

A TALE OF THREE ECONOMIES: INDIA, GERMANY & WORLD (2002–2023)

GDP Trends from 2002 to 2023

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Platform: Google Colab | Data Source: Our World in Data

Why GDP?

We live in a world of constant economic fluctuation, and GDP is one of the clearest indicators of a nation's economic health.

But how do countries like **India** and **Germany**—with vastly different histories, structures, and policies—compare over time?

We set out to find this out using open data and Python-based analysis.

The Cast – Our Three Subjects

We selected:

- **India:** A developing, fast-growing economy
- **Germany:** A mature, export-driven European powerhouse
- **World:** To offer context and macroeconomic backdrop

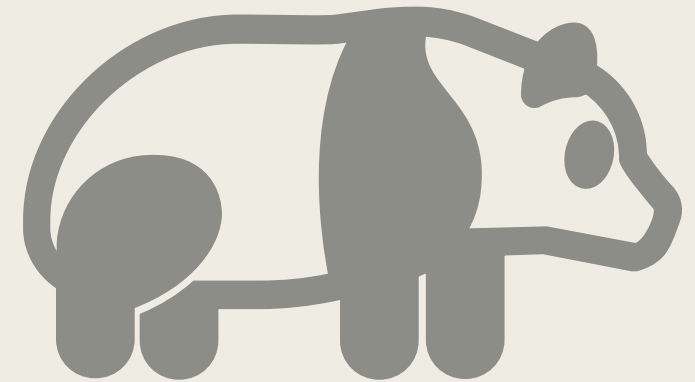
We examined GDP data from **2002 to 2023**, standardized to **constant 2015 USD** to remove inflation noise.

Behind the Scenes – Data Processing

We sourced our data from Our World in Data's World Bank dataset.

Then, using Python (Pandas + Seaborn), we:

- Cleaned and filtered the data for our countries and years
- Converted GDP values into **scaled units** (Millions or Trillions) to aid visualization
- Prepared separate datasets for country-level vs. global comparison

