



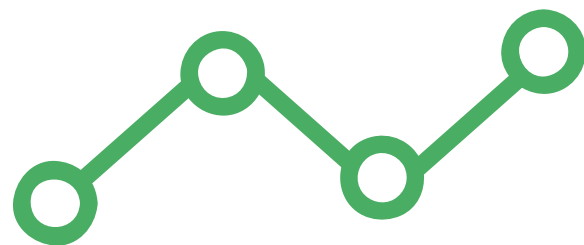
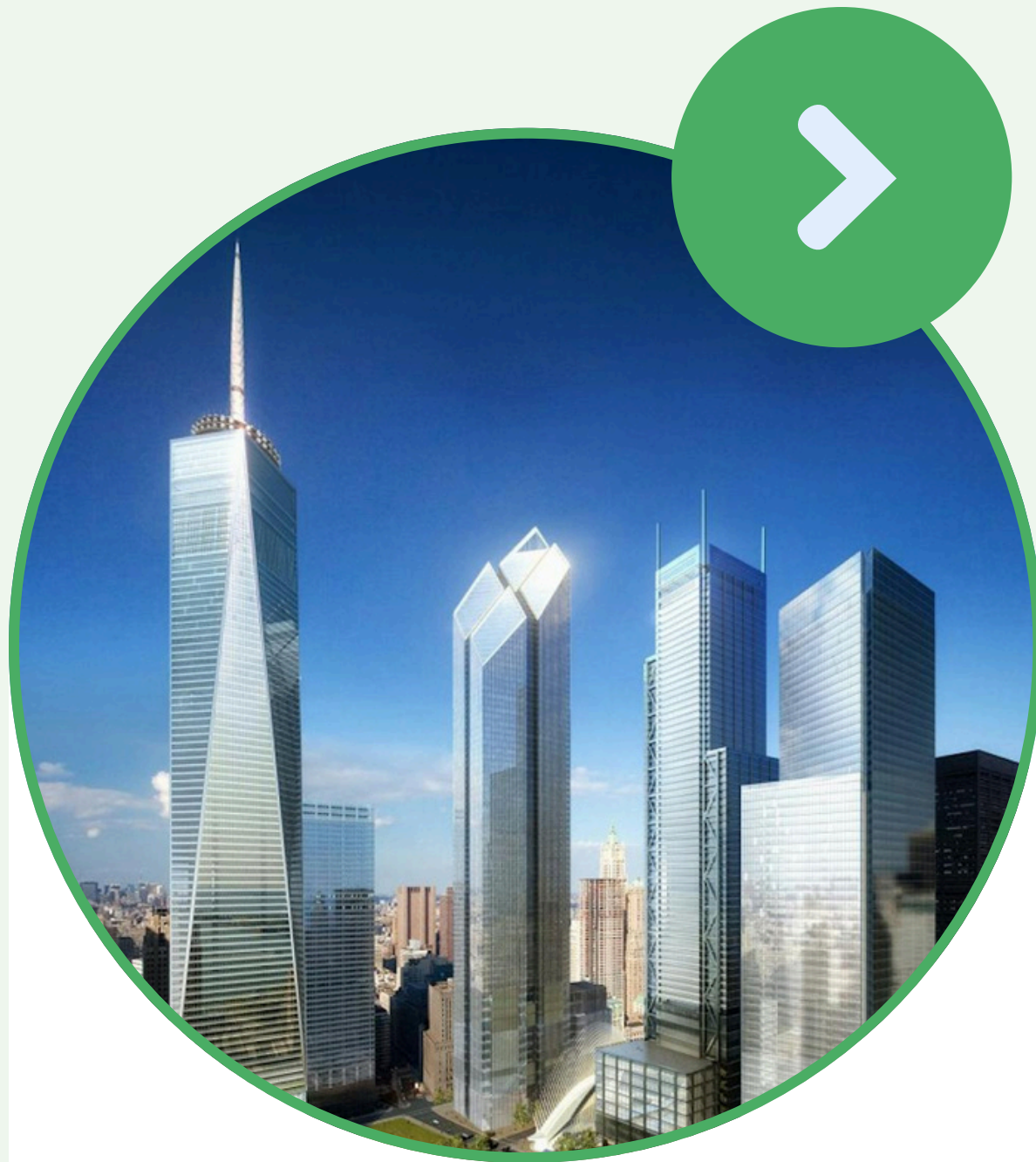
Global Trends : [www.rug.nl](http://www.rug.nl)

