# Gross capital formation and Gross fixed capital formation and Output of a country

## Time-anually

## For country:-Japan

## By

## Group-11

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# INTRODUCTION

This study deals into the relationship between gross capital formation, gross fixed capital formation, and output in Japan. It employs empirical and analytical methods to analyze investment patterns and their impact on the country's economic performance. By examining quantitative data, researchers investigate the dynamics of capital formation, considering factors such as government policies, economic conditions, and technological advancements. The study also examines the role of different sectors and industries in capital formation and explores the influence of foreign direct investment. Additionally, it explores the link between gross fixed capital formation and output growth, with a focus on the contribution of durable assets to productivity enhancement and economic expansion in Japan. The interdisciplinary nature of this topic draws from fields such as macroeconomics, finance, and industrial organization, combining theoretical frameworks with empirical analysis to provide valuable insights into Japan's investment dynamics, productivity trends, and the drivers of economic growth.

**Gross Domestic Product, sometimes known as GDP,** is a metric used to assess the health and size of an economy. It indicates the total amount of all products produced inside a nation's borders over a given time frame, usually a year.

**Gross capital formation,** formerly known as gross domestic investment, is made up of expenditures for new fixed assets for the economy as well as net changes in inventory levels.Net acquisitions of valuables are also regarded as capital formation in accordance with the 1993 SNA.

**Gross fixed capital formation,** or GFCF for short, refers to investments made in fixed assets by resident producers over a specific time period after subtracting disposals. Additionally, it incorporates specific increases in the value of non-produced assets that producers or institutional entities have realized.

# RESEARCH OBJECTIVE

**Research Objective 1: Gross Capital Formation (GCF)**

To analyze the trends and determinants of gross capital formation in Japan over a specific time period, with the following research objectives:

1.1. Examine the overall pattern and growth rate of gross capital formation in Japan.
1.2. Investigate the factors influencing changes in gross capital formation, such as government policies, investment incentives, and economic conditions.
1.3. Assess the role of foreign direct investment (FDI) in contributing to gross capital formation in Japan.
1.4. Compare and contrast the gross capital formation trends in Japan with other countries or regional economies.
1.5. Analyze the impact of gross capital formation on Japan's overall economic growth and productivity.


**Research Objective 2: Gross Fixed Capital Formation (GFCF)**

To understand the dynamics and significance of gross fixed capital formation in Japan, the research objectives are as follows:

2.1. Examine the trends and fluctuations in gross fixed capital formation, focusing on specific industries or asset types.
2.2. Investigate the factors influencing changes in gross fixed capital formation, such as technological advancements, infrastructure investments, and regulatory frameworks.
2.3. Assess the role of public and private sector investments in driving gross fixed capital formation in Japan.
2.4. Analyze the relationship between gross fixed capital formation and productivity growth in the Japanese economy.
2.5. Explore the impact of gross fixed capital formation on job creation, wages, and income distribution in Japan.

# DATA AND STYLIZED FACTS

```
dataset.describe()
```

|       | YEAR        | GDP          | GCFF         | GCF          |
|-------|-------------|--------------|--------------|--------------|
| count | 52.000000   | 5.200000e+01 | 5.200000e+01 | 5.200000e+01 |
| mean  | 1995.500000 | 3.418384e+12 | 9.538608e+11 | 9.598312e+11 |
| std   | 15.154757   | 1.927769e+12 | 4.866197e+11 | 4.869570e+11 |
| min   | 1970.000000 | 2.126090e+11 | 8.448635e+10 | 9.250181e+10 |
| 25%   | 1982.750000 | 1.237238e+12 | 4.108398e+11 | 4.161172e+11 |
| 50%   | 1995.500000 | 4.409820e+12 | 1.199300e+12 | 1.197795e+12 |
| 75%   | 2008.250000 | 4.947750e+12 | 1.282882e+12 | 1.292320e+12 |
| max   | 2021.000000 | 6.272360e+12 | 1.697270e+12 | 1.715440e+12 |