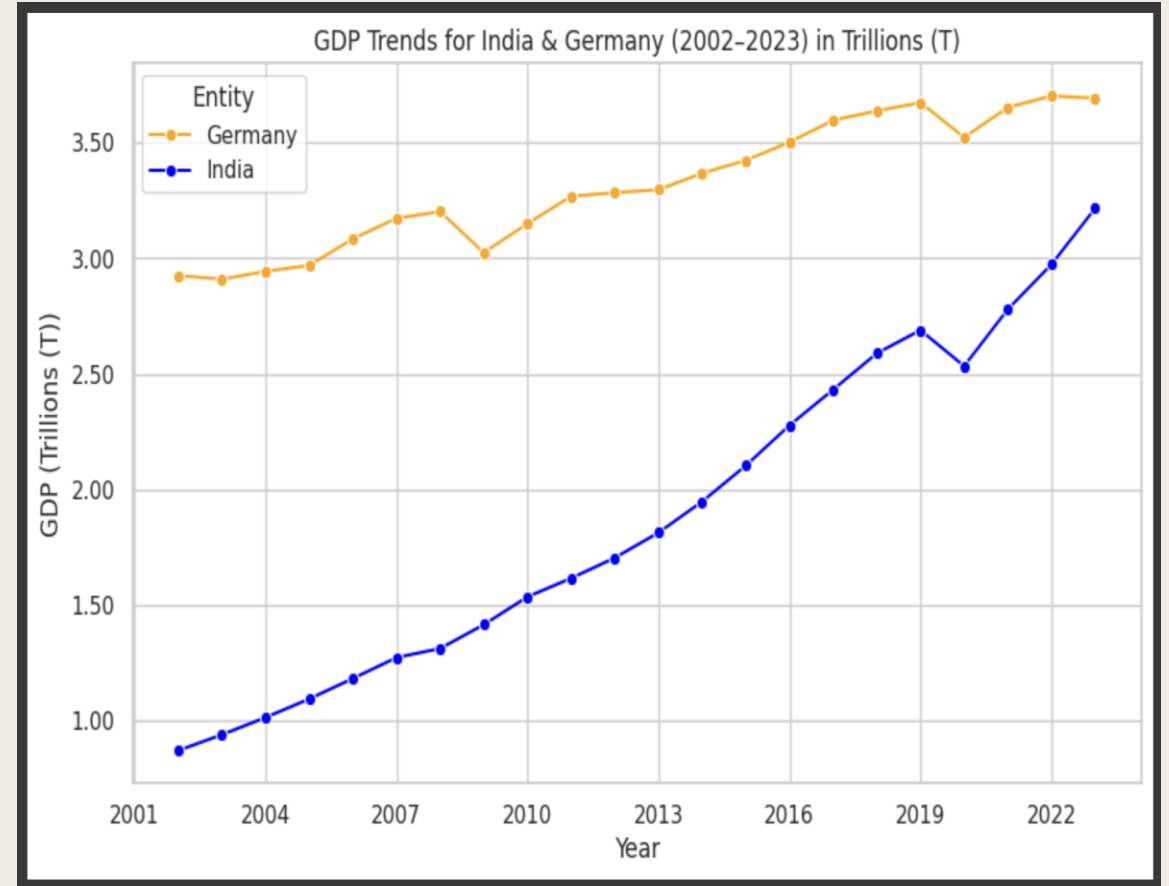


India vs Germany: GDP Trends

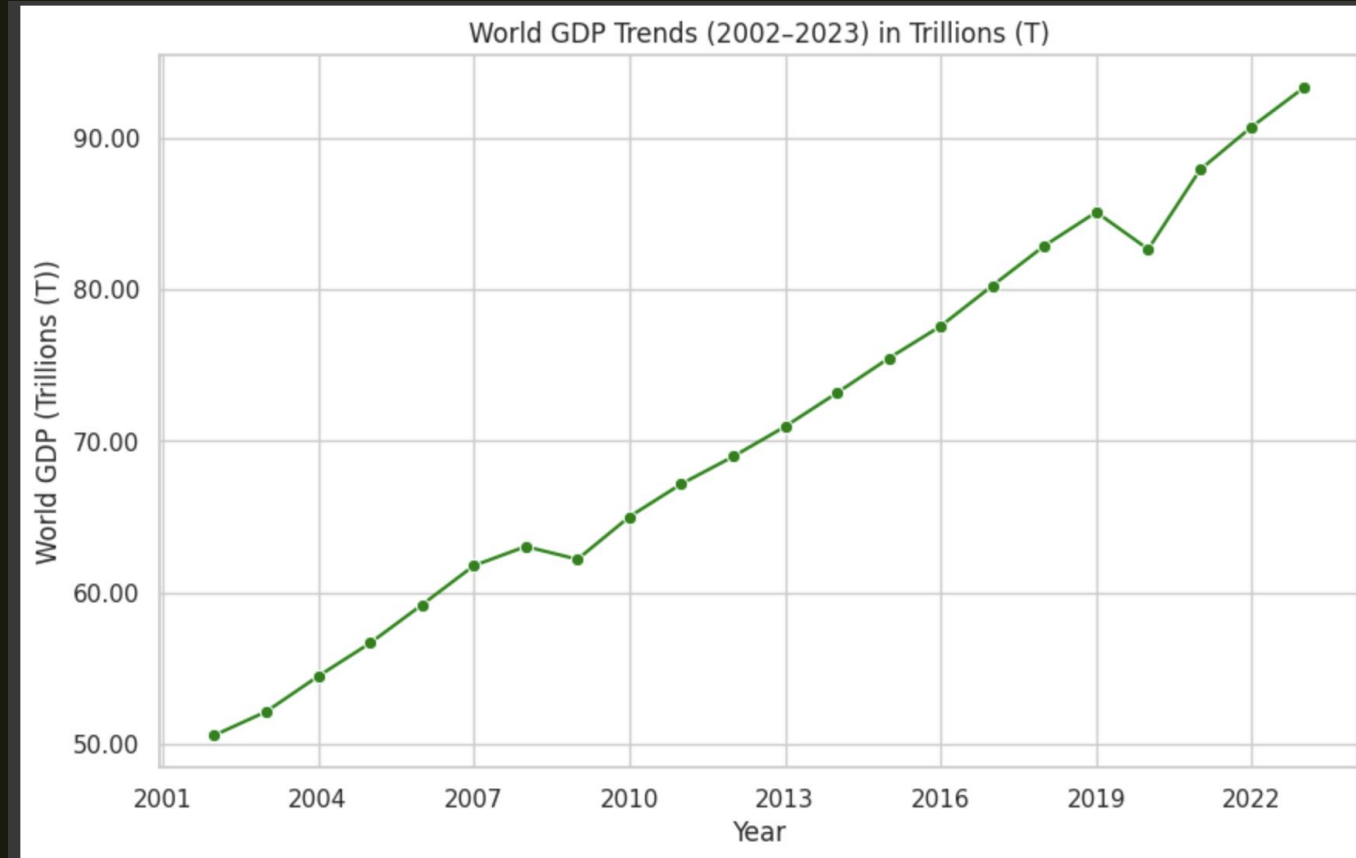
- **Germany** consistently ahead in absolute GDP terms.
- **India**, however, shows a **steeper and uninterrupted growth curve**, especially post-2005.

