Project_Safe_Travel

May 7, 2021

1 Safe Travels

1.1 "Thriving against the odds"

1.1.1 Where should Mexico puts its very limited economic efforts to increase tourism (in 2021 and 2022)?

[1]:
```
import matplotlib.pyplot as plt
import requests
import pandas as pd
import json
import scipy.stats as st
import plotly.express as px
```

[2]:
```
!pip install -U plotly
```

```
Requirement already up-to-date: plotly in c:\users\robmir\anaconda3\lib\site-
packages (4.14.3)
Requirement already satisfied, skipping upgrade: retrying>=1.3.3 in
c:\users\robmir\anaconda3\lib\site-packages (from plotly) (1.3.3)
Requirement already satisfied, skipping upgrade: six in
c:\users\robmir\anaconda3\lib\site-packages (from plotly) (1.15.0)
```

[3]:
```
# Covid Data API import
url = "https://api.apify.com/v2/key-value-stores/vpfkeiYLXPIDIea2T/records/
 ↪LATEST?disableRedirect=true"
```

[4]:
```
response = requests.get(url).json()
print(json.dumps(response, indent=4, sort_keys=True))
```

```
{
    "README": "https://apify.com/puorc/mexico-covid19?utm_source=app",
    "State": {
        "Aguascalientes": {
            "deceased": 676,
            "infected": 7753
        },
        "Baja California": {
            "deceased": 3680,
```

```
    "infected": 22137
},
"Baja California Sur": {
    "deceased": 537,
    "infected": 10925
},
"Campeche": {
    "deceased": 840,
    "infected": 6235
},
"Chiapas": {
    "deceased": 1323,
    "infected": 8079
},
"Chihuahua": {
    "deceased": 1483,
    "infected": 12753
},
"Ciudad de Mexico": {
    "deceased": 10730,
    "infected": 138329
},
"Coahuila": {
    "deceased": 1996,
    "infected": 28317
},
"Colima": {
    "deceased": 579,
    "infected": 5671
},
"Durango": {
    "deceased": 689,
    "infected": 9844
},
"Estado de Mexico": {
    "deceased": 13007,
    "infected": 88619
},
"Guanajuato": {
    "deceased": 3099,
    "infected": 43054
},
"Guerrero": {
    "deceased": 2057,
    "infected": 20295
},
"Hidalgo": {
    "deceased": 2061,
```

```
    "infected": 13844
},
"Jalisco": {
    "deceased": 3509,
    "infected": 29252
},
"Michoacan": {
    "deceased": 1827,
    "infected": 21927
},
"Morelos": {
    "deceased": 1125,
    "infected": 6283
},
"Nayarit": {
    "deceased": 782,
    "infected": 6247
},
"Nuevo Leon": {
    "deceased": 3306,
    "infected": 43667
},
"Oaxaca": {
    "deceased": 1554,
    "infected": 18694
},
"Puebla": {
    "deceased": 4372,
    "infected": 32922
},
"Queretaro": {
    "deceased": 997,
    "infected": 10086
},
"Quintana Roo": {
    "deceased": 1743,
    "infected": 12590
},
"San Luis Potosi": {
    "deceased": 1782,
    "infected": 24279
},
"Sinaloa": {
    "deceased": 3366,
    "infected": 19791
},
"Sonora": {
    "deceased": 2971,
```

```
            "infected": 35177
        },
        "Tabasco": {
            "deceased": 2893,
            "infected": 32868
        },
        "Tamaulipas": {
            "deceased": 2381,
            "infected": 30066
        },
        "Tlaxcala": {
            "deceased": 1133,
            "infected": 7820
        },
        "Veracruz": {
            "deceased": 4591,
            "infected": 34679
        },
        "Yucatan": {
            "deceased": 1635,
            "infected": 19426
        },
        "Zacatecas": {
            "deceased": 783,
            "infected": 8122
        }
    },
    "country": "Mexico",
    "deceased": 83507,
    "historyData":
"https://api.apify.com/v2/datasets/4efvuMEdxdQPCreW7/items?format=json&clean=1",
    "infected": 809751,
    "lastUpdatedAtApify": "2020-10-12T20:00:13.734Z",
    "lastUpdatedAtSource": "2020-10-09T00:00:00.000Z",
    "negative": 956251,
    "recovered": "N/A",
    "sourceUrl": "https://coronavirus.gob.mx/datos/",
    "suspected": 302645,
    "tested": "N/A"
}
```


[5]:
```
Covid_data_dic = response['State']
Covid_data_dic
```

[5]:

```
{'Ciudad de Mexico': {'infected': 138329, 'deceased': 10730},
 'Baja California Sur': {'infected': 10925, 'deceased': 537},
 'Tabasco': {'infected': 32868, 'deceased': 2893},
```

```
'Sonora': {'infected': 35177, 'deceased': 2971},
'Coahuila': {'infected': 28317, 'deceased': 1996},
'Yucatan': {'infected': 19426, 'deceased': 1635},
'San Luis Potosi': {'infected': 24279, 'deceased': 1782},
'Tamaulipas': {'infected': 30066, 'deceased': 2381},
'Nuevo Leon': {'infected': 43667, 'deceased': 3306},
'Quintana Roo': {'infected': 12590, 'deceased': 1743},
'Colima': {'infected': 5671, 'deceased': 579},
'Guanajuato': {'infected': 43054, 'deceased': 3099},
'Sinaloa': {'infected': 19791, 'deceased': 3366},
'Campeche': {'infected': 6235, 'deceased': 840},
'Baja California': {'infected': 22137, 'deceased': 3680},
'Tlaxcala': {'infected': 7820, 'deceased': 1133},
'Guerrero': {'infected': 20295, 'deceased': 2057},
'Aguascalientes': {'infected': 7753, 'deceased': 676},
'Durango': {'infected': 9844, 'deceased': 689},
'Estado de Mexico': {'infected': 88619, 'deceased': 13007},
'Puebla': {'infected': 32922, 'deceased': 4372},
'Zacatecas': {'infected': 8122, 'deceased': 783},
'Nayarit': {'infected': 6247, 'deceased': 782},
'Michoacan': {'infected': 21927, 'deceased': 1827},
'Oaxaca': {'infected': 18694, 'deceased': 1554},
'Hidalgo': {'infected': 13844, 'deceased': 2061},
'Queretaro': {'infected': 10086, 'deceased': 997},
'Veracruz': {'infected': 34679, 'deceased': 4591},
'Jalisco': {'infected': 29252, 'deceased': 3509},
'Chihuahua': {'infected': 12753, 'deceased': 1483},
'Morelos': {'infected': 6283, 'deceased': 1125},
'Chiapas': {'infected': 8079, 'deceased': 1323}}
```

[6]:
```
# Build a standard list of states for Mexico
```

[7]:
```
states = ['Aguascalientes'        ,
 'Baja California'        ,
 'Baja California Sur'        ,
 'Campeche'        ,
 'Chiapas'        ,
 'Chihuahua'        ,
 'Ciudad de Mexico'        ,
 'Coahuila'        ,
 'Colima'        ,
 'Durango'        ,
 'Estado de Mexico'        ,
 'Guanajuato'        ,
 'Guerrero'        ,
 'Hidalgo'        ,
 'Jalisco'        ,
```

```
 'Michoacan'         ,
 'Morelos'         ,
 'Nayarit'         ,
 'Nuevo Leon'          ,
 'Oaxaca'         ,
 'Puebla'         ,
 'Queretaro'          ,
 'Quintana Roo'           ,
 'San Luis Potosi'            ,
 'Sinaloa'         ,
 'Sonora'         ,
 'Tabasco'         ,
 'Tamaulipas'           ,
 'Tlaxcala'          ,
 'Veracruz'          ,
 'Yucatan'         ,
 'Zacatecas'          ]
```

[8]:
```
infected = []
```

[9]:
```
for x in states:
    infected.append(Covid_data_dic[x]['infected'])
```

[10]:
```
infected
```

[10]:
```
[7753,
 22137,
 10925,
 6235,
 8079,
 12753,
 138329,
 28317,
 5671,
 9844,
 88619,
 43054,
 20295,
 13844,
 29252,
 21927,
 6283,
 6247,
 43667,
 18694,
 32922,
 10086,
```

```
12590,
24279,
19791,
35177,
32868,
30066,
7820,
34679,
19426,
8122]
```

[11]:
```
data = {"State": states,"Covid Cases":infected}


covid_df = pd.DataFrame(data,columns=['State',  'Covid Cases'])
covid_df.head()

# Covid confirmed cases (Oct 2020) per state
```

[11]:

	State	Covid Cases
0	Aguascalientes	7753
1	Baja California	22137
2	Baja California Sur	10925
3	Campeche	6235
4	Chiapas	8079

[12]:
```
covid_df.to_csv("clean_data/covid.csv", index=False)
```

[13]:
```
print(f"COVID19 infected data has been updated succesfully")
```

```
COVID19 infected data has been updated succesfully
```

2 Who wants to take vacations on a place filled with Covid and Crime? Nobody!

[16]:
```
# Import other dataframes and clean them: Population (to normalize data and␣
 ↪make it comparable), Number of crimes
# and Number of tourists.
# 1. Population per state data
# https://www.inegi.org.mx/app/tabulados/interactivos/?
 ↪pxq=Poblacion_Poblacion_01_e60cd8cf-927f-4b94-823e-972457a12d4b
```

[17]:
```
inegi = "raw_data/INEGI_Censo_Población_Vivienda_2020.csv"
census = pd.read_csv(inegi)
```