# PENN WORLD TABLE

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# INTRODUCTION

This project analyzes **global economic growth patterns** from **2000 to 2018**, utilizing the Penn World Table (PWT) dataset. The PWT offers comprehensive data on income, output, inputs, and productivity across **183 countries**.

## OBJECTIVES

- Analyze key economic indicators to understand global growth trends.
- Identify temporary patterns and regional differences in economic development.
- Visualize findings to effectively communicate insights derived from the data.



## DATASET STRENGTHS



- Provides extensive data on income, output, input, and productivity for 183 countries, facilitating broad economic analyses.
- Utilizes consistent methodologies, allowing for reliable cross-country comparisons.
- Undergoes regular revisions to incorporate new data and methodological improvements, thereby improving its accuracy and relevance.

## DATASET ISSUES



- Certain variables, like rgdpe and emp, contain missing entries, which can hinder comprehensive analyses.
- Some columns, like year, were initially stored as strings, requiring type conversion for temporal analyses.
- For outliers, extreme values in variables like GDP per capita can skew results and interpretations.

## DATA CLEANING & FIXES



- **Handling Missing Values:** Rows with critical missing data were removed to ensure analytical integrity.
- **Outlier Detection:** Implemented statistical methods to identify and assess the impact of outliers.
- **Standardization:** Use scaling techniques to standardize variables to ensure comparability across different sizes.

# DESCRIPTIVE STATISTICS

## Dataset Overview

- Source: Penn World Table (PWT) Version 10.0
- Scope: Data spanning from 2000 to 2018
- Coverage: 183 countries

## Data Filtering

- Selected key variables: country, year, rgdpo (real GDP output), and pop (population).
- Removed missing values and rows with zero population.

## Descriptive Statistics of GDP per Capita

- Count: 2,987 data points
- Mean: 17,709
- Std. Dev: 20,757 (indicates high dispersion)
- Min - Max: 376 to 232,053
- Skewed distribution: A few countries have extremely high GDP per capita.



```
# Calculate gross domestic product per capita
df_selected = df_selected[df_selected["pop"] > 0] # Remove rows where population is zero
df_selected["gdp_per_capita"] = df_selected["rgdpo"] / df_selected["pop"] # Create new variable
print(df_selected[["gdp_per_capita"]].describe())
```

	gdp_per_capita
count	2987.000000
mean	17709.493130
std	20757.080828
min	376.275862
25%	3480.750000
50%	9860.428571
75%	25303.906699
max	232053.000000

```
# Calculate mean, median, mode, and quantiles

# Overall economic performance and standard of living of a country or region
mean_gdp = df_selected["gdp_per_capita"].mean()
median_gdp = df_selected["gdp_per_capita"].median()
# The most common economic condition among countries (detect clusters later)
mode_gdp = df_selected["gdp_per_capita"].mode().values
# Divide the GDP per capita data into intervals (determine income levels later)
quantiles_gdp = df_selected["gdp_per_capita"].quantile([0.25, 0.5, 0.75])
```

