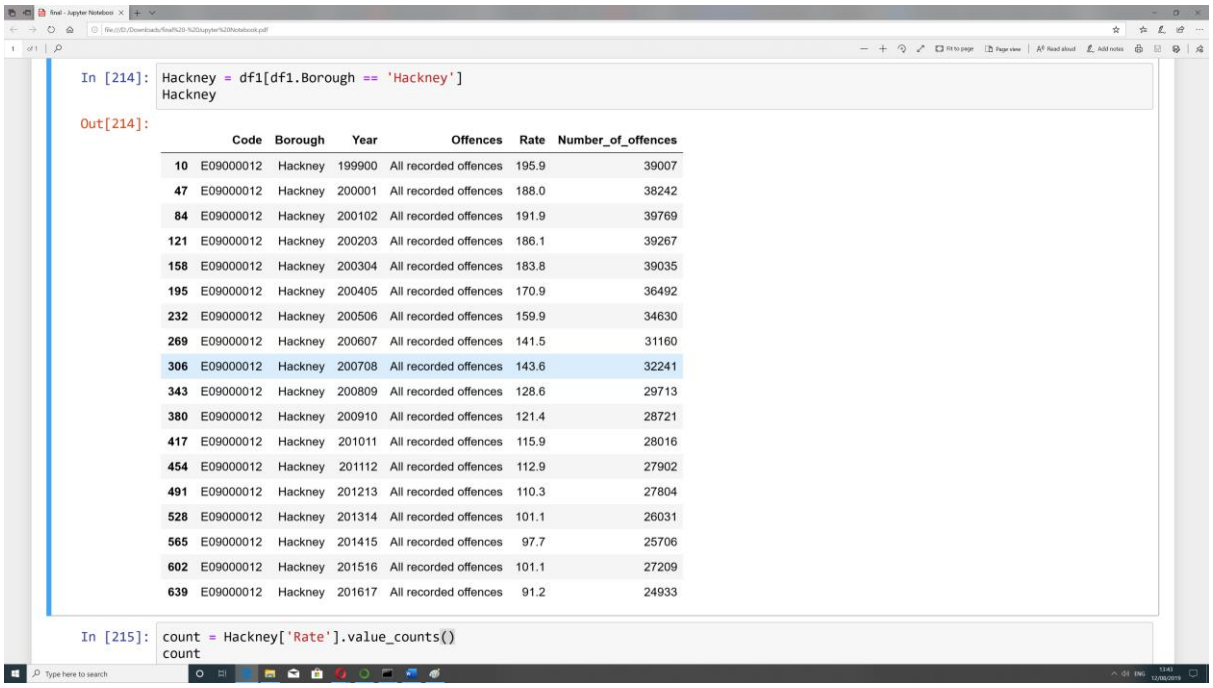
Research Question

Has crime rate reduced in Boroughs of London and areas under control of Metropolitan Police force ?

Introduction

This data was collected by Metropolitan Police, for areas of England and Wales, London and Outer London. There are 32 Boroughs that are under the control of the metropolitan police, due to the recent rise in knife offences, I am going to examine if the rate of crime per 1000 people has increased or decreased. This dataset consists of data collected over 17 years from 1999-2017.It includes data specific for each borough or area, for example it can show Hackney's crime rate through years and we can see this in the following table:



In [214]:
```
Hackney = df1[df1.Borough == 'Hackney']
Hackney
```

Out[214]:

	Code	Borough	Year	Offences	Rate	Number_of_offences
10	E09000012	Hackney	199900	All recorded offences	195.9	39007
47	E09000012	Hackney	200001	All recorded offences	188.0	38242
84	E09000012	Hackney	200102	All recorded offences	191.9	39769
121	E09000012	Hackney	200203	All recorded offences	186.1	39267
158	E09000012	Hackney	200304	All recorded offences	183.8	39035
195	E09000012	Hackney	200405	All recorded offences	170.9	36492
232	E09000012	Hackney	200506	All recorded offences	159.9	34630
269	E09000012	Hackney	200607	All recorded offences	141.5	31160
306	E09000012	Hackney	200708	All recorded offences	143.6	32241
343	E09000012	Hackney	200809	All recorded offences	128.6	29713
380	E09000012	Hackney	200910	All recorded offences	121.4	28721
417	E09000012	Hackney	201011	All recorded offences	115.9	28016
454	E09000012	Hackney	201112	All recorded offences	112.9	27902
491	E09000012	Hackney	201213	All recorded offences	110.3	27804
528	E09000012	Hackney	201314	All recorded offences	101.1	26031
565	E09000012	Hackney	201415	All recorded offences	97.7	25706
602	E09000012	Hackney	201516	All recorded offences	101.1	27209
639	E09000012	Hackney	201617	All recorded offences	91.2	24933

In [215]:
```
count = Hackney['Rate'].value_counts()
count
```

As the table above shows that rate of crime in Hackney has reduced severely since 1999. This table can also tell us the number of offences and the code for the Borough.

I have under taken this data analysis to show a correlation of rate of crime reducing over years and I am going to demonstrate the trend at hand.

This crime data can be an insight into how safe or unsafe our boroughs are compared to a few years ago we can also see trend and peaks at certain years for each borough.

Most graphs are interactive and not a picture please open the jupyter notebook and feel free to interact with the data. The visualisations are designed to help the user gain the information they need by interacting with the visualisations.

