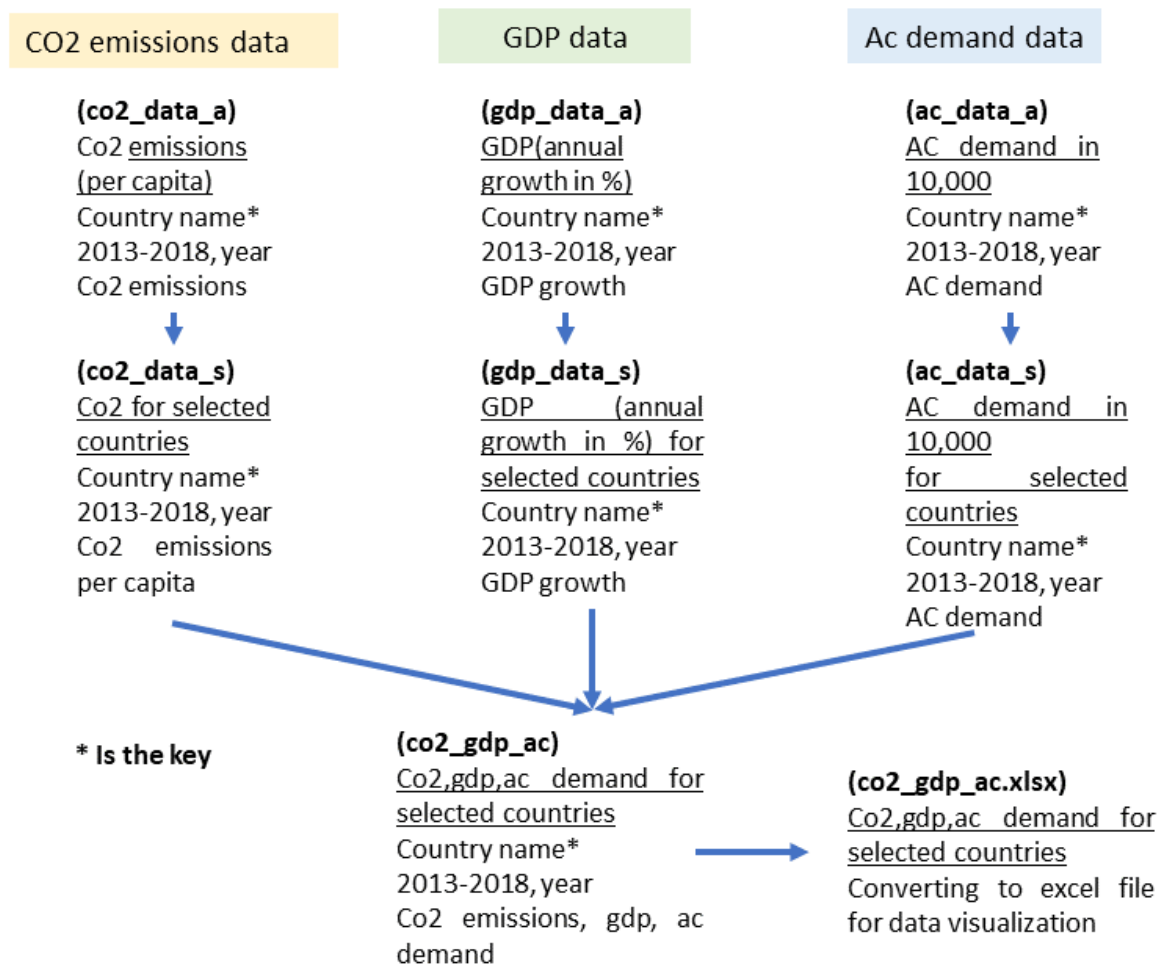


## DATA ANALYSIS - MATLAB ONLINE

### Question -

Did GDP growth had an effect on A.C demands in countries – Australia, Brazil, China, India, Indonesia, Nigeria, Pakistan, Russia, Saudi Arabia, and USA, leading to an increase in CO2 emissions between 2013 to 2018?