Key Observations:

- Germany dips slightly during the **2008 global financial crisis** and **2020 COVID shock**.
- India continues to rise, driven by domestic consumption, reforms, and demographics.



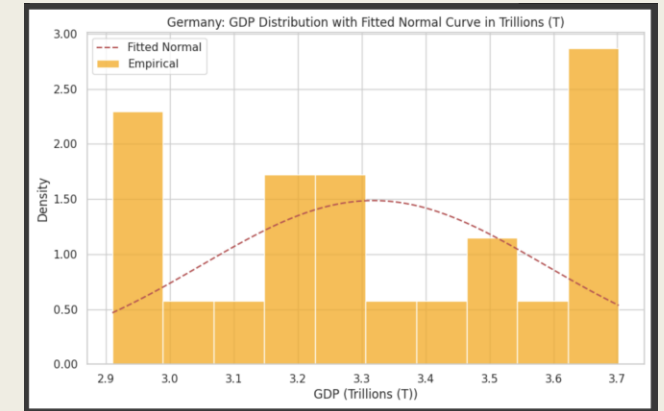
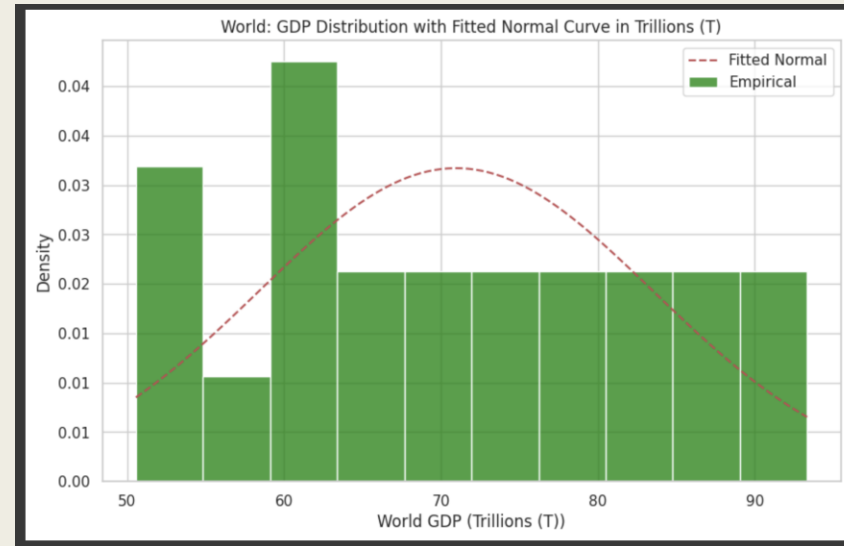
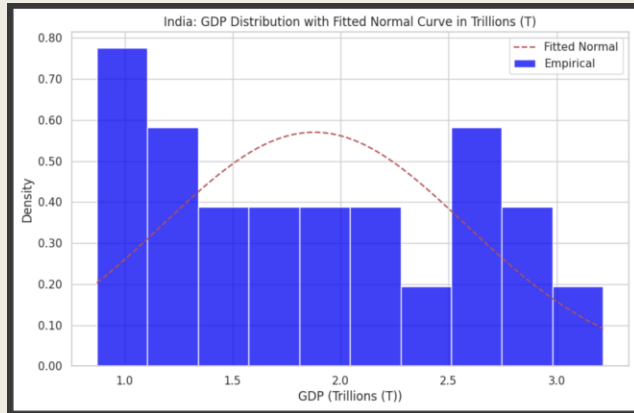
Enter the World



To understand the context better, we looked at **global GDP**.

