

# Global Economic Dynamics: Unraveling Methane Emissions, GDP Growth, and Future Trajectories

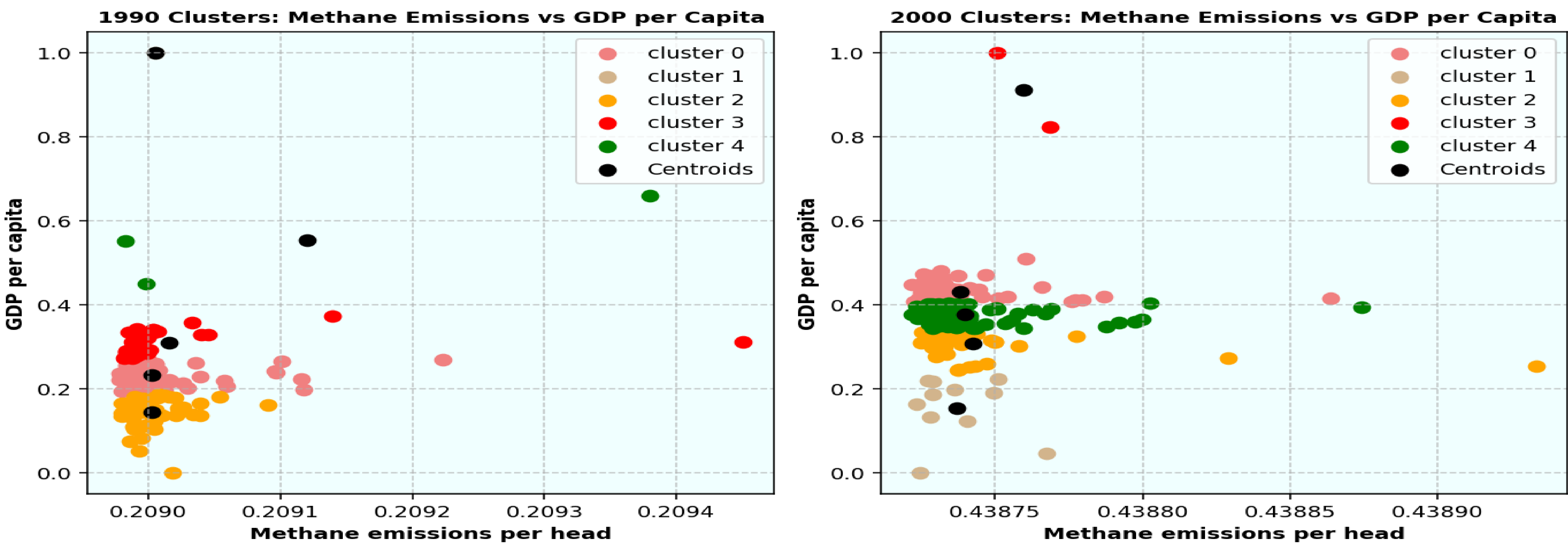
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## Abstract:

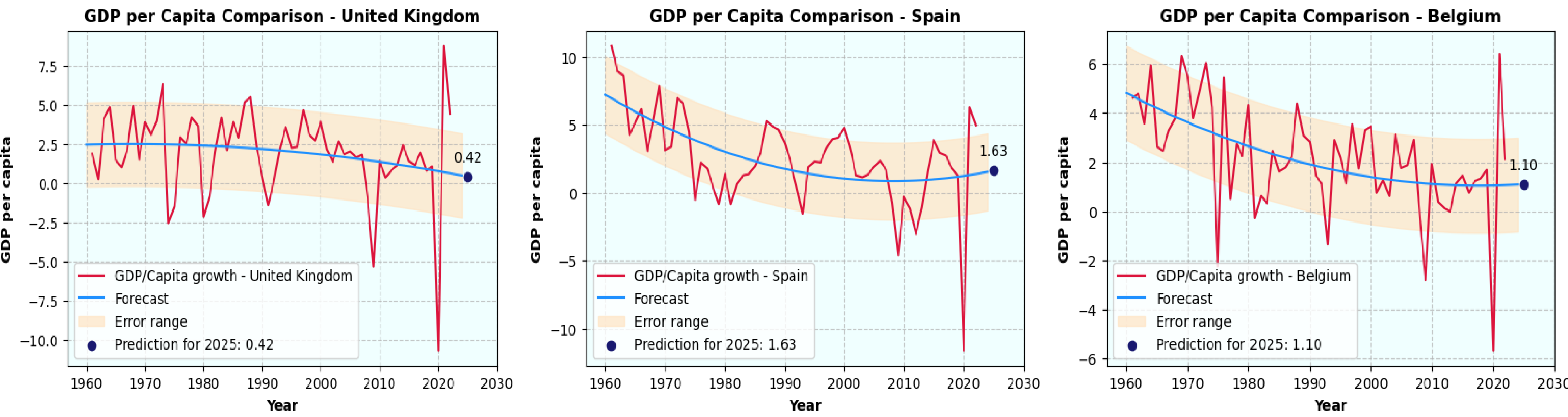
This study employs data-driven visualisations and analytical tools to investigate the complex relationship between methane emissions per head and GDP per capita on a global scale. The scatterplots for 1990 and 2020 showcase distinct clusters, shedding light on the diverse patterns among nations. Additionally, a focused analysis of GDP per capita growth for the United Kingdom, Spain, and Belgium provides insights into historical trajectories and anticipates future trends for 2025. Utilising polynomial curve fitting and error range estimation, the study not only captures historical dynamics but also acknowledges the uncertainty in forecasting. The findings contribute to a holistic understanding of the intersection between economic development and environmental impact, offering valuable insights for policymakers, researchers, and stakeholders.

