In [114…]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import sys
import warnings
warnings.filterwarnings('ignore')
from IPython.display import display
```

In [86]:
```
p_2016 = 'data/p4v2016.xls'
gdp_per = 'gdp_per_capita.xlsx'
data_2016 = pd.read_excel(p_2016, sheetname=0)
data_gdp = pd.read_excel(gdp_per, sheetname=0)
```

In [87]:
```
data_2016.head(3)
```

Out[87]:

	cyear	ccode	scode	country	year	flag	fragment	democ	autoc	polity	...	in
0	7001800	700	AFG	Afghanistan	1800	0	NaN	1	7	-6	...	
1	7001801	700	AFG	Afghanistan	1801	0	NaN	1	7	-6	...	
2	7001802	700	AFG	Afghanistan	1802	0	NaN	1	7	-6	...	

3 rows × 36 columns

In [88]:
```
data_gdp.head(3)
```

Out[88]:

	Country	Currency	Year	Per capita GDP
0	Afghanistan	US$	1970	157.258461
1	Afghanistan	US$	1971	160.443153
2	Afghanistan	US$	1972	136.175612

In [89]:
```
time_range = [1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 198
              2008, 2009, 2010, 2011, 2012, 2013, 2013, 2014, 2015]
only_africa = ["Angola", "Gabon", "Nigeria", "Benin", "Gambia, The", "Rwanda", "Gui
   "Botswana", "Ghana", "São Tomé and Principe", "Burkina Faso", "Guinea", "Senegal
```

In [97]:
```
len(only_africa)
```

Out[97]:
```
46
```

In [91]:
```
data_2016 = data_2016.rename(columns={'country': 'Country', 'year': 'Year'})
```

In [92]:
```
merged_data = pd.merge(left=data_gdp, right=data_2016, how='left', on=['Country', '
```

In [93]:
```
merged_data.head()
```

Out[93]:

	Country	Currency	Year	Per capita GDP	cyear	ccode	scode	flag	fragment	dem
0	Afghanistan	US$	1970	157.258461	7001970.0	700.0	AFG	0.0	NaN	(
1	Afghanistan	US$	1971	160.443153	7001971.0	700.0	AFG	0.0	NaN	(
2	Afghanistan	US$	1972	136.175612	7001972.0	700.0	AFG	0.0	NaN	(
3	Afghanistan	US$	1973	144.173945	7001973.0	700.0	AFG	0.0	NaN	(
4	Afghanistan	US$	1974	175.027098	7001974.0	700.0	AFG	0.0	NaN	(

5 rows × 38 columns

In [94]:
```
final_merged = merged_data[(merged_data['Year'].isin(time_range)) & (merged_data['C
#final_merged['Year'] = pd.to_datetime(final_merged['Year'])
