World Population Data

This dataset has the total population numbers for every country from 1960 to 2020. Additionally, there is a table that contains country information, including region, income group, and any special notes.

In [ ]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import statsmodels.formula.api as smf

sns.set_context('talk')

population = pd.read_csv("world_pop_data.csv")
```

In [ ]:
```
meta = pd.read_csv('metadata_country.csv')
```

Source and license of dataset.

Working:

- 🗺️ **Explore**: Which countries have experienced the highest population growth?
- 📊 **Visualize**: Create a plot that visualizes the population growth of countries over time grouped by region.
- 🔎 **Analyze**: How does income group affect a country's population growth?

Deeply analyze the population growth over the time in each region

In [ ]:
```
population_simple = population[['Country Code'] + list(population.loc[:, '1960' : '2020'])]
population.iloc[:10]
```

Out[ ]:

	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964	1965	1966	...	2011	
0	ABW	Population, total	SP.POP.TOTL	54208.0	55434.0	56234.0	56699.0	57029.0	57357.0	57702.0	...	102050.0	1(
1	AFE	Population, total	SP.POP.TOTL	130836765.0	134159786.0	137614644.0	141202036.0	144920186.0	148769974.0	152752671.0	...	532760424.0	5474
2	AFG	Population, total	SP.POP.TOTL	8996967.0	9169406.0	9351442.0	9543200.0	9744772.0	9956318.0	10174840.0	...	30117411.0	311(
3	AFW	Population, total	SP.POP.TOTL	96396419.0	98407221.0	100506960.0	102691339.0	104953470.0	107289875.0	109701811.0	...	360285439.0	3702
4	AGO	Population, total	SP.POP.TOTL	5454938.0	5531451.0	5608499.0	5679409.0	5734995.0	5770573.0	5781305.0	...	24220660.0	251(
5	ALB	Population, total	SP.POP.TOTL	1608800.0	1659800.0	1711319.0	1762621.0	1814135.0	1864791.0	1914573.0	...	2905195.0	29(
6	AND	Population, total	SP.POP.TOTL	13410.0	14378.0	15379.0	16407.0	17466.0	18542.0	19646.0	...	83748.0	8
7	ARB	Population, total	SP.POP.TOTL	92197715.0	94724540.0	97334438.0	100034191.0	102832792.0	105736428.0	108758634.0	...	363156846.0	3714
8	ARE	Population, total	SP.POP.TOTL	92417.0	100801.0	112112.0	125130.0	138049.0	149855.0	159979.0	...	8946778.0	91
9	ARG	Population, total	SP.POP.TOTL	20481781.0	20817270.0	21153042.0	21488916.0	21824427.0	22159644.0	22494031.0	...	41261490.0	417

10 rows × 64 columns

Manipulation and Visualization of Top five countries by population growth Rate (1960 - 2020)

Population Growth: Let's calulculate the Top Five Most Countries by population Growth Rate in the world.

In [ ]:
```
def sort_columns(table_name, column_names : list, ascending=True):
```

```
    return table_name.sort_values(by=column_names, ascending=ascending)

pop_table = pd.melt(population_simple, id_vars=['Country Code'], var_name='Date', value_name='Population', ignore_index=False)
pop_table_sorted = sort_columns(pop_table, ['Country Code' , 'Date']).set_index('Country Code').fillna(method='ffill').fillna(0)
```

Top Five Coutries by Growth Rate (2019 - 2020): The following five countries' names listed in descending order who have highest population growth rate from 2019 to 2020.