GCF GROWTH RATE (1971-2021)
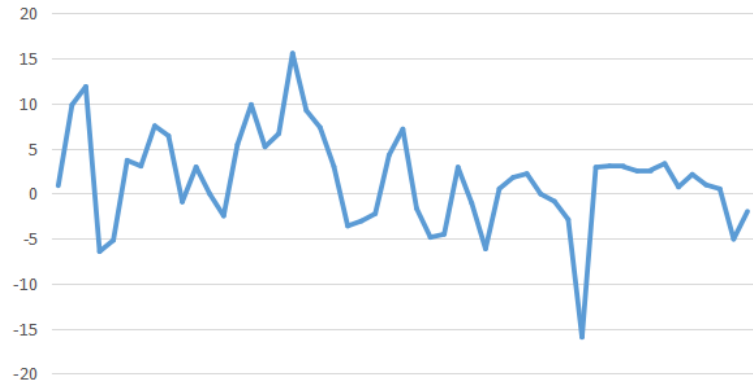
GDP GROWTH RATE
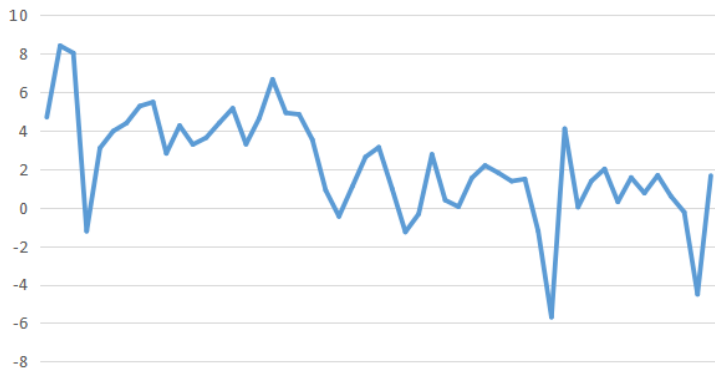
GFCF GROWTH RATE
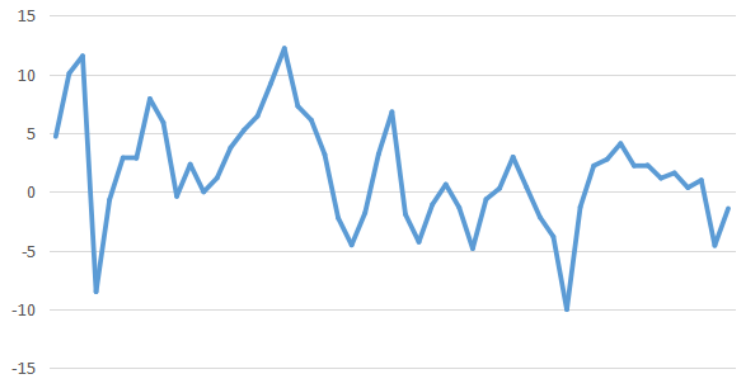
**Post-WWII Recovery**: After World War II, Japan experienced a rapid economic recovery known as the "Japanese post-war economic miracle." From the 1950s to the 1970s, Japan's GDP grew at an average annual rate of around 9%. This period was characterized by high export growth and industrialization for example: In 1950, Japan's GDP was approximately $13.8 billion, and by 1970, it had risen to around $214.3 billion.

**Economic Bubble and Burst**: In the late 1980s, Japan's economy witnessed a massive speculative bubble, primarily driven by real estate and stock market speculation.GDP growth

during the bubble years (1986-1990) peaked at around 6%. The bubble eventually burst in the early 1990s, leading to a prolonged period of economic stagnation and a significant decline in asset prices. This era is often referred to as the **"Lost Decade"** or **"Lost Twenty"**.

**Periods of Recovery**: Throughout the 1990s and early 2000s, Japan made various efforts to stimulate economic growth and recover from the bubble burst. The country implemented monetary policy measures, structural reforms, and stimulus packages to revitalize the economy. These efforts resulted in intermittent periods of recovery, although growth rates remained modest compared to the earlier post-war period. Example: In 2000, Japan's GDP was approximately **$4.887 trillion.**

**Global Financial Crisis**: Japan's economy was not immune to the impact of the global financial crisis that began in 2008. Exports and industrial production suffered due to reduced demand, leading to a sharp contraction in GDP. However, Japan implemented stimulus measures, including monetary easing and fiscal stimulus, to mitigate the effects and support economic recovery.Example: In 2008, Japan's GDP was roughly $5.038 trillion, and by 2009, it had declined to approximately **$4.919 trillion**

**Deflationary Pressures**: Japan has experienced persistent deflationary pressures for much of the past three decades. Deflation, accompanied by low consumer spending and investment, has posed challenges to sustained economic growth.

**Recent Years**: In recent years, Japan's economy has shown some signs of recovery. The government has implemented various policies aimed at boosting growth, including Abenomics, a series of economic reforms initiated by Prime Minister Shinzo Abe. These policies focused on monetary easing, fiscal stimulus, and structural reforms to stimulate growth and combat deflation.Example: In 2019, Japan's GDP was approximately **$5.154 trillion**.