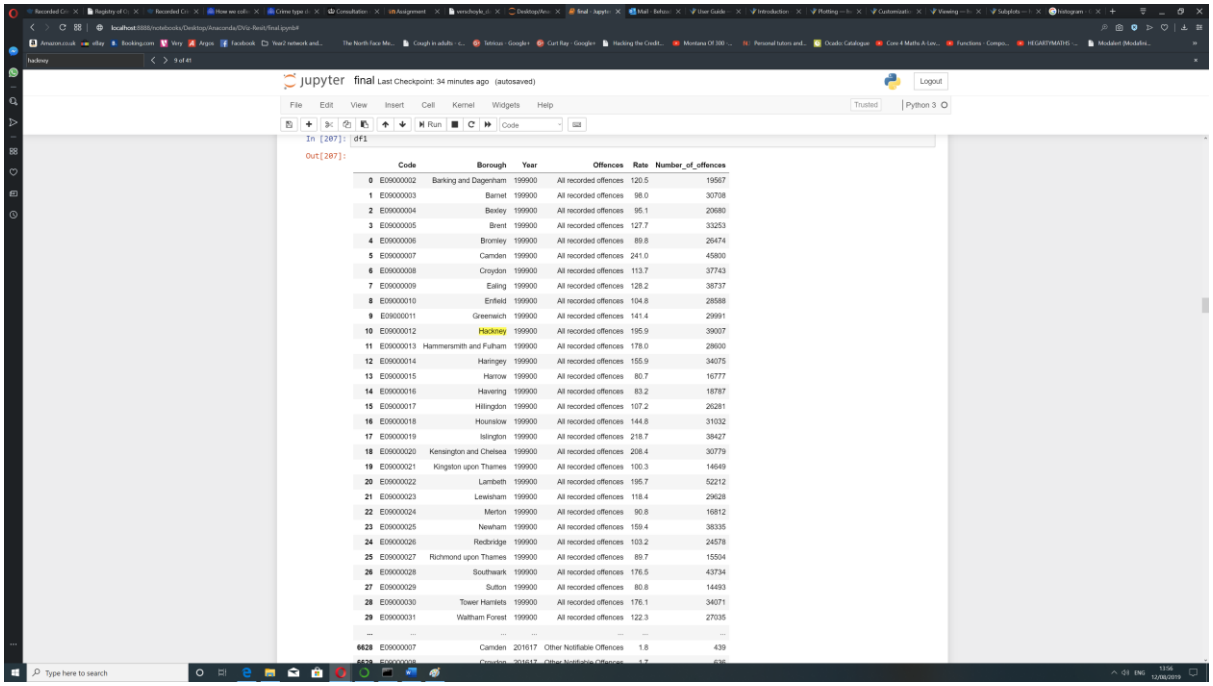
Crime

There was a wide variety of criminal offences that were being reported back, however, for the purposes of this research, we are only interested in the rate of crime for all offences therefore, by getting rid of unnecessary data we are able to achieve our desirable goals.

The metropolitan police has adopted new legislations regarding classification of different crimes starting from the year 2011-2012, therefore it was not possible to compare data from previous years of specific criminal offences to the years after the law was introduced.

The data itself has 6 columns: Code (The unique code assigned to each area/borough) , Borough(Name of the borough), Year(Year of the recording of data, for example 201112 is the year 2011-12,Offences(It indicates what type of offence was committed, I have dropped all, expect All offences), Rate (this is how many crimes get committed per 1000 people), Number of offences(this is the raw number of offences before being divided by 100 to become Rate).

I was not interested in areas that are not a borough or clearly defined therefore I have dropped all data concerning those areas.
The table below shows the Crime Rates data frame.



	Code	Borough	Year	Offences	Rate	Number_of_offences
0	E09000002	Barking and Dagenham	199900	All recorded offences	120.5	19567
1	E09000003	Barnet	199900	All recorded offences	98.0	30708
2	E09000004	Bexley	199900	All recorded offences	95.1	20680
3	E09000005	Brent	199900	All recorded offences	127.7	33253
4	E09000006	Bromley	199900	All recorded offences	89.8	26474
5	E09000007	Camden	199900	All recorded offences	241.0	45800
6	E09000008	Croydon	199900	All recorded offences	113.7	37743
7	E09000009	Ealing	199900	All recorded offences	128.2	38737
8	E09000010	Enfield	199900	All recorded offences	104.8	28588
9	E09000011	Greenwich	199900	All recorded offences	141.4	29991
10	E09000012	Hackney	199900	All recorded offences	195.9	39007
11	E09000013	Hammersmith and Fulham	199900	All recorded offences	178.0	28600
12	E09000014	Haringey	199900	All recorded offences	155.9	34075
13	E09000015	Harrow	199900	All recorded offences	80.7	16777
14	E09000016	Havering	199900	All recorded offences	83.2	18787
15	E09000017	Hillingdon	199900	All recorded offences	107.2	26281
16	E09000018	Hounslow	199900	All recorded offences	144.8	31032
17	E09000019	Islington	199900	All recorded offences	218.7	38427
18	E09000020	Kensington and Chelsea	199900	All recorded offences	208.4	30779
19	E09000021	Kingston upon Thames	199900	All recorded offences	100.3	14649
20	E09000022	Lambeth	199900	All recorded offences	195.7	52212
21	E09000023	Lewisham	199900	All recorded offences	118.4	29628
22	E09000024	Merton	199900	All recorded offences	90.8	16812
23	E09000025	Newham	199900	All recorded offences	159.4	38335
24	E09000026	Redbridge	199900	All recorded offences	103.2	24578
25	E09000027	Richmond upon Thames	199900	All recorded offences	89.7	15504
26	E09000028	Southwark	199900	All recorded offences	176.5	43734
27	E09000029	Sutton	199900	All recorded offences	80.8	14493
28	E09000030	Tower Hamlets	199900	All recorded offences	176.1	34071
29	E09000031	Waltham Forest	199900	All recorded offences	122.3	27035
...	...	...	...	...	...	...
6628	E09000007	Camden	201617	Other Notifiable Offences	1.8	439

