Covid

October 17, 2020

[342]:
```
import pandas as pd
import numpy as np
from datetime import datetime
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import PolynomialFeatures
```

0.0.1 firstly, let´s check the dataframe structure

[160]:
```
df= pd.read_csv("covid-19-uk-historical-data.csv")
df
```

[160]:

	Unnamed: 0	date	country	areacode	area	totalcases
0	0	2020-01-30	England	E06000014	York	1.0
1	1	2020-02-03	England	E10000002	Buckinghamshire	1.0
2	2	2020-02-03	Wales	W11000028	Aneurin Bevan	0.0
3	3	2020-02-03	Wales	W11000023	Betsi Cadwaladr	0.0
4	4	2020-02-03	Wales	W11000029	Cardiff and Vale	0.0
…	…	…	…	…	…	…
23293	23293	2020-07-29	Scotland	S08000024	Lothian	3192.0
23294	23294	2020-07-29	Scotland	S08000025	Orkney	9.0
23295	23295	2020-07-29	Scotland	S08000026	Shetland	54.0
23296	23296	2020-07-29	Scotland	S08000030	Tayside	1785.0
23297	23297	2020-07-29	Scotland	S08000028	Western Isles	7.0

```
[23298 rows x 6 columns]
```

[161]:
```
date_lst=[]

for date in df.date:

    date=datetime.strptime(date, "%Y-%m-%d")
    date_lst.append(date)
df["datetime"]=date_lst



def find_days(df):
    days_lst=[0]
    m=0
    n=0
    for days in df["datetime"]:

            m+=1

            if m<df.shape[0]:

                delta=df["datetime"][m]-df["datetime"][n]
                n+=1

                #print(delta)
                #print(delta.days)
                days_lst.append(delta.days)
            else:
                break
    df["days"] = days_lst


find_days(df)
```

[162]:
```
df.days= df.datetime - df.datetime[0]   # simplest way to find intervals! No␣
↪function required, no for cycles no df.apply() etc
```

[163]:
```
time_range= df.datetime[df.shape[0]-1]-df.datetime[0]   #This trick is amazing␣
↪to avoid having a Series as a result. Not sure why it works

"this will be used for plotting later: "

tot_days= time_range.days
```

lockdown was imposed on the 23rd of March 2020, 23-03-2020

[230]:
```
df[df["date"]=="2020-03-23"].head(1)
```

[230]:
```
      Unnamed: 0        date  country   areacode                  area  \
2503        2503  2020-03-23  England  E09000002  Barking and Dagenham

      totalcases   datetime    days
2503        70.0 2020-03-23 53 days
```

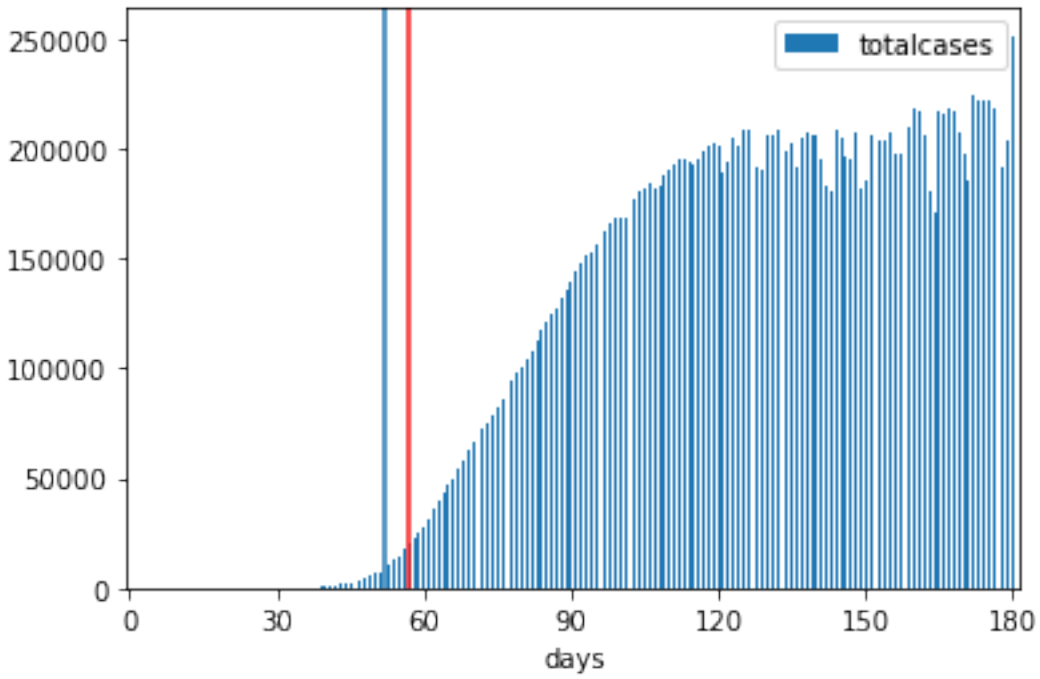
Lockdown began on day 52!