- Notice how **world GDP growth mirrors** large-scale events—2008 crash, pandemic downturn, and recovery post-2021.
- Comparing this with India and Germany reveals how national economies respond differently to global shocks.

Insight: India appears **less synchronized** with global dips, possibly due to domestic insulation and demographic momentum.



The Transformation – Scaling GDP

To fairly compare the countries despite different magnitudes, we scaled GDP:

- India's GDP is in **trillions (T)** USD.
- Germany, though ahead, shows **slower compound growth** in comparison.

This transformation highlights **growth rate trends**, not just scale.

What the Data Reveals

Let's reflect:

- India is rapidly catching up—its GDP more than **tripled** over two decades.
- Germany remains economically robust but is reaching a plateau.
- Both economies are **deeply influenced by global events**, but react differently.

Question to ponder: Will India surpass Germany in the next decade?

Descriptive Statistics: What's in the Numbers?

We calculated descriptive statistics for GDP (2002–2023) for:

- India
- Germany
- World

Key Metrics Included:

- Mean, Standard Deviation
- Min/Max values
- 25%, 50%, and 75% percentiles

These help us understand the **spread and central tendency** of economic output.

Insight:

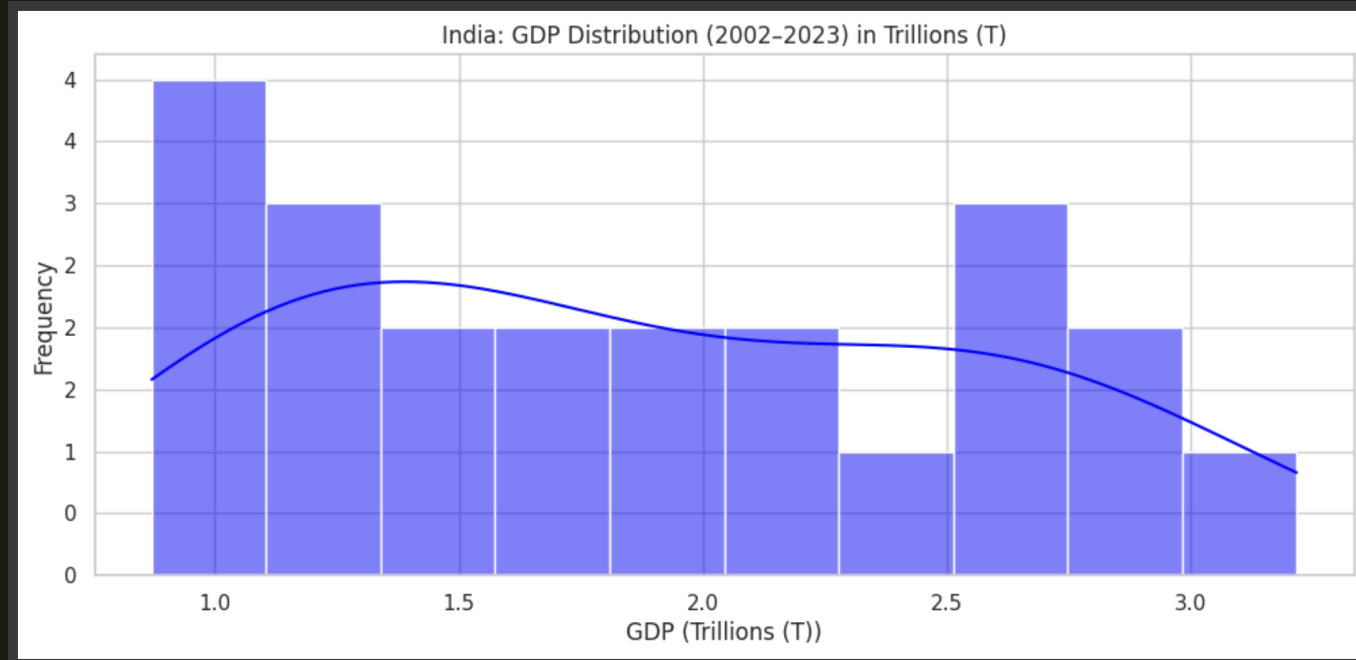
- India shows **lower average GDP** but **rapid growth trajectory**.
- Germany has **higher GDP mean** but also **larger deviations** due to global exposure.
- World GDP aggregates show **global economic shocks** clearly.

