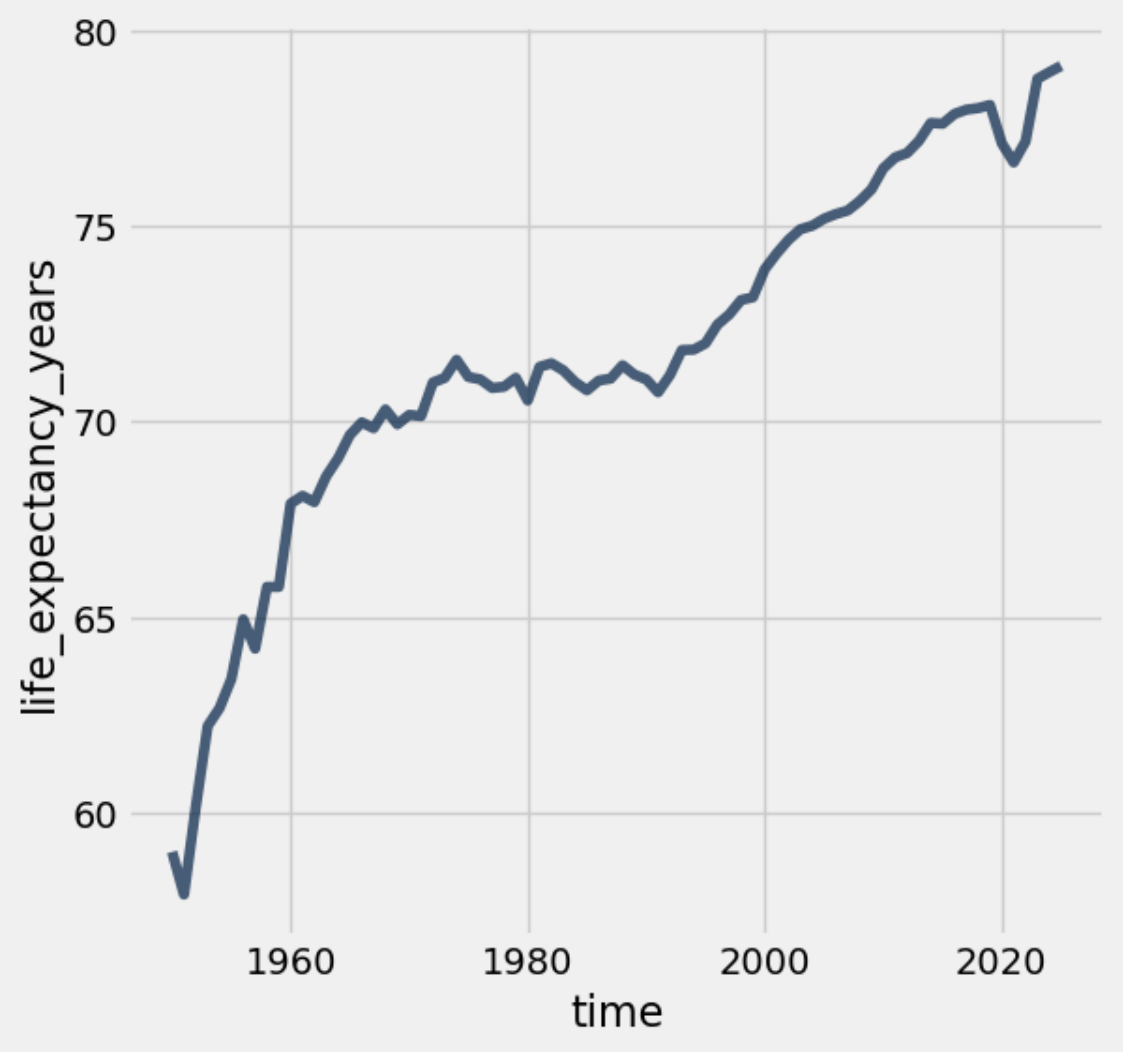

Question 3. Is population growing more slowly perhaps because people aren't living as long? Use the `life_expectancy` table to draw a line graph with the years 1950 and later on the horizontal axis that shows how the *life expectancy at birth* has changed in Poland.

Hint: Make sure you filter the table properly; otherwise, the graph may look funky!

```
In [17]: # Fill in code here
         ...
         poland_life_expectancy = life_expectancy.where('geo', 'pol').where('time', are.above_or_equal_
         poland_life_expectancy.plot('time', 'life_expectancy_years')
```



Question 4. Assuming no other factors, such as birth rates or fertility rates, have changed, do the trends in life expectancy in the graph above directly explain why the population growth rate decreased since 1950 in Poland? Why or why not?

The chart does not explain the trends in the life expectancy decreasing in Poland. Actually it appears to be steadily increasing from 1980-2000, with a drop during COVID (2020). In the 1950s, we see also see a drop, and then a drastic spike in population from then on

Question 6. Assuming everything else is constant, do the trends in fertility in the graph above help directly explain why the population growth rate decreased since 1950 in Poland? Why or why not?

Yes, the trends in fertility shown in the graph directly explain why the population growth rate decreased since 1950 in Poland. The average number of children per woman has decreased over time since 1950. Assuming everything else—such as death rates—remains constant, a declining fertility rate reduces the birth rate.

Since population growth rate is calculated as birth rate minus death rate, a lower birth rate with a constant death rate would result in a decreased growth rate. Thus, the observed decrease in fertility makes sense for the reduction in Poland's population growth rate.

Question 8. In one or two sentences, describe the association (if any) that is illustrated by this scatter plot. Does the diagram show any causal relation between fertility and child mortality?

The scatter plot depicts fertlity rates and child mortality rates both decreasing as time passes, thus there is a positive correlation between fertlity rates and mortality rates. Even though there is a correlation between fertlity rates and child mortality rates, it's not enough data to confidently say its a cause/effect between the two variables

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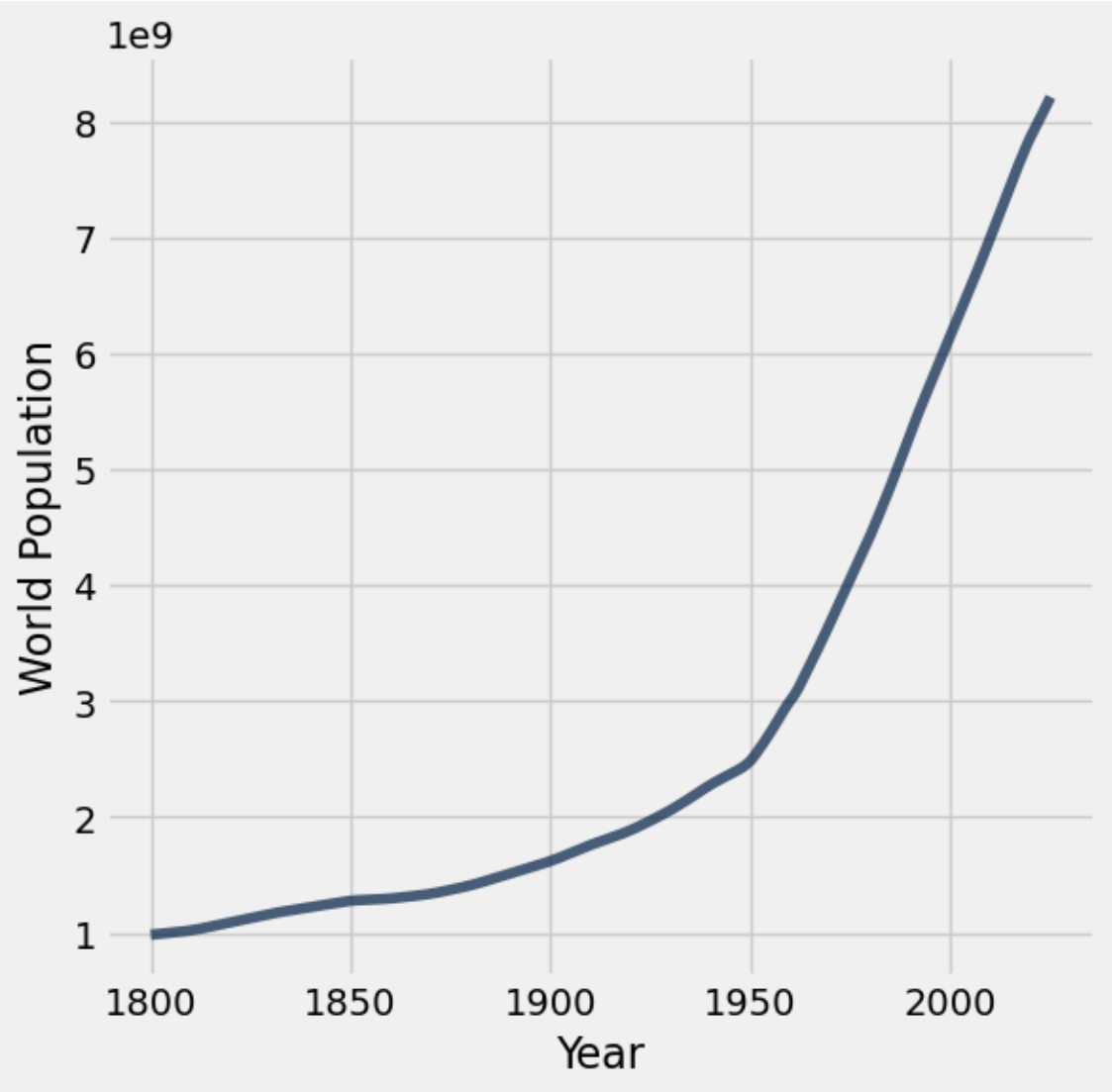
Question 10. Draw a line plot of the **world population** from 1800 through 2025 (inclusive of both endpoints). The world population is the sum of all of the countries' populations. You should use the `population` table defined earlier in the project.

```
In [29]: #Fill in code here
         population_over_time = population.where("time", are.between_or_equal_to(1800, 2025))\
             .group("time", sum).select("time", "population_total sum")\
             .relabeled("time", "Year").relabeled("population_total sum", "World Population")

         population_over_time.plot("Year", "World Population")
```



Question 6. It is important to study the absolute number of people living in poverty, not just the percent. The absolute number is an important factor in determining the amount of resources needed to support people living in poverty. In the next two questions you will explore this.

In Question 7, you will be asked to write a function called `poverty_timeline` that takes **the name of a country** as its argument (not the Alpha-3 country code). It should draw a line plot of the number of people living in poverty in that country with time on the horizontal axis. The line plot should have a point for each row in the poverty table for that country. To compute the population living in poverty from a poverty percentage, multiply by the population of the country **in that year**.

For this question, write out a generalized process for Question 7. Make sure to answer/include the following: - What should this function output? - Additionally, **make a numbered list** of the steps you take within the function body. If you added/edited, say, 5 lines in the function body, then it would be good to see the numbers 1 through 5 describing what you did (i.e. what functions/methods you used) in each line and why.

As a tip, after finishing question 7, we recommend polishing up your description of the steps for this question. This question will be graded for correctness.

The function outputs a line plot showing the number of people living in extreme poverty in the specified country over time. The x-axis displays years from the poverty table entries for that country, and the y-axis shows the absolute number of people in poverty, calculated by multiplying the poverty percentage by the population for each corresponding year. The plot includes a point for each row in the poverty table for that country and is displayed without returning any value.

Question 7. Now, we'll actually write the function called `poverty_timeline`. Recall that `poverty_timeline` takes **the name of a country** as its argument (not the Alpha-3 country code). It should draw a line plot of the number of people living in poverty in that country with time on the horizontal axis. The line plot should have a point for each row in the `poverty` table for that country. To compute the population living in poverty from a poverty percentage, multiply by the population of the country **in that year**.

Note: You **should not** return anything from your function. Simply call `plots.show()` at the end of your function body.

Hint 1: This question is long. Feel free to create cells and experiment. You can create cells by going to the toolbar and hitting the `+` button.

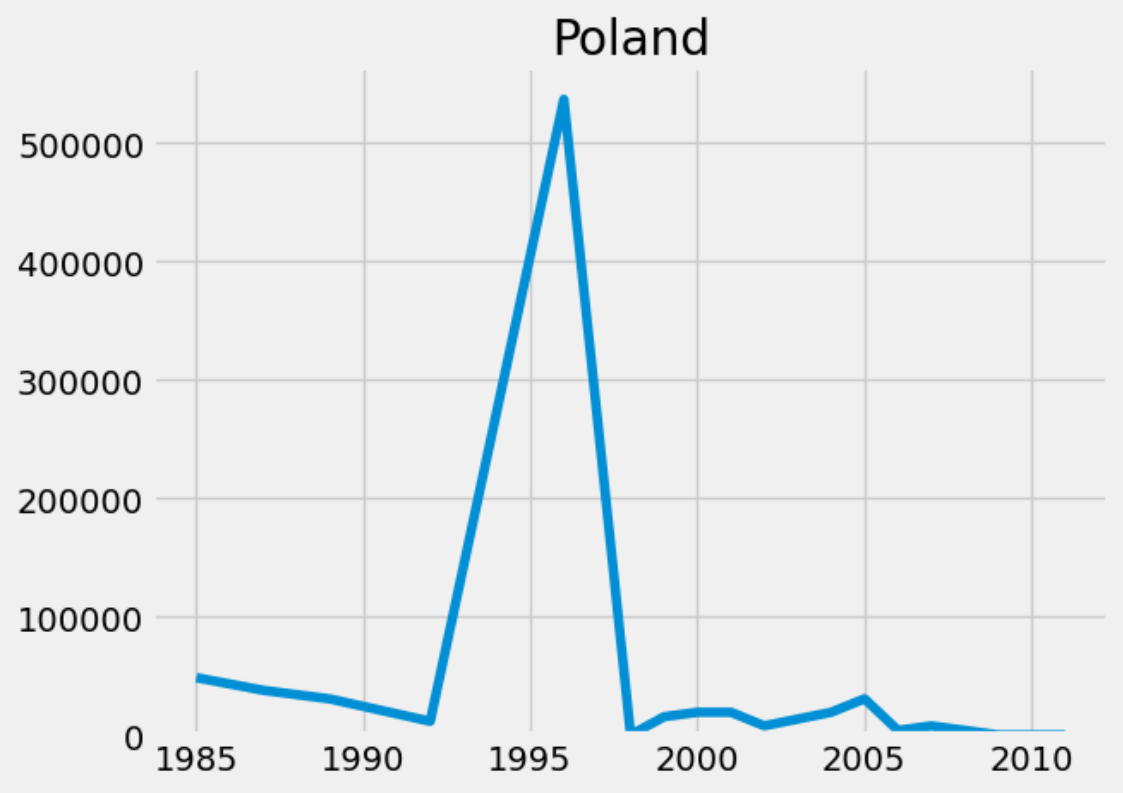
Hint 2: Consider using `join` in your code.

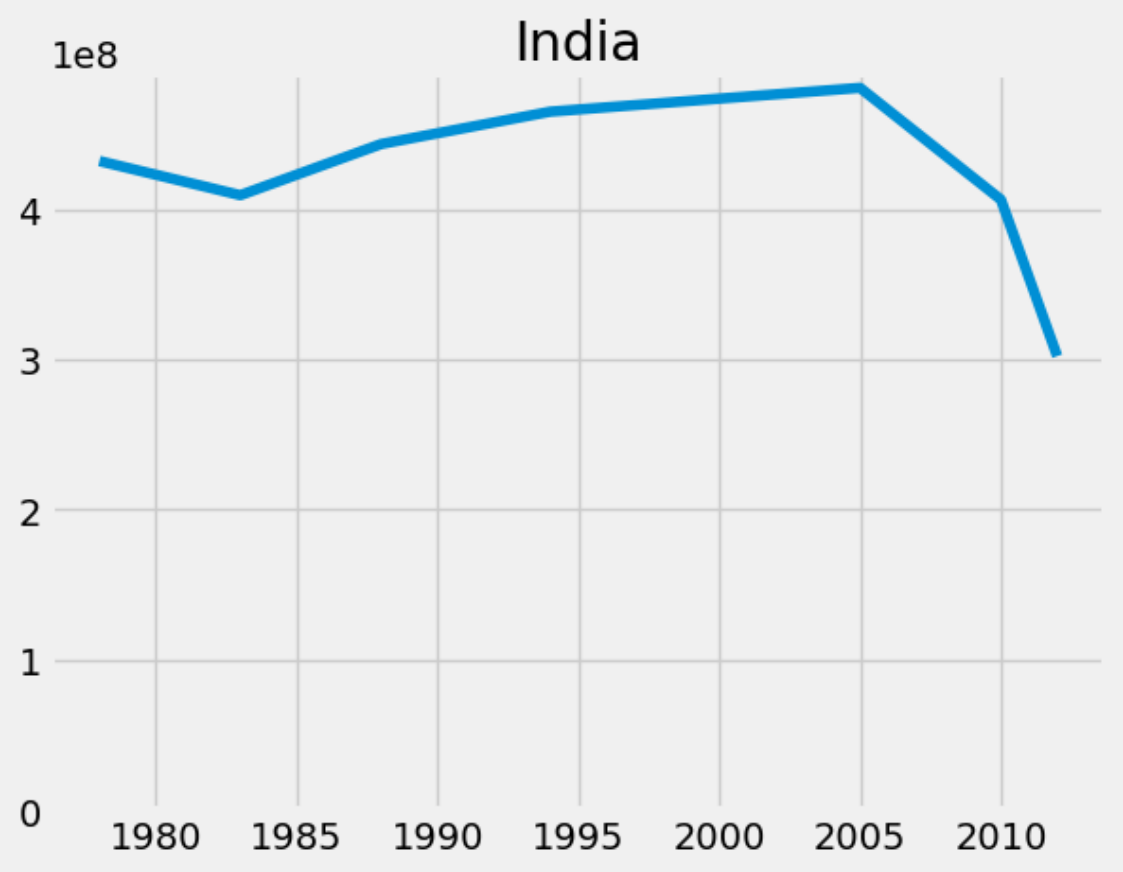
Feel free to use the markdown cell below to plan out your answer, but you needn't fill it in.

The five steps include: 1- Get the geo code from the country name, with .where 2- Filtering the poverty table for country. 3- Join with population data for matching years years from both datasets are included. 4- Calculate number of people in poverty to get the absolute number of people living in extreme poverty. 5- Plot number of people living in extreme poverty over time with the x-axis representing years and y-axis, showing people in extreme poverty.

```
In [56]: def poverty_timeline(country):
             '''Draw a timeline of people living in extreme poverty in a country.'''
             # Step 1: Get the geo code from the country name
             geo = countries.where('name', country).column('country').item(0)

             # Step 2: Filter poverty table for this country
             country_poverty = poverty.where('geo', geo)

             # Step 3: Join with population data for matching years
             timeline = country_poverty.join('time', population.where('geo', geo), 'time')

             # Step 4: Calculate number of people in poverty
             poverty_numbers = (timeline.column('extreme_poverty_percent_people_below_125_a_day') *
                                timeline.column('population_total') / 100)

             # Step 5: Plot the timeline
             plots.plot(timeline.column('time'), poverty_numbers)

             # Provided lines (fixed ylim syntax)
             plots.title(country)
             plots.ylim(0)  # Changed from custom=0 to standard Matplotlib syntax
             plots.show()
```

In [57]:
```
poverty_timeline('Poland')
poverty_timeline('India')
poverty_timeline('Nigeria')
poverty_timeline('China')
poverty_timeline('Colombia')
poverty_timeline('United States')
```

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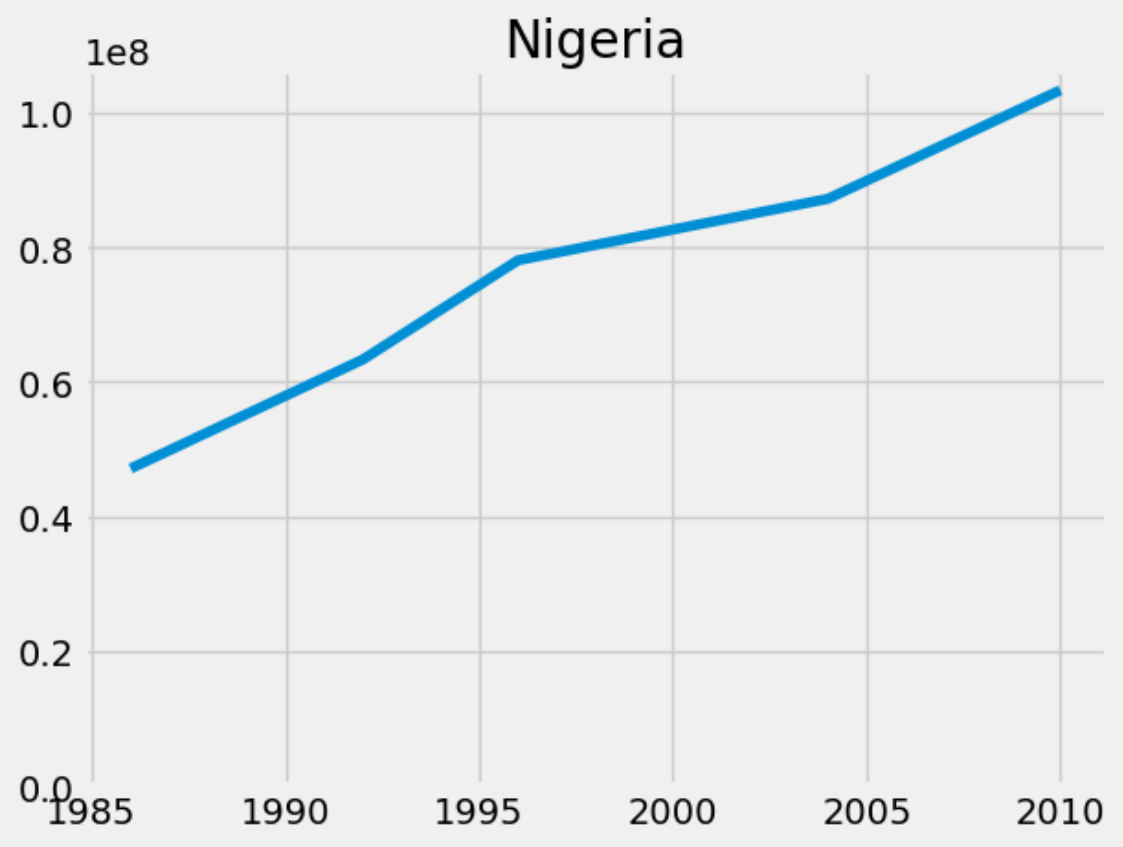
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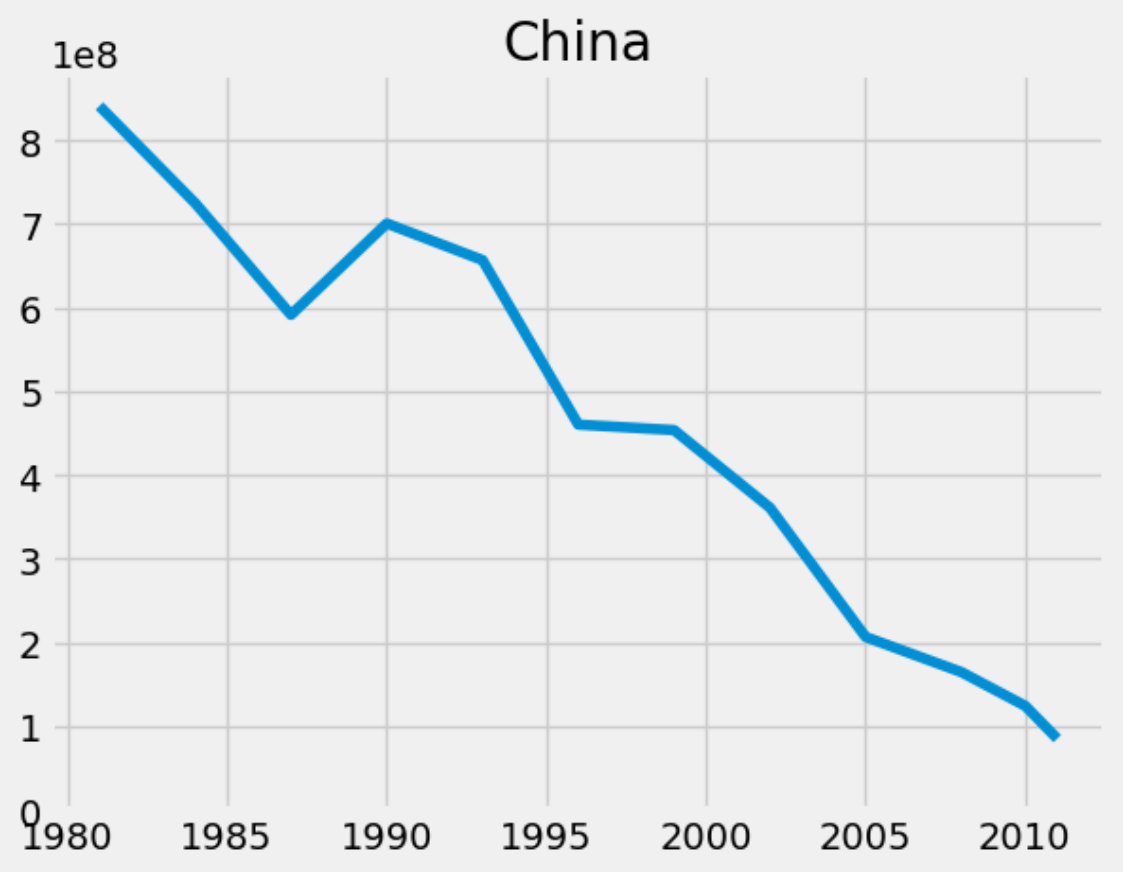
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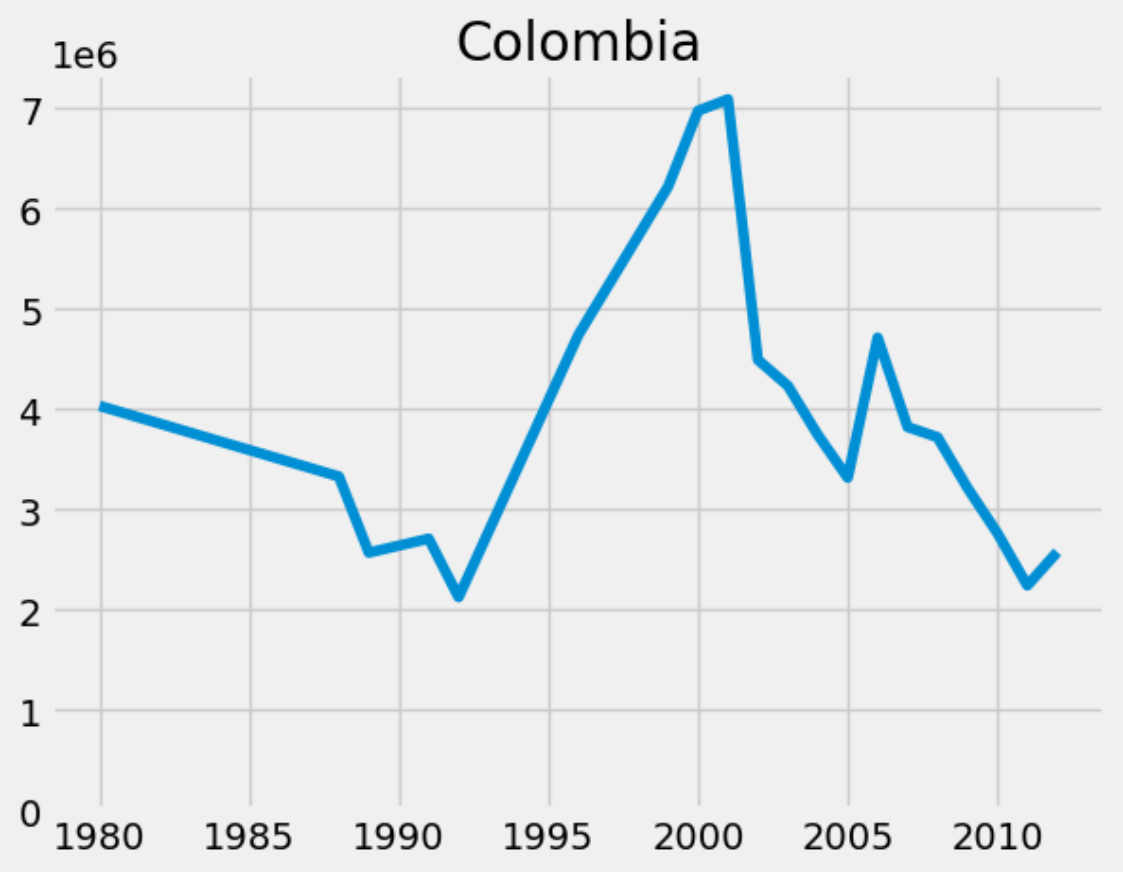
