

## Set -1: GDP and Trade of national economies

Dhananjay Vora (2020001417)\* and Kashish Shroff (202001425)<sup>†</sup>  
*Dhirubhai Ambani Institute of Information & Communication Technology,  
Gandhinagar, Gujarat 382007, India  
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The six nations with the greatest GDPs in the world—the United States, China, Japan, Germany, the United Kingdom, and India—are modelled using the logistic equation. We forecast the maximum values of the growth of the economic data from the modelling of those made accessible by the World Bank.

### I. INTRODUCTION

GDP measures the whole result of a nation's year-round economic activity. As a result, the GDP of a country's economy is a dynamic number whose evolution (which typically suggests growth) can be observed over time. Contribution to the GDP of a country comes from another dynamic quantity—the annual trade in which the country engages itself.

### II. MODEL

Keeping into account the assumptions and other studies[1][2], we model the system using a basic model of a nonlinear function which leads to the logistic equation,

$$\dot{x} = f(x) = ax - bx^2 \quad (1)$$

with a and b being fixed parameters.

$$\dot{G} \equiv \frac{dG}{dt} = \mathcal{G}(G) = \gamma_1 G - \gamma_2 G^2 \quad (2)$$

$$\dot{T} \equiv \frac{dT}{dt} = \mathcal{T}(T) = \tau_1 T - \tau_2 T^2 \quad (3)$$

For GDP-Trade correlation, we have

$$G(T) \sim T^\alpha \quad (4)$$

### III. RESULTS

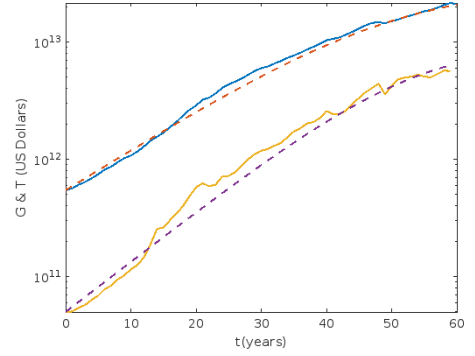


fig. 1. GDP and Trade for USA

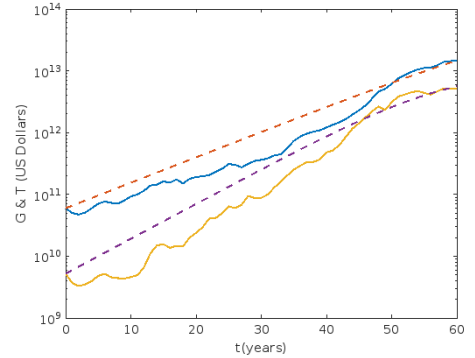


fig. 2. GDP and Trade for China

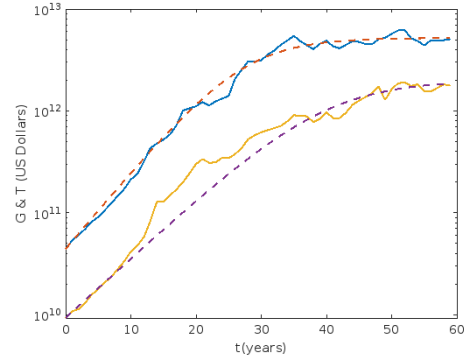


fig. 3. GDP and Trade for Japan

\*Electronic address: [202001417@daiict.ac.in](mailto:202001417@daiict.ac.in)

<sup>†</sup>Electronic address: [202001425@daiict.ac.in](mailto:202001425@daiict.ac.in)