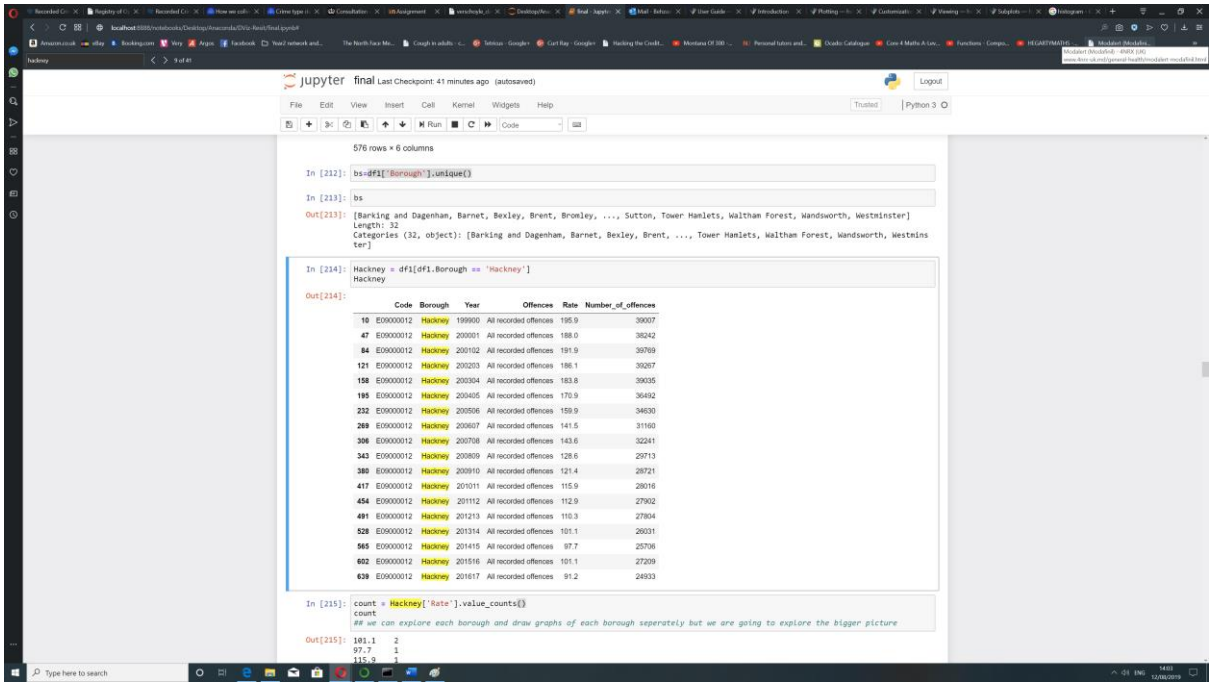
As it can be seen in the data, from year to year there are unique reccordings of crime rate per Borough.

Heathrow also had values of NaN , due to the population being 0, therefore I have dropped all the rows that contain missing or empty values.

I have used PyViz libraries successfully to analyse and visualize the data, PyViz is a library of tools designed to help make analysing and visualizing data easier.

By using tools such as Holowviews, HVPLOT, Bokeh, Param, Panel and others we are able to demonstrate the data more interactively rather than a picture, this also allows for large data sets with many columns to be represented clearly and for the users to interact with the graphs to achieve the results that they need.

Results



```
576 rows × 6 columns

In [212]: bs=df1['Borough'].unique()

In [213]: bs

Out[213]: [Barking and Dagenham, Barnet, Bexley, Brent, Bromley, ..., Sutton, Tower Hamlets, Waltham Forest, Wandsworth, Westminster]
Length: 32
Categories (32, object): [Barking and Dagenham, Barnet, Bexley, Brent, ..., Tower Hamlets, Waltham Forest, Wandsworth, Westminster]

In [214]: Hackney = df1[df1.Borough == 'Hackney']
          Hackney
```

Out[214]:

	Code	Borough	Year	Offences	Rate	Number_of_offences
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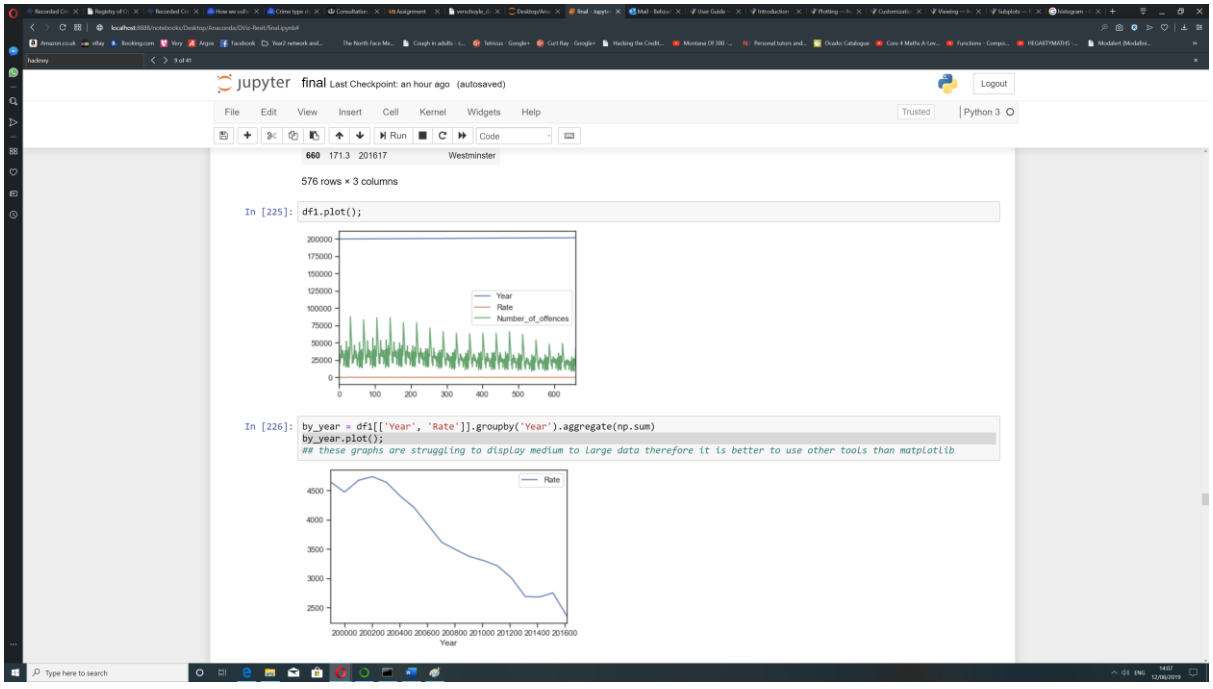
```
In [215]: count = Hackney['Rate'].value_counts()
          count
          ## we can explore each borough and draw graphs of each borough seperately but we are going to explore the bigger picture

Out[215]: 101.1    2
          97.7     1
          115.9    1
```

Table1. this table shows the rates of crime happening per year for the borough of Hackney, I was personally interested in knowing this data as I live in Hackney. As we can see in the above table the year 1999-2000 had the highest crime rate and reached the levels 195.9 criminal offences per 1000 people.



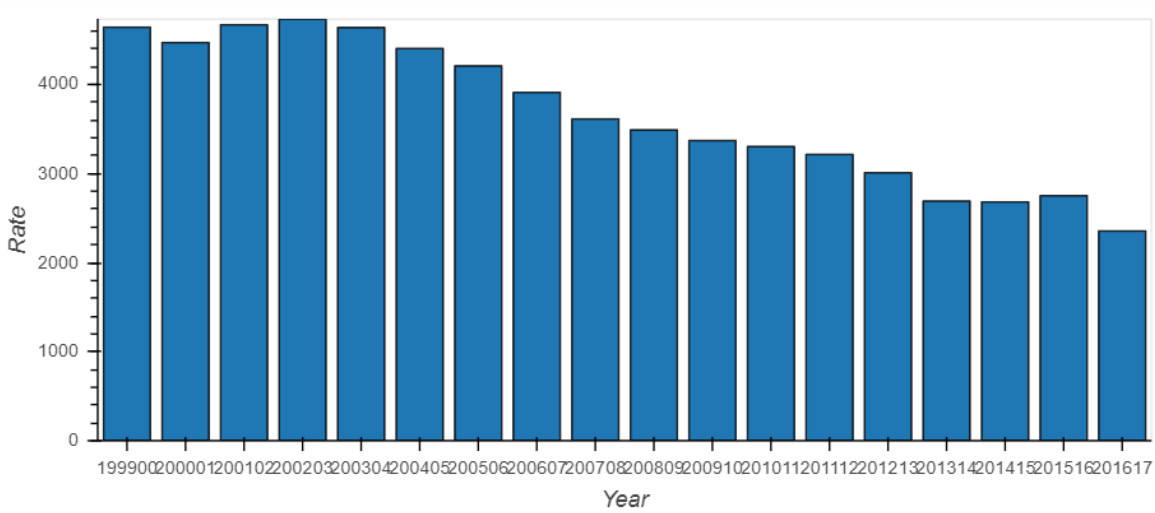
```
660  171.3  201617  Westminster

576 rows × 3 columns

In [225]: df1.plot();
```



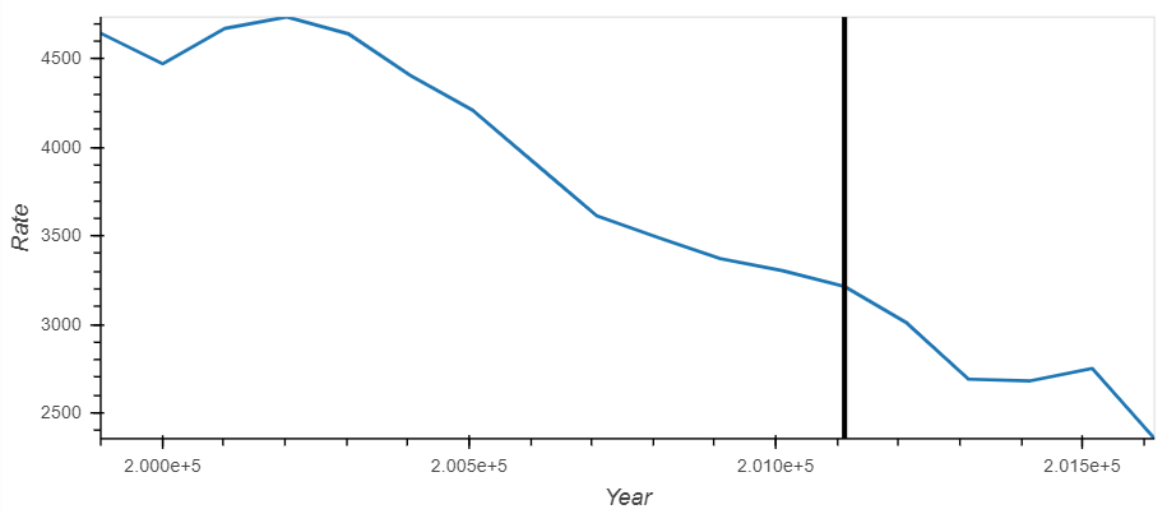
```
In [226]: by_year = df1[['Year', 'Rate']].groupby('Year').aggregate(np.sum)
          by_year.plot();
          ## these graphs are struggling to display medium to large data therefore it is better to use other tools than matplotlib
```