### Schema



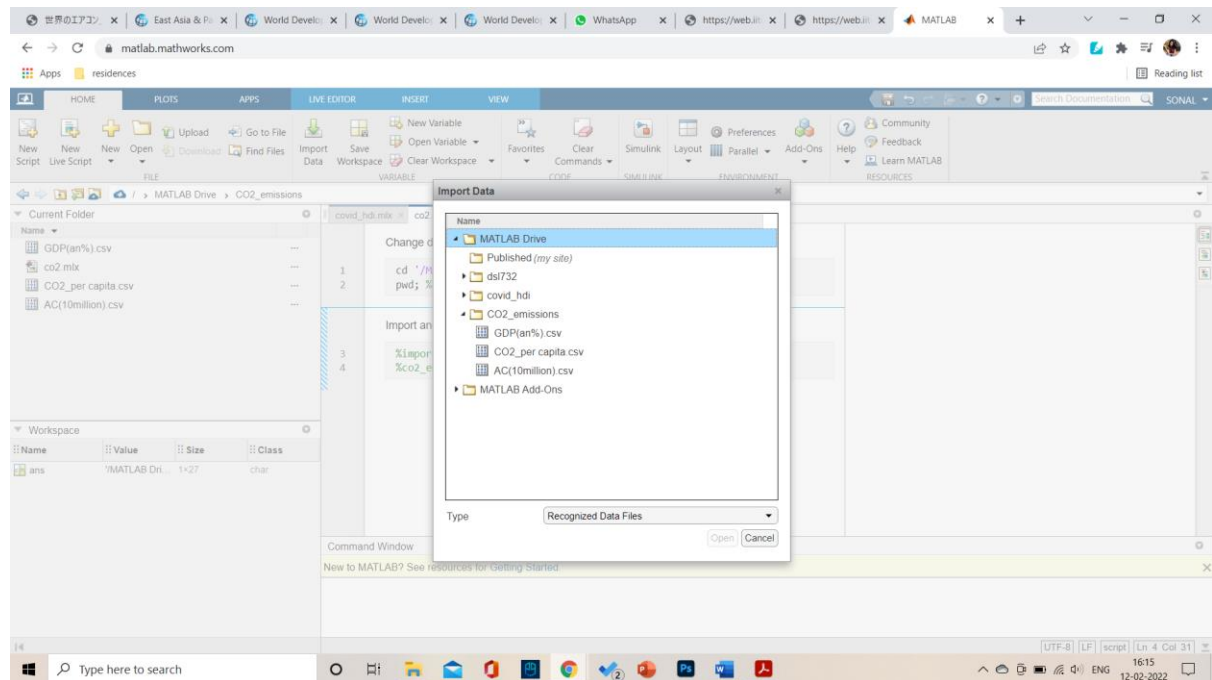
### Finding data sets

<https://databank.worldbank.org/reports.aspx?source=2&type=metadata&series=EN.ATM.CO2E.PC>

<https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.MKTP.KD.ZG&country=#>

World air conditioner demand by region, The Japan Refrigeration and Air Conditioning Industry Association, June 2019

## Importing data



Select CO2\_per capita.csv

In this table, the data of our importance is

### Change directory to the present working directory

```
cd '/MATLAB Drive/CO2_emissions';  
pwd; %present working directory
```

### Import and make datasets

#### CO2 dataset

```
%import data for CO2 emissions in metric tonnes  
%co2_data=CO2_per capita;
```

```
%take the data of interest from this table  
%from this table, the data of our interest is under columns - CountryName,  
CountryCode,x2013_YR2013 to x2018_YR2018  
%Now from the imported table in our workspace, co2_data , we will have to  
%find the column numbers of our corresponding required data, which in this  
%case are 3,4,9, 10, 11, 12, 13, 14  
%now we will form a new dataset named co2_data_a where we will consolidate  
%the selected data in the form of datasetname(rows,columns)  
% ':' means every rows of the data, while for column select only the specified  
columns from the dataset written within [] and separated by ','  
% 9:14 means selecting cols from 9 to 14, : is the replacement for to  
co2_data_a=co2_data(:,[3,4,9:14]);
```

#### GDP dataset

```
%import data for GDP growth(annual %)
```

```
%gdp_data=GDP(an%)
```

```
%We will select the required data from the gdp dataset  
gdp_data_a=gdp_data(:, [3,4,9:14]);
```

### AC demand dataset

```
%import data for Air conditioning demand (in 10 million)  
%ac_data=AC(10million)
```

```
%We will select the required data from the air conditioner demand dataset  
ac_data_a=ac_data(:, (3:10));
```

### Processing data

for sum of data

```
%if the data in any of the datasets, for example, had data of different co2  
%emissions for different states of a country making repetitive occurrence of  
country name for the year 2013, then we would have to sum the data for which we  
would  
%have to follow following function-  
%%This also ensures unique data points  
%co2_data_x = varfun(@sum,co2_data_a,'GroupingVariables',{'Country'},  
...'InputVariables',{'2013'});  
%group variable = the common category, and input variable is what we need to  
sum up
```

```
%after the sum, the new dataset should be renamed, for which we can apply the  
following functions  
%co2_data_y = renamevars(co2_data_x,'Country','Country_all');  
%co2_data_y = renamevars(co2_data_y,'2013','2013_all');
```

### Extracting and merging data from the datasets

```
%for running the innerjoin function, we have to take the set of column which is  
common in both the datasets  
%in our problem, the common is country but the year in both the data set is  
%under same name, which can result in confusion. So, we will have to rename  
%the datasets of CO2 emissions, GDP and AC demands  
co2_data_b= renamevars(co2_data_a,'x2013_YR2013_', 'co2_YR2013_');  
co2_data_b= renamevars(co2_data_b,'x2014_YR2014_', 'co2_YR2014_');  
co2_data_b= renamevars(co2_data_b,'x2015_YR2015_', 'co2_YR2015_');  
co2_data_b= renamevars(co2_data_b,'x2016_YR2016_', 'co2_YR2016_');
```

```
co2_data_b= renamevars(co2_data_b, 'x2017_YR2017_', 'co2_YR2017_');
co2_data_b= renamevars(co2_data_b, 'x2018_YR2018_', 'co2_YR2018_');
```

```
gdp_data_b=renamevars(gdp_data_a, 'x2013_YR2013_', 'gdp_YR2013_');
gdp_data_b=renamevars(gdp_data_b, 'x2014_YR2014_', 'gdp_YR2014_');
gdp_data_b=renamevars(gdp_data_b, 'x2015_YR2015_', 'gdp_YR2015_');
gdp_data_b=renamevars(gdp_data_b, 'x2016_YR2016_', 'gdp_YR2016_');
gdp_data_b=renamevars(gdp_data_b, 'x2017_YR2017_', 'gdp_YR2017_');
gdp_data_b=renamevars(gdp_data_b, 'x2018_YR2018_', 'gdp_YR2018_');
```

```
ac_data_b=renamevars(ac_data_a, 'x2013_YR2013_', 'ac_YR2013_');
ac_data_b=renamevars(ac_data_b, 'x2014_YR2014_', 'ac_YR2014_');
ac_data_b=renamevars(ac_data_b, 'x2015_YR2015_', 'ac_YR2015_');
ac_data_b=renamevars(ac_data_b, 'x2016_YR2016_', 'ac_YR2016_');
ac_data_b=renamevars(ac_data_b, 'x2017_YR2017_', 'ac_YR2017_');
ac_data_b=renamevars(ac_data_b, 'x2018_YR2018_', 'ac_YR2018_');
```

%so, now we have new datasets with distinctive columns for the data of years

### Merging CO2 emissions data with GDP data

```
%lets apply the innerjoin function
%make a new dataset with the co2 dataset and gdp dataset
co2_gdp=innerjoin(co2_data_b,gdp_data_b);
```

### Merging AC demand data with GDP data

```
%lets apply the innerjoin function
%make a new dataset with the ac demand dataset and gdp dataset
ac_gdp=innerjoin(ac_data_b,gdp_data_b);
```

%as there were only 10 selected countries in ac dataset, when we applied  
%innerjoin, only the 10 common countries were then selected from the gdp  
%dataset also

### Merging CO2 emissions with AC demands data

```
%lets apply the innerjoin function
co2_ac=innerjoin(ac_data_b,co2_data_b);
```

### Merging all the three datasets

```
%lets apply the innerjoin function
co2_gdp_ac=innerjoin(co2_gdp,ac_gdp);
```

```
%now we have all the selected countries and their respective co2 emissions,  
%gdp and ac demand
```

### Visualization of the data

```
%for visualizing the data, first we will extract the selected countries  
%from co2_gdp dataset  
co2_gdp_s=co2_gdp_ac(:,(1:14));
```

```
%now we have three important datasets for visualization of relationships  
%and one dataset to visualize the datasets countrywise  
%co2_gdp_s , ac_gdp , co2_ac , and co2_gdp_ac
```

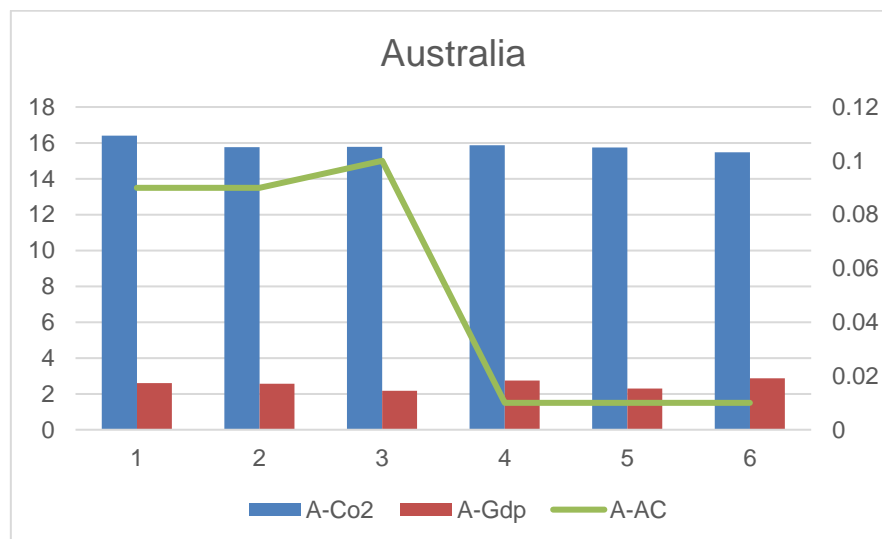
### Make datasets to plot

```
filename='co2_gdp_ac.xlsx';  
writetable(co2_gdp_ac,filename,'sheet',1,'Range','A1');
```

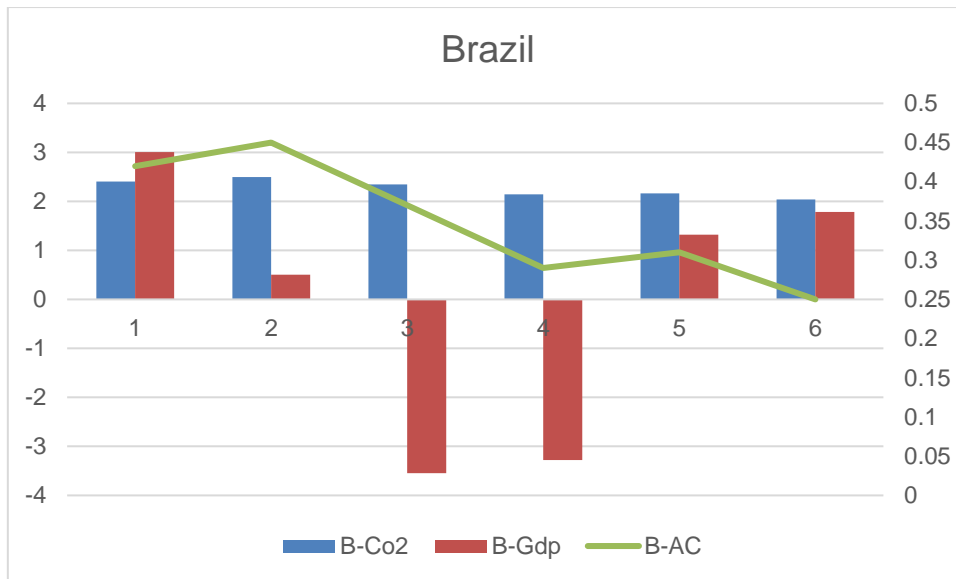
```
%The consolidated file of the dataset where then downloaded into Excel file  
%for visualization
```

### Plots and analysis

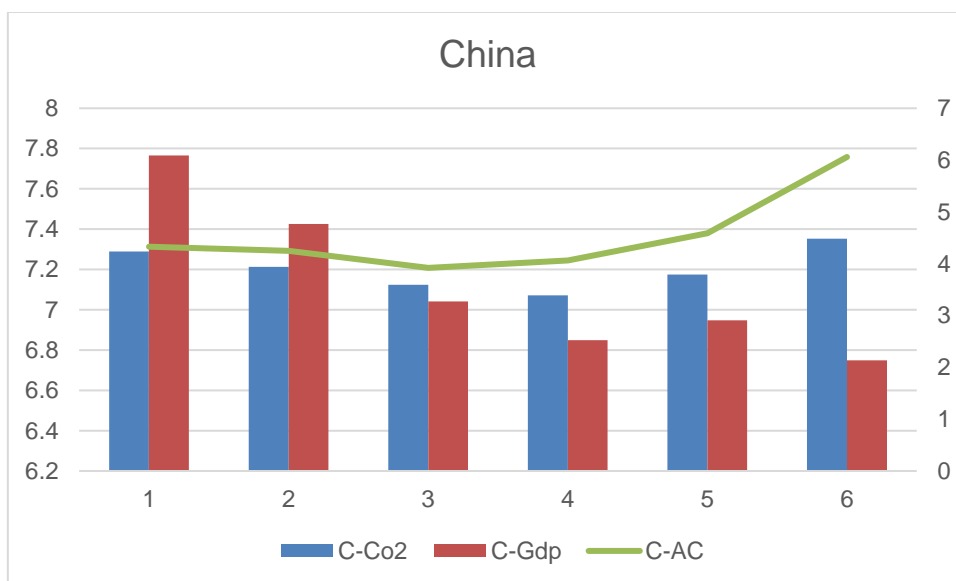
So the datasets – Co2 emissions per capita, Gdp annual growth in percentage and AC demands in 10 millions for the time interval of 6 years (2013 to 2018) were plotted in graphs for each selected country to understand the relationship between them. The analysis is as follows:



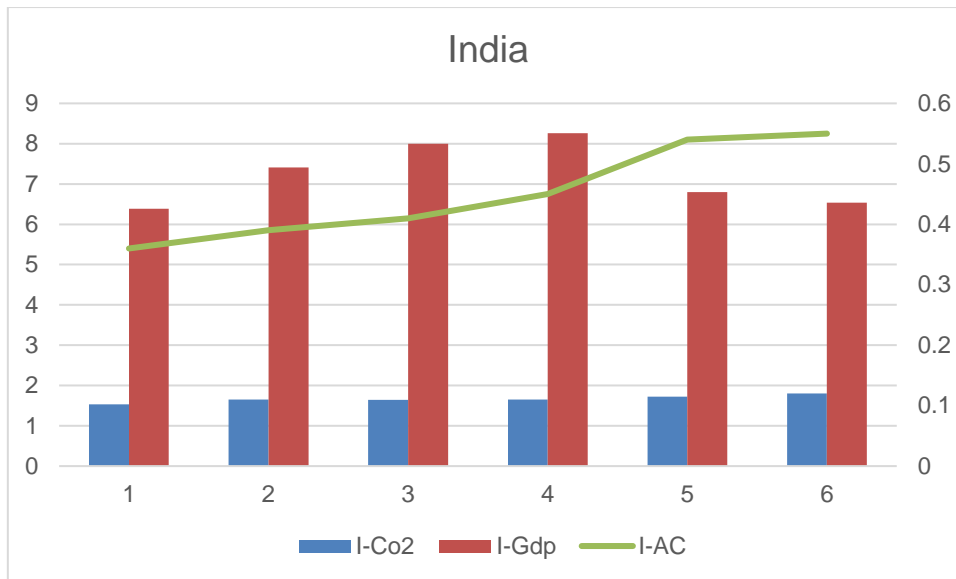
No significant connection between the 3 is observed in Australia



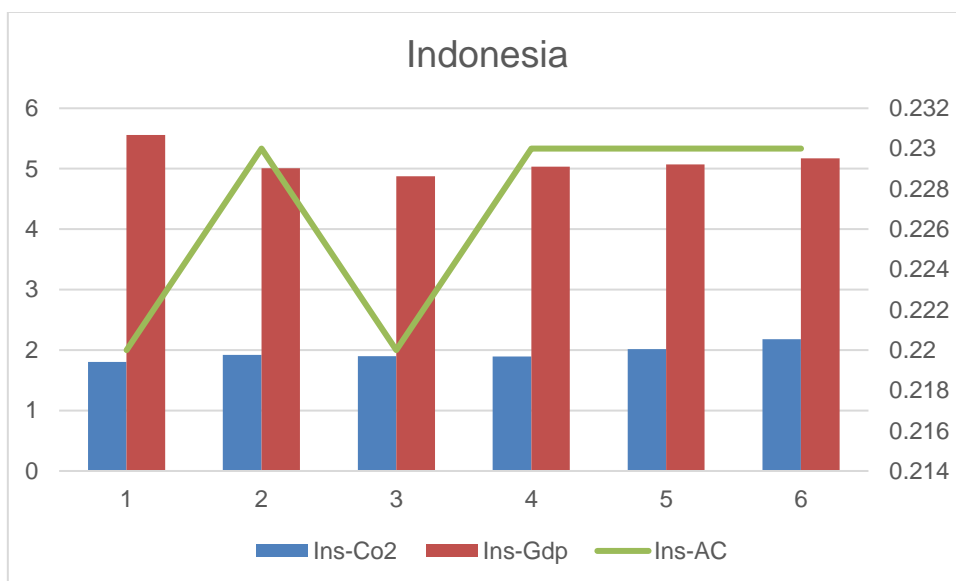
In Brazil, it can be seen that with increase in GDP, there has been a decrease in Co2 emissions as well as AC demand in 2018, while in 2014 there was a spike in AC demand and increased Co2 emissions, even when the GDP was decreasing.



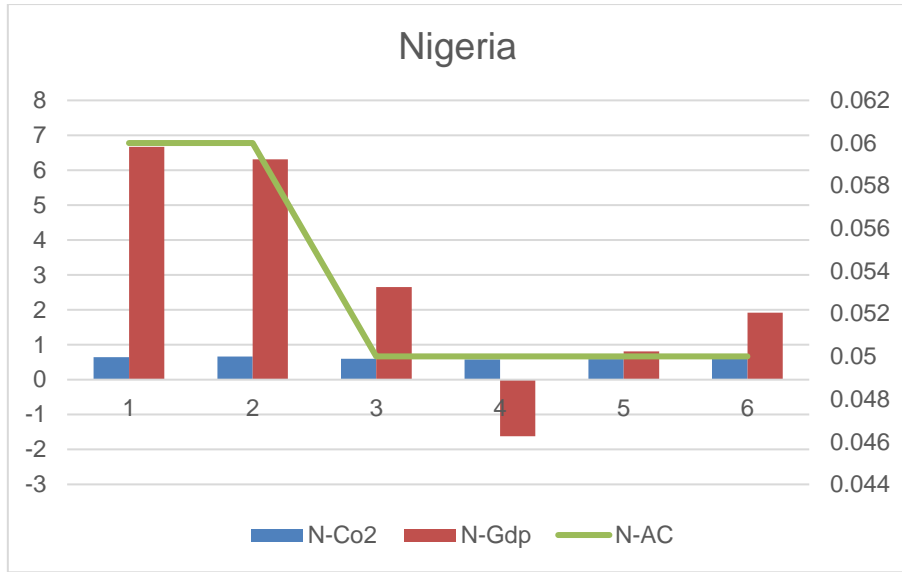
In China, the Co2 emissions and AC demands have been increasing proportionally, while there has been no significant effect of GDP on them.