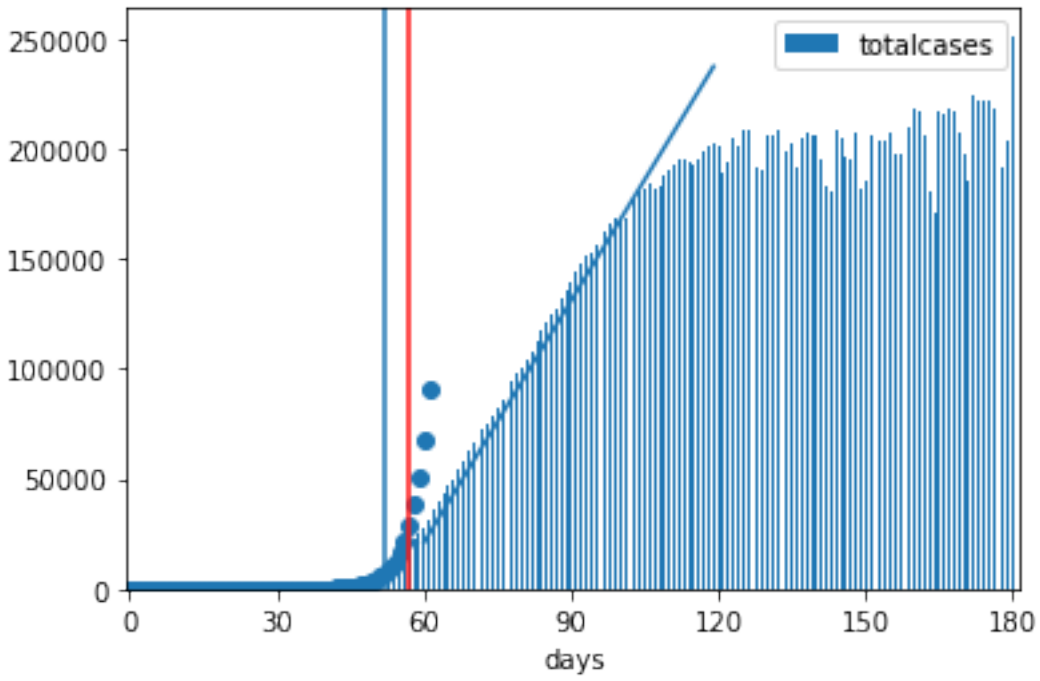
[338]:
```
England_df= df[df["country"]== "England"]

Scotland_df= df[df["country"]== "Scotland"]

Wales_df= df[df["country"]== "Wales"]

NI_df= df[df["country"]== "Northern Ireland"]



def get_total(df):


    days=[]
    total_cases=[]
    for n in range(182):
        tot= df[df["days"] ==pd.Timedelta(n, unit='d') ].totalcases.sum()
        days.append(n)
        total_cases.append(tot)

    new_df= pd.DataFrame({"days": days,"totalcases": total_cases})
    new_df.plot(kind='bar',x='days',y='totalcases', xticks=range(0,182,30),␣
↪rot=0)

    plt.axvline(x=52)


    """the buffer period has been included to show possible delay in how the␣
↪measures affected transmission,
    namely up to 5 days after the lockdown started,
    the registered cases were still of infections occurred before the lockdown␣
↪itself"""

    plt.axvline(x=57, color='#ff1414') # a buffer period of 10 days has been␣
↪considered
```

```
'''MACHINE LEARNING PART WITH SCI-KIT LEARN '''
'''MACHINE LEARNING PART WITH SCI-KIT LEARN '''


Y_1= new_df[new_df["days"] < 57 ]
Y_1= Y_1.totalcases
Y_1= Y_1 + 0.01 # get rid of zeroes
Y_1= np.log(Y_1)# to make it "fittable" with linear regression

Y_2= new_df[new_df["days"] < 90 ][new_df["days"] > 57 ]
Y_2= Y_2.totalcases


'X used to train:'

X_1=np.array(range(57))
X_2=np.array(range(32))

X_1=X_1.reshape(-1, 1)
X_2=X_2.reshape(-1, 1)


linear_1=LinearRegression()
linear_2=LinearRegression()
model_1=linear_1.fit(X_1,Y_1)
model_2=linear_2.fit(X_2,Y_2)


'X used to predict:'

X_pred_2= np.array(range(60))
X_pred_2= X_pred_2.reshape(-1, 1)

X_pred_1= np.array(range(62))
X_pred_1= X_pred_1.reshape(-1, 1)


pred_1=model_1.predict(X_pred_1) #I expect this to be exponential
pred_2=model_2.predict(X_pred_2) #I expect this to be linear

''' END OF THE MACHINE LEARNING PART '''
''' END OF THE MACHINE LEARNING PART '''

pred_1= np.exp(pred_1)
```

```
    "Same code as before just to duplicate plot"
    new_df.plot(kind='bar',x='days',y='totalcases', xticks=range(0,182,30),␣
↪rot=0)
    plt.axvline(x=52)
    plt.axvline(x=57, color='#ff1414')
    "END"

    plt.scatter(np.array(range(62)),pred_1)

    #print(model_2.get_params())
    plt.plot(np.array(range(60,120)),pred_2)

    return new_df

total_England_df= get_total(England_df)
```