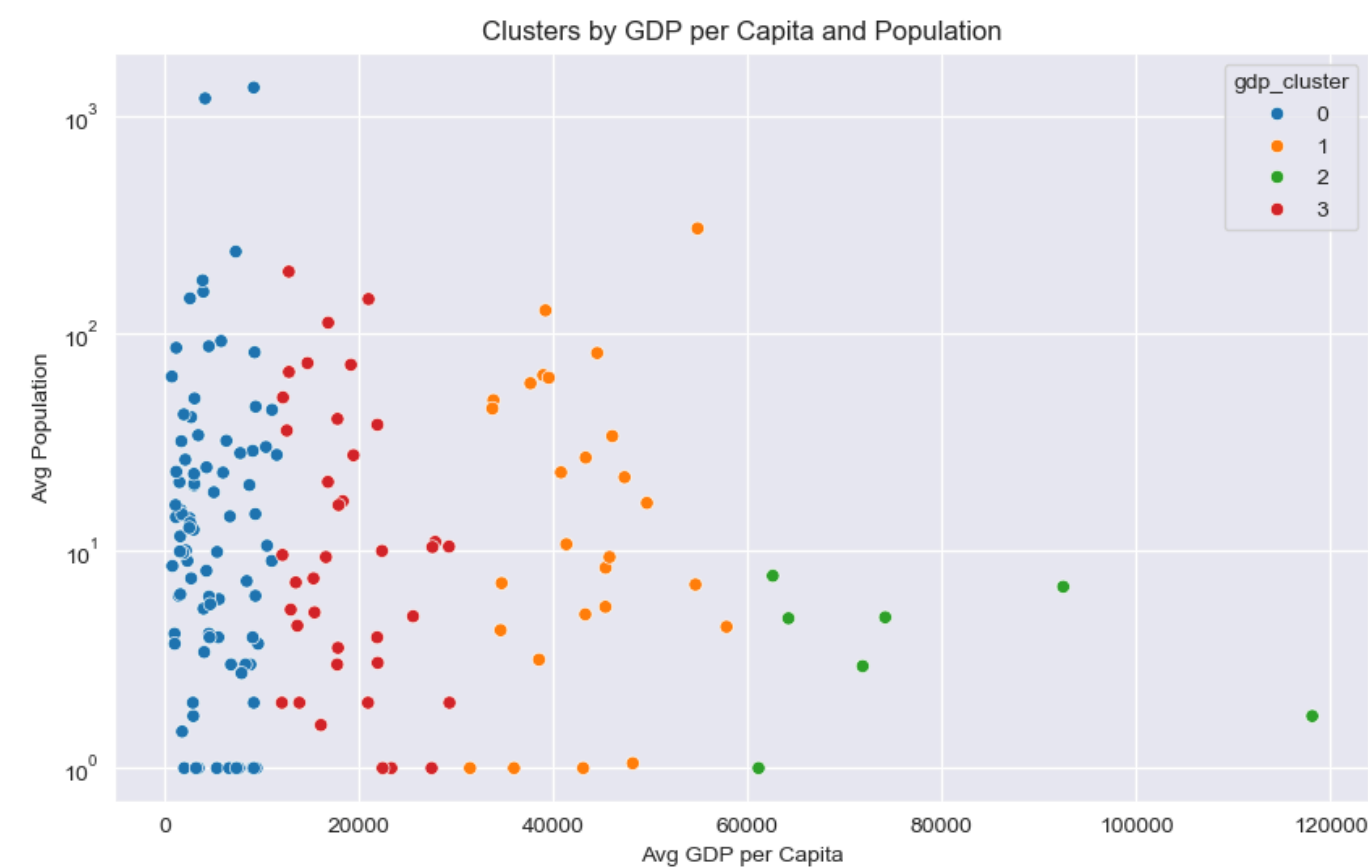
```
# GDP statistics
print("\nDescriptive Statistics for GDP per Capita (2000-2018):")
print(f"Mean GDP per Capita: {mean_gdp}")
print(f"Median GDP per Capita: {median_gdp}")
print(f"Mode GDP per Capita: {mode_gdp}")
print("Quantiles of GDP per Capita:")
print(quantiles_gdp)
```

```
Descriptive Statistics for GDP per Capita (2000-2018):
Mean GDP per Capita: 17709.49312963972
Median GDP per Capita: 9860.42857142857
Mode GDP per Capita: [2213. 6102.]
Quantiles of GDP per Capita:
0.25    3480.750000
0.50    9860.428571
0.75   25303.906699
Name: gdp_per_capita, dtype: float64
```



