

VIDYASAGAR UNIVERSITY



THE IMPACT OF EDUCATION ON ECONOMIC GROWTH: THE CASE OF INDIA

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ACKNOWLEDGEMENT

It gives me tremendous pleasure in acknowledging that valuable assistance extended to me by various people in the successful completion of this program.

Primarily I would thank Haldia Govt. College, Vidyasagar University for providing me an opportunity to do the project work. Then I wish to feel great pleasure to express my deep sense of gratitude to Dr. Shyamsundar Sahoo, Mr. Sibsankar Karan, Mr. Tanmay Kumar Maity, Mr. Bijitsh Halder for their excellent guidance, instructions, constant encouragement and keen interest through the progress of this project work.

last but not least I would like to thank all of my friends who have helped and gave me timely support due to which the project has been completed successfully.

CONTANTS

1. INTRODUCTION
2. OBJECTIVE
3. DATA COLLECTION
4. VARIABLE DESCRIPTION
5. METHODOLOGY
6. RESULTS
 - 6.1. Determining the missing value:-
 - 6.2. correlation
7. CONCLUSION
8. REFERENCE
9. APPENDIX

1) INTRODUCTION:-

Many developing countries attach great importance to education in order for their countries to reach a certain stage of development, both economically and socially. The reason for this is that countries need new technologies and developments to keep up with the world market and competition at the economic level. Today, the productivity of countries is greatly affected by the rate of the qualified labor force. For this reason, in order to obtain a qualified workforce, the importance and investments given to education are increased. In this context, education is actually closely related to the field of the economy. When Turkey's efforts to become a modern society are examined, it is seen that education constitutes the basis of the development movement. Within the westernization movements that have been going on for about a century and a half, educational institutions and teachers have had a special place and education has been accepted as a dynamic social force that changes the structure of the society and provides a better living level to the society.

In this paper, we will explore the theoretical and empirical evidence on how education affects economic outcomes, and discuss the implications for policy and practice.

2) OBJECTIVE:-

_____There are 32 years data from 1990 to 2021. Some values are missing from my data.

A) To obtain the missing value .

B) Detrend value is find out from the time series data.

C) TO check the relation between education and economic ,cross correlation is used.

year	GDP (current US\$)	GNI, PPP (current international \$)	School enrollment, primary (% gross)	School enrollment, secondary (% gross)	Computer, communications and other services (% of commercial service imports)	Secondary education, pupils	Primary education, pupils	Communications, computer, etc. (% of service exports, BoP)
1990	3.20979E+11	1.03451E+12	91.44030762	..	30.0780713		97318112	42.89379956
1991	2.70105E+11	1.07847E+12	91.14649963	..	30.55505362		99118320	40.64726281
1992	2.88208E+11	1.16343E+12	91.4284668	..	26.25022755		101577088	29.45681574
1993	2.79296E+11	1.2495E+12	93.118927	45.34304047	23.07356007	62245636	105370216	30.63259793
1994	3.27276E+11	1.36262E+12	94.2408905	45.65306091	27.47335369	64115976	108200536	31.57381176
1995	3.60282E+11	1.49891E+12	93.97062683	45.35134888	27.86800555	65206356	109043664	31.47833715
1996	3.92897E+11	1.64459E+12	93.84932709	45.28039932	27.75427089	66633720	109734288	30.51114507
1997	4.15868E+11	1.74216E+12	93.48976898	45.82965088	28.27894341	68872392	110390408	44.45170011
199	4.21351E	1.87092E	91.87738	..	33.5223216		109412	57.64597098

8	+11	+12	8		6		904	
199 9	4.5882E+ 11	2.06654E +12	92.56268 311	43.03517 914	43.6586557 2	670898 92	110985 880	64.90843809
200 0	4.68395E +11	2.1882E+ 12	94.27111 816	44.87197 876	28.3708387 2	710305 12	113612 544	62.41565866
200 1	4.85441E +11	2.35007E +12	94.11492 92	45.15169 907	28.1170408 5	723927 28	113826 976	63.1524361
200 2	5.14938E +11	2.48241E +12	94.74552 917	47.07345 963	30.9827800 6	762156 88	115194 576	64.59941284
200 3	6.07699E +11	2.72841E +12	102.6829 071	49.62504 959	39.8093552 2	810501 28	125568 600	63.42039439
200 4	7.09149E +11	3.02482E +12	97.64243 317	51.37184 906	40.5104249 1	845690 80		67.78727623
200 5	8.20382E +11	3.36629E +12	97.35142 517	53.96905 899	35.1764240 7	894617 92		69.11783817
200 6	9.4026E+ 11	3.74753E +12	96.82868 195	54.88293 839	36.8971694 7	915294 32		70.1099552
200 7	1.21674E +12	4.15879E +12	110.0201 187	57.27587 128	34.1830457	960490 56	137742 640	70.1629611
200 8	1.1989E+ 12	4.36156E +12	110.6973 801	60.35649 109	48.2492962 9	101783 936	139317 984	71.25224061
200 9	1.34189E +12	4.73463E +12	109.4510 727	59.61365 128	51.3533487 4	101110 384	138368 128	70.39496354
201 0	1.67562E +12	5.17387E +12	109.1013 718	63.11619 949	57.8167114 1	107686 864	138413 840	65.90241992
201 1	1.82305E +12	5.56897E +12	106.4125 214	66.25070 19	49.5115877 5	113727 864	135316 944	63.33763833
201 2	1.82764E +12	6.0809E+ 12	109.7612 991	69.01283 264	56.0301577 8	119148 200	139869 904	67.70741005
201 3	1.85672E +12	6.39686E +12	103.4455 719	68.75912 476	57.9410784 9	119400 528	132043 744	69.76817676
201 4	2.03913E +12	6.70084E +12	100.1041 107	74.14153 29	54.7809122 4	129438 992	127894 256	68.38519099
201	2.10359E	7.07673E	100.1130	73.86563	57.7808244	129542	127828	69.90334748

5	+12	+12	295	11	3	056	088	
201 6	2.2948E+ 12	7.57706E +12	99.42523 956	75.09179 688	61.3569272 8	132161 360	126564 216	70.03285168
201 7	2.65147E +12	8.18743E +12	97.64243 317	73.47688 293	61.0358569	129829 192	123807 888	64.55392689
201 8	2.70293E +12	8.92504E +12	97.35142 517	74.12949 371	61.8427982	131316 880	122378 528	63.59163625
201 9	2.83155E +12	9.4346E+ 12	96.82868 195	73.79296 875	60.5409331 2	130932 816	120064 160	67.91853823
202 0	2.66769E +12	8.88383E +12	99.90045 929	75.48119 354	66.0857013	134043 304	121700 216	75.85231129
202 1	3.1763E+ 12	1.00349E +13	102.0513 077	77.98330 688	61.7036902 6	138364 336	122027 752	76.04892559
202 2								
202 3								

3. DATA COLLECTION:-

We collect the data from (data.govt.in) website

INDICATOR:-

A) Educational Indicator:

- School enrollment, primary (% gross)
- School enrollment, secondary (% gross)
- Computer, communications and other services (% of commercial service imports)
- Secondary education, pupils
- Primary education, pupils
- Communications, computer, etc. (% of service exports, BoP)

B) Economical Indicator:

- GDP (current US\$)
- GNI, PPP (current international \$)

9. DATA DESCRIPTION:-

❖ **GDP (current US\$):**

Gross domestic product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country's economic health.

Though GDP is typically calculated on an annual basis, it is sometimes calculated on a quarterly basis as well. In the U.S., for example, the government releases an annualized GDP estimate for each fiscal quarter and also for the calendar year. The individual data sets included in this report are given in real terms, so the data is adjusted for price changes and is, therefore, net of inflation.

❖ **GNI:-**

Gross national income (GNI) is defined as gross domestic product, plus net receipts from abroad of compensation of employees, property income and net taxes less subsidies on production. Compensation of employees receivable from abroad are those that are earned by residents who essentially live inside the economic territory but work abroad (this happens in border areas on a regular basis), or for people who live and work abroad for short periods (seasonal workers) and whose centre of economic interest remains in their home country. Property income receivable from/payable to abroad includes interest, dividends, and all (or part of) retained earnings of foreign enterprises owned fully (or in part) by resident enterprises (and vice versa). This indicator is based on GNI at current prices and is available in different measures: US dollars and US dollars per capita (both in current PPPs). All OECD countries compile their data according to the 2008 System of National Accounts (SNA). This indicator is less suited for comparisons over time, as developments are not only caused by real growth, but also by changes in prices and PPPs.

❖ **School enrollment, primary (% gross):-**

Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.

❖ **Secondary education, pupils:-**

Secondary general pupils are the number of secondary students enrolled in general education programs, including teacher training.

Methodology:-

Determining the missing value:-

This process involves a combination of techniques and considerations to accurately estimate the missing values based on the available information while minimizing bias and distortion.

Here's a step-by-step process for creating a missing plot using trend values:

- **Gather Data:** Collect a dataset containing the values we want to plot. Ensure that the dataset has a clear trend over time.
- **Analyze the Trend:** Examine the dataset to identify the underlying trend. This can be done through visual inspection or by using statistical techniques such as linear regression or exponential smoothing, polynomial etc.

Detrend:-

From time series data to remove trend ,we find detrend value.Detrending is the process of removing the underlying trend from a dataset, allowing us to focus on the remaining patterns or fluctuations. This technique is useful for analyzing the residual components of a time series and identifying other meaningful features. Here's a step-by-step process for detrending a dataset.

- Gather Data: Collect the dataset which we want to detrend. Ensure that it represents a time series or a sequence of observations over a specific period.
- Visualize the Data: Plot the data to visualize the overall trend and any other patterns present. This will help us to understand the nature of the trend and decide on an appropriate detrending method.

$$D_t = \frac{Y_t}{T_t}, Y_t = \text{the value of } t \text{ year.}$$

T_t = trend value of t year.

Cross correlation:-

Cross-correlation is a mathematical operation that measures the similarity between two signals as they vary in time or space. It is commonly used in various fields such as signal processing, image analysis, communication systems, and data analysis. Cross-correlation helps us understand how two signals are related, especially in terms of their timing and phase differences.

The cross-correlation operation can be represented mathematically as follows, assuming we have two discrete signals $x[n]$ and $y[n]$:

$$R_{xy}[m] = \sum_n x[n] \cdot y[n + m]$$

Where:

- $R_{xy}[m]$ is the cross-correlation sequence at lag m .
- $x[n]$ is the input signal.
- $y[n + m]$ is the template signal shifted by m positions.

Key points to note about cross-correlation:

ACF:-

Auto-correlation is a mathematical concept used to measure the similarity between a signal and a delayed version of itself. In essence, it quantifies how much a signal resembles itself as it shifts in time. Auto-correlation is particularly useful in analyzing periodicity, repeating patterns, and the underlying structure of a signal.

The auto-correlation function is computed by taking a signal, shifting it by different time lags, and calculating the similarity between the original signal and the shifted version at each lag. Mathematically, the auto-correlation function for a discrete signal $x[n]$ is given by:

$$R_{xx}[m] = \sum_n x[n] \cdot x[n - m]$$

Where:

- $R_{xx}[m]$ is the auto-correlation function at lag m .
- $x[n]$ is the input signal.
- $x[n - m]$ is the signal shifted by m positions.

Result And Discussion:-

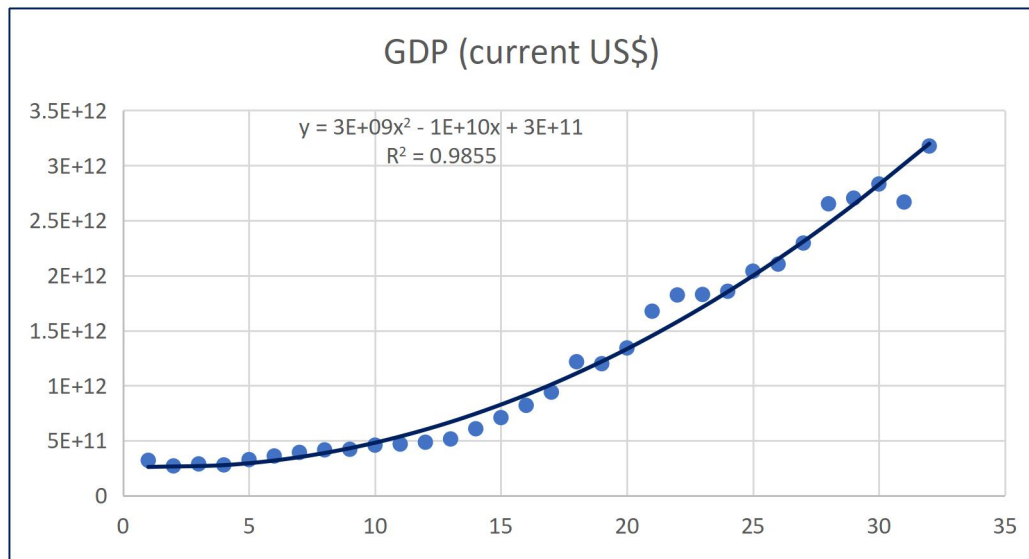
year	GDP (current US\$)(Y _t)	GNI, PPP (current international \$)	School enrollment, primary (% gross)	School enrollment, secondary (% gross)	Computer, communications and other services (% of commercial service imports)	Primary education, pupils	Secondary education, pupils	Communications, computer, etc. (% of service exports, BoP)
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201 1	1.82305E +12	5.56897E +12	106.4125 214	66.25070 19	49.5115877 5	135316 944	113727 864	63.33763833

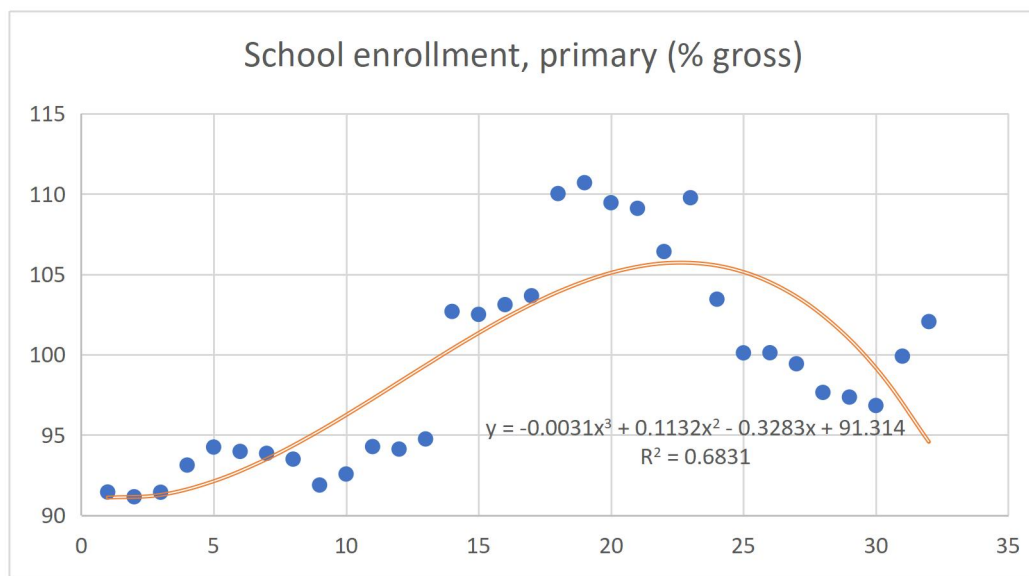
201 2	1.82764E +12	6.0809E+ 12	109.7612 991	69.01283 264	56.0301577 8	139869 904	119148 200	67.70741005
201 3	1.85672E +12	6.39686E +12	103.4455 719	68.75912 476	57.9410784 9	132043 744	119400 528	69.76817676
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201 5	2.10359E +12	7.07673E +12	100.1130 295	73.86563 11	57.7808244 3	127828 088	129542 056	69.90334748
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201 7	2.65147E +12	8.18743E +12	97.64243 317	73.47688 293	61.0358569	123807 888	129829 192	64.55392689
201 8	2.70293E +12	8.92504E +12	97.35142 517	74.12949 371	61.8427982	122378 528	131316 880	63.59163625
201 9	2.83155E +12	9.4346E+ 12	96.82868 195	73.79296 875	60.5409331 2	120064 160	130932 816	67.91853823
202 0	2.66769E +12	8.88383E +12	99.90045 929	75.48119 354	66.0857013	121700 216	134043 304	75.85231129
202 1	3.1763E+ 12	1.00349E +13	102.0513 077	77.98330 688	61.7036902 6	122027 752	138364 336	76.04892559

the values which are marked by red colour are found out.

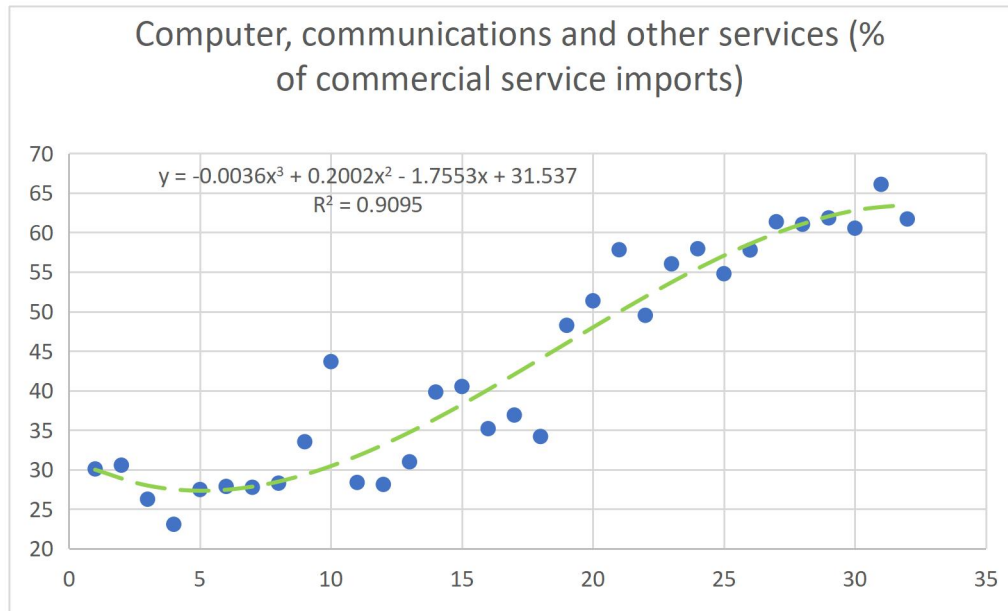
Polynomial curve fitting



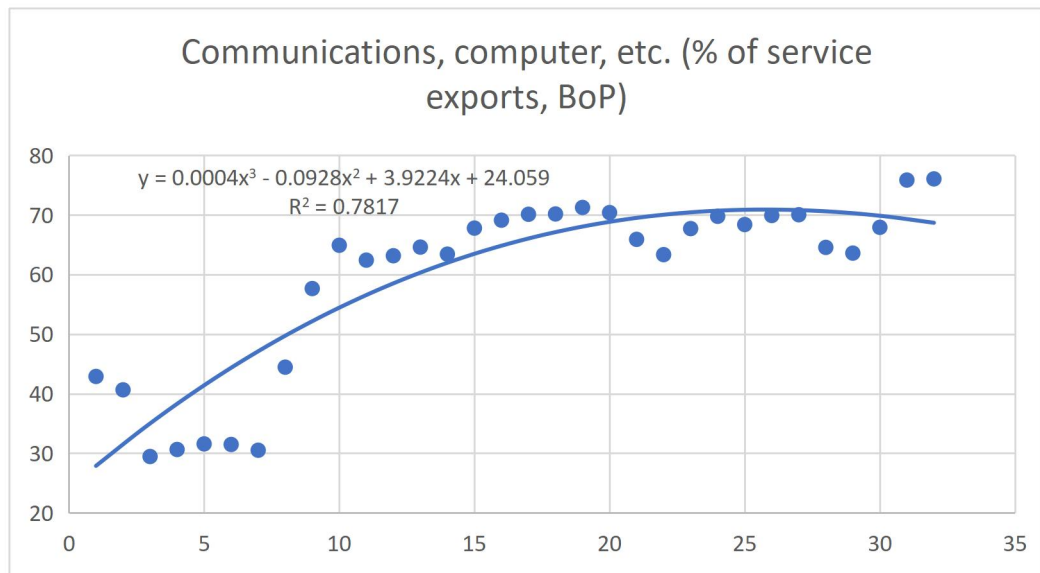
Here when we use 3 degree polynomial curve fitting ,then R^2 value is maximum.



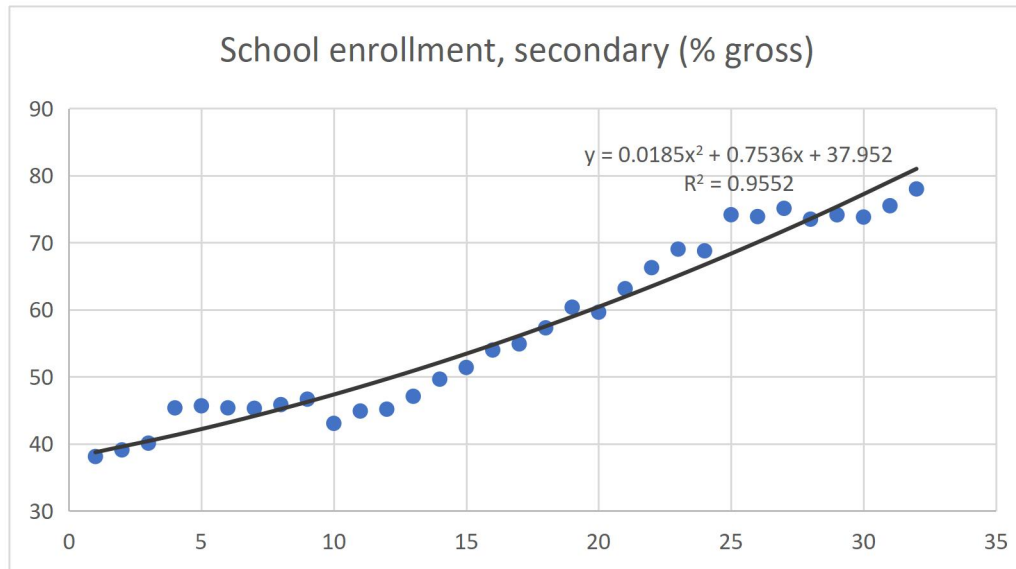
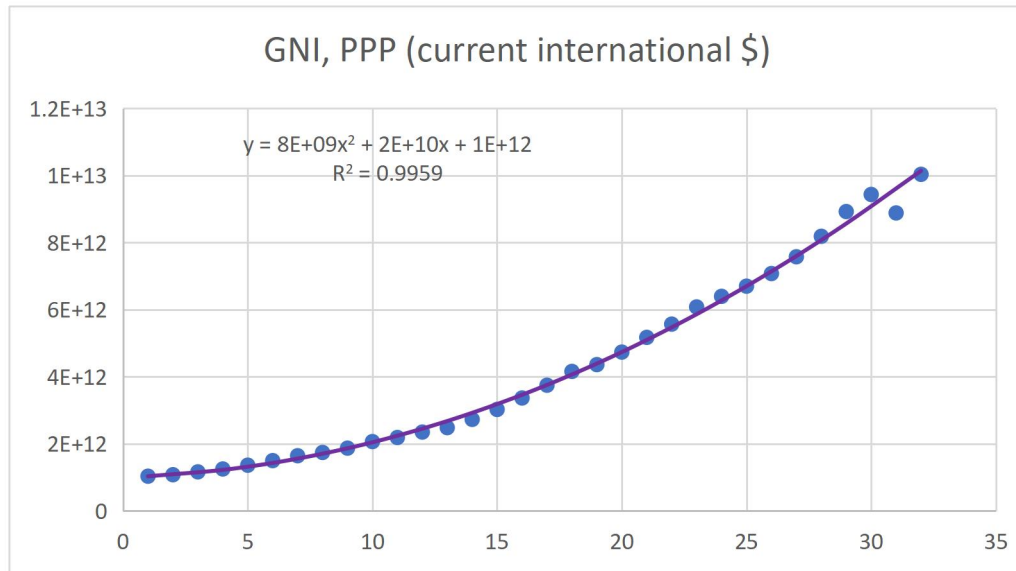
Here also 3degree polynomial curve is appropriate.



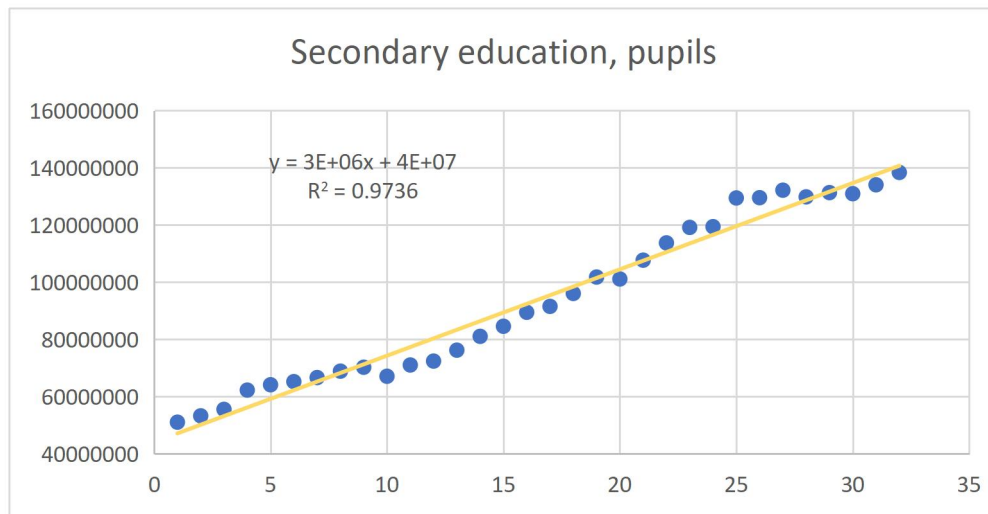
As previous ,it is also appropriate for three degree polynomial.



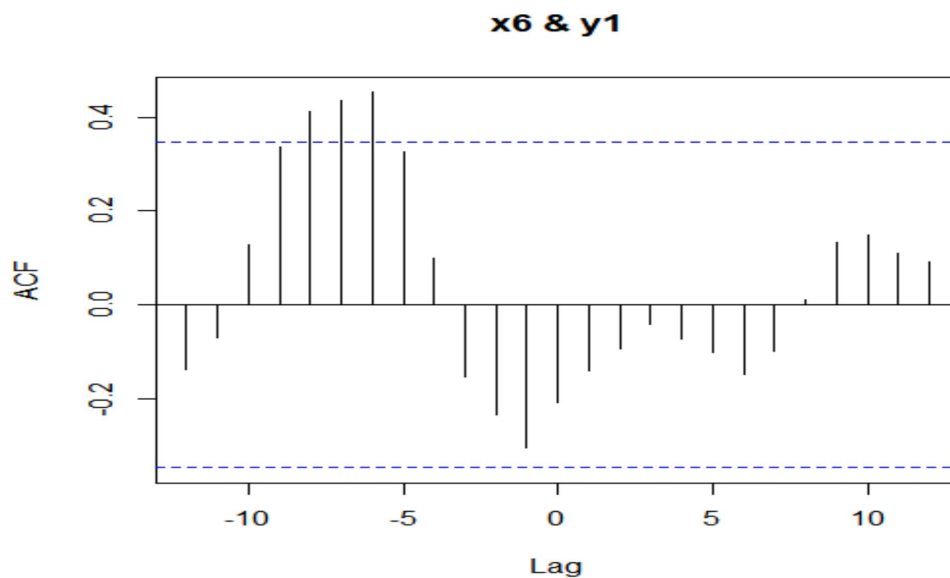
2nd degree polynomial



Linear equation

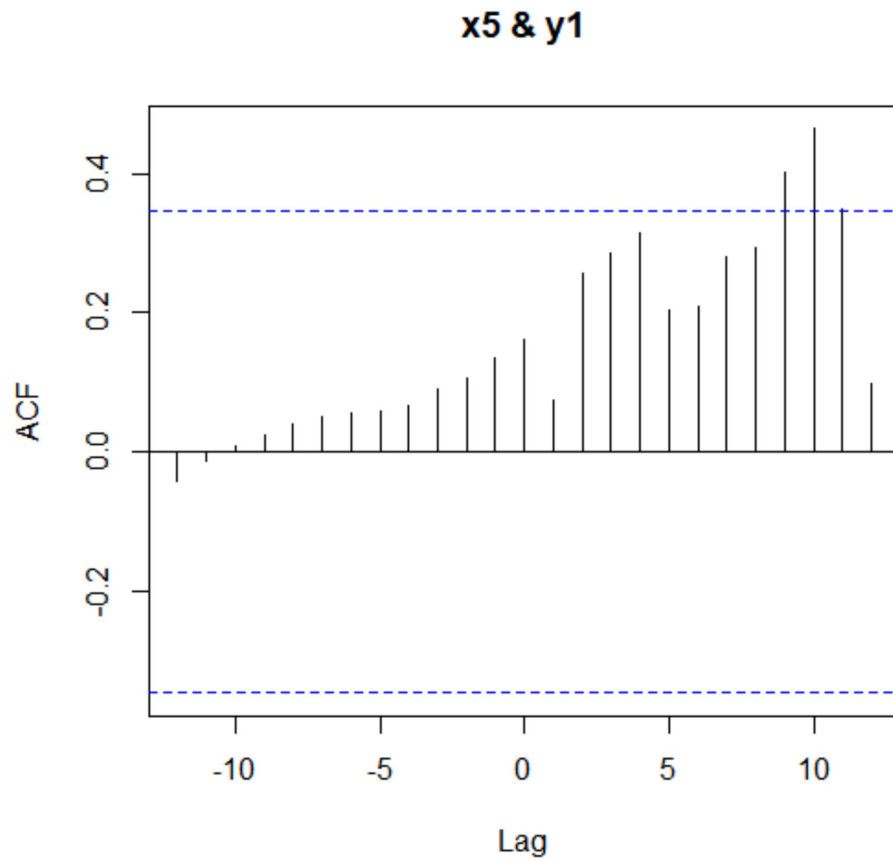


Correlation between education indicators and economical indicators:-



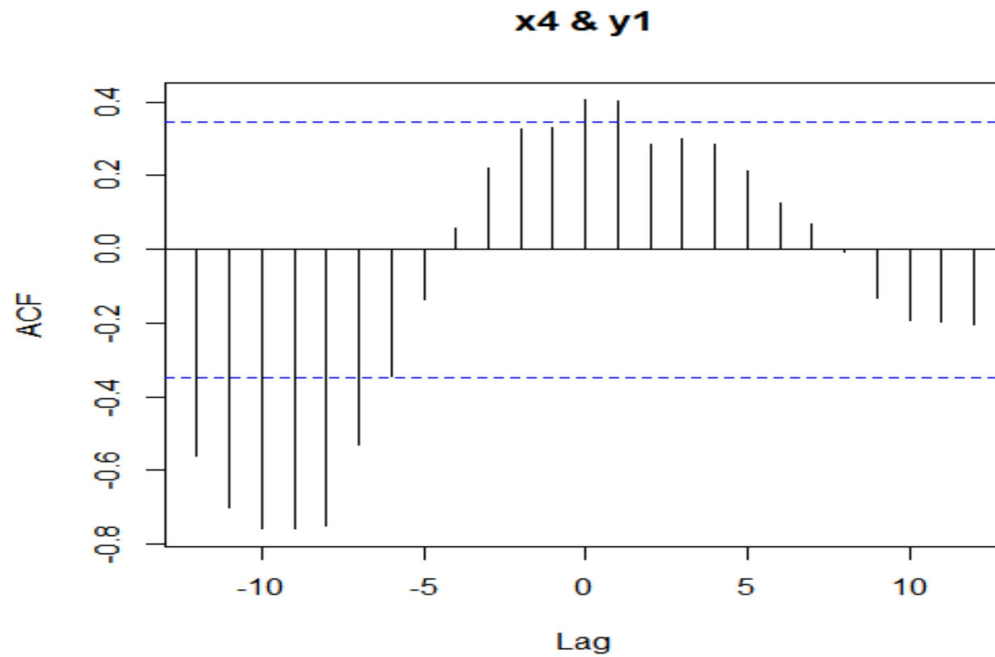
Communications, computer, etc. (% of service exports, BoP) VS GDP

Here if communications, computer, etc (service export) increase in this year, then GDP should be increased at least 6 years ago.



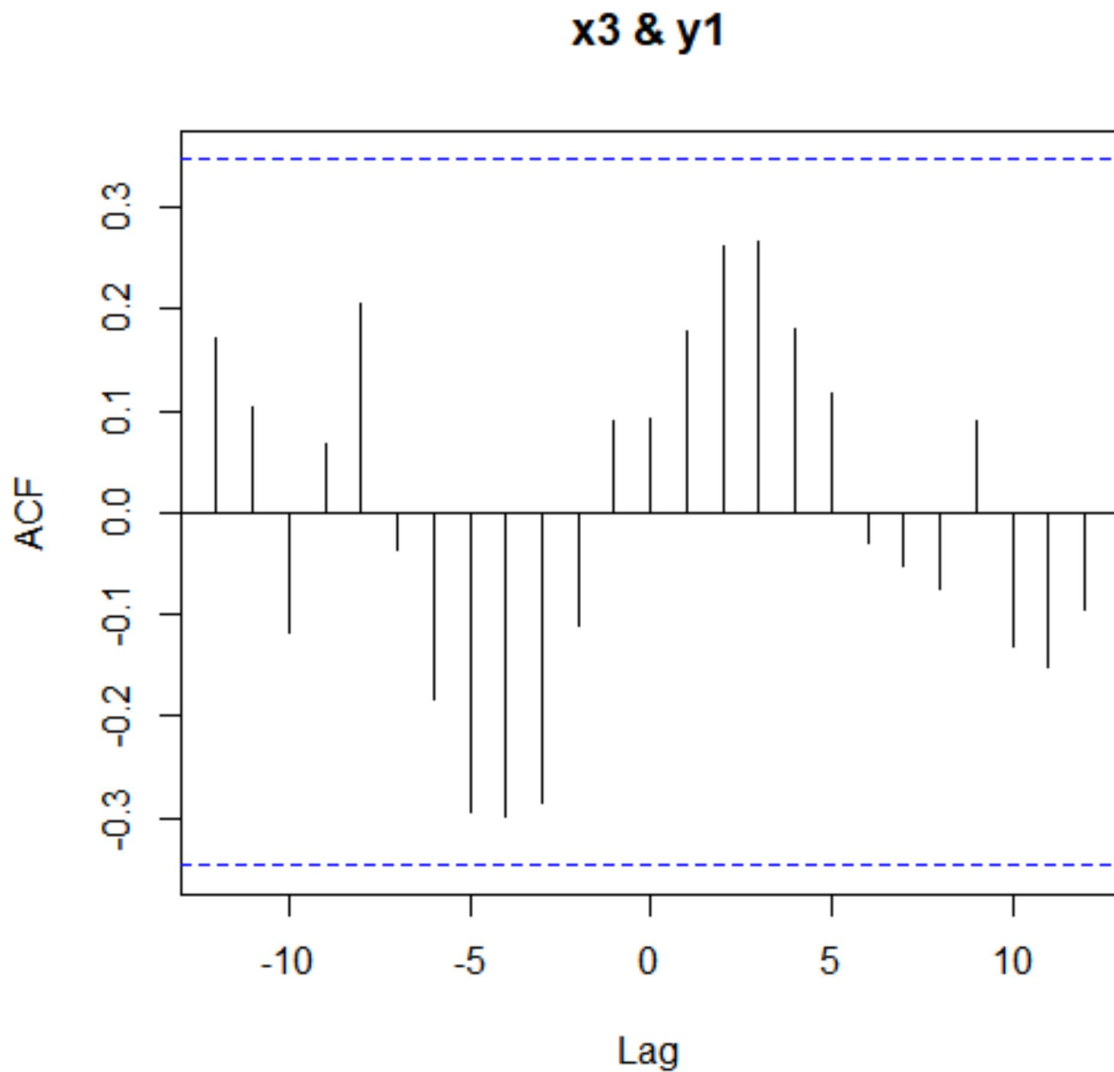
Primary education, pupils VS GDP

If number of primary education pupils increase in this year, the GDP will increase after 10 years.



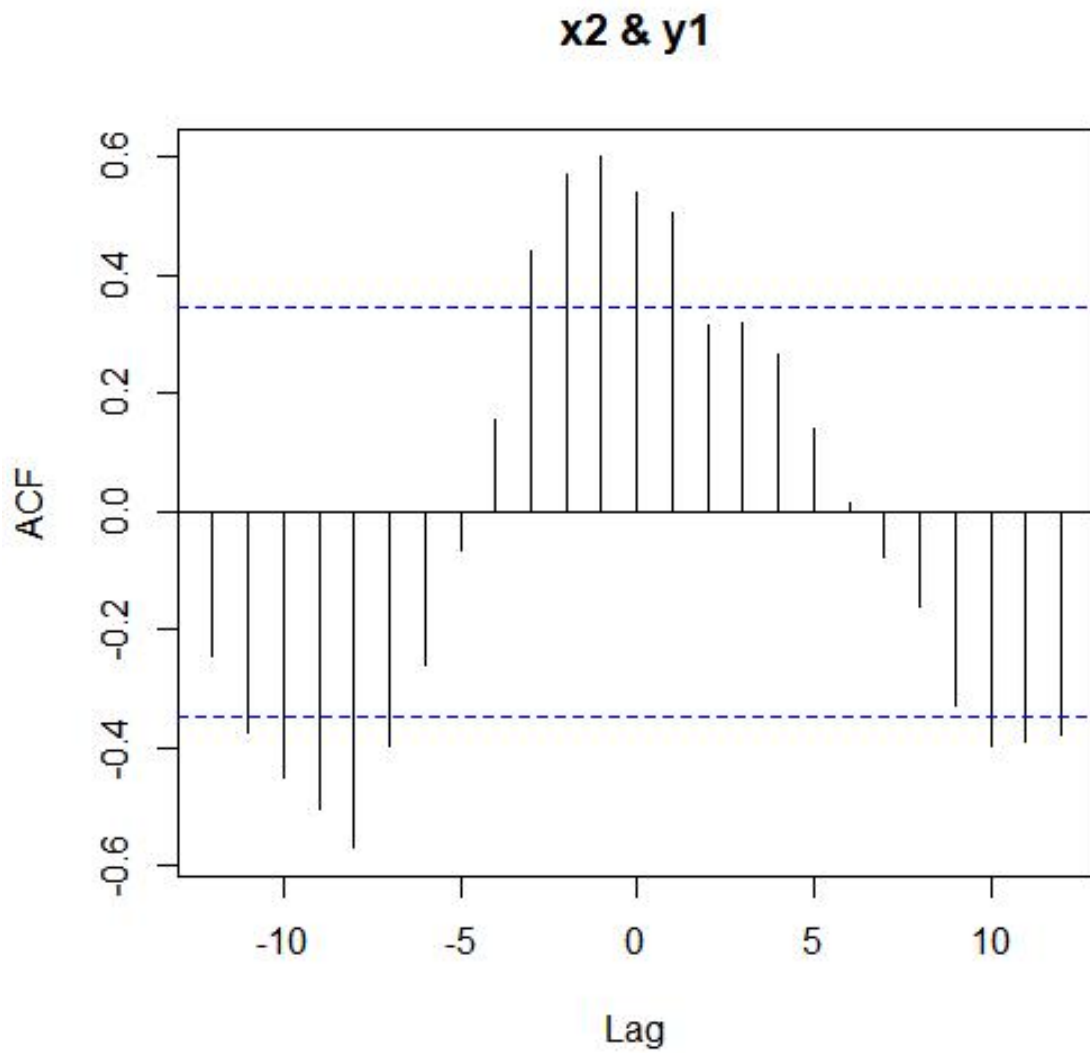
Secondary education, pupils VS GDP

Here, if secondary education is increasing, the GDP also increases in that year.



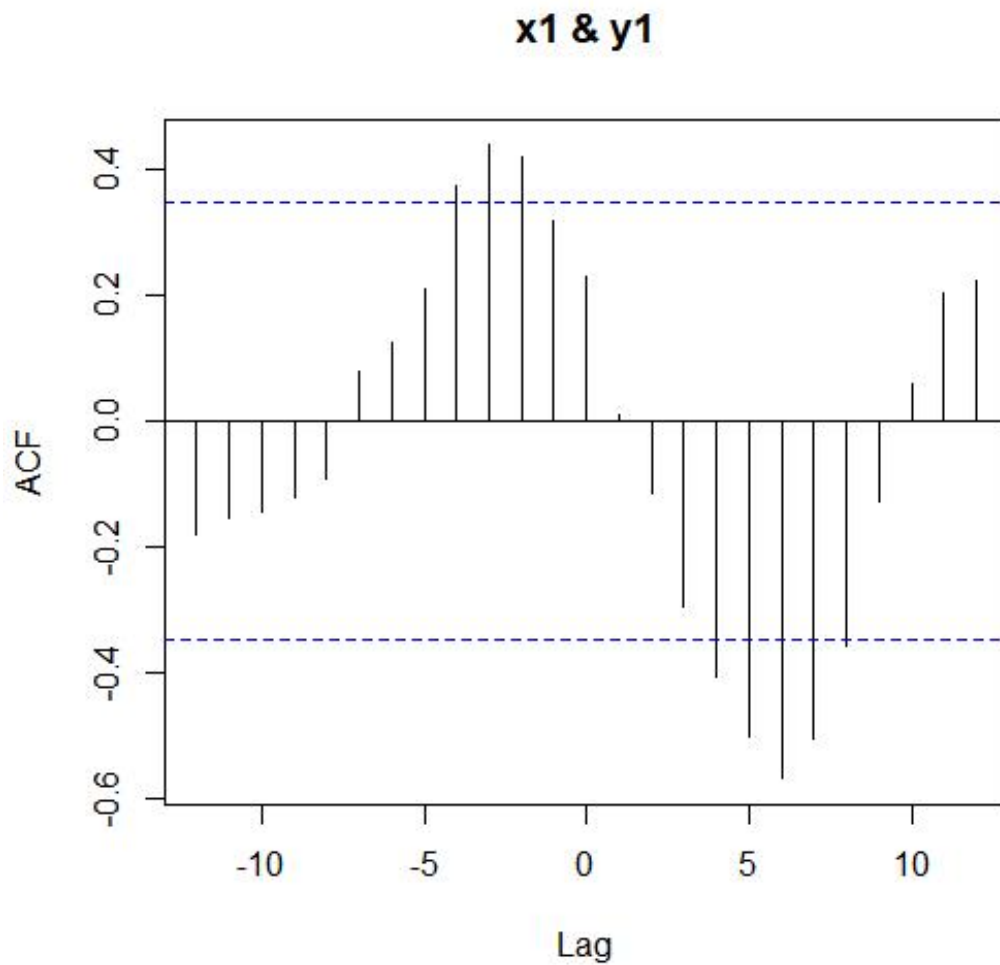
Computer, communications and other services (% of commercial service imports) VS GDP.

There is no relationship between Computer, communications and other services (% of commercial service imports) and GDP.



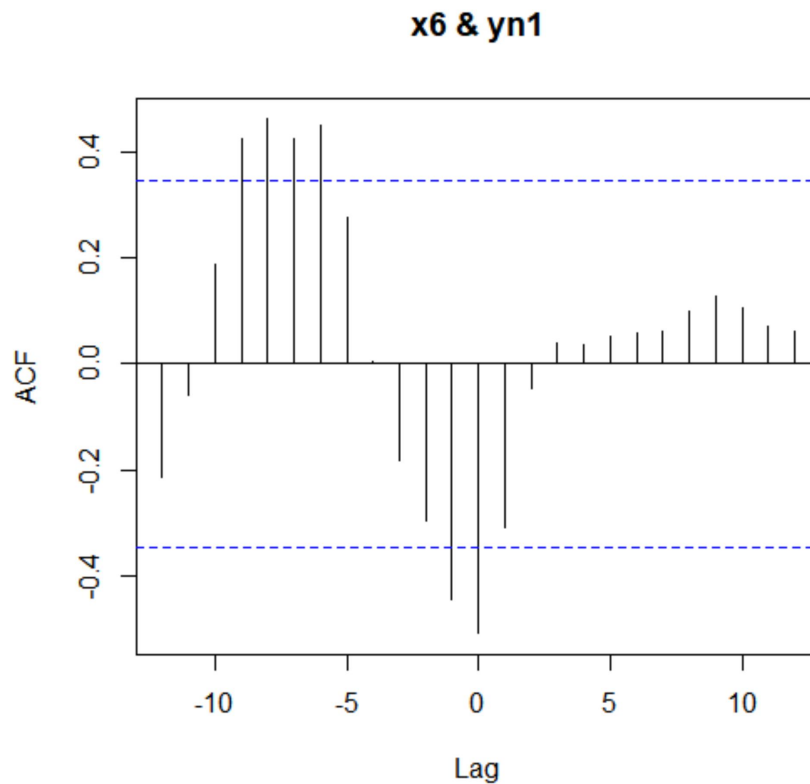
School enrollment, secondary (% gross) VS GDP

Here, if School enrollment, secondary (% gross) increases then GDP also will increase.



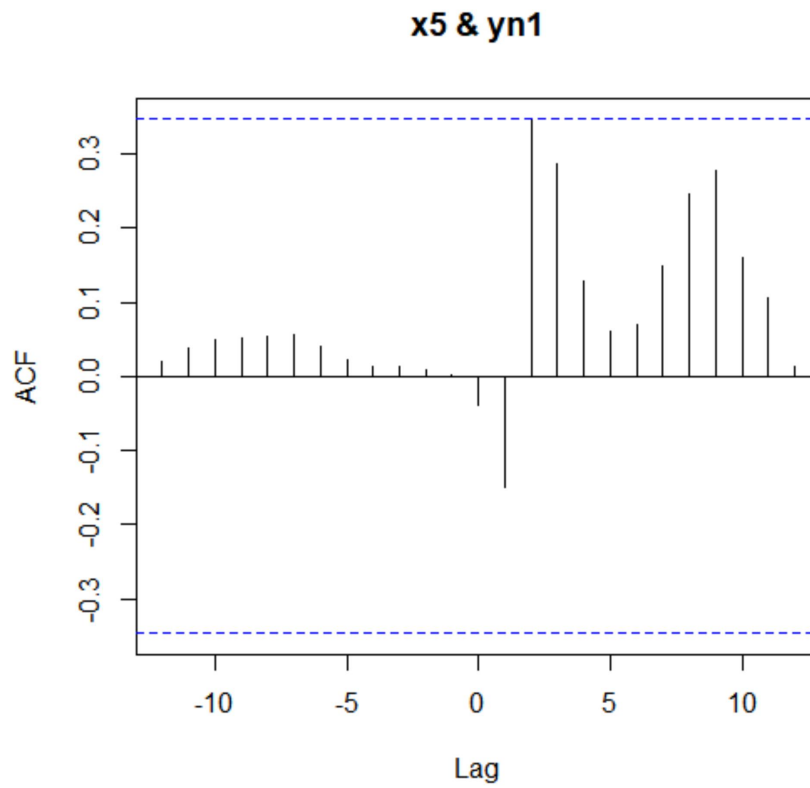
School enrollment, primary (% gross) VS GDP

Here if school enrollment,primary(%gross) was increased 4 years ago,GDP will increasing nowadays.



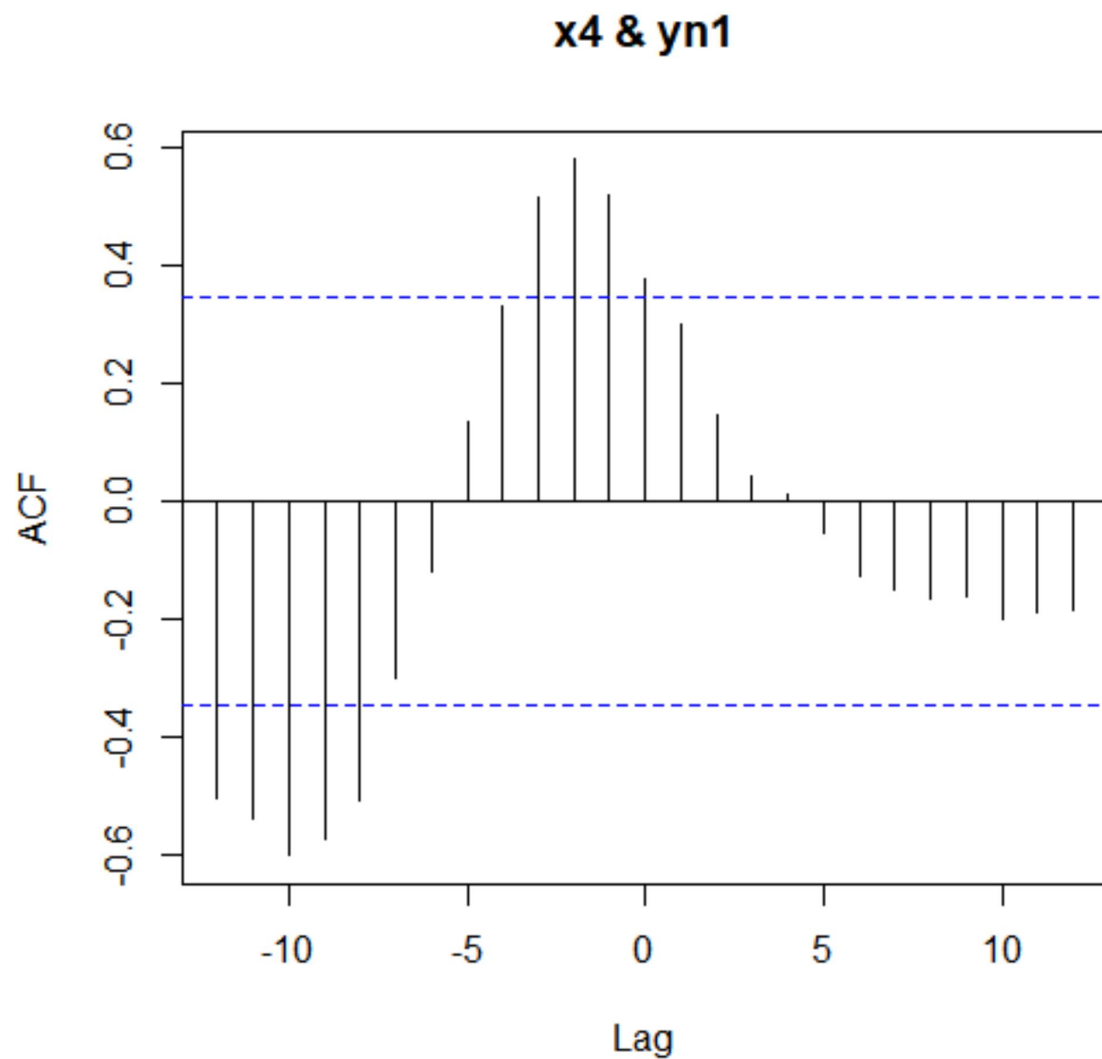
Communications, computer, etc. (% of service exports,
BoP VS GNI

Here if GNI increase atleast 6 years ago
then ,communication,computer,etc(% of service
exports,Bop) will increase in this year.



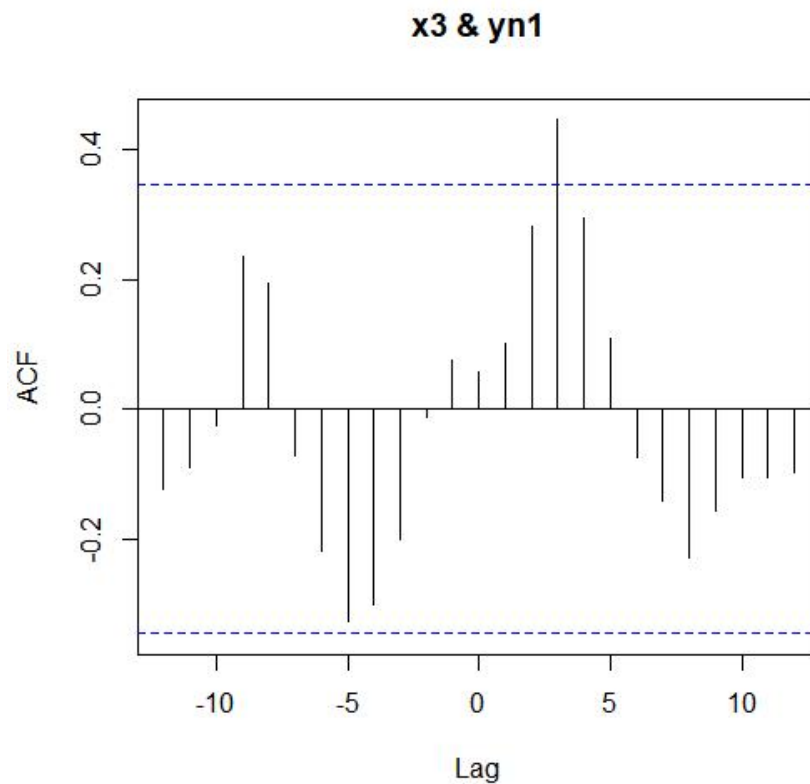
Primary education, pupils VS GNI

There is no relationship between Primary education, pupils VS GNI



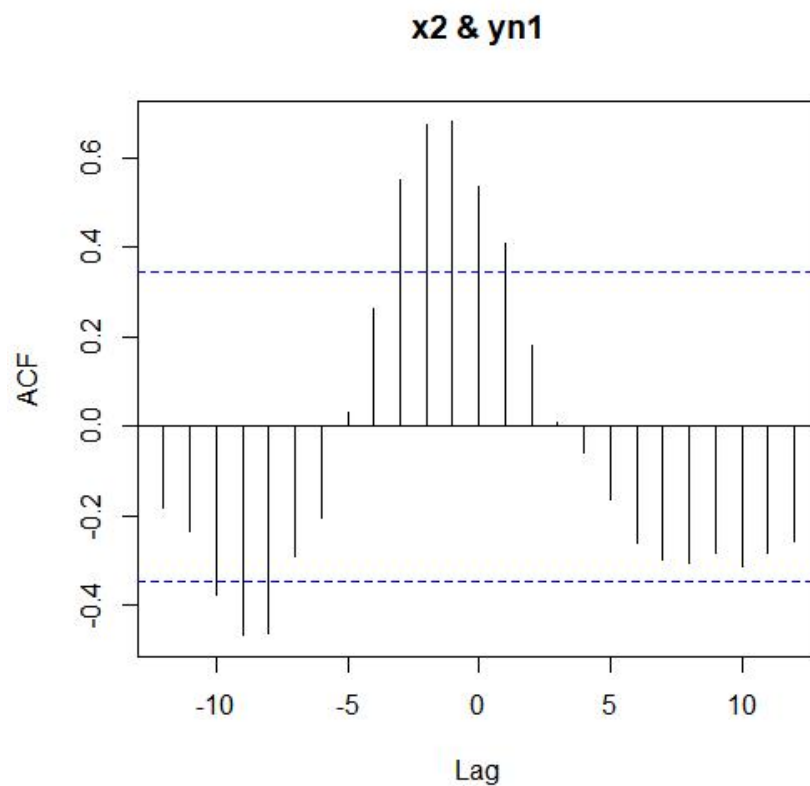
Secondary education, pupils VS GNI

if GNI increases 4 years ago then Secondary education, pupils will increase in this year



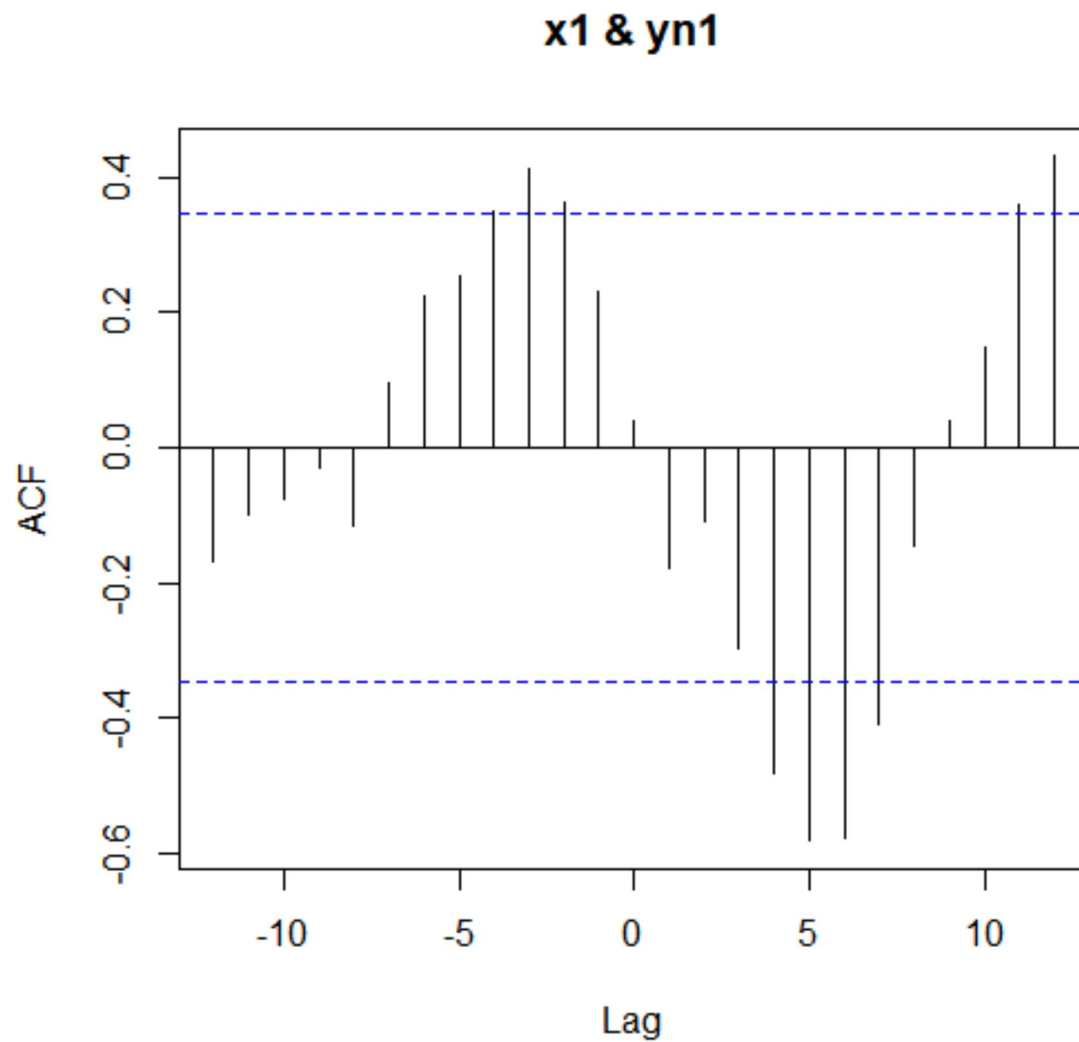
Computer, communications and other services (% of commercial service imports) VS GNI

If Computer, communications and other services (% of commercial service imports) increases in this year then after 5 years GNI will increase.



School enrollment, secondary (% gross) VS GNI

If School enrollment, secondary (% gross) increases in this year, then GNI also will increase in this year.



School enrollment, primary (% gross) VS GNI

If GNI increases 4years ago then School enrollment, primary (% gross) will increase in this year.

From the maximum graph if education increases in this year then economical condition will be effected after atleast 4 years.suppose if education increases in 2023,we will get the result probably after 2027.now finally we can say that if education increases ,then economical condition also will increases.

1. *Fundamental of Statistics, Vol-1, Vol-2, A.M Gun , M.K Gupta , B. Dasgupta.*
2. *Fundamental of Mathematical Statistics, Gupta & Kapoor.*
3. *Probability Distribution Theory and Statistical inference, K C Bhuyan.*

9. APPENDIX:-

```
setwd("C:\\Users\\sudip\\OneDrive\\Desktop\\project")
df <- read.csv("final_r_dataset.csv")
# tial(df)
x12 <- df$GDP_T2
x12 <- x1n[-1]
y62 <- df$exp_com_T2
y62 <- y1[-1]
ccf(x12,y62)
ccf(x1n,y2)
ccf(x1n,y3)
ccf(x1n,y4)
ccf(x1n,y5)
ccf(x1n,y6)
  setwd("C:\\Users\\sudip\\OneDrive\\Desktop\\project")
df <- read.csv("final_r_dataset.csv")
df
head(df)
x1 <- df$GDP_T1

y1 <- df$pri_gro_T1
y2 <- df$exp_com_T1

ccf(x1,y1)
ccf(x1,y2)
```