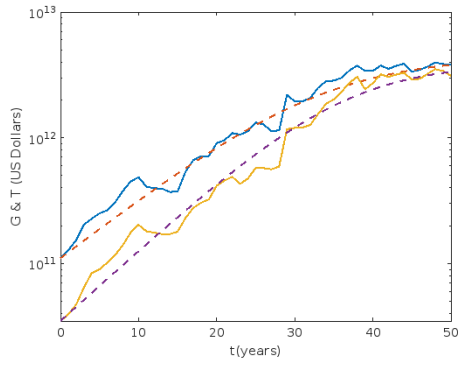


fig. 4. GDP and Trade for Germany

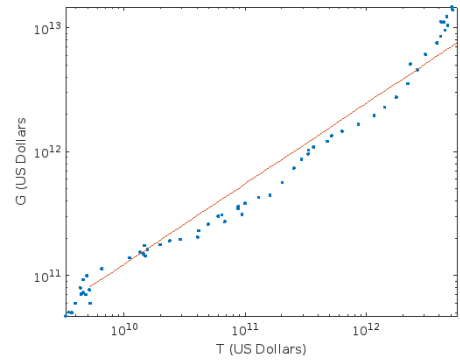


fig. 8. GDP-Trade correlation for China

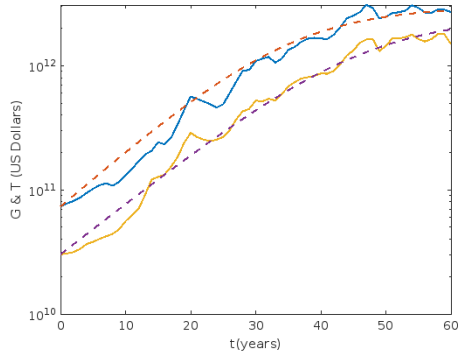


fig. 5. GDP and Trade for UK

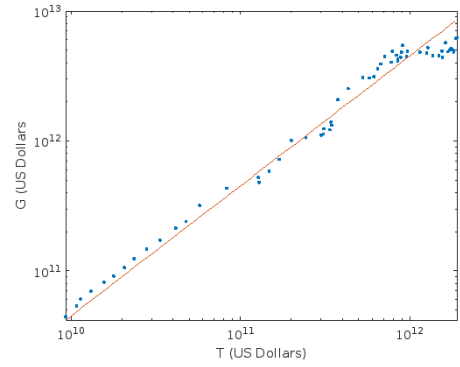


fig. 9. GDP-Trade correlation for Japan

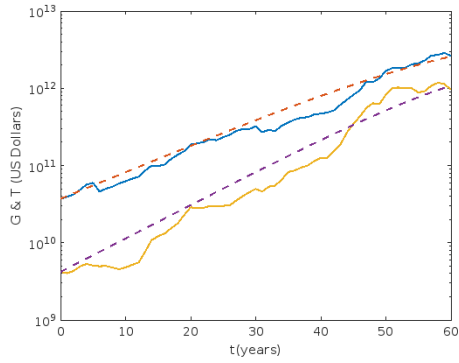


fig. 6. GDP and Trade for India

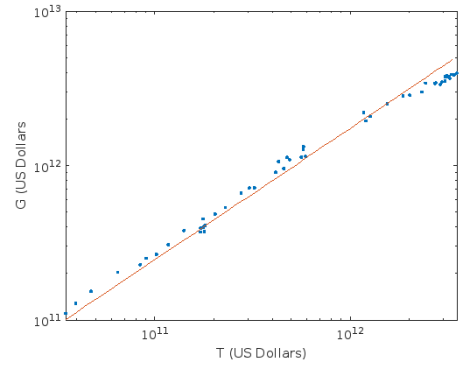


fig. 10. GDP-Trade correlation for Germany

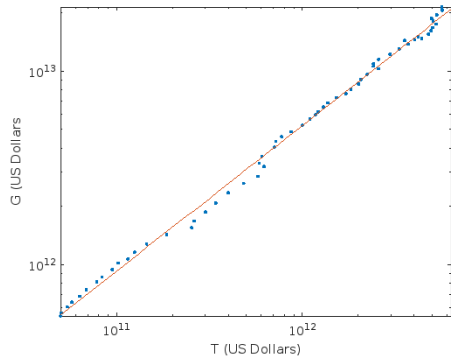


fig. 7. GDP-Trade correlation for USA

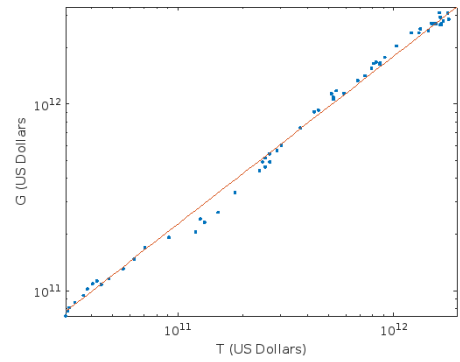


fig. 11. GDP-Trade correlation for UK



## V. CONCLUSIONS

- Under ideal circumstances, such as stable internal politics, military engagements, and economic policies, the logistic equation is effective at modeling the growth of GDP and trade. The logistic equation also predicts a long-term slowdown in the economy due to problems like pandemics, dwindling natural resources, and armed conflicts.
- The growth of GDP and trade is correlated and driven by a power-law, which can be used utilized

to coordinate international initiatives for economic recovery, particularly through the reactivation of the global trade network in key economic centers.

- Despite the logistic equation's accuracy in predicting GDP competitiveness, unforeseen events may reduce its accuracy. Actual data as well as prospective shocks should be considered when making predictions, and models should be thoroughly tested and updated.

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- [1] Kakkad, A. and Ray, A.K., 2021. Global dynamics of GDP and trade. arXiv preprint arXiv:2109.05262.
  - [2] Ray, A.K., 2022. Logistic forecasting of GDP competitiveness. arXiv preprint arXiv:2211.03125.
  - [3] Ray, A.K. (2010). Modeling Saturation in Industrial Growth. In: Basu, B., Chakravarty, S.R., Chakrabarti,

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