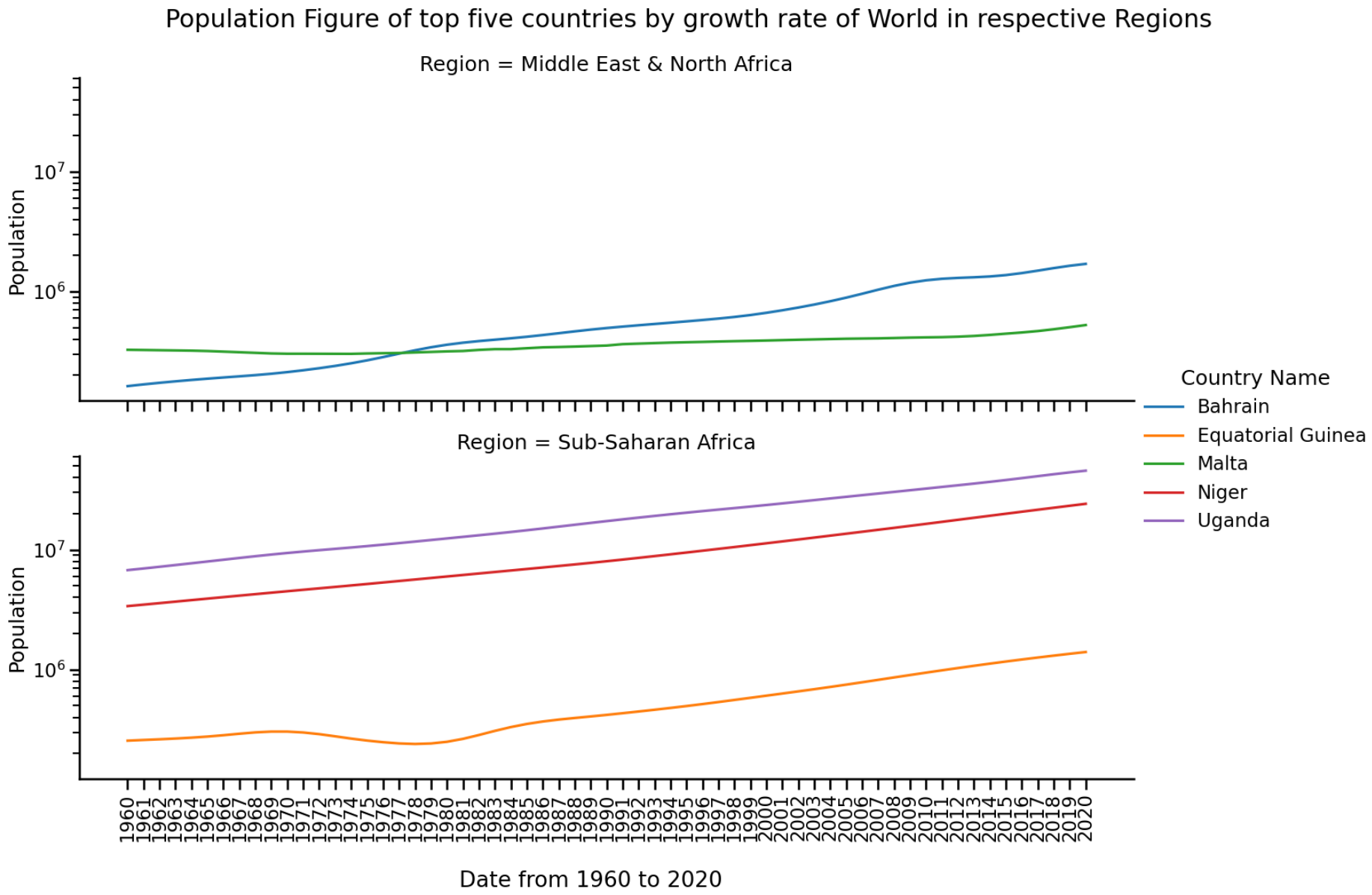
In [ ]:
```
# code to check the population from 1960 to 2020 to ensure the max initially although the population growth of each country shoul
def cal_growth(column):
    return ((column[-1] - column[-2]) / column[-2]) * 100

growth_rate =  pop_table_sorted.groupby('Country Code')[['Population']].agg(cal_growth).rename(columns={'Population' : 'Populatio
top_growth_rate_sorted = sort_columns(growth_rate, 'Population Rate', ascending=False).iloc[: 5]
print(top_growth_rate_sorted)
```

```
              Population Rate
Country Code
MLT                 4.210395
NER                 3.843369
BHR                 3.681472
GNQ                 3.466344
UGA                 3.323756
```

In [ ]:
```
pop_table_sorted_meta_merged = pop_table_sorted.merge(meta, on='Country Code')
```

Visualzation: The visualization of top five countries by Growth Rate is below displayed according to the region:

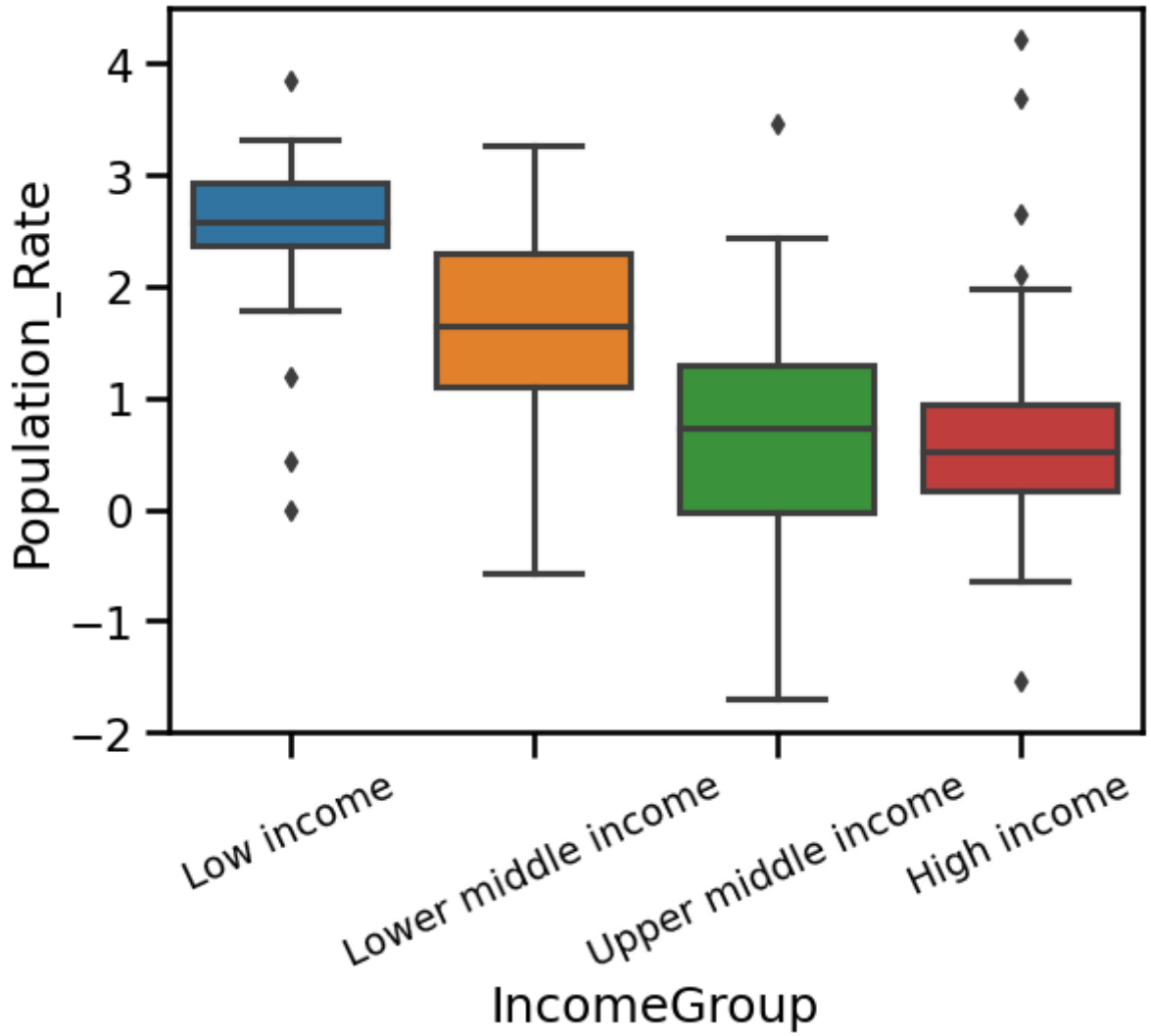
In [ ]:
```
countries_top_pop_by_region = pop_table_sorted_meta_merged[pop_table_sorted_meta_merged['Country Code'].isin(top_growth_rate_sort
f = sns.relplot(y='Population', x='Date', data=countries_top_pop_by_region, kind='line', hue='Country Name', col='Region', col_wr
plt.yscale('log')
f.set_xticklabels(rotation = 90)
f.fig.supxlabel('Date from 1960 to 2020', y=-0.04, x=0.43, fontsize=19)
f.set_xlabels('')
f.fig.suptitle('Population Figure of top five countries by growth rate of World in respective Regions', y=1.03)
countries_top_pop_by_region
plt.show()
```



It seems that the highest population growth rate countries are those who have lower and lower-middle income, lets take a look at relation of Population rate with income group to have a idea.

In [ ]:
```
growth_rate_income = pop_table_sorted_meta_merged.merge(growth_rate, on='Country Code')
```

```
growth_rate_income_model = growth_rate_income[['Country Code', 'IncomeGroup' , 'Population Rate']].set_index('Country Code').drop
fig = sns.boxplot(x='IncomeGroup', y='Population_Rate', data=growth_rate_income_model, order=['Low income' , 'Lower middle income
plt.xticks(rotation=25, fontsize=14)
plt.show()
fig.set(ylabel='Population Rate', xlabel ='Income Group')
plt.clf()
```



Population vs Income Group: The upper box plot shows that at average the High income have low Population rate, as well as outliers of countries' population. But in general the box plot tells that at most cases the higher the income , the lower the population rate. The outliers in this

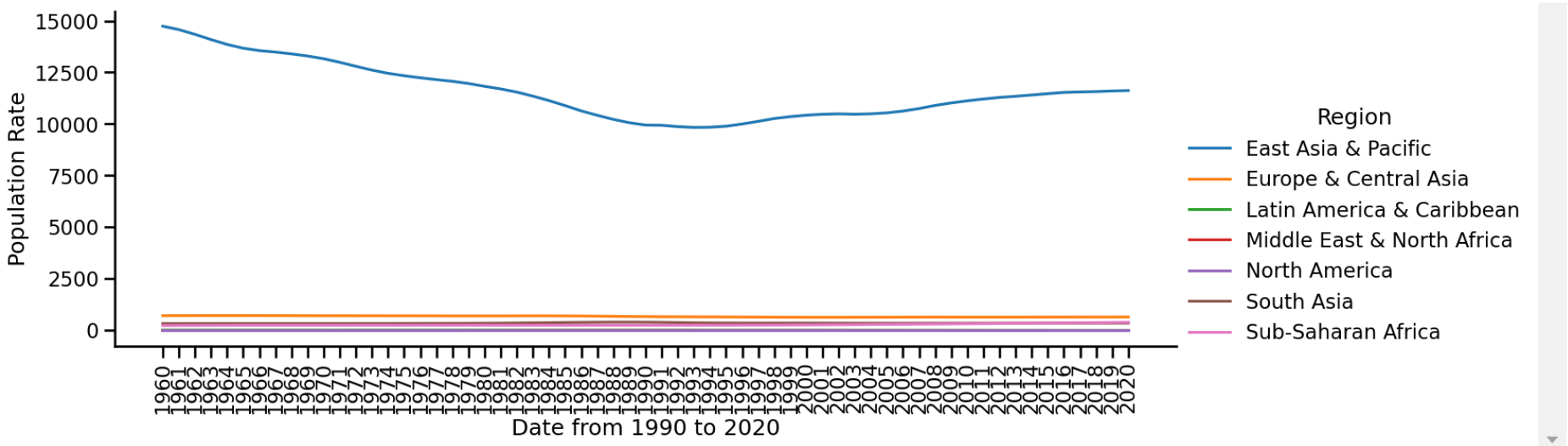
case are exceptional. The inter quantile range of the income categories tell us that the most high income countries have lower population rate. The downward outliers in low income show less population due to extreme low income, while the upward outliers in High income show of the countries where people have higher income at genral and they are fond of growing population. But generally, this is exception, not a rule.

The population Rate coverage by each Region (1960 - 2020)

Visualization of Population rate (1960 - 2020): Let's Visualize the population rate of each region from 1960 - 2020.

In [ ]:
```
def cal_growth_rate_mean(column):
    column = list(column)
    rate = column[0]
    growth = [0]
    for index, value in enumerate(column):
        if (index != 0):
            rate = ((value - column[index-1]) / column[index-1]) * 100
            growth.append(rate)
    return np.mean(growth)

table =  pop_table_sorted_meta_merged.dropna().groupby(['Region', 'Date'], as_index=False)[['Population']].agg(cal_growth_rate_me
fig = sns.relplot(x='Date', y='Population Rate', data=table, hue='Region', kind='line', aspect=2.8)
plt.yscale('linear')
plt.xticks(rotation=90)
plt.xlabel('Date from 1990 to 2020')
plt.show()
```

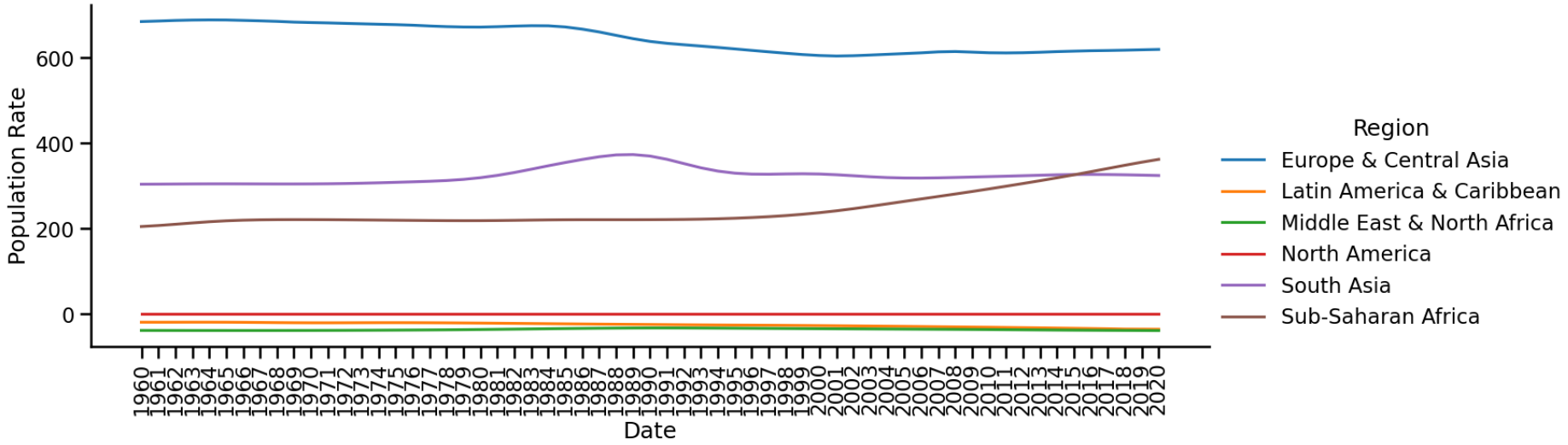
```
<Figure size 640x480 with 0 Axes>
```



Teriible: Oh It seems that the East Asia and Pacific region has the such highest popualtion growth over the time that we cannnot conclude the insights of other regions. Lets visualize by removing the East Asia and Pacific.

Although the population growth decreased from 1960 to 1990, but after that it managed to somehow increase the population growth.

In [ ]:
```
table_outside_asia = table[table['Region'] != 'East Asia & Pacific']
fig = sns.relplot(x='Date', y='Population Rate', data=table_outside_asia, hue='Region', kind='line', aspect=2.8)
fig.set_xticklabels(rotation=90)
plt.show()
```



Warning!!

The visualization of the other regions tells nothing special except the three ones. North America, Middle East & North Africa, Latin America and Central Asia. These three regions'countries are warned to increase their population growth rate, except Malta and Bahrain from Middle East and North Africa, who have higher growth Rate and managed to increase their population Rate. If these regions want man power and population growth upon their own country men, not from outsiders, they must find ways to increase population growth.