final_merged.index = pd.RangeIndex(len(final_merged.index))
final_merged['Region'] = 'SSA'
```

In [102…
```
final_merged['Country'].unique()
```

Out[102…
```
array(['Angola', 'Benin', 'Botswana', 'Burkina Faso', 'Burundi',
       'Cabo Verde', 'Cameroon', 'Central African Republic', 'Chad',
       'Comoros', "Côte d'Ivoire", 'Equatorial Guinea', 'Ethiopia',
       'Gabon', 'Ghana', 'Guinea', 'Guinea-Bissau', 'Kenya', 'Lesotho',
       'Liberia', 'Madagascar', 'Malawi', 'Mali', 'Mauritania',
       'Mauritius', 'Mozambique', 'Niger', 'Nigeria', 'Rwanda', 'Senegal',
       'Seychelles', 'Sierra Leone', 'Somalia', 'South Africa', 'Sudan',
       'Swaziland', 'Togo', 'Uganda', 'Zambia', 'Zimbabwe'], dtype=object)
```

In [96]:
```
final_merged.tail()
```

Out[96]:

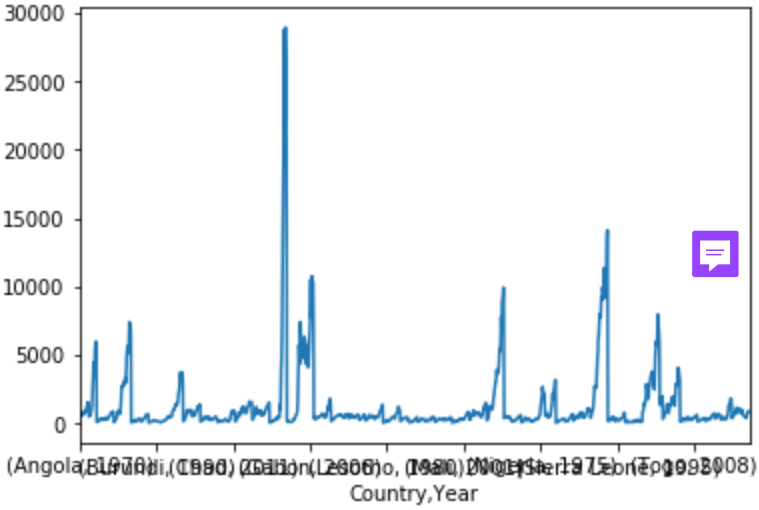
	Country	Currency	Year	Per capita GDP	cyear	ccode	scode	flag	fragment	de
1739	Zimbabwe	US$	2011	768.540514	5522011.0	552.0	ZIM	0.0	0.0	
1740	Zimbabwe	US$	2012	850.847229	5522012.0	552.0	ZIM	0.0	0.0	
1741	Zimbabwe	US$	2013	905.485078	5522013.0	552.0	ZIM	2.0	0.0	
1742	Zimbabwe	US$	2014	931.203924	5522014.0	552.0	ZIM	2.0	0.0	
1743	Zimbabwe	US$	2015	890.421576	5522015.0	552.0	ZIM	2.0	0.0	

5 rows × 39 columns

In [109…
```
group_data = final_merged.groupby(['Country', 'Year'])['Per capita GDP'].mean()
```

In [116…
```
group_data.plot(kind='line')
```

Out[116…
```
<matplotlib.axes._subplots.AxesSubplot at 0x1d76310e0b8>
```



In [ ]:

In [147…
```
# setting up data table
# we are interested only investigating Country, Region, Per capita GDP
analysis_table = final_merged[['Country', 'Region', 'Per capita GDP','Year']]
```

In [148…
```
analysis_table.tail()
```

Out[148…

	Country	Region	Per capita GDP	Year
1739	Zimbabwe	SSA	768.540514	2011
1740	Zimbabwe	SSA	850.847229	2012
1741	Zimbabwe	SSA	905.485078	2013
1742	Zimbabwe	SSA	931.203924	2014
1743	Zimbabwe	SSA	890.421576	2015

In [224…
```
group_analysis = analysis_table.groupby(['Country']).agg({'Per capita GDP':'mean'})
```

In [231…