Graphs 1 and 2. As Can be seen in these pictures, Graph 1 is not a good representative of data it does not clearly show the years neither does display the data correctly, this is due to

limitations of matplotlib to deal with bigger data.In the second graph however, I have taken the sum of all crime rate amongst boroughs and plotted that against the year in which it happened. In this graph we can clearly see the downward trend, for example we can see that in the years 2013-2015 there was a slight rise in the crime rate.

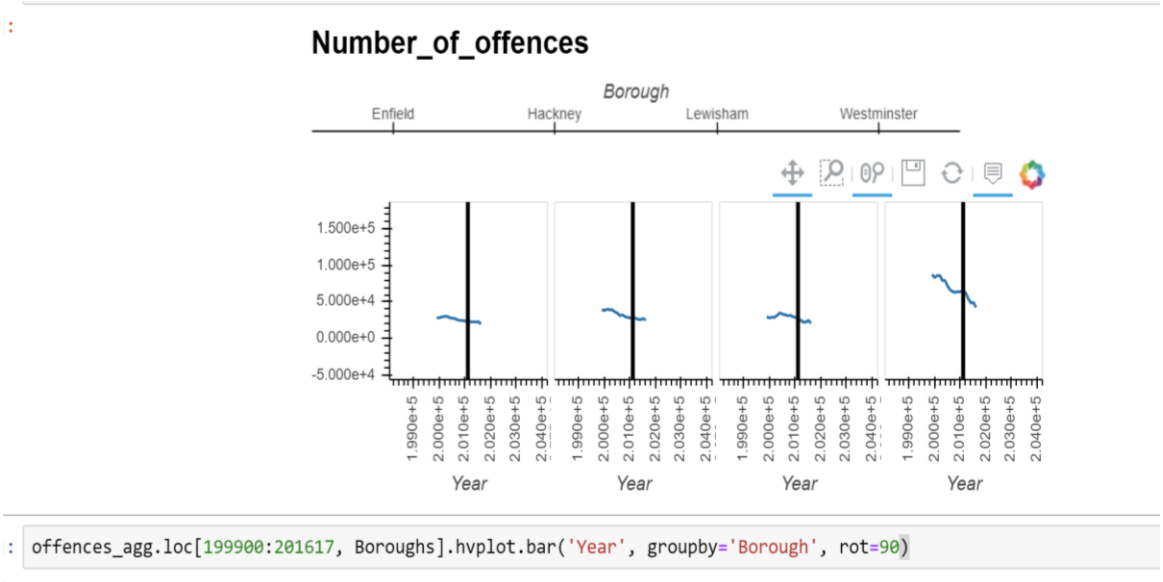


Graph3, this graph was constructed using Bokeh, I would recommend opening the Jupyter notebook and using the interactive interface of the graph. This is a distribution graph, as we can see there is a downward spiral, in here we can more clearly see that rate of crime stayed the same in the year 2013 and 2014 but increase in 2015 only to decrease further in 2016.

