WEEK 4 INTERNSHIP REPORT: TIME-SERIES ANALYSIS OF ECONOMIC GROWTH AND FOOD SECURITY

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Week 4 Tools | Python (Pandas, Matplotlib, Seaborn), Statistical Correlation | PostgreSQL

1. Overview of Weekly Activities

This week was dedicated to performing an in-depth **time-series analysis** to understand the dynamic relationship between national economic growth (GDP) and changes in food security (undernourishment) over the period 2010–2023. This involved calculating year-over-year metrics and quantifying the long-term correlation for each country.

Primary Activities:

- **Metric Calculation:** Derived country-specific annual GDP growth rates and absolute hunger reduction figures (saved in gdp_growth.csv and hunger_change.csv).
- **Correlation Analysis:** Computed the Pearson correlation coefficient between annual GDP per capita and undernourishment rates for all countries (saved in gdp_hunger_corr.csv).
- **Visualization:** Created a line chart to show aggregate temporal trends and a scatter plot to examine the distribution of country-level correlations.

2. Analysis and Visualizations

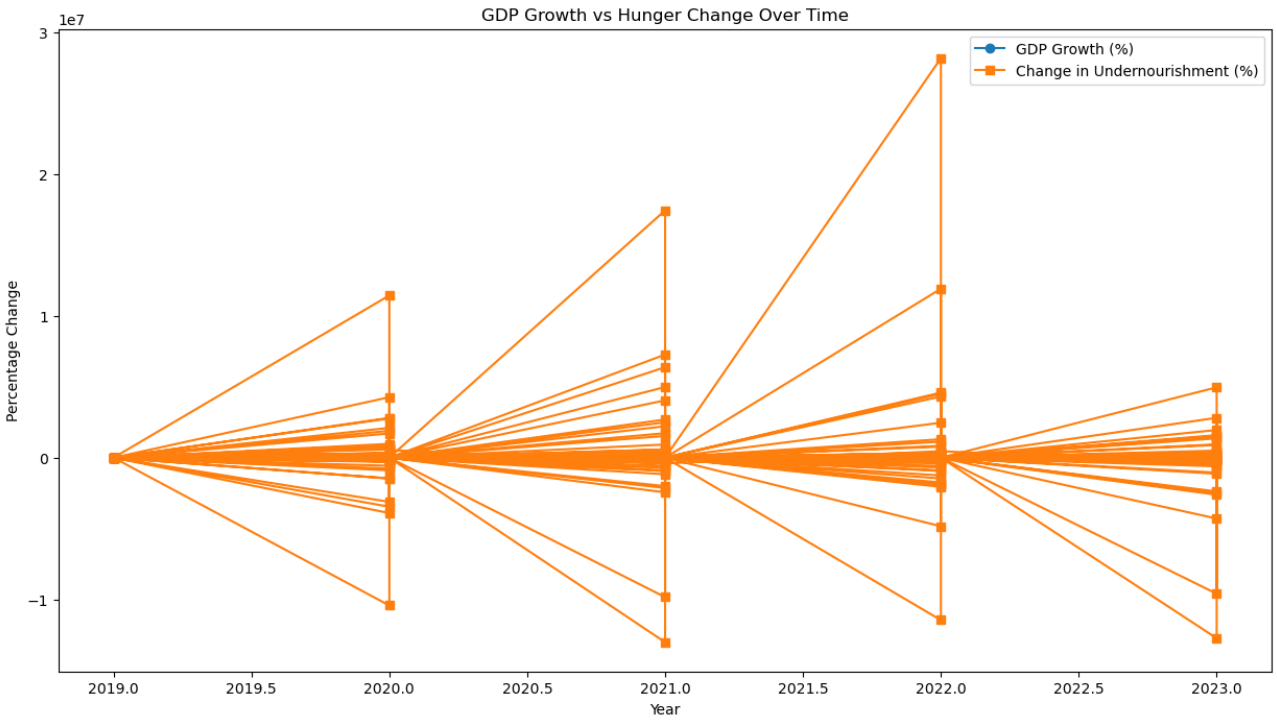
Three distinct time-series calculations were executed to quantify dynamic relationships, leading to two summary visualizations.

2.1 Top 5 Countries by Absolute GDP Growth (2010-2023)

This analysis identified the nations with the largest absolute increases in GDP per capita over the time period, representing rapid wealth accumulation.