[18]:
```
census.head(15)
#Remove Estados Unidos Mexicanos, keep only 2020 data and stay only with Total␣
 ↪data (from age group)
```

[18]:

	Entidad federativa	Grupo quinquenal de edad	1990	1995	2000	2005	2010	2020
0	Estados Unidos Mexicanos	Total	81249645	91158290	97483412	103263388	112336538	126014024
1	Estados Unidos Mexicanos	0 a 4 años	10195178	10724100	10635157	10186243	10528322	10047365
2	Estados Unidos Mexicanos	5 a 9 años	10562234	10867563	11215323	10511738	11047537	10764379
3	Estados Unidos Mexicanos	10 a 14 años	10389092	10670048	10736493	10952123	10939937	10943540
4	Estados Unidos Mexicanos	15 a 19 años	9664403	10142071	9992135	10109021	11026112	10806690
5	Estados Unidos Mexicanos	20 a 24 años	7829163	9397424	9071134	8964629	9892271	10422095
6	Estados Unidos Mexicanos	25 a 29 años	6404512	7613090	8157743	8103358	8788177	9993001
7	Estados Unidos Mexicanos	30 a 34 años	5387619	6564605	7136523	7933951	8470798	9420827
8	Estados Unidos Mexicanos	35 a 39 años	4579116	5820178	6352538	7112526	8292987	9020276
9	Estados Unidos Mexicanos	40 a 44 años	3497770	4434317	5194833	6017268	7009226	8503586
10	Estados Unidos Mexicanos	45 a 49 años	2971860	3612452	4072091	5015255	5928730	7942413
11	Estados Unidos Mexicanos	50 a 54 años	2393791	2896049	3357953	4090650	5064291	7037532
12	Estados Unidos Mexicanos	55 a 59 años	1894484	2231897	2559231	3117071	3895365	5695958
13	Estados Unidos Mexicanos	60 a 64 años	1611317	1941953	2198146	2622476	3116466	4821062
14	Estados Unidos Mexicanos	65 a 69 años	1183651	1425809	1660785	1958069	2317265	3645077

[19]:
```
census.count()
```

[19]:
```
Entidad federativa          759
Grupo quinquenal de edad    759
1990                        759
1995                        759
2000                        759
2005                        759
2010                        759
```

```
2020                        759
dtype: int64
```

[20]:
```
census.dtypes
```

[20]:
```
Entidad federativa          object
Grupo quinquenal de edad    object
1990                         int64
1995                         int64
2000                         int64
2005                         int64
2010                         int64
2020                         int64
dtype: object
```

[21]:
```
del census['1990']
del census['1995']
del census['2000']
del census['2005']
del census['2010']
```

[22]:
```
census.describe()
```

[22]:
```
               2020
count  7.590000e+02
mean   6.641055e+05
std    4.808992e+06
min    5.500000e+01
25%    2.965800e+04
50%    1.257660e+05
75%    2.778645e+05
max    1.260140e+08
```

[23]:
```
census.head()
```

[23]:
```
          Entidad federativa Grupo quinquenal de edad       2020
0  Estados Unidos Mexicanos                     Total  126014024
1  Estados Unidos Mexicanos               0 a 4 años   10047365
2  Estados Unidos Mexicanos               5 a 9 años   10764379
3  Estados Unidos Mexicanos             10 a 14 años   10943540
4  Estados Unidos Mexicanos             15 a 19 años   10806690
```

[24]:
```
census_new = census.loc[census["Grupo quinquenal de edad"] == "Total"]
census_new.head(25)
```

[24]:
```
            Entidad federativa Grupo quinquenal de edad       2020
0    Estados Unidos Mexicanos                     Total  126014024
23             Aguascalientes                     Total    1425607
```

```
46            Baja California                    Total    3769020
69        Baja California Sur                    Total     798447
92                   Campeche                    Total     928363
115                  Coahuila                    Total    3146771
138                    Colima                    Total     731391
161                   Chiapas                    Total    5543828
184                 Chihuahua                    Total    3741869
207          Ciudad de Mexico                    Total    9209944
230                   Durango                    Total    1832650
253                Guanajuato                    Total    6166934
276                  Guerrero                    Total    3540685
299                   Hidalgo                    Total    3082841
322                   Jalisco                    Total    8348151
345          Estado de Mexico                    Total   16992418
368                 Michoacan                    Total    4748846
391                   Morelos                    Total    1971520
414                   Nayarit                    Total    1235456
437                Nuevo Leon                    Total    5784442
460                    Oaxaca                    Total    4132148
483                    Puebla                    Total    6583278
506                 Queretaro                    Total    2368467
529              Quintana Roo                    Total    1857985
552            San Luis Potosi                   Total    2822255
```

[25]:
```
census_final = census_new.loc[census_new["Entidad federativa"] != "Estados␣
↪Unidos Mexicanos", ["Entidad federativa", "2020"] ]
census_final.head()
```

[25]:
```
      Entidad federativa     2020
23        Aguascalientes  1425607
46       Baja California  3769020
69   Baja California Sur   798447
92              Campeche   928363
115             Coahuila  3146771
```

[26]:
```
census_export = census_final.rename(columns={"Entidad federativa": "State",
                                             "2020": "Total"})
```

[27]:
```
census_sorted = census_export.sort_values(["State"], ascending=True )
census_sorted['Total'] = pd.to_numeric(census_sorted['Total'])
census_sorted.to_csv("clean_data/poblacion.csv", index=False)
```

[28]:
```
# 2. Crime per state data
# https://www.gob.mx/sesnsp/acciones-y-programas/
↪datos-abiertos-de-incidencia-delictiva
```

[29]:
```
gobfed = "raw_data/Gobierno_Federal_Incidencia_Delictiva.csv"
crime_df = pd.read_csv(gobfed)
```

[30]:
```
crime_df.head()
```

[30]:

	Año	Clave_Ent	Entidad	Bien jurídico afectado	Tipo de delito	Subtipo de delito	Modalidad	Enero	Febrero	Marzo	Abril	Mayo	Junio	Julio	Agosto	Septiembre	Octubre	Noviembre	Diciembre	Total
0	2019	1	Aguascalientes	La vida y la Integridad corporal	Homicidio	Homicidio doloso	Con arma de fuego	7	4	6	2	2	5	3	1	11	10	3	2	15
1	2019	1	Aguascalientes	La vida y la Integridad corporal	Homicidio	Homicidio doloso	Con arma blanca	1	1	1	2	4	0	2	0	0	1	3	4	8
2	2019	1	Aguascalientes	La vida y la Integridad corporal	Homicidio	Homicidio doloso	Con otro elemento	1	2	2	2	2	1	0	1	0	0	1	2	3
3	2019	1	Aguascalientes	La vida y la Integridad corporal	Homicidio	Homicidio doloso	No especificado	0	0	0	0	2	0	0	0	0	0	0	0	0
4	2019	1	Aguascalientes	La vida y la Integridad corporal	Homicidio	Homicidio culposo	Con arma de fuego	0	0	0	0	0	1	0	1	0	0	0	0	0

[31]:
```
crime_df.count()
```

[31]:
```
Año                       3520
Clave_Ent                 3520
Entidad                   3520
Bien jurídico afectado    3520
Tipo de delito            3520
Subtipo de delito         3520
Modalidad                 3520
Enero                     3520
Febrero                   3520
Marzo                     3520
Abril                     3520
Mayo                      3520
```

```
Junio                    3520
Julio                    3520
Agosto                   3520
Septiembre               3520
Octubre                  3520
Noviembre                3520
Diciembre                3520
Total                    3520
dtype: int64
```

[32]:
```
del crime_df['Total']
del crime_df['Modalidad']
del crime_df['Subtipo de delito']
del crime_df['Tipo de delito']
del crime_df['Bien jurídico afectado']
del crime_df['Clave_Ent']
```

[33]:
```
crime_df.dtypes
```

[33]:
```
Año             int64
Entidad        object
Enero           int64
Febrero         int64
Marzo           int64
Abril           int64
Mayo            int64
Junio           int64
Julio           int64
Agosto          int64
Septiembre      int64
Octubre         int64
Noviembre       int64
Diciembre       int64
dtype: object
```

[34]:
```
# COVID latest data is from OCT 2020 so we want to use crime data corresponding␣
 ↪to Jan-Sep 2020 and Oct-Dec 2019 (Rolling year)
```

[35]:
```
df2019 = crime_df.loc[crime_df["Año"] == 2019 ]
```

[36]:
```
df2019.head()
```

[36]:

	Año	Entidad	Enero	Febrero	Marzo	Abril	Mayo	Junio	Julio	\
0	2019	Aguascalientes	7	4	6	2	2	5	3	
1	2019	Aguascalientes	1	1	1	2	4	0	2	
2	2019	Aguascalientes	1	2	2	2	2	1	0	
3	2019	Aguascalientes	0	0	0	0	2	0	0	

```
4  2019  Aguascalientes      0        0      0      0     0      1      0

   Agosto  Septiembre  Octubre  Noviembre  Diciembre
0       1          11       10          3          2
1       0           0        1          3          4
2       1           0        0          1          2
3       0           0        0          0          0
4       1           0        0          0          0
```

[37]:
```
del df2019['Enero']
del df2019['Febrero']
del df2019['Marzo']
del df2019['Abril']
del df2019['Mayo']
del df2019['Junio']
del df2019['Julio']
del df2019['Agosto']
del df2019['Septiembre']
del df2019['Año']
```

