SCIE1500

Week 1 Laboratory

Analysis of Global Plastics Production Data

SCIE1500 | Instructions

1. Get the data - follow this link (or scan the QR code) to download the dataset *global-plastics-production.csv*:

* Scroll down to "*How much plastic does the world produce?*"
* Select the tab "DOWNLOAD" on the right chart.
* Download the **Full data (CSV)**.

2. Guided analysis - select a software to read in the data on global plastics production, visualise and explore it, and then determine what type of equation or mathematical model would describe the relationship between production and time. We will guide you along the way!

3. Softwares - the exercises can also be done in Excel, Jupyter notebooks (Python) or other softwares.

Get the data

SCIE1500 | Get the data

1. Go to (QR code) *https://ourworldindata.org/plastic-pollution*
2. Scroll down to “How much plastic does the world produce?”
3. Select the tab “DOWNLOAD” on the right chart.

Guided analysis

Step 1: read in downloaded data and explore

Questions

1. What is the min, max, mean of gpp?
2. What are the log values of these statistics (min, max, mean)?

Step 2: extract variables and use shorter simpler names

1. Change the last column title from *Global plastics production (million tonnes)* to, for example, *GPP (million tonnes)*
2. Also, create a time trend based on year (for easier modelling) as it is the passage of time rather than the actual calendar year that we are interested in. t is also smaller than calendar year.

Step 3: visualise data

- Plot the GGP as function of year and the new variable "t".

Step 4: Explore effect of scaling and transformation (logs)

1. Effects of scaling:
    A. Add a column expressing the plastic production in trillion tonnes.
    B. Plot the result and add a horizontal line at the mean value.

    - Why do think we need to scale data?

2. Effects of transformation (logs):
    A. Plot using a log scale for the y-axis
    B. Add a column expressing the log of the plastic production in million tonnes.
    C. Plot the logarithmic values, from item B, and compare with the log scale plot of item A.

Compare the effects of using log scale in plotting against transforming the data (using logs) and then plotting the transformed data.

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Student Exercise

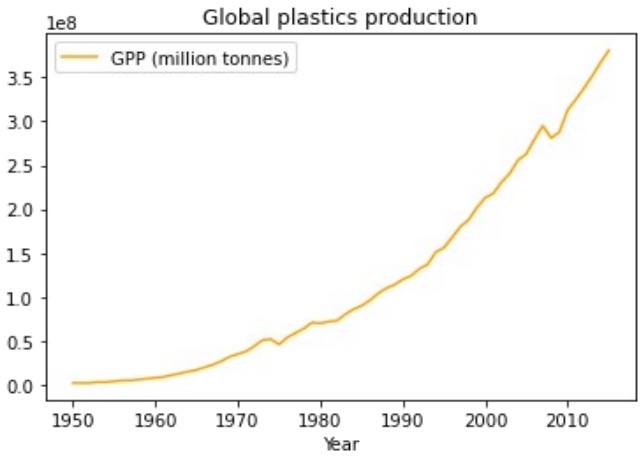
Step 7: Student exercise

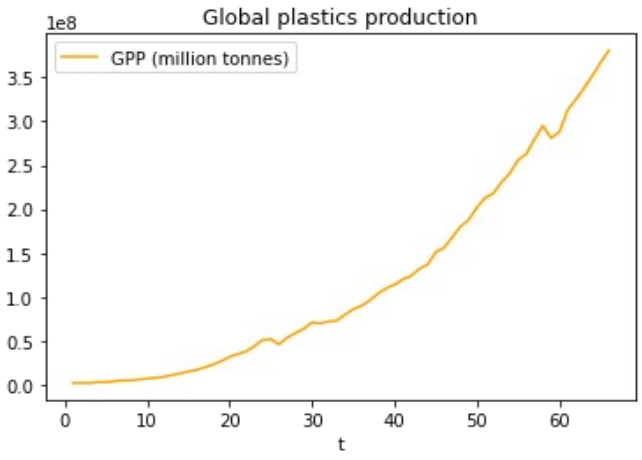
- What does the model $log(gpp) = 14.38 + 0.1539t - 0.001147t^2$ imply about the predicted growth rate plastic production between 1960 and 1961, between 2000 and 2001 and between 2010 and 2011? How do these compare with the actual growth rates and with the prediction from the exponential equation?
- What does this model tell us about the maximum level global plastic production could reach? When would that be reached according the model?
- Generate a plot that includes the following three curves: a plot of the actual plastics production, the predicted values accoring to **M1** and **M2**. See the following:

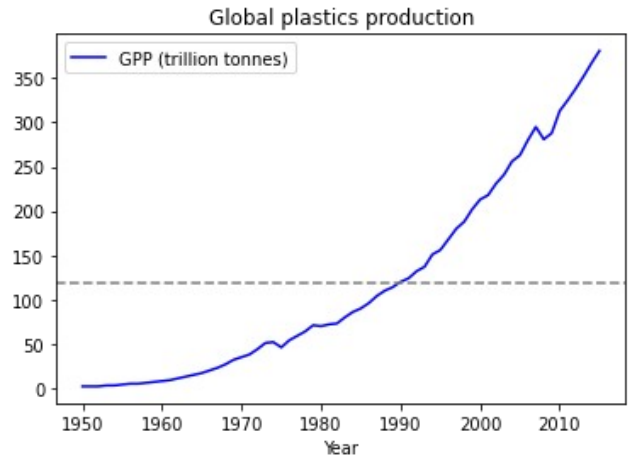
Is it wise to use a model (**M1**, **M2**, or any other similar model) to predict plastic production far into the future? Explian why?

Examples of expected results

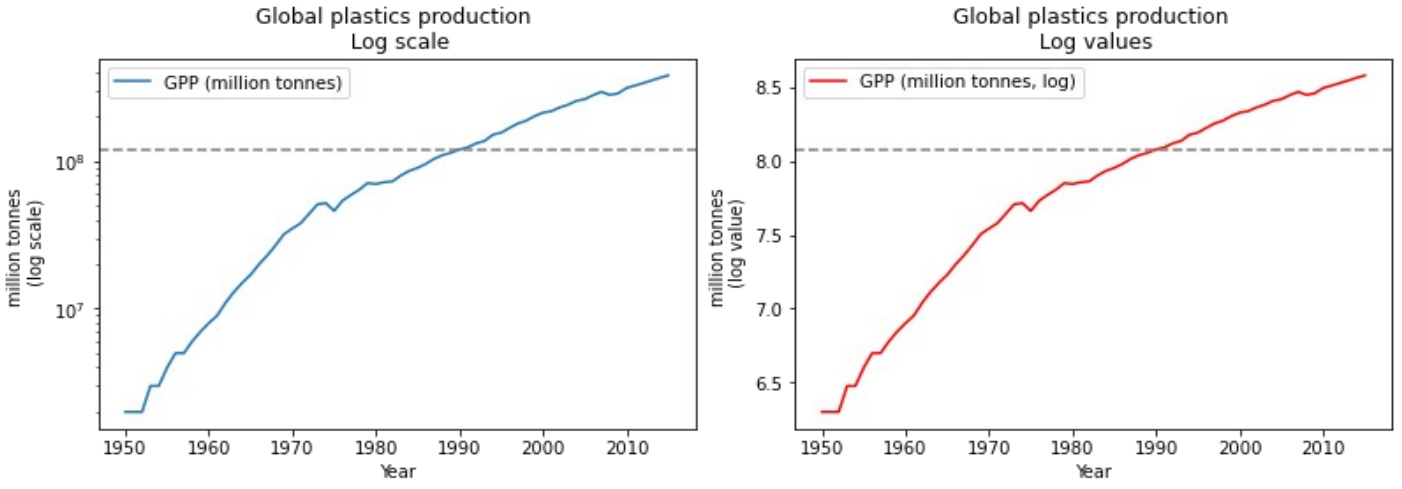
Step 3: Visualise the data



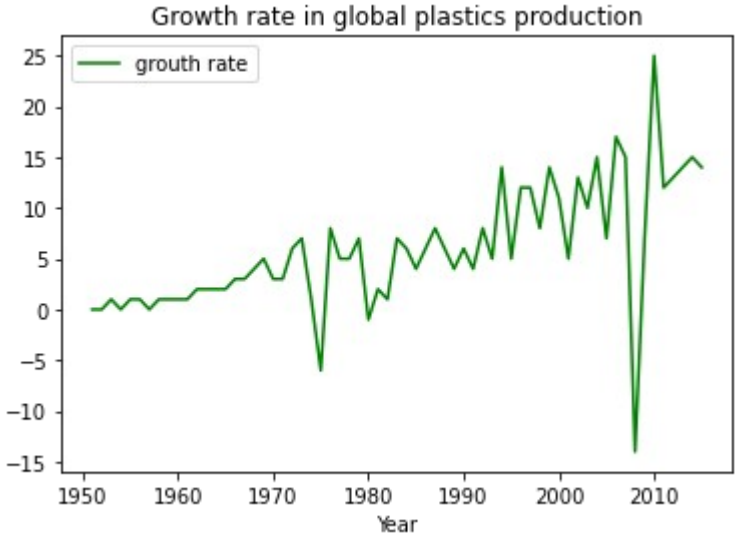




Step 4: Explore effect of scaling and transformation (logs)



Step 5: What is the story about the growth rates in plastic production?