```
gdp_column = group_analysis
```

In [230…
```
group_analysis2 = analysis_table.groupby(['Country']).agg({'Per capita GDP':'mean'}
group_analysis2.head()
```

Out[230…

Country	Per capita GDP
Angola	1701.670683
Benin	430.773726
Botswana	2798.869019
Burkina Faso	318.221919
Burundi	169.639283

In [ ]:

In [ ]:

In [ ]:

In [232…
```
gdp_column = gdp_column.reset_index()
```

In [233…
```
gdp_column
```

Out[233...

	Year	Per capita GDP
0	1970	244.270864
1	1971	264.173091
2	1972	294.230738
3	1973	360.156807
4	1974	461.033039
5	1975	527.671029
6	1976	576.436836
7	1977	599.206065
8	1978	639.873761
9	1979	760.638047
10	1980	918.063002
11	1981	871.431405
12	1982	815.286905
13	1983	787.278590
14	1984	753.292101
15	1985	730.841014
16	1986	774.951558
17	1987	839.783886
18	1988	893.961149
19	1989	926.260088
20	1990	1032.975772
21	1991	1027.052726
22	1992	1070.707839
23	1993	1007.133626
24	1994	949.946416
25	1995	1035.006466
26	1996	1056.685945
27	1997	1074.636997
28	1998	1025.690368
29	2000	1059.376316

	Year	Per capita GDP
30	2001	1050.631149
31	2002	1112.226479
32	2003	1325.199861
33	2004	1547.390205
34	2005	1792.528190
35	2006	1960.215663
36	2007	2229.897188
37	2008	2601.776708
38	2009	2227.931900
39	2010	2450.441175
40	2011	2867.053181
41	2012	2859.741626
42	2013	2930.637001
43	2014	2927.080450
44	2015	2436.102496

In [234…
```
gdp_column['Region'] = analysis_table['Region']
```

In [235…
```
gdp_column.head()
```

Out[235…

	Year	Per capita GDP	Region
0	1970	244.270864	SSA
1	1971	264.173091	SSA
2	1972	294.230738	SSA
3	1973	360.156807	SSA
4	1974	461.033039	SSA

In [236…
```
gdp_column.set_index('Year', drop=True, inplace=True)
```

In [237…
```
gdp_column.head()
```

Out[237…

Year	Per capita GDP	Region
1970	244.270864	SSA
1971	264.173091	SSA
1972	294.230738	SSA
1973	360.156807	SSA
1974	461.033039	SSA

In [238…

```
# adding column
gdp_column['counter'] = range(0, len(gdp_column.index.values))
```

In [239…

```
gdp_column.head()
```

Out[239…

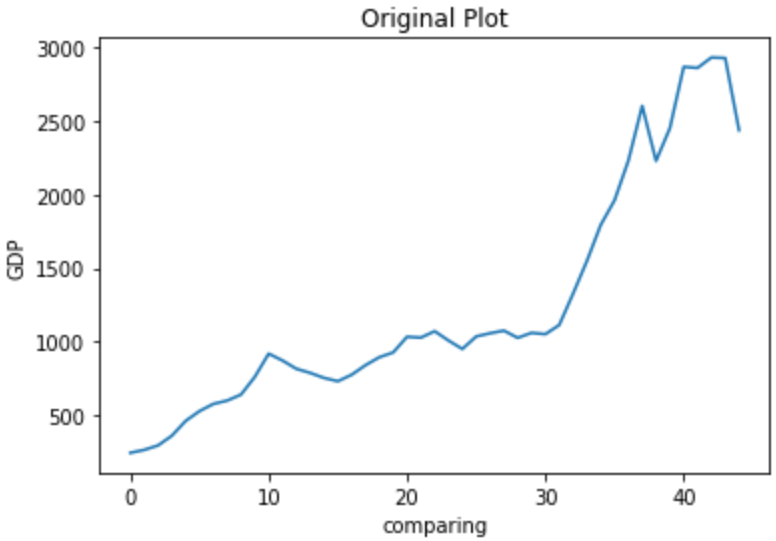