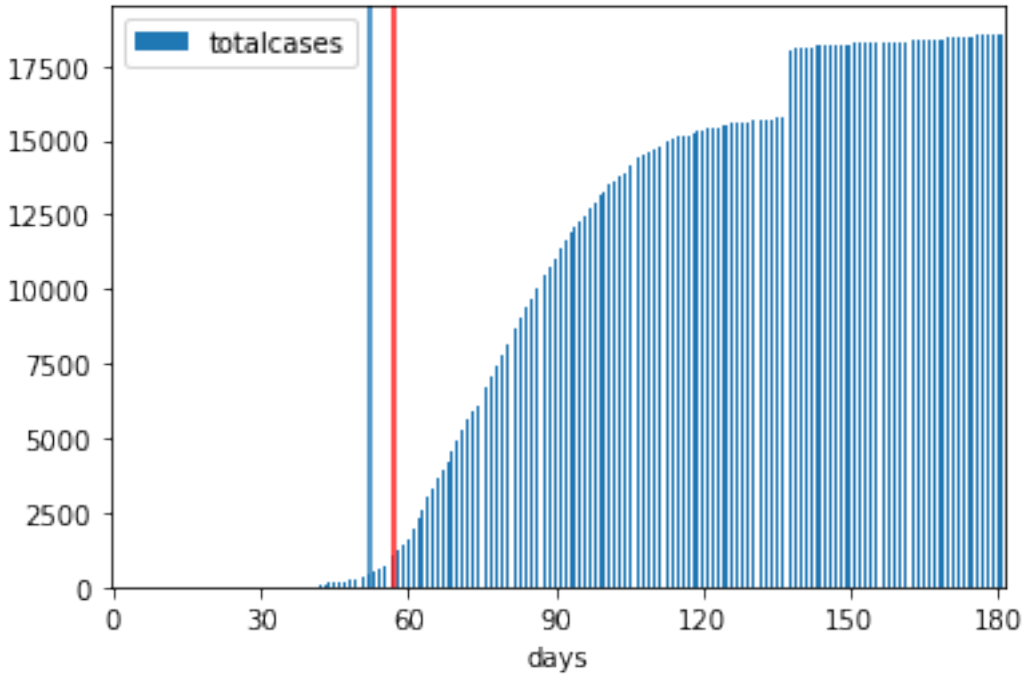
```
<ipython-input-338-445e17944fa8>:44: UserWarning: Boolean Series key will be
reindexed to match DataFrame index.
  Y_2= new_df[new_df["days"] < 90 ][new_df["days"] > 57 ]
```