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Descriptive Statistics for India GDP:
count    22.00
mean      1.88
std       0.72
min       0.87
25%       1.28
50%       1.76
75%       2.51
max       3.22
Name: GDP_scaled, dtype: object

Descriptive Statistics for Germany GDP:
count    22.00
mean      3.32
std       0.27
min       2.91
25%       3.10
50%       3.29
75%       3.58
max       3.70
Name: GDP_scaled, dtype: object

Descriptive Statistics for World GDP:
count    22.00
mean     70.97
std      12.88
min      50.57
25%      61.87
50%      69.97
75%      82.08
max      93.35
Name: GDP_scaled, dtype: object
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Histogram: India's Economic Footprint



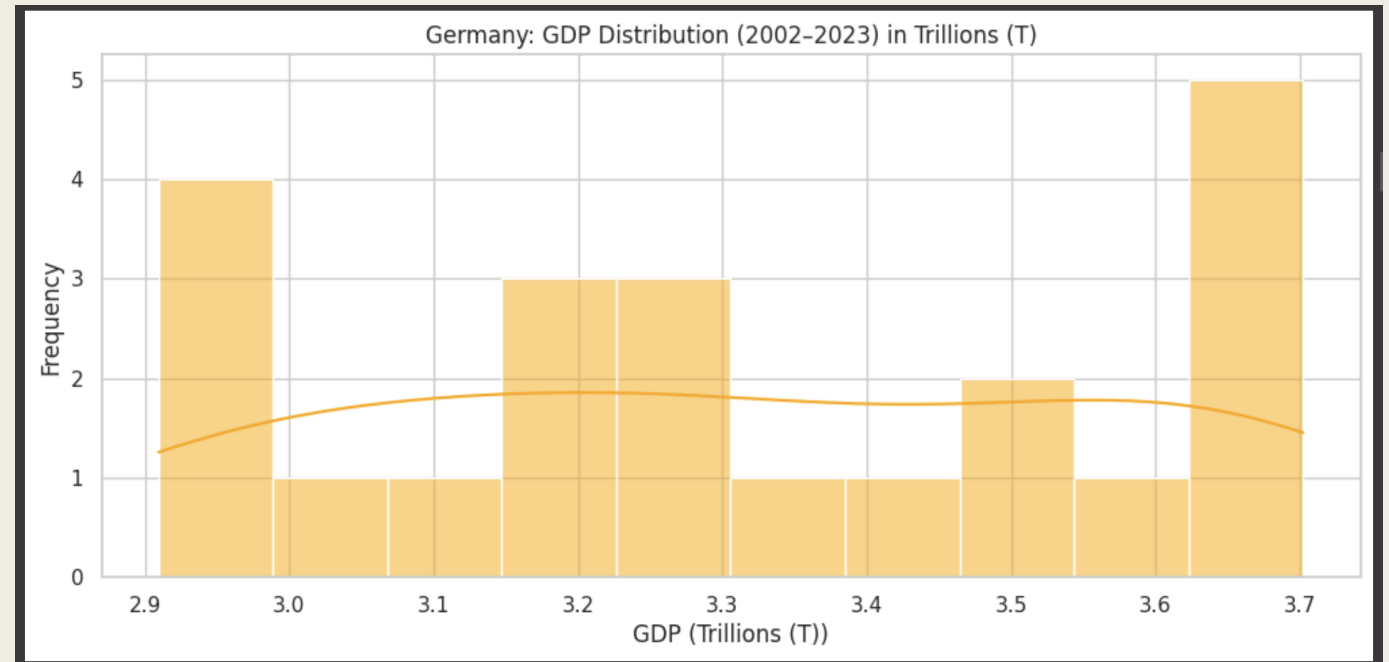
The histogram for India's GDP:

- Skews **positively (right-skewed)** indicating rapid growth over time.
- A **tight cluster** at the lower end confirms initial low GDP values in early 2000s.
- The **KDE line** suggests it's not perfectly normal—indicative of a **growth-phase economy**.