[38]:
```
df2019.head()
```

[38]:
```
           Entidad  Octubre  Noviembre  Diciembre
0  Aguascalientes       10          3          2
1  Aguascalientes        1          3          4
2  Aguascalientes        0          1          2
3  Aguascalientes        0          0          0
4  Aguascalientes        0          0          0
```

[39]:
```
df_2019 = df2019.groupby(["Entidad"])
crimes_2019 = df_2019.sum()
new2019 = crimes_2019.reset_index()
```

[40]:
```
new2019.head()
```

[40]:
```
               Entidad  Octubre  Noviembre  Diciembre
0       Aguascalientes     1117        958        967
1      Baja California     3890       3485       3441
2  Baja California Sur      757        679        616
3             Campeche       73         78         73
4              Chiapas      591        567        572
```

[41]:
```
df2020 = crime_df.loc[crime_df["Año"] == 2020 ]
del df2020['Octubre']
del df2020['Noviembre']
del df2020['Diciembre']
del df2020['Año']
```

```
df_2020 = df2020.groupby(["Entidad"])
crimes_2020 = df_2020.sum()
new2020 = crimes_2020.reset_index()
```

[42]:
```
new2020.head()
```

[42]:
```
                Entidad  Enero  Febrero  Marzo  Abril  Mayo  Junio  Julio  \
0       Aguascalientes   1207     1209   1304    848   945   1064   1048
1      Baja California   3363     3417   3525   2482  2621   2954   3253
2  Baja California Sur    708      699    718    353   412    594    642
3              Campeche     77       86     89     41    54     52     55
4              Chiapas    634      614    664    403   374    368    580

   Agosto  Septiembre
0     866         867
1    3279        3091
2     564         614
3      73          76
4     537         578
```

[43]:
```
crime_df_final = pd.merge(new2020, new2019, on="Entidad")
```

[44]:
```
crime_df_final.head()
```

[44]:
```
                Entidad  Enero  Febrero  Marzo  Abril  Mayo  Junio  Julio  \
0       Aguascalientes   1207     1209   1304    848   945   1064   1048
1      Baja California   3363     3417   3525   2482  2621   2954   3253
2  Baja California Sur    708      699    718    353   412    594    642
3              Campeche     77       86     89     41    54     52     55
4              Chiapas    634      614    664    403   374    368    580

   Agosto  Septiembre  Octubre  Noviembre  Diciembre
0     866         867     1117        958        967
1    3279        3091     3890       3485       3441
2     564         614      757        679        616
3      73          76       73         78         73
4     537         578      591        567        572
```

[45]:
```
crime_df_final["Total"] = crime_df_final.sum(axis=1)
crime_df_export = crime_df_final[["Entidad", "Total"]]

crime_renamed_df = crime_df_export.rename(columns={"Entidad": "State",
                                                   "Total": "Crimes"})
crime_renamed_df.head()
```

[45]:
```
                State  Crimes
0       Aguascalientes   12400
```

```
1      Baja California   38801
2  Baja California Sur    7356
3             Campeche     827
4              Chiapas    6482
```

[46]:
```
crime_sorted = crime_renamed_df.sort_values(["State"], ascending=True )
crime_sorted.to_csv("clean_data/crimenes.csv", index=False)
```

[47]:
```
# 3. Tourist per state data
# Source INEGI - Webchat
# http://www.datatur.sectur.gob.mx/SitePages/InfTurxEdo.aspx
```

[48]:
```
tourist = "raw_data/INEGI_Tourist_data.csv"
tourist_df = pd.read_csv(tourist)
```

[49]:
```
tourist_df.head()
```

[49]:
```
                  State  Number of Tourists
0       Aguascalientes            856960.0
1      Baja California           3958843.0
2  Baja California Sur           3445908.0
3             Campeche           1578131.0
4              Chiapas           4376440.0
```

[50]:
```
tourist_df.dtypes
```

[50]:
```
State                  object
Number of Tourists    float64
dtype: object
```

[51]:
```
tourist_sorted = tourist_df.sort_values(["State"], ascending=True )
tourist_sorted['Number of Tourists'] = pd.to_numeric(tourist_sorted['Number of␣
 ↪Tourists'])

tourist_sorted.to_csv("clean_data/Tourist.csv", index=False)
```

[52]:
```
## Getting all data in the same dataframe
```

[53]:
```
file1 = "clean_data/poblacion.csv"
file2 = "clean_data/tourist.csv"
file3 = "clean_data/crimenes.csv"
```

[54]:
```
poblacion_df = pd.read_csv(file1)
tourist_df = pd.read_csv(file2)
crimes_df = pd.read_csv(file3)
```

[55]:
```
poblacion_df.head()
```

[55]:

	State	Total
0	Aguascalientes	1425607
1	Baja California	3769020
2	Baja California Sur	798447
3	Campeche	928363
4	Chiapas	5543828

[56]:
```
tourist_df.head()
```

[56]:

	State	Number of Tourists
0	Aguascalientes	856960.0
1	Baja California	3958843.0
2	Baja California Sur	3445908.0
3	Campeche	1578131.0
4	Chiapas	4376440.0

[57]:
```
crimes_df.head()
```

[57]:

	State	Crimes
0	Aguascalientes	12400
1	Baja California	38801
2	Baja California Sur	7356
3	Campeche	827
4	Chiapas	6482

[58]:
```
covid_df.head()
```

[58]:

	State	Covid Cases
0	Aguascalientes	7753
1	Baja California	22137
2	Baja California Sur	10925
3	Campeche	6235
4	Chiapas	8079

[59]:
```
merge_df = pd.merge(covid_df, poblacion_df, on="State")
```

[60]:
```
merge_df.head()
```

[60]:

	State	Covid Cases	Total
0	Aguascalientes	7753	1425607
1	Baja California	22137	3769020
2	Baja California Sur	10925	798447
3	Campeche	6235	928363
4	Chiapas	8079	5543828

[61]:
```
final_df = pd.merge(merge_df, tourist_df, on="State")
final_df.head()
```

[61]:

	State	Covid Cases	Total	Number of Tourists
0	Aguascalientes	7753	1425607	856960.0
1	Baja California	22137	3769020	3958843.0
2	Baja California Sur	10925	798447	3445908.0
3	Campeche	6235	928363	1578131.0
4	Chiapas	8079	5543828	4376440.0

[62]:
```
final_final_df = pd.merge(final_df, crimes_df, on="State")
final_final_df.head()
```

[62]:

	State	Covid Cases	Total	Number of Tourists	Crimes
0	Aguascalientes	7753	1425607	856960.0	12400
1	Baja California	22137	3769020	3958843.0	38801
2	Baja California Sur	10925	798447	3445908.0	7356
3	Campeche	6235	928363	1578131.0	827
4	Chiapas	8079	5543828	4376440.0	6482

[63]:
```
renamed_df = final_final_df.rename(columns={"Covid Cases": "Covid Cases",
                                            "Total": "Population",
                                            "Number of Tourists":␣
 ↪"Tourists",
                                            "Crimes": "Crimes"
                                            })
renamed_df
```

[63]:

	State	Covid Cases	Population	Tourists	Crimes
0	Aguascalientes	7753	1425607	856960.0	12400
1	Baja California	22137	3769020	3958843.0	38801
2	Baja California Sur	10925	798447	3445908.0	7356
3	Campeche	6235	928363	1578131.0	827
4	Chiapas	8079	5543828	4376440.0	6482
5	Chihuahua	12753	3741869	5228183.0	25089
6	Ciudad de Mexico	138329	9209944	11331505.0	72500
7	Coahuila	28317	3146771	1956640.0	19368
8	Colima	5671	731391	1450627.0	7881
9	Durango	9844	1832650	829529.0	9696
10	Estado de Mexico	88619	16992418	3127227.0	147717
11	Guanajuato	43054	6166934	5026515.0	54610
12	Guerrero	20295	3540685	9065181.0	9692
13	Hidalgo	13844	3082841	2925426.0	15484
14	Jalisco	29252	8348151	9499223.0	44860
15	Michoacan	21927	4748846	3005225.0	20195
16	Morelos	6283	1971520	1659199.0	14566
17	Nayarit	6247	1235456	3073656.0	1220
18	Nuevo Leon	43667	5784442	3222964.0	25930
19	Oaxaca	18694	4132148	3666038.0	15474
20	Puebla	32922	6583278	6608202.0	20145

21	Queretaro	10086	2368467	2520716.0	24457
22	Quintana Roo	12590	1857985	16675407.0	15369
23	San Luis Potosi	24279	2822255	2132770.0	15504
24	Sinaloa	19791	3026943	5271130.0	9194
25	Sonora	35177	2944840	2671758.0	12693
26	Tabasco	32868	2402598	1408949.0	15546
27	Tamaulipas	30066	3527735	3743766.0	11018
28	Tlaxcala	7820	1342977	458161.0	1055
29	Veracruz	34679	8062579	5332441.0	26453
30	Yucatan	19426	2320898	2617911.0	1207
31	Zacatecas	8122	1622138	1325235.0	9806

[64]:
```
Covid_rate = renamed_df["Covid Cases"] / renamed_df["Population"]
States = renamed_df["State"]
Tourist_rate = renamed_df["Tourists"] / renamed_df["Population"]
Crime_rate = renamed_df["Crimes"] / renamed_df["Population"]

ratio_df = pd.DataFrame({"State": States,
                         "Covid Rate":Covid_rate,
                         "Tourist Rate": Tourist_rate,
                         "Crime Rate": Crime_rate})
ratio_df.head()
```