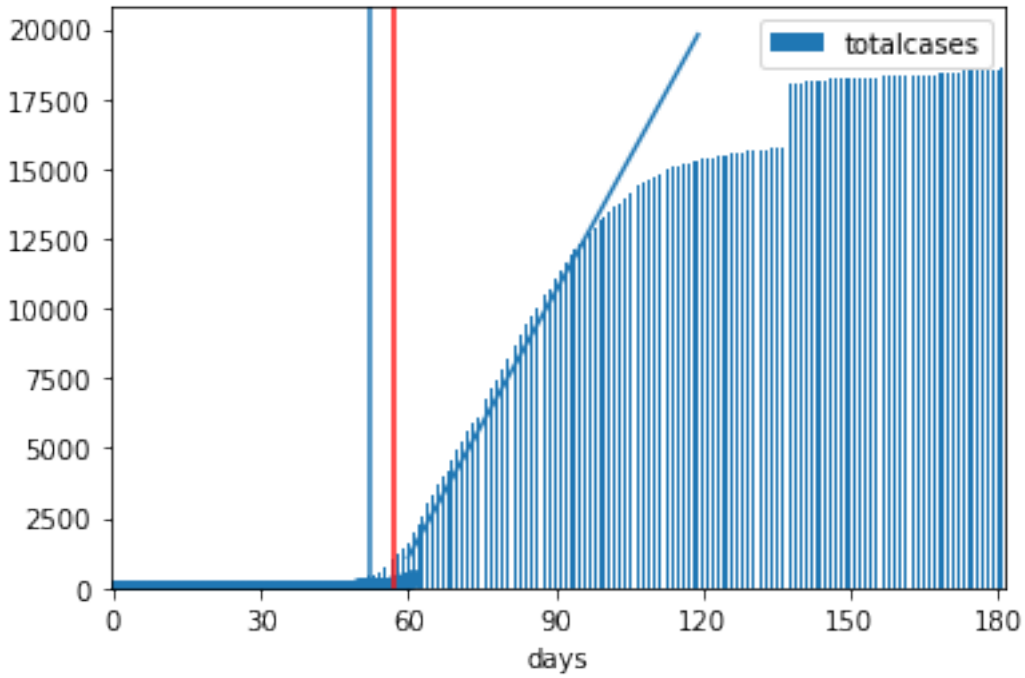




[339]:
```
total_Scotland_df= get_total(Scotland_df)
```

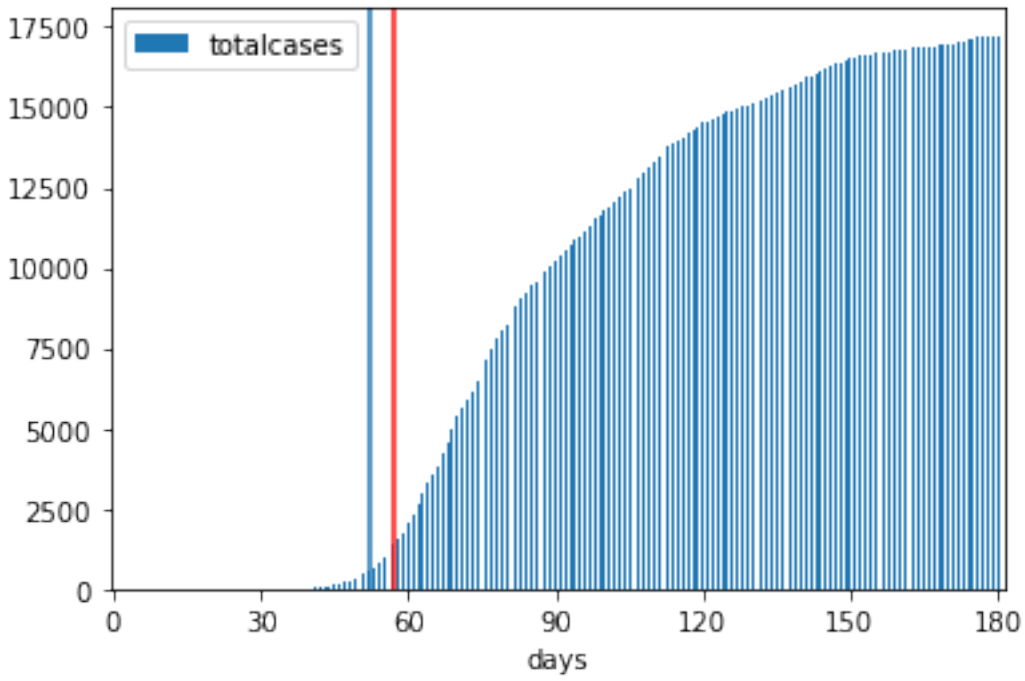
```
<ipython-input-338-445e17944fa8>:44: UserWarning: Boolean Series key will be
reindexed to match DataFrame index.
  Y_2= new_df[new_df["days"] < 90 ][new_df["days"] > 57 ]
```