# GEOGRAPHIC INSIGHTSVE STATISTICS

## Clusters by GDP per Capita and Population



### Clusters Overview:

- Cluster 0 (88 countries)
- Cluster 1 (27 countries)
- Cluster 2 (7 countries) - **With Outliers**
- Cluster 3 (38 countries)

### Clusters Analysis:

The data identifies clusters of countries based on their average GDP per capita and population, categorized into four groups (0, 1, 2, and 3), with varying numbers of countries in each cluster.

## Check Data Distribution Using Shapiro-Wilk Test

Distribution Check:  
{'avg\_gdp\_per\_capita': 'Not Normal', 'gdp\_cluster': 'Not Normal'}  
**Mann-Whitney U Test:** U-statistic: 54.0000 P-value: 0.000000

### Factors that could be affecting results:

- The population in developing countries is very high.
- Developing countries have lower production and manufacturing.
- There is poor management of resources in developing countries.
- Developed countries are more industrialized.

## Mean GDP per Capita by Country (2000-2018)

If the countries have high mean = higher standard of living

Mean GDP per Capita by Country (2000-2018):

country	
Egypt	9257.437132
Germany	44525.402015
India	4158.292134
United States	54865.084563

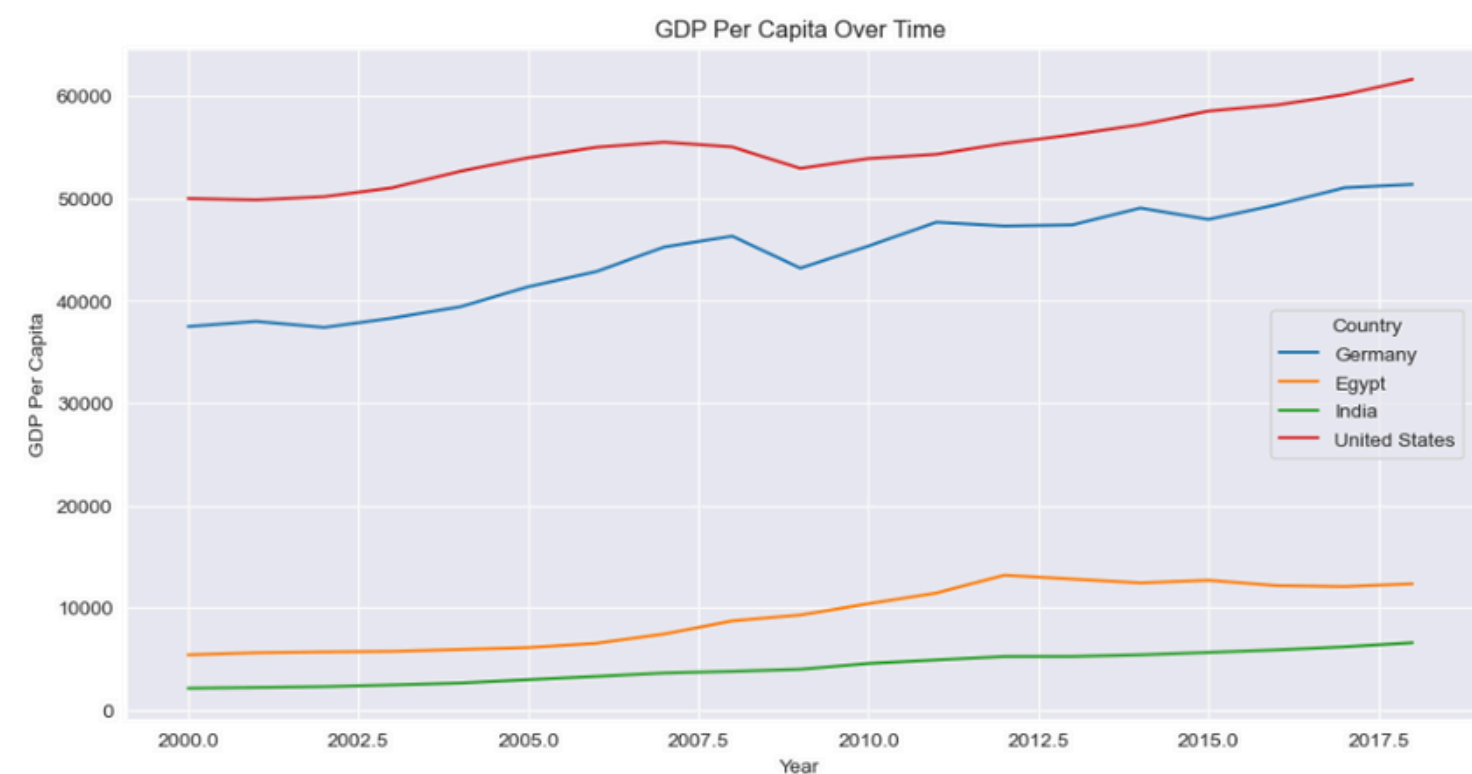
Name: gdp\_per\_capita, dtype: float64

### GDP Insights:

A comparison of mean GDP per capita (2000-2018) for Egypt, Germany, India, and the United States highlights significant disparities, reflecting different standards of living.