[64]:

	State	Covid Rate	Tourist Rate	Crime Rate
0	Aguascalientes	0.005438	0.601119	0.008698
1	Baja California	0.005873	1.050364	0.010295
2	Baja California Sur	0.013683	4.315763	0.009213
3	Campeche	0.006716	1.699907	0.000891
4	Chiapas	0.001457	0.789426	0.001169

[65]:
```
# Using data for Covid, tourists and Crime divided by the population in each␣
 ↪state allows us to have
# comparable data to avoid arriving at obvious/wrong conclusions. i.e. Mexico␣
 ↪City and Mexico State will have
# the most number of crimes and Covid cases just beacuse they have the largest␣
 ↪populations.
```

[66]:
```
renamed_df["Tourists"]= renamed_df["Tourists"].astype(int)
renamed_df.dtypes
```

[66]:
```
State          object
Covid Cases     int64
Population      int64
Tourists        int32
Crimes          int64
dtype: object
```

3 Summary statistics

[67]:
```
#We calculated the mean,median,variance, standard_dv and sem for each Covid␣
↪Case in the Mexico.
#We then created a dataframe with all the information.

mean_covid = renamed_df['Covid Cases'].mean()
median = renamed_df['Covid Cases'].median()
variance = renamed_df['Covid Cases'].var()
standard_dv = renamed_df['Covid Cases'].std()
sem = renamed_df['Covid Cases'].sem()

summary_stats_covid = pd.DataFrame({"Mean": mean_covid, "Median": median,␣
↪"Variance": variance, "Standard Deviation": standard_dv, "SEM":␣
↪sem},index=[0])
summary_stats_covid
```

[67]:

	Mean	Median	Variance	Standard Deviation	SEM
0	25304.71875	19608.5	7.015299e+08	26486.410258	4682.180076

[68]:
```
#Verifying the results with another method
summary_stats2 = renamed_df.agg(['mean','median','var','std','sem'])["Covid␣
↪Cases"]
summary_stats2
```

[68]:
```
mean      2.530472e+04
median    1.960850e+04
var       7.015299e+08
std       2.648641e+04
sem       4.682180e+03
Name: Covid Cases, dtype: float64
```

[69]:
```
#We calculated the mean,median,variance, standard_dv and sem for Population in␣
↪the Mexico.
#We then created a dataframe with all the information.

mean = renamed_df['Population'].mean()
median = renamed_df['Population'].median()
variance = renamed_df['Population'].var()
standard_dv = renamed_df['Population'].std()
sem = renamed_df['Population'].sem()

summary_stats_covid = pd.DataFrame({"Mean": mean, "Median": median, "Variance":␣
↪variance, "Standard Deviation": standard_dv, "SEM": sem},index=[0])
summary_stats_covid
```

[69]:

	Mean	Median	Variance	Standard Deviation	SEM
0	3937938.25	3054892.0	1.074534e+13	3.278009e+06	579475.614521

[70]:
```
#Verifying the results with another method
summary_stats2 = renamed_df.
 ↪agg(['mean','median','var','std','sem'])["Population"]
summary_stats2
```

[70]:
```
mean      3.937938e+06
median    3.054892e+06
var       1.074534e+13
std       3.278009e+06
sem       5.794756e+05
Name: Population, dtype: float64
```

[71]:
```
#We calculated the mean,median,variance, standard_dv and sem for Tourists in␣
 ↪the Mexico.
#We then created a dataframe with all the information.
mean_tourists = renamed_df['Tourists'].mean()
median = renamed_df['Tourists'].median()
variance = renamed_df['Tourists'].var()
standard_dv = renamed_df['Tourists'].std()
sem = renamed_df['Tourists'].sem()

summary_stats_covid = pd.DataFrame({"Mean": mean, "Median": median, "Variance":␣
 ↪variance, "Standard Deviation": standard_dv, "SEM": sem},index=[0])
summary_stats_covid
```

[71]:

	Mean	Median	Variance	Standard Deviation	SEM
0	3937938.25	3100441.5	1.179505e+13	3.434392e+06	607120.43243

[72]:
```
#Verifying the results with another method
summary_stats2 = renamed_df.agg(['mean','median','var','std','sem'])["Tourists"]
summary_stats2
```

[72]:
```
mean      4.064058e+06
median    3.100442e+06
var       1.179505e+13
std       3.434392e+06
sem       6.071204e+05
Name: Tourists, dtype: float64
```

[73]:
```
#We calculated the mean,median,variance, standard_dv and sem for Crimes in the␣
 ↪Mexico.
#We then created a dataframe with all the information.
mean = renamed_df['Crimes'].mean()
median = renamed_df['Crimes'].median()
```

```
variance = renamed_df['Crimes'].var()
standard_dv = renamed_df['Crimes'].std()
sem = renamed_df['Crimes'].sem()

summary_stats_covid = pd.DataFrame({"Mean": mean, "Median": median, "Variance":␣
↪variance, "Standard Deviation": standard_dv, "SEM": sem},index=[0])
summary_stats_covid
```

[73]:

	Mean	Median	Variance	Standard Deviation	SEM
0	22268.59375	15421.5	7.701380e+08	27751.360507	4905.7938

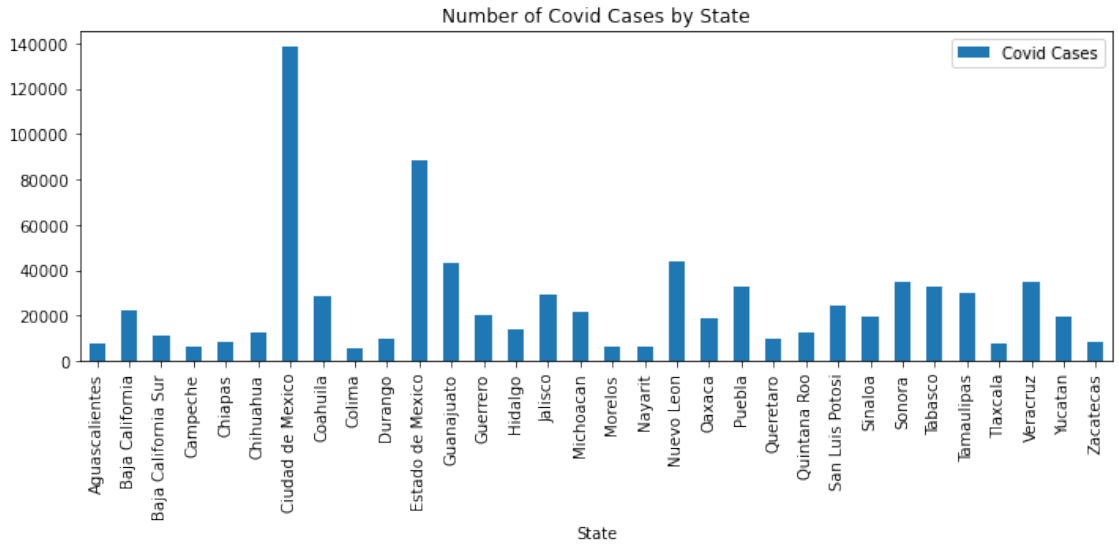
[74]:
```
summary_stats2 = renamed_df.agg(['mean','median','var','std','sem'])["Crimes"]
summary_stats2
```

[74]:
```
mean      2.226859e+04
median    1.542150e+04
var       7.701380e+08
std       2.775136e+04
sem       4.905794e+03
Name: Crimes, dtype: float64
```

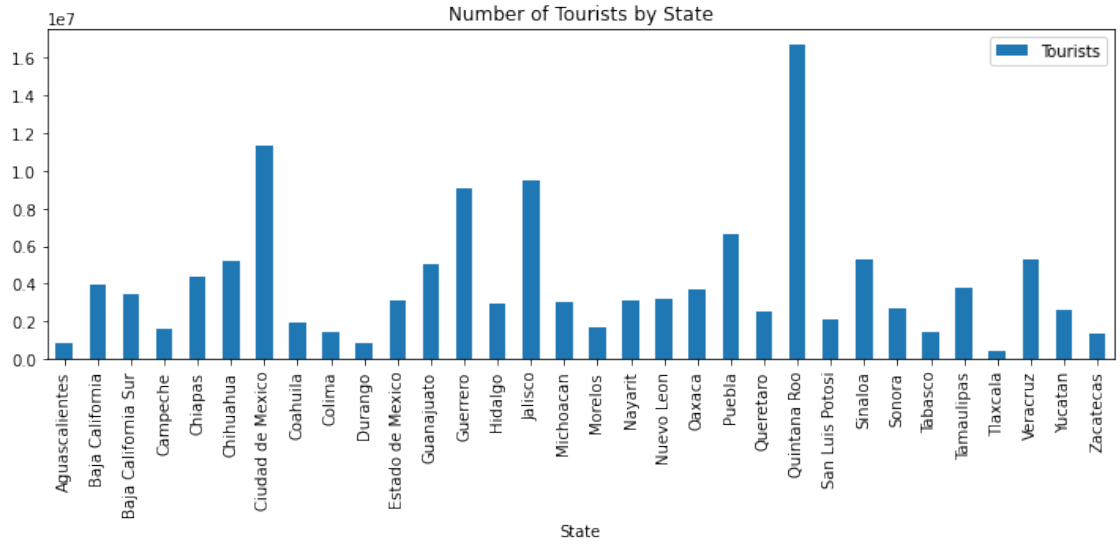
[75]:
```
#Error en merge
unique_items=len(renamed_df["Tourists"].unique())
unique_items
```

[75]:
```
32
```

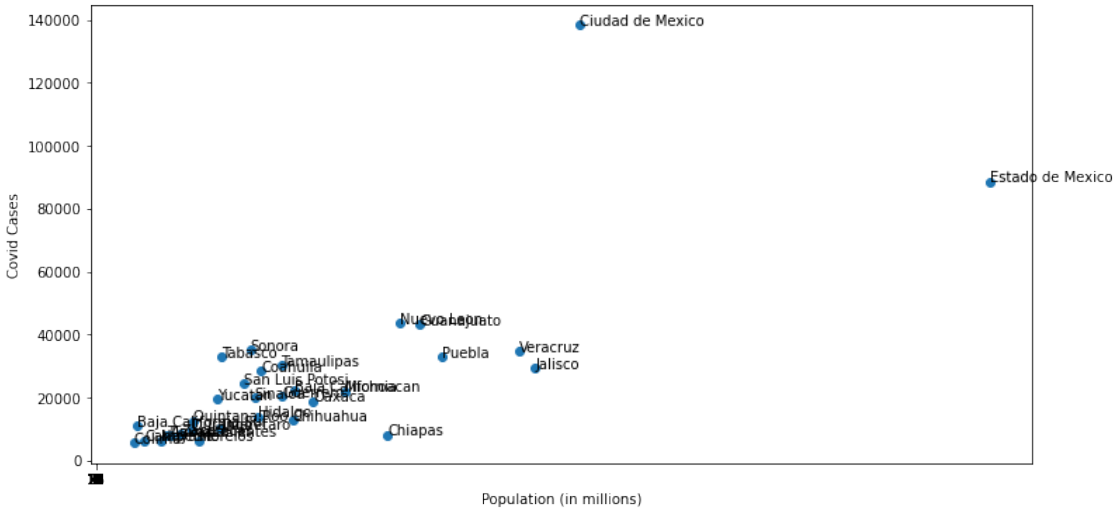
[76]:
```
# Generate a bar plot showing the total number of Covid Cases by State
bar_data = pd.DataFrame(renamed_df.groupby(["State"]).sum()).reset_index()
bar_data
# #Barframe into two columns
bar_data = bar_data [["State", "Covid Cases"]]
bar_data = bar_data .set_index("State")

#Creating the bar chart
bar_data.plot(kind="bar", figsize=(10,5))

plt.title("Number of Covid Cases by State")
plt.tight_layout()
plt.savefig("images/Number of Covid Cases by State.png")
plt.show()
```



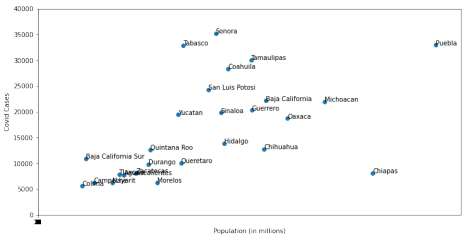
[77]:
```
# Generate a bar plot showing the total number of tourists by State
bar_data = pd.DataFrame(renamed_df.groupby(["State"]).sum()).reset_index()
bar_data
# #Barframe into two columns
bar_data = bar_data [["State", "Tourists"]]
bar_data = bar_data .set_index("State")

#Creating the bar chart
bar_data.plot(kind="bar", figsize=(10,5))

plt.title("Number of Tourists by State")
plt.tight_layout()
plt.savefig("images/Number of Tourists by State.png")
plt.show()
```



[78]:
```
# Pull values for x and y values
fig, ax = plt.subplots(figsize=(12,6))
covid_cases = renamed_df["Covid Cases"]
population = renamed_df["Population"]
n = renamed_df["State"]
# Create Scatter Plot with values calculated above
ax.scatter(population,covid_cases)
for i,txt in enumerate(n):
    ax.annotate(txt,(population[i],covid_cases[i]))
ax.set_xticks(range(len(population)))
ax.set_xlabel("Population (in millions)")
ax.set_ylabel("Covid Cases")
# Zooming on the image
# plt.xlim(0,7000000)
# plt.ylim(0, 40000)
plt.savefig("images/ScatterPlot of Covid and Population.png")
plt.show()
```



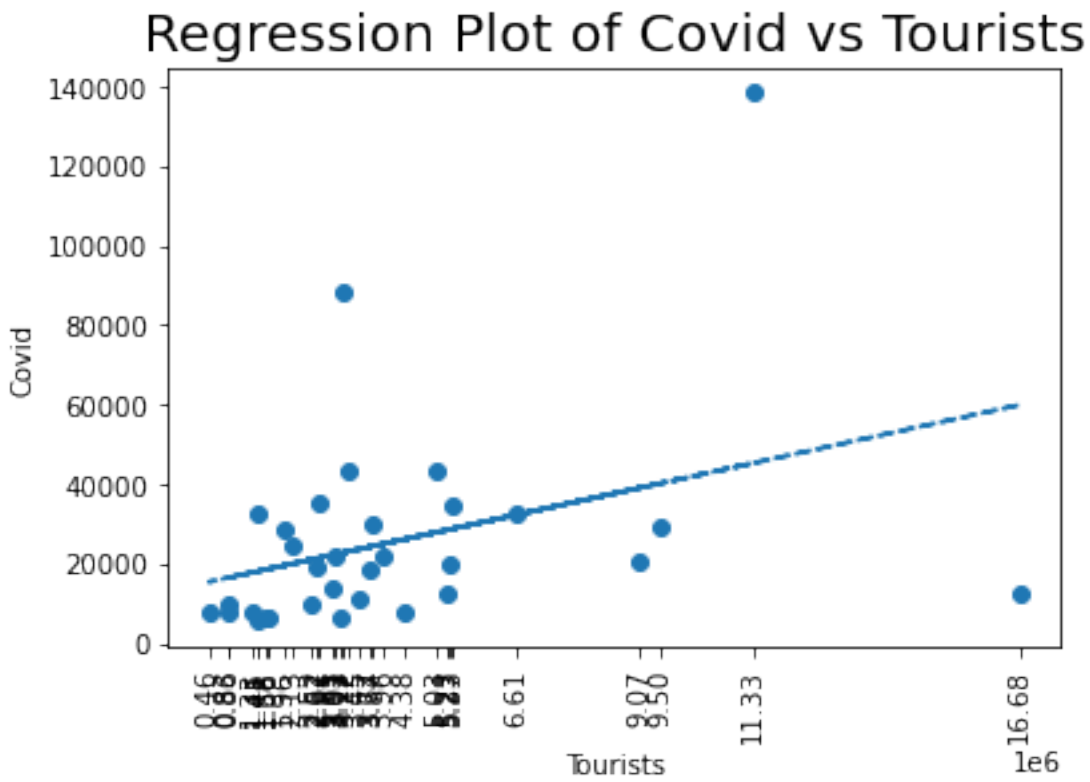
[94]:
```
## Zooming in on the graph
# Pull values for x and y values
fig, ax = plt.subplots(figsize=(12,6))
covid_cases = renamed_df["Covid Cases"]
population = renamed_df["Population"]
n = renamed_df["State"]
# Create Scatter Plot with values calculated above
ax.scatter(population,covid_cases)
for i,txt in enumerate(n):
    ax.annotate(txt,(population[i],covid_cases[i]))
ax.set_xticks(range(len(population)))
ax.set_xlabel("Population (in millions)")
ax.set_ylabel("Covid Cases")
# Zooming on the image
plt.xlim(0,7000000)
plt.ylim(0, 40000)
plt.savefig("images/ScatterPlot of Covid and Population_zoom.png")
plt.show()
```



4 Correlation and Regression

[79]:
```
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_covid = renamed_df.groupby(renamed_df["State"])["Covid Cases"].mean()
mean_tourists= renamed_df.groupby(renamed_df["State"])["Tourists"].mean()
mean_covidtrim= mean_covid.loc[mean_covid.index!="Quintana Roo"]
#Independent variable is number of Tourists
#Covid cases is the dependent variable

#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_tourists, mean_covid)
# Create equation of line to calculate our regression
fit = slope *mean_tourists + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_tourists,mean_covid)
plt.title('Regression Plot of Covid vs Tourists',fontsize =20)
plt.xlabel("Tourists")
plt.ylabel("Covid")
plt.plot(mean_tourists,fit,"--")
plt.xticks(mean_tourists, rotation=90)
```

```
plt.savefig("images/Regression Plot of Covid vs Tourists.png")
plt.show()

# Caculate correlation coefficient
corr = round(st.pearsonr(mean_covid,mean_tourists)[0],2)
print(f'The correlation between Covid and Tourists {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```

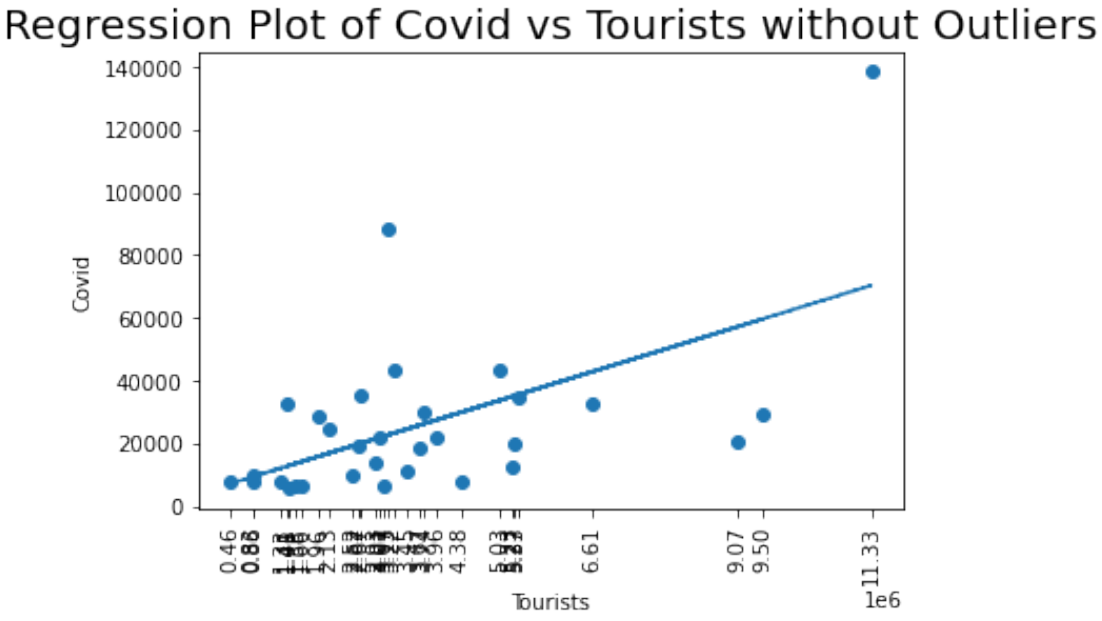



```
The correlation between Covid and Tourists 0.36
The r-squared is: 0.1296
y = 0.0x + 14135.69
```

Quintana Roo state appears to be an outlier. Removing it to see how the model changes

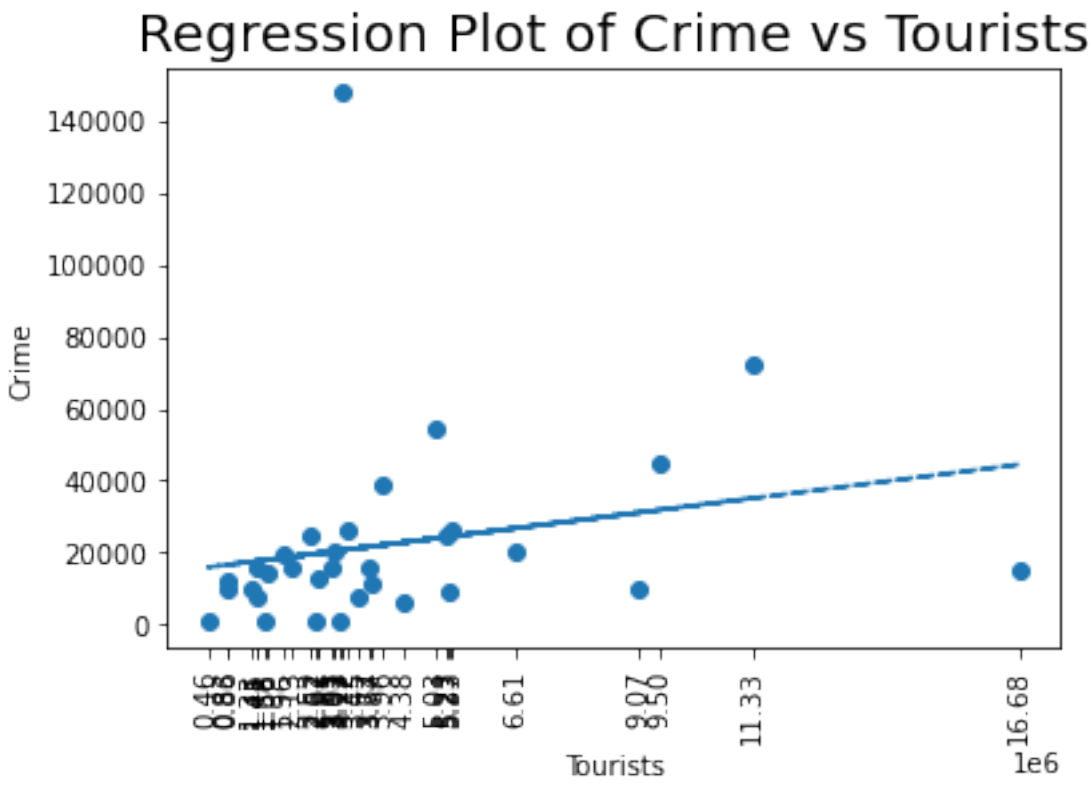
[80]:
```
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_covid = renamed_df.groupby(renamed_df["State"])["Covid Cases"].mean()
```

```
mean_tourists= renamed_df.groupby(renamed_df["State"])["Tourists"].mean()
mean_covidtrim= mean_covid.loc[mean_covid.index!="Quintana Roo"]
mean_touristtrim= mean_tourists.loc[mean_tourists.index!="Quintana Roo"]

#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_touristtrim,␣
 ↪mean_covidtrim)
# Create equation of line to calculate our regression
fit = slope *mean_touristtrim + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_touristtrim,mean_covidtrim)
plt.title('Regression Plot of Covid vs Tourists without Outliers',fontsize =20)
plt.xlabel("Tourists")
plt.ylabel("Covid")
plt.plot(mean_touristtrim,fit,"--")
plt.xticks(mean_touristtrim, rotation=90)
plt.savefig("images/Regression Plot of Coviv vs Tourists without Outliers.png")
plt.show()

# Caculate correlation coefficient
corr = round(st.pearsonr(mean_covidtrim,mean_touristtrim)[0],2)
print(f'The correlation between Covid and Tourists {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```



```
The correlation between Covid and Tourists 0.56
The r-squared is: 0.31360000000000005
y = 0.01x + 4468.68
```

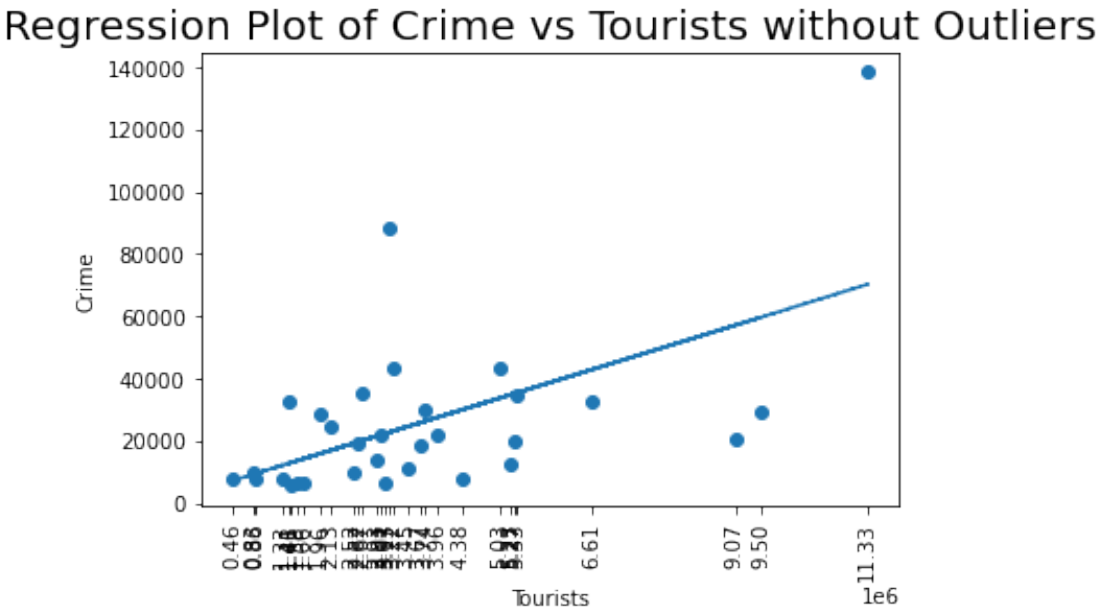
[81]:
```
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_crime= renamed_df.groupby(renamed_df["State"])["Crimes"].mean()
mean_tourists= renamed_df.groupby(renamed_df["State"])["Tourists"].mean()
mean_crimestrim= mean_covid.loc[mean_covid.index!="Quintana Roo"]

# How does Crime impact Tourism?

#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_tourists, mean_crime)
# Create equation of line to calculate our regression
fit = slope *mean_tourists + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_tourists,mean_crime)
plt.title('Regression Plot of Crime vs Tourists',fontsize =20)
plt.xlabel("Tourists")
plt.ylabel("Crime")
plt.plot(mean_tourists,fit,"--")
plt.xticks(mean_tourists, rotation=90)
plt.savefig("images/Regression Plot of Crime vs Tourists.png")
plt.show()

# Calculate correlation coefficient
corr = round(st.pearsonr(mean_crime,mean_tourists)[0],2)
print(f'The correlation between Crime and Tourists {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```




```
The correlation between Crime and Tourists 0.22
The r-squared is: 0.0484
y = 0.0x + 15096.34
```

[82]:
```
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_crime = renamed_df.groupby(renamed_df["State"])["Crimes"].mean()
mean_tourists= renamed_df.groupby(renamed_df["State"])["Tourists"].mean()
mean_crimetrim= mean_covid.loc[mean_crime.index!="Quintana Roo"]
mean_touristtrim= mean_tourists.loc[mean_tourists.index!="Quintana Roo"]