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Grouth rate (trillion tonnes/year):
- minimum:  -14.0
- maximum:  25.0
- median:  5.0
- mean:  5.8307692307692305
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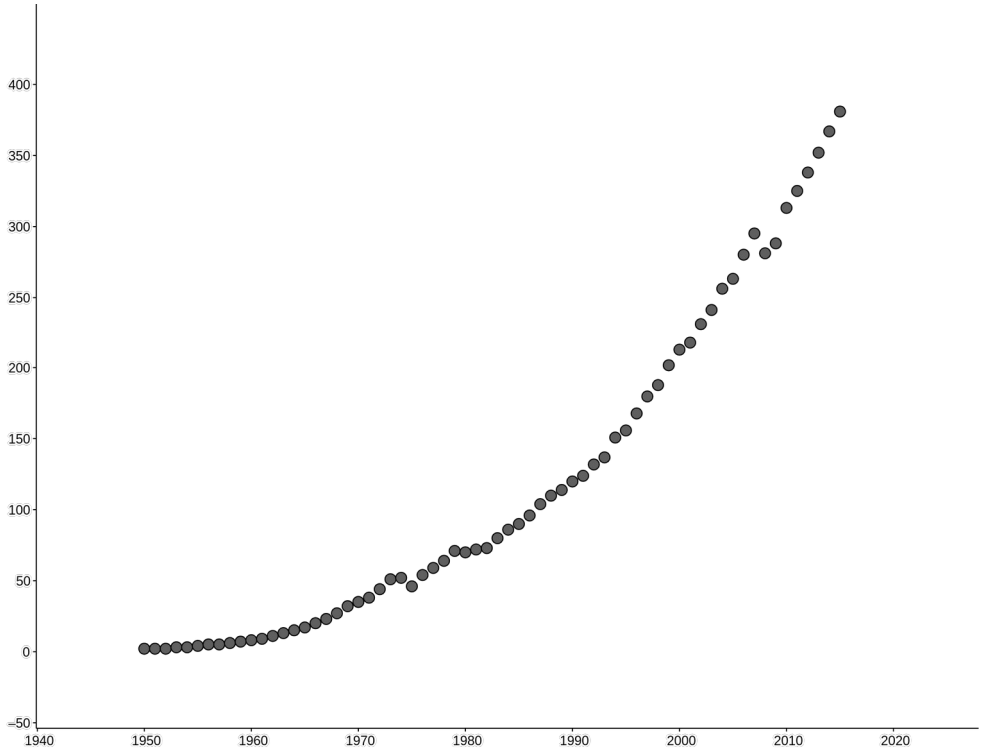
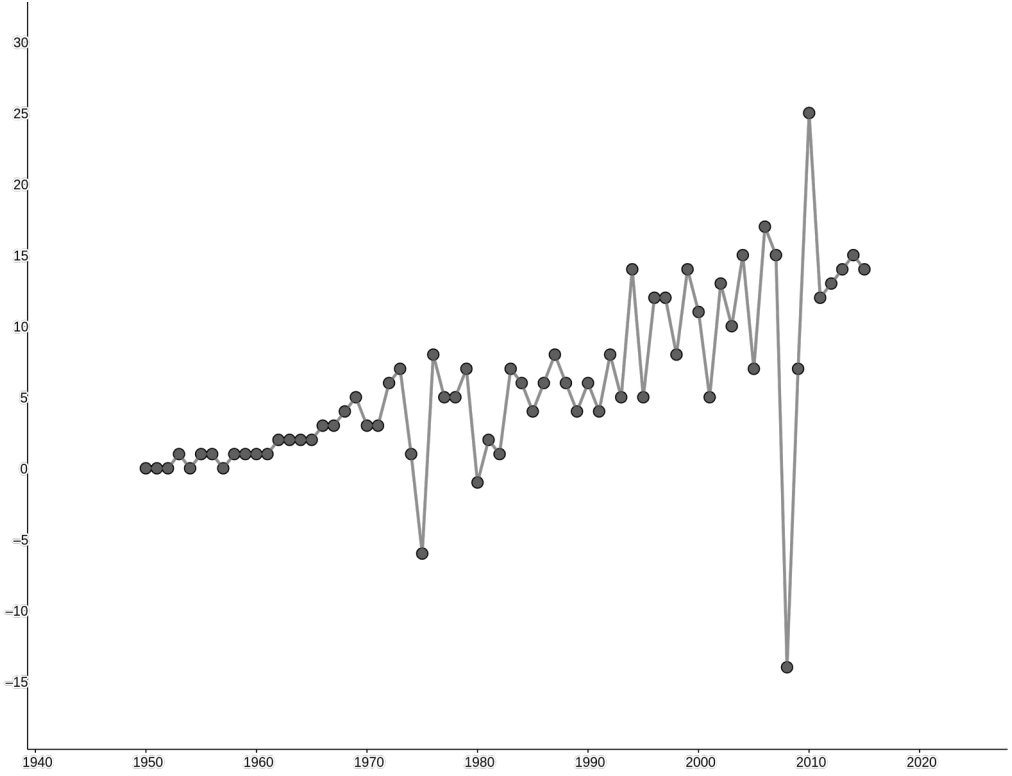
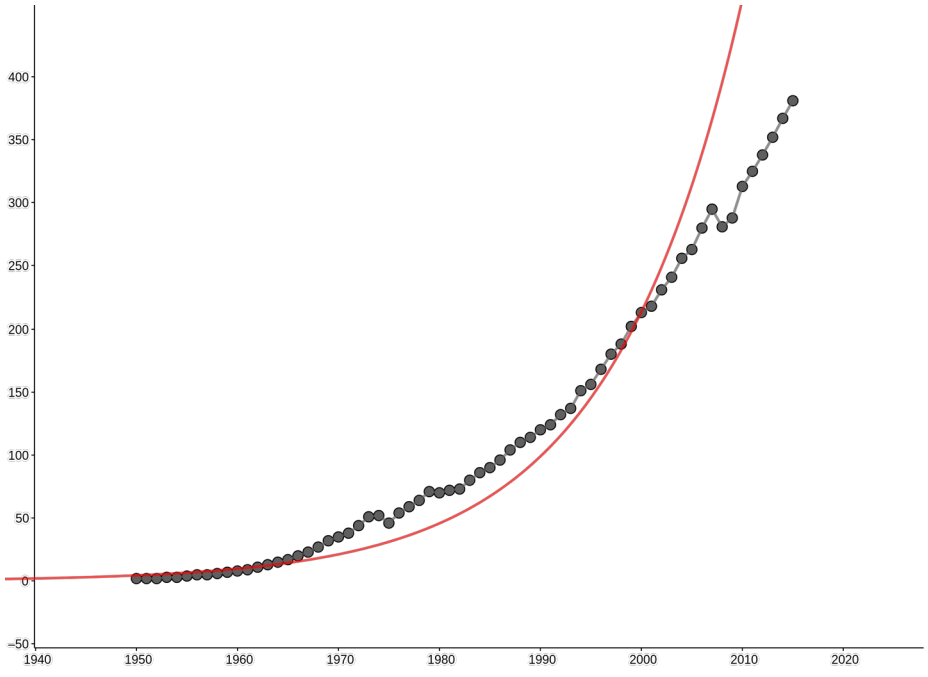
Step 3: Visualise the data