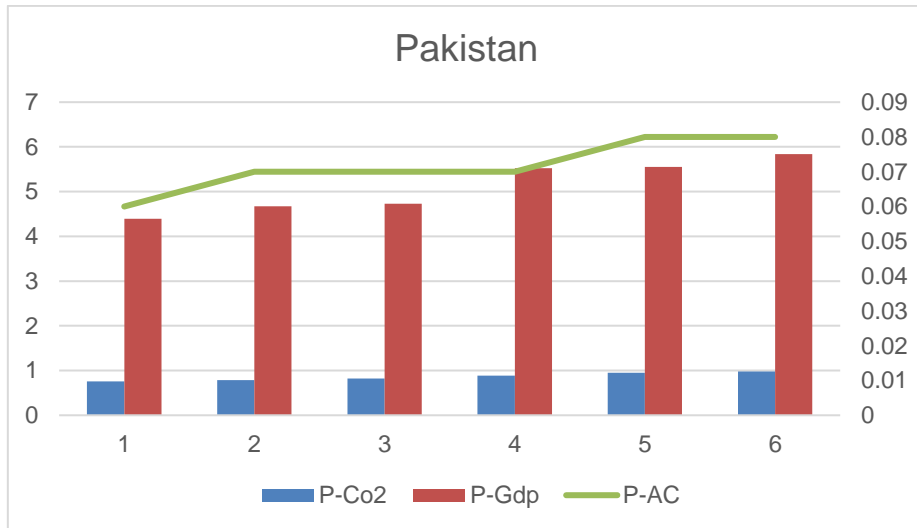
In India, Co2 emissions have been increasing with increase in AC demands. Though all the 3 data were increasing from 2013 to 2016, decrease in GDP in 2017 and 2018 hasn't affected the AC demand and Co2 emissions.



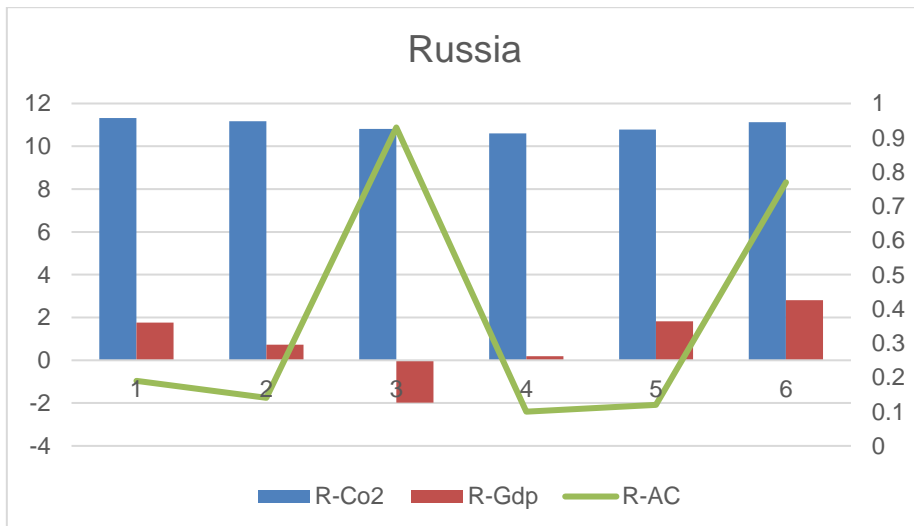
In Indonesia, the AC demands have been uniformed from 2016 to 2018, increase in Co2 demand has been proportional to GDP growth. Throughout the 6 years, Spike and fall of Ac demand has shown some effect on Co2 consumption, while the change in GDP was not significant.



In Nigeria, there is no significant relationship seen between the 3 variables.