#Same question without Quintana Roo (Outlier)

#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_touristtrim,␣
 ↪mean_crimetrim)
# Create equation of line to calculate our regression
fit = slope *mean_touristtrim + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_touristtrim,mean_crimetrim)
plt.title('Regression Plot of Crime vs Tourists without Outliers',fontsize =20)
```

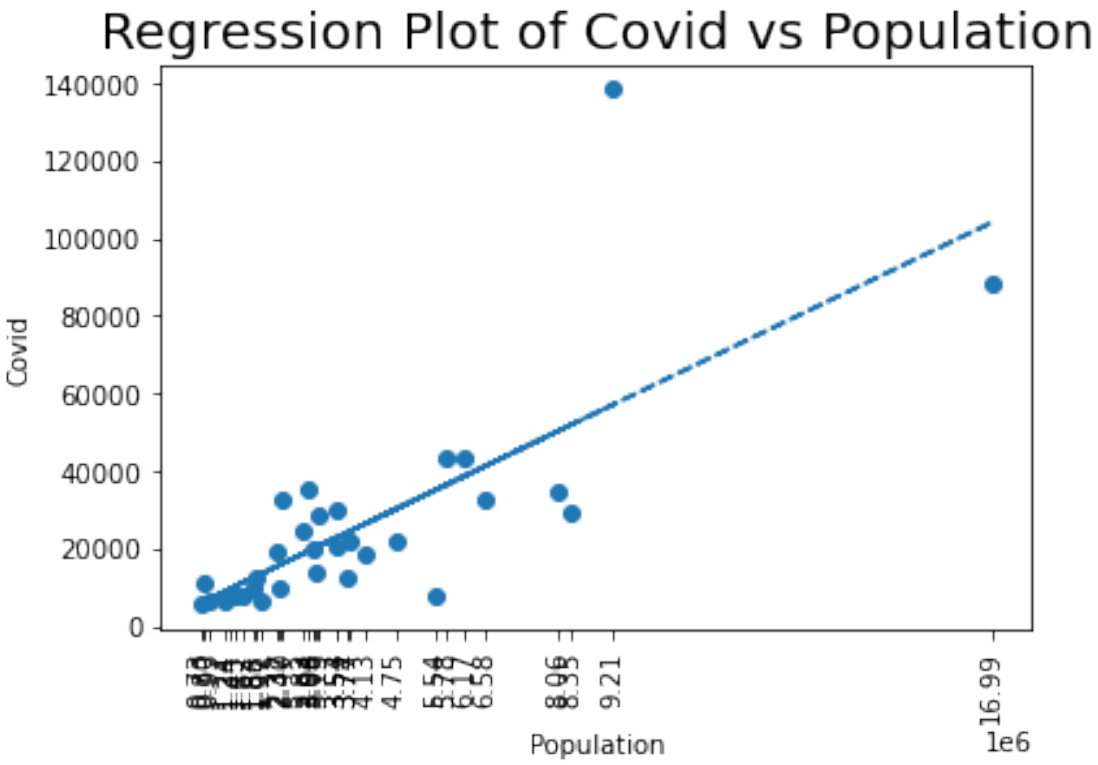
```
plt.xlabel("Tourists")
plt.ylabel("Crime")
plt.plot(mean_touristtrim,fit,"--")
plt.xticks(mean_touristtrim, rotation=90)
plt.savefig("images/Regression Plot of Crime vs Tourists without Outliers.png")
plt.show()

# Caculate correlation coefficient
corr = round(st.pearsonr(mean_crimetrim,mean_touristtrim)[0],2)
print(f'The correlation between Crime and Tourists {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```




```
The correlation between Crime and Tourists 0.56
The r-squared is: 0.31360000000000005
y = 0.01x + 4468.68
```

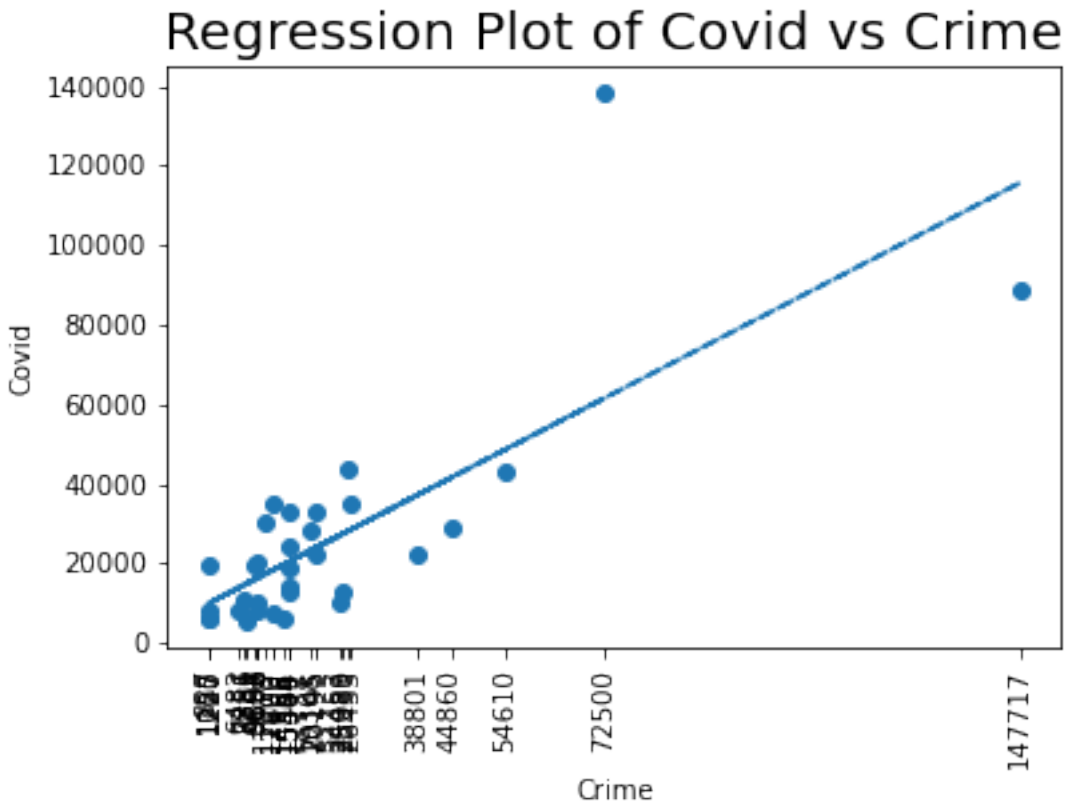
[83]:
```
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_covid = renamed_df.groupby(renamed_df["State"])["Covid Cases"].mean()
mean_population= renamed_df.groupby(renamed_df["State"])["Population"].mean()
mean_covidtrim= mean_covid.loc[mean_covid.index!="Quintana Roo"]
```

```
#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_population, mean_covid)
# Create equation of line to calculate our regression
fit = slope *mean_population + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_population,mean_covid)
plt.title('Regression Plot of Covid vs Population',fontsize =20)
plt.xlabel("Population")
plt.ylabel("Covid")
plt.plot(mean_population,fit,"--")
plt.xticks(mean_population, rotation=90)
plt.savefig("images/Regression Plot of Covid vs Population.png")
plt.show()

# Caculate correlation coefficient
corr = round(st.pearsonr(mean_covid,mean_population)[0],2)
print(f'The correlation between Covid and Population {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```



```
The correlation between Covid and Population 0.75
The r-squared is: 0.5625
y = 0.01x + 1523.15
```

[84]:
```python
# Calculate the correlation coefficient and linear regression model
#Getting our x and y values
mean_covid = renamed_df.groupby(renamed_df["State"])["Covid Cases"].mean()
mean_crime= renamed_df.groupby(renamed_df["State"])["Crimes"].mean()

#Performing the linear regression
slope, intercept, r, p, std_err = st.linregress(mean_crime, mean_covid)
# Create equation of line to calculate our regression
fit = slope *mean_crime + intercept
equation = "y = " + str(round(slope,2)) + "x + " + str(round(intercept,2))
# Plot the linear model on top of scatter plot
plt.scatter(mean_crime,mean_covid)
plt.title('Regression Plot of Covid vs Crime',fontsize =20)
plt.xlabel("Crime")
plt.ylabel("Covid")
plt.plot(mean_crime,fit,"--")
plt.xticks(mean_crime, rotation=90)
plt.savefig("images/Regression Plot of Covid vs Crime.png")
plt.show()

# Caculate correlation coefficient
corr = round(st.pearsonr(mean_covid,mean_crime)[0],2)
print(f'The correlation between Covid and Crime {corr}')

#calculate the R squared
print(f"The r-squared is: {corr**2}")

#Calculate the regression formula
print(equation)
```




```
The correlation between Covid and Crime 0.76
The r-squared is: 0.5776
y = 0.72x + 9255.85
```

4.1 Covid Rate Heat Map

4.2 Which states have the biggest ratios of Covid cases?

[85]:
```
df=pd.read_csv('clean_data/covid_a.csv', encoding = "ISO-8859-1")
repo_url = 'https://raw.githubusercontent.com/angelnmara/geojson/master/
 ↪mexicoHigh.json' #Archivo GeoJSON
mx_regions_geo = requests.get(repo_url).json()
fig = px.choropleth(data_frame=df,
                    geojson=mx_regions_geo,
                    locations='State', # nombre de la columna del Dataframe
                    featureidkey='properties.name',  # ruta al campo del␣
 ↪archivo GeoJSON con el que se hará la relación (nombre de los estados)
                    color="Rate" , #El color depende de las cantidades
                    color_continuous_scale="burg", #greens
                    #scope="north america"
                   )
```