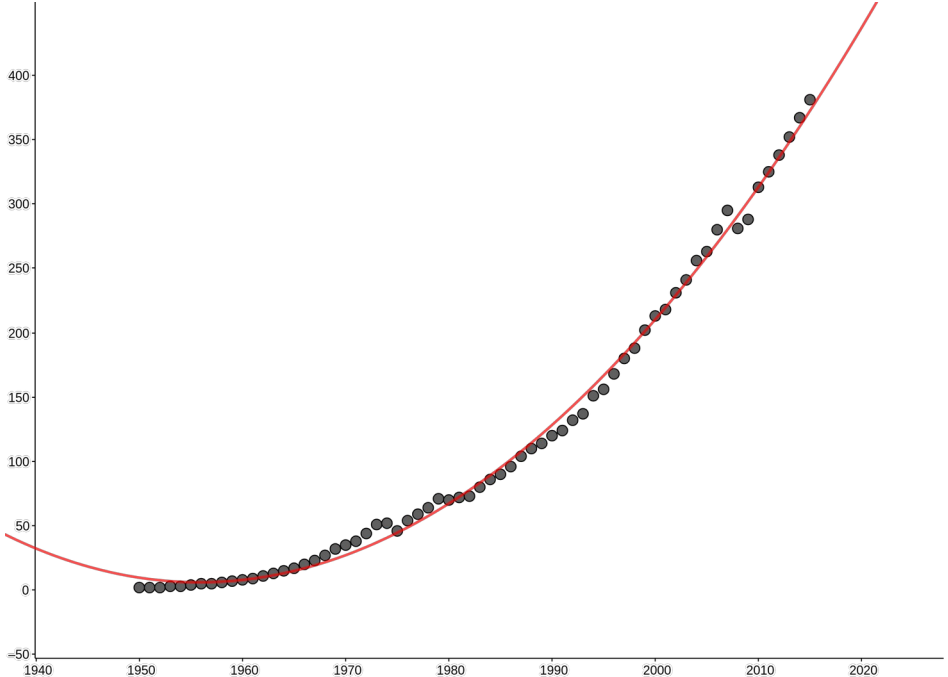
Step 4: Explore effect of scaling and transformation (logs)



Regression Model

Exponential $y = 0\ e^{0.077x}$

Symbolic Evaluation: x = 2020 y = 996.3615



Regression Model

Polynomial 2 $y = 0.1\ x^2 - 409.18\ x + 400146.81$

Symbolic Evaluation: x = 2020 y = 436.9303

Step 5: What is the story about the growth rates in plastic production?

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- median:  5.0
- mean:  5.830769230769230 5
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Hannah Ritchie and Max Roser (2018) - "Plastic Pollution". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/plastic-pollution' [Online Resource]