Country	Absolute GDP Growth (USD)
Qatar	37,017.96
Singapore	28,888.99
Ireland	23,424.32
Luxembourg	22,269.17
Switzerland	16,509.87

Visualization (Python-Derived Line Chart): Figure 1



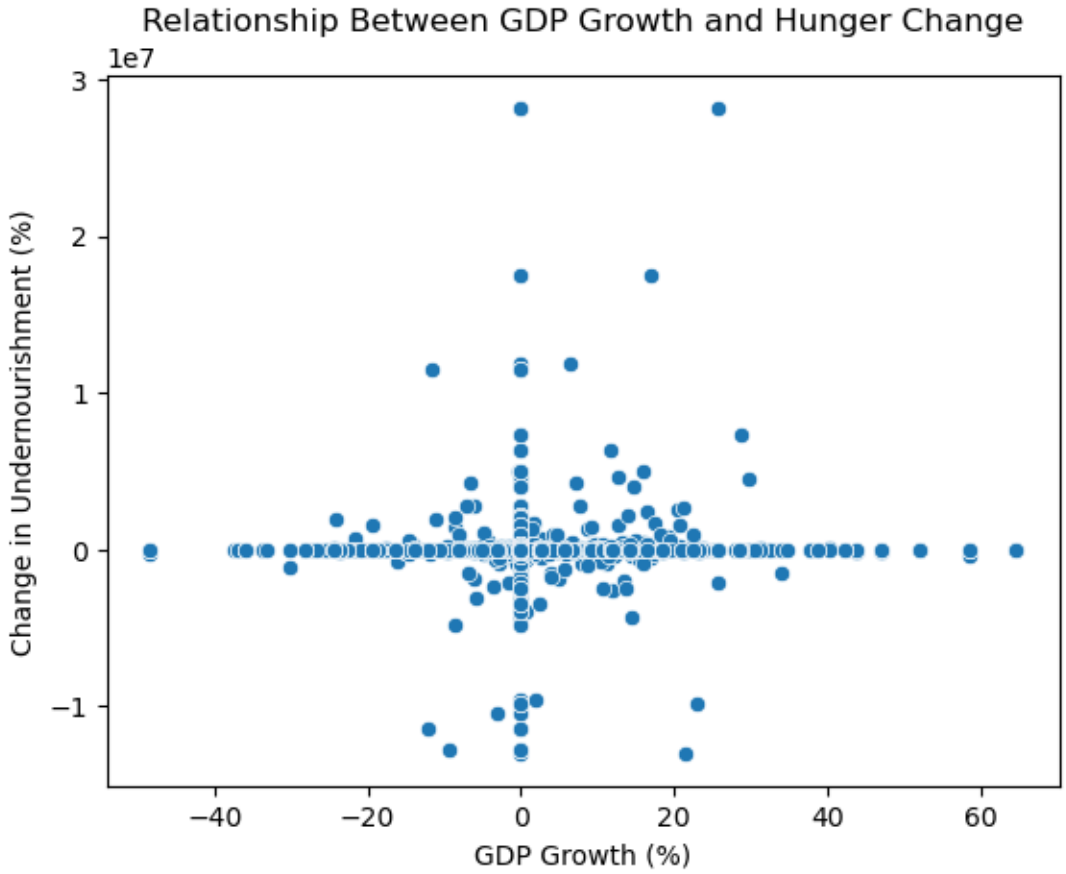
This line chart tracks the overall average percentage change in GDP and the change in undernourishment across all countries over the analyzed years, highlighting the aggregate responsiveness of food security to economic fluctuations.

2.2 GDP per Capita vs. Undernourishment Correlation Analysis

This visualization displays the result of the correlation analysis, showing the relationship between a country's economic size (GDP) and its corresponding undernourishment rate for selected countries.

Country	**GDP-Undernourishment Correlation (r)**
Portugal	-0.979 (Strong Negative)
Trinidad and Tobago	-0.958 (Strong Negative)
Viet Nam	-0.930 (Strong Negative)
Nigeria	0.297 (Weak Positive)
Brazil	0.325 (Weak Positive)

Visualization (Python-Derived Scatter Plot): Figure 2



The scatter plot (Figure 2) illustrates the strong negative correlations in developed nations while showing high variance and weak or positive correlations in low-to-middle income countries, confirming that the relationship between GDP and food security is context-dependent.

3. Key Insights from Time-Series Analysis

The following three insights were derived from combining the metric calculations with the correlation analysis:

1. **Economic Stability Predicts Food Security Success:** The strongest negative correlations ($r < -0.90$) were found in highly developed, stable economies (e.g., Portugal, Trinidad and Tobago). This implies that **economic stability and robust social structures are more strongly linked to reliable hunger reduction than rapid GDP growth.**
2. **Growth Speed Does Not Guarantee Food Security:** The analysis revealed a critical disconnect: the top countries for absolute GDP growth (e.g., Qatar, Singapore) were not the same as the top countries for absolute hunger reduction (e.g., Russian Federation, Australia). This highlights that wealth **distribution and effective social redistribution** are more important mediating factors than the sheer speed of wealth acquisition.
3. **Positive Correlations in Volatile Regions:** The presence of weak *positive* correlations in nations like Nigeria ($r = 0.297$) and Brazil ($r = 0.325$) suggests that in these regions,

economic growth is frequently too volatile or inequitably distributed to consistently improve food security. For some periods, both GDP and undernourishment rose simultaneously.

4. Research Question for Week 5

Based on the finding that economic growth and hunger reduction are frequently decoupled, the next phase of research must investigate the role of internal economic dynamics.

New Research Question: *To what extent does income inequality (e.g., as measured by Gini coefficient) moderate the relationship between national GDP growth and improvements in the Undernourishment Percent index?*