# GEOGRAPHIC INSIGHTSVE STATISTICS

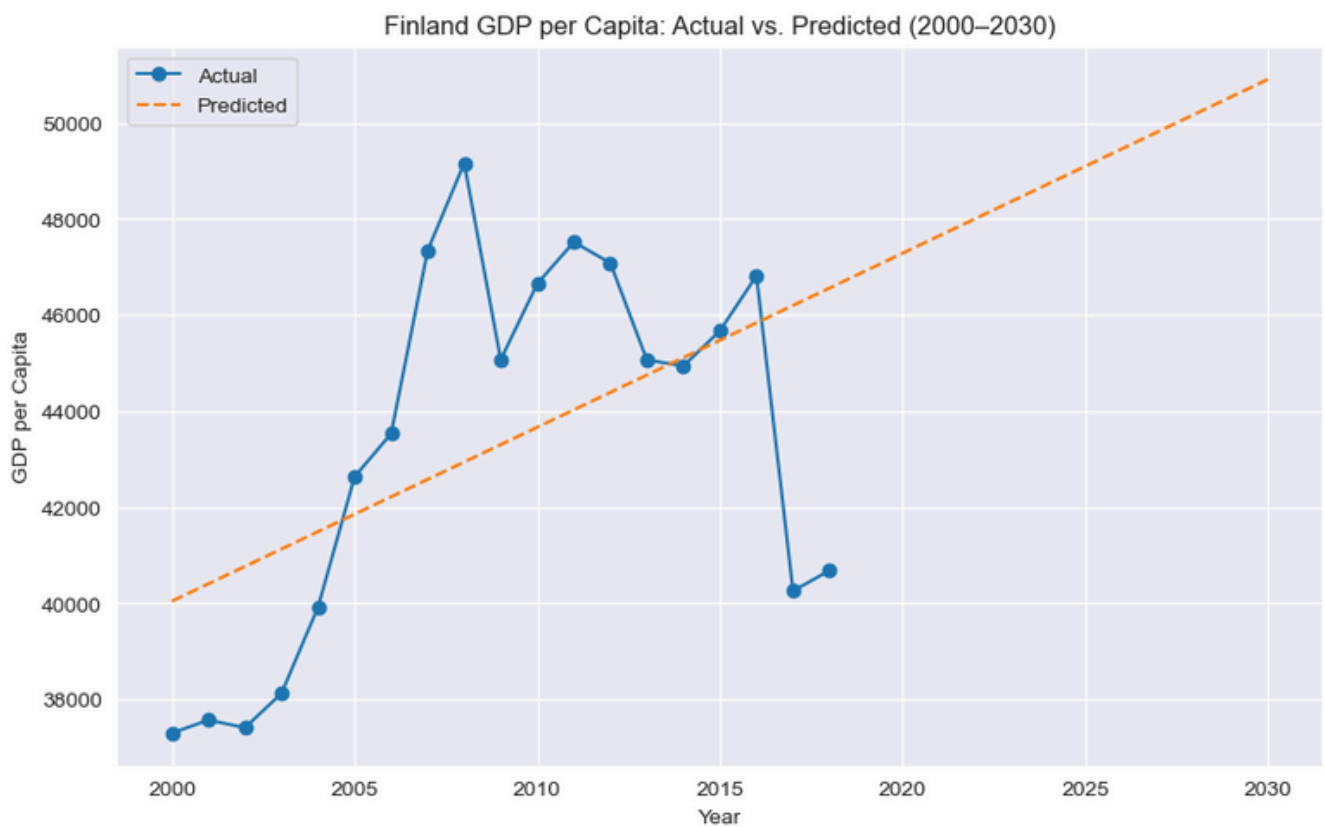
GDP per Capita Over Time



Top performing countries over the years:

	country	avg_gdp_per_capita	gdp_cluster
117	Qatar	118147.359649	2
150	United Arab Emirates	92509.161487	2
108	Norway	74182.536842	2
78	Kuwait	71859.482456	2
127	Singapore	64219.769298	2
137	Switzerland	62605.226295	2
30	China, Macao SAR	61139.166667	2
70	Ireland	57841.960526	1
152	United States	54865.084563	1
29	China, Hong Kong SAR	54644.285714	1

Finland GDP per Capita: Actual vs. Predicted (2000-2030)