## Introduction:

The global landscape of economic development and environmental sustainability is undergoing significant transformations, necessitating a thorough examination of the intricate relationship between economic indicators and environmental factors. This analysis focuses on the interplay between methane emissions per head and GDP per capita, utilising comprehensive scatterplots to visually represent patterns and clusters for the years 1990 and 2020. The investigation extends to specific countries, namely the United Kingdom, Spain, and Belgium, offering a detailed exploration of their historical GDP per capita dynamics and forecasting insights for 2025. This study aims to provide a nuanced understanding of the evolving trends in economic growth and environmental impact, contributing to informed decision-making and policy formulation.



The above plots offer a comprehensive visual analysis of the relationship between methane emissions per head and GDP per capita for the years 1990 and 2020. In the 1990 Clusters Scatterplot, countries are depicted as points, each characterized by its normalized methane emissions and GDP per capita. The colour-coded clusters and centroids reveal distinct groupings among nations. Similarly, the 2020 Clusters Scatterplot illustrates the evolving clustering patterns over time. Furthermore, the GDP per capita growth analysis scatterplots for specific countries, such as the United Kingdom, Spain, and Belgium, provide insights into historical trends and forecasted values for 2025. These visualisations collectively contribute to a nuanced understanding of the interplay between economic indicators and methane emissions, shedding light on both historical patterns and potential future trends for individual countries.



- The above plot for the United Kingdom visualizes the historical GDP per capita values, revealing an upward trend with fluctuations.
- A polynomial curve is fitted to the historical data, capturing the overall growth trajectory.
- The shaded error range around the curve indicates the uncertainty in the forecasted values.
- The point for the year 2025, based on the polynomial fit, is plotted and annotated.
- Overall, the analysis provides insights into the historical and projected GDP per capita dynamics for the United Kingdom.
- The predicted value of GDP per Capita for United Kingdom is 0.42.

- The GDP per Capita Growth Analysis Scatterplot for Spain showcases the historical and forecasted trends in GDP per capita.
- Similar to the United Kingdom, a polynomial curve is fitted to the historical data, offering a representation of the growth pattern.
- The shaded error range around the curve provides a visual indication of the potential variability in the forecasted values.
- The point for the year 2025 is plotted, allowing for a comparison with other countries and historical trends.
- This analysis contributes to an understanding of Spain's economic performance and potential future trajectory.
- The predicted value of GDP per Capita for Spain is 1.63.

- For Belgium, the above plot illustrates the historical GDP per capita values, capturing the country's economic evolution over time.
- The fitted polynomial curve offers insights into the growth pattern, considering the historical data.
- The shaded error range around the curve adds a layer of uncertainty to the forecasted values.
- The point for the year 2025, based on the polynomial fit, is highlighted, providing a glimpse into Belgium's potential economic scenario.
- Overall, this analysis contributes to a comparative understanding of GDP per capita growth among the selected countries.
- The predicted value of GDP per Capita for Belgium is 1.10.

## Conclusion:

In conclusion, the presented analysis provides a comprehensive exploration of the intricate relationship between methane emissions and GDP per capita, elucidating patterns, clusters, and historical trends. The scatterplots offer a visual narrative of global dynamics, while the focused examination of specific countries enriches our understanding of their economic journeys. The GDP per capita growth analysis, coupled with polynomial curve fitting and uncertainty estimation, contributes to a nuanced interpretation of future trajectories. This study serves as a valuable resource for policymakers and stakeholders seeking informed strategies for sustainable economic development. By bridging the gap between economic indicators and environmental impact, it highlights the importance of holistic approaches in shaping a resilient and environmentally conscious global landscape.

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Data Source Link: <https://data.worldbank.org/topic/climate-change>

GitHub Link: [https://github.com/Harikrishnan03/Clustering\\_and\\_fitting](https://github.com/Harikrishnan03/Clustering_and_fitting)