The finally Markdown on East Asia and Pacific

The East Asia and Pacific region, which has highest growth rate over the period of time, must have the higher or middle income coutries at most. We can verify the results

In [ ]:
```
table = growth_rate_income.drop_duplicates('Country Code')
table.value_counts(['Region' , 'IncomeGroup'])
```

Out[ ]:
```
Region                      IncomeGroup
Europe & Central Asia       High income            37
Sub-Saharan Africa          Low income             23
Latin America & Caribbean   Upper middle income    19
Sub-Saharan Africa          Lower middle income    18
Europe & Central Asia       Upper middle income    17
Latin America & Caribbean   High income            16
East Asia & Pacific         High income            14
                            Lower middle income    14
                            Upper middle income     8
Middle East & North Africa  High income            8
                            Lower middle income     7
South Asia                  Lower middle income     6
Sub-Saharan Africa          Upper middle income     6
Latin America & Caribbean   Lower middle income     6
Middle East & North Africa  Upper middle income     4
Europe & Central Asia       Lower middle income     4
North America               High income            3
Middle East & North Africa  Low income             2
South Asia                  Low income             1
East Asia & Pacific         Low income             1
South Asia                  Upper middle income     1
Sub-Saharan Africa          High income            1
dtype: int64
```

Verification: The East Asia and Pacific region has the most countries. It managed to upgrade the the population growth rate due to more than 50 % of 14 lower middle income countries. So, the credits goes to these 14 lower middle countries group.

In [ ]:
```
growth_rate_income = growth_rate_income.drop_duplicates('Country Code')
growth_rate_income_by_region = growth_rate_income.groupby(['Region', 'Country Code', 'IncomeGroup'], as_index=False)[['Populatior
growth_rate_income_by_region_sorted = growth_rate_income_by_region.sort_values('Population Rate', ascending=False).reset_index(dr
growth_rate_income_by_region_sorted_by_east_asia = growth_rate_income_by_region_sorted[growth_rate_income_by_region_sorted['Regic
growth_rate_income_by_region_sorted_by_east_asia
```

Out[ ]:

	Region	Country Code	IncomeGroup	Population Rate
29	East Asia & Pacific	SLB	Lower middle income	2.546501
36	East Asia & Pacific	VUT	Lower middle income	2.423620
45	East Asia & Pacific	NZL	High income	2.108730
51	East Asia & Pacific	TLS	Lower middle income	1.958210
52	East Asia & Pacific	PNG	Lower middle income	1.947421
65	East Asia & Pacific	MNG	Lower middle income	1.647233
70	East Asia & Pacific	KIR	Lower middle income	1.562819
77	East Asia & Pacific	LAO	Lower middle income	1.479889
79	East Asia & Pacific	KHM	Lower middle income	1.409810
81	East Asia & Pacific	MAC	High income	1.389032
84	East Asia & Pacific	PHL	Lower middle income	1.354522
85	East Asia & Pacific	MYS	Upper middle income	1.302697
89	East Asia & Pacific	AUS	High income	1.266653
98	East Asia & Pacific	TUV	Upper middle income	1.175461
99	East Asia & Pacific	TON	Upper middle income	1.148358
105	East Asia & Pacific	IDN	Lower middle income	1.070872
107	East Asia & Pacific	FSM	Lower middle income	1.063166
115	East Asia & Pacific	BRN	High income	0.966314
119	East Asia & Pacific	VNM	Lower middle income	0.908621
121	East Asia & Pacific	GUM	High income	0.889447
128	East Asia & Pacific	FJI	Upper middle income	0.729138
133	East Asia & Pacific	MHL	Upper middle income	0.685479
136	East Asia & Pacific	MMR	Lower middle income	0.674196
137	East Asia & Pacific	WSM	Lower middle income	0.668212

	Region	Country Code	IncomeGroup	Population Rate
138	East Asia & Pacific	NRU	High income	0.650316
139	East Asia & Pacific	MNP	High income	0.601262
142	East Asia & Pacific	PYF	High income	0.579695
149	East Asia & Pacific	PLW	High income	0.505527
154	East Asia & Pacific	PRK	Low income	0.438932
163	East Asia & Pacific	CHN	Upper middle income	0.314585
170	East Asia & Pacific	THA	Upper middle income	0.250478
171	East Asia & Pacific	NCL	High income	0.243273
180	East Asia & Pacific	KOR	High income	0.138237
196	East Asia & Pacific	ASM	Upper middle income	-0.207911
200	East Asia & Pacific	SGP	High income	-0.311419
201	East Asia & Pacific	JPN	High income	-0.339691
202	East Asia & Pacific	HKG	High income	-0.340997

Verification More: Hurray! It's glad to know that the most mainting the growth rate countries in East Asia & Pacific belong to lower middle Income.

Note: The population Growth is as per 2020.

Hope you like the Presentation.