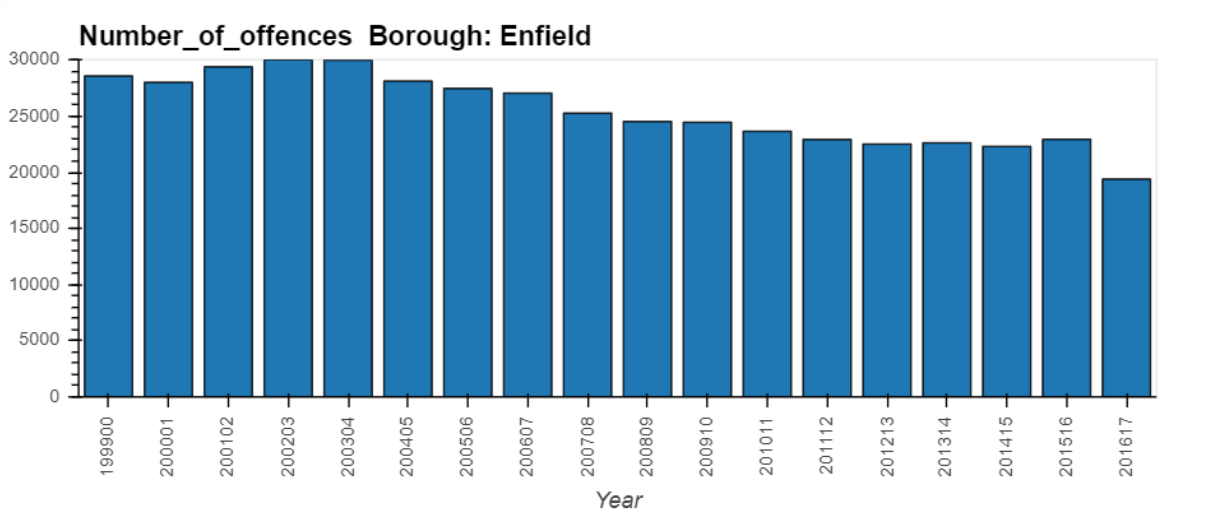


Graph4, made with PyViz Bokeh also, this graph shows us the year that the law was introduced, unfortunately because of the formatting the date is not clear and I was not able to change this e number to the real numbers. However this graph provides valuable data as it shows that the introduction of the legislation did not have an affect on the rate at which crime was reducing.

We can also clearly see the downward trend.

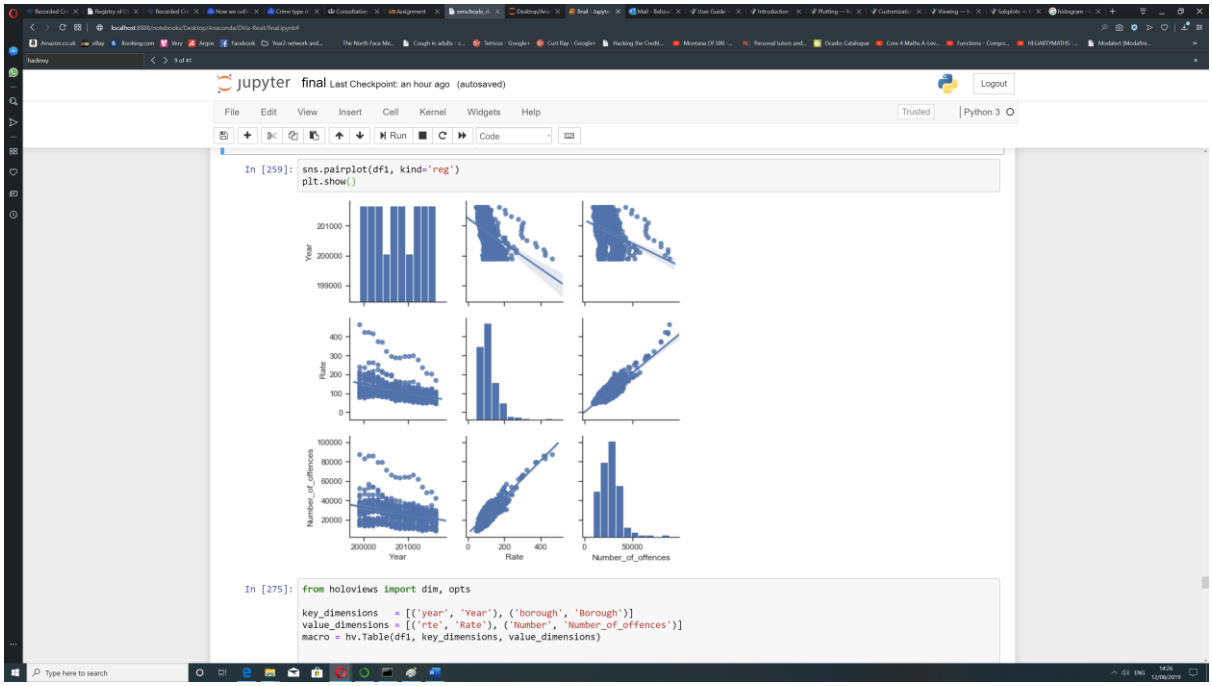


Graph5. The graph show data for number of offences between 1999 and 2016 between four different boroughs which are Enfield, Hackney Lewisham, Westminster. The data is grouped by borough. Looking at the graph it is visible that in Enfield, Hackney and Lewisham during those years the number of offences stayed more less similar, whereas in Westminster in 1999 the number of offences was very high (87615) compared to other three boroughs(28588 - 39007), it gradually started going down from that on, however in 2016 it is still the highest number of offences there (42414) compared to others.