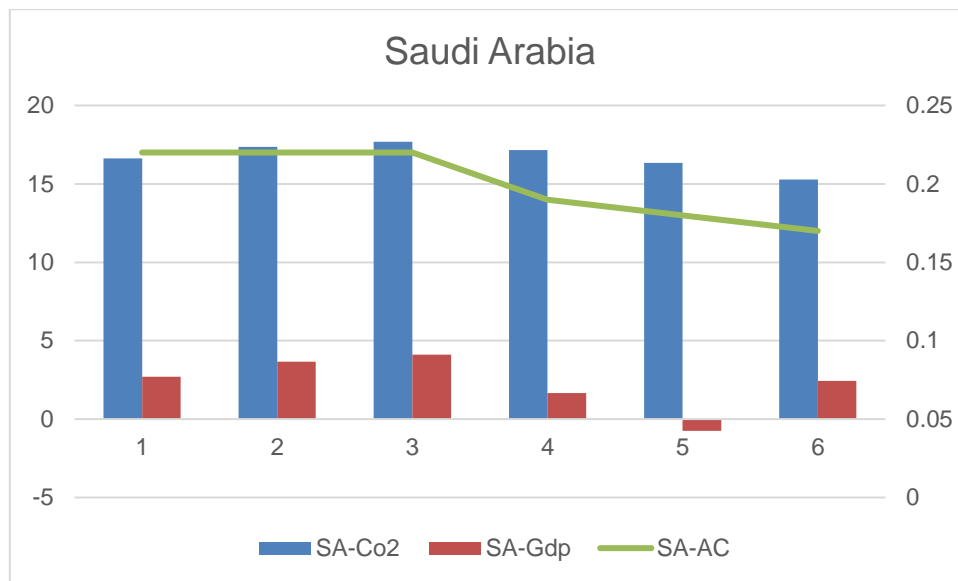


In, Pakistan all the 3 variables are seen to be increasing proportionately with each other.

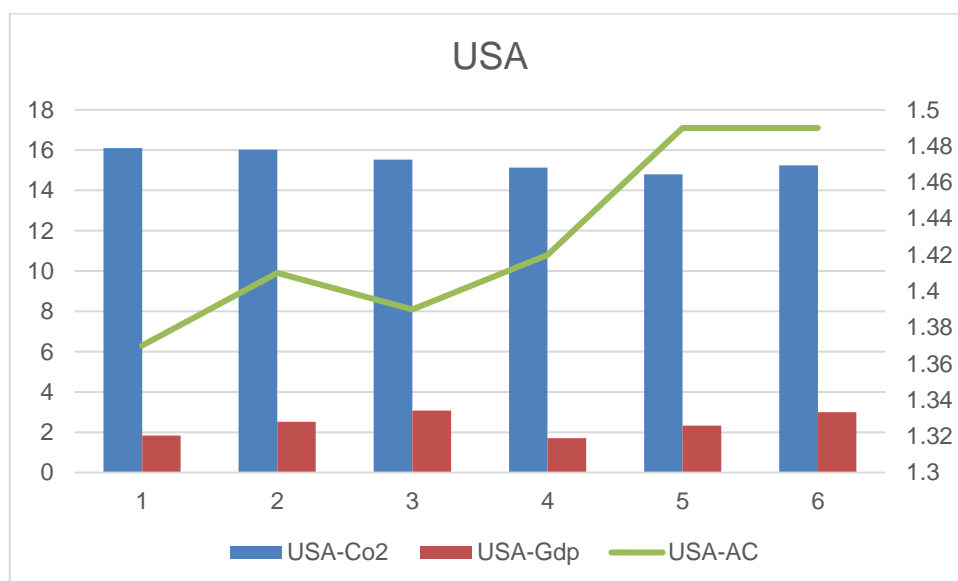




In Russia, there has been no significant relationship observed between the 3 variables.



In Saudi Arabia, there has been a decrease in Co2 emissions with a decrease in AC demands. While no significant relationship is observed with respect to GDP.



There has been no significant relationship observed.

### Conclusion

Relationship between Ac demand and Co2 emissions was observed in Brazil, China, India, Indonesia, Pakistan and Saudi Arabia. There has been no significant relationship observed between GDP growth and AC demands in most of the countries except in Pakistan. Hence, it can be concluded that GDP growth has no significant effect on AC demand and Co2 emissions.