# DATA ANALYSIS

## AUGMENTED DICKEY FULLER TEST

ADF test is used to check the stationarity or non stationarity of data. The null hypothesis is that the data is non stationary .It can be observed in the data that p value is much greater than 0.1 that is 10% significance level hence the null hypothesis remains valid and the data is non stationary.

```
. tsset TIME, yearly
        time variable:  TIME, 1 to 52
               delta:  1 year

. dfuller GDP, regress lags(3)
```

| | Test Statistic | 1% Critical Value | 5% Critical Value | 10% Critical Value |
|---|---|---|---|---|
| Z(t) | -1.608 | -3.594 | -2.936 | -2.602 |

MacKinnon approximate p-value for Z(t) = 0.4794

| D.GDP | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| GDP | | | | | | |
| L1. | -.043696 | .0271671 | -1.61 | 0.115 | -.0984837 | .0110918 |
| LD. | .2812166 | .1437159 | 1.96 | 0.057 | -.0086142 | .5710474 |
| L2D. | -.0858167 | .1495851 | -0.57 | 0.569 | -.3874838 | .2158503 |
| L3D. | -.2493644 | .1439572 | -1.73 | 0.090 | -.5396818 | .040953 |
| _cons | 2.57e+11 | 1.11e+11 | 2.32 | 0.025 | 3.34e+10 | 4.80e+11 |

The data is made stationary by taking the difference of the consecutive years. It can be noted that p value is below 0.1 hence null hypothesis is rejected and our data is now stationary.

```
Augmented Dickey-Fuller test for unit root          Number of obs    =      47
```

| | Test Statistic | 1% Critical Value | Interpolated Dickey-Fuller 5% Critical Value | 10% Critical Value |
|---|---|---|---|---|
| Z(t) | -2.644 | -3.600 | -2.938 | -2.604 |

MacKinnon approximate p-value for Z(t) = 0.0842

# ARIMA TEST

ARIMA stands for auto regressive integrated moving average . The data after being stationary is regressed. GDP is being considered as a dependent variable while GCF and GCFC are considered independent variables in different regressions.

```
Sample:  1 - 51                                Number of obs     =        51
                                               Wald chi2(4)      =   1640.41
Log likelihood = -78.10564                     Prob > chi2       =    0.0000
```

| gdp | Coef. | OPG Std. Err. | z | P>\|z\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| **gdp** | | | | | | |
| gcf | .3434242 | .0208058 | 16.51 | 0.000 | .3026455 | .3842029 |
| _cons | 1.66436 | 1.530242 | 1.09 | 0.277 | -1.334859 | 4.663579 |
| **ARMA** | | | | | | |
| ar | | | | | | |
| L1. | .9820509 | .0361597 | 27.16 | 0.000 | .9111791 | 1.052923 |
| ma | | | | | | |
| L1. | -1.13349 | .1367055 | -8.29 | 0.000 | -1.401428 | -.8655521 |
| L2. | .4033453 | .1456971 | 2.77 | 0.006 | .1177843 | .6889063 |
| /sigma | 1.095564 | .1117397 | 9.80 | 0.000 | .8765582 | 1.31457 |

*REGRESSION OF GCF WITH GDP*

```
Sample:  1 - 51                                Number of obs     =        51
                                               Wald chi2(4)      =   1162.10
Log likelihood = -81.56014                     Prob > chi2       =    0.0000
```

| gdp | Coef. | OPG Std. Err. | z | P>\|z\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| **gdp** | | | | | | |
| gfcf | .4104246 | .0341018 | 12.04 | 0.000 | .3435863 | .477263 |
| _cons | 1.56945 | 1.584544 | 0.99 | 0.322 | -1.536199 | 4.675099 |
| **ARMA** | | | | | | |
| ar | | | | | | |
| L1. | .9784998 | .0549242 | 17.82 | 0.000 | .8708503 | 1.086149 |
| ma | | | | | | |
| L1. | -1.026931 | .1273145 | -8.07 | 0.000 | -1.276463 | -.7773996 |
| L2. | .2583789 | .1658742 | 1.56 | 0.119 | -.0667286 | .5834864 |
| /sigma | 1.179428 | .1105017 | 10.67 | 0.000 | .9628483 | 1.396007 |

*REGRESSION OF GFCF WITH GDP*

# CONCLUSION

Over the last 50 years, Japan's macroeconomy has undergone significant transformations. The country experienced a period of rapid economic growth during the 1960s and 1970s, known as the "Japanese economic miracle." During this time, Japan's GDP grew at an astonishing pace, fueled by its manufacturing and export sectors. However, since the early 1990s, Japan has faced various challenges, including economic stagnation, deflation, and an aging population. These factors have impacted the country's macroeconomy, leading to a more subdued growth trajectory. Despite these challenges, Japan has remained one of the world's largest economies, driven by innovation, technological advancements, and a commitment to education and research. The Japanese government has implemented several policy measures to stimulate growth, but sustained economic revitalization continues to be a priority.

As we can observe in above test performed, the arima regression coefficient between the gdp and gcf we got was **0.3434242** and the arima regression coefficient between the gdp and gfcf was **0.4104246** when we perform arima regression test in given data set using stata software.

Thus, here we can conclude that there is a positive relation between GFCF, GDP and GCF, GDP hence,if any prior variable increases then the latter will also increase which supports the fact that increase in investment will increase the aggregate deemed which will shift the equilibrium output level.

# REFERENCES

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