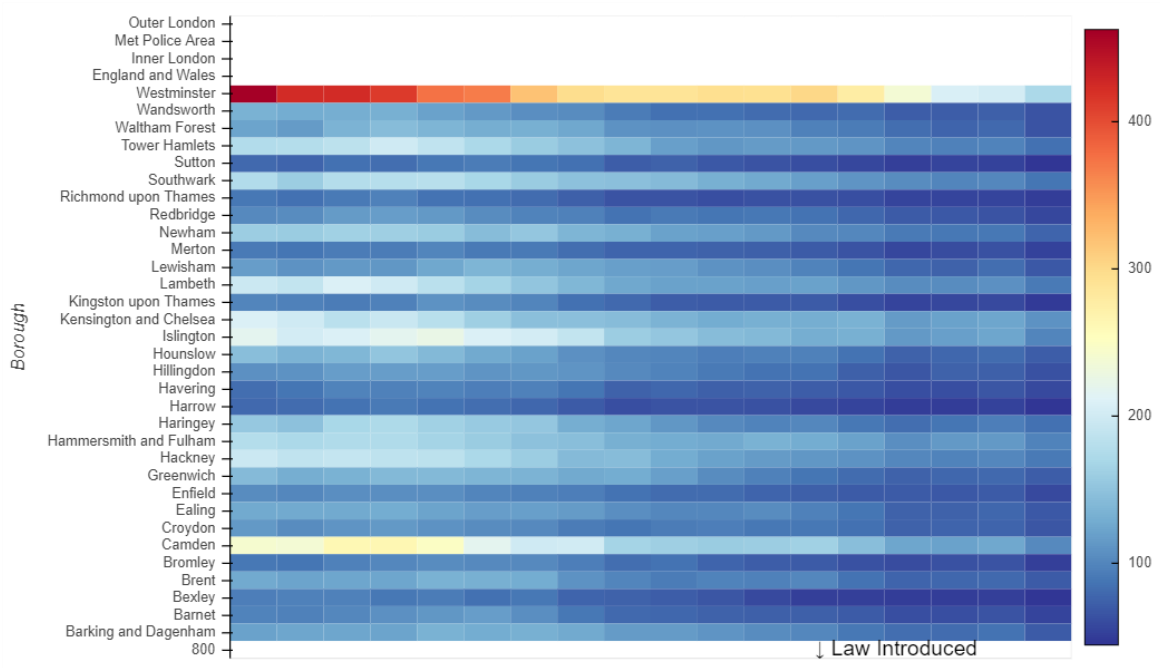
Graph6

All these graphs are mad ewith PyViz, Bokeh and holowviews. This distribution plot represents the Borough of Enfield and its rate of crime per year for all offences. As we can see there has been downward trend since 2004,there is a slight spike in crime levels in 2015 however this did not continue and therefor did not become a trend.



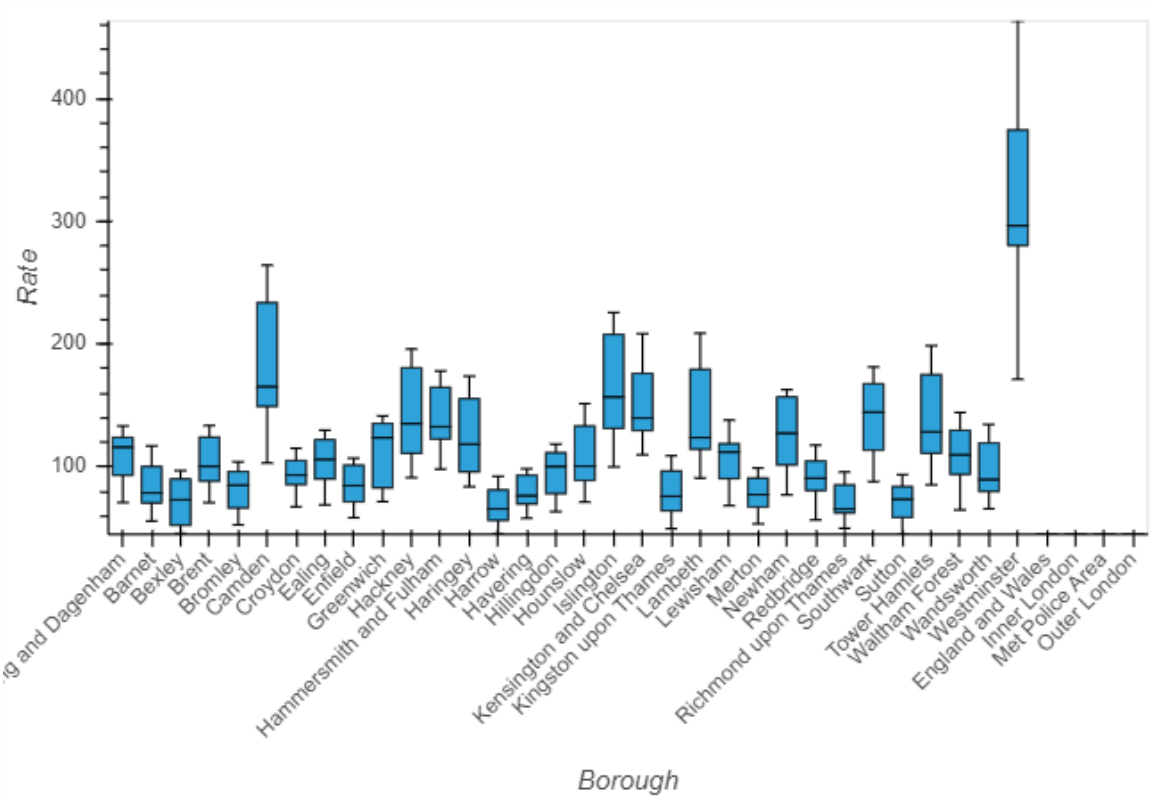
Graph 7

This Graph was plotted using seaborn, seaborn is useful for representing scatter plots, distributions of data and to get more of a general over view.