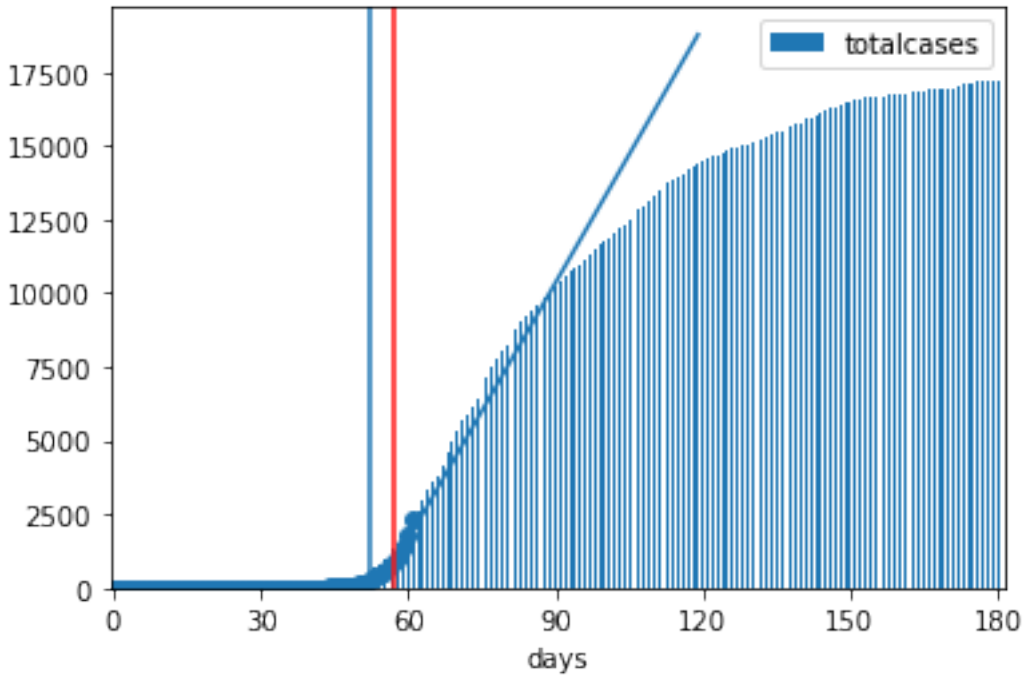




[340]:
```
total_Wales_df= get_total(Wales_df)
```

```
<ipython-input-338-445e17944fa8>:44: UserWarning: Boolean Series key will be
reindexed to match DataFrame index.
  Y_2= new_df[new_df["days"] < 90 ][new_df["days"] > 57 ]
```





[341]:
```
total_NI_df= get_total(NI_df)
```

```
<ipython-input-338-445e17944fa8>:44: UserWarning: Boolean Series key will be
```

```
reindexed to match DataFrame index.
  Y_2= new_df[new_df["days"] < 90 ][new_df["days"] > 57 ]
```