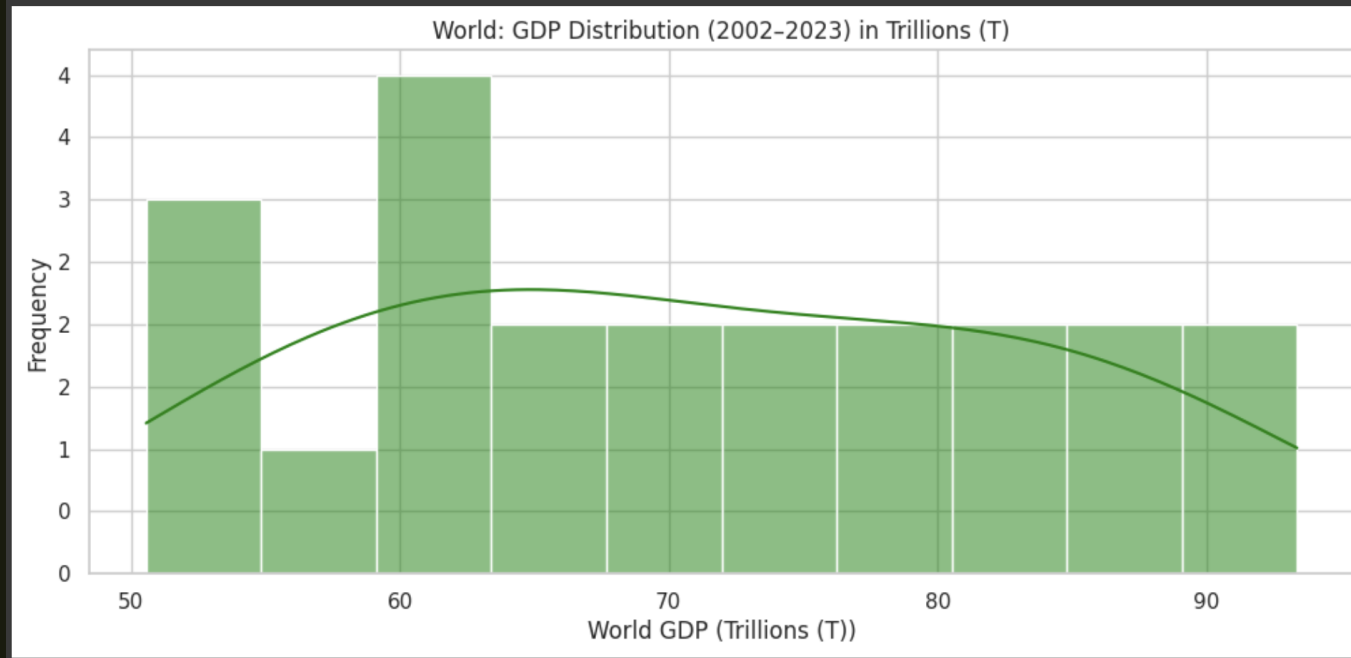
Histogram: Germany's Economic Stability

Germany's histogram:

- Appears more **normally distributed**.
- The GDP values are centered and fairly symmetrical.
- Shows **less volatility** compared to India—indicating **economic maturity**.