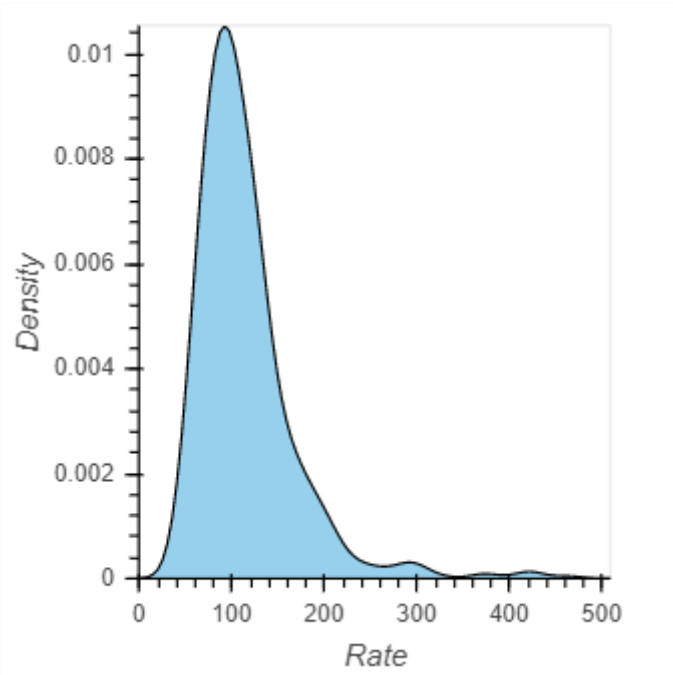
Graph 8

This is a heat map, the above diagram has a atempreturw meter which shows that colours that are warmer have a higher crime rate and the cooler colours a Lower crime rate as we can see the Borough of Westminster has been the worst for the crime rate through the period in which this data was collected.

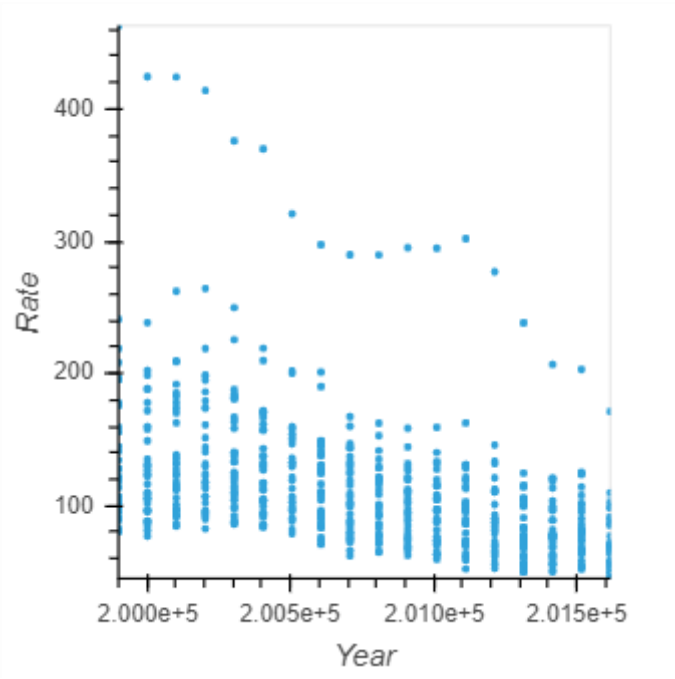


Graph 9

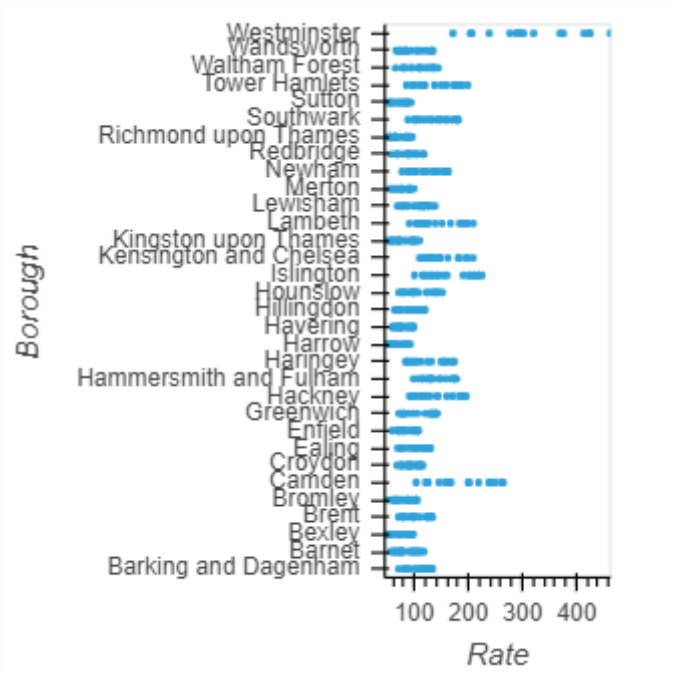
This is a box and whiskers graph, plotted using PyVi. This graph clearly shows the outliers the mean the median and which Boroughs have a higher crime rate. As we can see in this diagram, Camden is a close follower to Westminster Borough for the rates of crime.



Graoh 10. This graph is a distribution graph and it shows that the crime rate of 100 is the most common.



Graoh11



Graoh 12

Conclusion

This research was designed to discover the current trend of crimes, from the visualisations above we can see that there is a downward trend in rate of crime across the metropolitan police force area.

Over the past 17 years, the number of offences and the crime rate consequently have gone down. Plots such as box and whiskers are very good at showcasing mean, median and outlines of the data, the box plot was also very useful in determining the Boroughs with highest crimes rates over the past few years, it is clear that Westminster has always been a Borough with some. Of the highest crime rate, where as Camden and Islington take the 2nd and 3rd place in this regard.

The visualisations in Bokeh and Holoviews and PyViz are very useful. They have helped to simplify the visualisation process and also provide interactivity to the user.. Please open the Jupyter notebook to have the full experience. To conclude, this research has identified the 3 Boroughs with consistent high levels of crime rate as well as identifying years with the highest crime rate as can be seen in correlation line graphs, we have also discovered that the crime rate as a whole is on a downward trend.

These graphs are capable of delivering different sets of values and or for comparing several Boroughs together so the user can indulge in interacting with the data rather than downloading a picture.