```
fig.update_geos(showcountries=True, showcoastlines=True, showland=True,␣
 ↪fitbounds="locations")
fig.update_layout(
    title_text = 'Covid confirmed cases rate (%) in Mexico',
    font=dict(
        #family="Courier New, monospace",
        family="Ubuntu",
        size=18,
        color="#7F7F7F"
    ),
)
# plt.savefig("images/Covid confirmed cases rate in Mexico.png")
fig.show()
```

4.3 Crime Rate Heat Map

4.4 Which states have the highest Crime rates?

[86]:
```
df=pd.read_csv('clean_data/crimenes_a.csv', encoding = "ISO-8859-1")
repo_url = 'https://raw.githubusercontent.com/angelnmara/geojson/master/
 ↪mexicoHigh.json' #Archivo GeoJSON
mx_regions_geo = requests.get(repo_url).json()
fig = px.choropleth(data_frame=df,
                    geojson=mx_regions_geo,
                    locations='State', # nombre de la columna del Dataframe
                    featureidkey='properties.name',  # ruta al campo del␣
 ↪archivo GeoJSON con el que se hará la relación (nombre de los estados)
                    color="Rate" , #El color depende de las cantidades
                    color_continuous_scale='Blues', #blue
                    #scope="north america"
                   )
fig.update_geos(showcountries=True, showcoastlines=True, showland=True,␣
 ↪fitbounds="locations")
fig.update_layout(
    title_text = 'Crime rate (%) in Mexico',
    font=dict(
        #family="Courier New, monospace",
        family="Ubuntu",
        size=18,
        color="#7F7F7F"
    ),
)
#plt.savefig("images/Crime rate in Mexico.png")
fig.show()
```

[87]:
```
# Safe Travel Locations Mexico Heatmap
## Which states have the lowest Crime rates and Covid rates combined?
```

```
### We want to direct Toruism investment to the safest places for tourists.
```

[88]:
```
df=pd.read_csv('clean_data/Combined_rates.csv', encoding = "ISO-8859-1")
repo_url = 'https://raw.githubusercontent.com/angelnmara/geojson/master/
 ↪mexicoHigh.json' #Archivo GeoJSON
mx_regions_geo = requests.get(repo_url).json()
fig = px.choropleth(data_frame=df,
                    geojson=mx_regions_geo,
                    locations='State', # nombre de la columna del Dataframe
                    featureidkey='properties.name',  # ruta al campo del␣
 ↪archivo GeoJSON con el que se hará la relación (nombre de los estados)
                    color="Rate" , #El color depende de las cantidades
                    color_continuous_scale='twilight', #blue
                    #scope="north america"
                   )
fig.update_geos(showcountries=True, showcoastlines=True, showland=True,␣
 ↪fitbounds="locations")
fig.update_layout(
    title_text = 'Safe Travel Locations Mexico Heatmap',
    font=dict(
        #family="Courier New, monospace",
        family="Ubuntu",
        size=18,
        color="#7F7F7F"
    ),
)
# plt.savefig("images/Safe Travel Locations Mexico Heatmap.png")
fig.show()
```

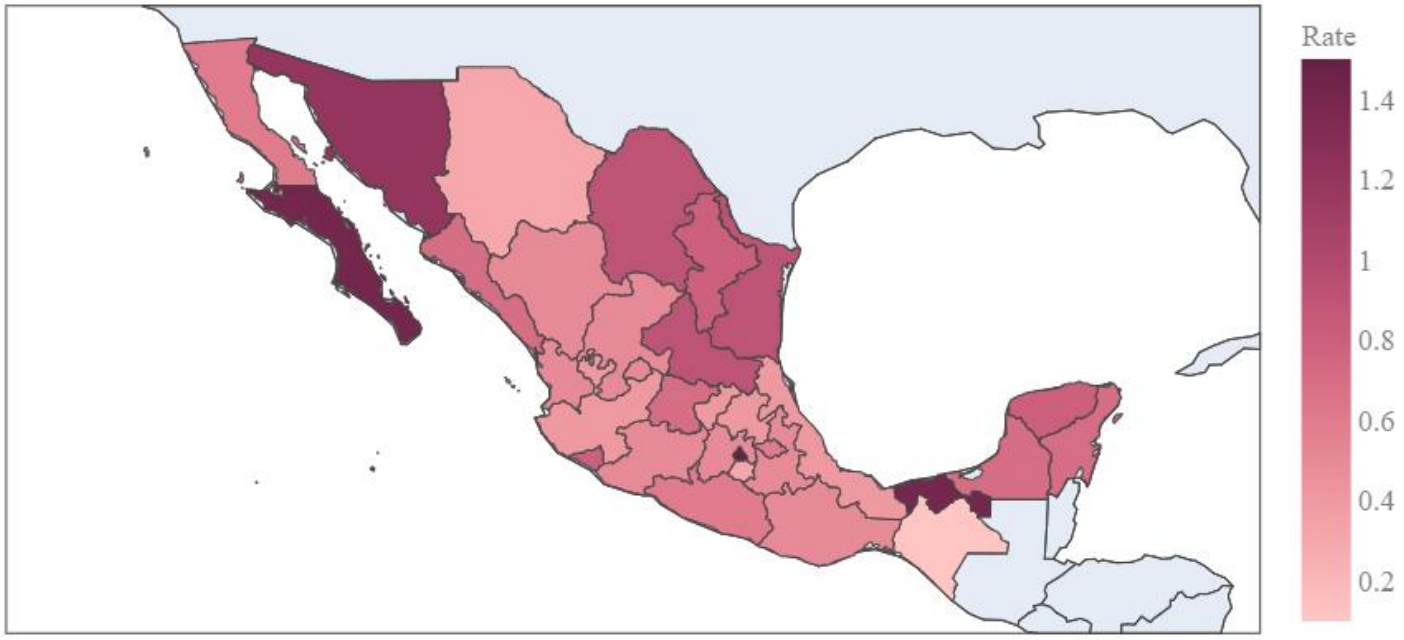
5 Best places to invest in Safe Tourism are Baja California Sur, Campeche, Yucatán and Chiapas.

[92]:
```
## If you cant see the maps please refer to the images folder
```

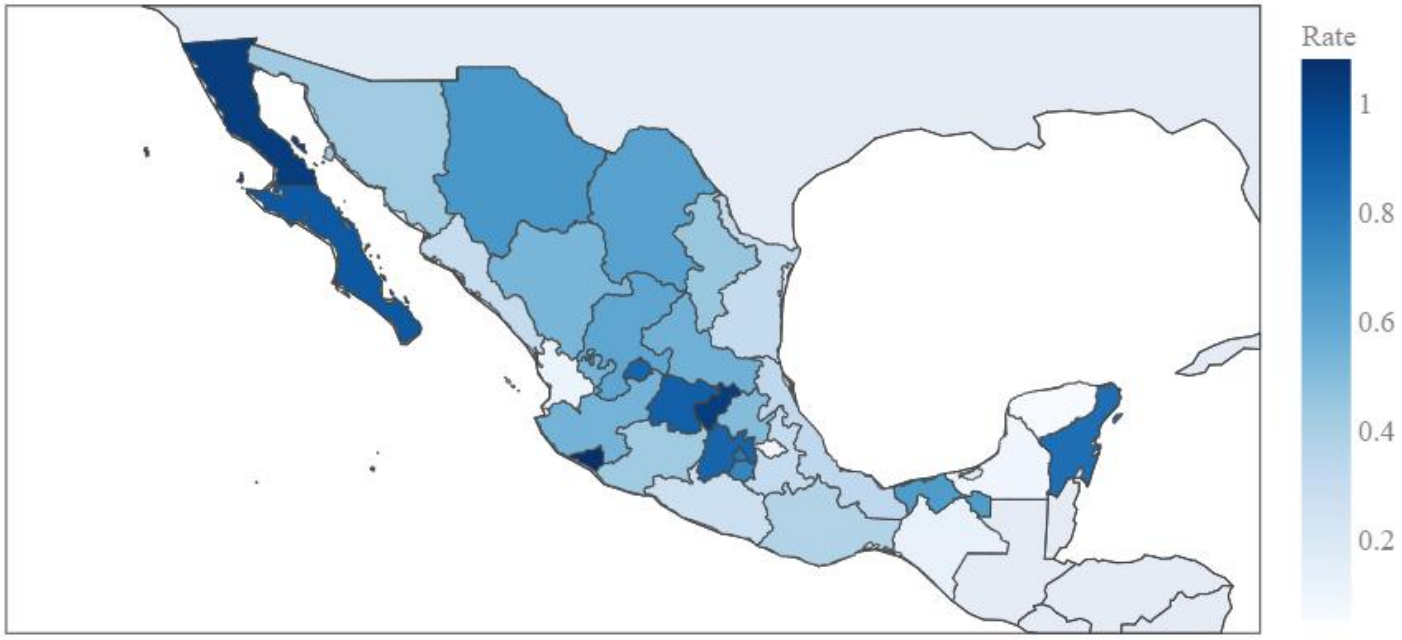
[ ]:
```

```

[ ]:
```

```

Covid confirmed cases rate (%) in Mexico



Crime rate (%) in Mexico



Safe Travel Locations Mexico Heatmap