Year	Per capita GDP	Region	counter
1970	244.270864	SSA	0
1971	264.173091	SSA	1
1972	294.230738	SSA	2
1973	360.156807	SSA	3
1974	461.033039	SSA	4

In [240…

```
#plot counter(index) vs per capita gdp
fig = plt.figure(1)
ax1 = fig.add_subplot(111)
ax1.set_xlabel("comparing")
ax1.set_ylabel("GDP")
ax1.set_title("Original Plot")
ax1.plot('counter','Per capita GDP', data = gdp_column)
```

Out[240…

```
[<matplotlib.lines.Line2D at 0x1d7684a4128>]
```



In [241…

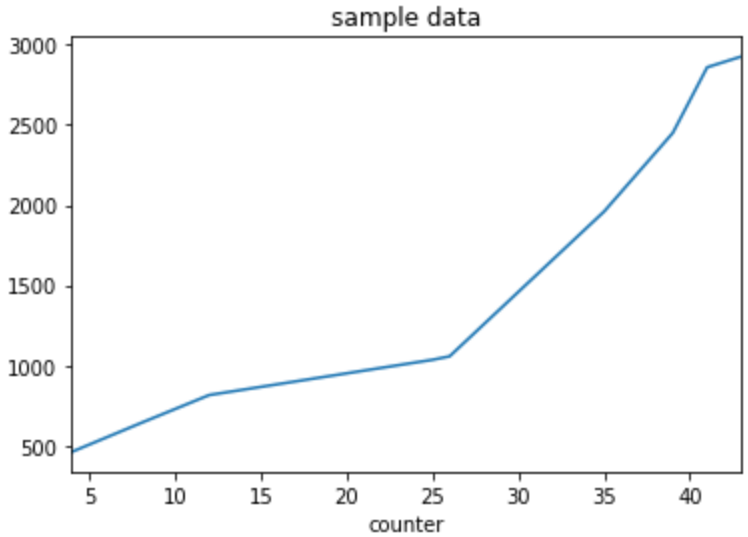
```
# choosing same of the data
sample_data = gdp_column.sample(frac=.2, random_state=4)
sample_data.index.name = None
sample_data = sample_data.sort_values(by = ['counter'], ascending=[True])
sample_data.head()
```

Out[241…

	Per capita GDP	Region	counter
1974	461.033039	SSA	4
1978	639.873761	SSA	8
1982	815.286905	SSA	12
1995	1035.006466	SSA	25
1996	1056.685945	SSA	26

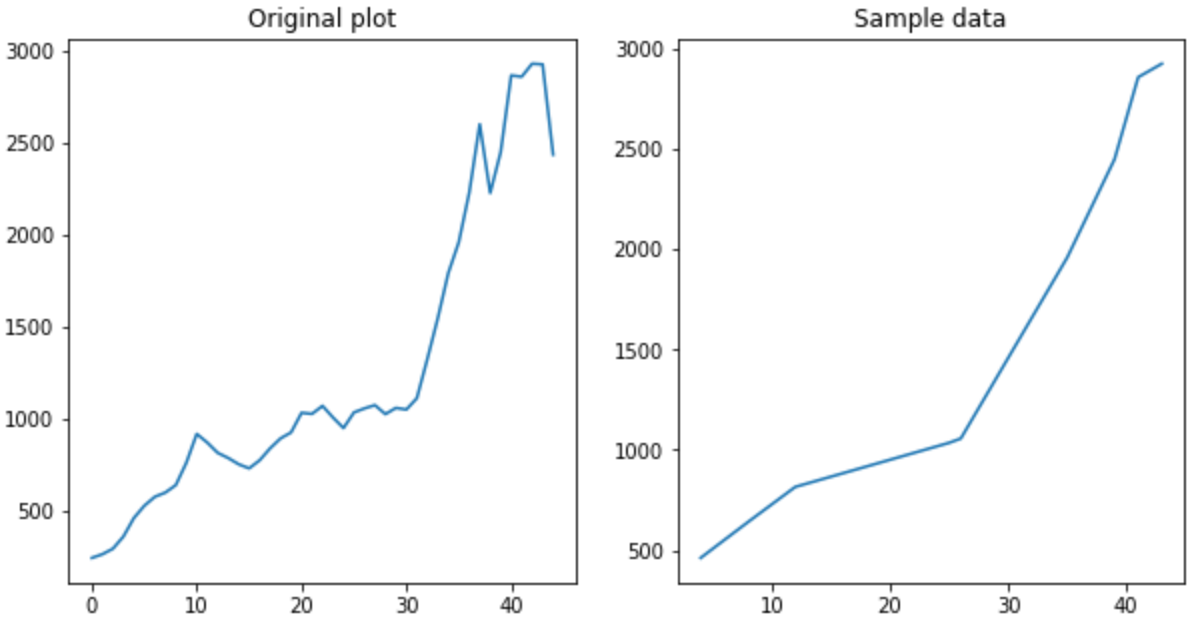
In [242…

```
axes = sample_data.plot('counter', 'Per capita GDP', legend=False, title="sample da
```



In [243…
```
fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize = (10, 5))
axes[0].plot('counter','Per capita GDP', data = gdp_column)
axes[0].set_title("Original plot")
axes[1].plot('counter', 'Per capita GDP', data = sample_data)
axes[1].set_title("Sample data")
```

Out[243…
```
Text(0.5,1,'Sample data')
```



In [244…
```
gdp_column.reset_index(inplace=True)
```

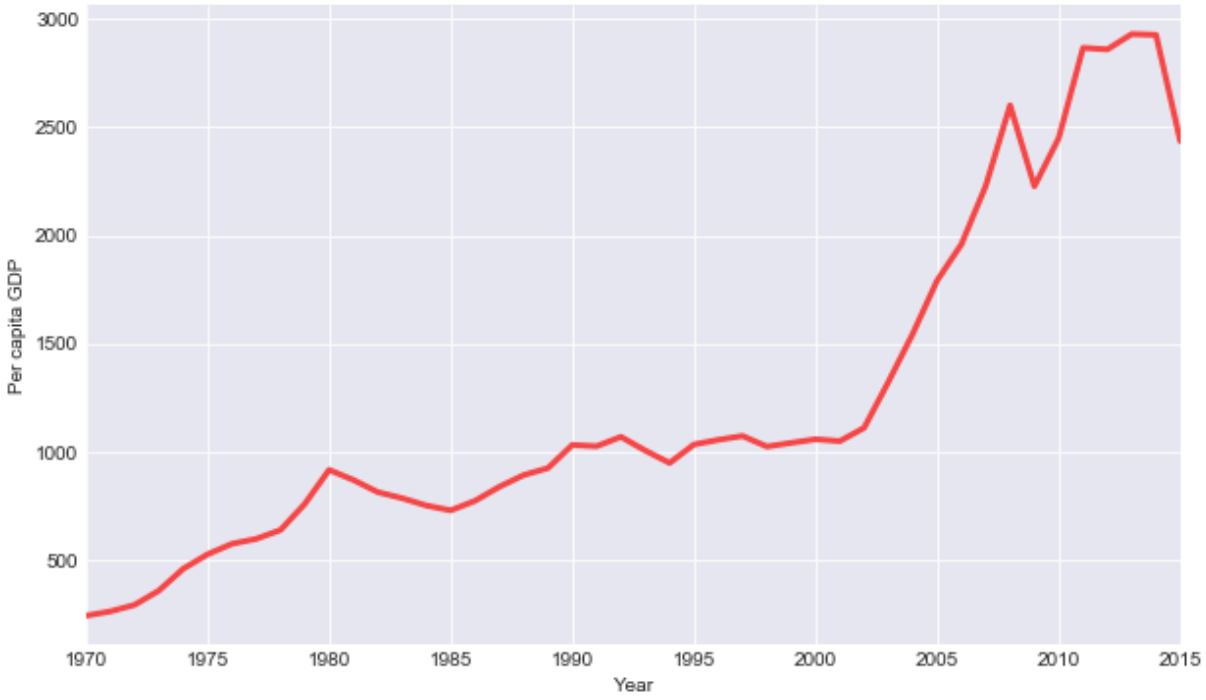
In [251…
```
gdp_column.tail()
```

Out[251…

	Year	Per capita GDP	Region	counter
40	2011	2867.053181	SSA	40
41	2012	2859.741626	SSA	41
42	2013	2930.637001	SSA	42
43	2014	2927.080450	SSA	43
44	2015	2436.102496	SSA	44

In [274…
```
#time series analysis
sns.set_style("darkgrid")
fig = plt.figure(figsize=(10,6))
ax = fig.add_subplot(111)
ax.plot(gdp_column['Year'], gdp_column['Per capita GDP'], color = 'red',
        linewidth = 3, alpha = .7, label = "GDP")
ax.set_xlim(xmin=1970, xmax=2015)
ax.set_xlabel("Year")
ax.set_ylabel("Per capita GDP")
```

Out[274…
```