World GDP Histogram

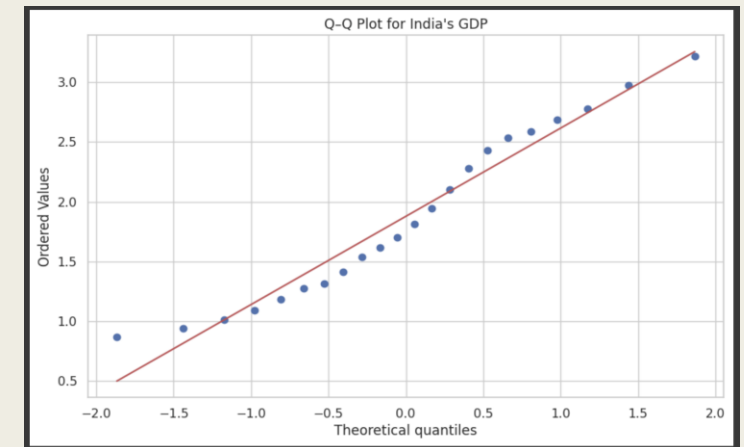
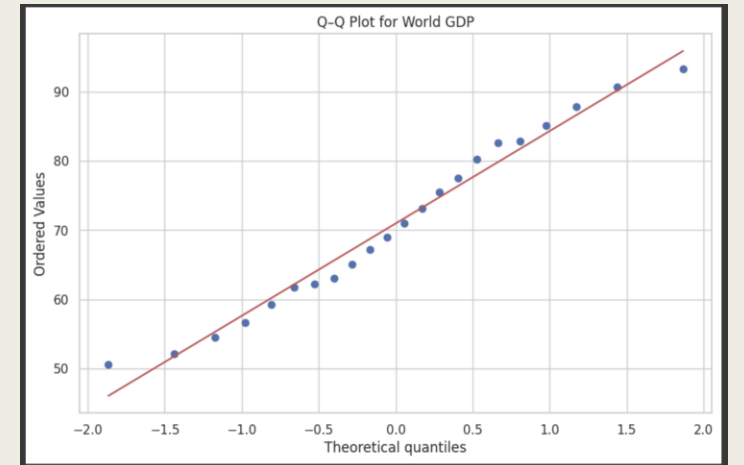
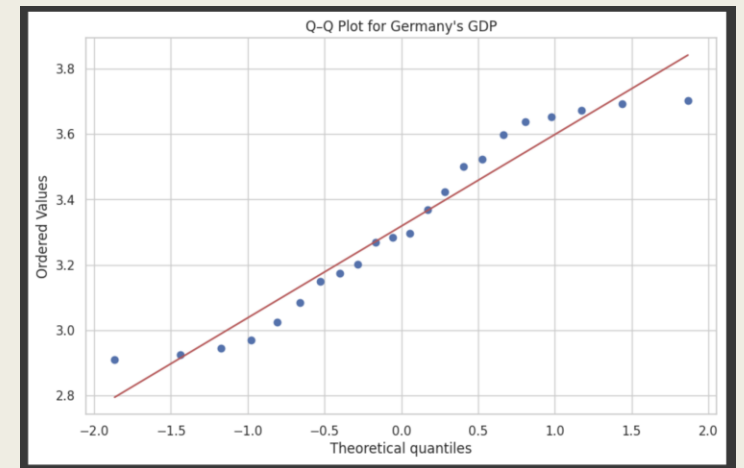


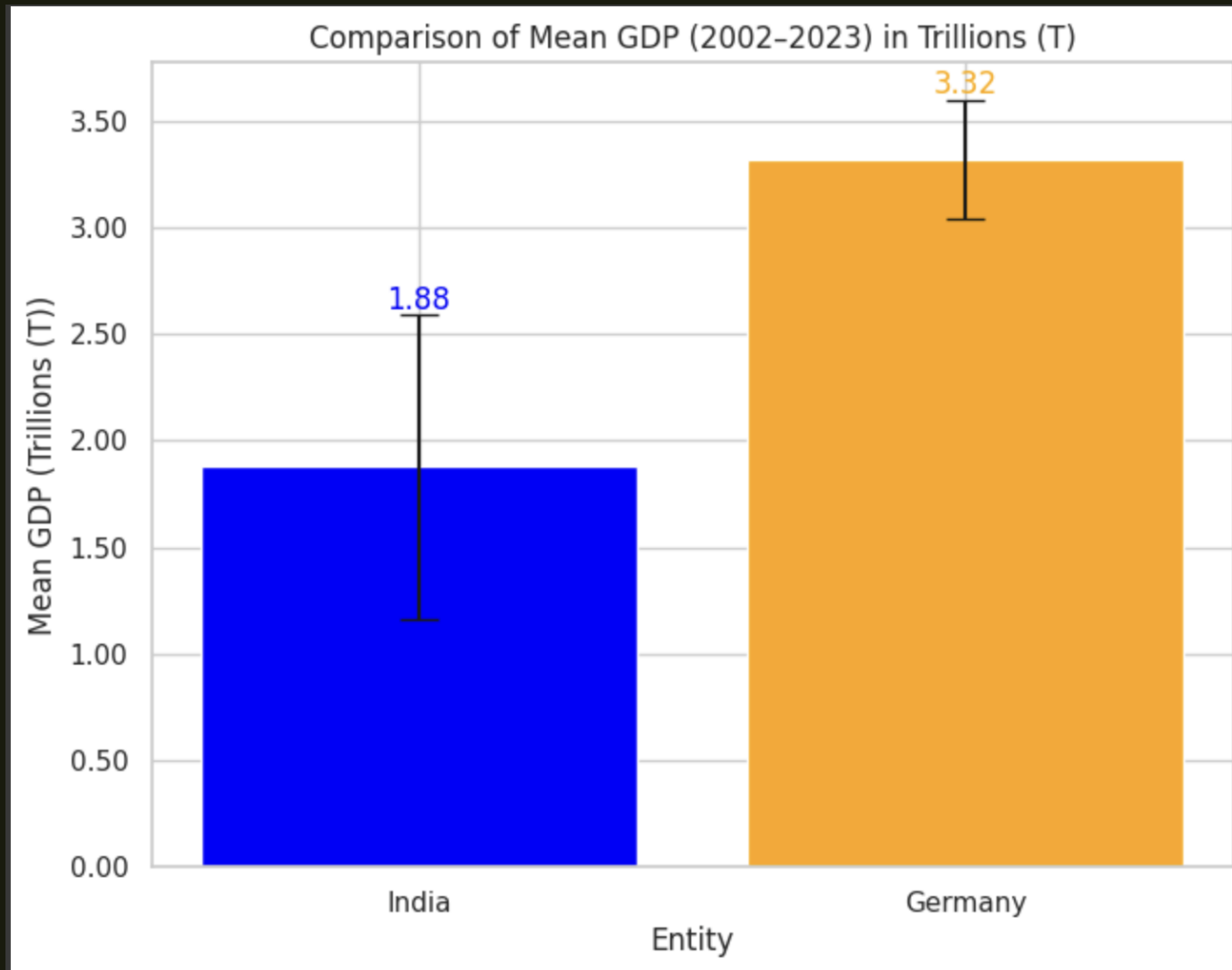
- The global GDP curve displays a **uniform distribution**.
- Multiple peaks may reflect regional growth differences or crises like **2008** or **COVID**.

Are They Normally Distributed?

To validate assumptions for any statistical modeling, we used Q-Q plots.

- **India:** Q-Q plot curves away from the line → **Not normally distributed**
- **Germany:** Points lie closer to the line → **Roughly normal**
- **World:** Shows deviation at both ends → suggests **multimodal or skewed distribution**





Mean GDP Comparison: India vs Germany (2002– 2023)

This bar chart compares the mean GDP of:

- India: 1.88 Trillion USD
- Germany: 3.32 Trillion USD

Insights:

- Germany's economy is significantly larger and more stable.
- India's lower GDP mean reflects its developing status but has room for rapid growth.

T-Test Results: Statistical Validation of GDP Difference

We conducted a **two-sample t-test** to statistically compare the GDP means of India and Germany from 2002 to 2023.

Results:

- T-statistic: -8.804
- P-value: 0.000

Interpretation:

- The **very low p-value** indicates that the difference in mean GDP between India and Germany is **highly statistically significant**.
- The **negative t-statistic** suggests that **India's mean GDP is lower** than Germany's — consistent with our descriptive stats.

Insight:

This confirms that observed differences in economic size are **not due to random variation**. Germany's economy is statistically and practically larger during this period.

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Two-sample t-test results:  
t-statistic: -8.804  
p-value: 0.000
```

Tools of the Trade

Our analysis was powered by:

- **Google Colab & Python** for interactive, shareable analysis
- **Pandas & NumPy** for data handling
- **Matplotlib & Seaborn** for rich visualizations
- And most importantly: **Open Data** from OWID

What's Next?

This story opens doors to many follow-ups:

- Include **GDP per capita** for a richer comparison
- Analyze **inflation-adjusted, sectoral GDP**
- Include **more countries** or **economic indicators** (like debt, trade balance, HDI)

Takeaways

GDP tells a compelling story—but only part of it.

- **India** is a rising economic force.
- **Germany** remains stable, with global integration.
- **The world** is a complex, interconnected economic system—reflected in this simple dataset.

THANK YOU

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