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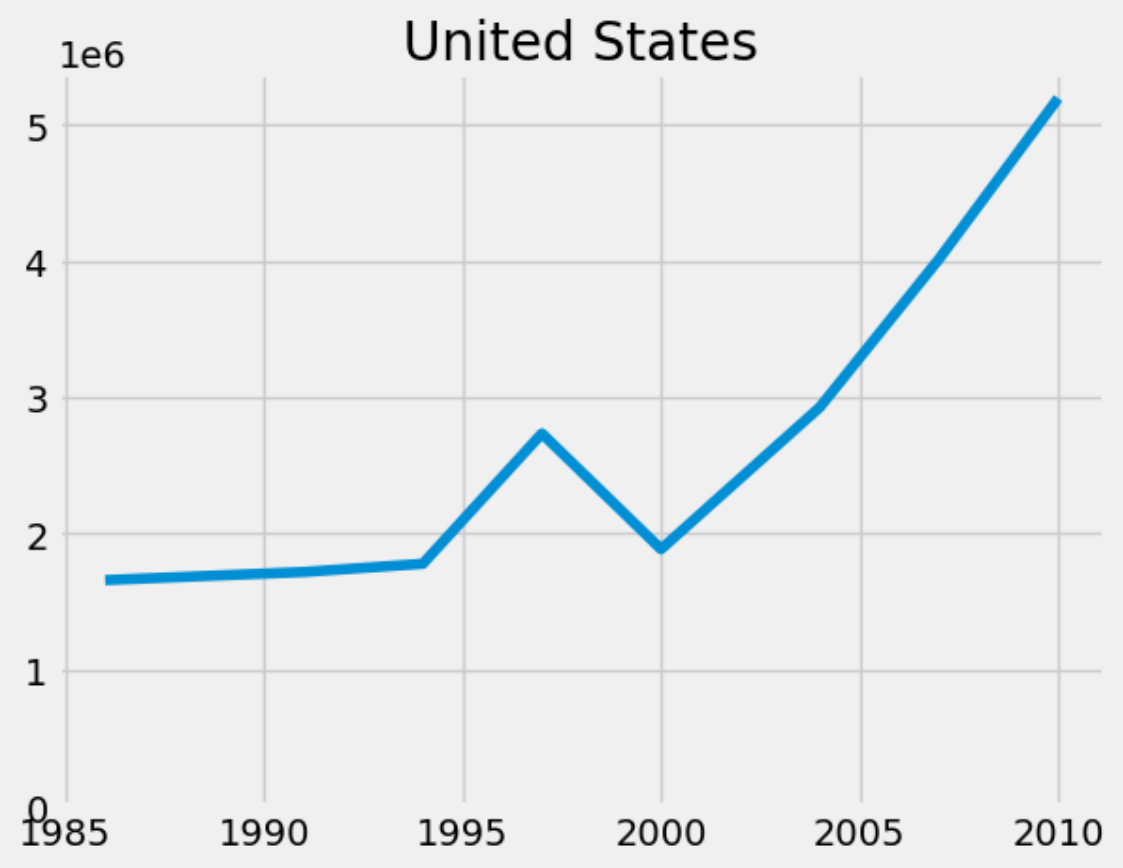
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