## GDP Trends:

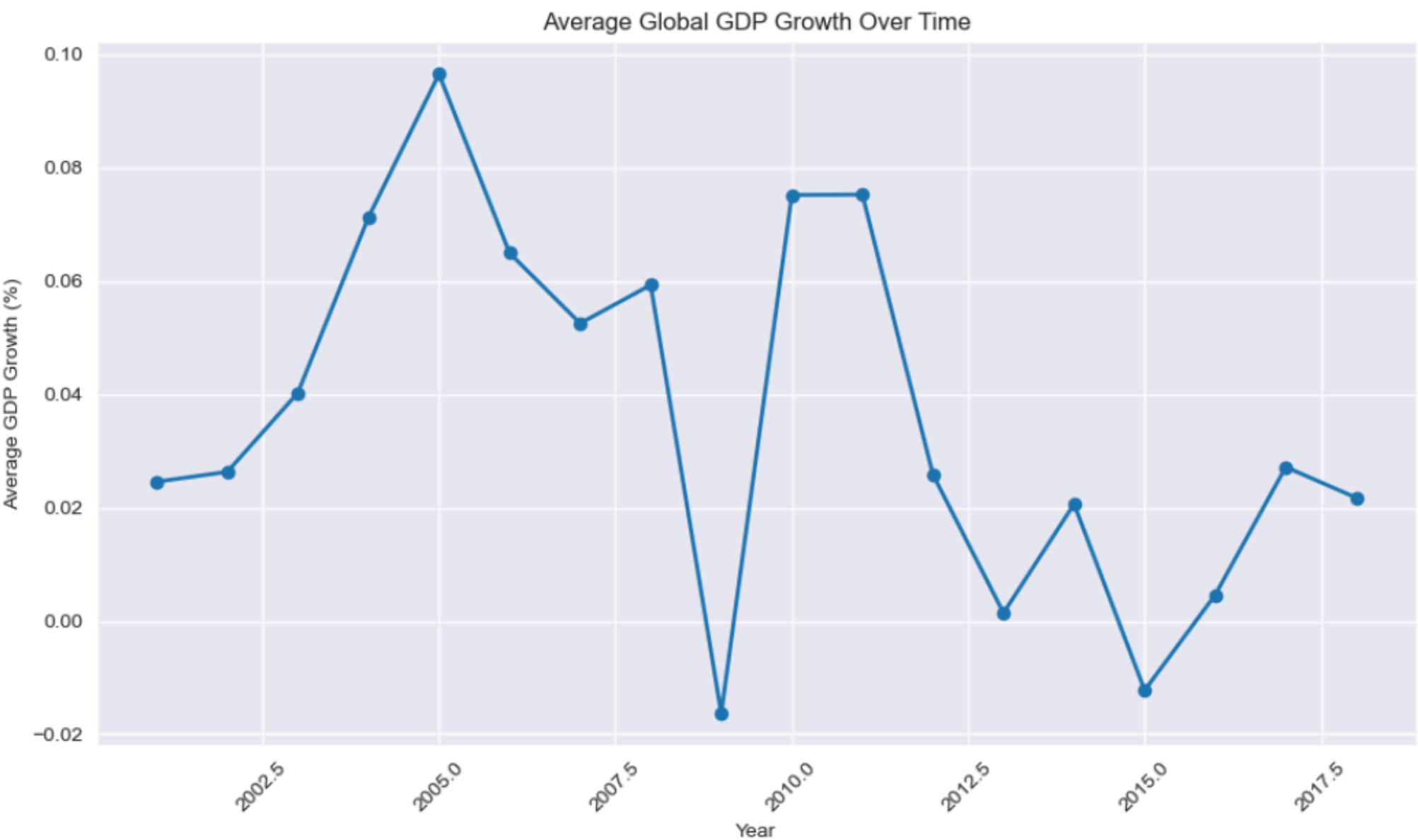
- The United States consistently has the highest GDP per capita compared to Egypt, India, and Germany between 2000 and 2017.
- Finland's GDP per capita shows actual fluctuations up to 2015 but is predicted to steadily increase through 2030.

## Top Performing Countries:

- Qatar, Norway, and Switzerland are among the countries highlighted in GDP Cluster 2, renowned for their exceptional economic performance and high living standards.

# TIME-BASED ANALYSIS

Average Global GDP Growth Over Time



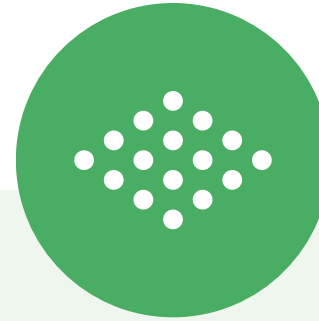
```
year
2000      NaN
2001    0.024582
2002    0.026327
2003    0.040269
2004    0.071240
Name: delta, dtype: float64
```

**GDP Growth Over Time:**

- Global average GDP growth has fluctuated significantly, with peaks such as 2005 of almost 10% growth driven by private consumption and investment
- The Great Recession of 2008-2009 saw a 2% decline in the economy due to businesses and homeowners prioritizing debt repayment over borrowing and spending.

**Key Drivers:**

- Economic booms were influenced by investments and consumption, while 2008 declines were shaped by systemic financial challenges, including banks' inability to provide sufficient funds.



## CONCLUSION

**The Penn World Table dataset revealed significant disparities in global economic trends, with a right-skewed distribution. Time-based analysis revealed fluctuations in GDP growth, reflecting economic events.**



**The project highlights the unevenness of global economic development and emphasizes the need for continuous data monitoring for informed policy and investment decisions.**



**THANK YOU FOR YOUR ATTENTION!**