Text(0,0.5,'Per capita GDP')
```



In [279…
```
demo = final_merged[['Country', 'Region', 'Per capita GDP','Year', 'democ']]
demo.tail()
```

Out[279…

	Country	Region	Per capita GDP	Year	democ
1739	Zimbabwe	SSA	768.540514	2011	3.0
1740	Zimbabwe	SSA	850.847229	2012	3.0
1741	Zimbabwe	SSA	905.485078	2013	5.0
1742	Zimbabwe	SSA	931.203924	2014	5.0
1743	Zimbabwe	SSA	890.421576	2015	5.0

In [281…
```
democracy = final_merged.groupby(['Year']).agg({'democ':'mean'})
```

In [283…
```
democracy.head()
```

Out[283…

Year	democ
1970	1.516129
1971	1.419355
1972	1.096774
1973	0.967742
1974	0.937500

In [292…
```
democracy.reset_index(inplace=True)
```

In [299…
```
gdp_column = gdp_column.merge(democracy, on='Year')
#gdp_column.drop(['democ_x'])
```

In [307…
```
#gdp_column.drop('democ_x', axis=1, inplace=True)
gdp_column = gdp_column.rename(columns={'democ_y':'democ'})
gdp_column.head()
```

Out[307…

	Year	Per capita GDP	Region	counter	democ
0	1970	244.270864	SSA	0	1.516129
1	1971	264.173091	SSA	1	1.419355
2	1972	294.230738	SSA	2	1.096774
3	1973	360.156807	SSA	3	0.967742
4	1974	461.033039	SSA	4	0.937500

In [336…
```
#time series analysis
sns.set_style("darkgrid")
fig = plt.figure(figsize=(10,8))
ax = fig.add_subplot(211)
ax.plot(gdp_column['Year'], gdp_column['Per capita GDP'], color = 'red',
        linewidth = 3, alpha = .7, label = "Per capita GDP")
ax.set_xlim(xmin=1970, xmax=2015)
ax.set_ylabel("Per capita GDP")
plt.legend()
#-----------------------------------------------------------------
ax = fig.add_subplot(212)
ax.plot(gdp_column['Year'], gdp_column['democ'], color = 'blue',
        linewidth = 3, alpha = .7, label = "Democracy Score")
#ax.plot(gdp_column['Year'])
ax.set_xlim(xmin=1970, xmax=2015)
ax.set_xlabel("Year")
ax.set_ylabel("Democracy")
plt.legend()
```

Out[336…
```
<matplotlib.legend.Legend at 0x1d769201940>
```


Per capita GDP
Per capita GDP
3000
2500
2000
1500
1000
500
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Democracy Score
Democracy
0
−5
−10
−15
−20
Year

In [ ]: