

# WORLD CEMENT STATISTICS BOOKLET

with Country Level Data



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## **with Country Level Data**

**A country-based time-series set of cement  
consumption/production data in graphical  
format**

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- Cement Consumptions vs GDP: A Review

## INTRODUCTION

### A COUNTRY-BASED TIME-SERIES SET OF CEMENT CONSUMPTION DATA IN GRAPHICAL FORMAT

This Booklet presents in a graphical format a large dataset of country-based statistics of cement consumption, complemented with macro-data on population and GDP.

To our understanding there is no such compilation of data readily available with similar depth and breadth.

The data cover 185 countries (some of them already gone as the USRR, others are far more recent as Timor-Leste). The time-series varies in extension: in few cases it starts in the XIX century, but for most countries it begins in the 60's and reaches 2018/19. In the case of some former Soviet republics the data opens in the 90's.

While it is a large enough dataset, with over 100,000 yearly data points, neither all countries nor all periods are equally covered.

The sources include more than 400 technical documents of diverse types, whose quality is uneven, as we discuss below.

The Booklet provides for the majority of countries a complete enough longitudinal view, and it allows cross-country comparisons.

The project started in 2017, and we have uploaded it to our webpage (<http://globbulk.com/Cement-vs-GDP>). This Booklet presents a major update of the data included in the web version, which we also intend to revise. We plan to continue gathering information and releasing periodic reviews of both the Booklet and the webpage. The reader is welcome to provide additional input to [ricardo.gonzalez@globbulk.com](mailto:ricardo.gonzalez@globbulk.com)

The set of data is presented by country, and for each country there are six charts showing:

- The evolution of population vs time (mostly from 1950).
- The evolution of GDP vs time (mostly from 1960).

- The evolution of cement consumption vs time, in absolute and relative forms (Mt/y and kg/cap-y).
- The relationship between the per capita cement consumption and GDP (with the GDP measured in standard and PPP forms).

### REMARKS ON THE DATA, FOR A BETTER UNDERSTANDING OF THE CHARTS

In the time span covered by this database there have been a number of changes in the international status of countries, mainly the de-colonization wave and the fall of the Soviet world. This creates some continuity and separation issues which we have not aimed at solving in detail.

A considerable effort has been devoted to spot data errors, and we believe that the larger ones have been cleared. If the charts show what may seem an outlier, it is likely that we have already double checked and confirmed that the source indicated that figure. In some few cases we have removed data which we thought was clearly wrong, but otherwise we present the information as provided by the sources. However, the database may still contain errors of different types and we appreciate the reader's feedback.

We have selected what we think are reliable sources of information, but not even this is free from difficulties:

- Population data is from the UN WPP (World Population Program), and we have only used this source.
- GDP (always per capita) is presented in two flavors: GDP at constant 2010 USD, and GDP-PPP (Purchasing Power Parity) at constant 2011 USD. The sources are the IMF's WEO (World Economic Outlook), the World Bank' WDI (World Development Indicators) and UN's GDP estimates. For some specific countries, mostly French DOMTOM, we have used other sources.

We show the data with greenish color for the GDP-PPP, and brownish for the conventional GDP. The reader can spot the considerable differences that occasionally arise among the sources.

- Cement consumption has been collected from more than 400 technical sources, either as a per capita figure, or as a tonnage/year. We have converted across them with the country population mentioned above.

The data includes (apparent) consumption as well as production. However, in some cases the sources do not make it clear whether they

refer to consumption or production, and the comparison of data may help to spot the difference. Data whose scope is explicitly production is represented as greyish dots, while the other sources are presented in different hues of red, brown and orange.

The reader will easily notice that the cement consumption/production data is rather blurry, especially since the year 2000. This is not only due to the difference between production and consumption, but probably intrinsic to the difficulties of measuring actual cement consumption and production at a country scale at different times.

It is worth noting that the majority of the sources are either official or professional, and that the “unqualified data collected from the general newspaper” that might create the uncertainty is a small fraction of the data. Some countries may also produce fake statistics, but that is also a minority, and easily identifiable.

On the same side is the observation that the GDP measured by different international organisms produce quite different results.

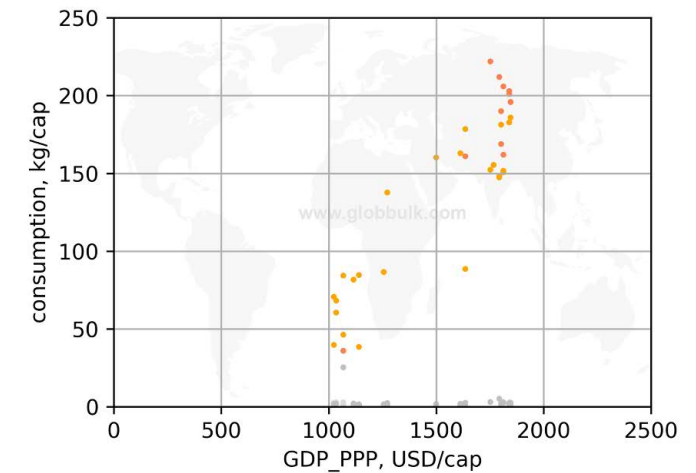
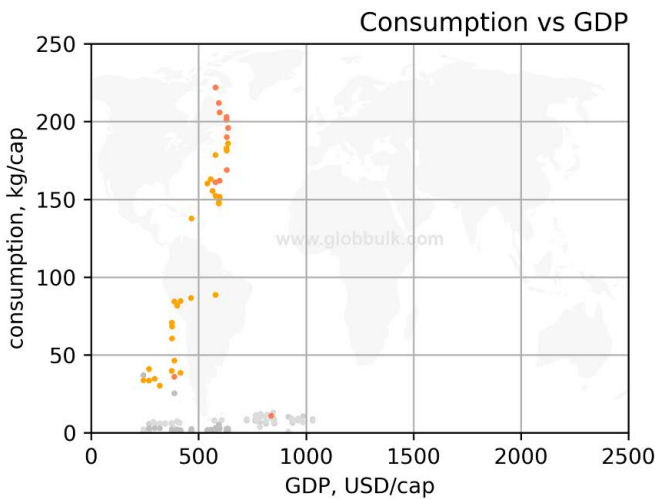
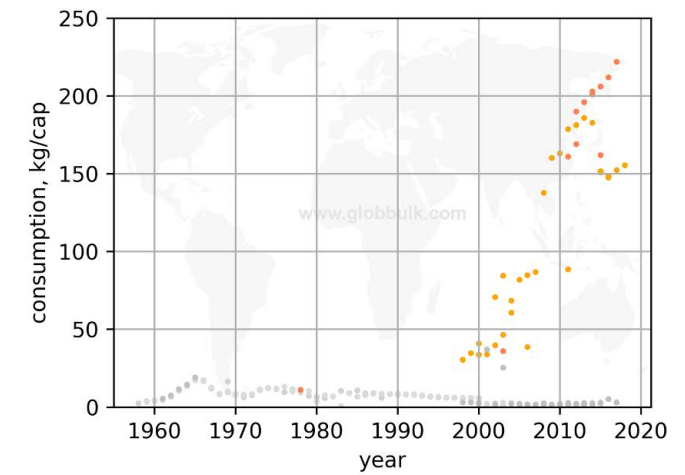
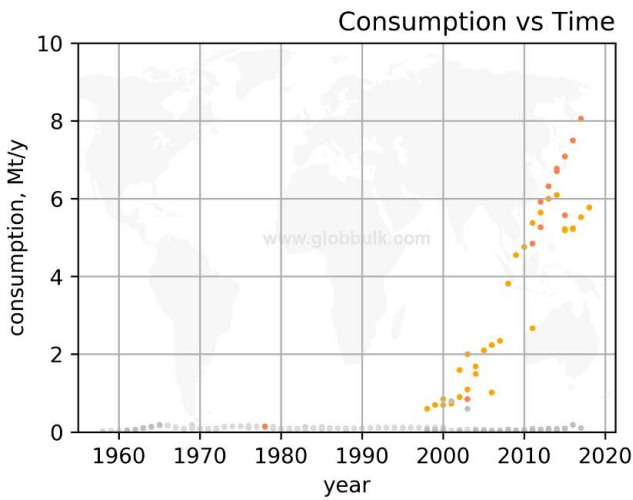
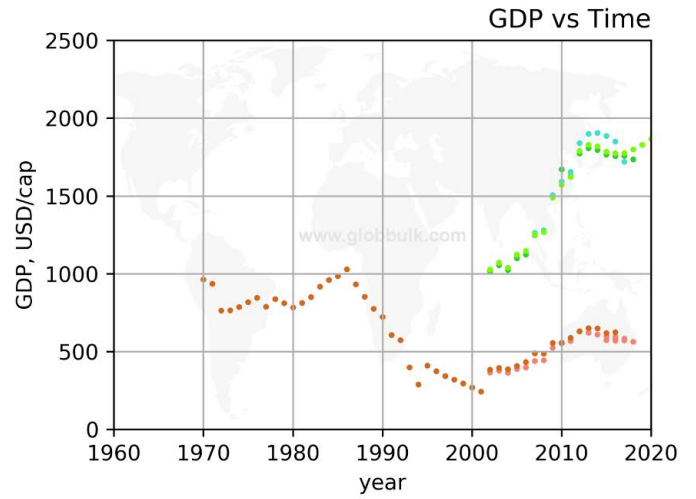
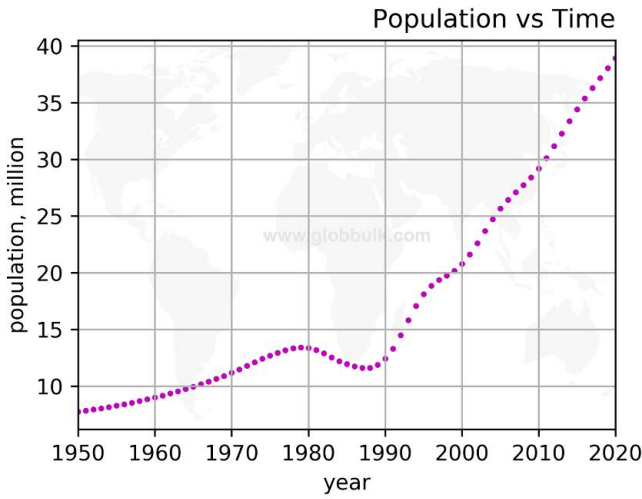
The obvious consequence is that if measurements of GDP and cement consumption or production have such uncertainties, as clearly shown in the charts, then the insight that can be derived from the conventional sources of data should be carefully evaluated.

As mentioned above, we have not screened the data unless for flagrant outliers, and we have preferred to show the data as published by the authors. It is possible to reduce the uncertainty through a detailed analysis, but that is beyond the scope of the Booklet.

A particular case refers to the relationship between GDP and cement consumption/production: at the final of the Booklet we include a review article on this relationship.



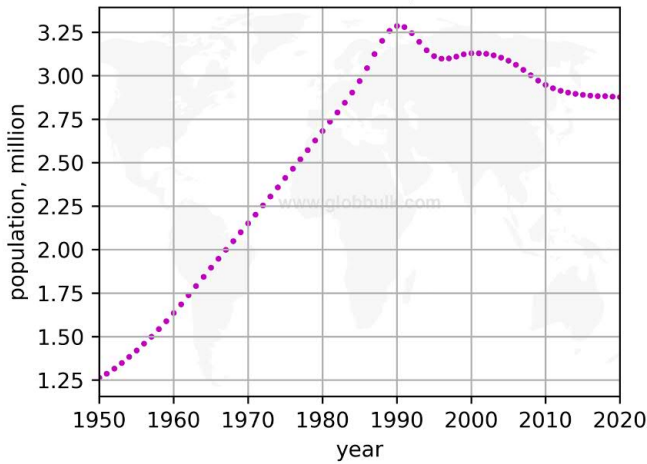
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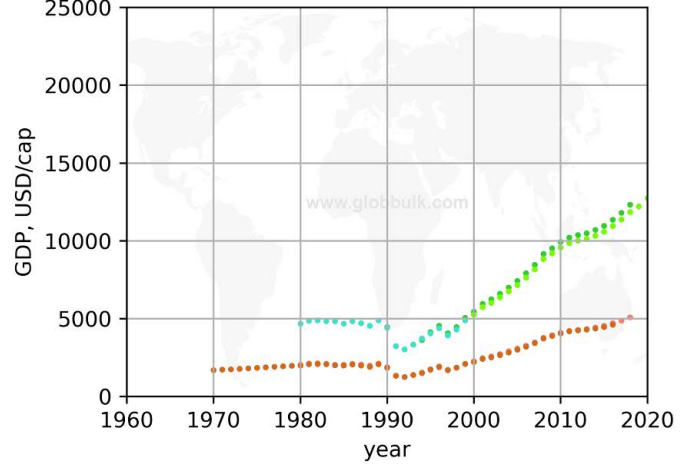


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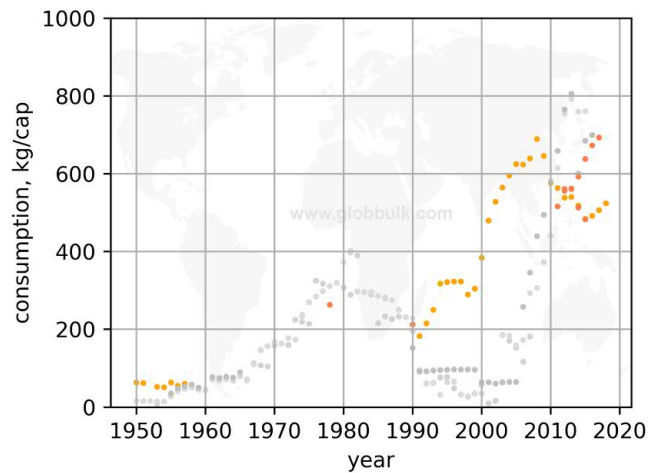
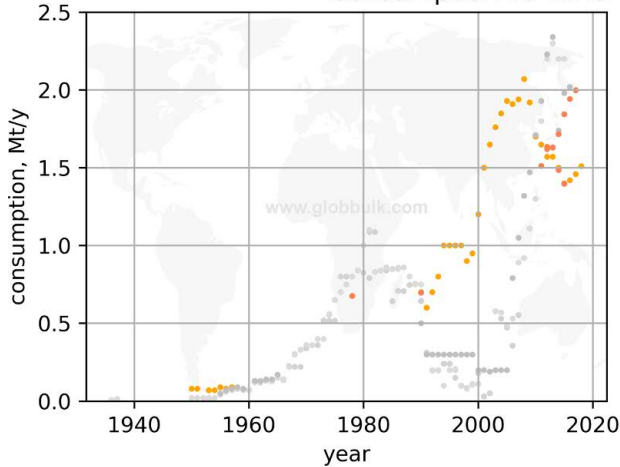
Population vs Time



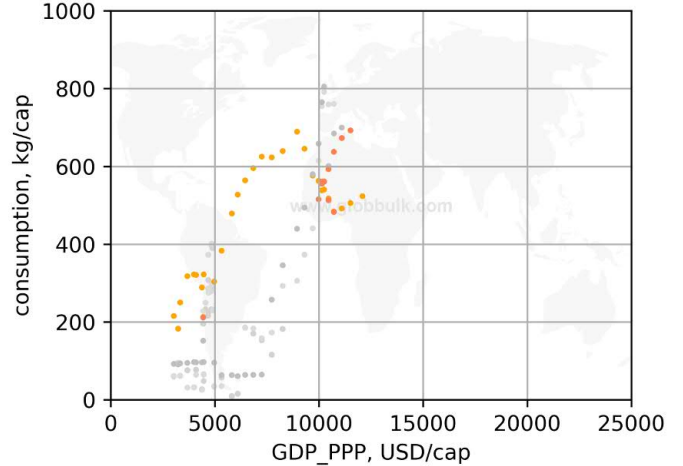
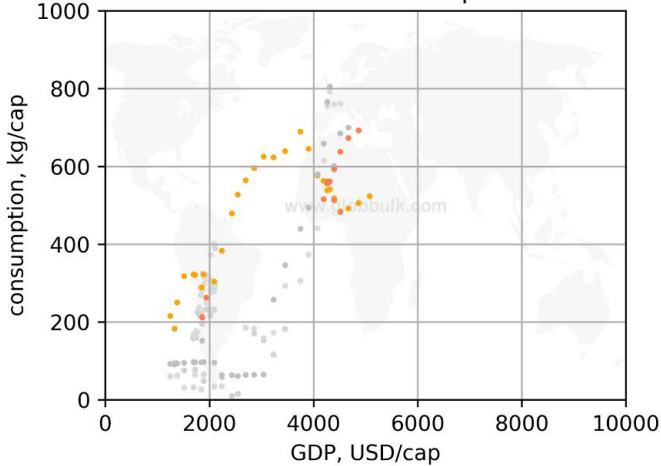
GDP vs Time



Consumption vs Time



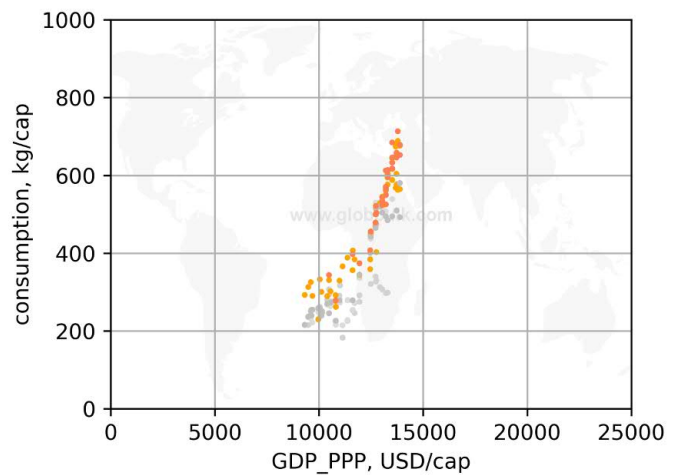
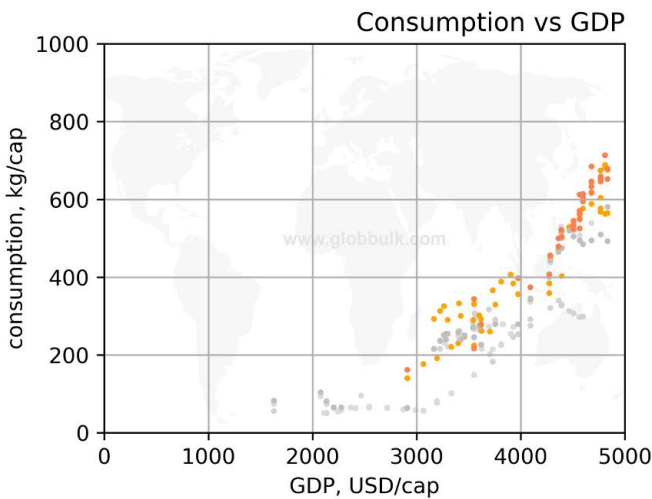
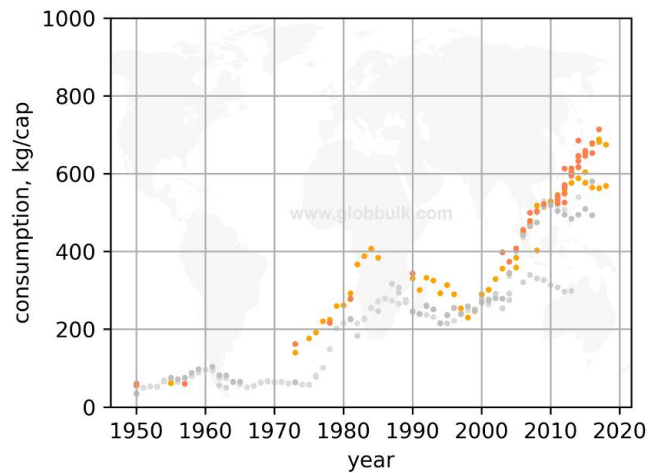
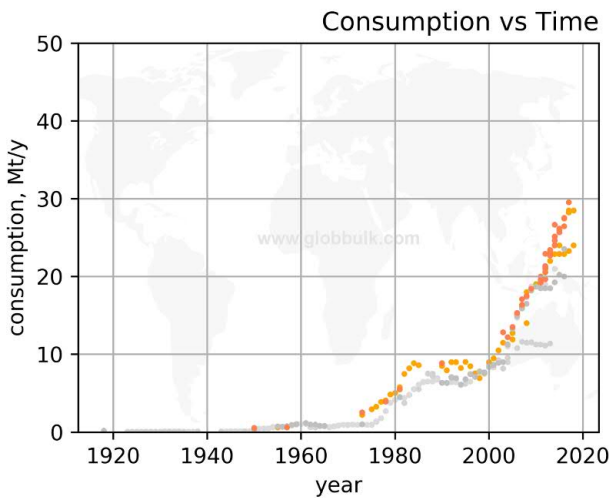
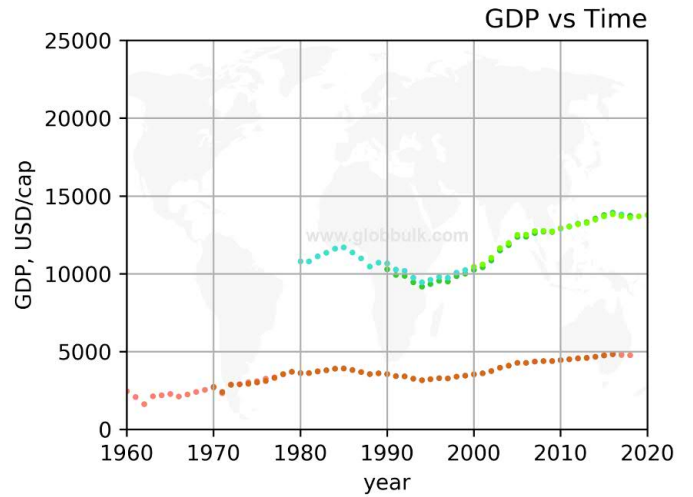
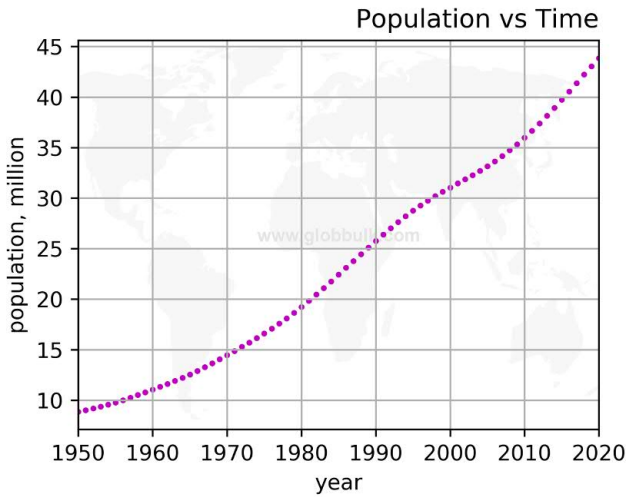
Consumption vs GDP





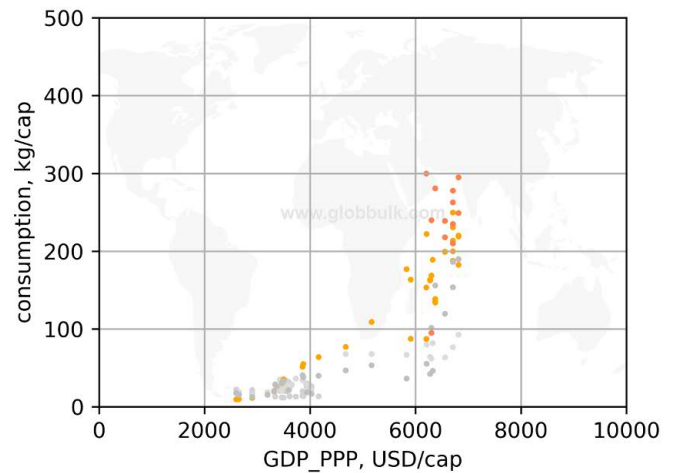
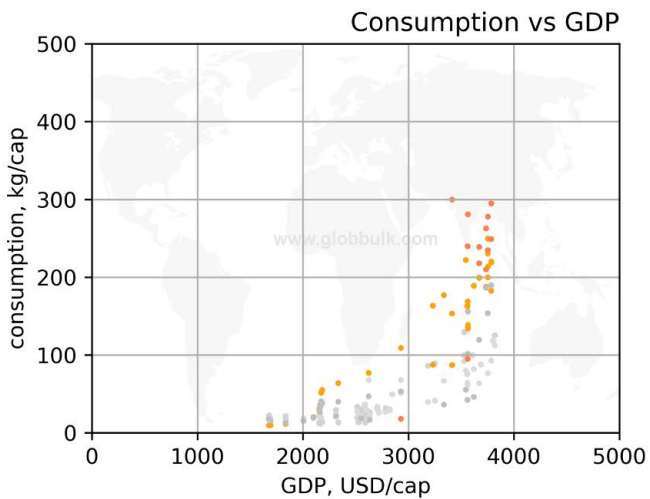
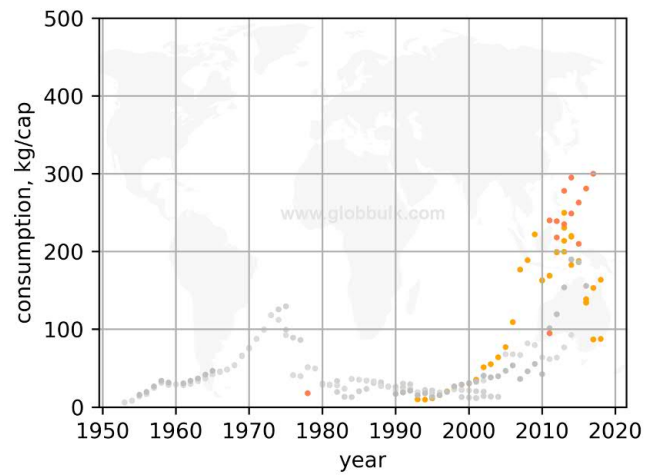
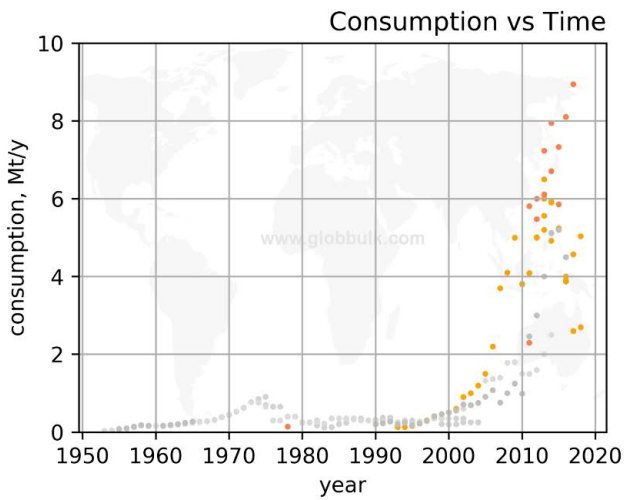
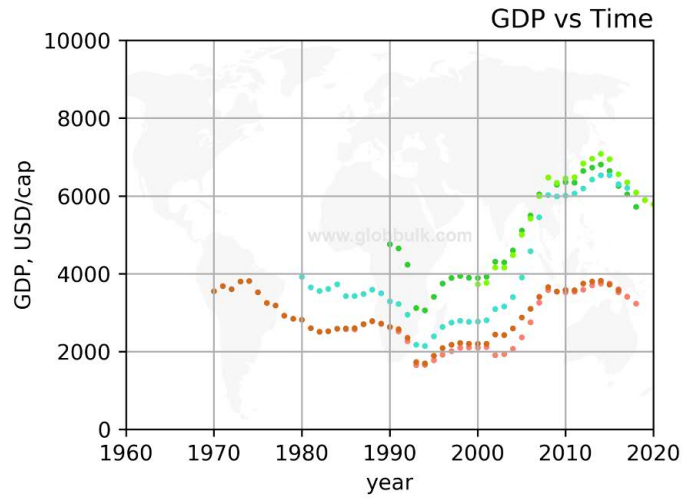
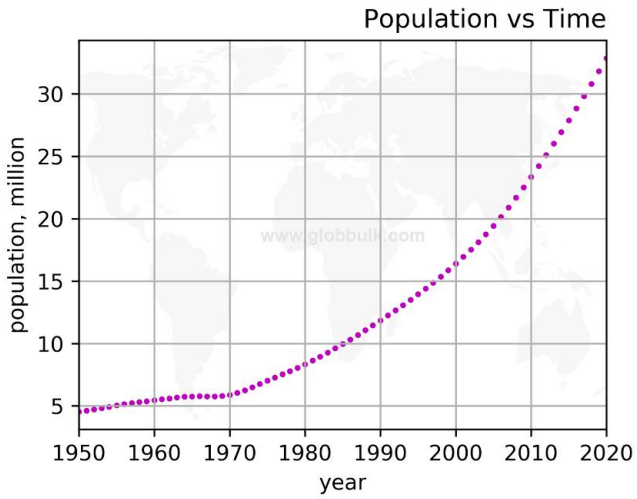


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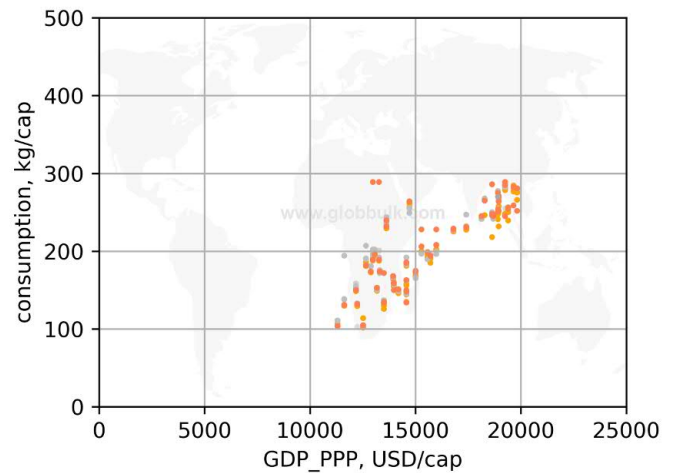
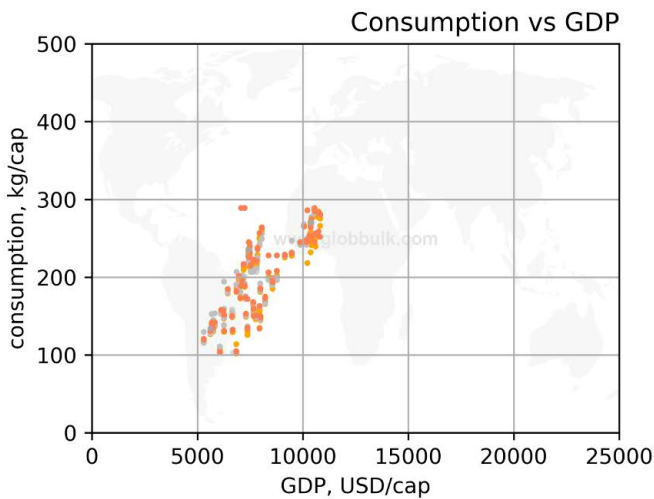
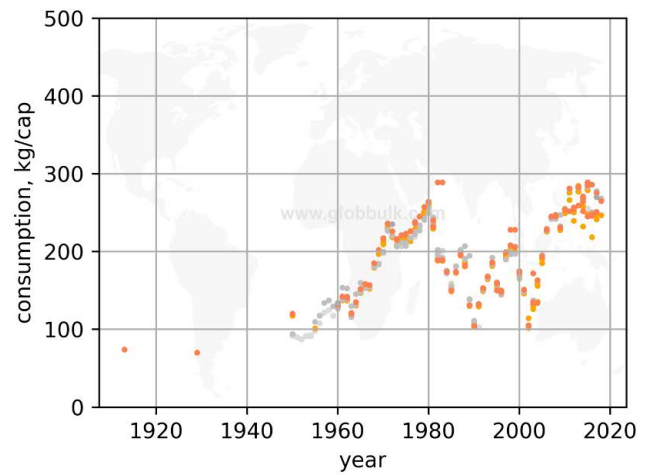
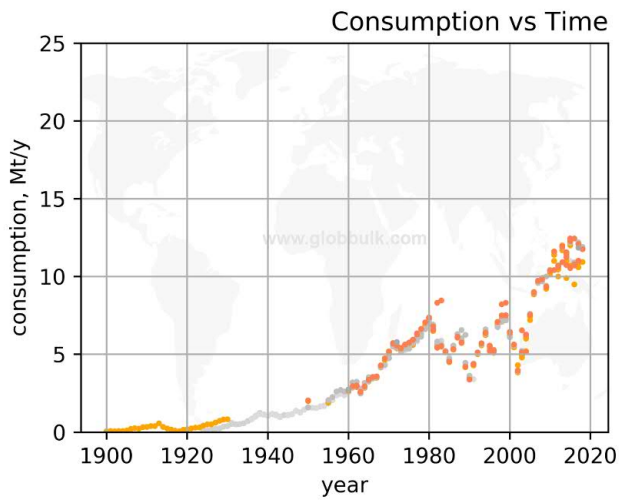
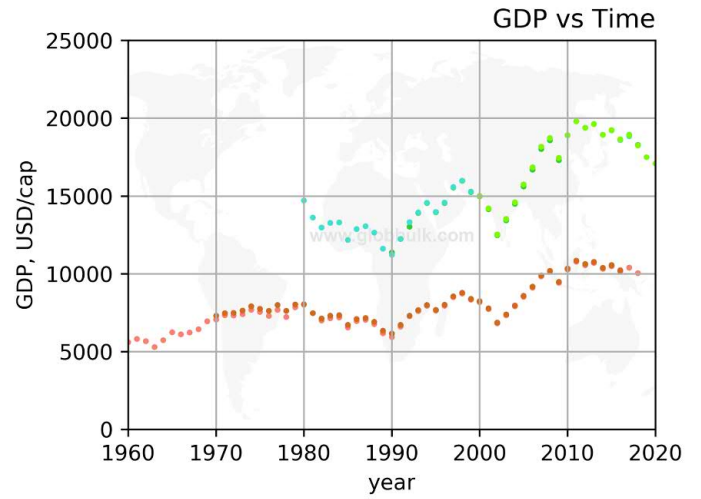
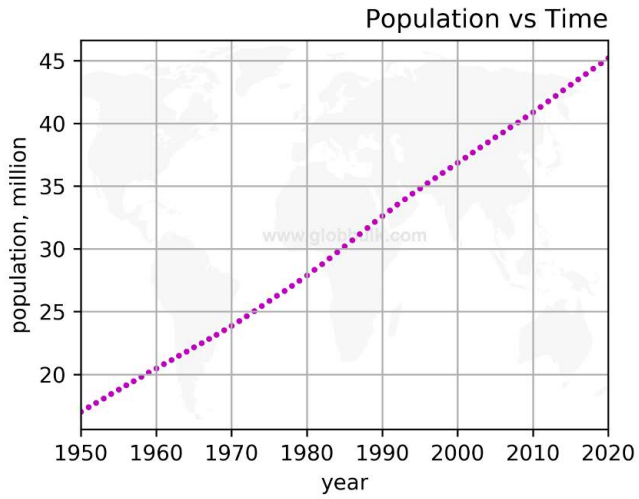


# Angola



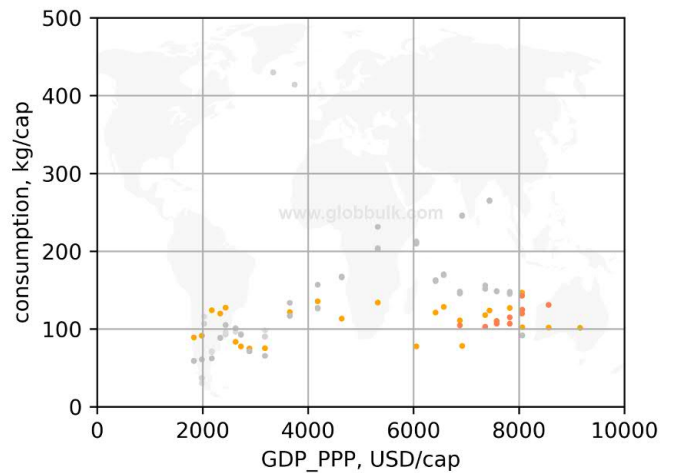
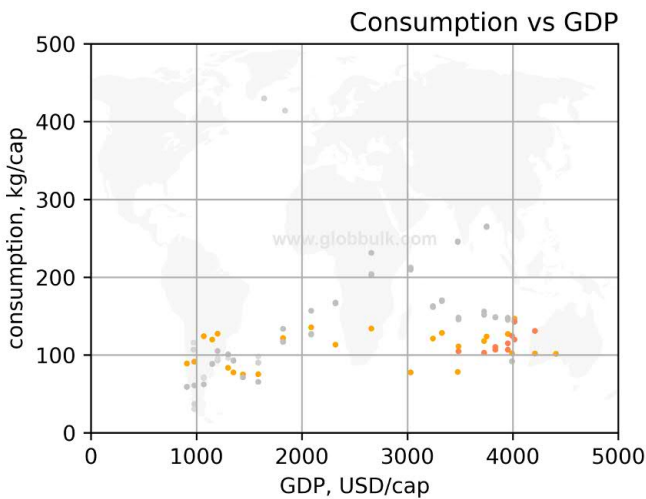
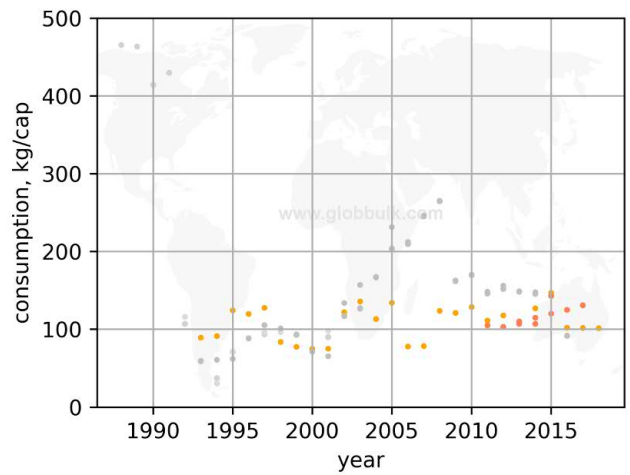
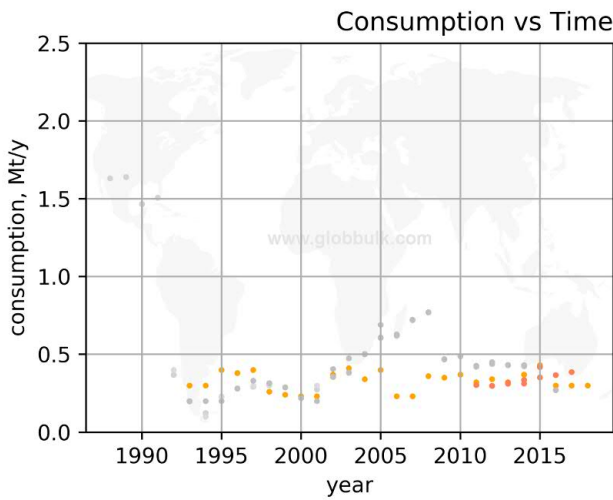
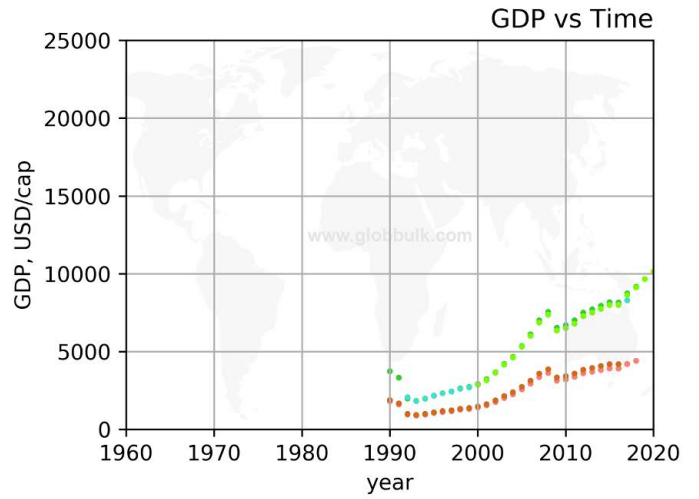
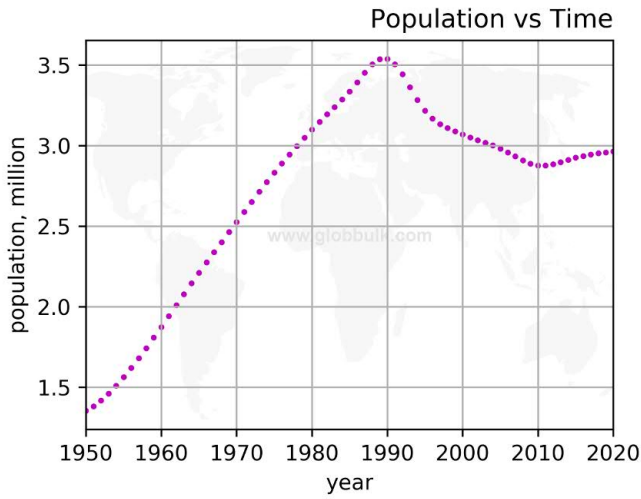


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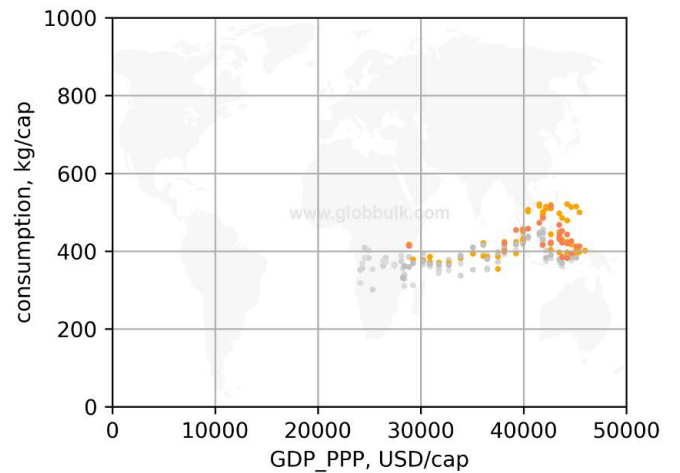
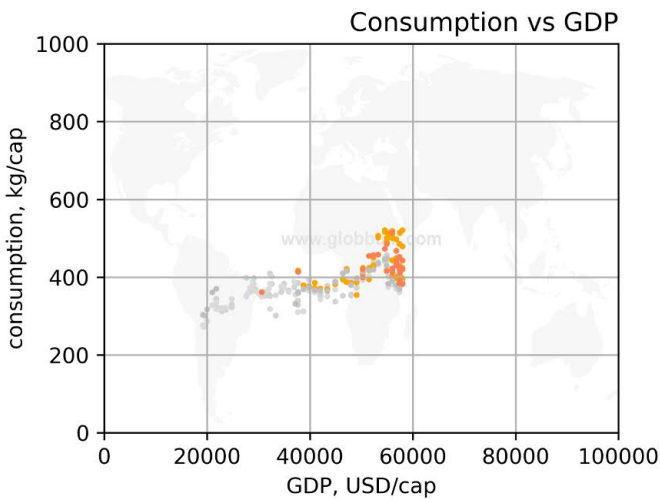
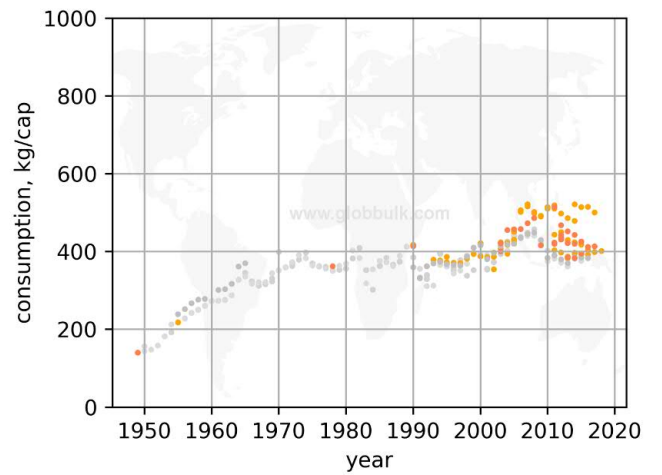
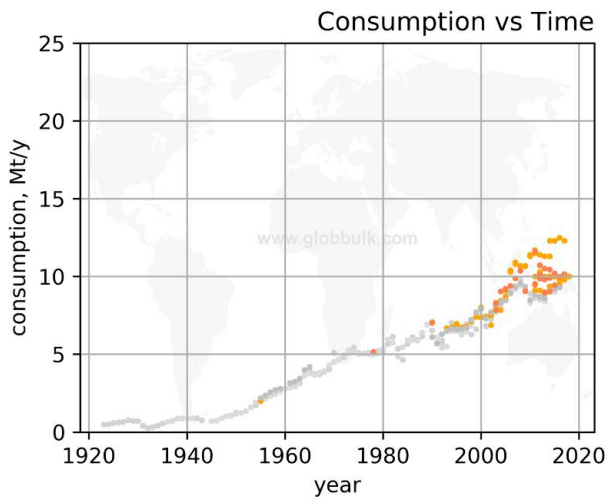
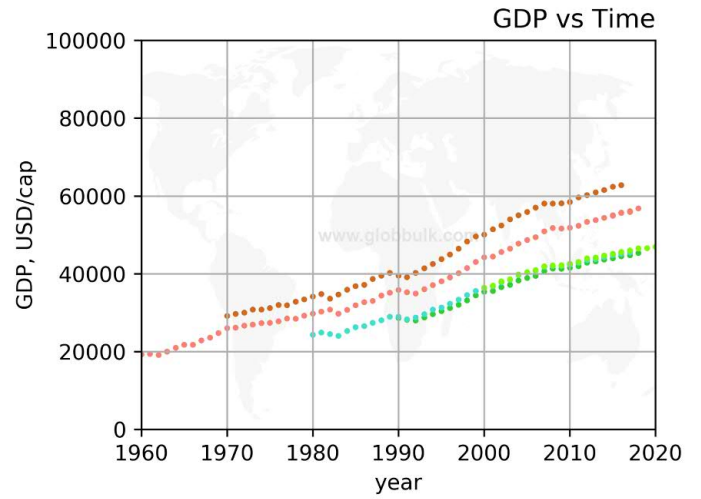
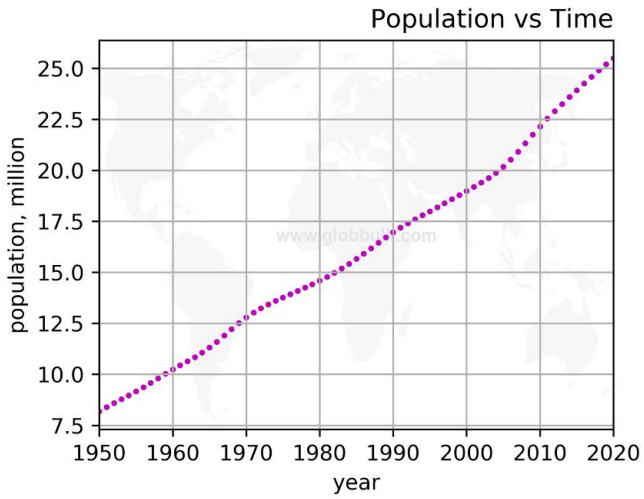


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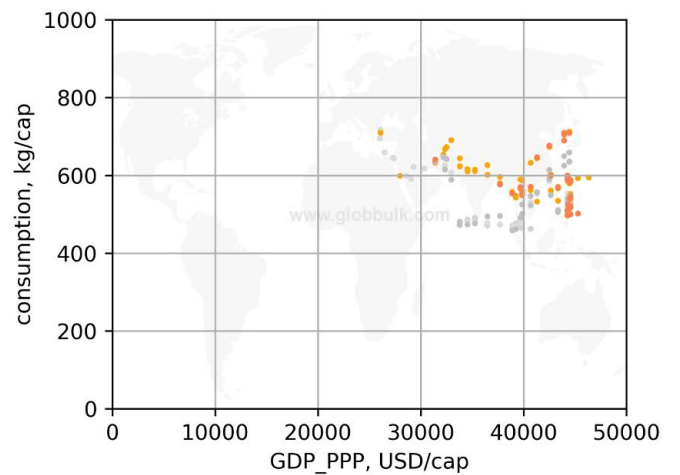
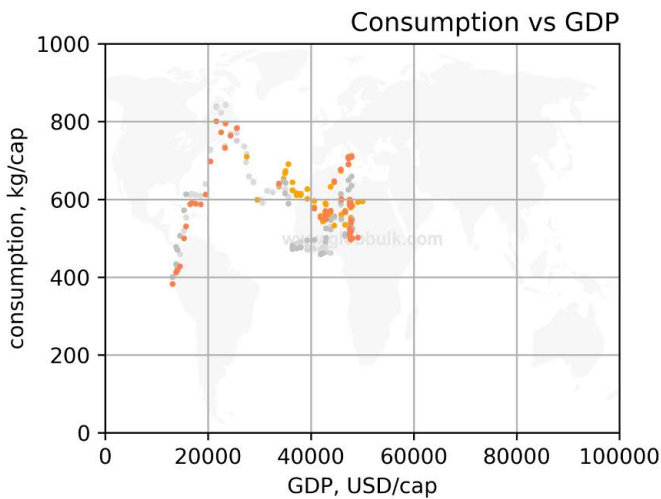
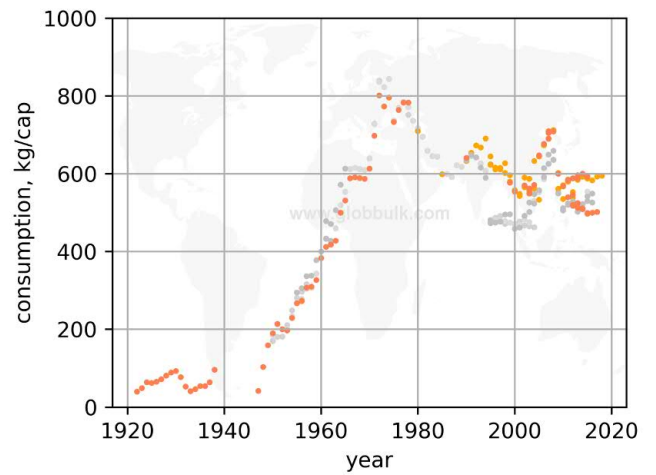
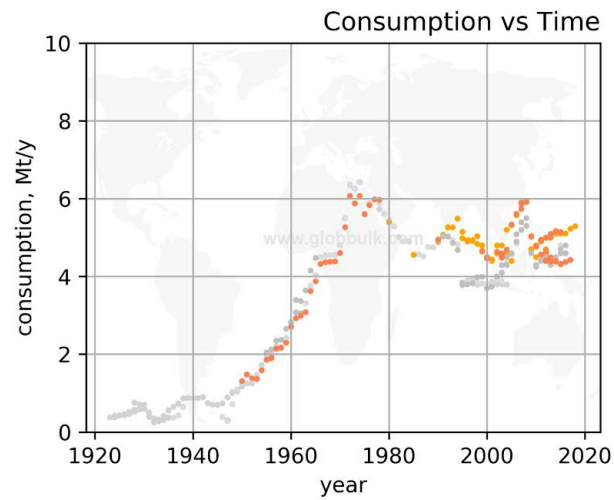
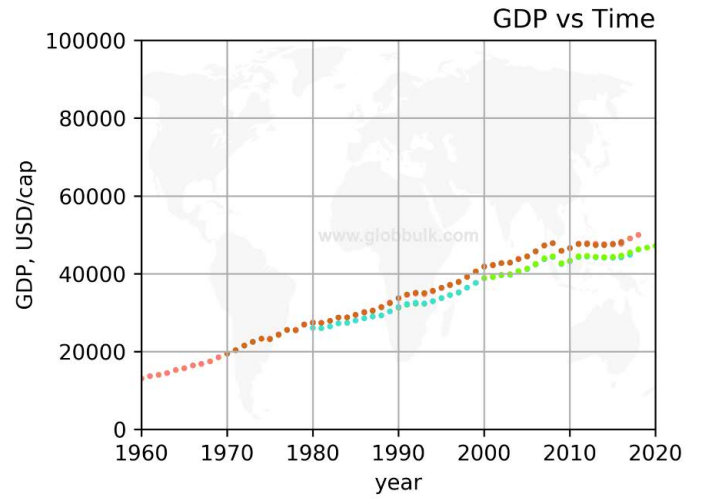
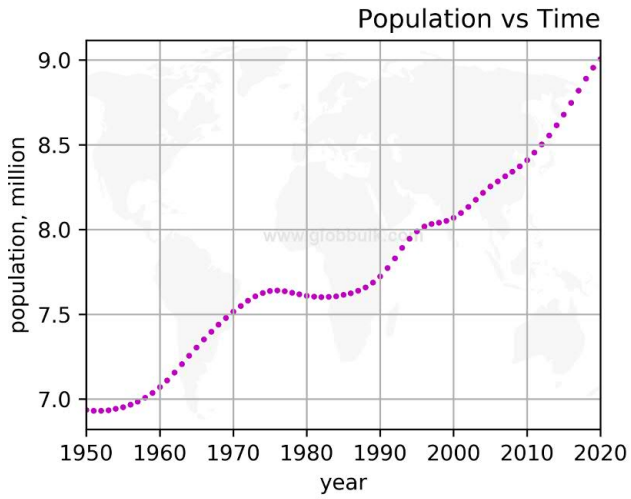


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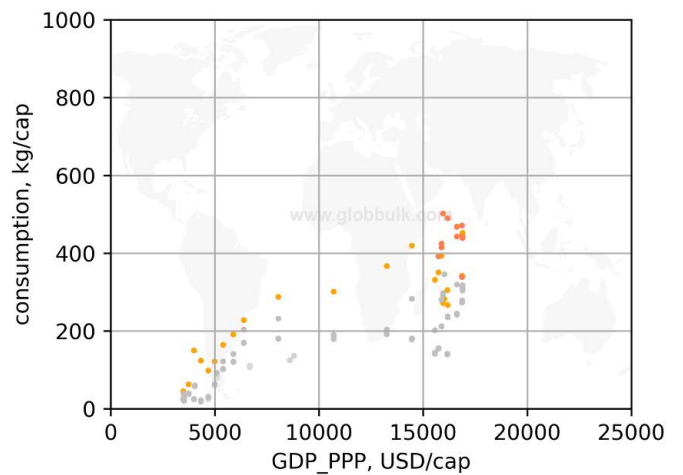
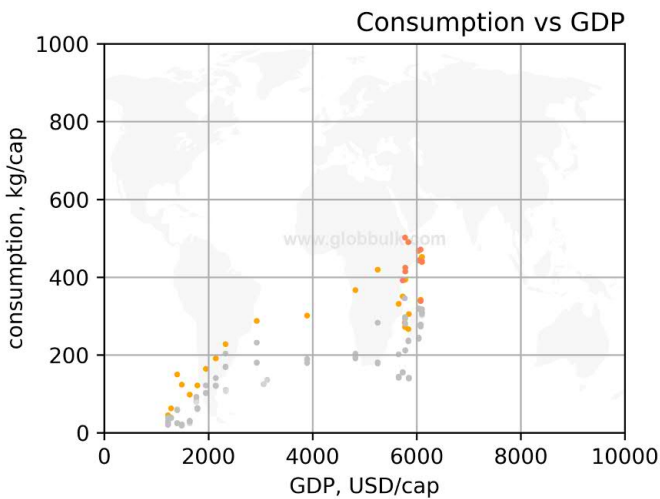
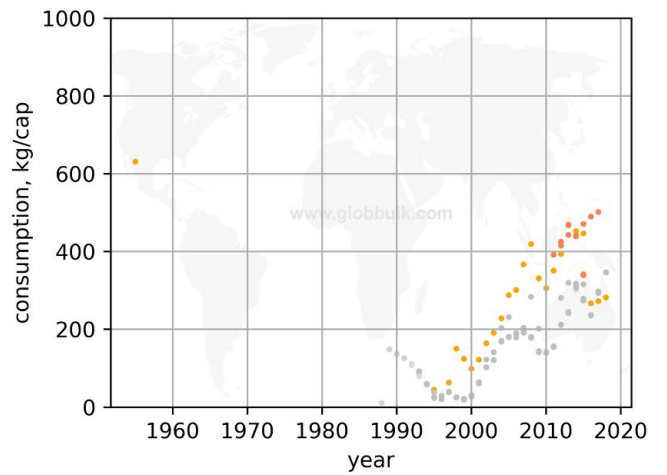
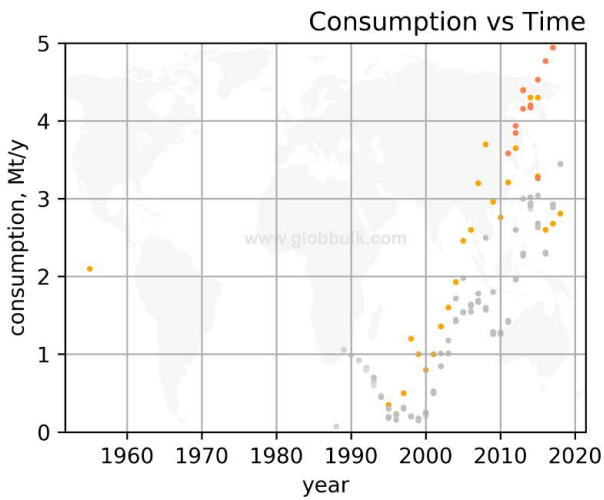
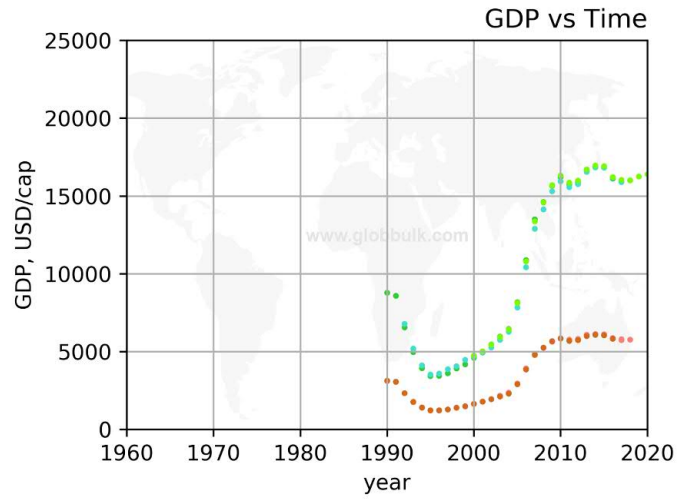
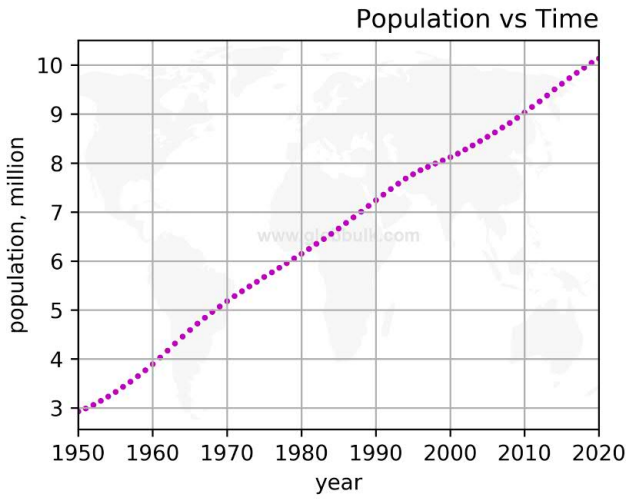


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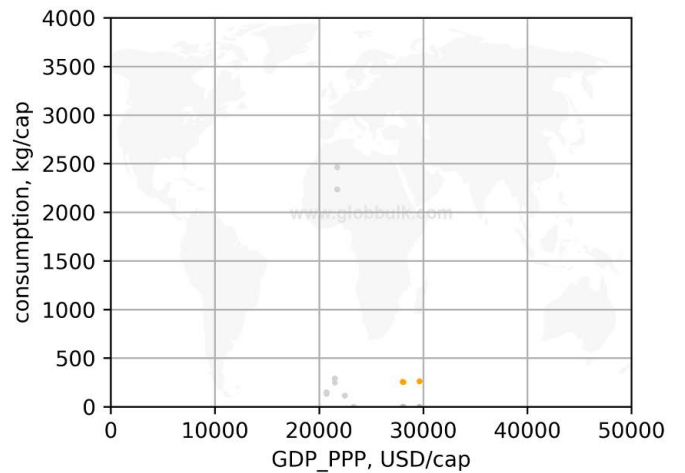
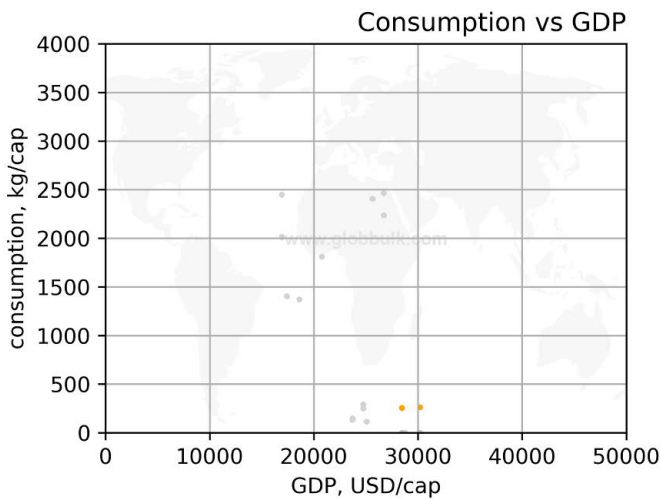
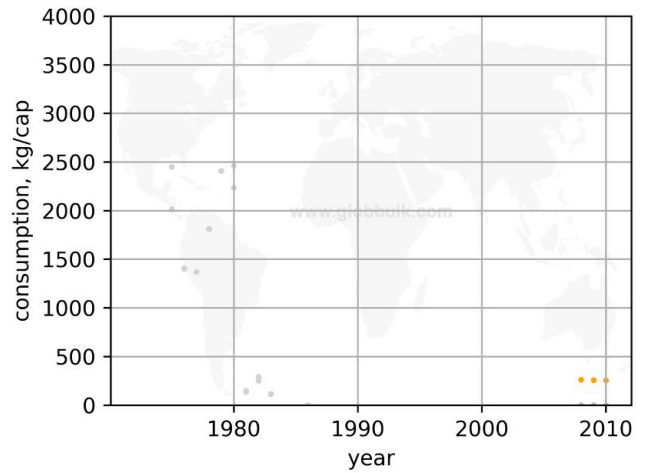
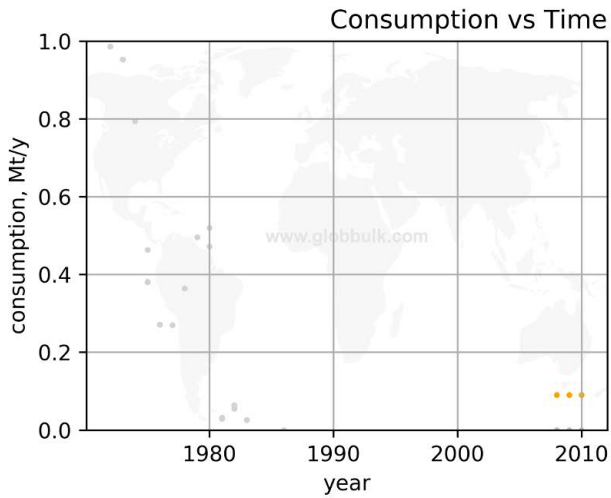
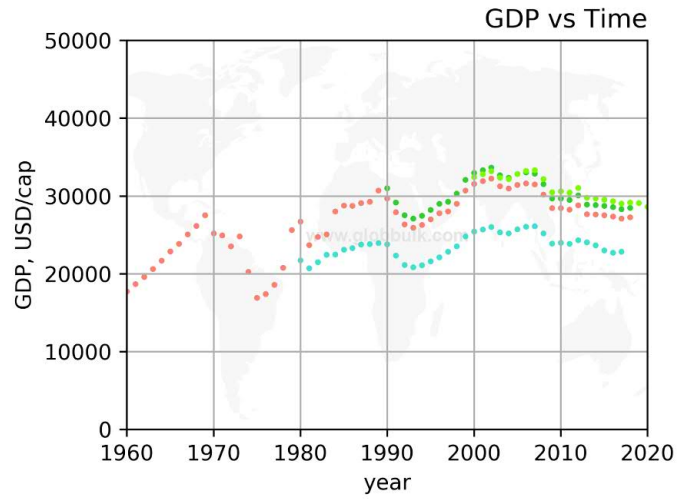
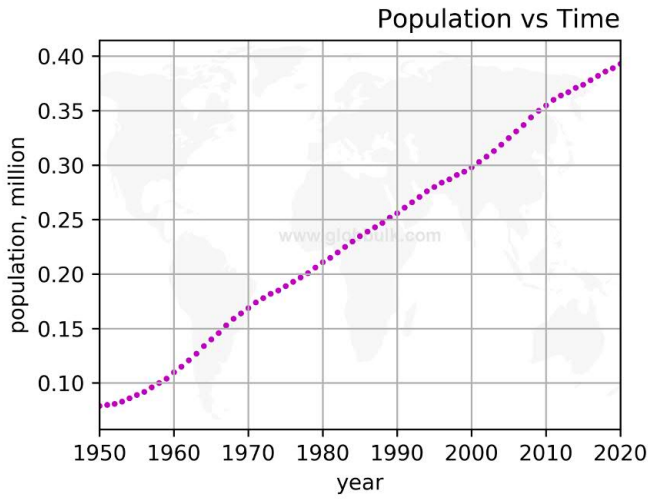


# Azerbaijan





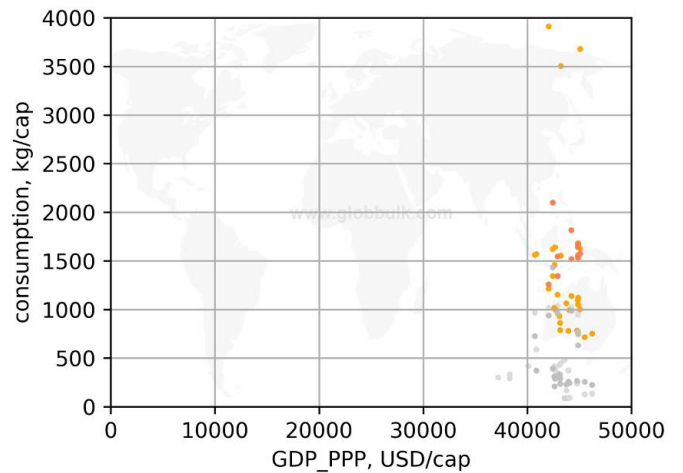
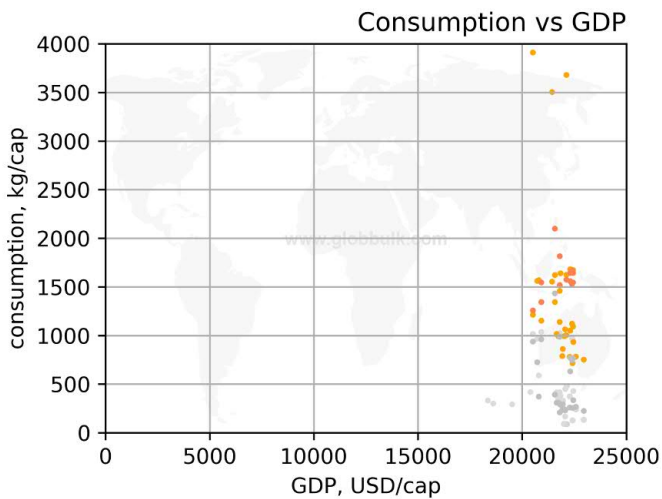
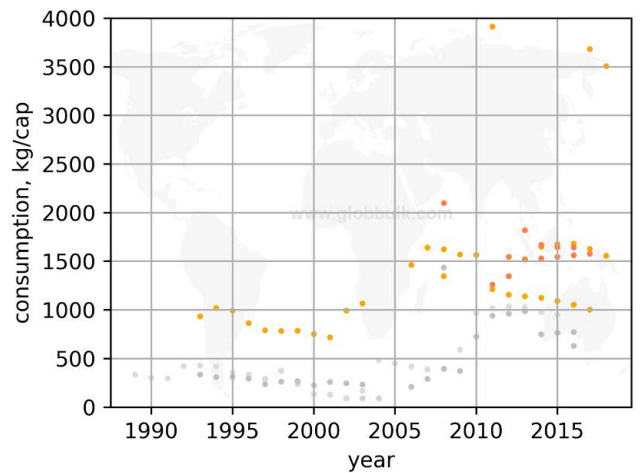
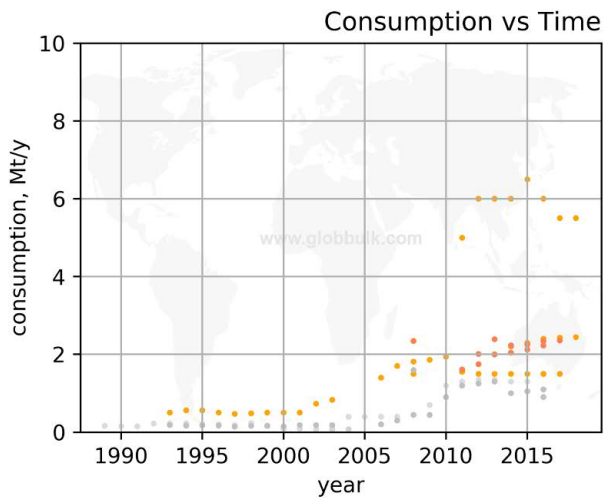
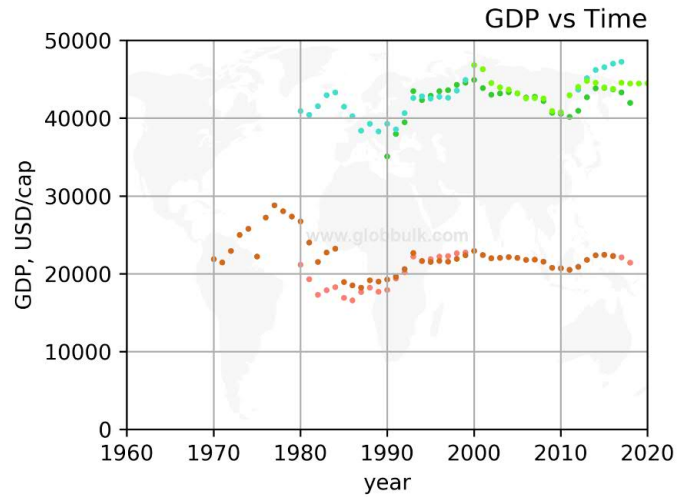
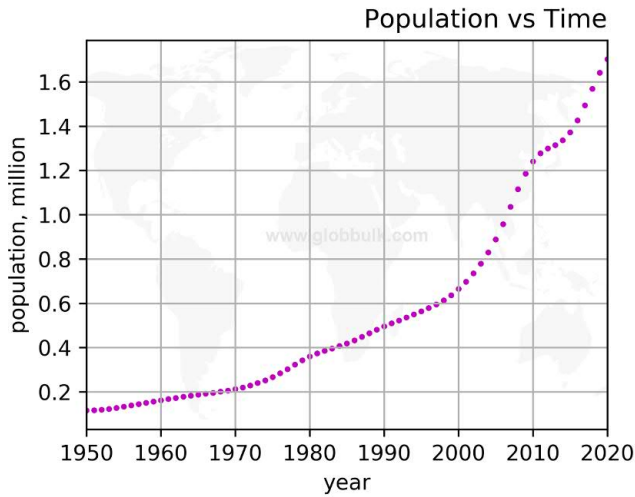
# Bahamas







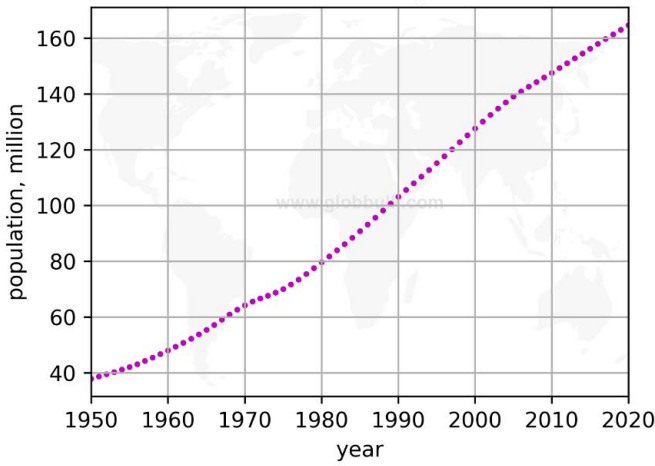
# Bahrain



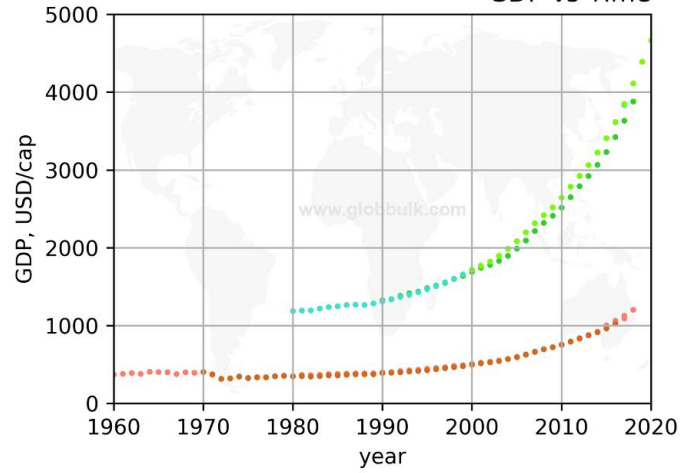


# Bangladesh

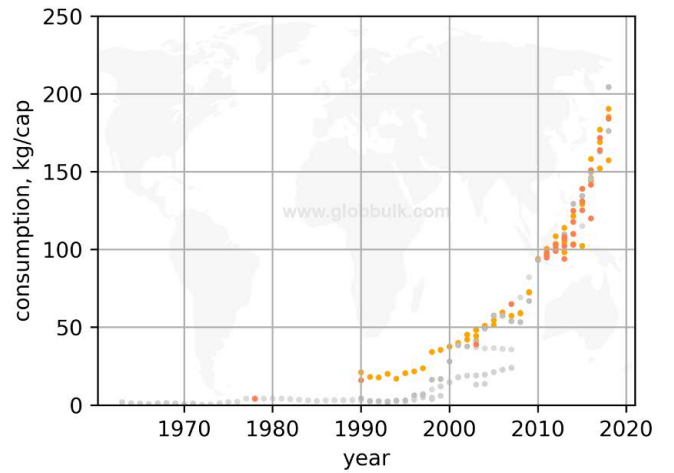
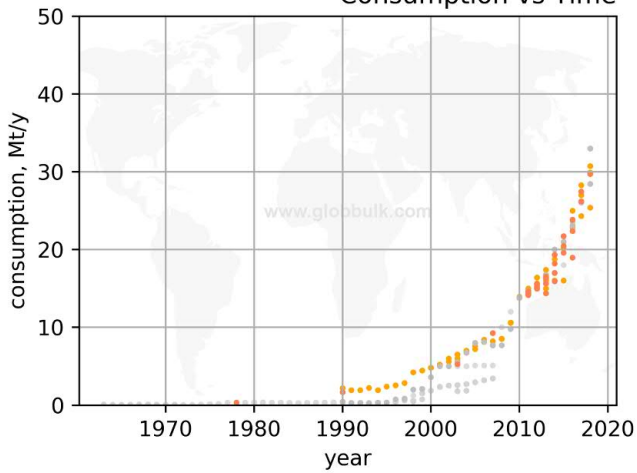
Population vs Time



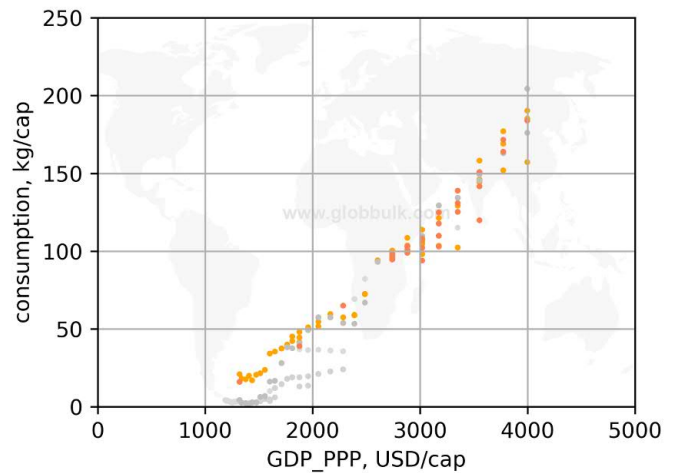
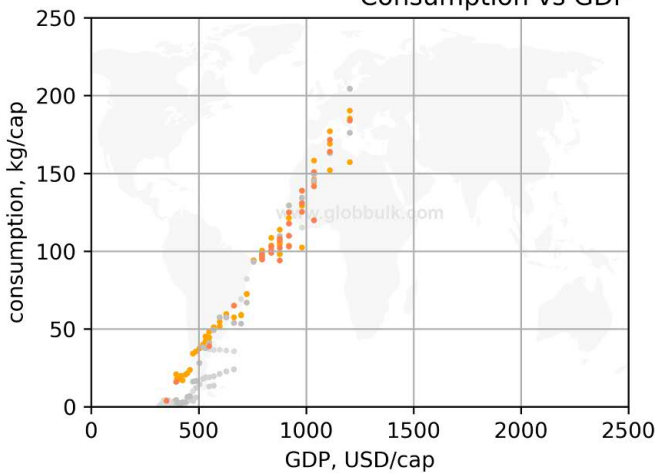
GDP vs Time



Consumption vs Time

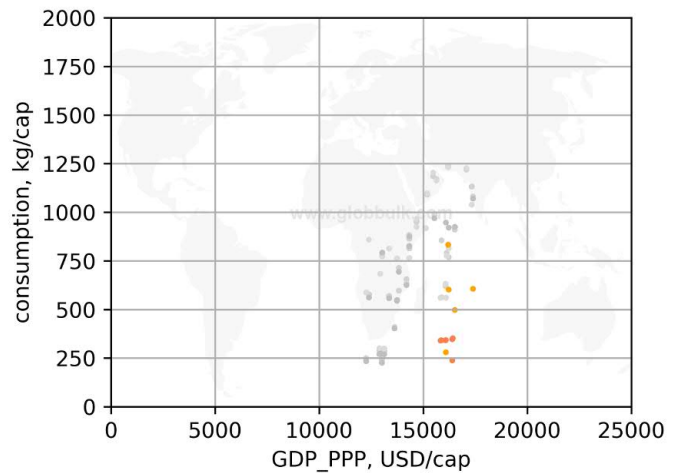
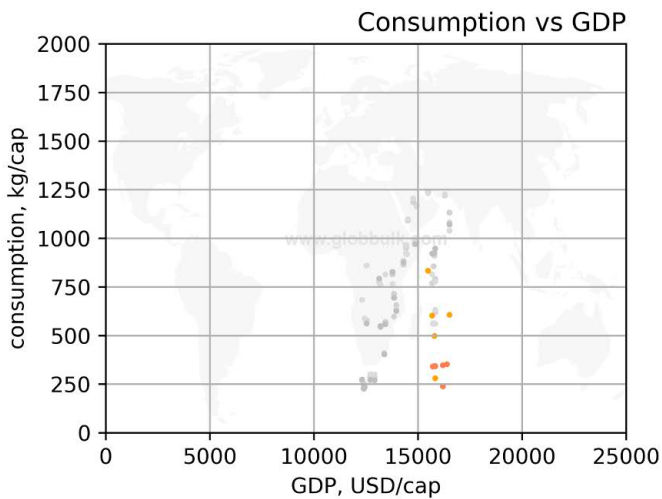
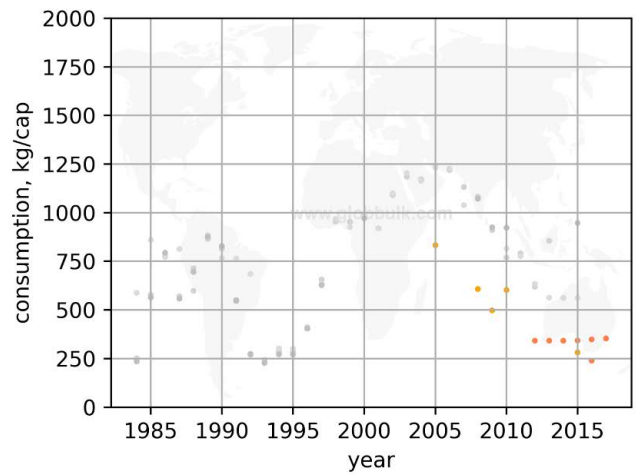
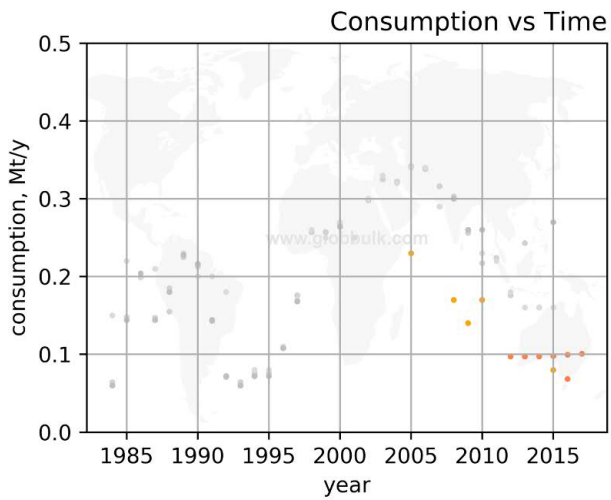
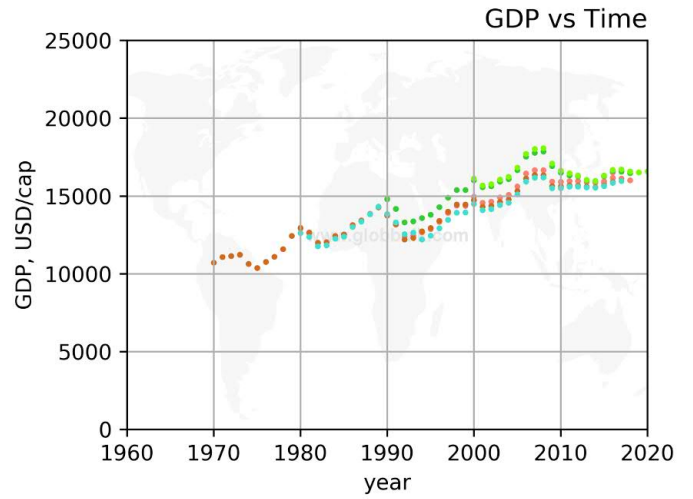
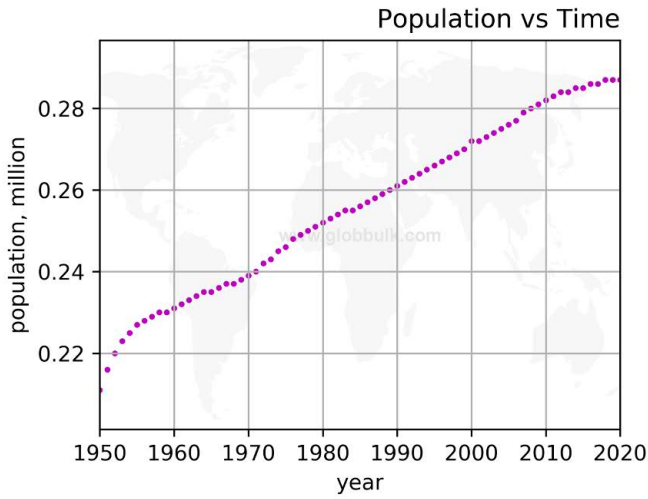


Consumption vs GDP



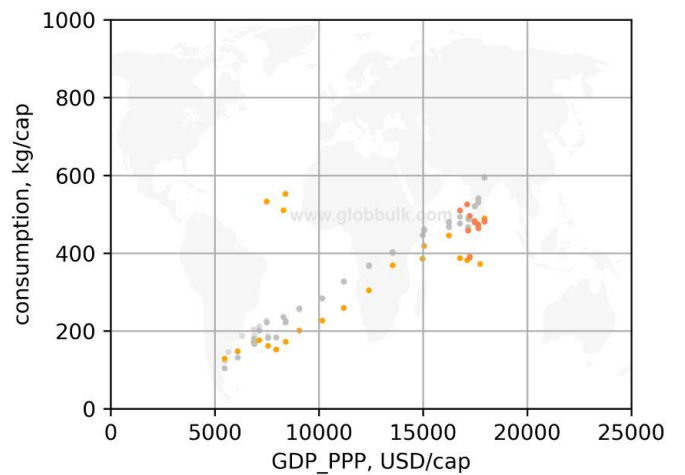
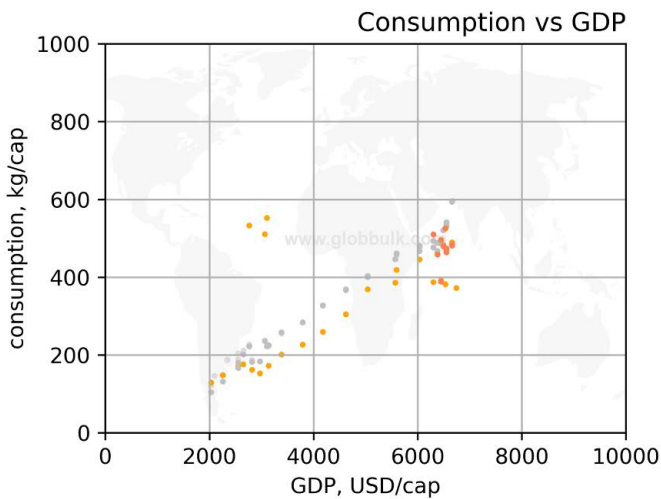
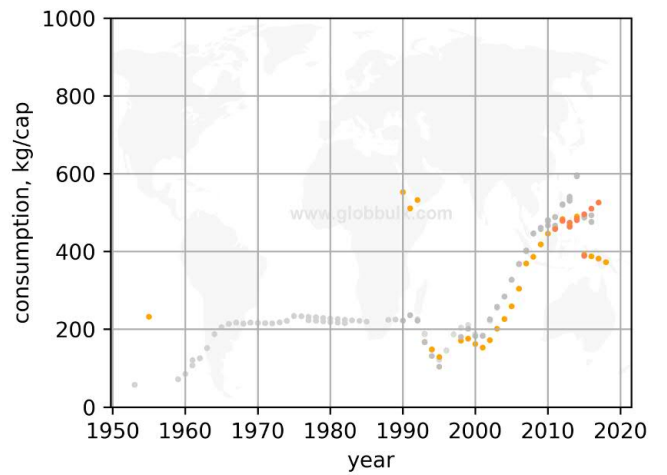
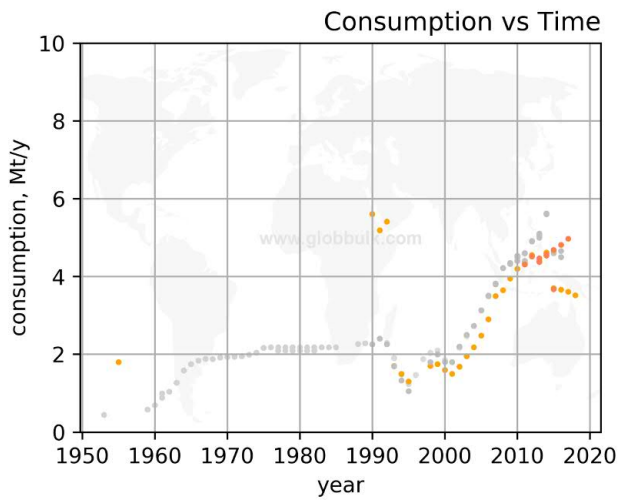
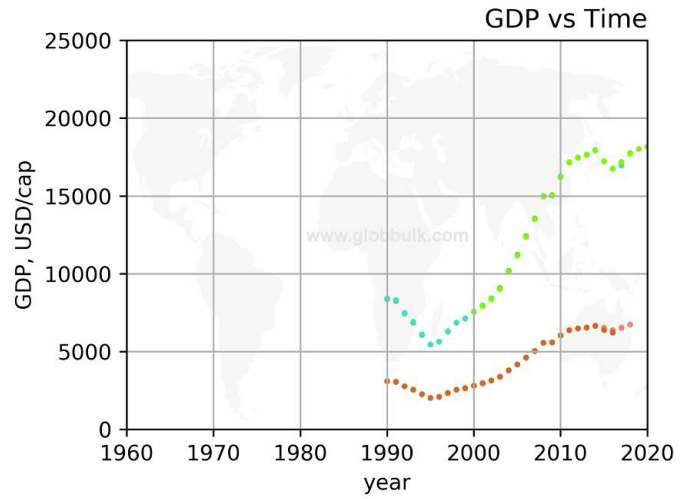
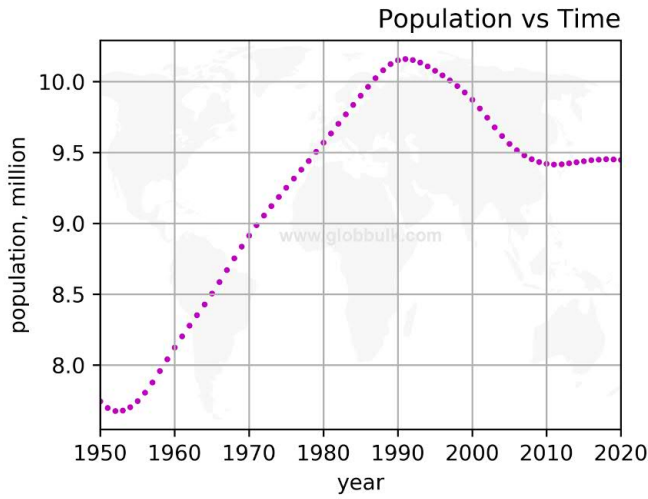


# Barbados



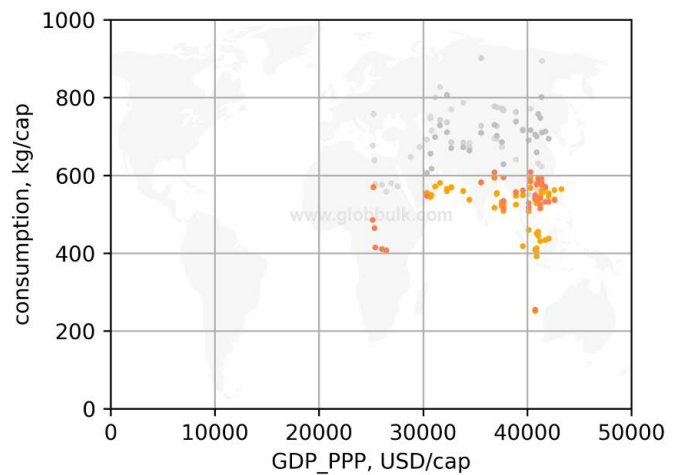
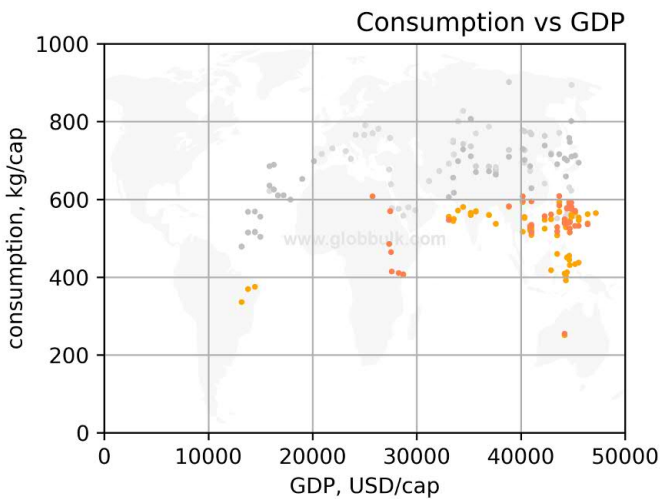
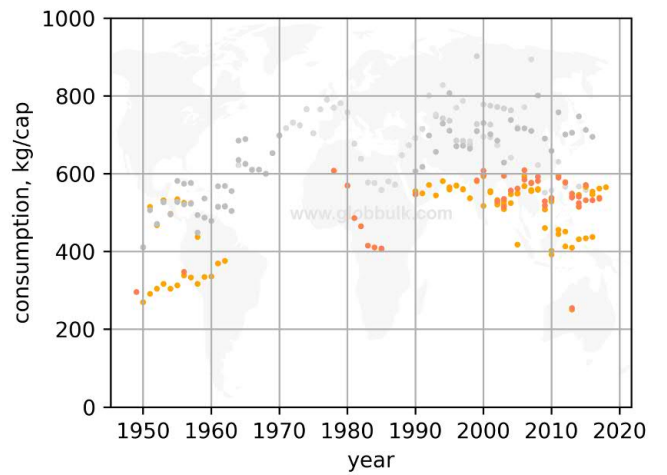
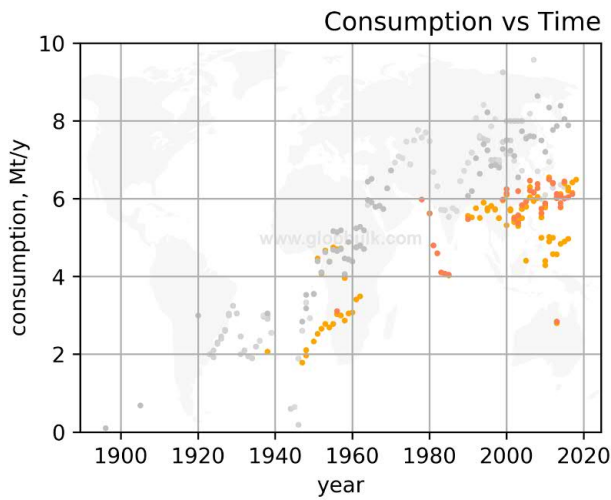
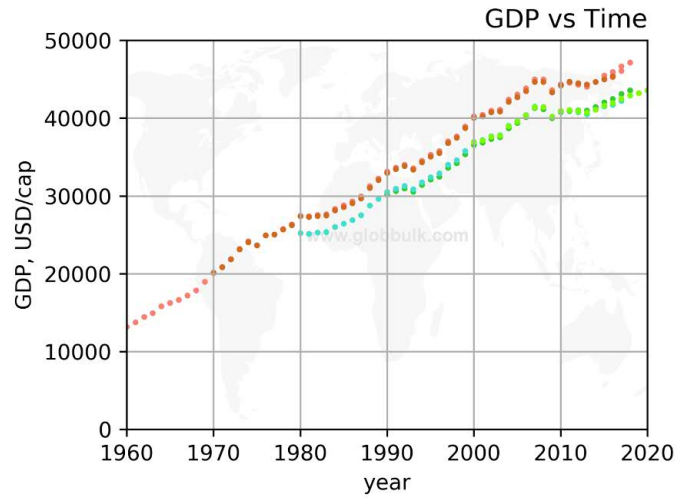
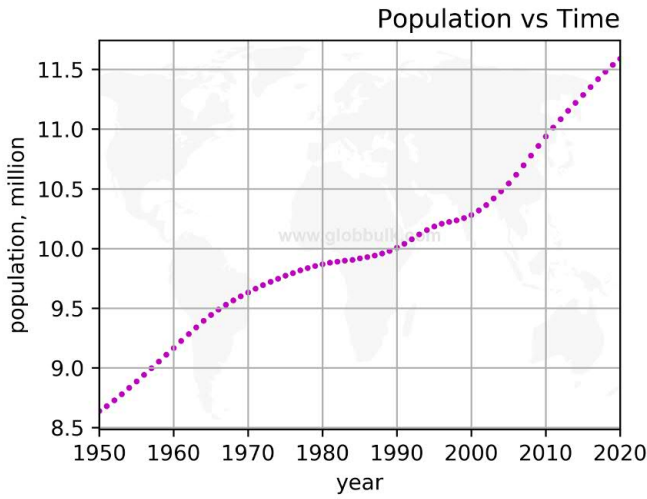


# Belarus



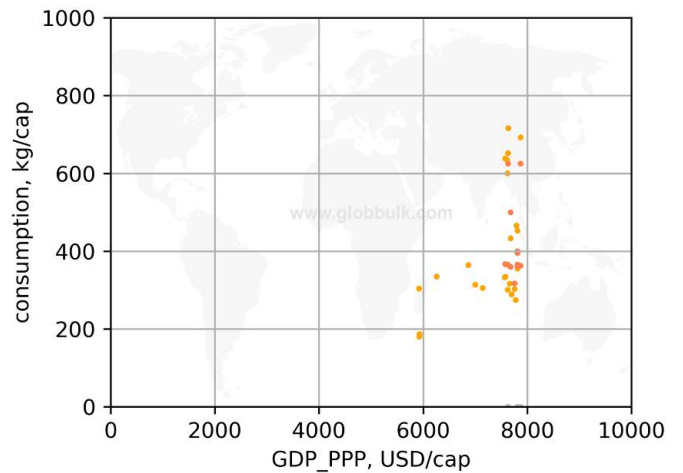
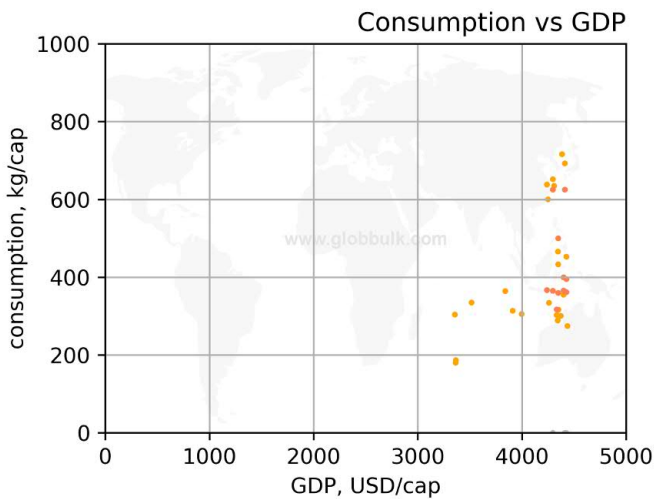
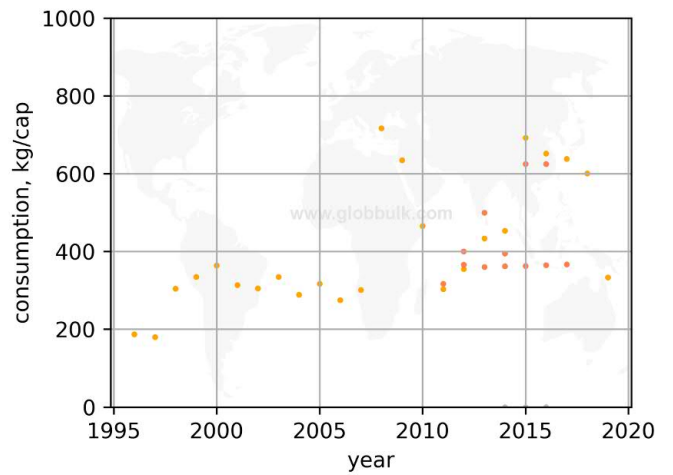
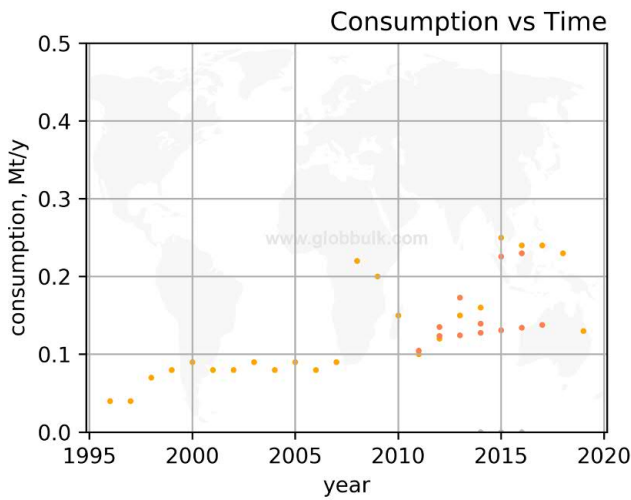
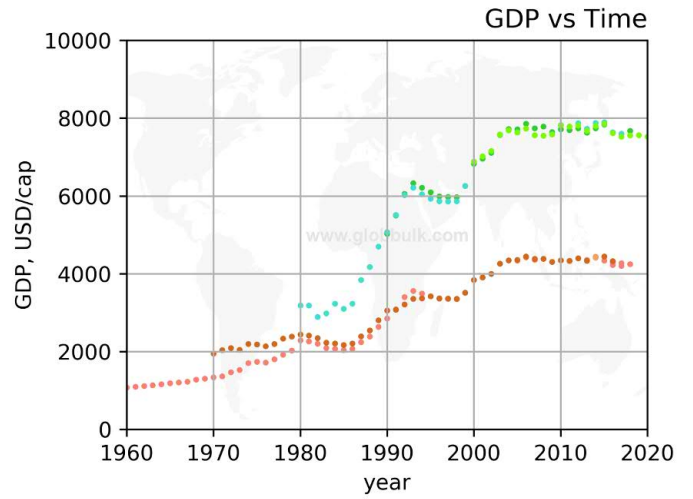
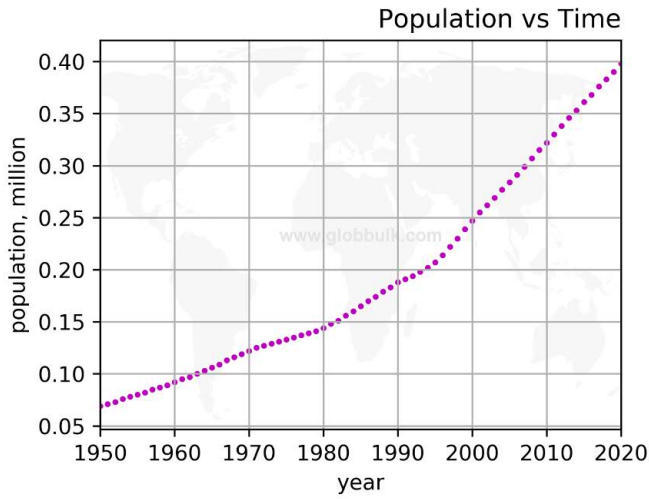


# Belgium





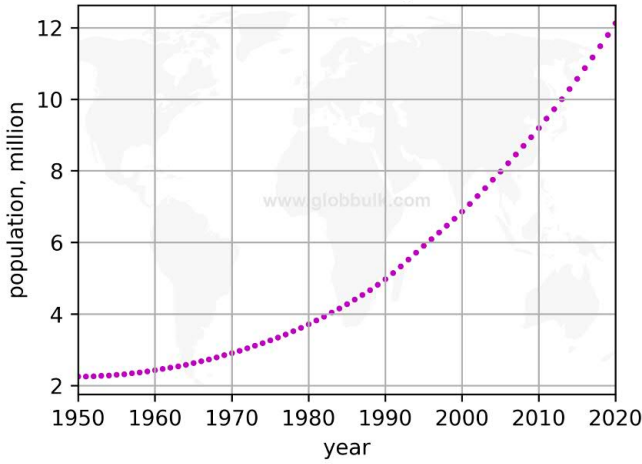
# Belize



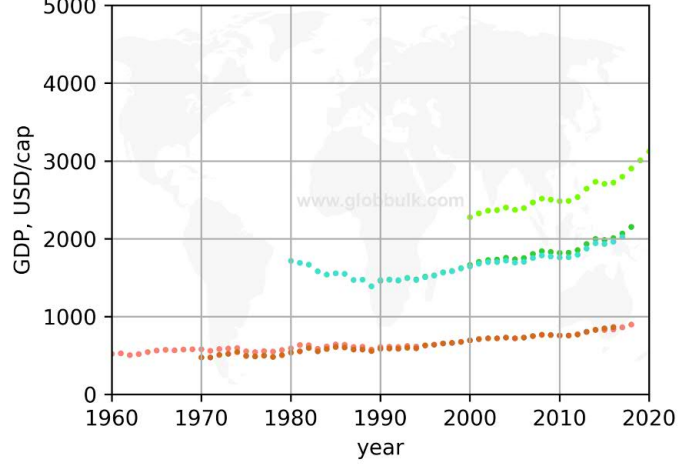


# Benin

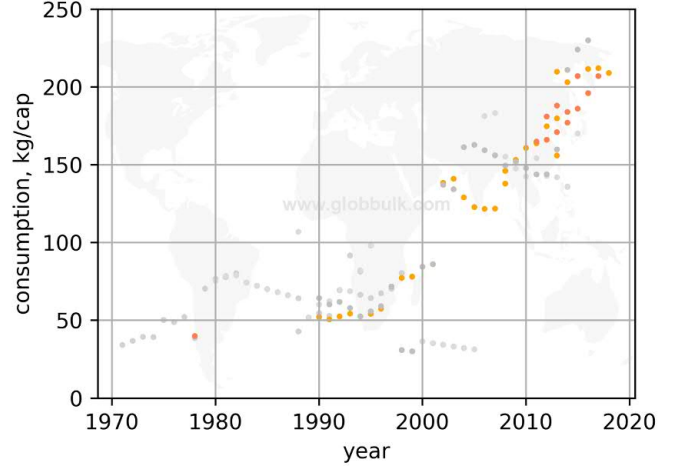
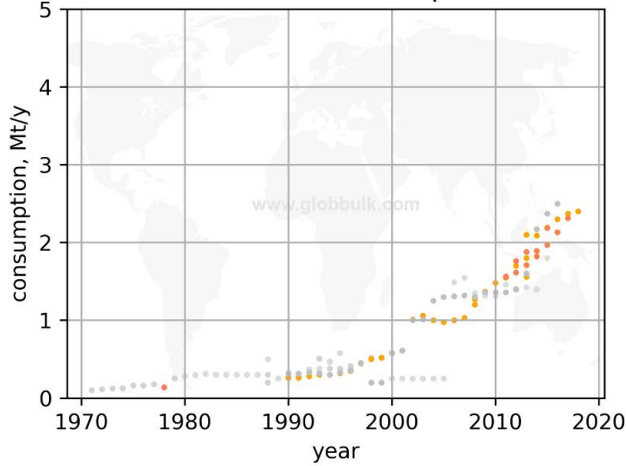
Population vs Time



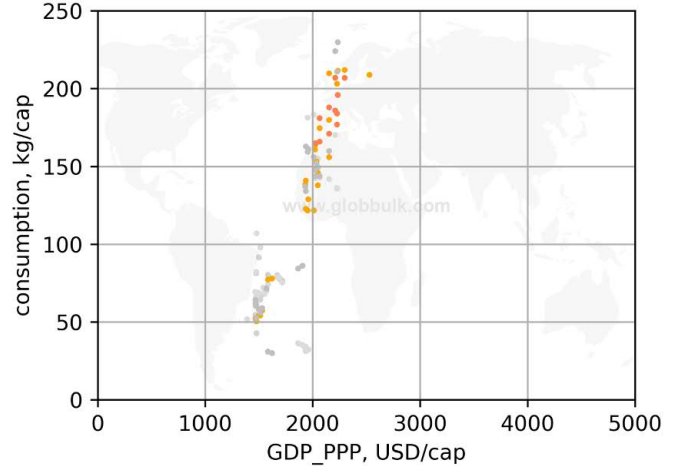
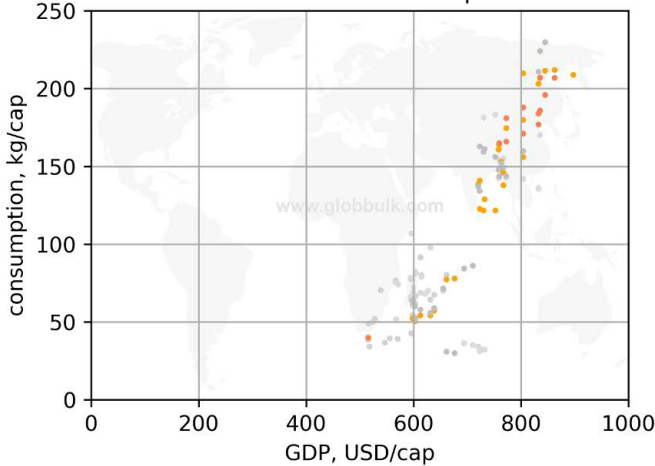
GDP vs Time



Consumption vs Time

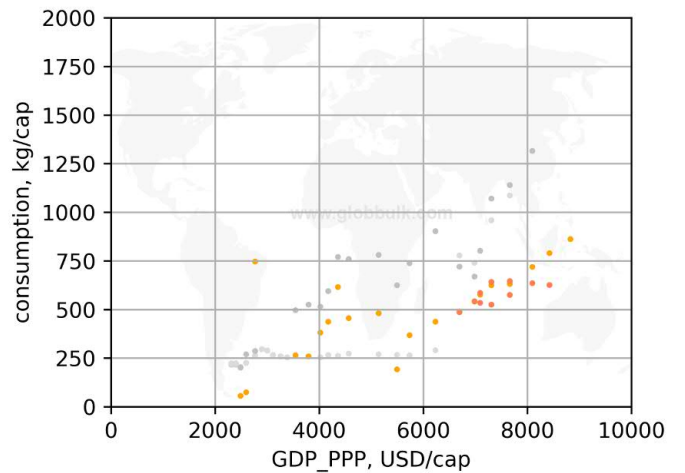
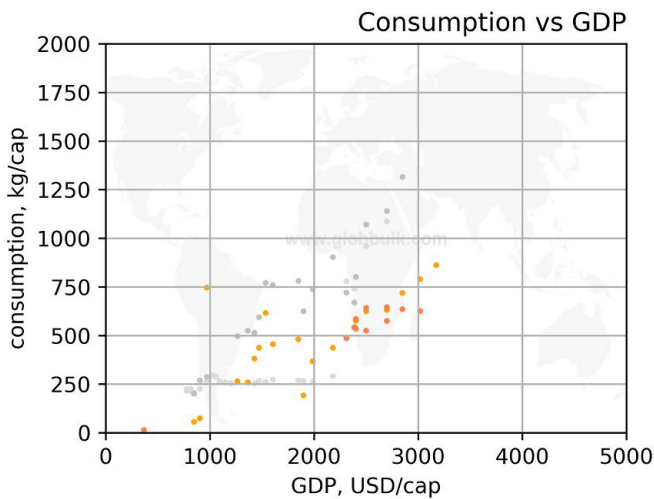
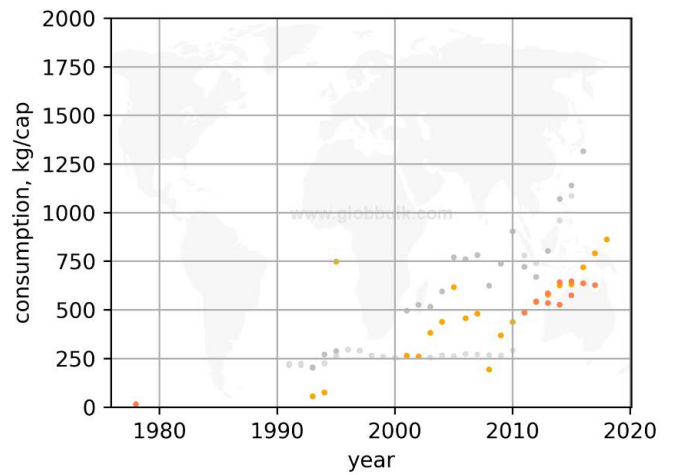
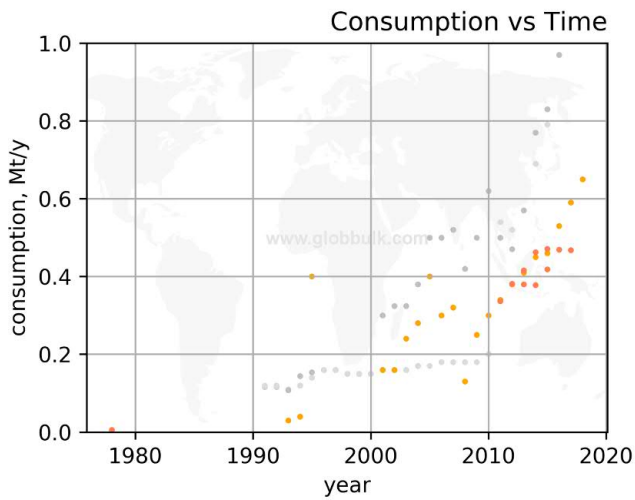
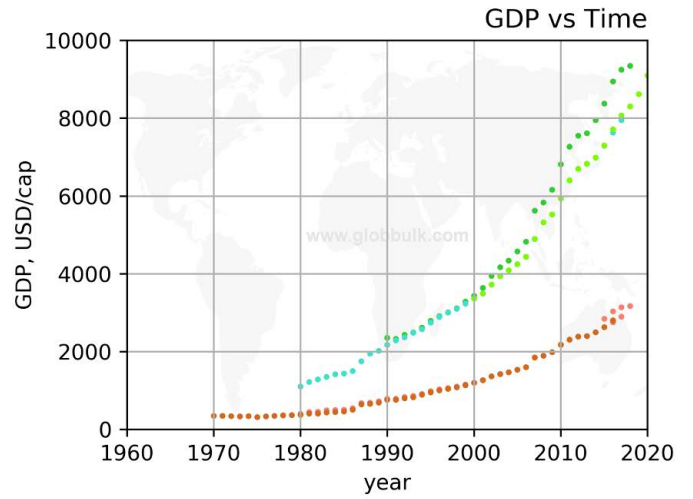
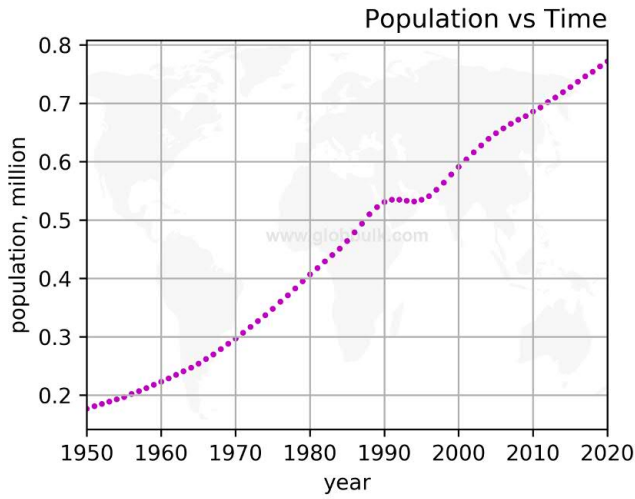


Consumption vs GDP





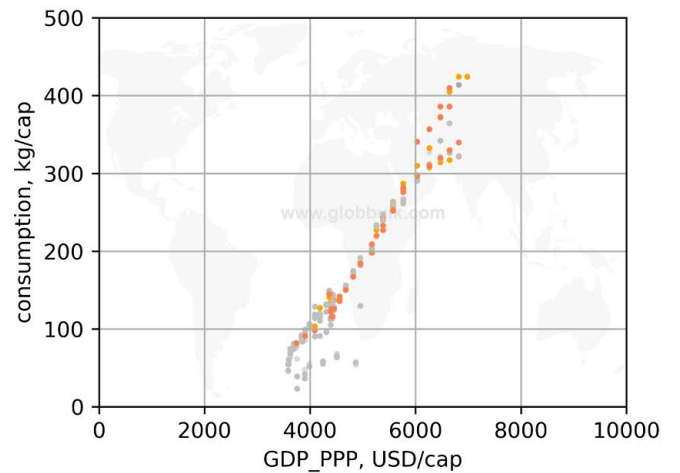
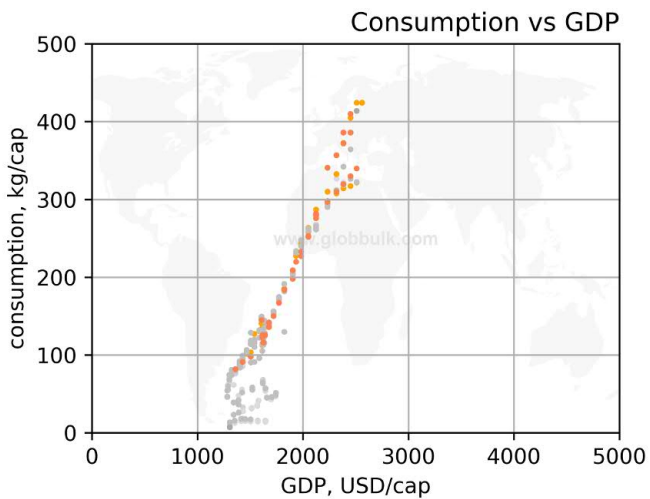
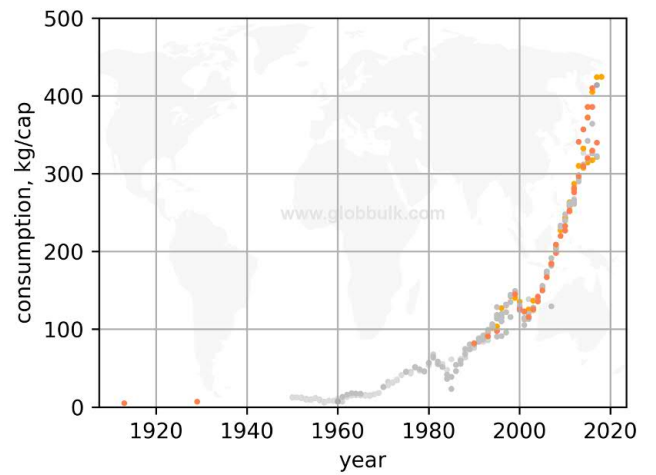
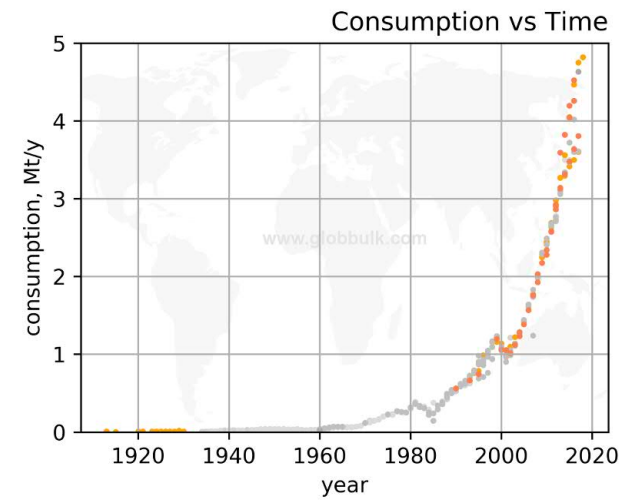
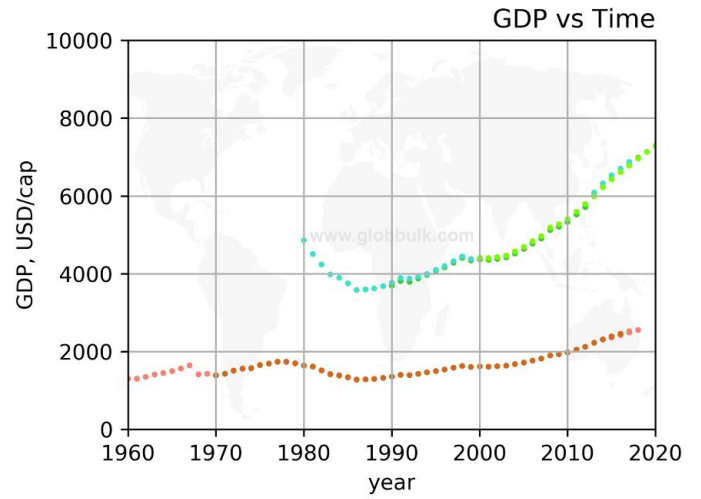
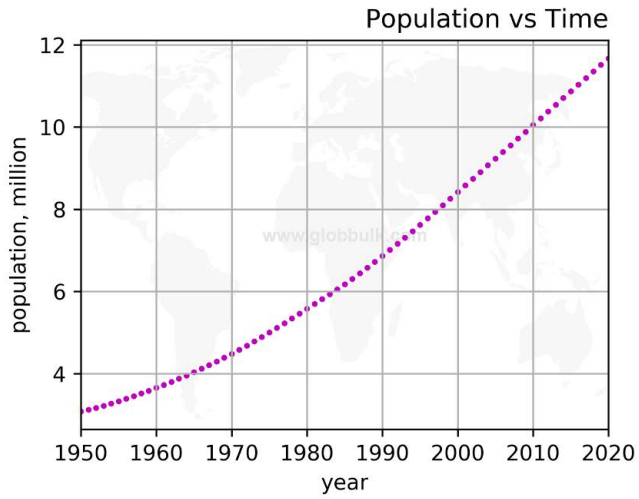
# Bhutan





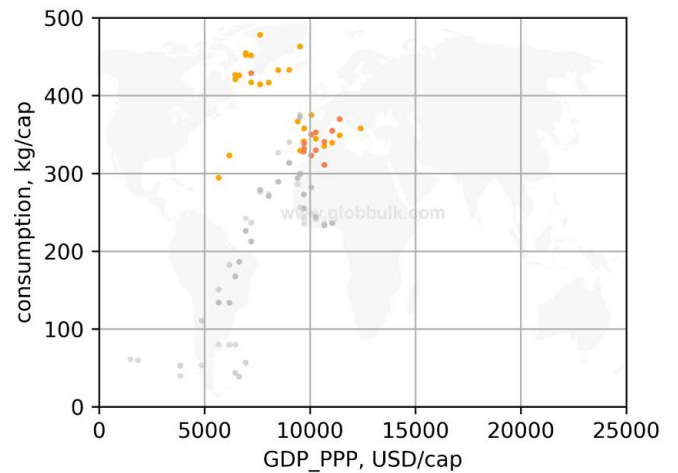
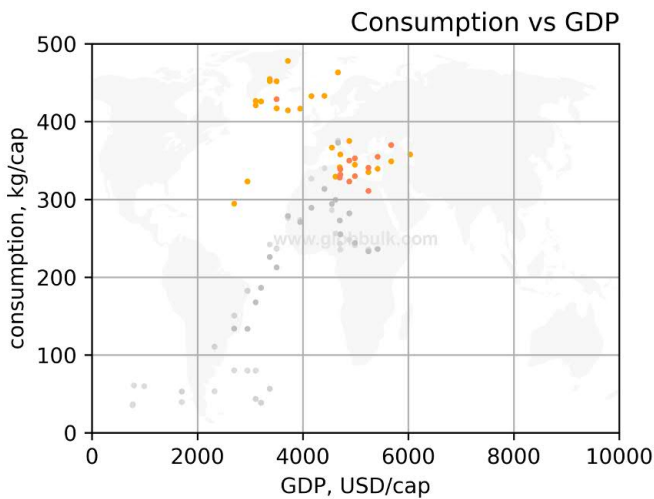
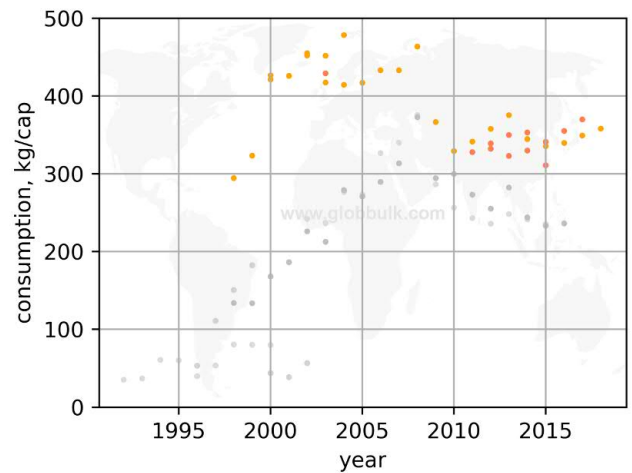
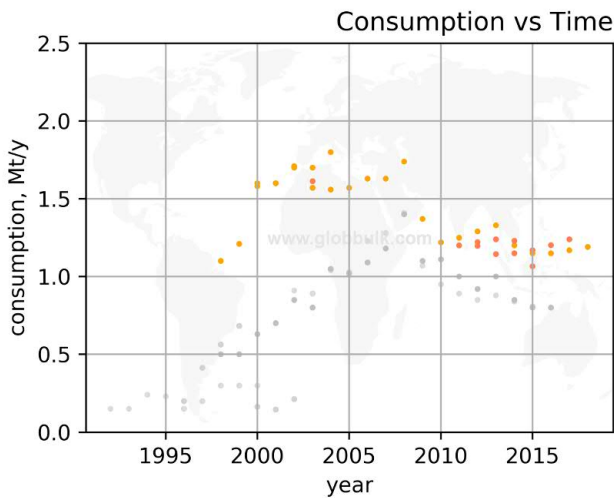
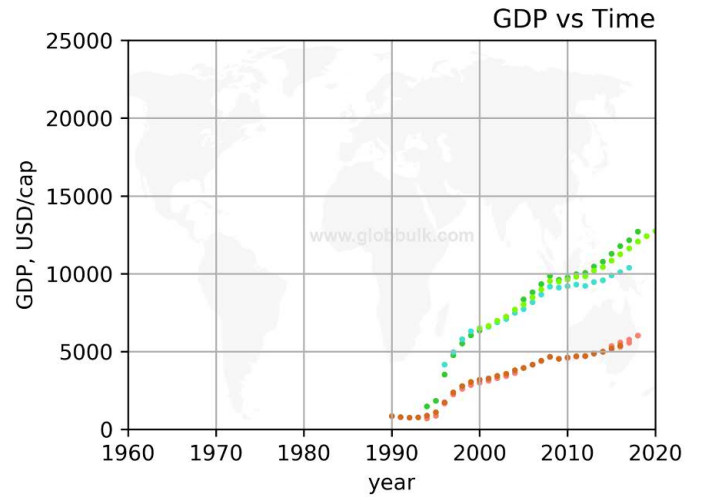
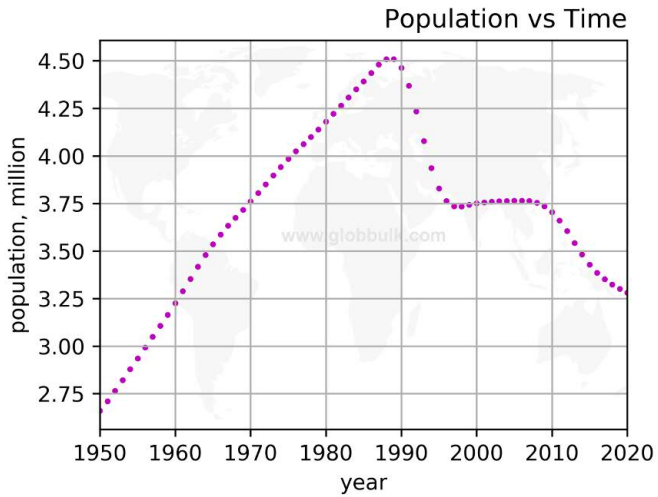


# Bolivia



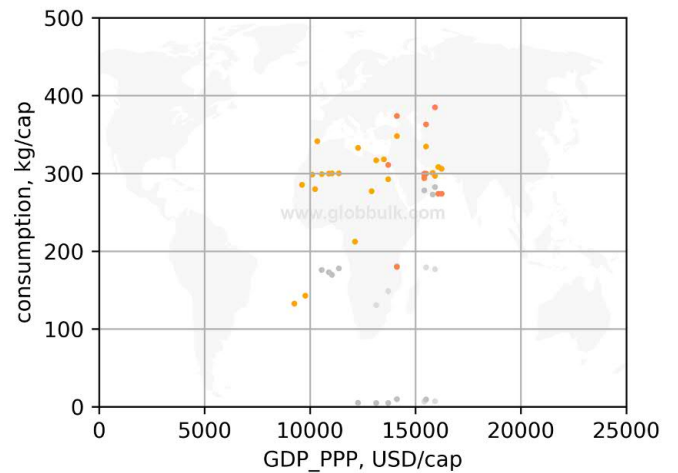
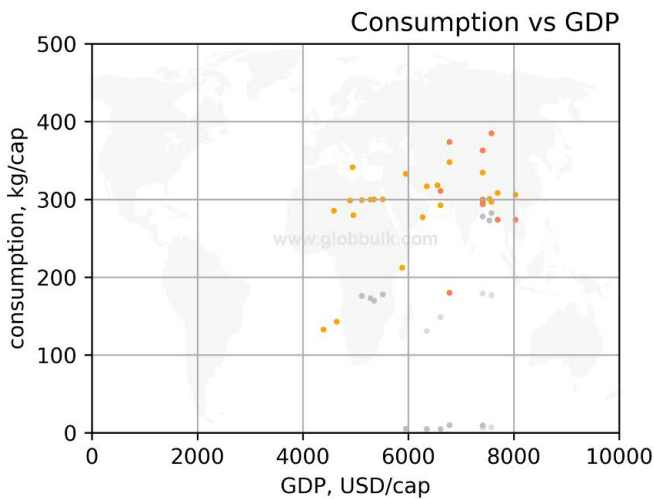
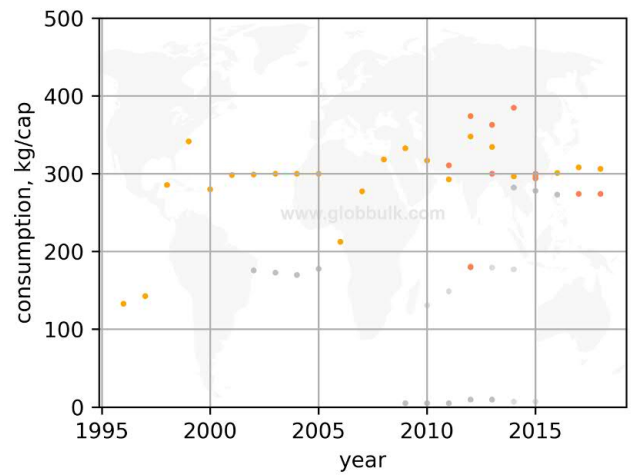
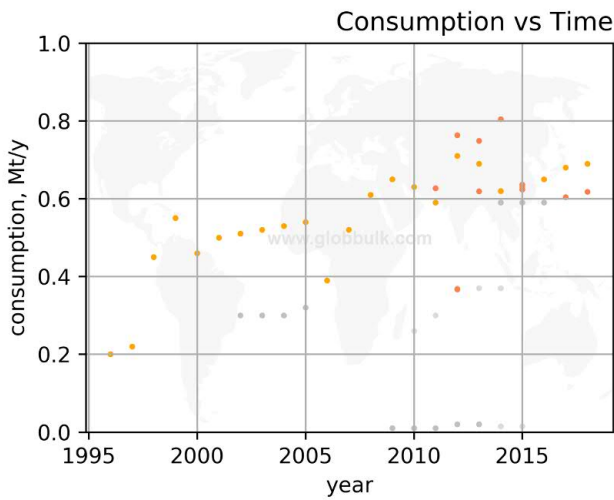
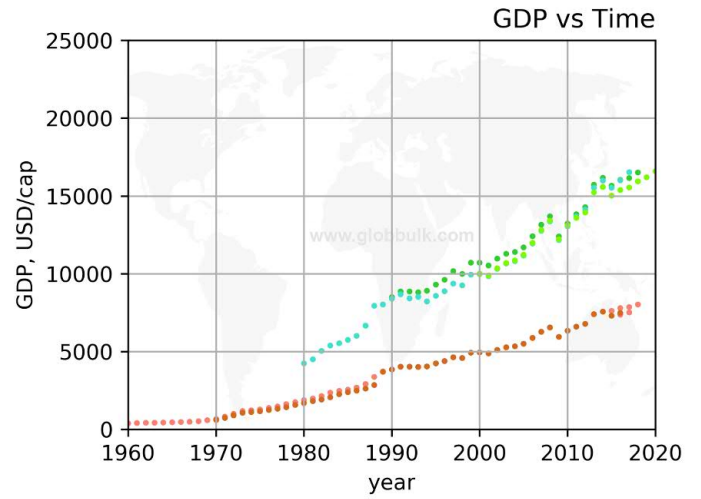
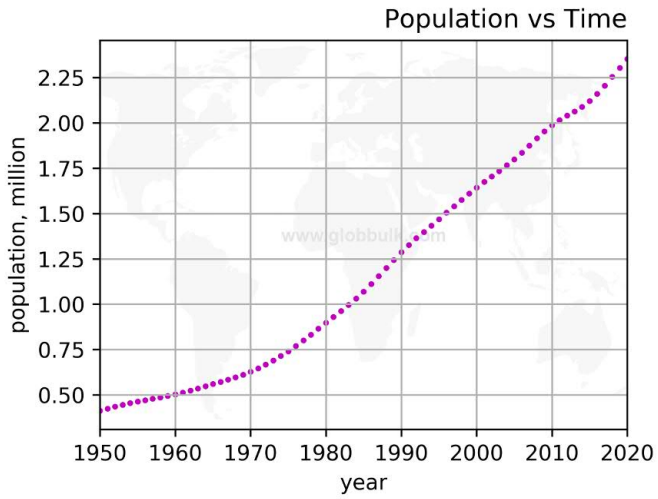


# Bosnia Herz.



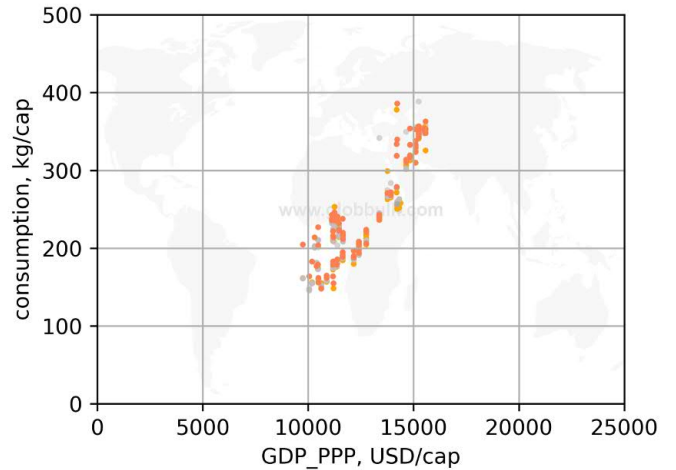
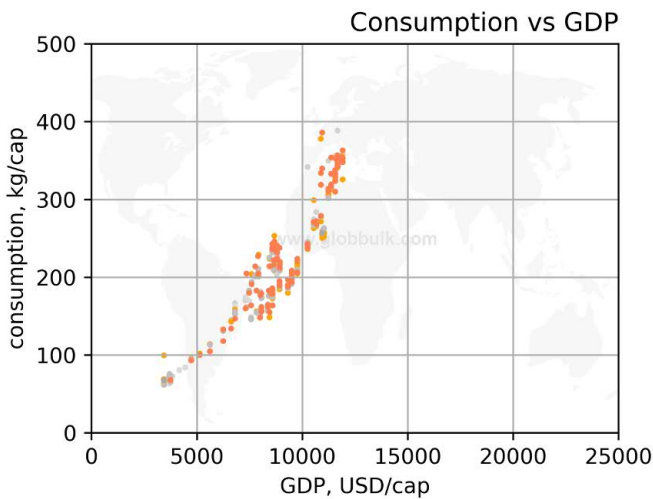
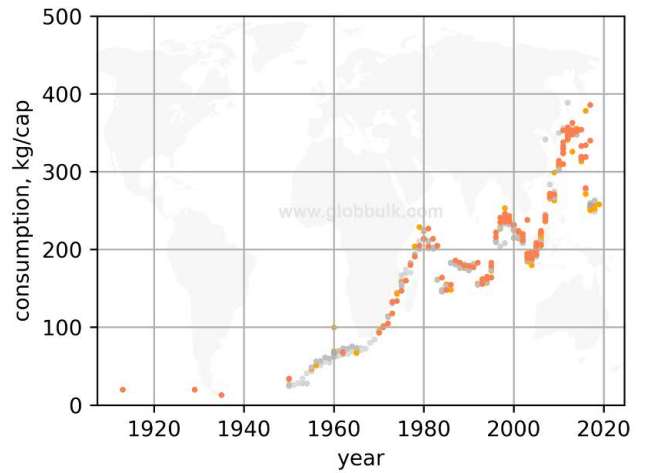
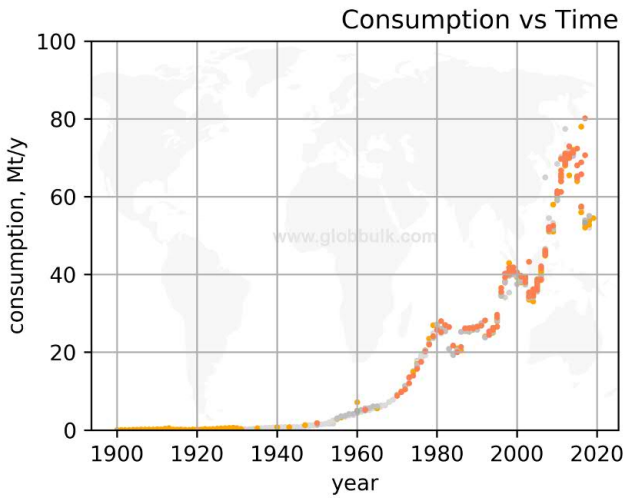
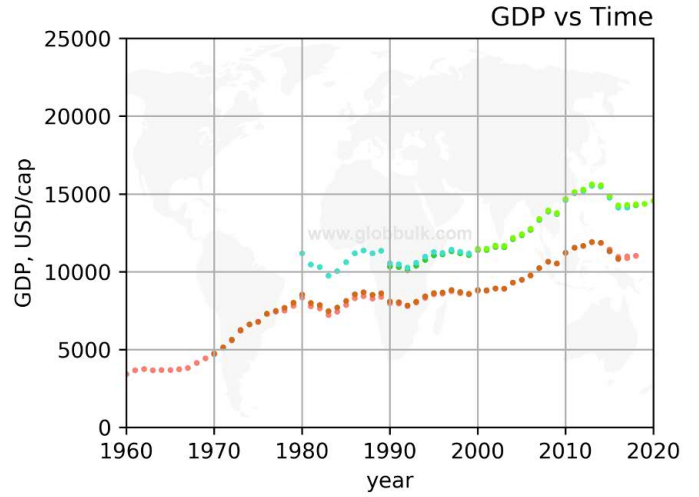
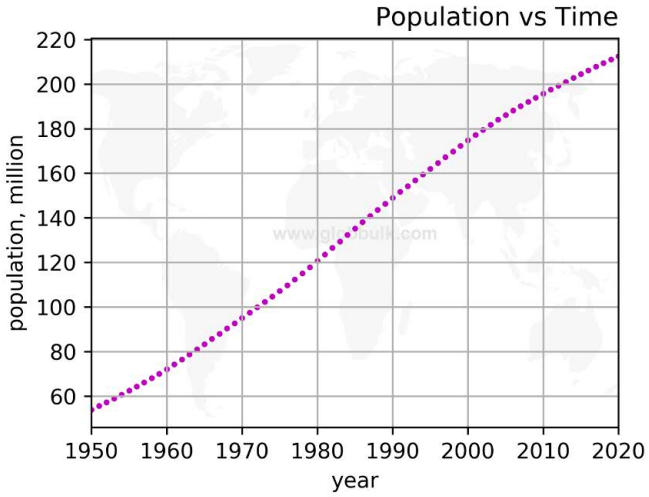


# Botswana



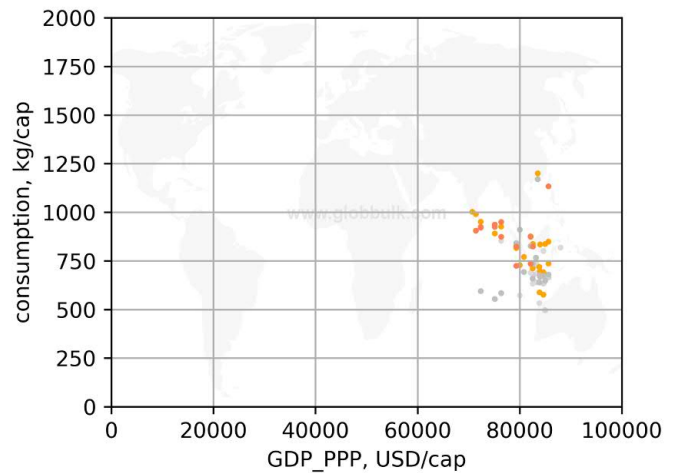
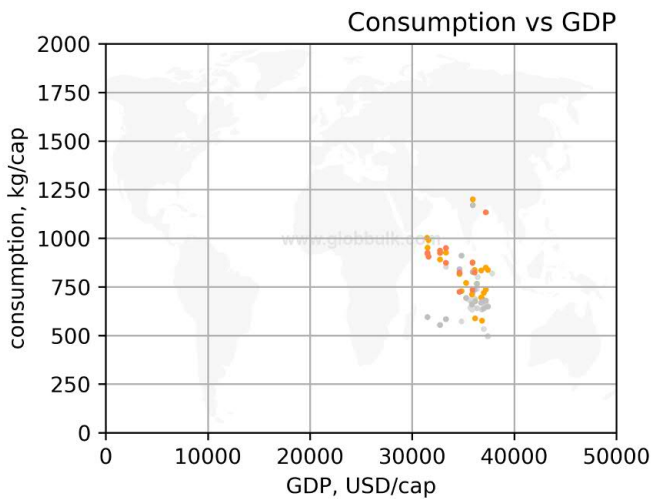
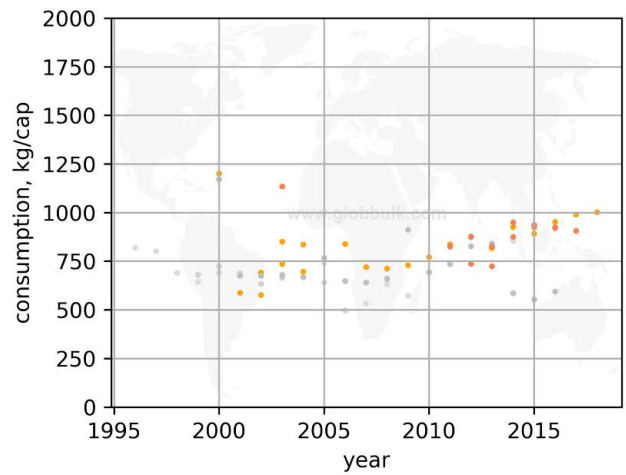
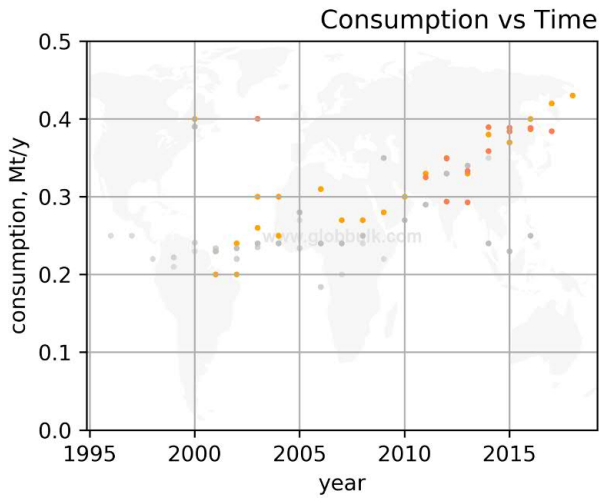
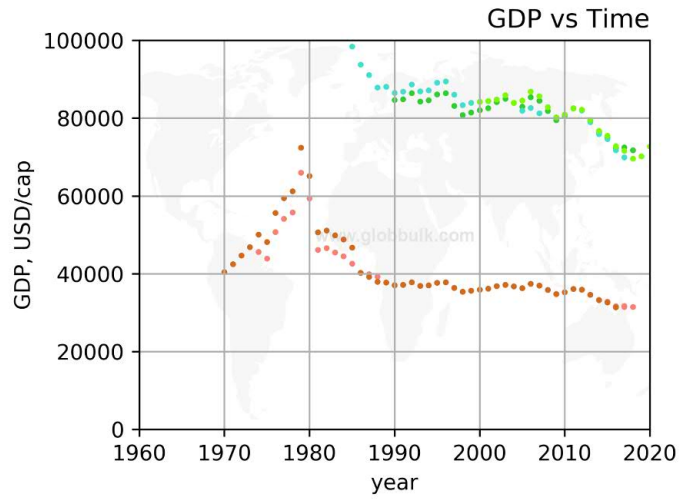
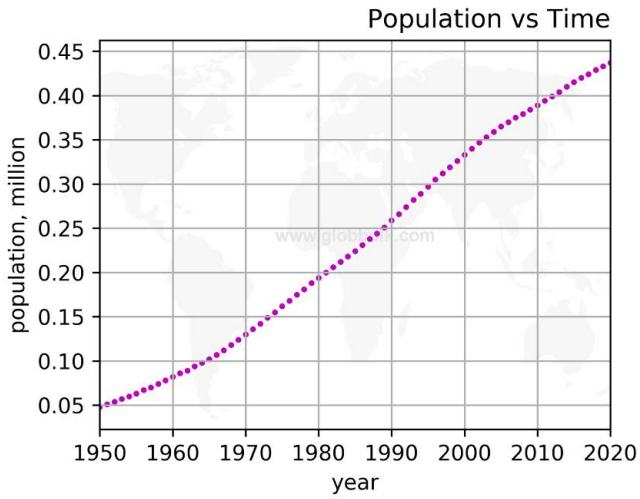


# Brazil



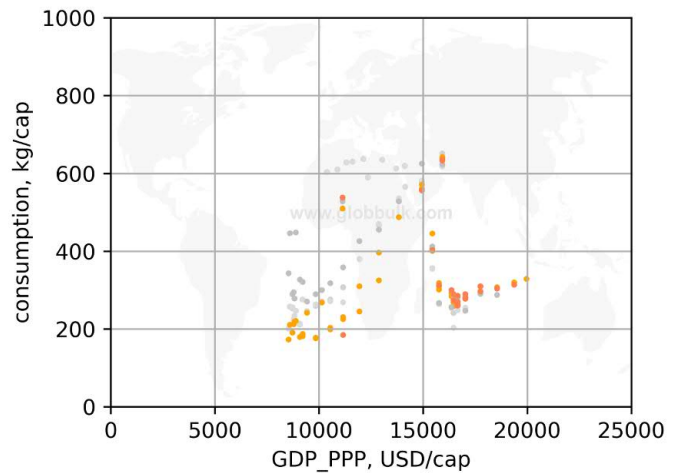
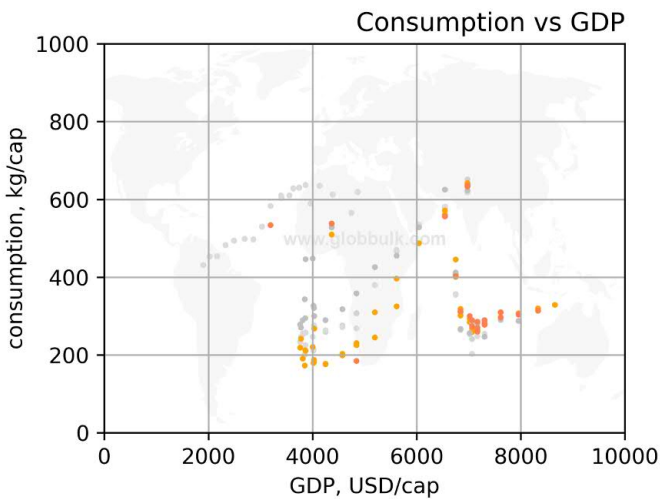
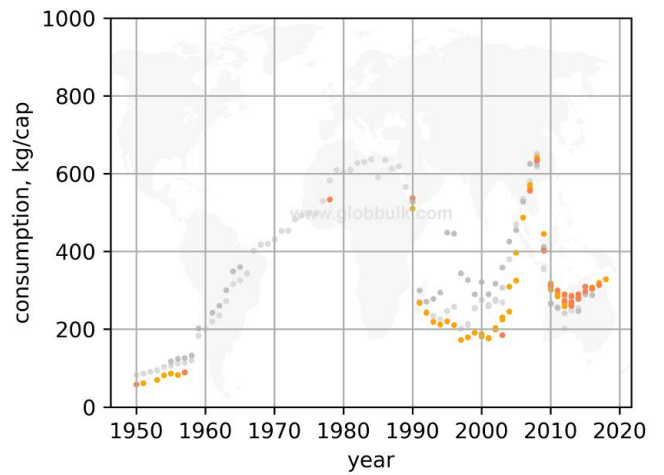
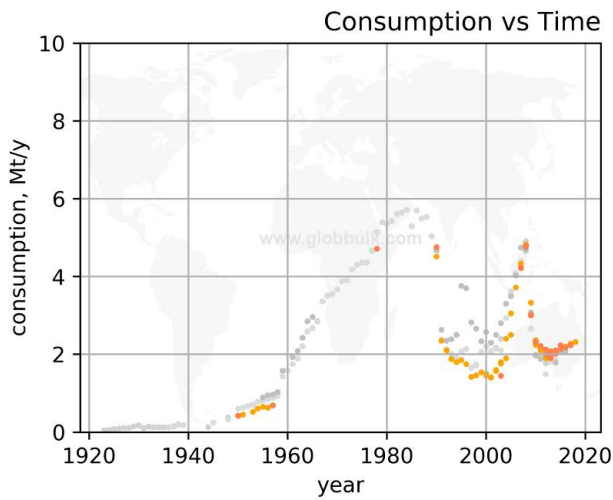
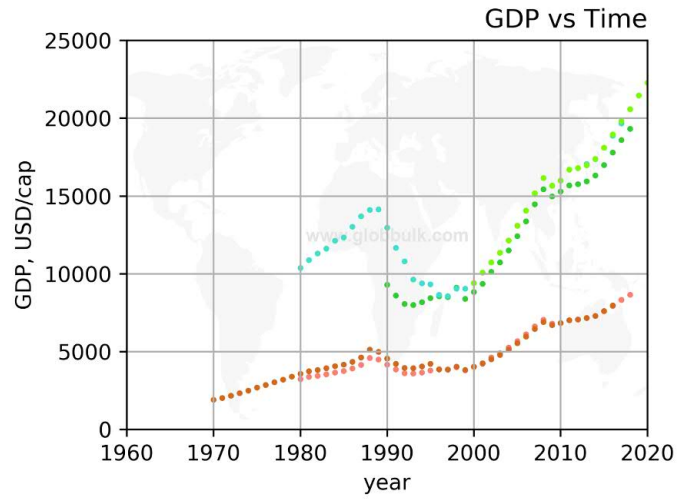
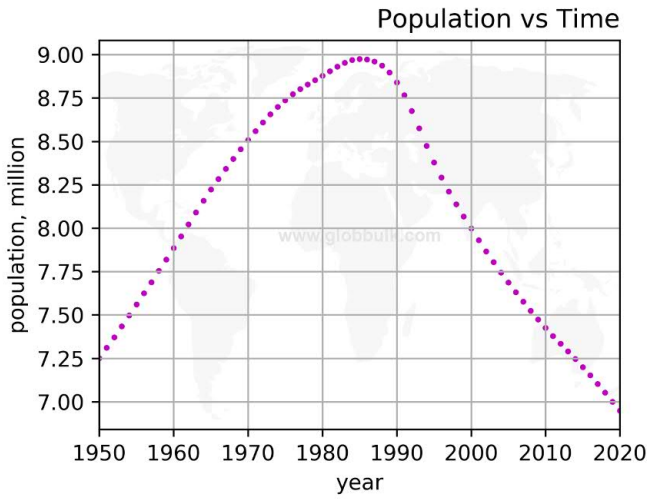


# Brunei



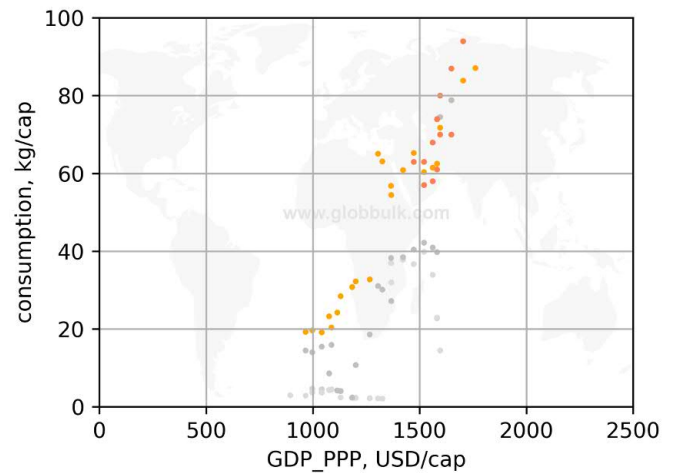
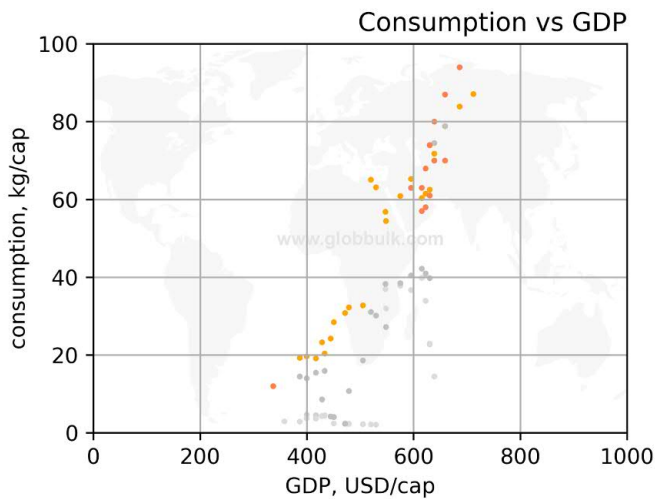
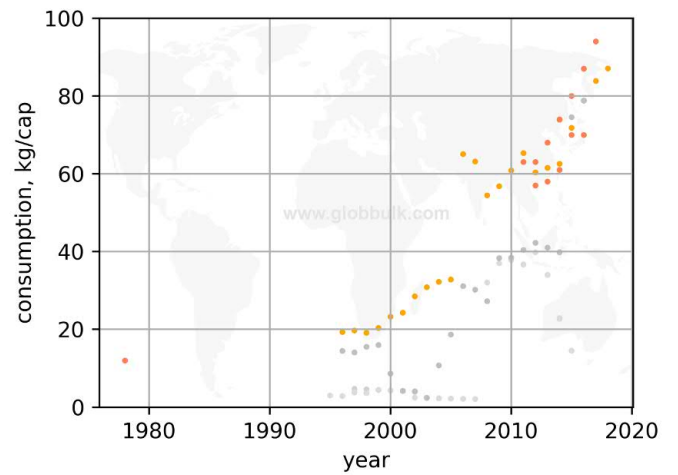
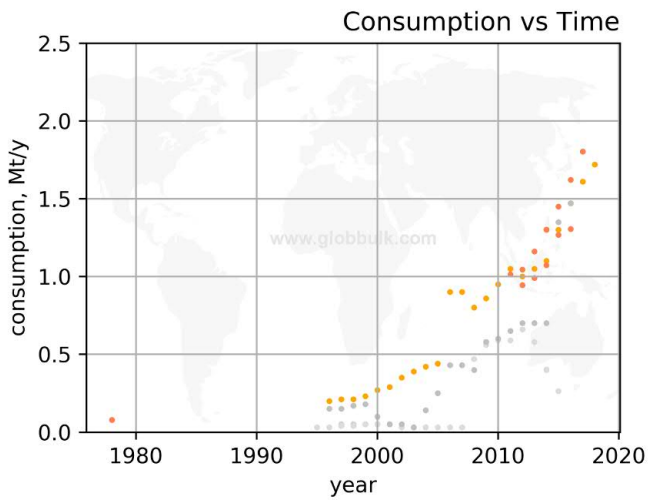
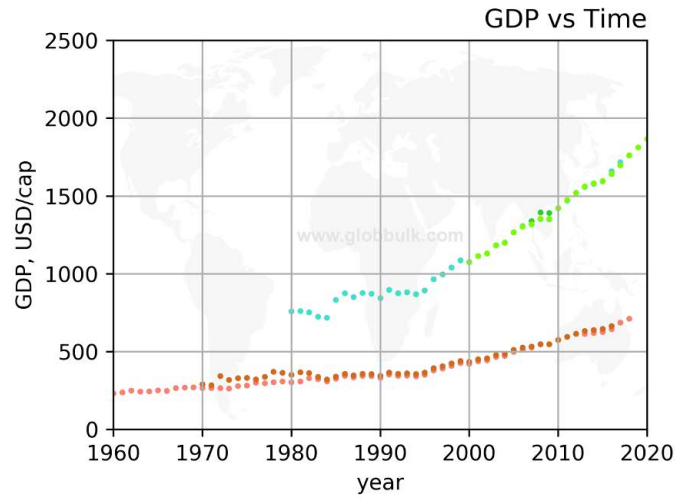
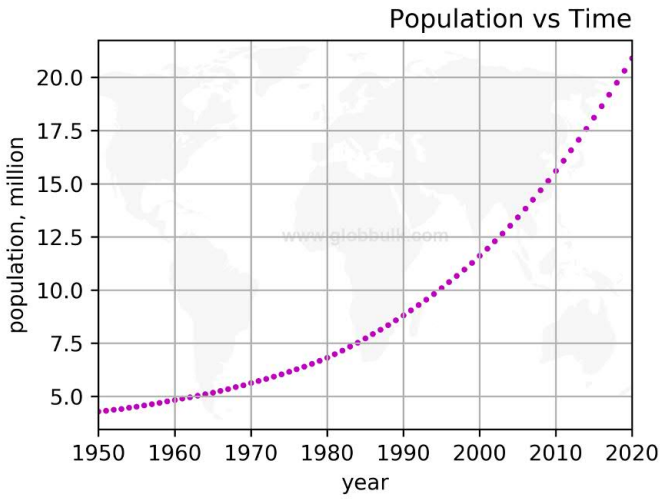


# Bulgaria





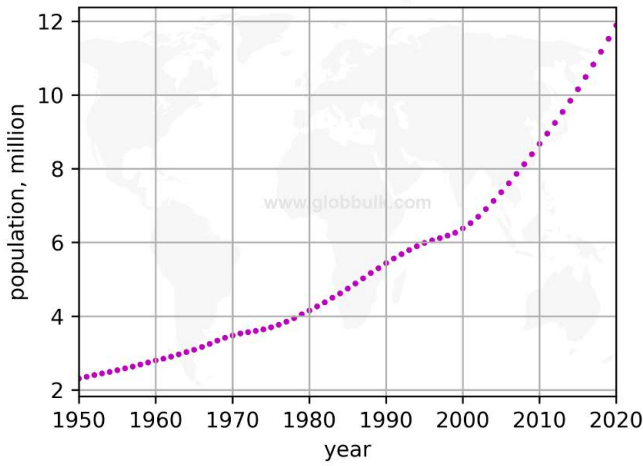
# Burkina Faso



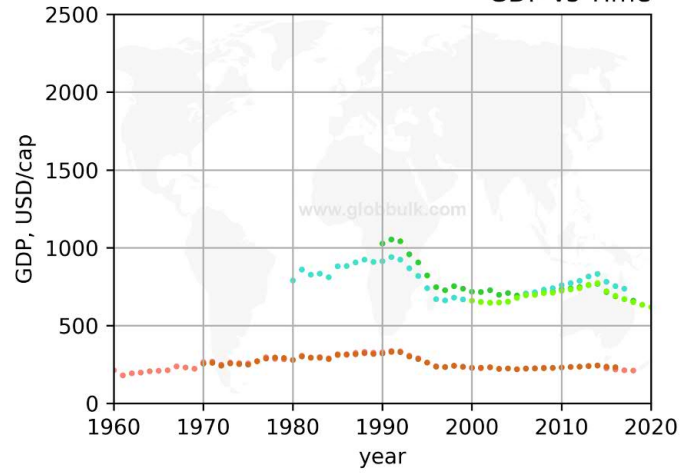


# Burundi

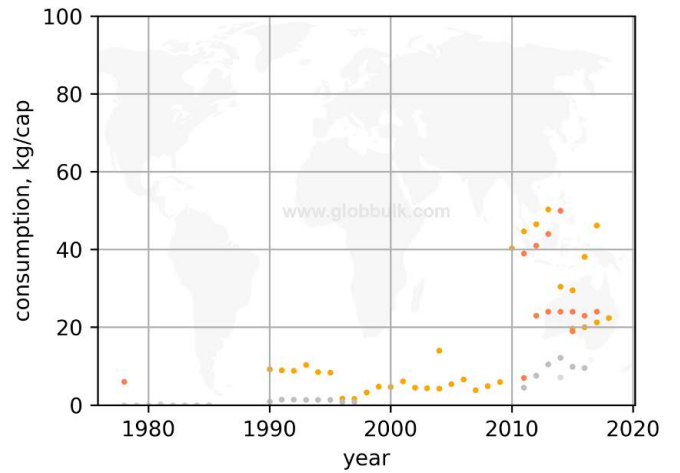
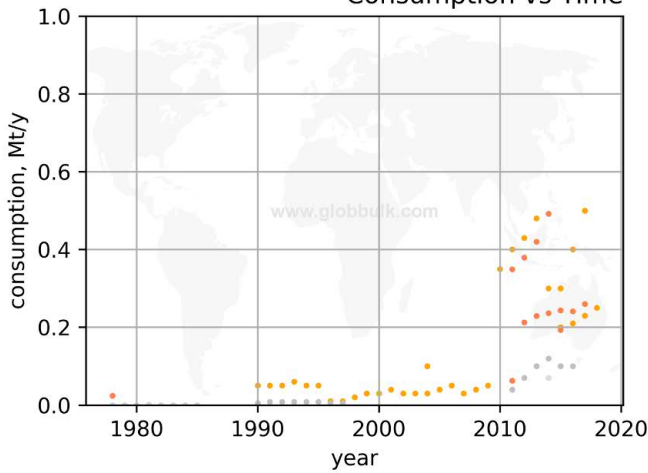
Population vs Time



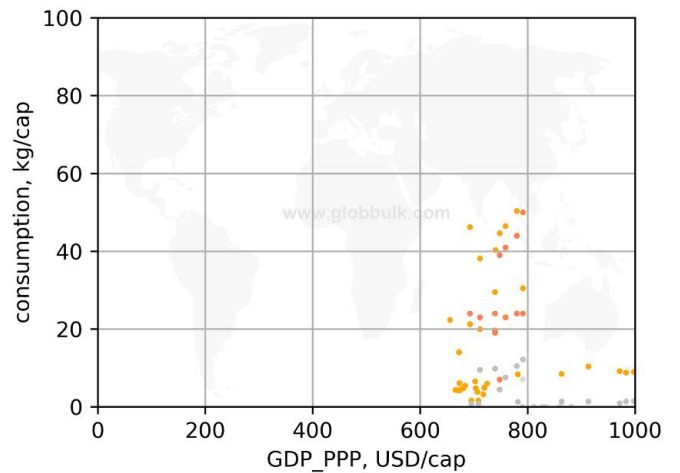
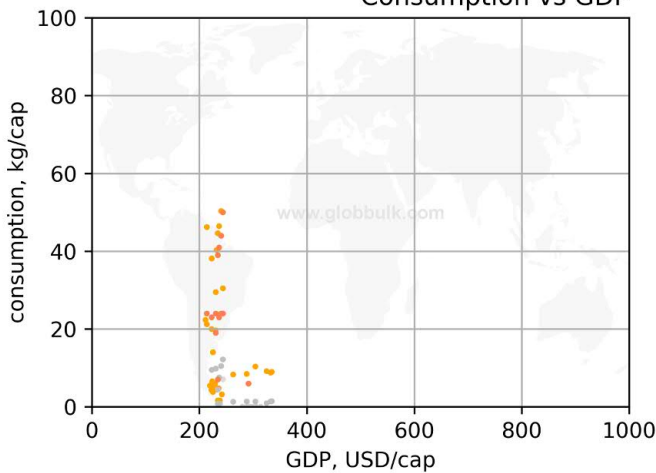
GDP vs Time



Consumption vs Time



Consumption vs GDP

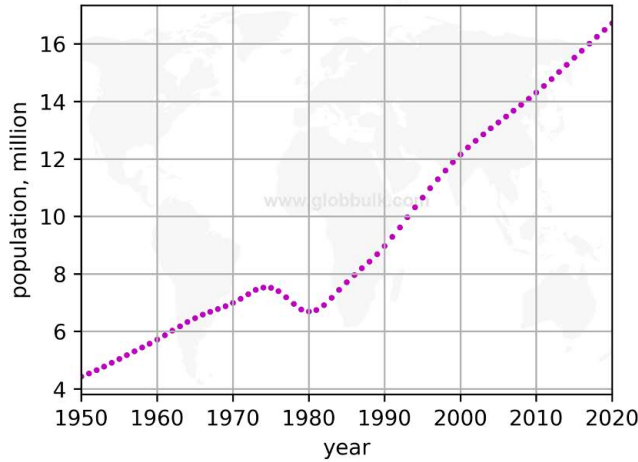




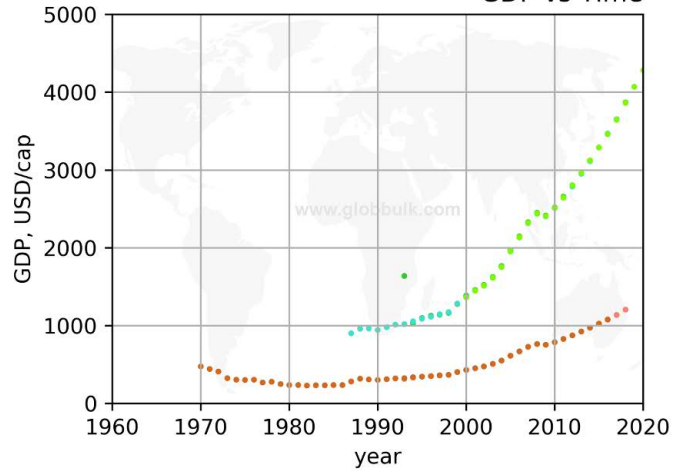


# Cambodia

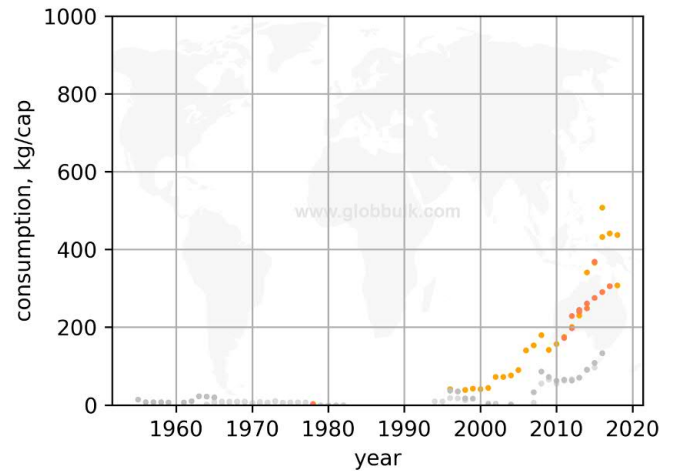
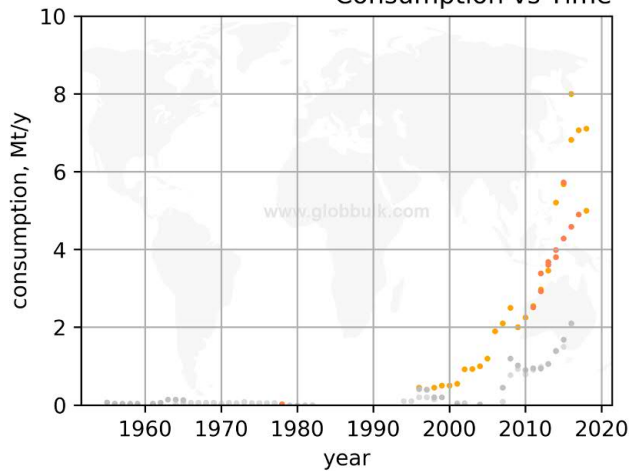
Population vs Time



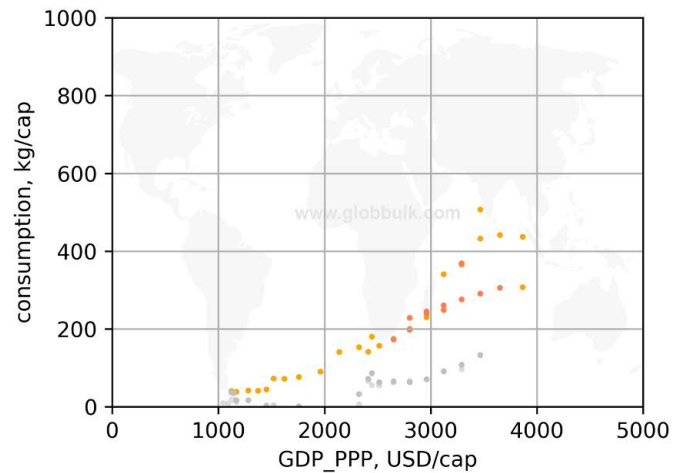
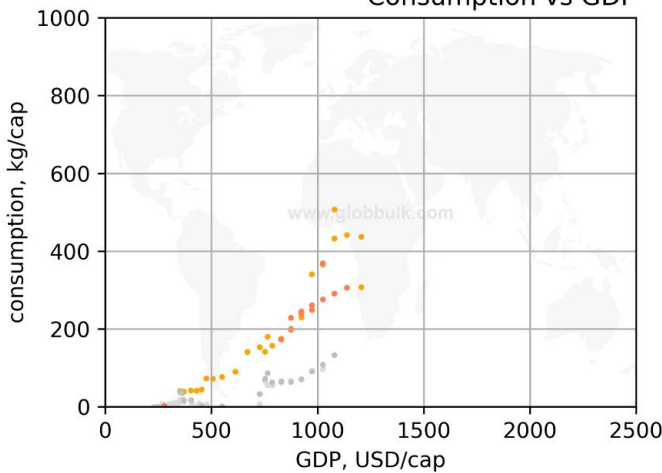
GDP vs Time



Consumption vs Time



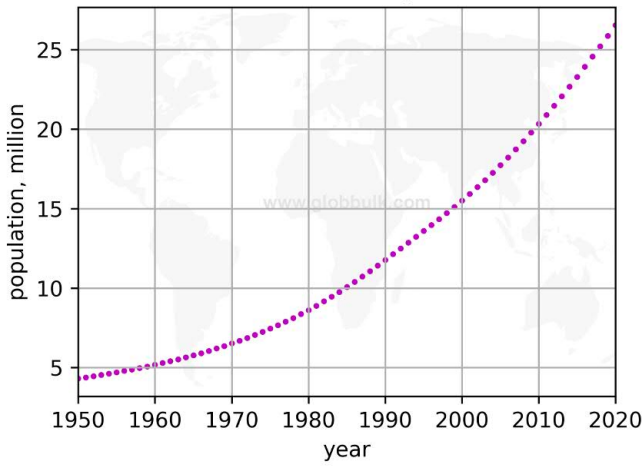
Consumption vs GDP



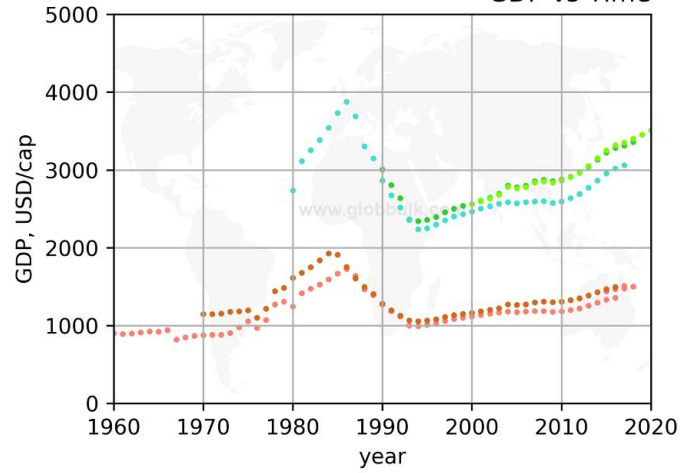


# Cameroon

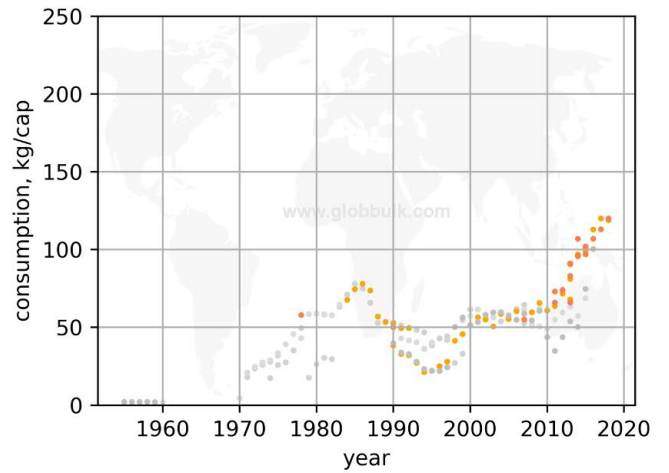
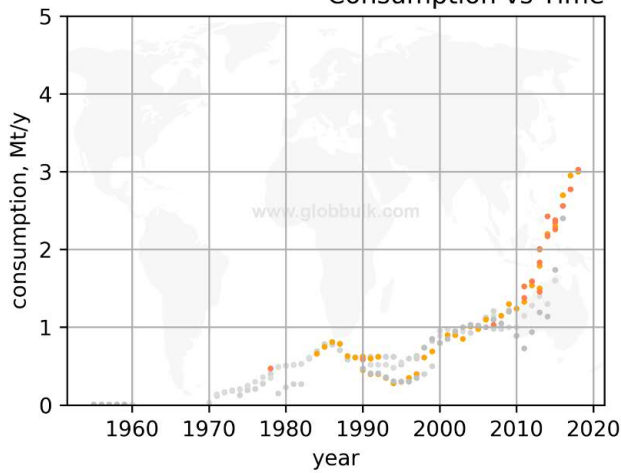
Population vs Time



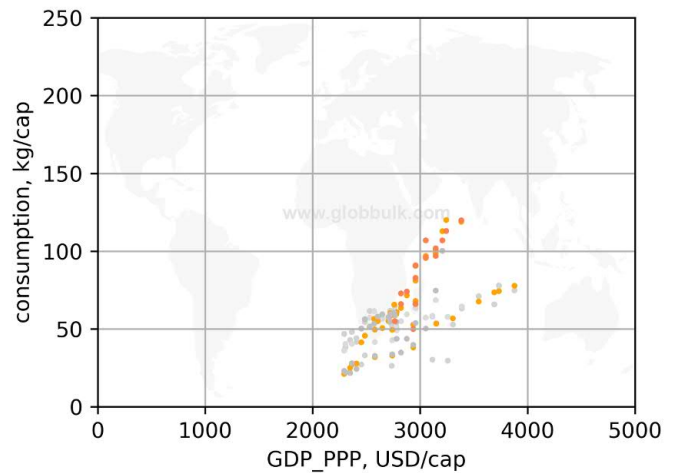
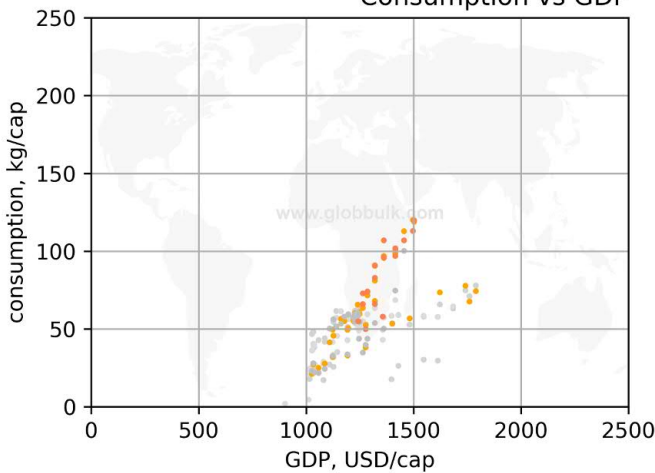
GDP vs Time



Consumption vs Time



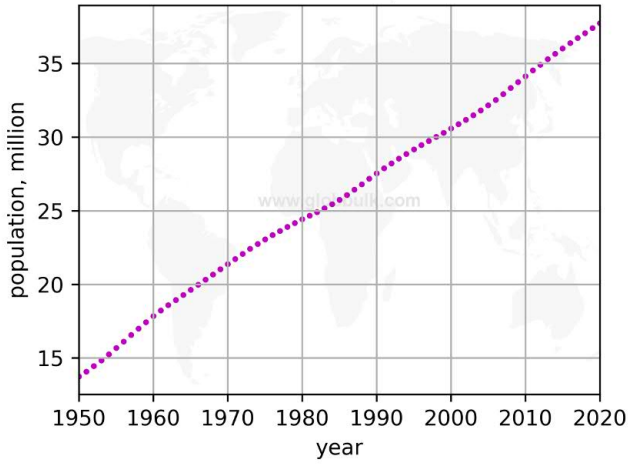
Consumption vs GDP



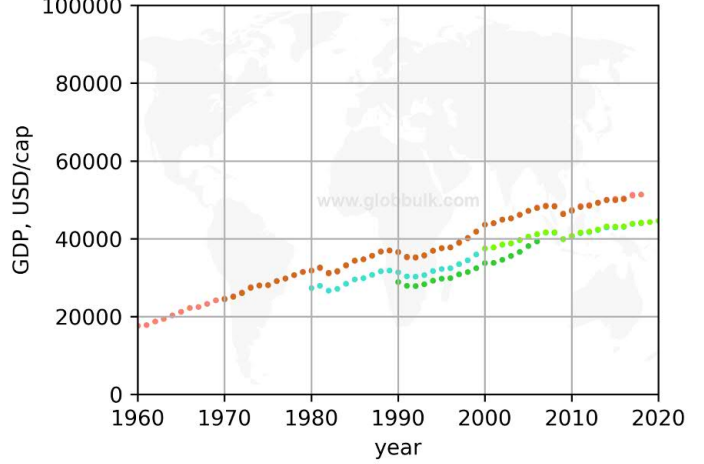


# Canada

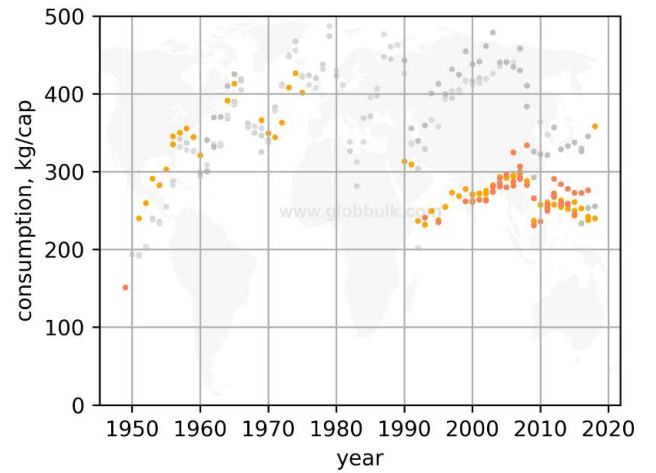
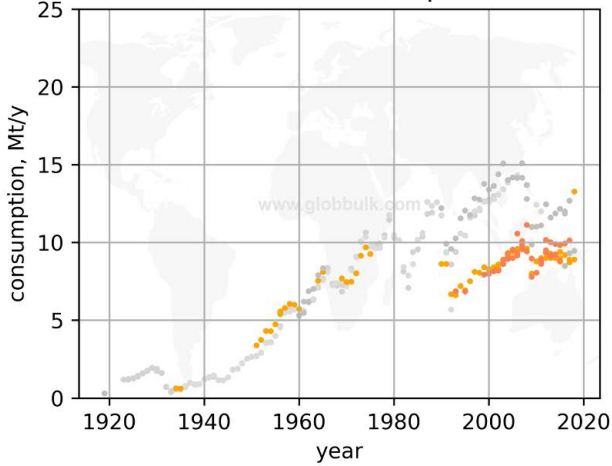
Population vs Time



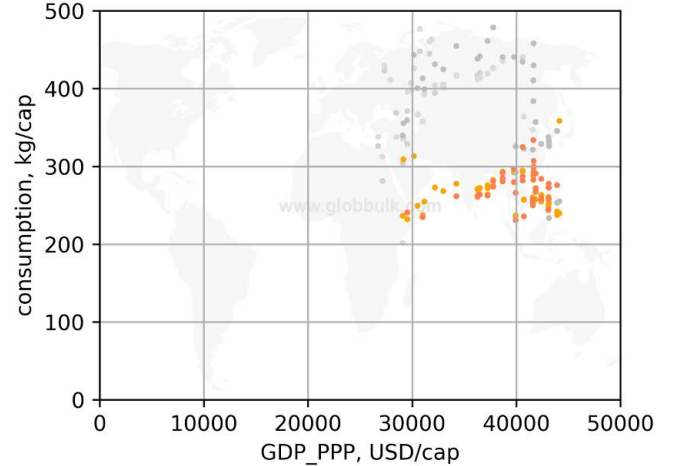
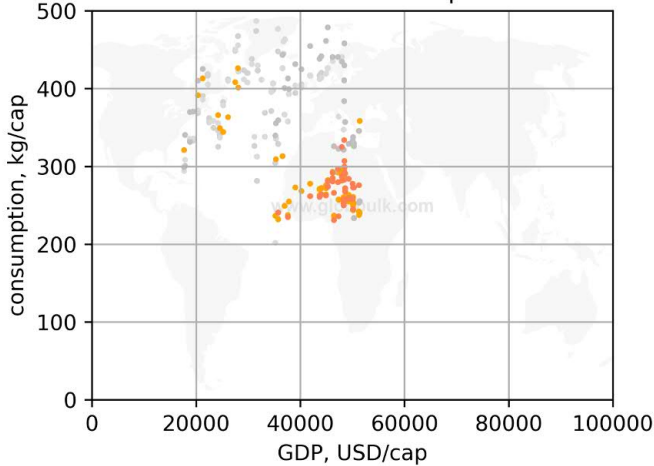
GDP vs Time



Consumption vs Time

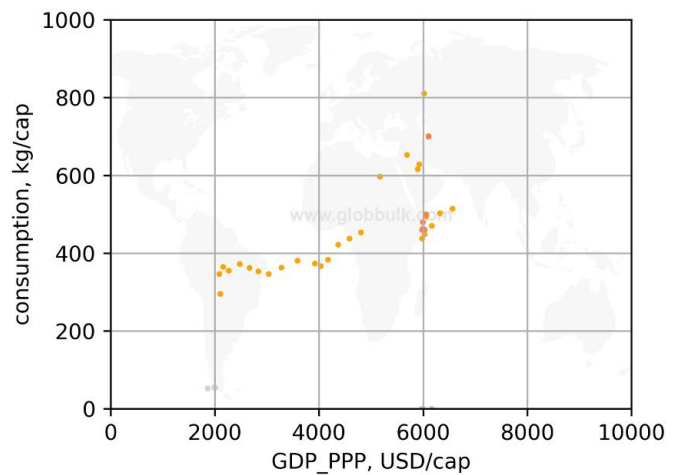
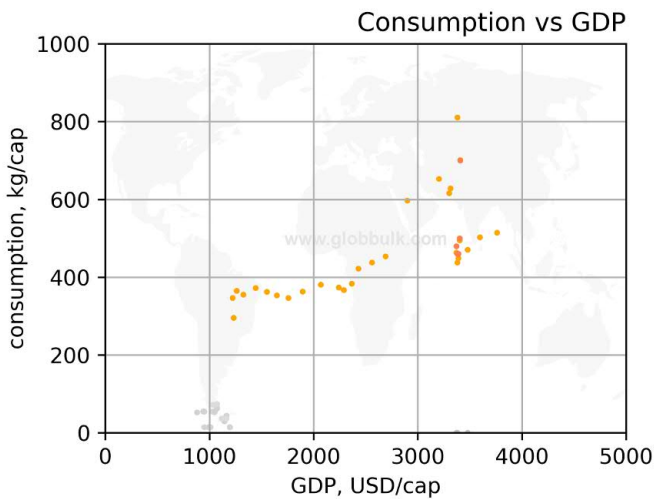
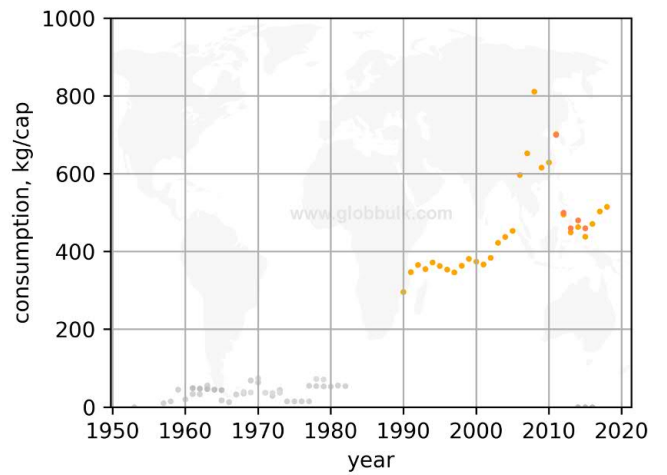
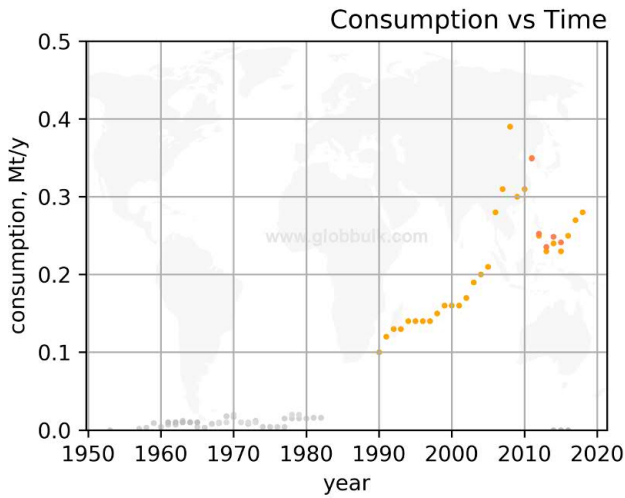
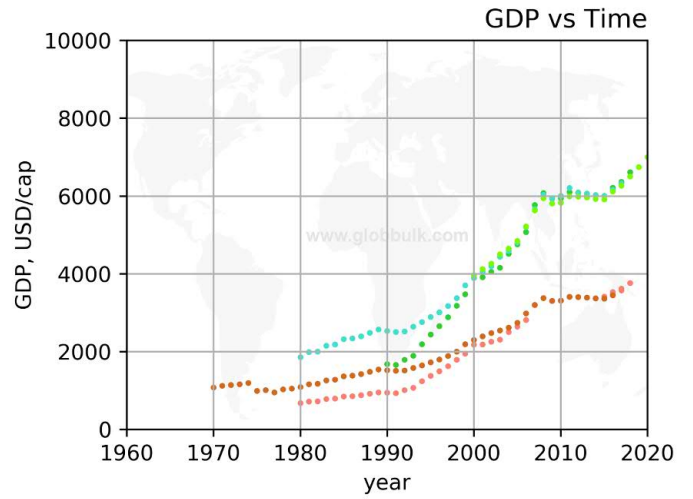
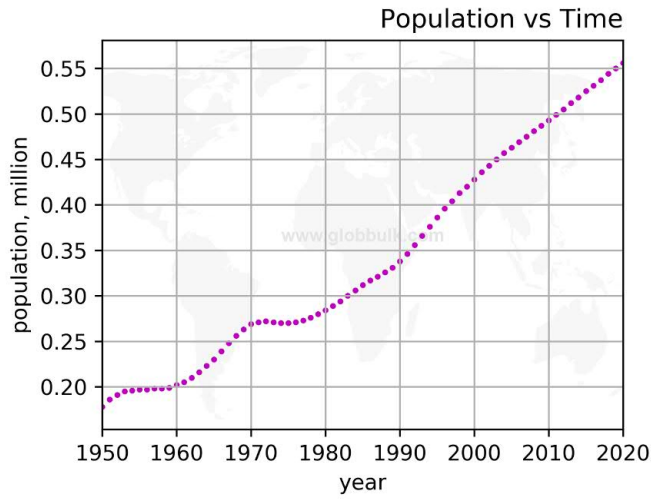


Consumption vs GDP



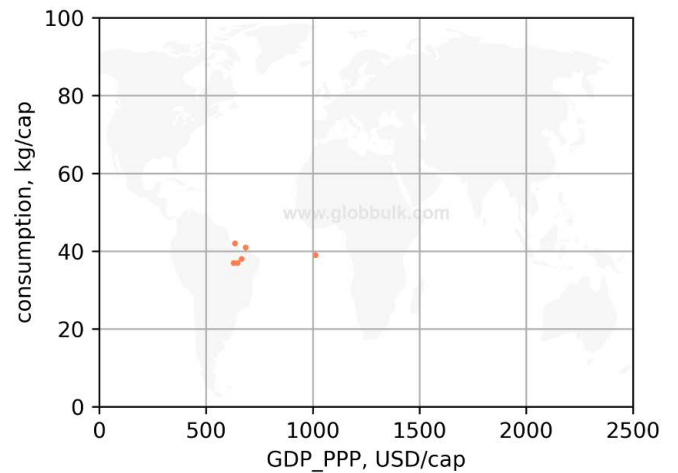
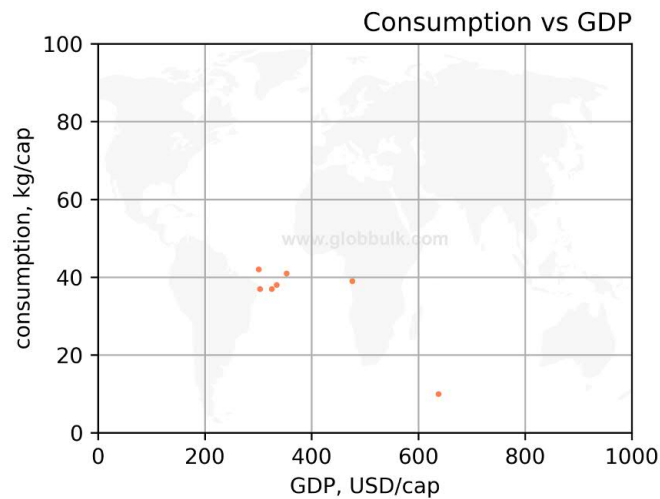
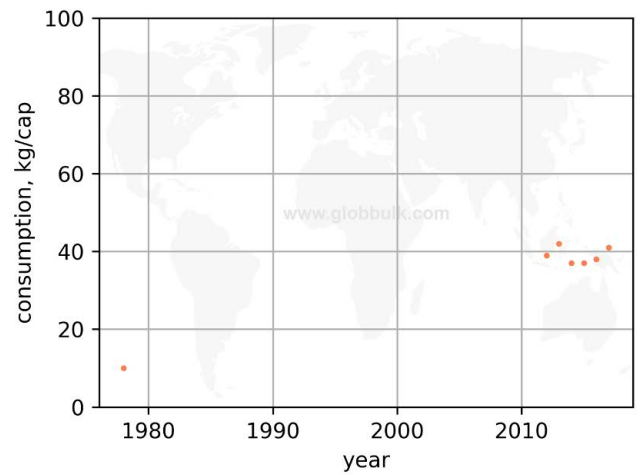
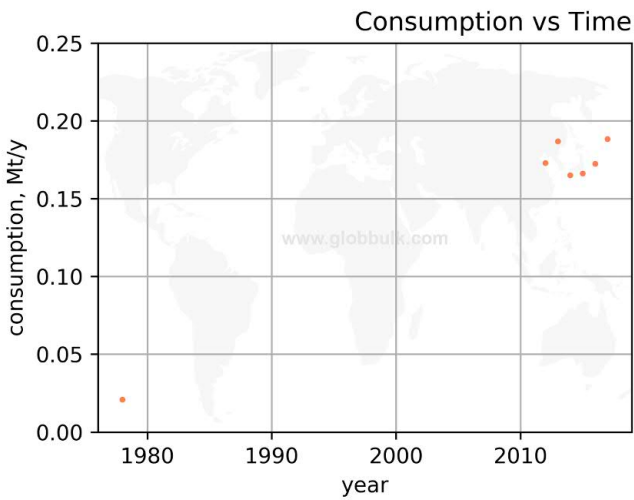
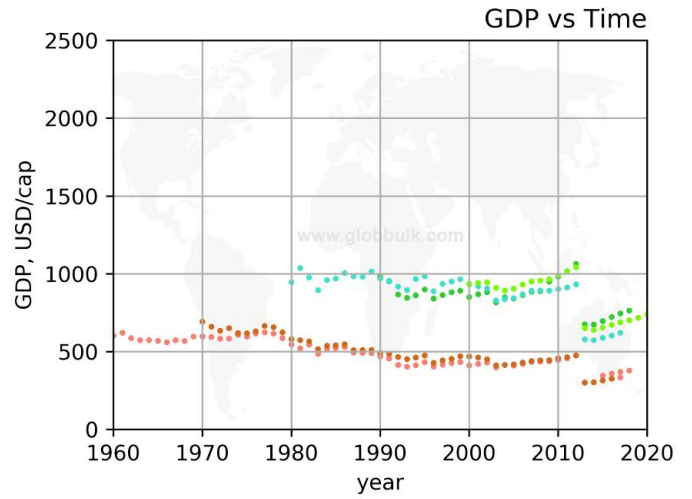
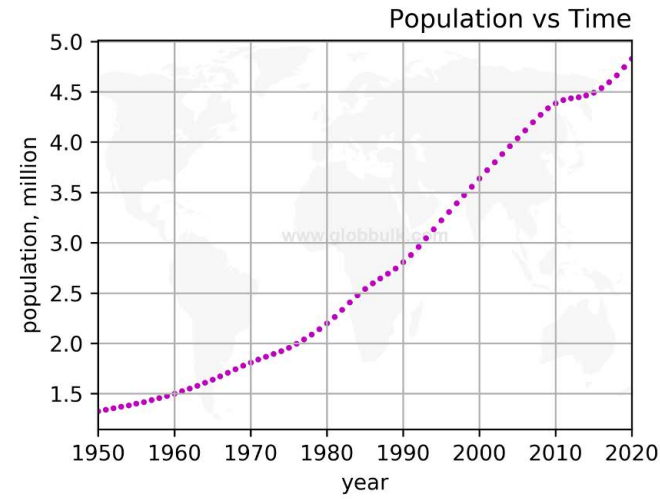


# Cape Verde





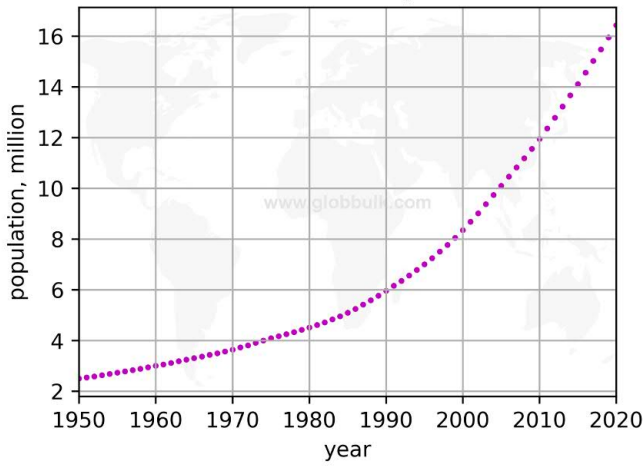
# Central Afr. Rep.



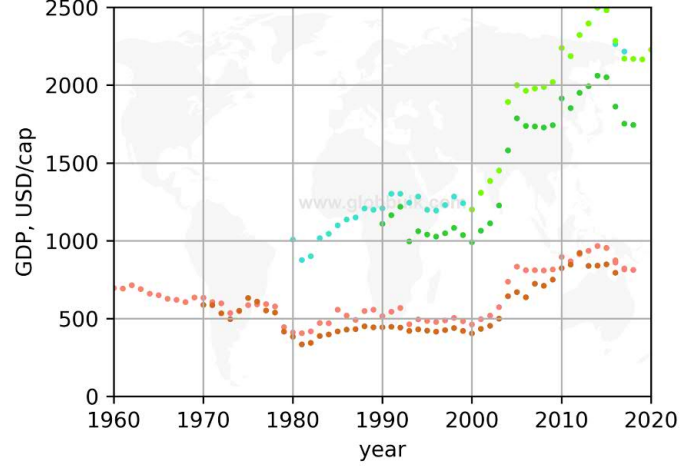


# Chad

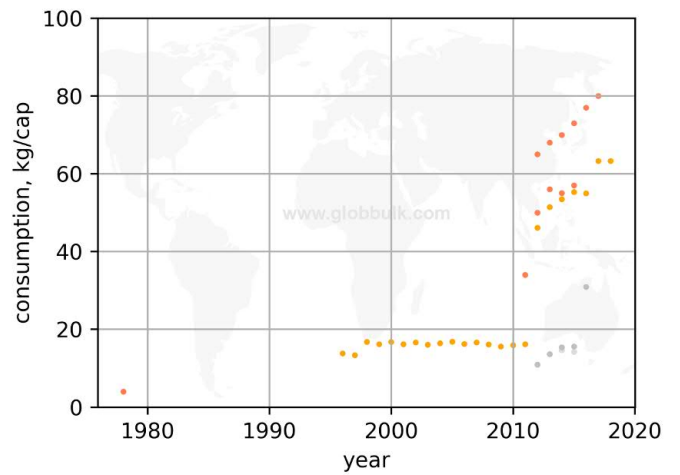
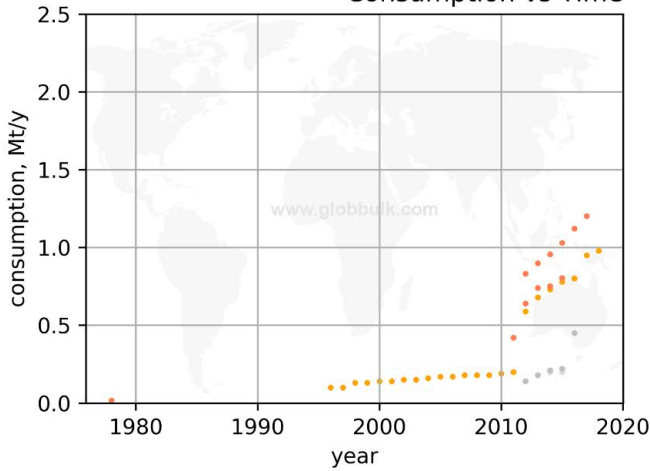
Population vs Time



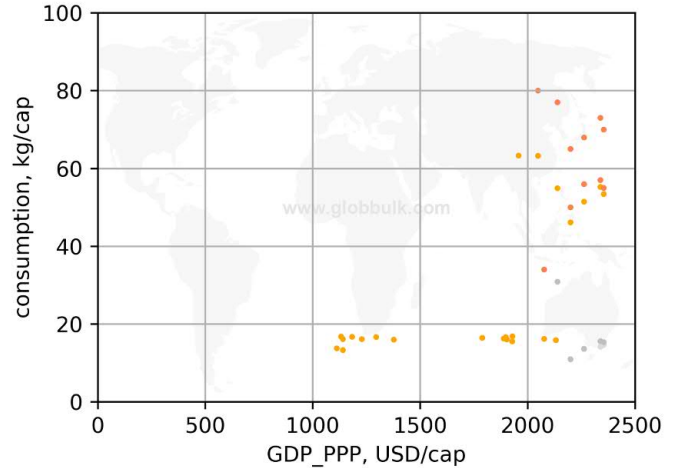
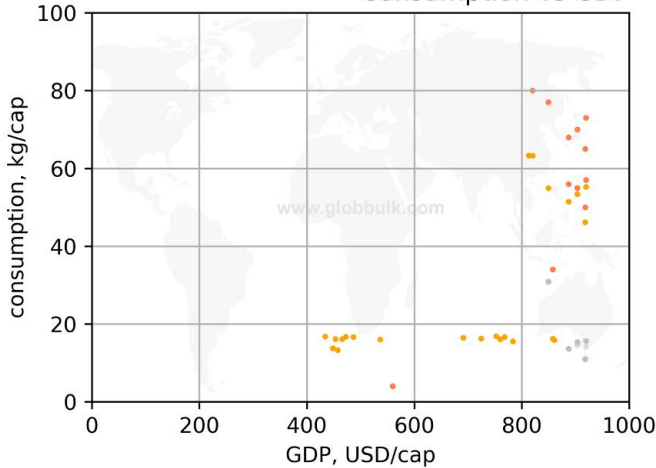
GDP vs Time



Consumption vs Time



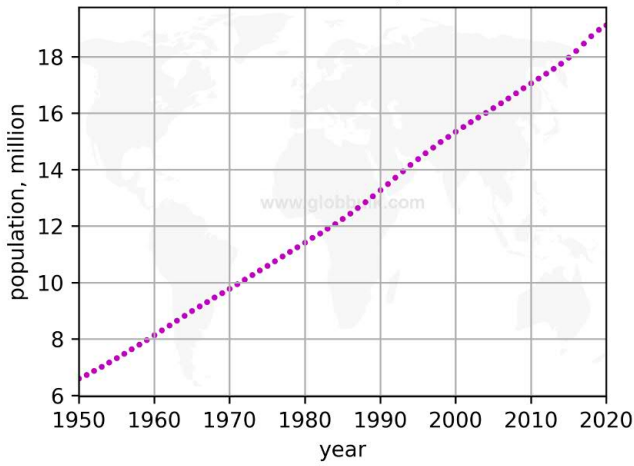
Consumption vs GDP



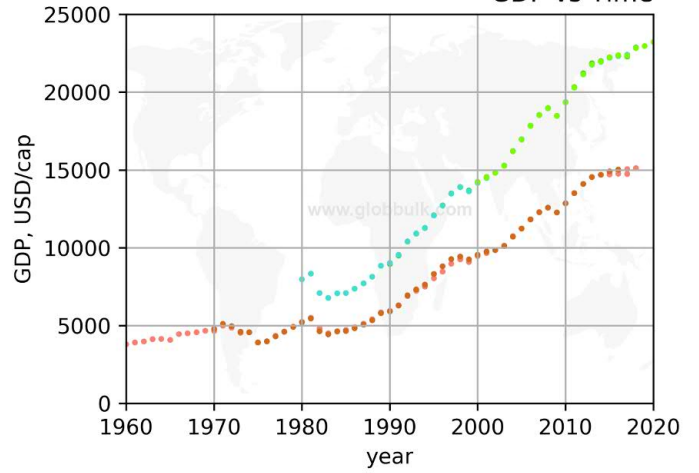


# Chile

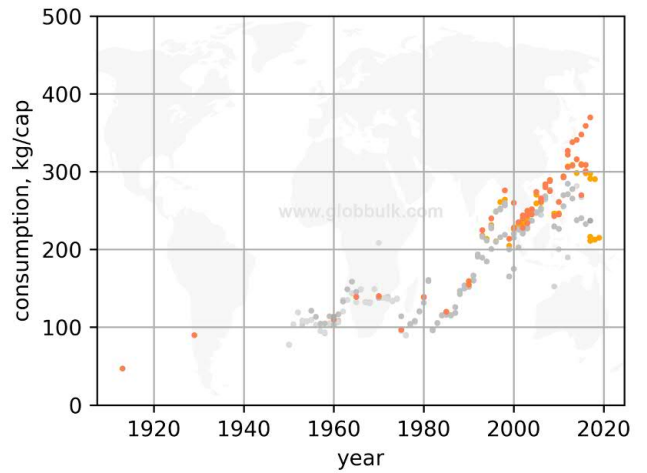
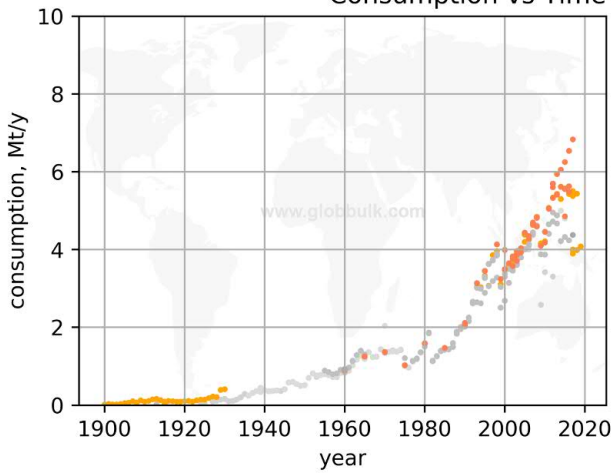
Population vs Time



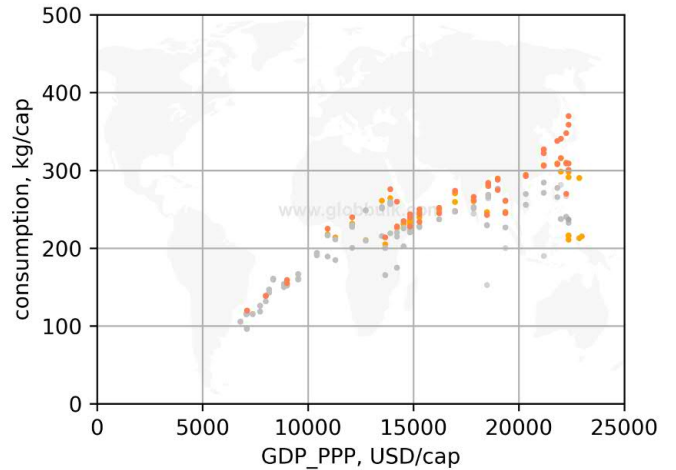
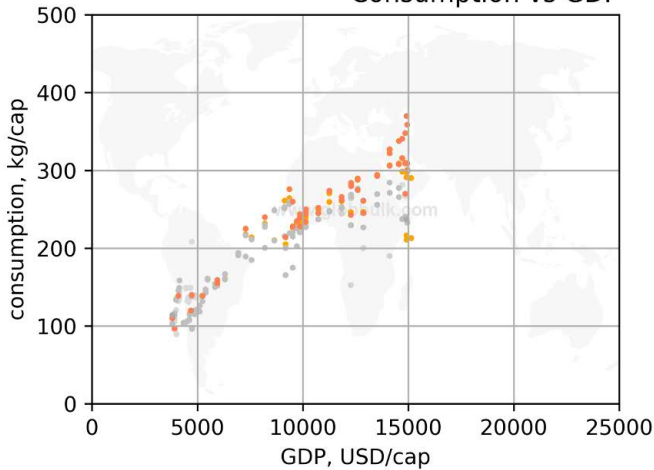
GDP vs Time



Consumption vs Time



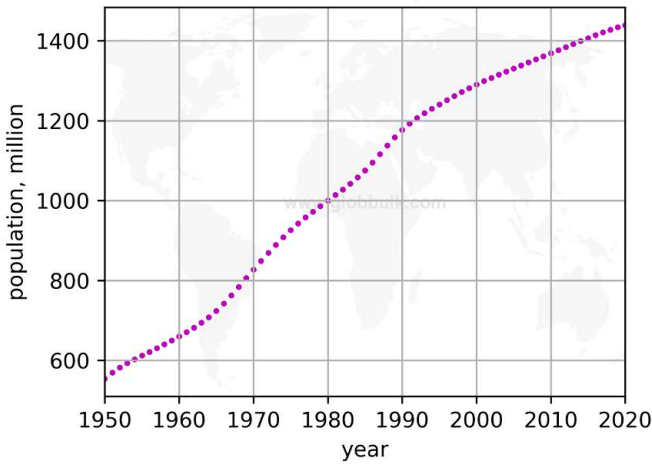
Consumption vs GDP



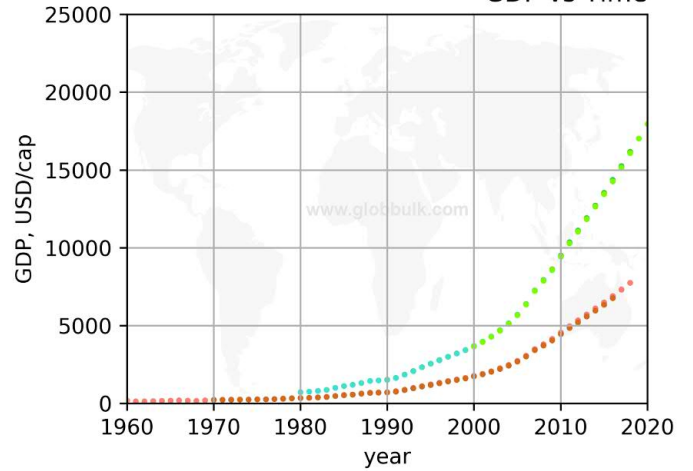


# China

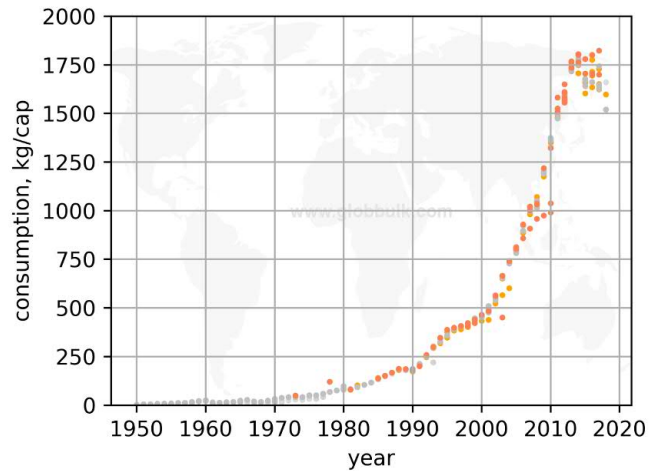
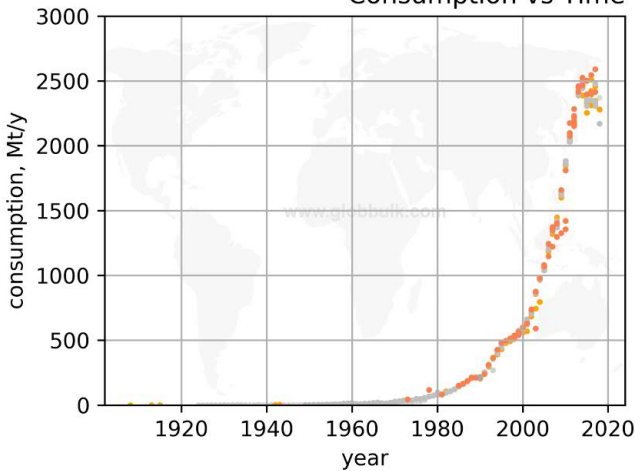
Population vs Time



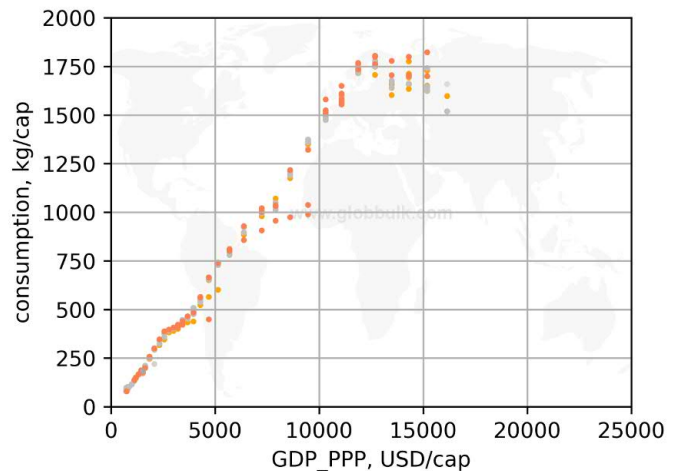
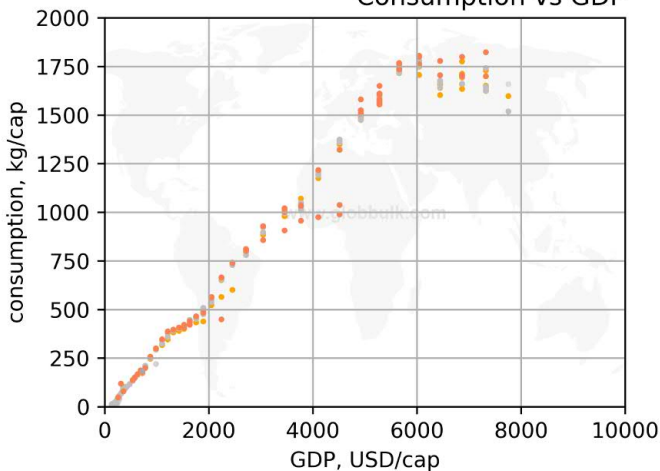
GDP vs Time



Consumption vs Time



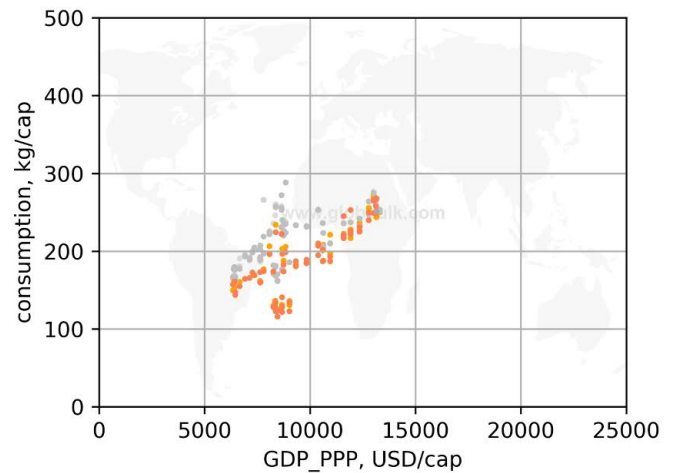
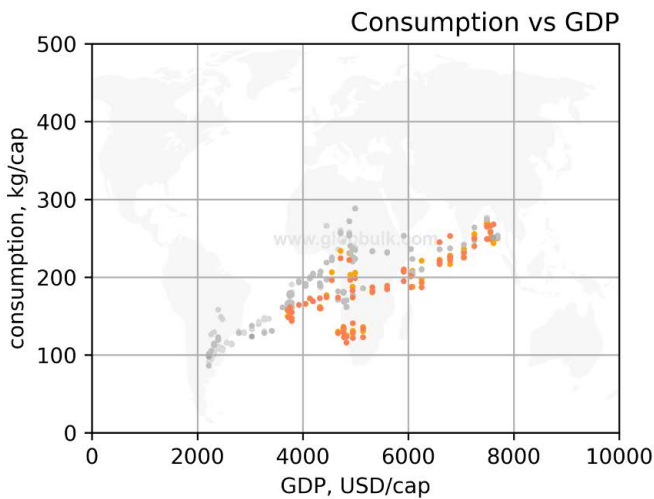
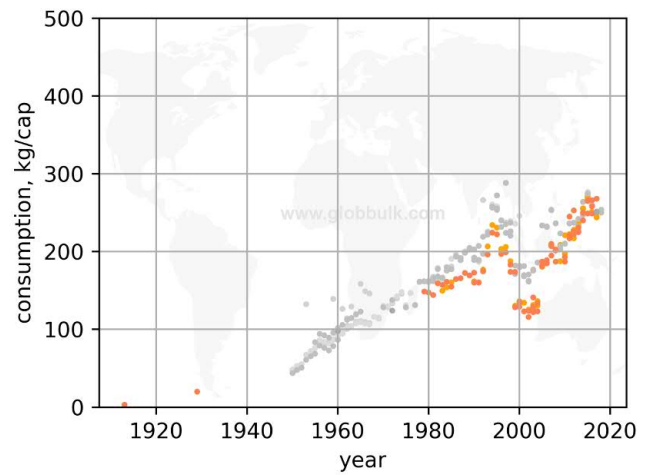
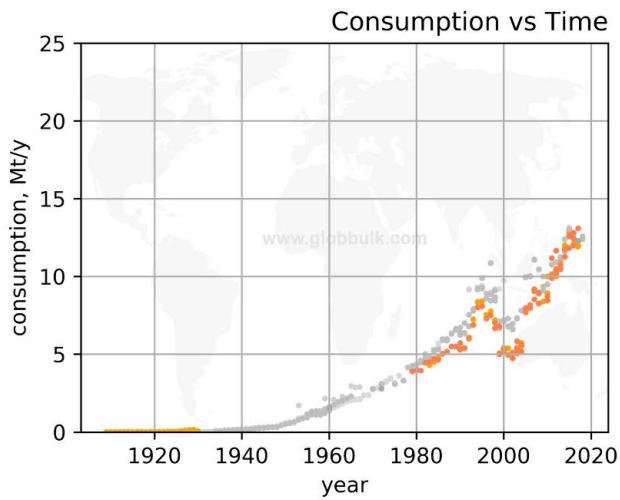
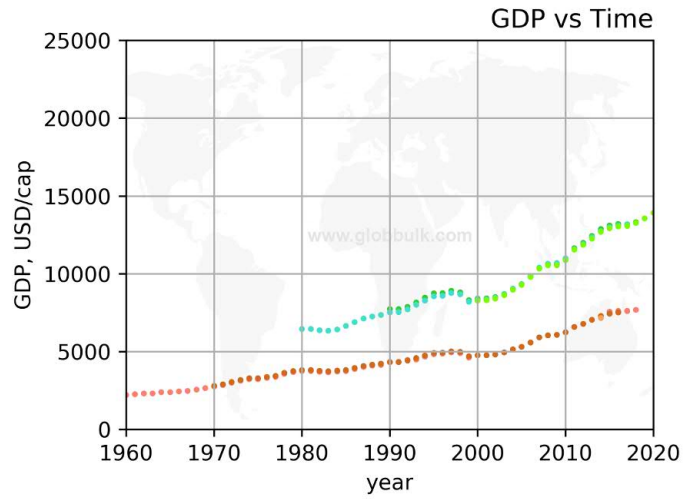
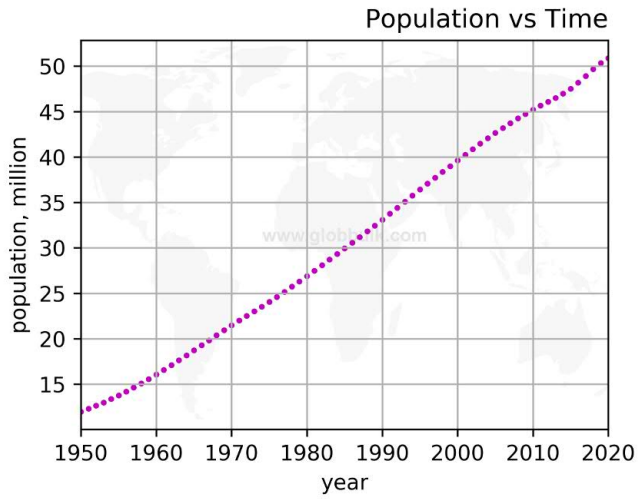
Consumption vs GDP







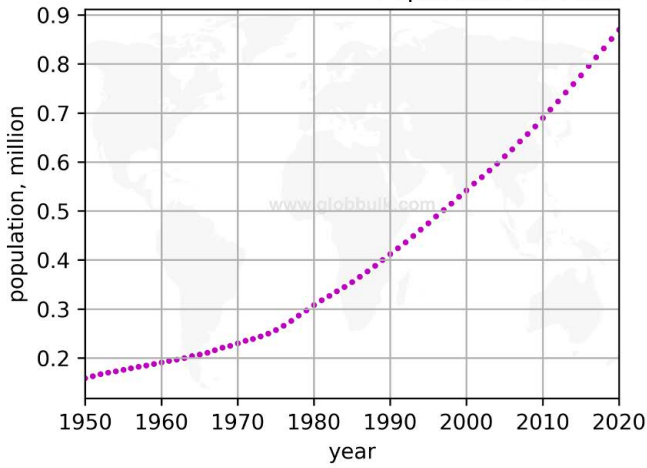
# Colombia



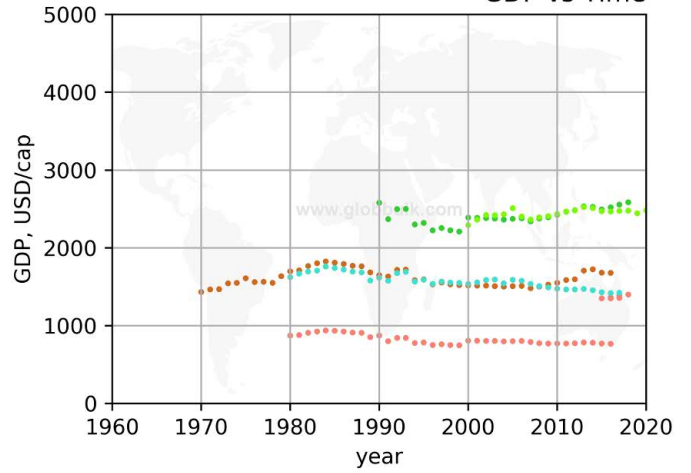


# Comoros

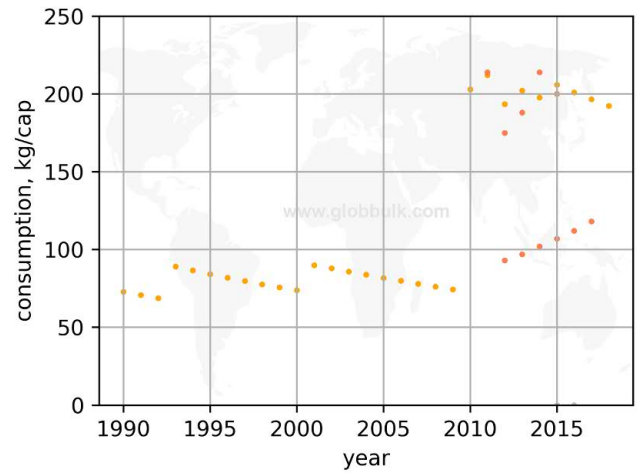
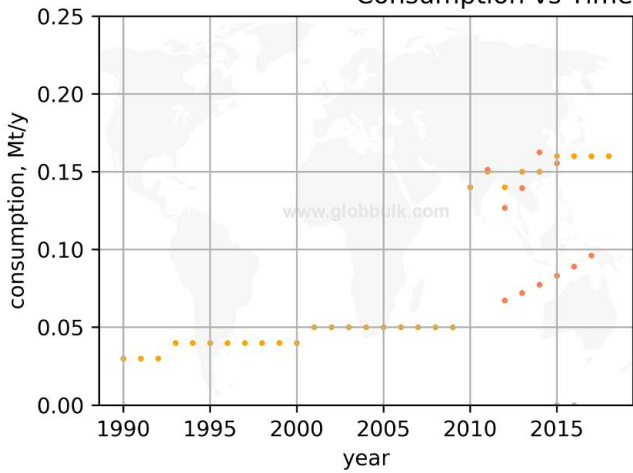
Population vs Time



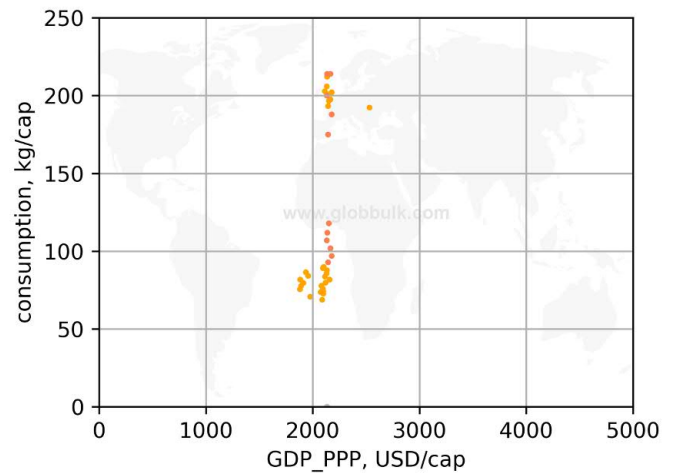
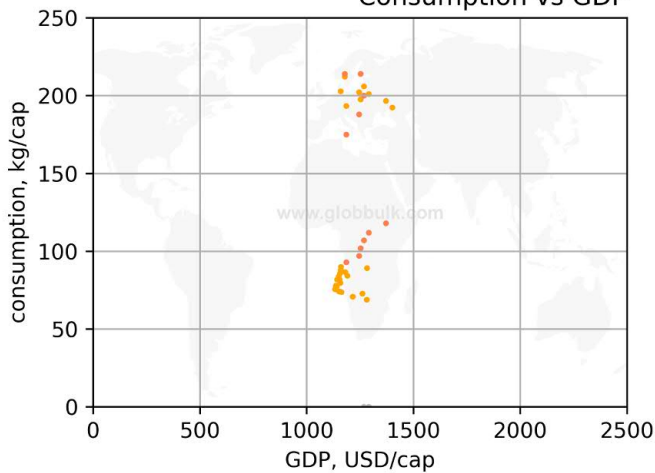
GDP vs Time



Consumption vs Time

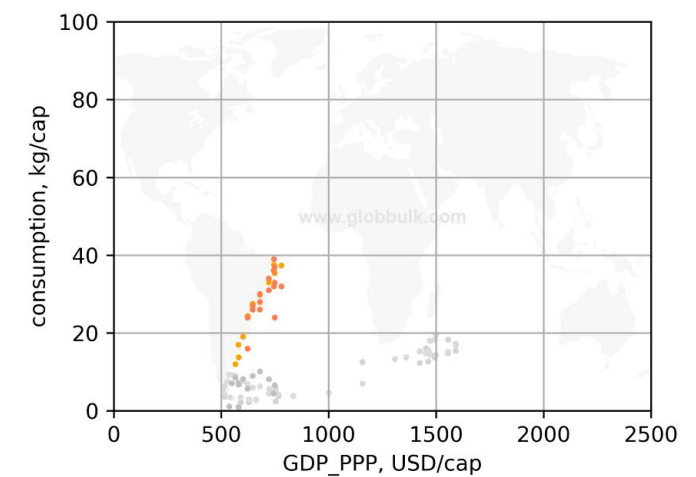
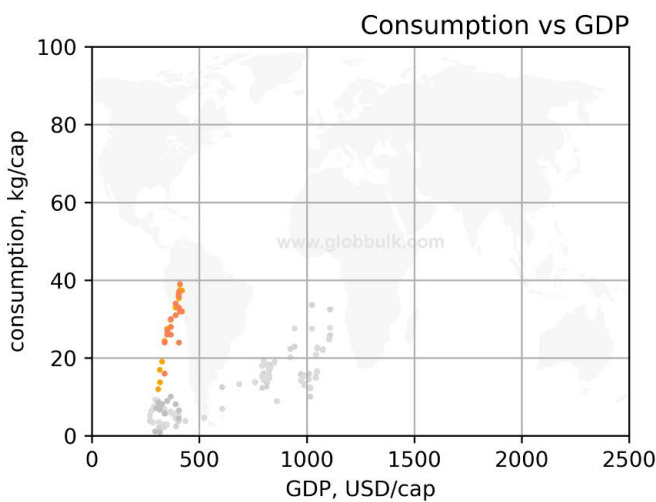
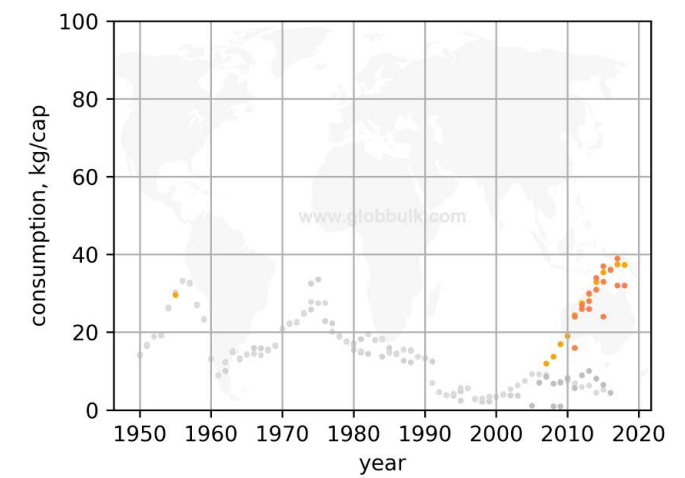
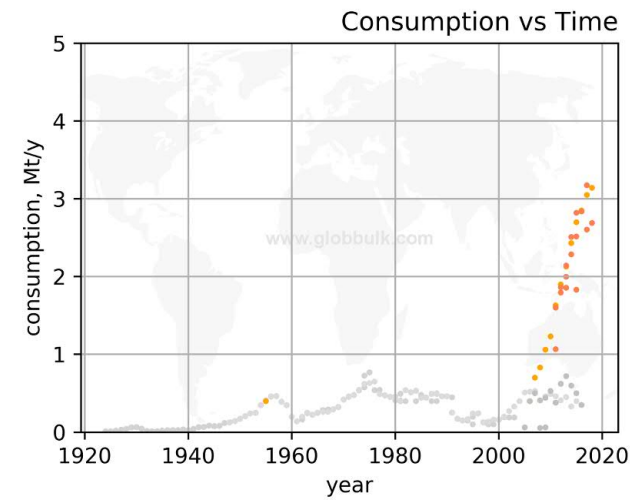
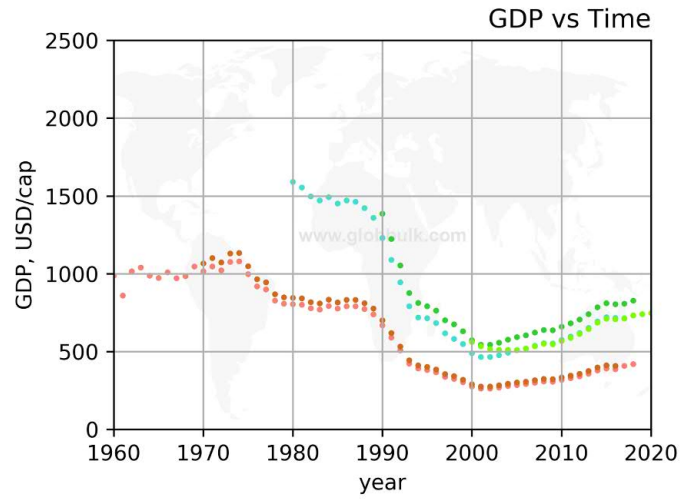
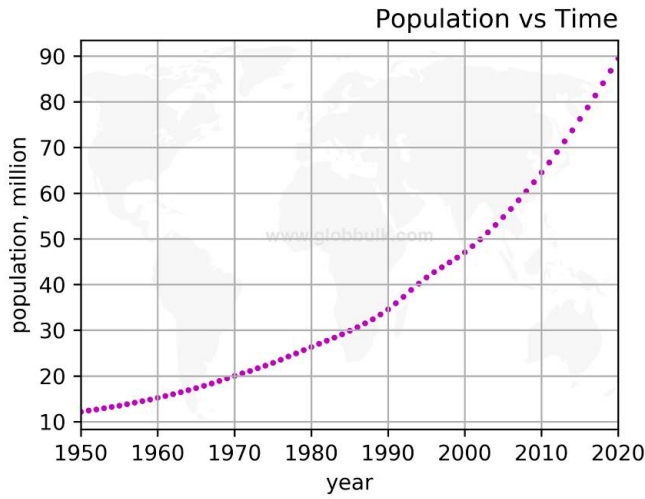


Consumption vs GDP





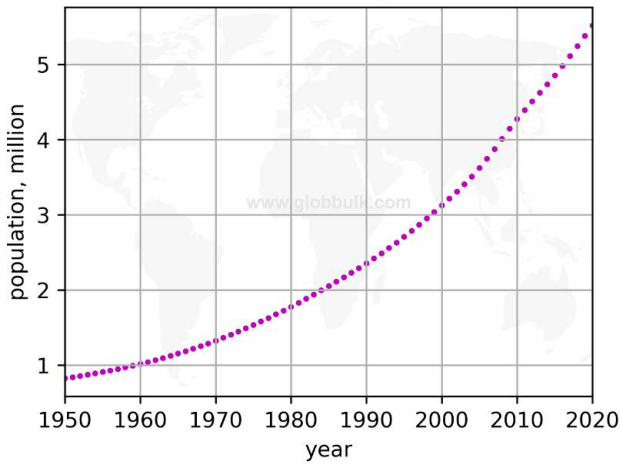
# Congo Dem. Rep.



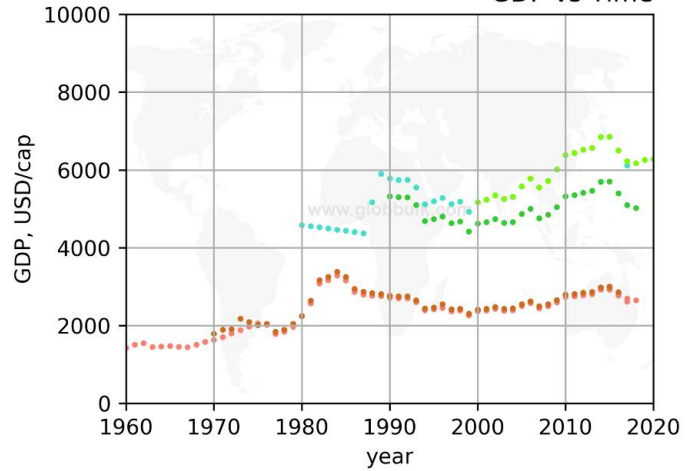


# Congo Rep.

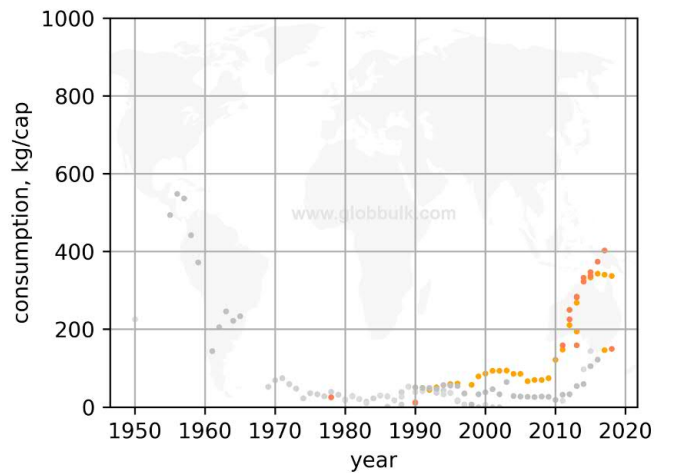
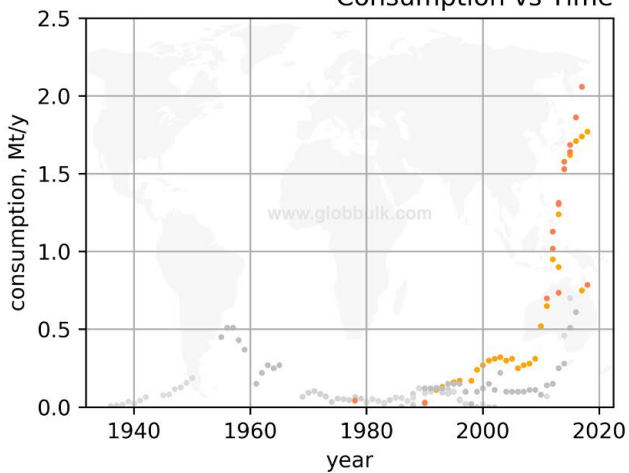
Population vs Time



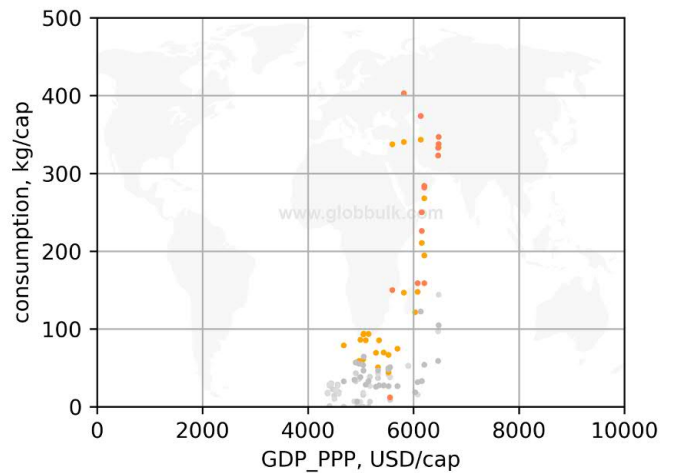
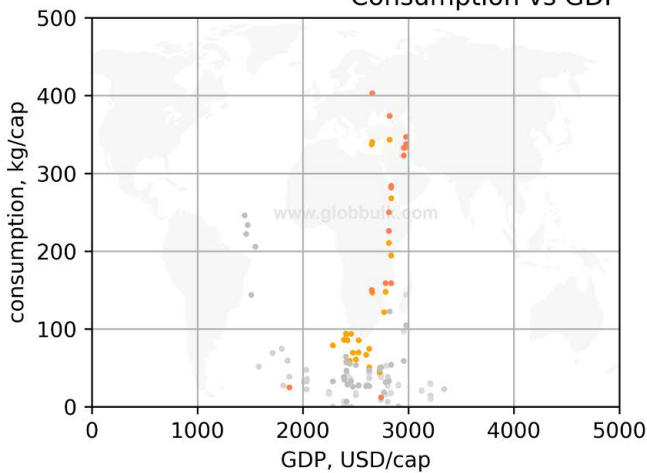
GDP vs Time



Consumption vs Time



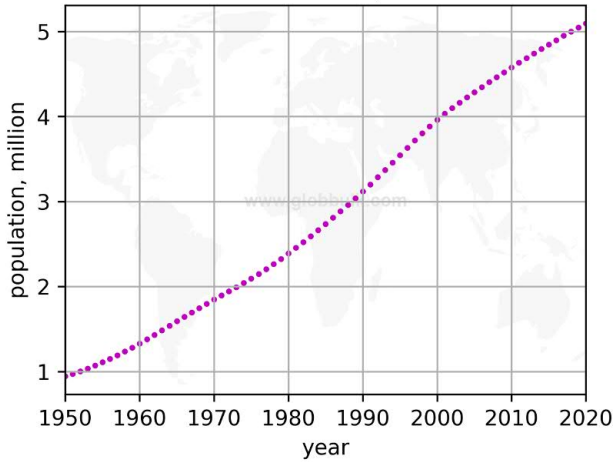
Consumption vs GDP



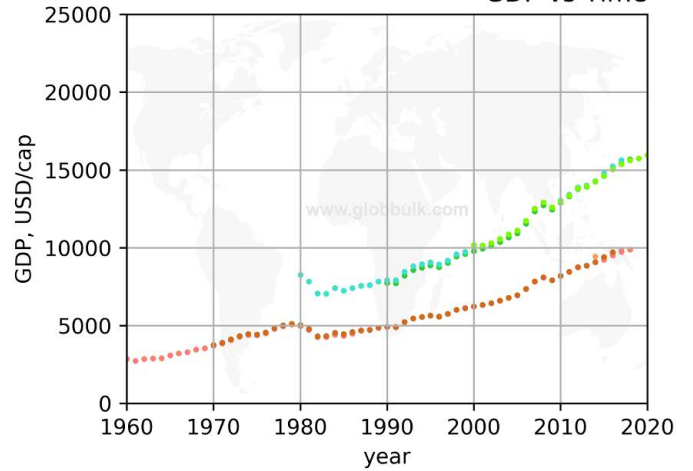


# Costa Rica

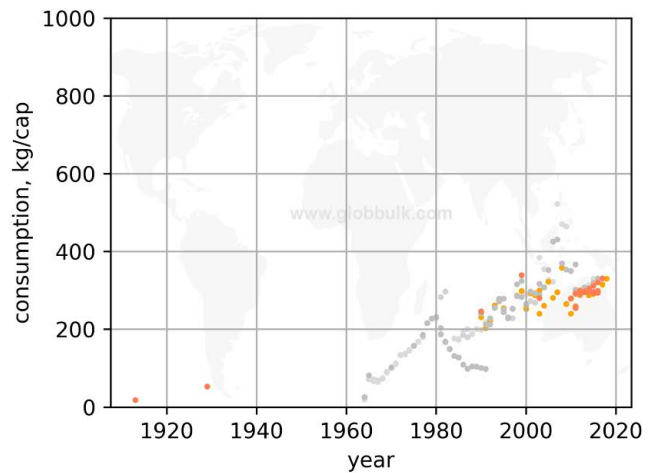
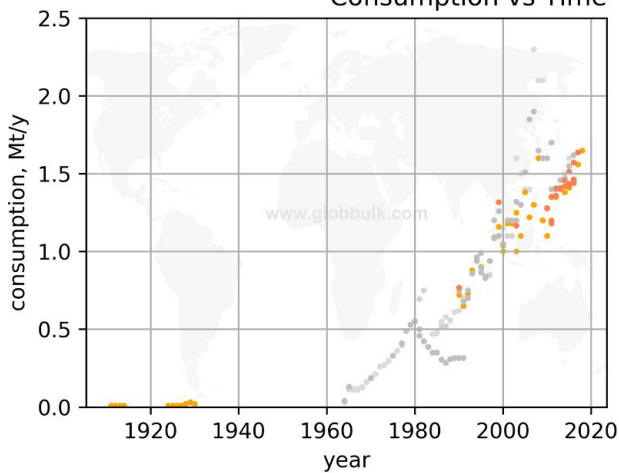
Population vs Time



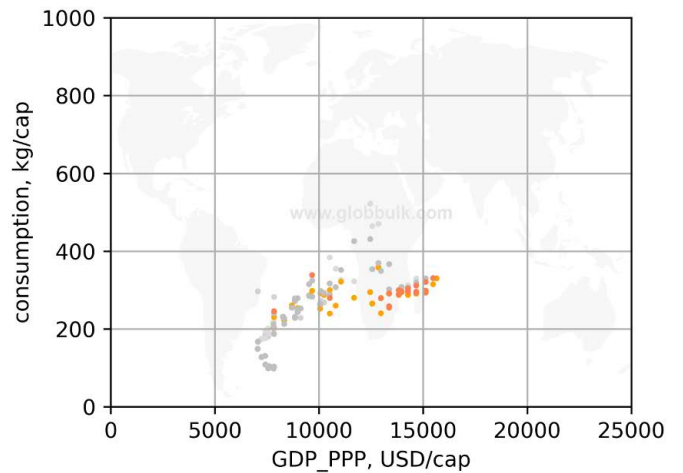
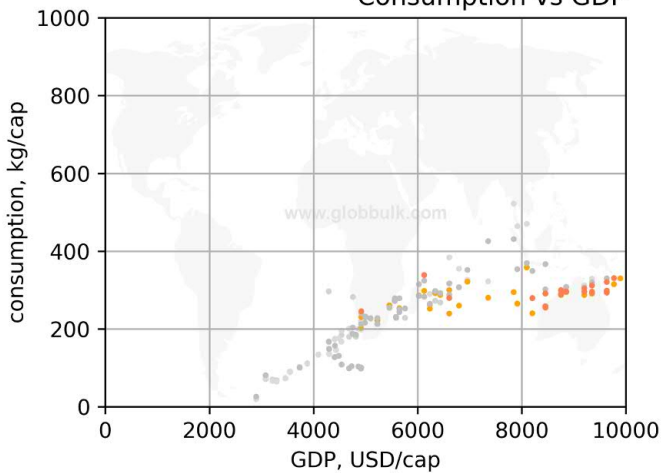
GDP vs Time



Consumption vs Time



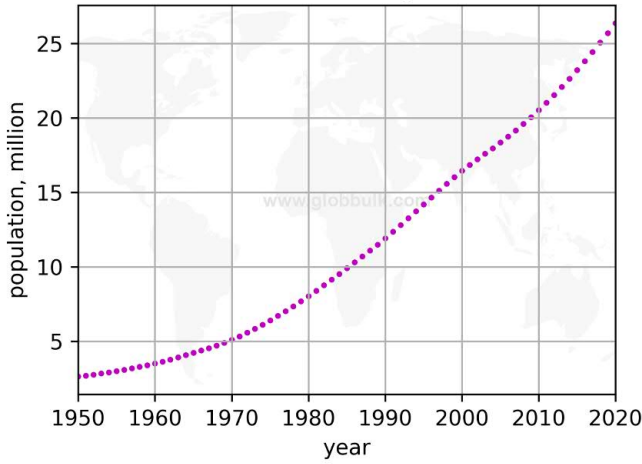
Consumption vs GDP



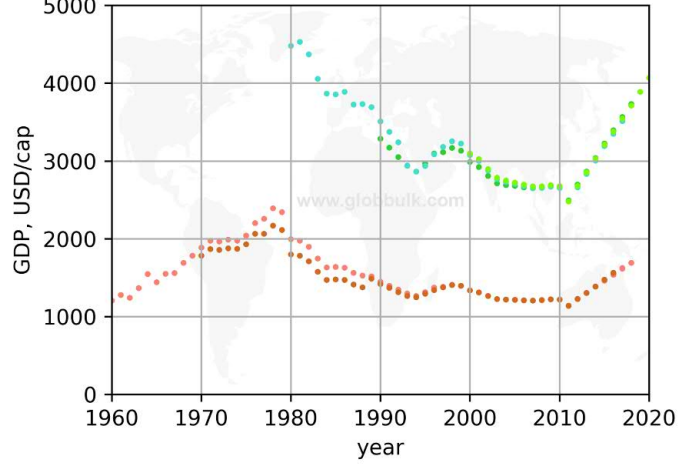


# Côte d'Ivoire

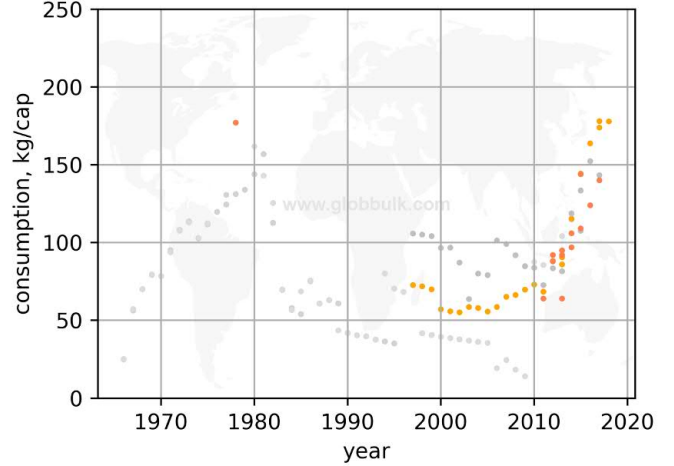
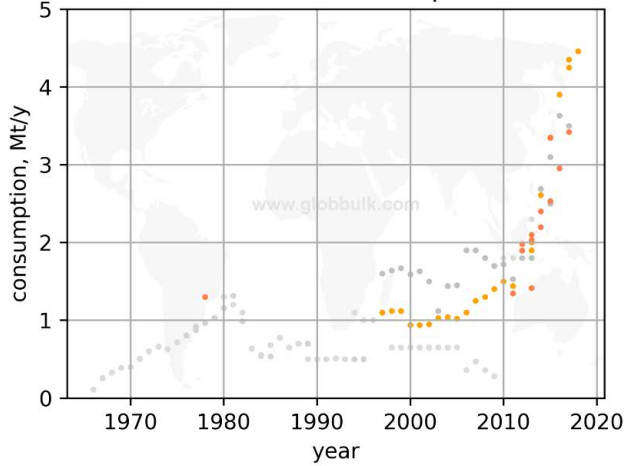
Population vs Time



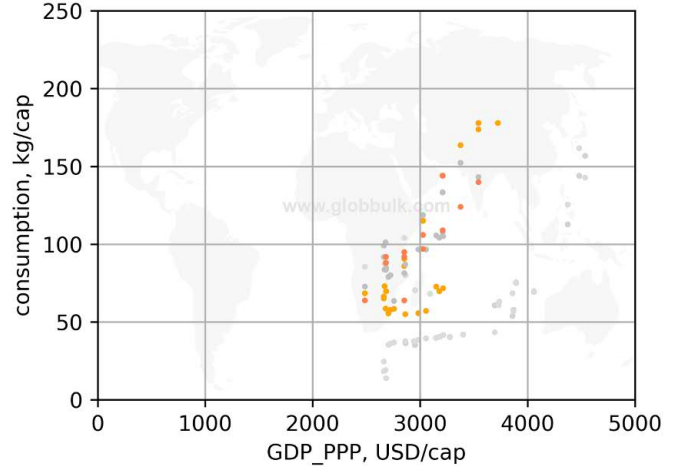
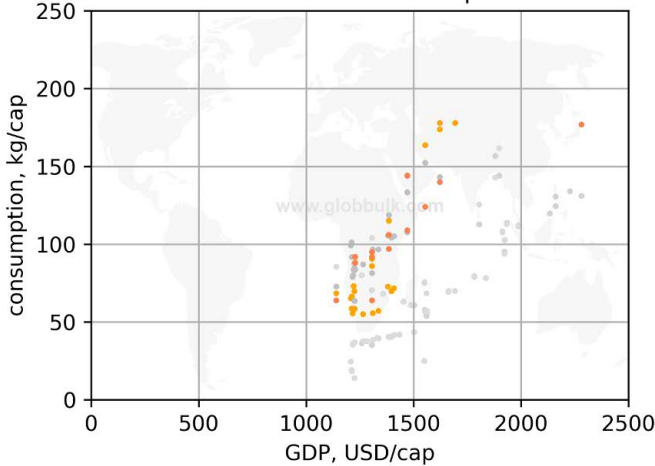
GDP vs Time



Consumption vs Time

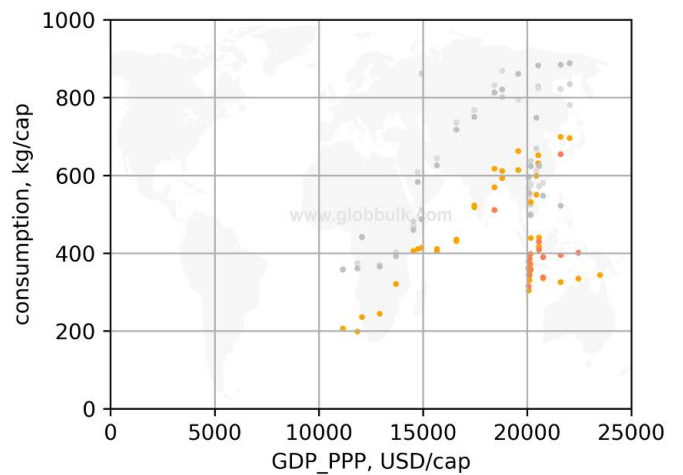
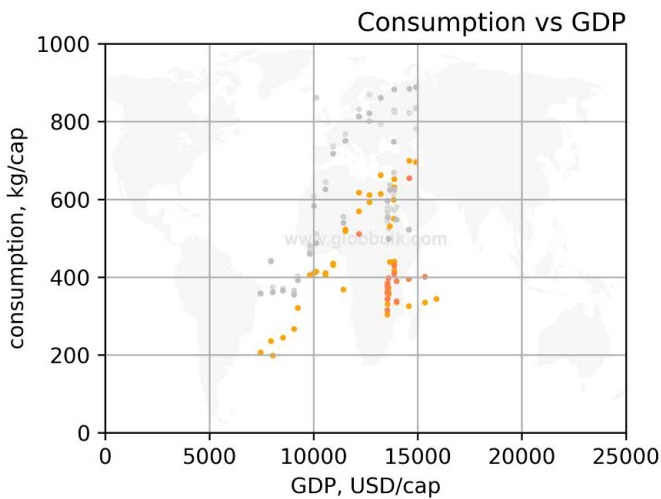
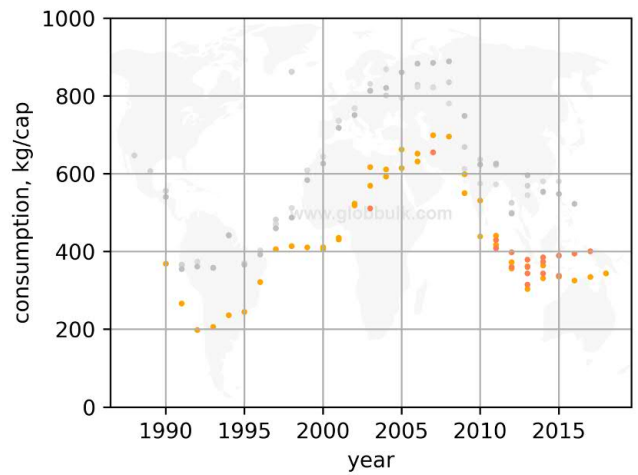
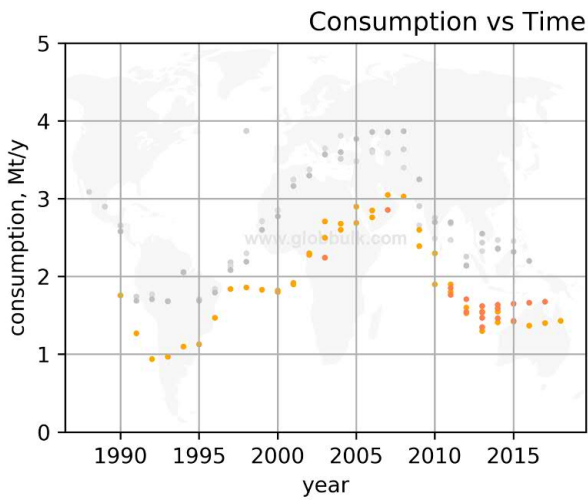
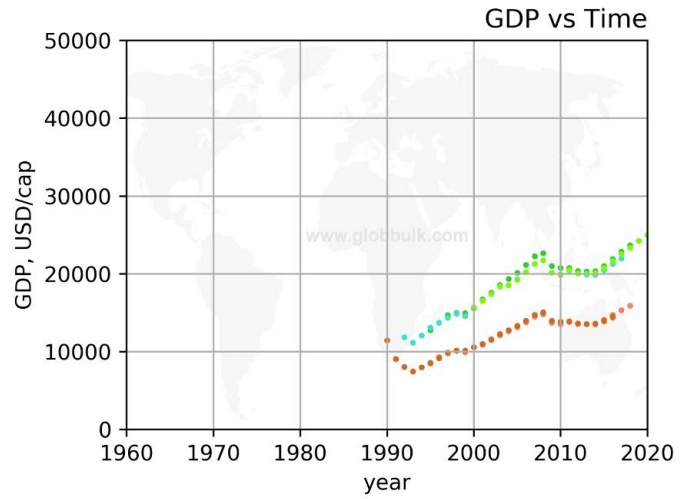
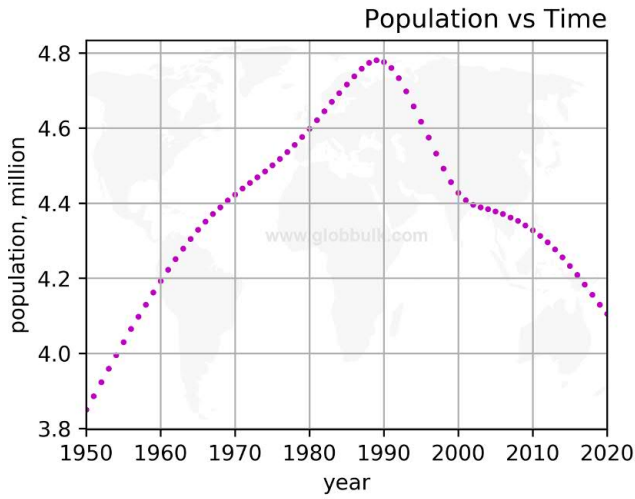


Consumption vs GDP





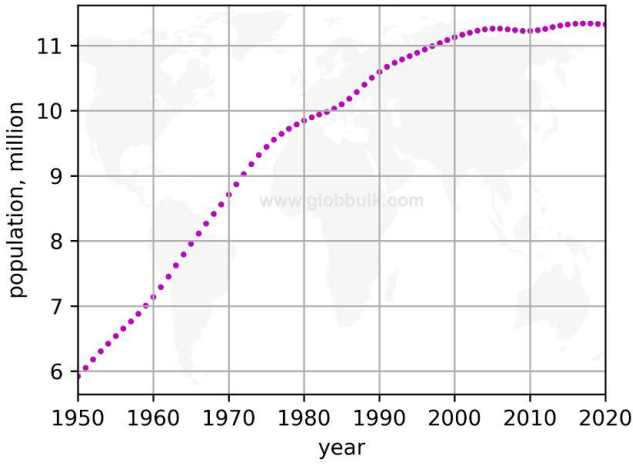
# Croatia



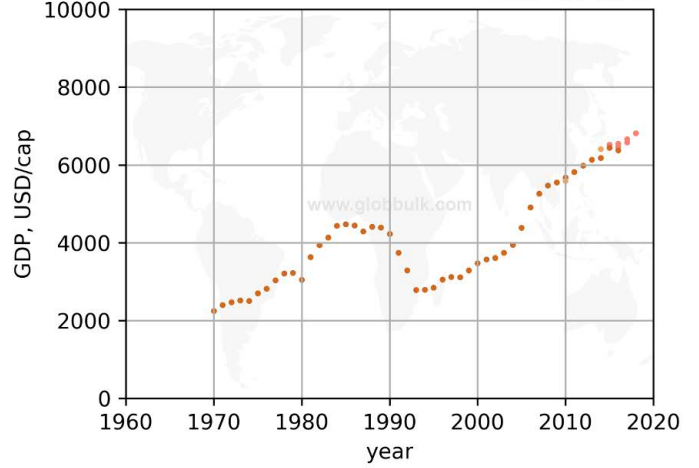


# Cuba

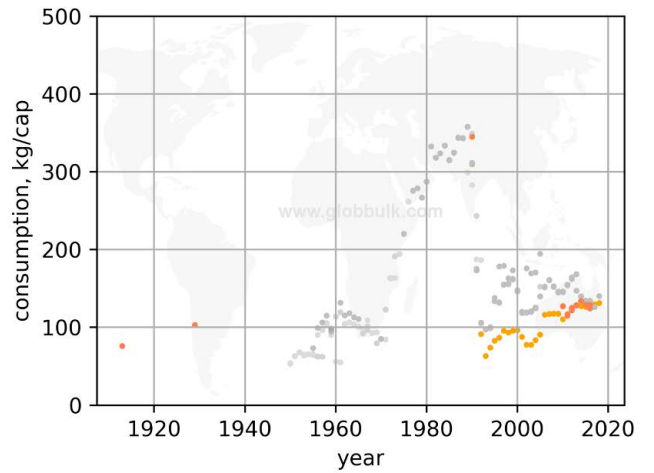
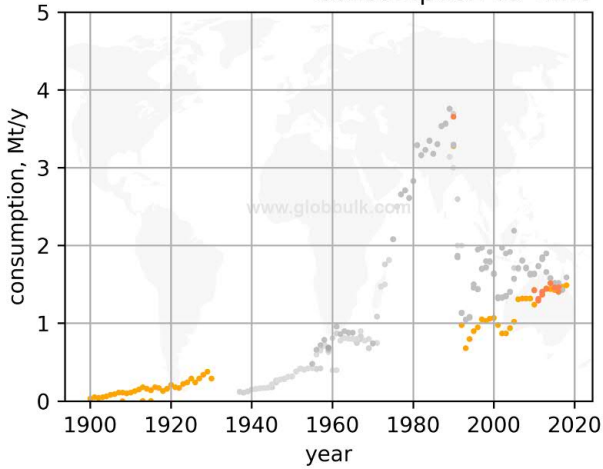
Population vs Time



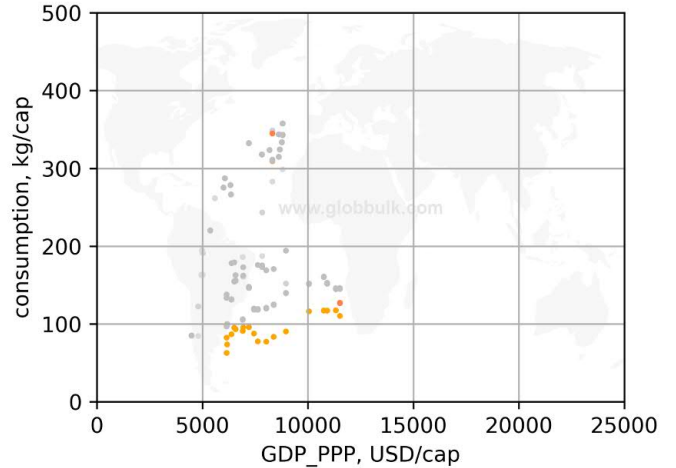
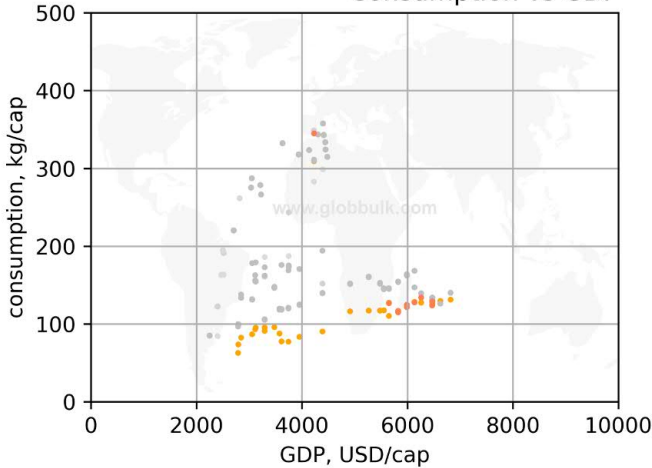
GDP vs Time



Consumption vs Time



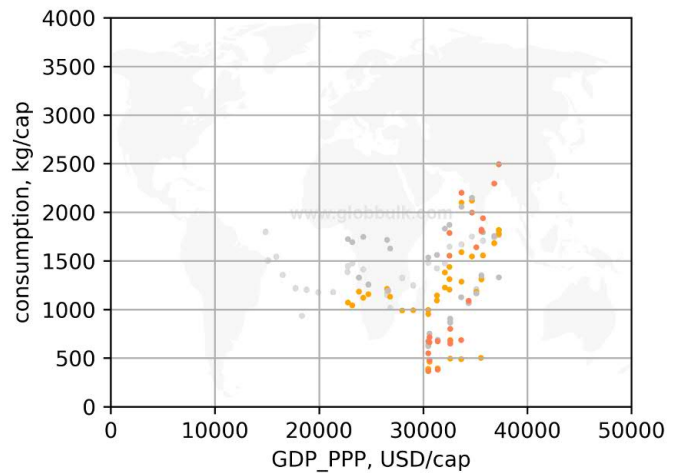
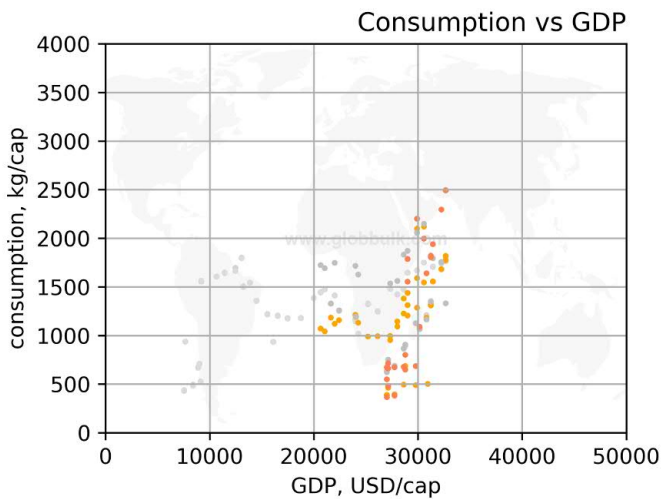
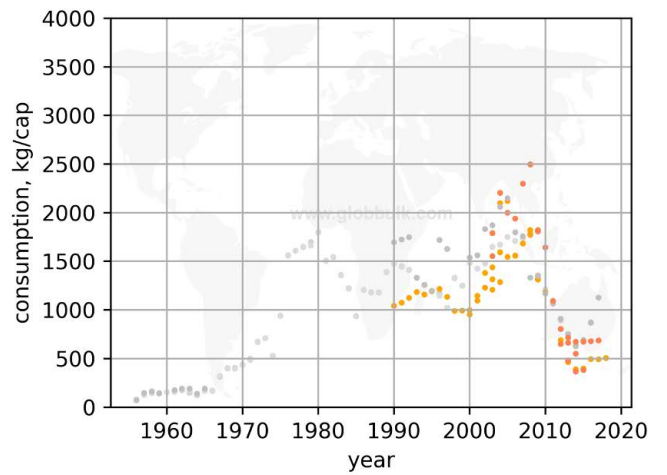
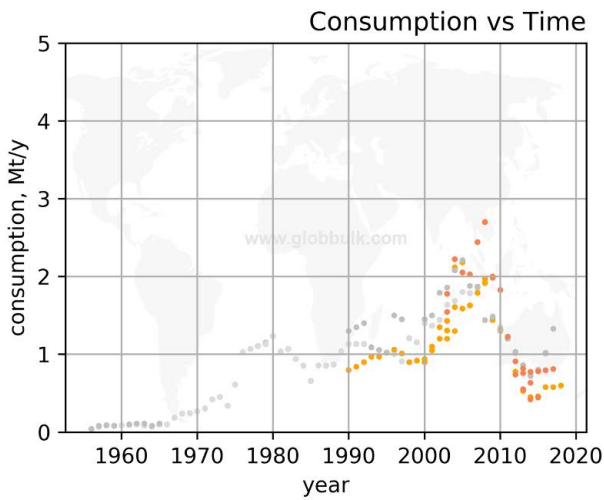
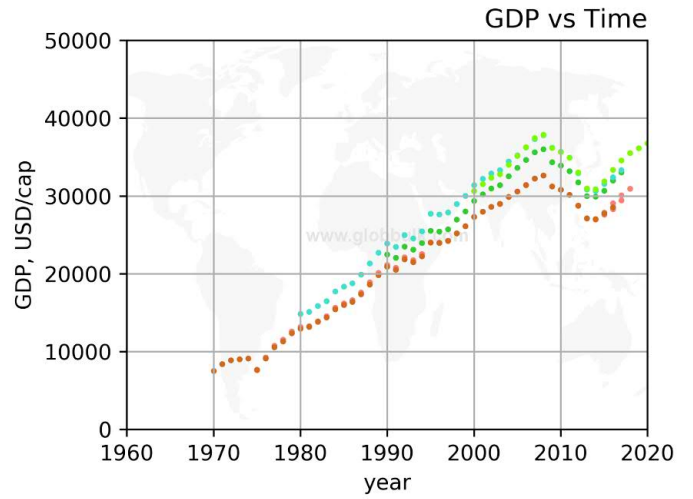
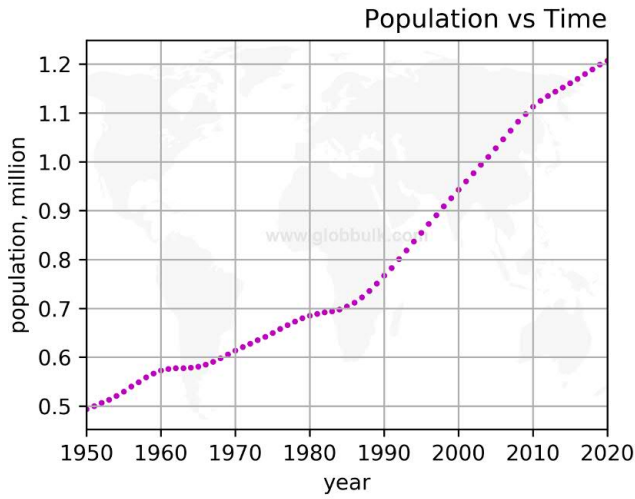
Consumption vs GDP





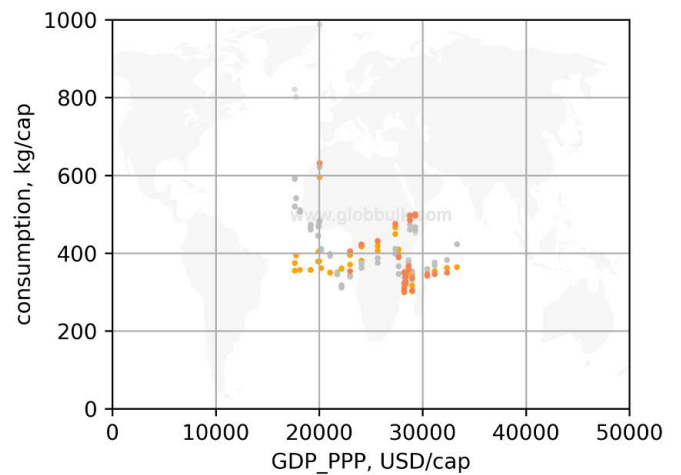
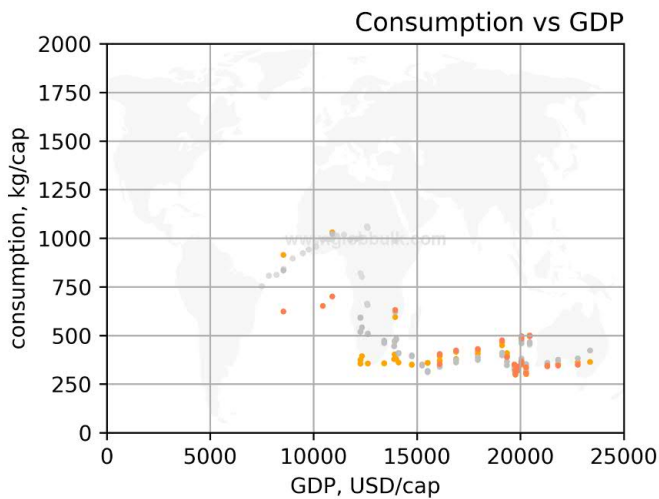
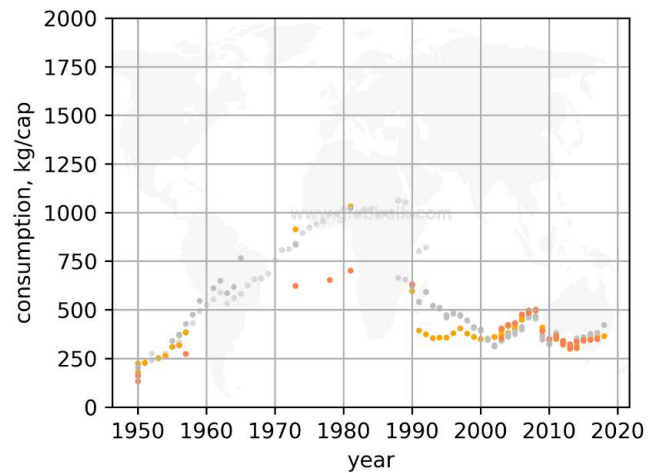
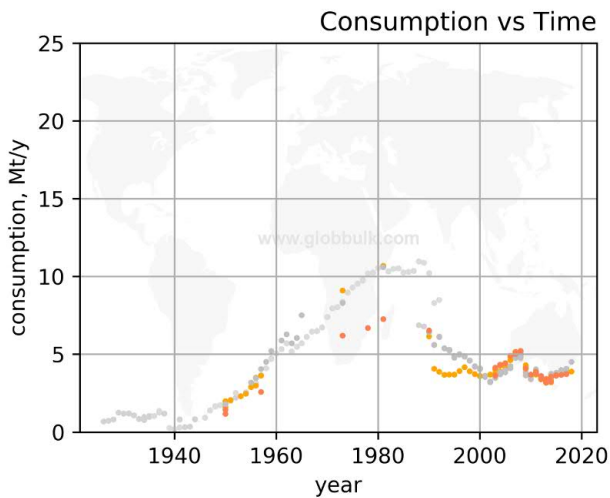
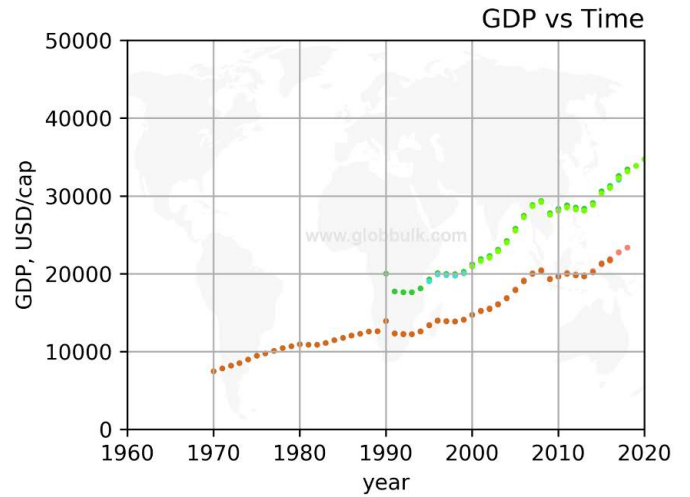
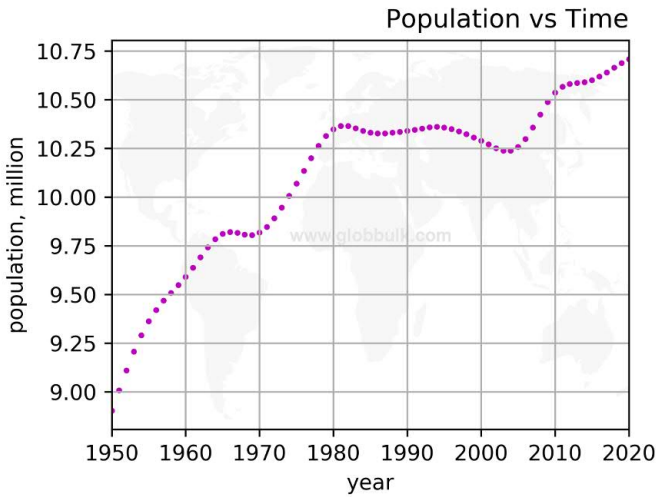


# Cyprus



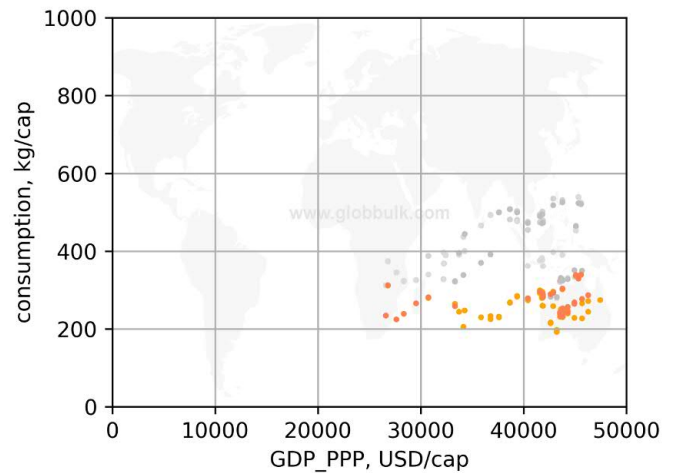
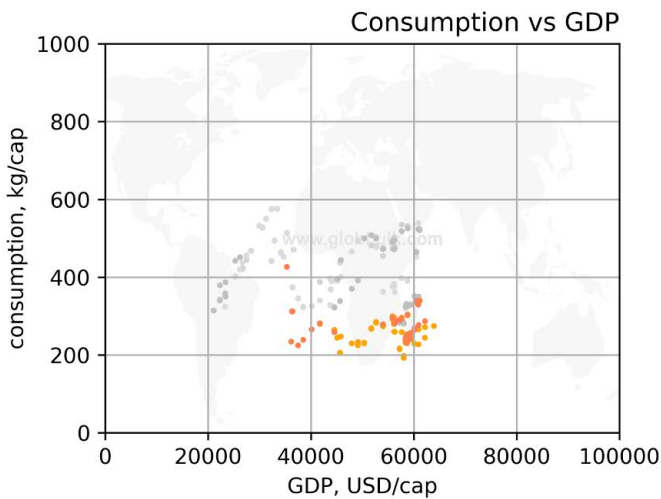
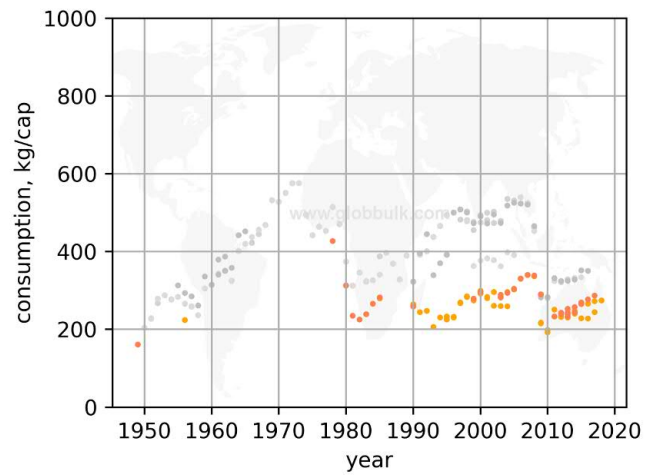
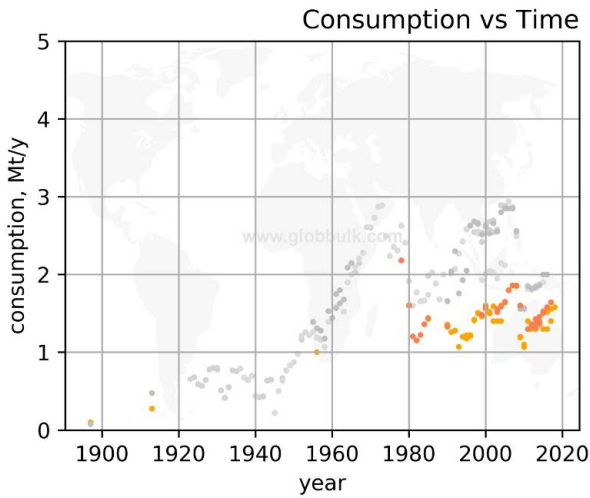
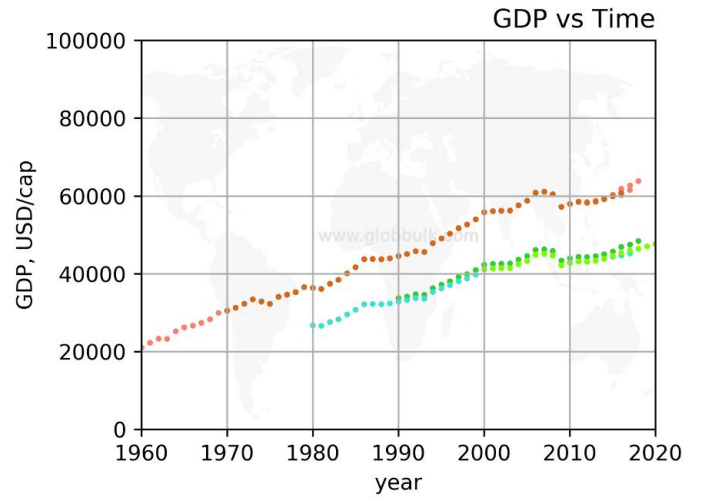
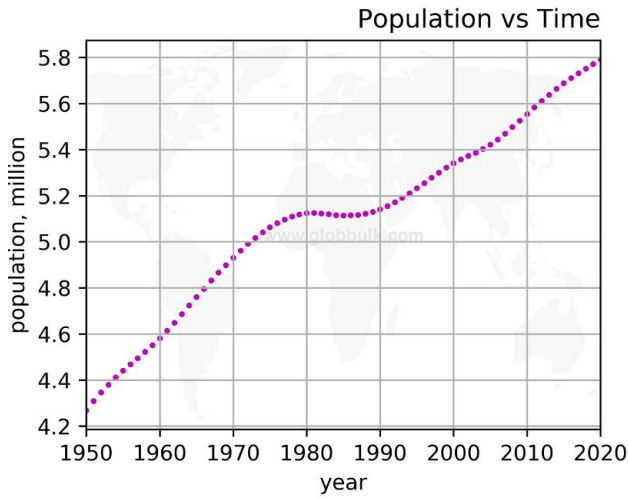


# Czech Rep.





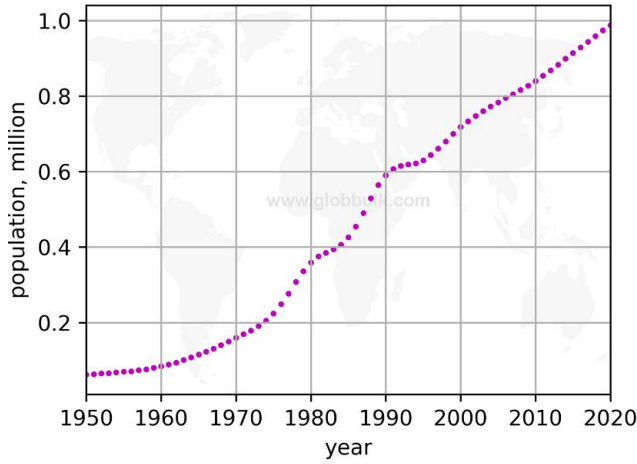
# Denmark



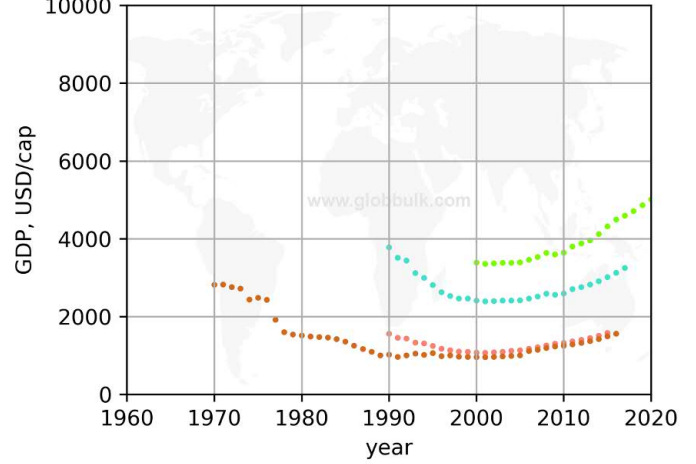


# Djibouti

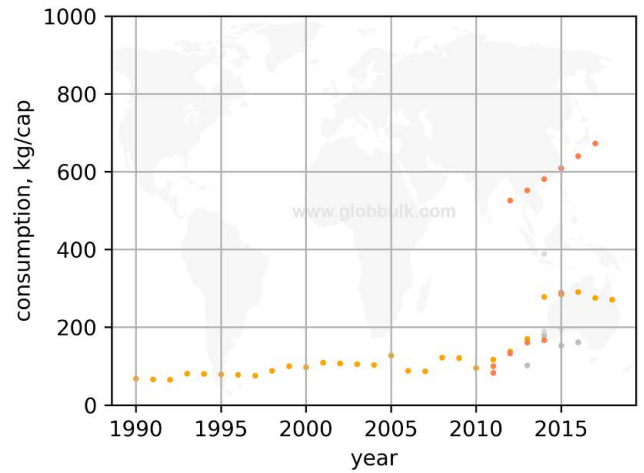
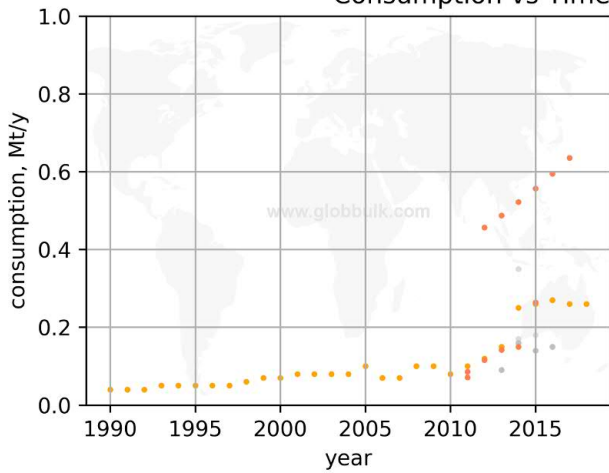
Population vs Time



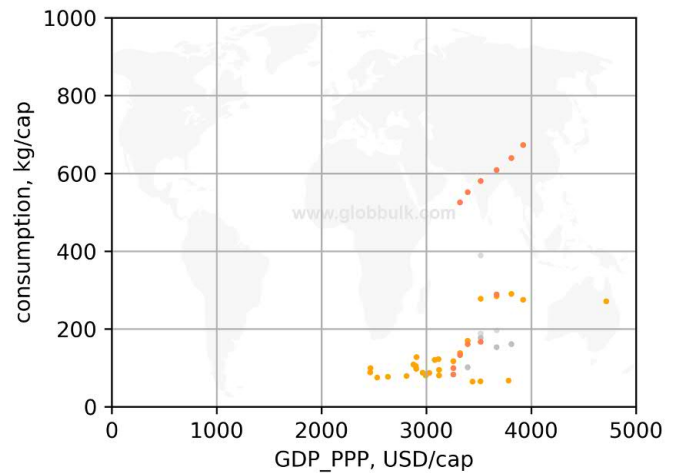
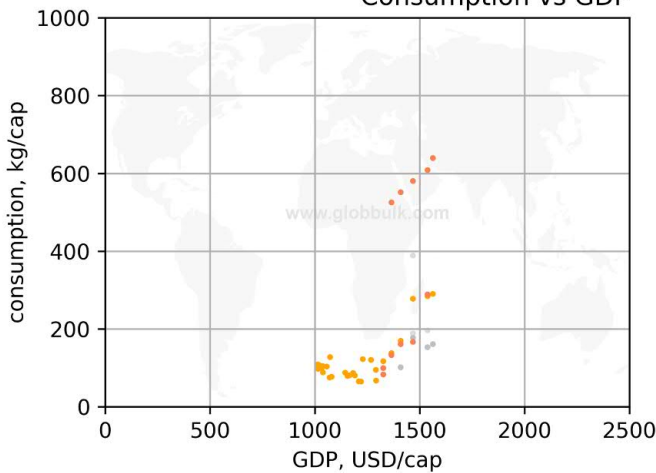
GDP vs Time



Consumption vs Time



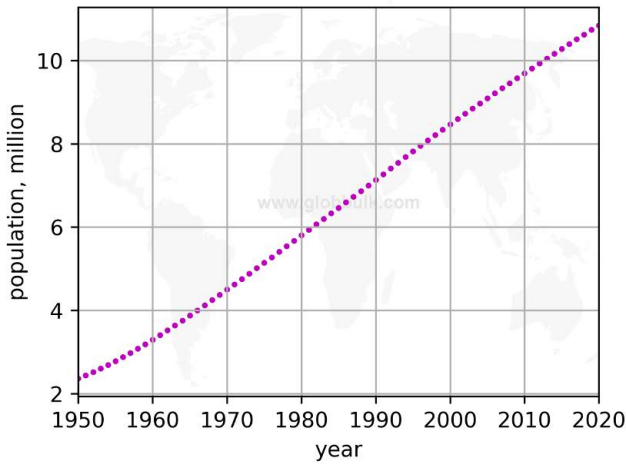
Consumption vs GDP



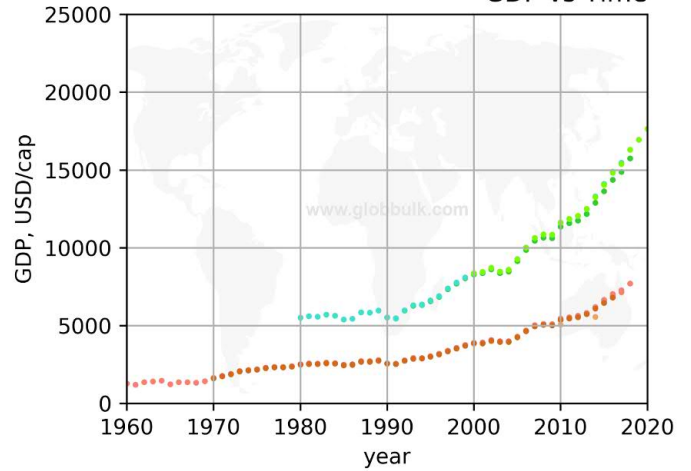


# Dominican Rep.

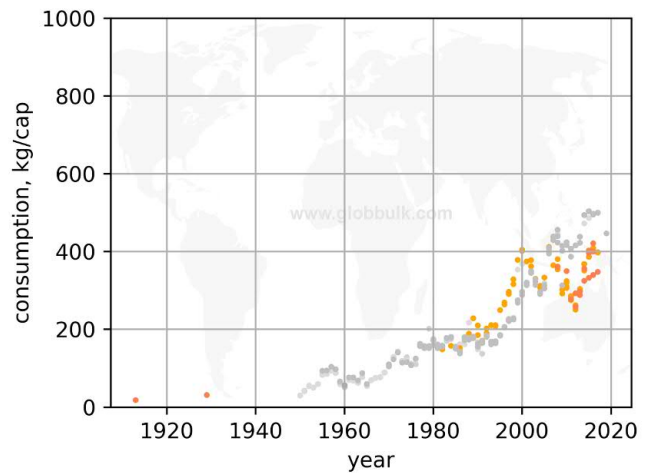
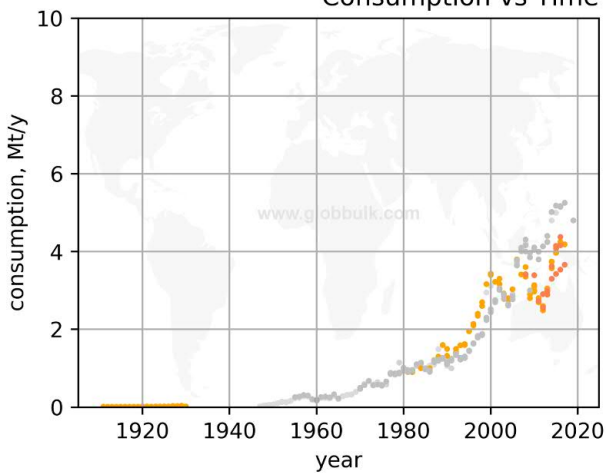
Population vs Time



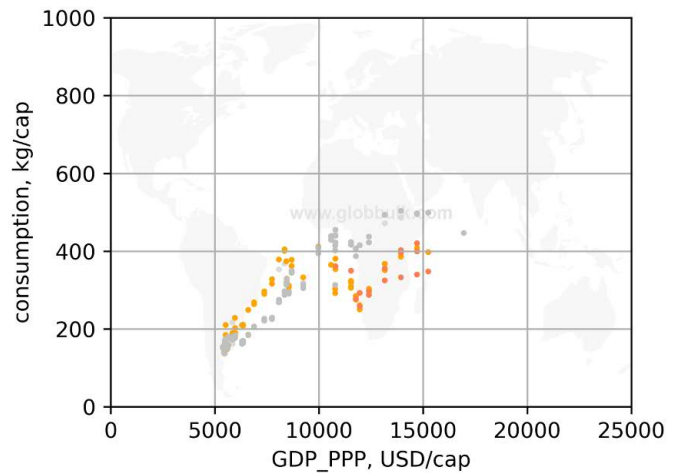
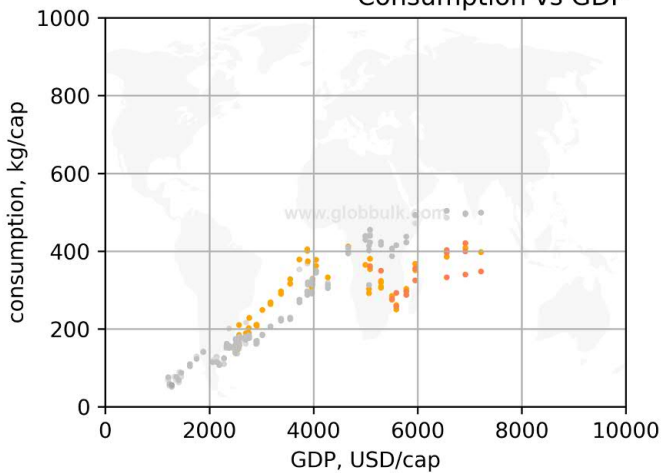
GDP vs Time



Consumption vs Time

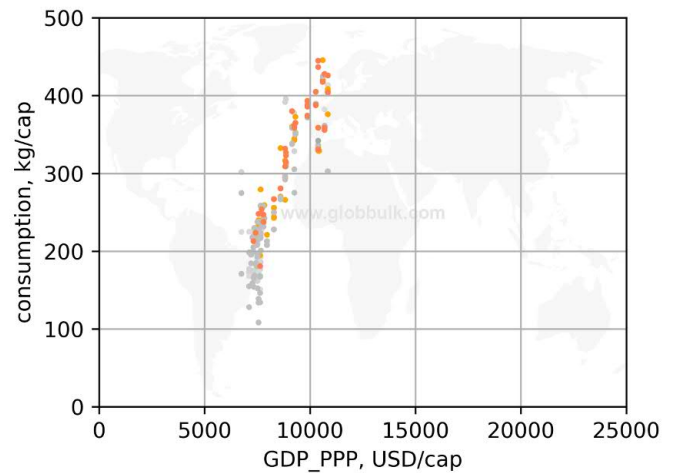
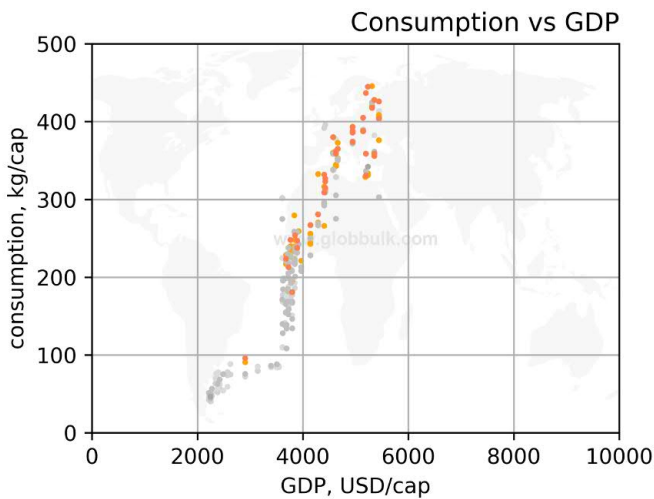
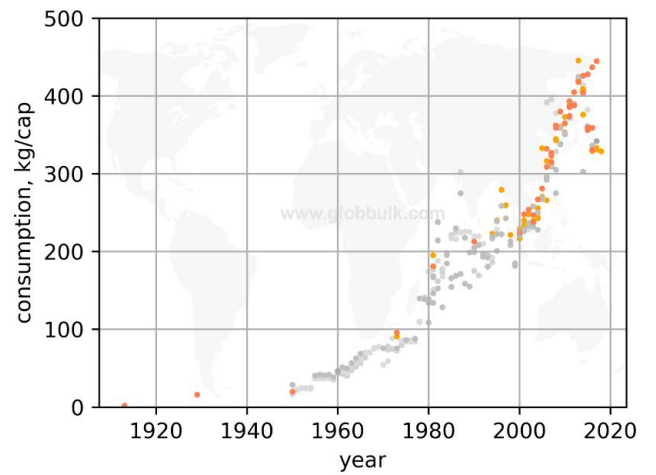
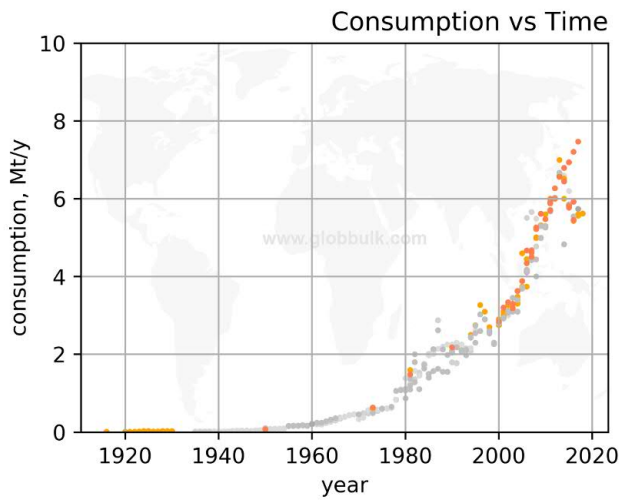
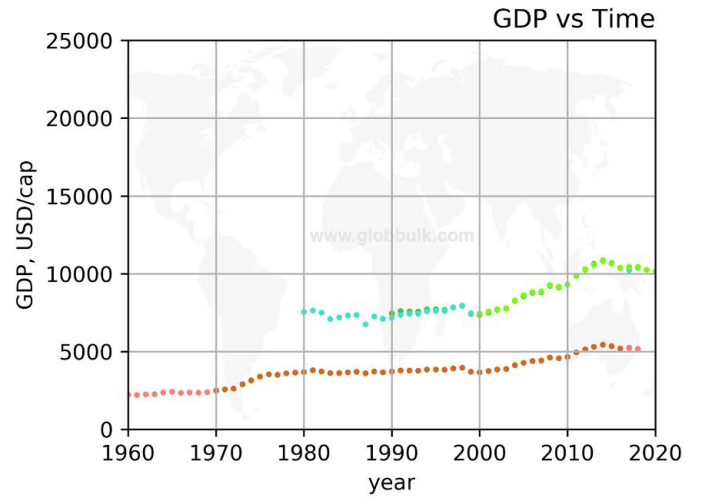
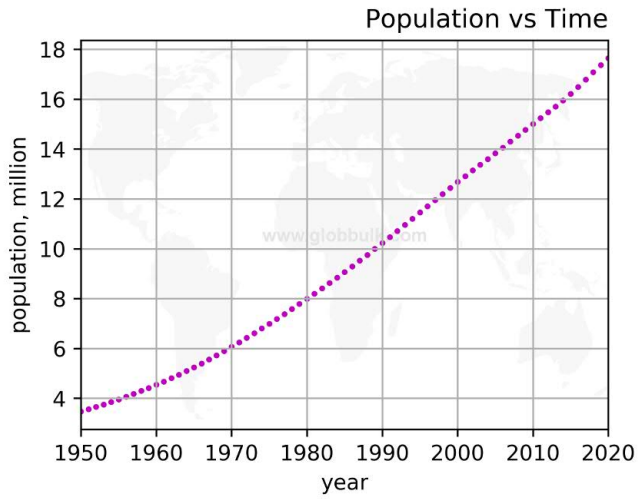


Consumption vs GDP





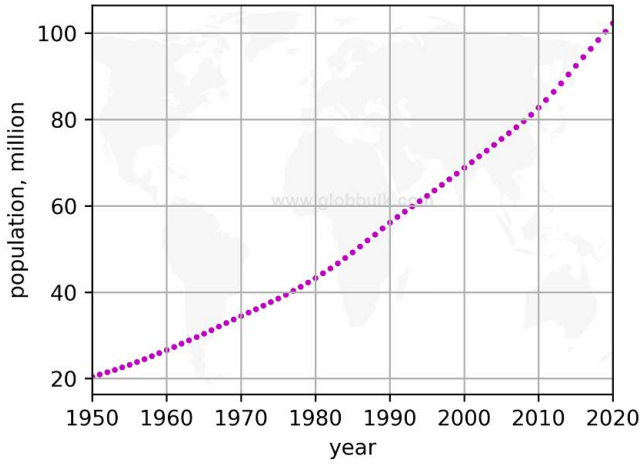
# Ecuador



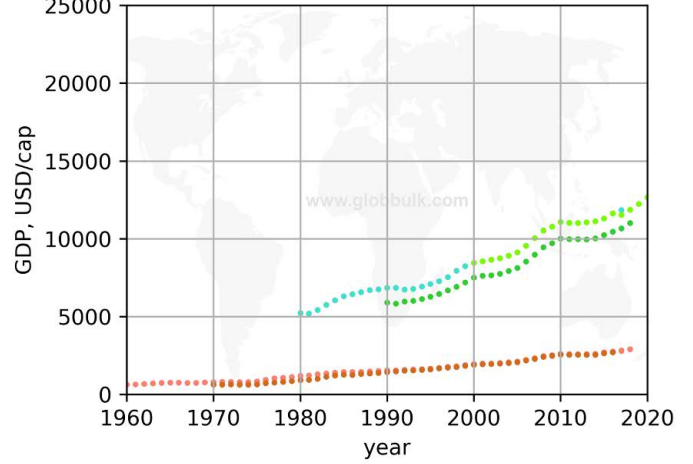


# Egypt

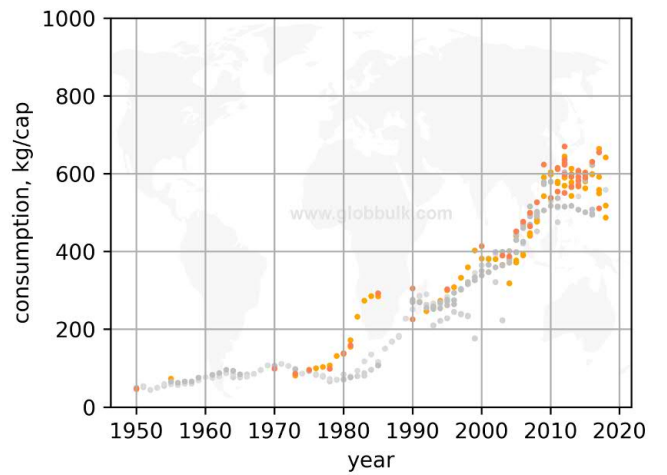
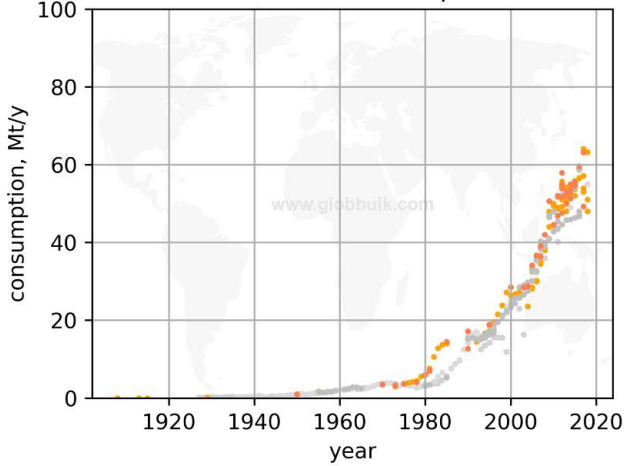
Population vs Time



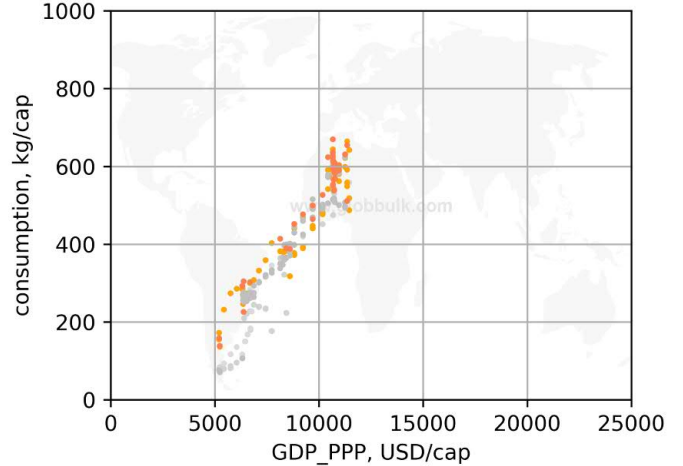
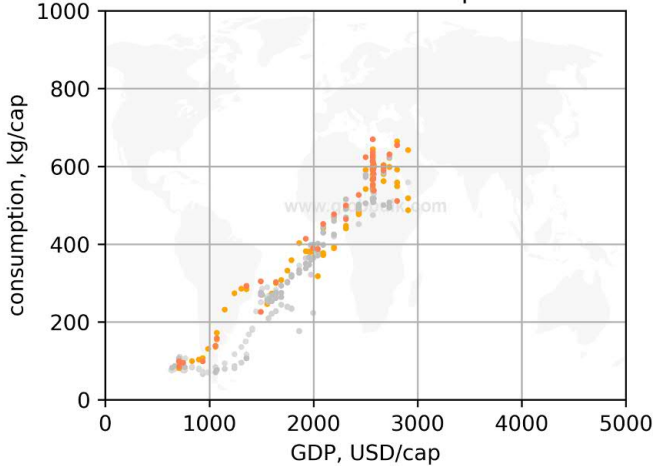
GDP vs Time



Consumption vs Time



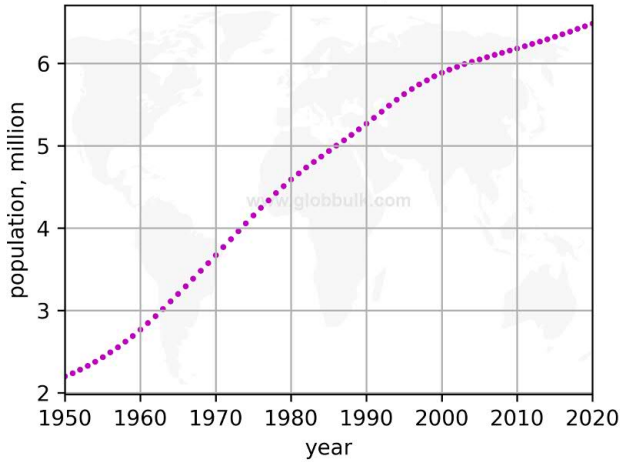
Consumption vs GDP



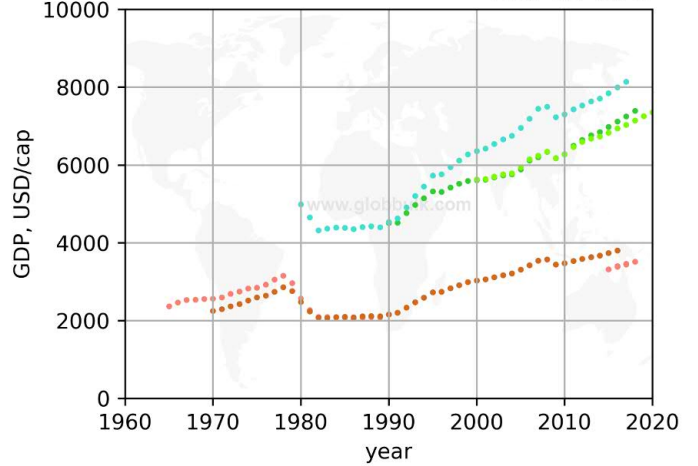


# El Salvador

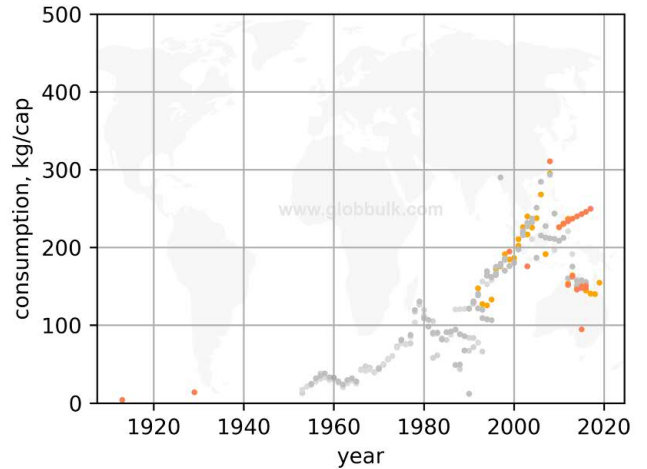
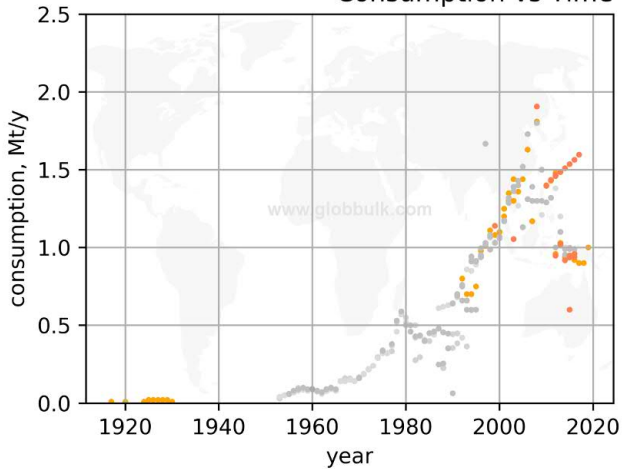
Population vs Time



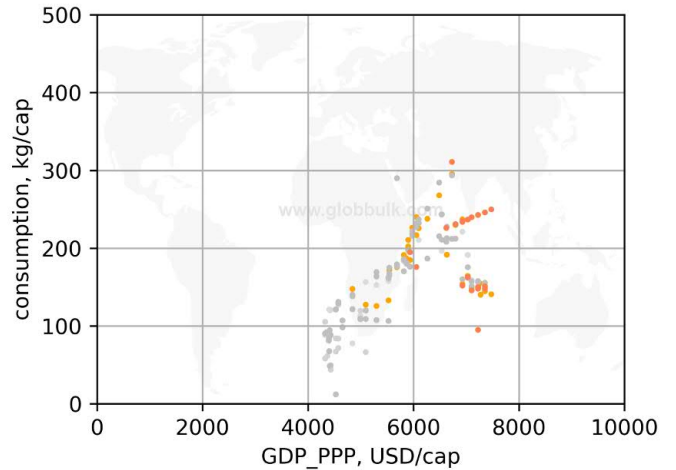
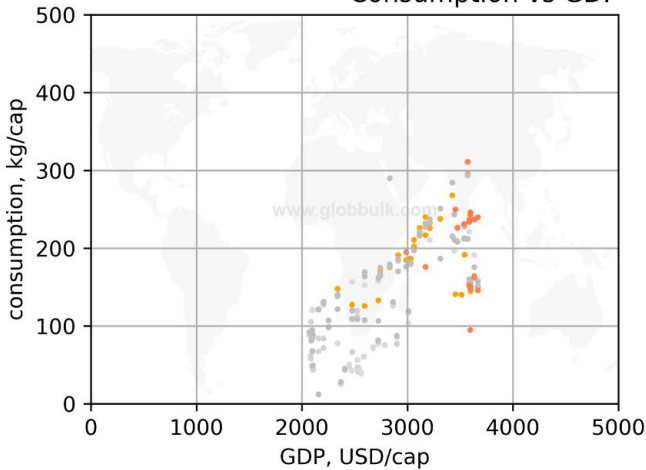
GDP vs Time



Consumption vs Time



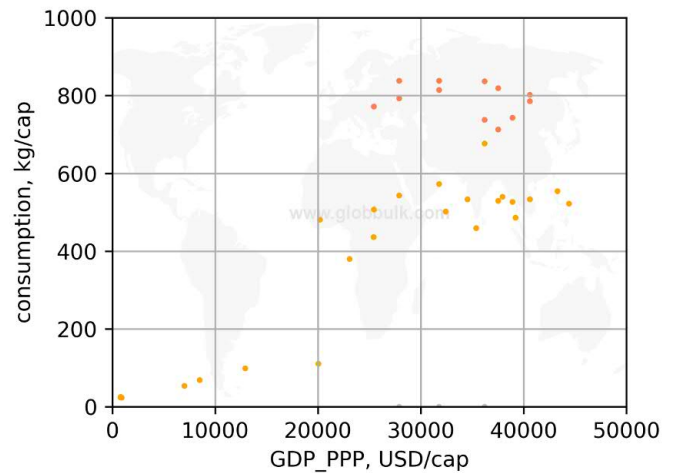
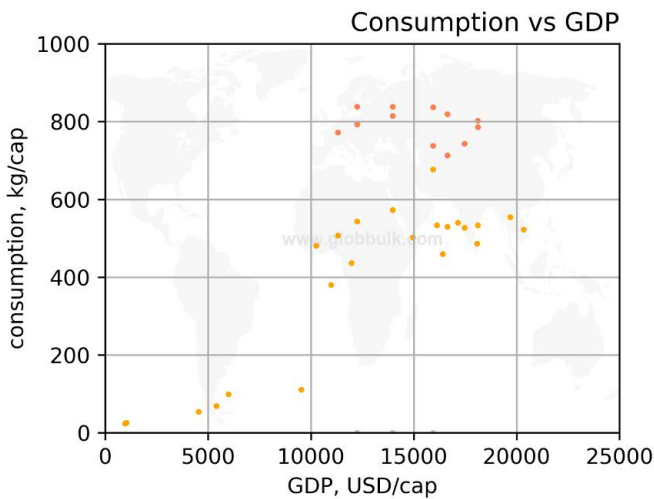
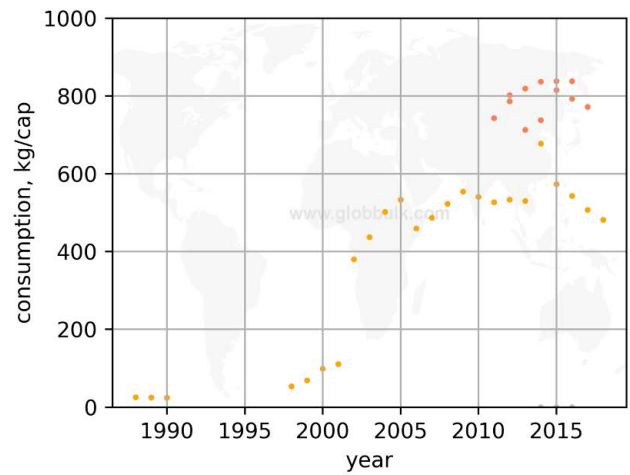
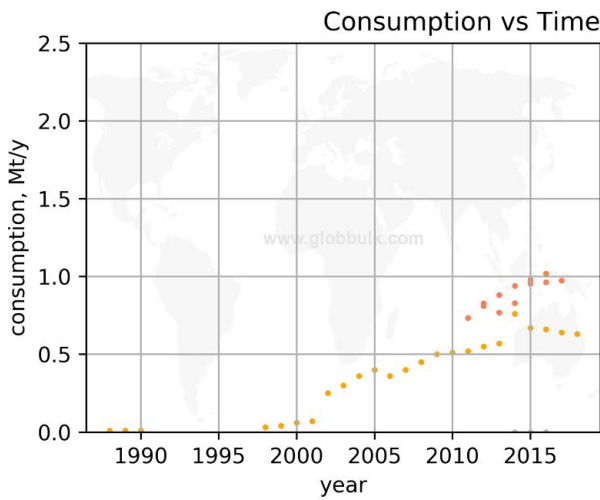
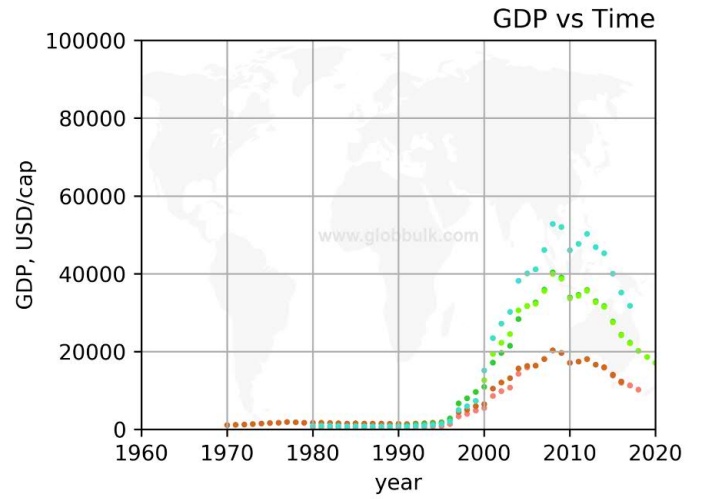
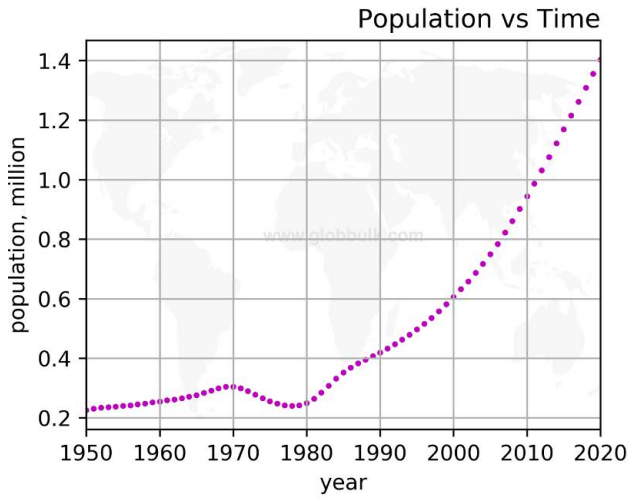
Consumption vs GDP







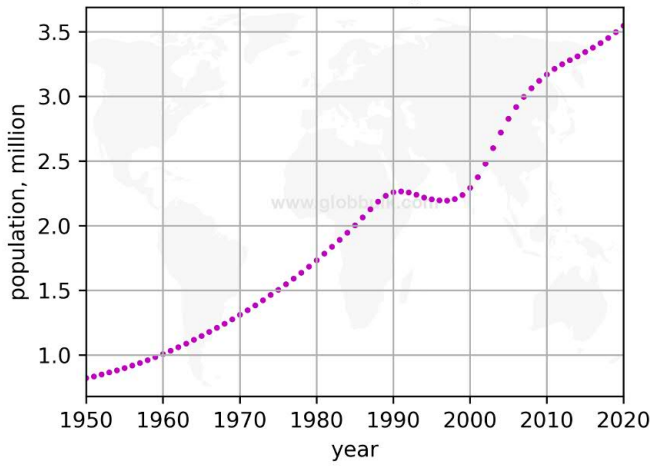
# Equat. Guinea



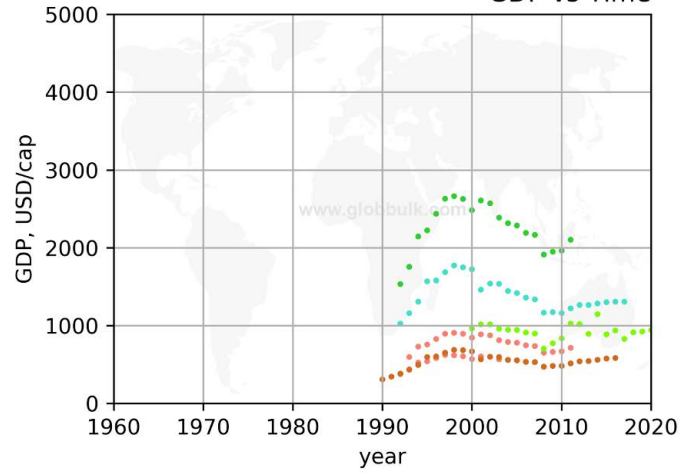


# Eritrea

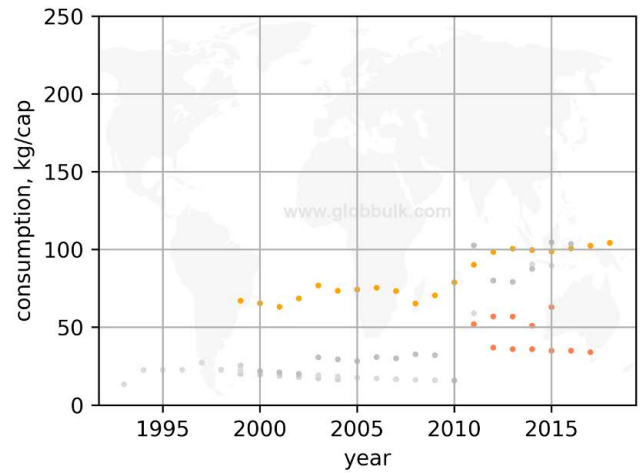
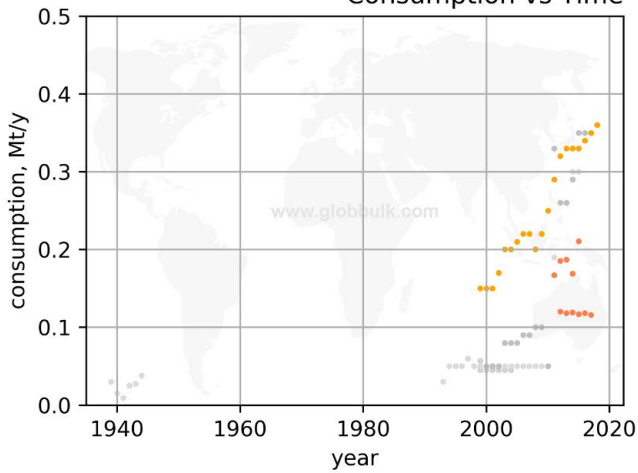
Population vs Time



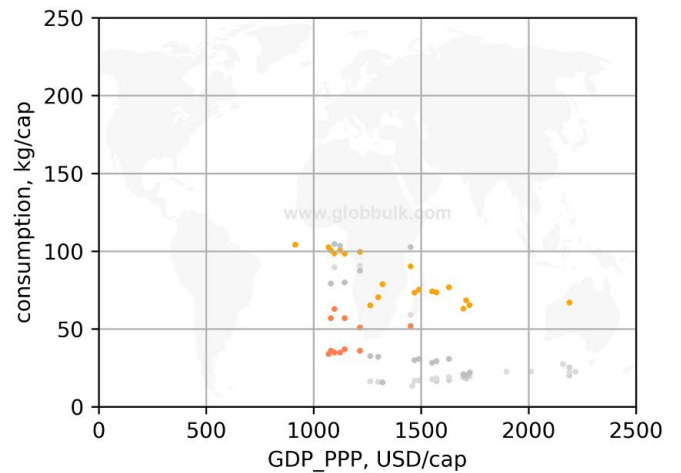
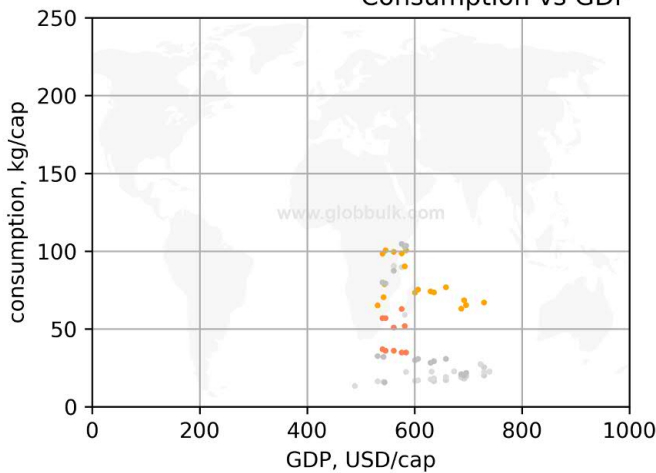
GDP vs Time



Consumption vs Time

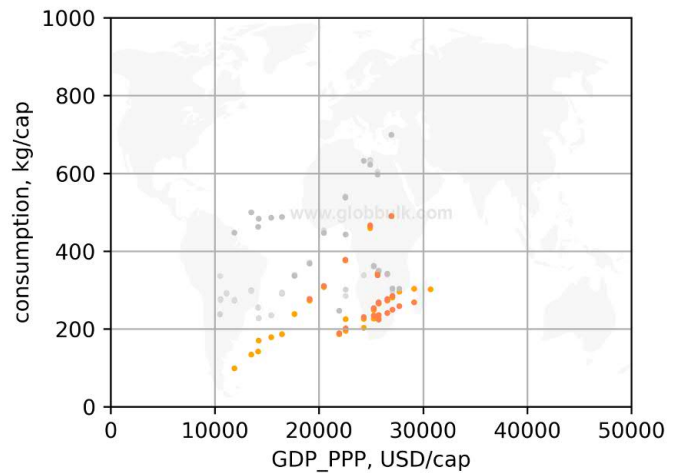
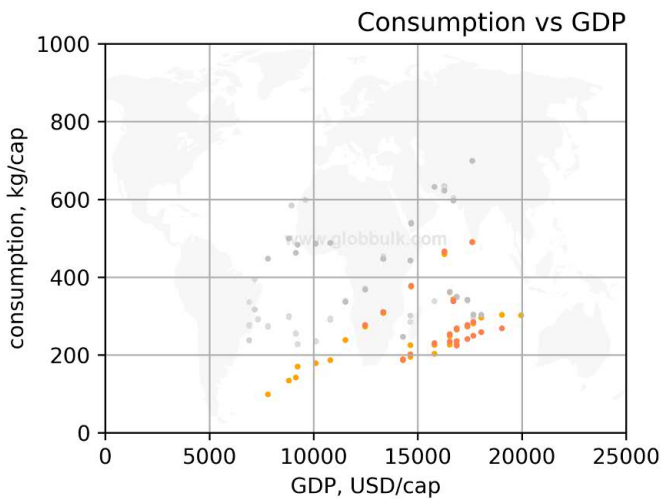
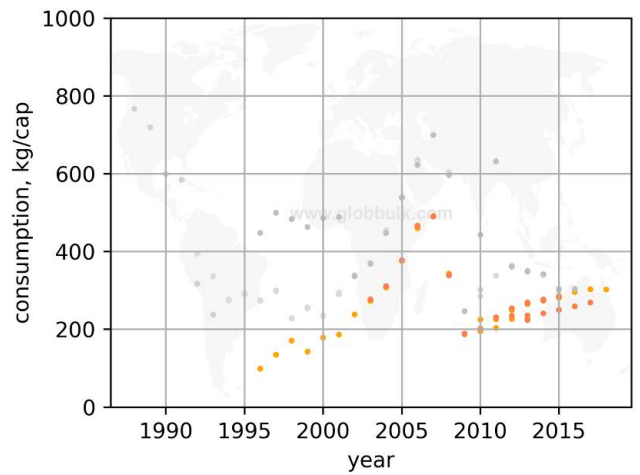
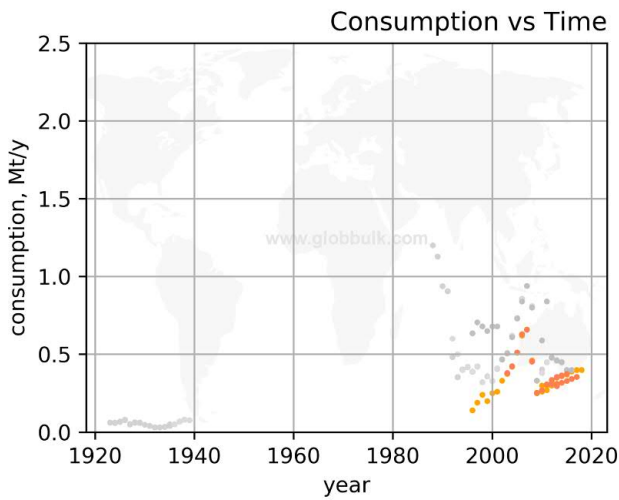
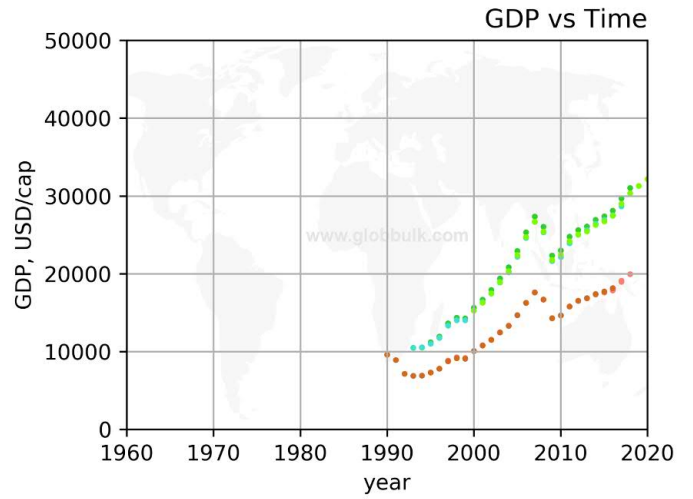
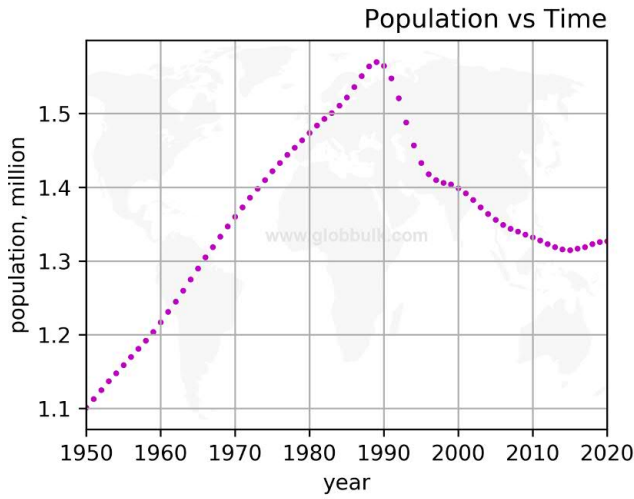


Consumption vs GDP





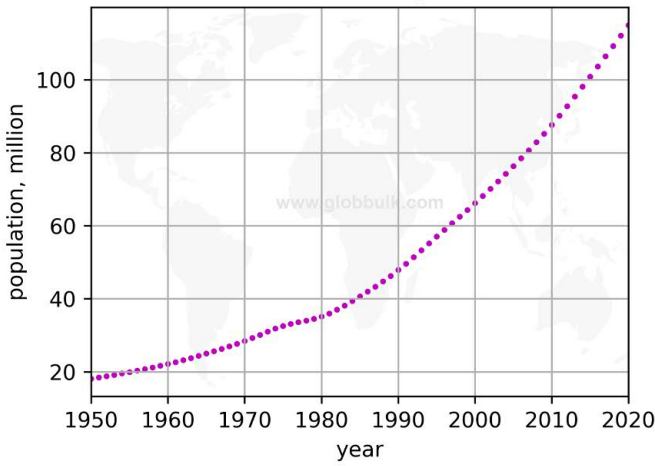
# Estonia



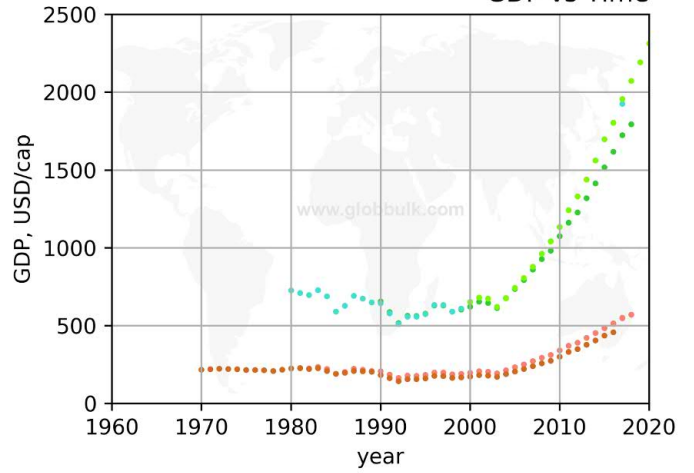


# Ethiopia

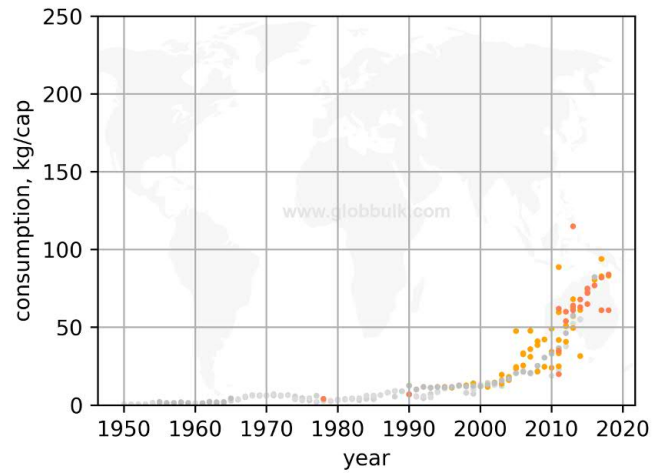
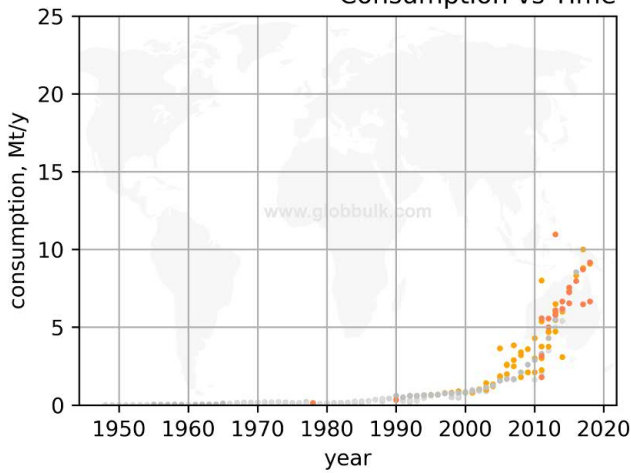
Population vs Time



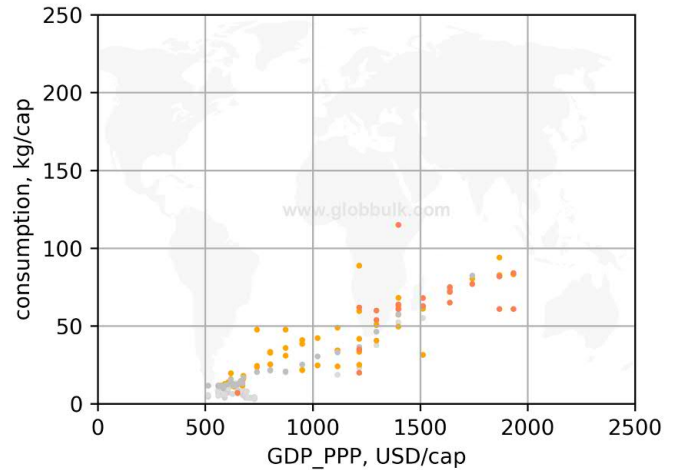
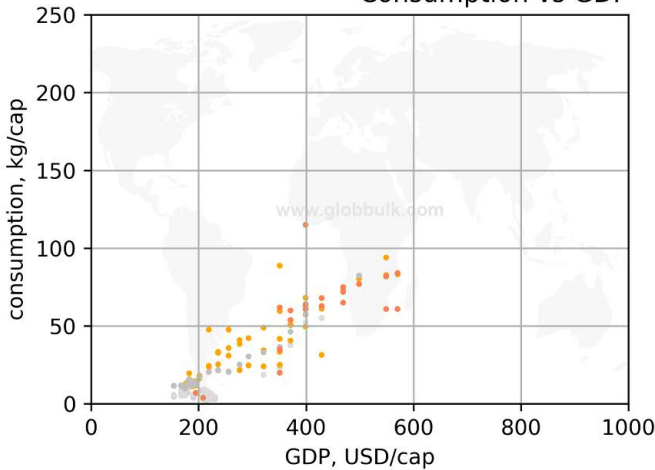
GDP vs Time



Consumption vs Time



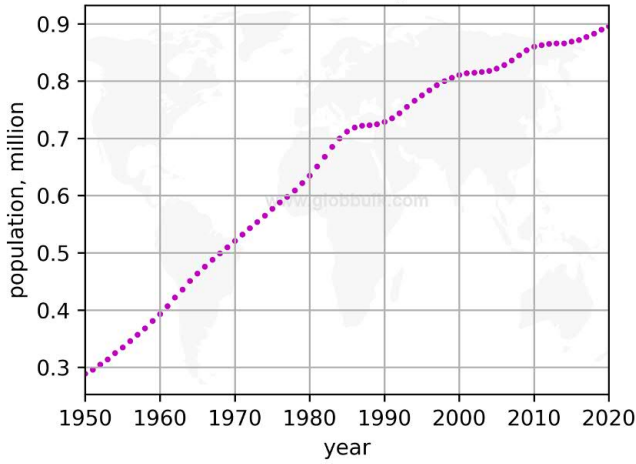
Consumption vs GDP



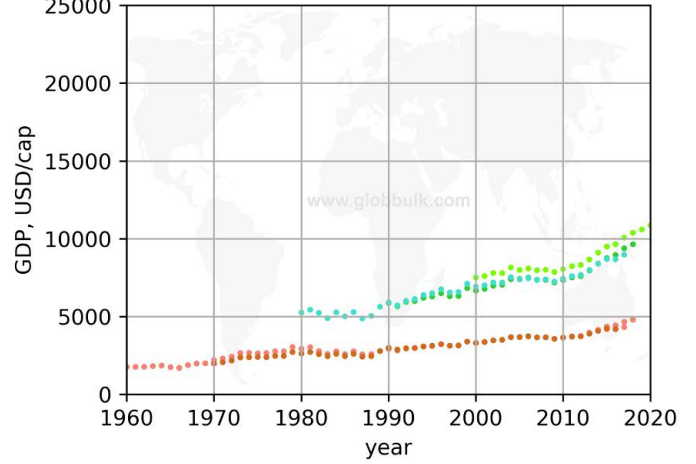


# Fiji

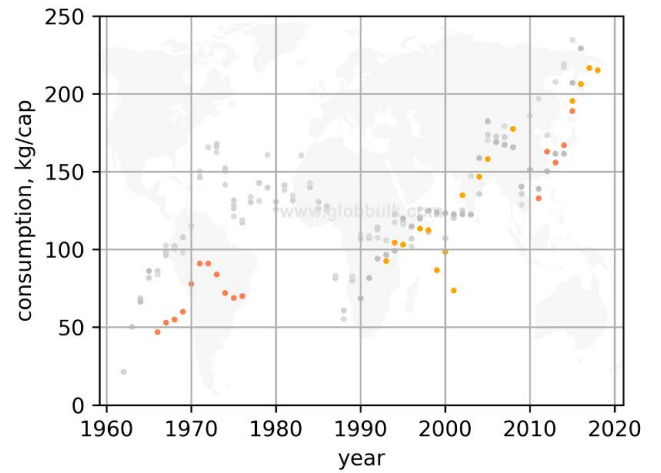
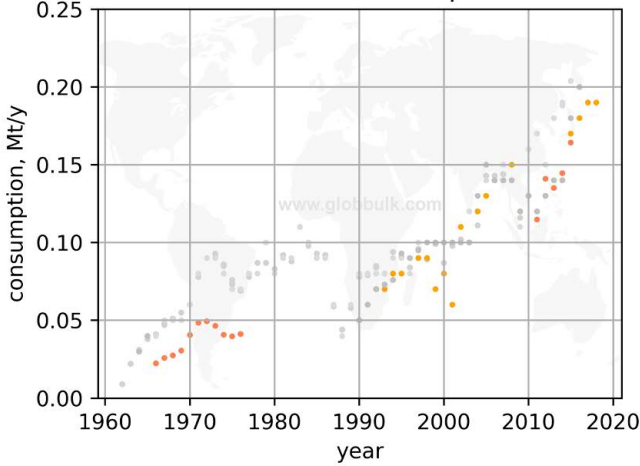
Population vs Time



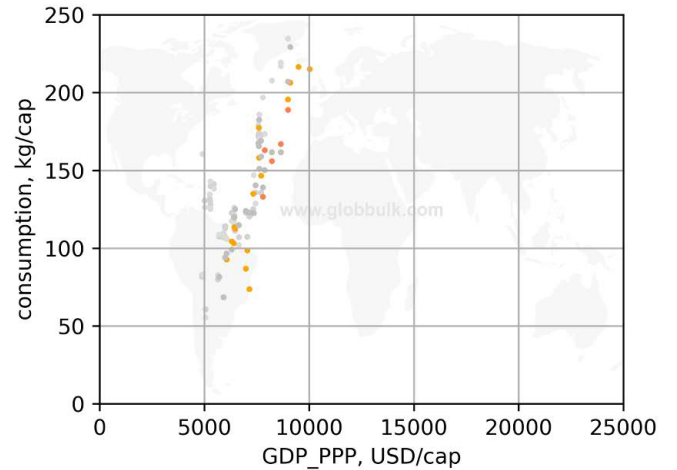
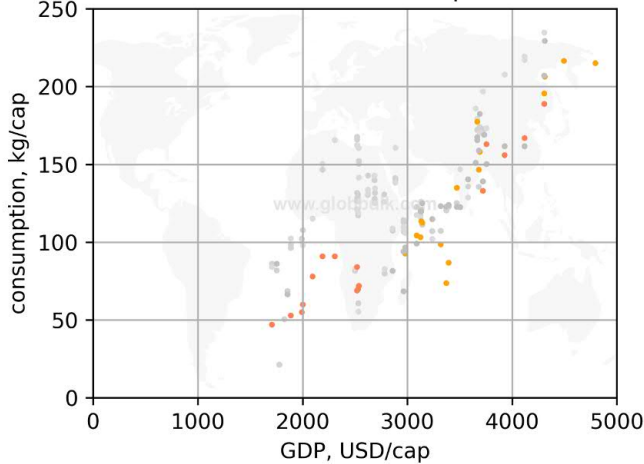
GDP vs Time



Consumption vs Time

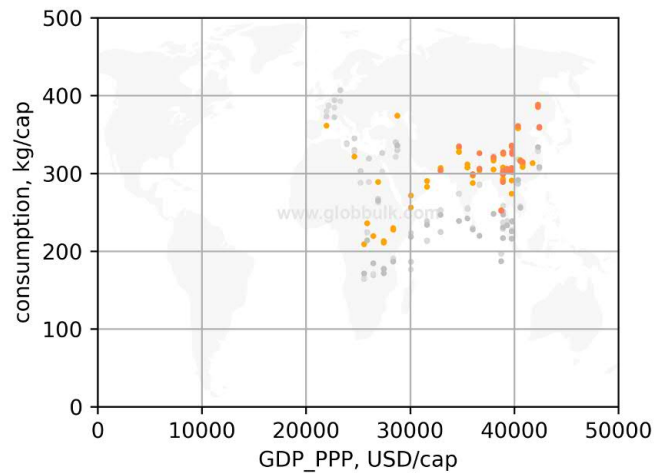
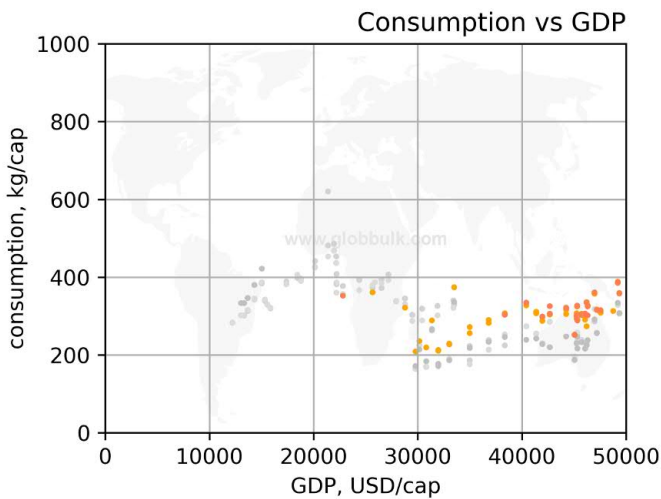
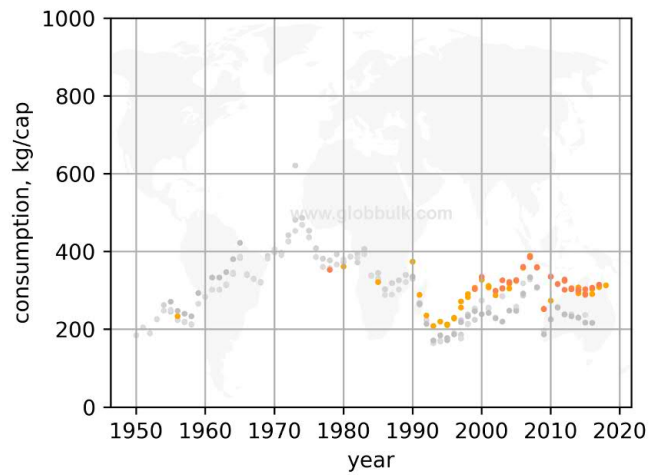
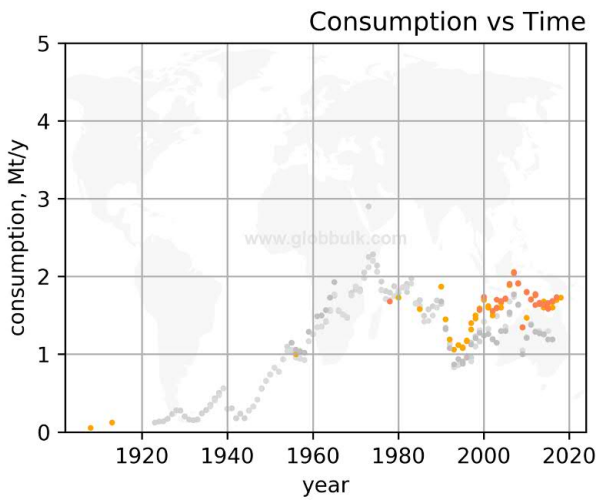
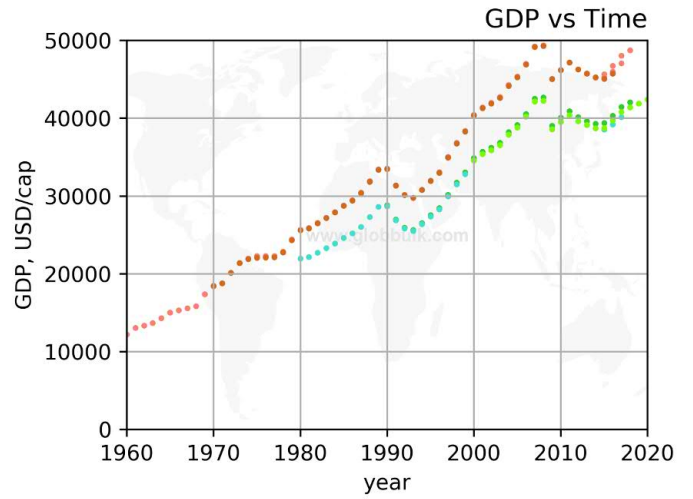
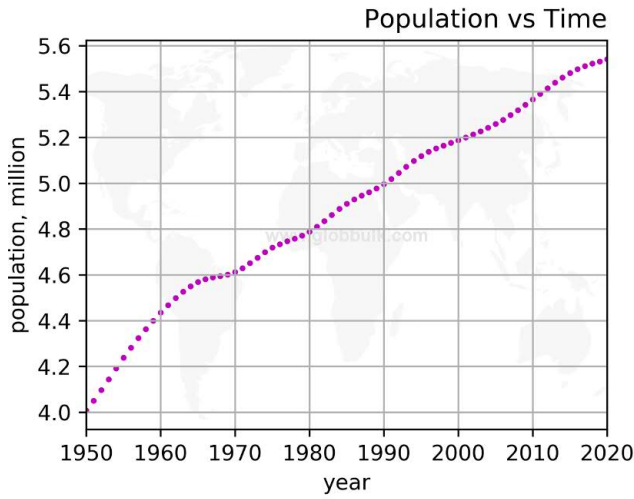


Consumption vs GDP



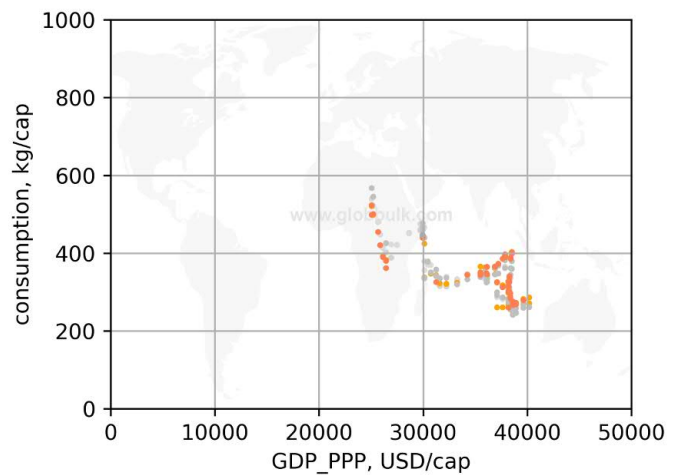
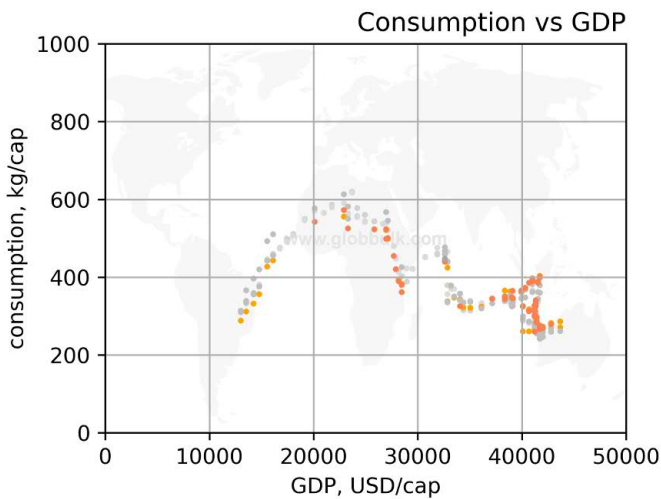
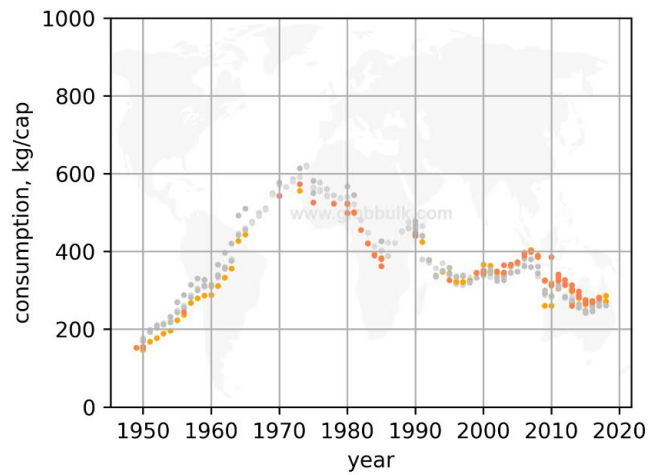
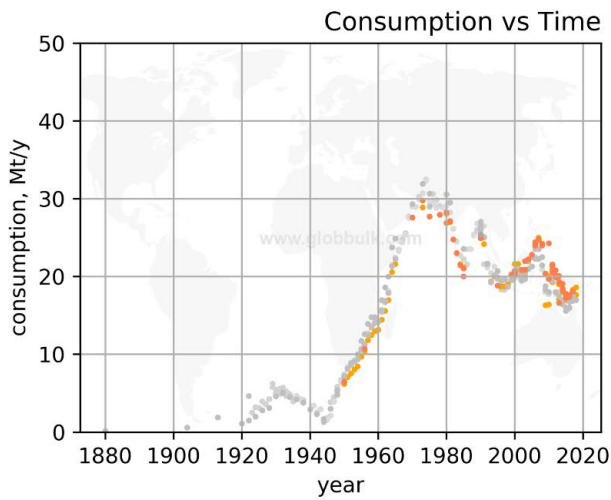
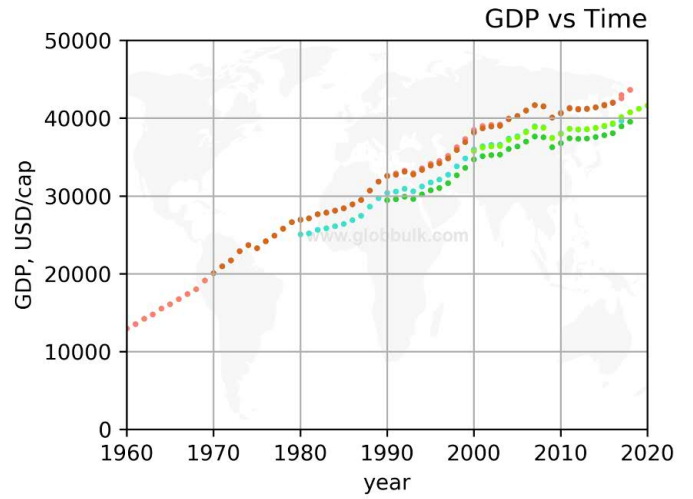
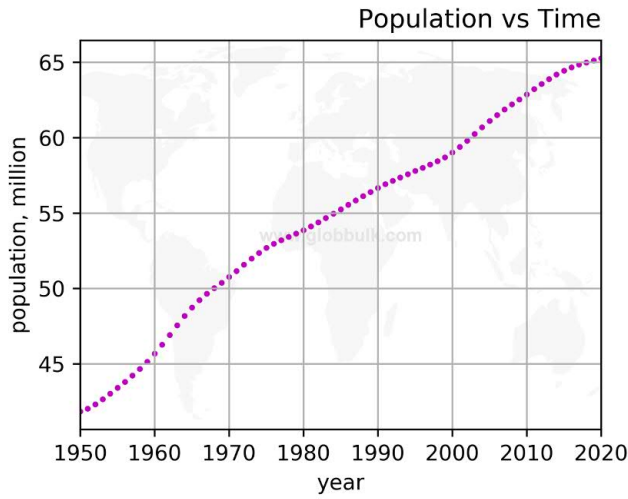


# Finland



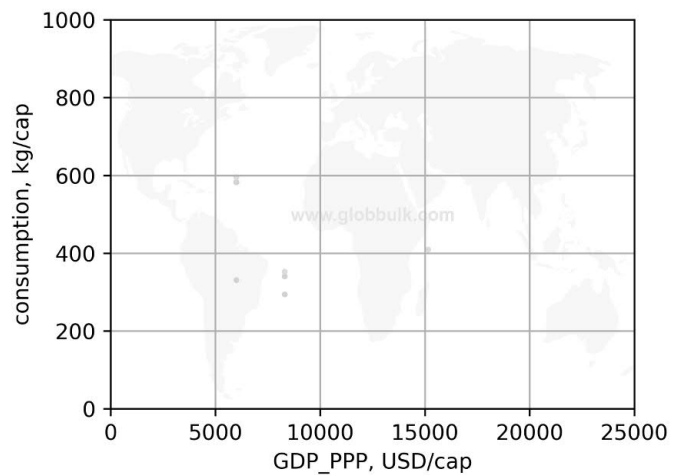
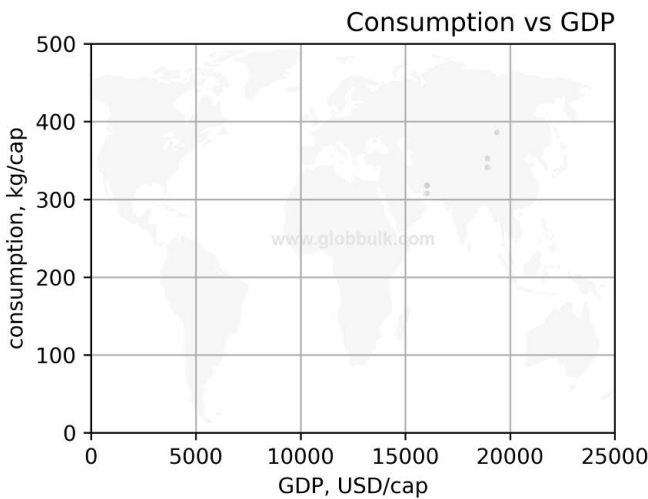
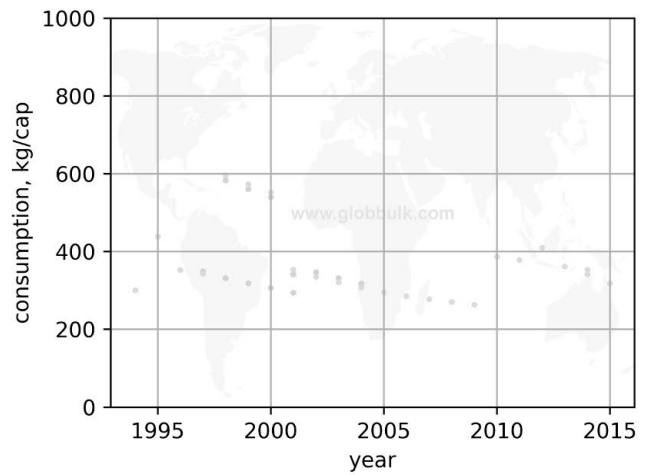
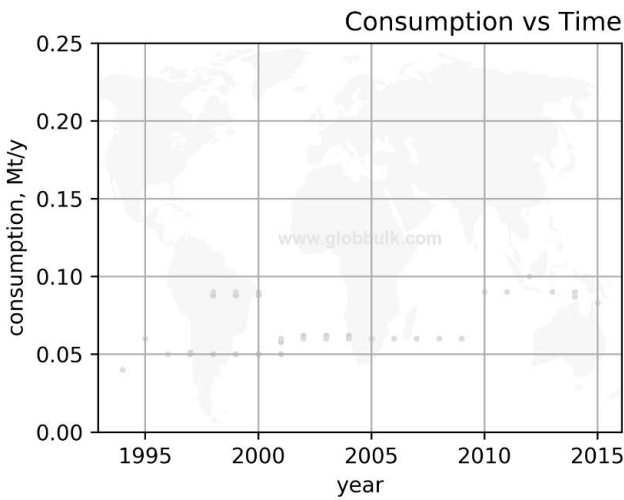
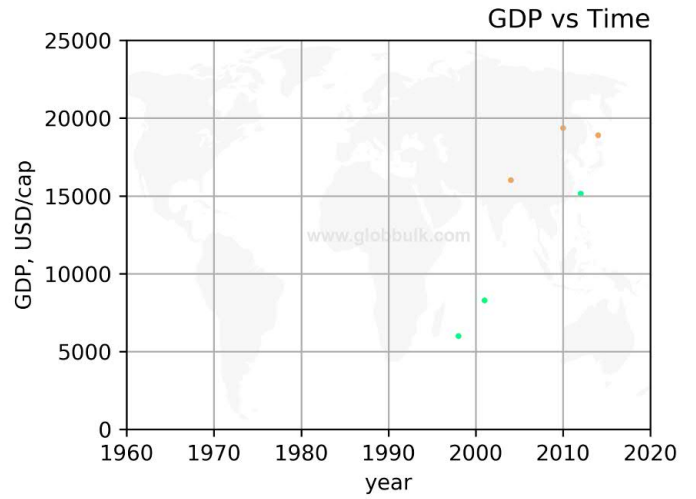
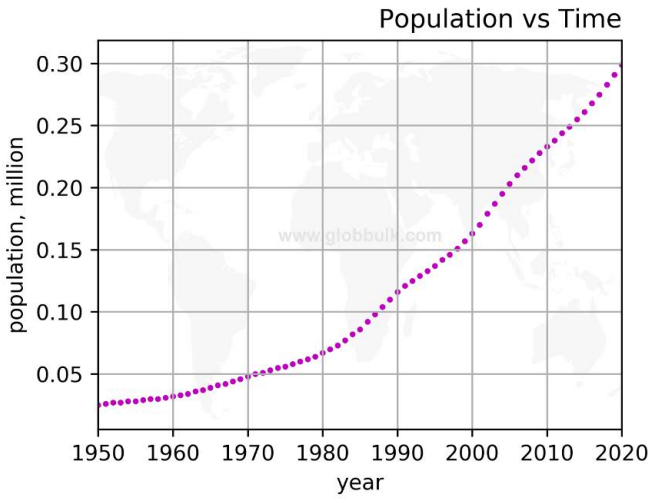


# France





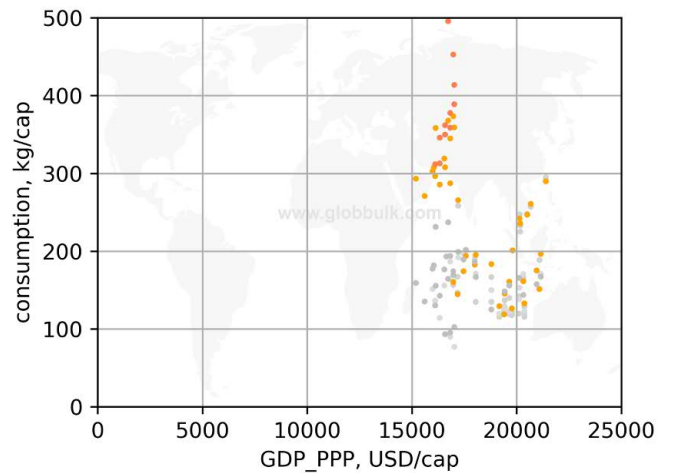
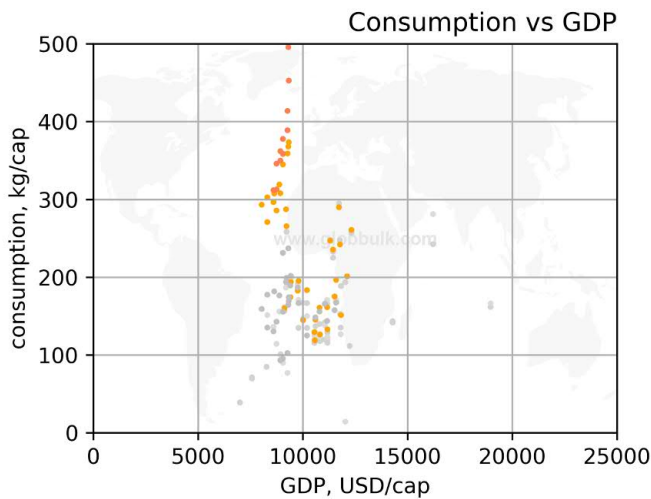
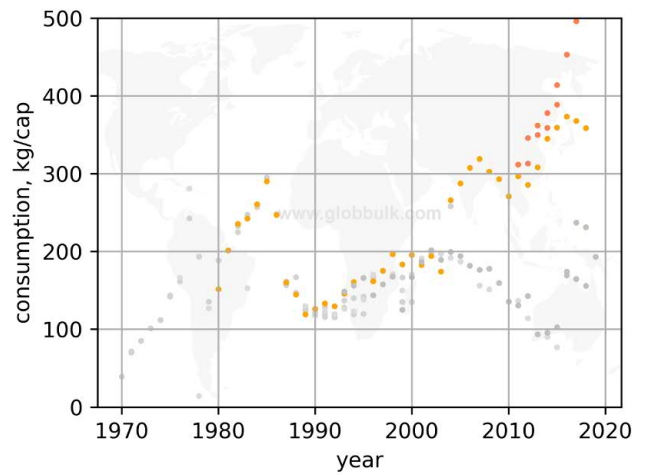
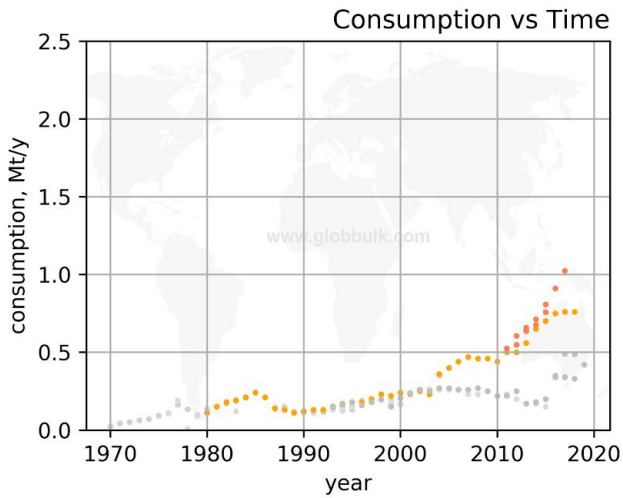
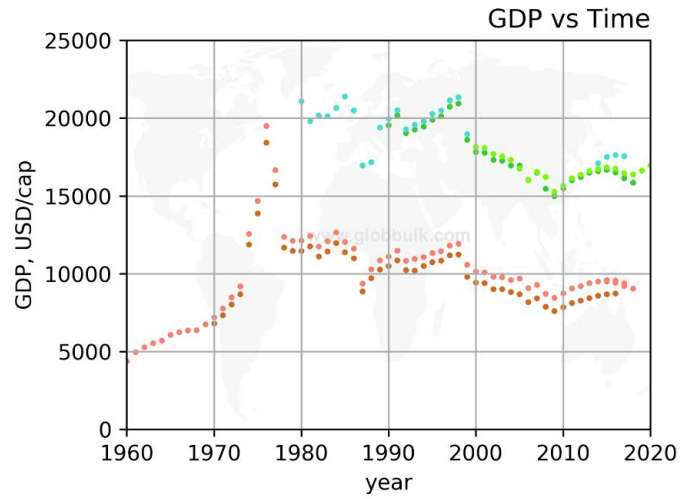
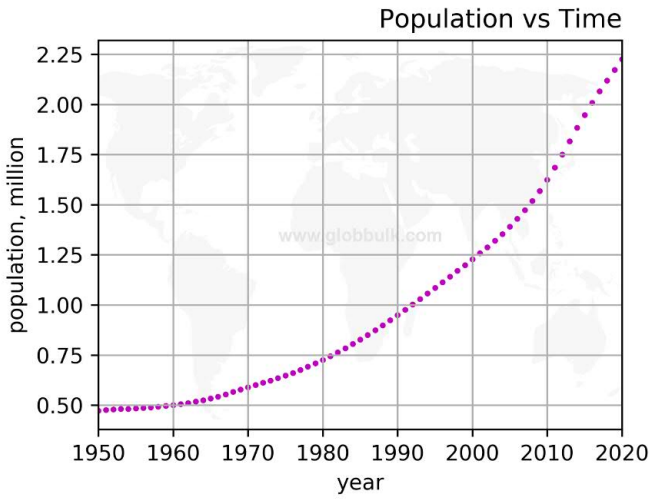
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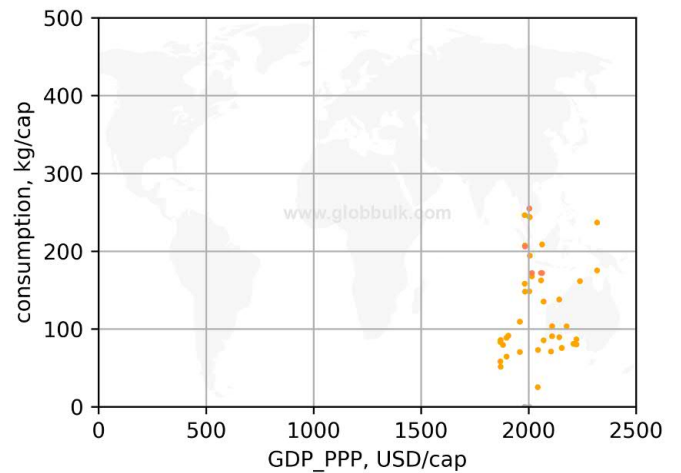
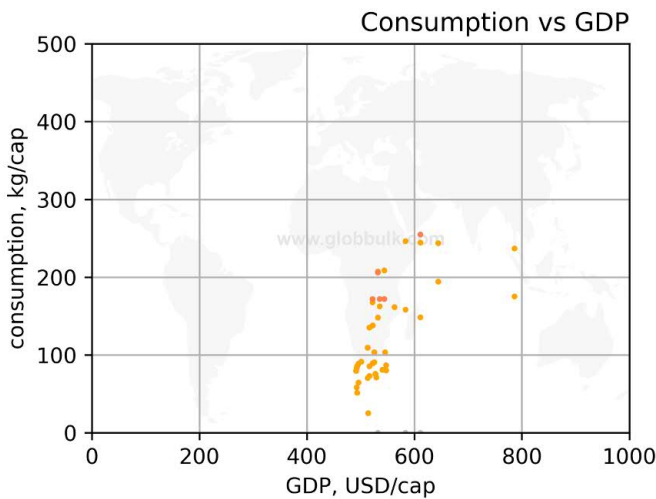
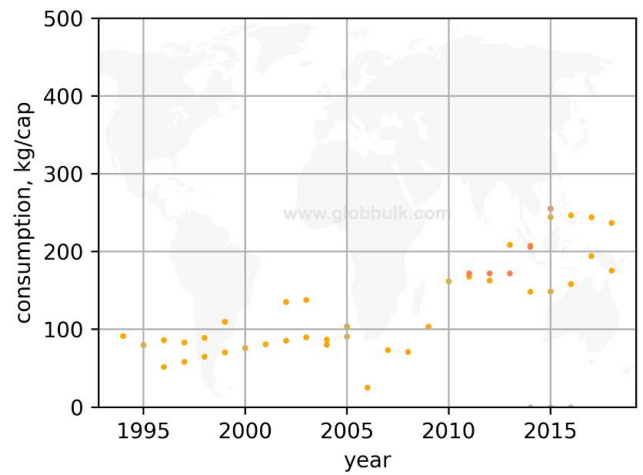
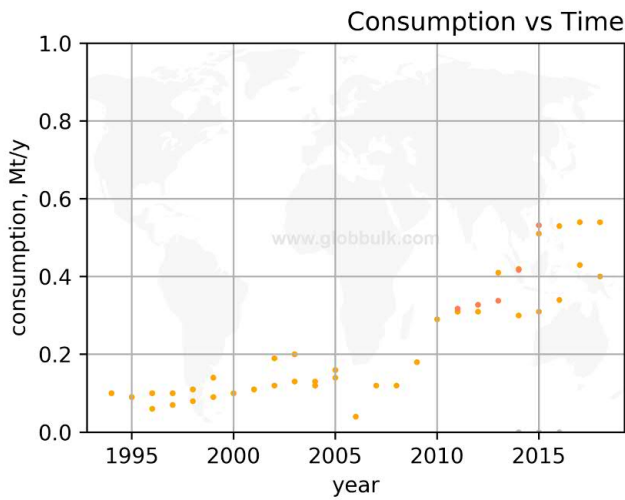
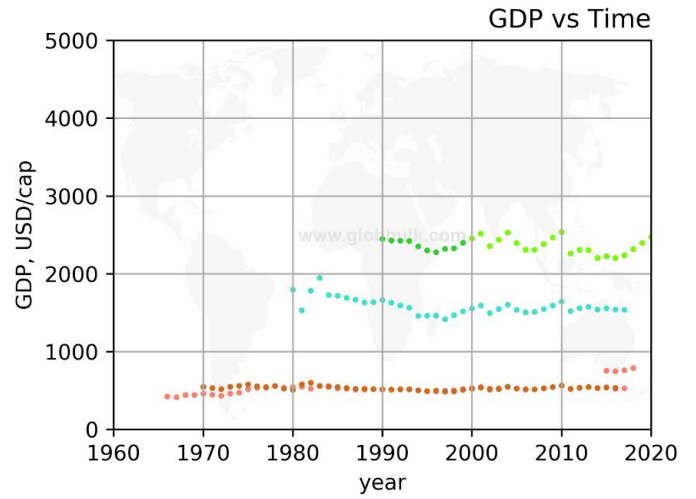
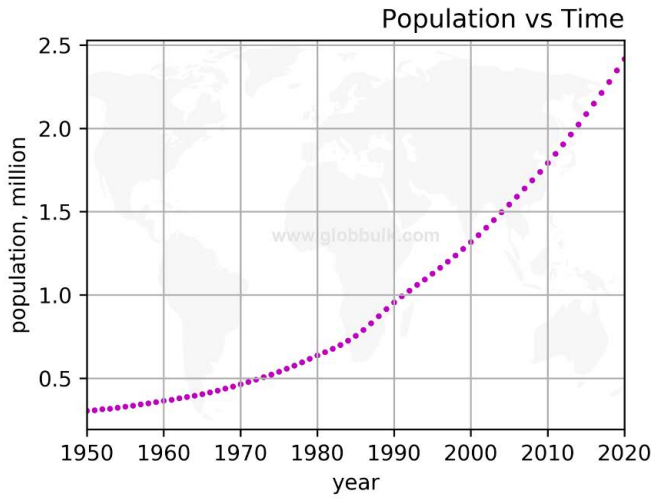


# Gabon



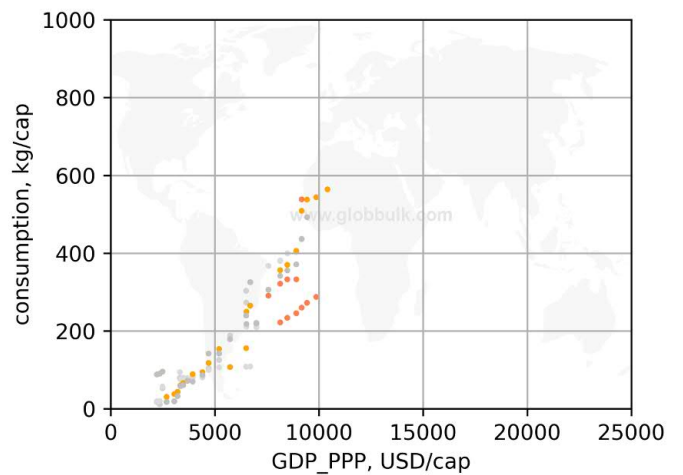
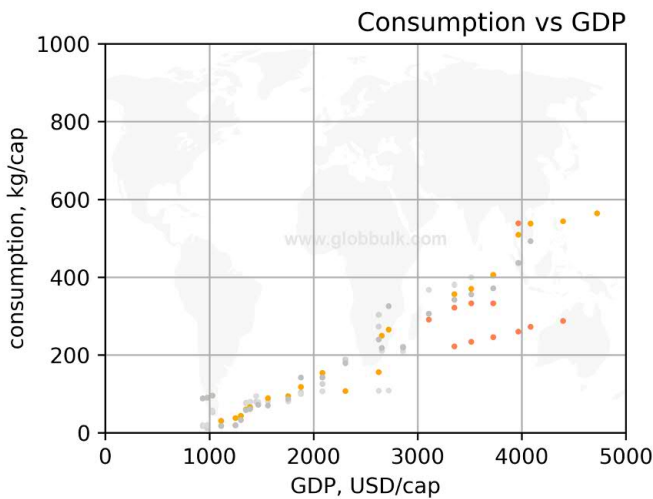
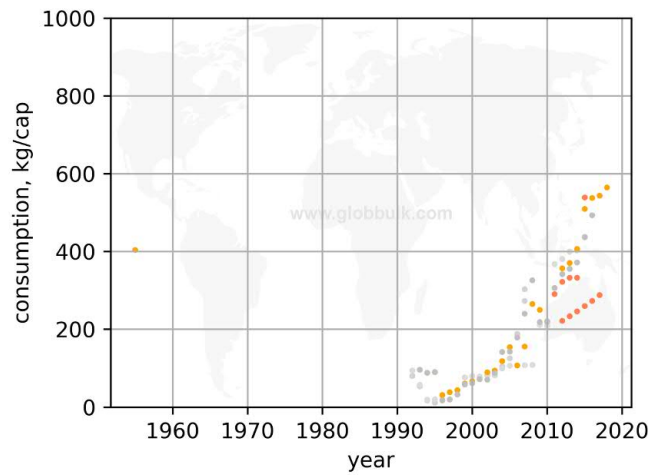
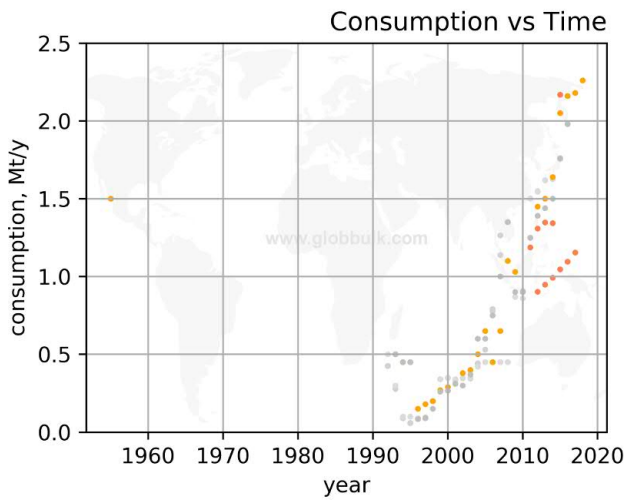
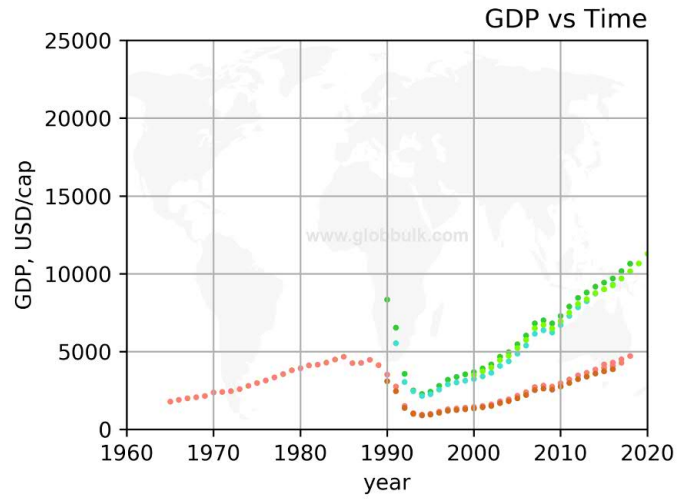
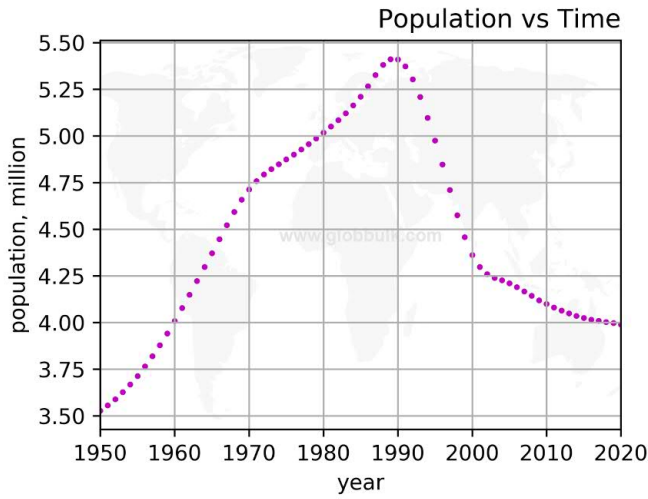


# Gambia



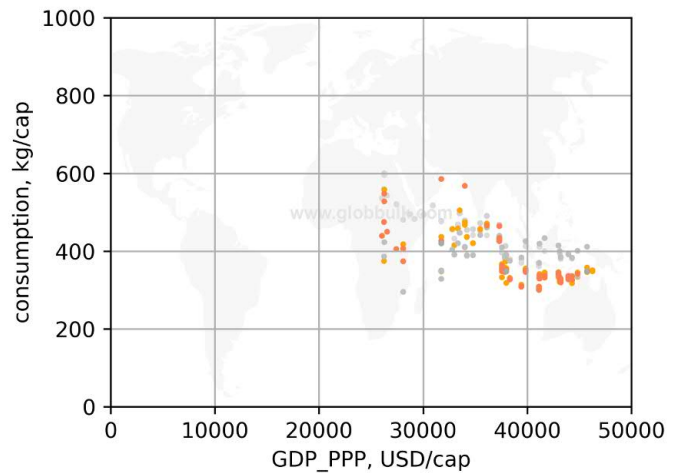
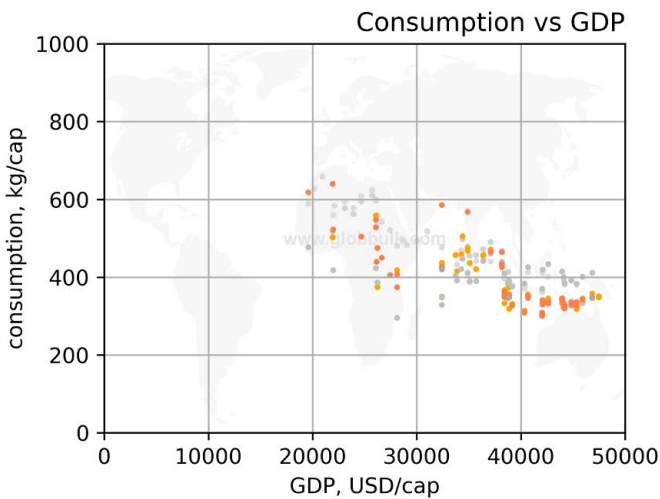
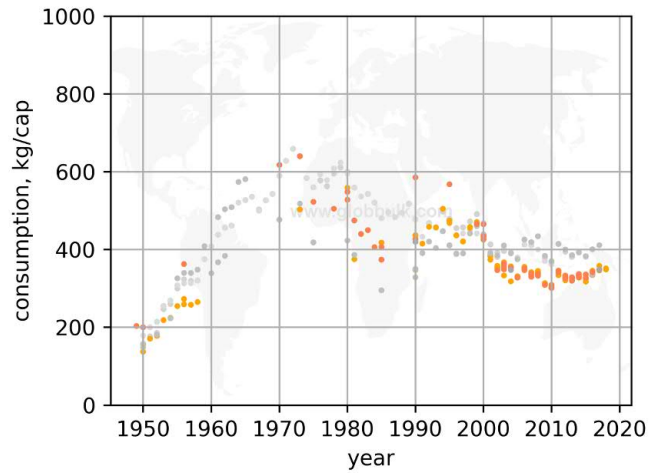
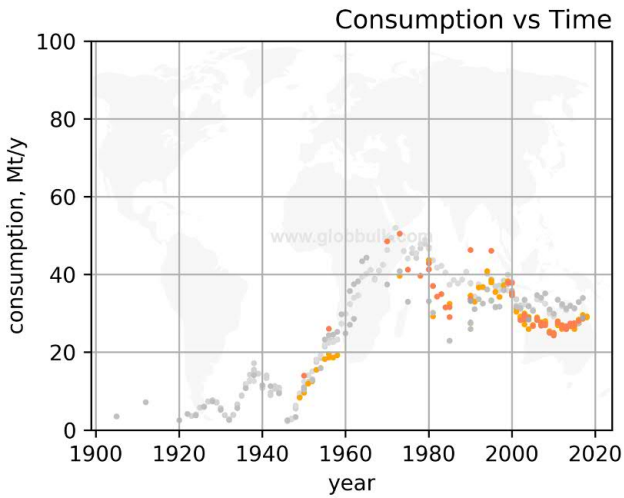
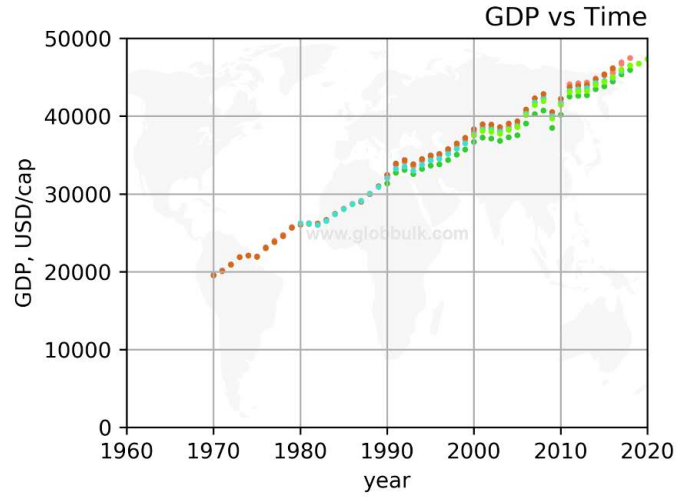
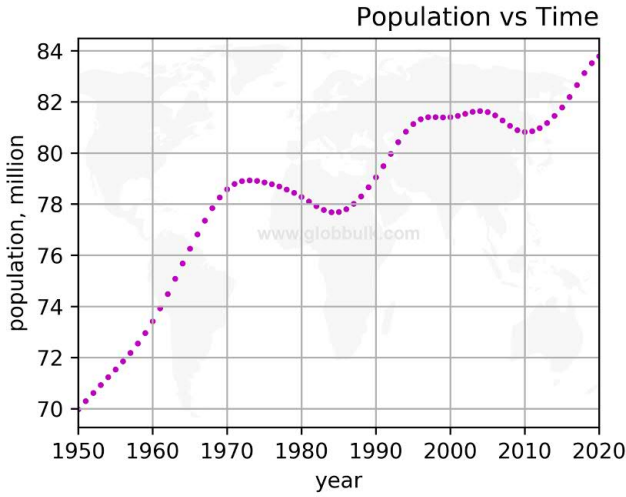


# Georgia



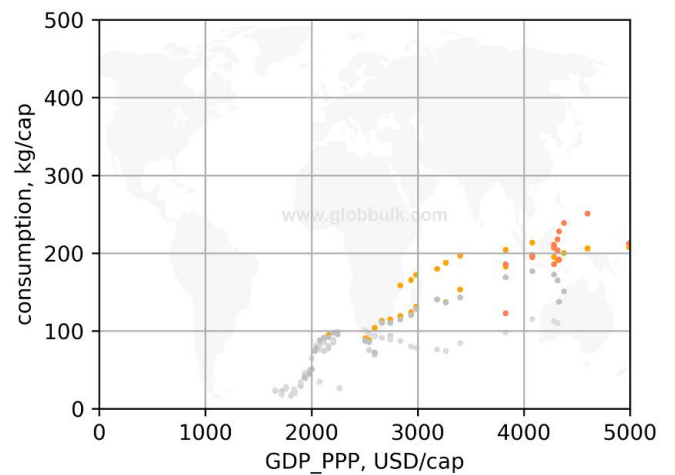
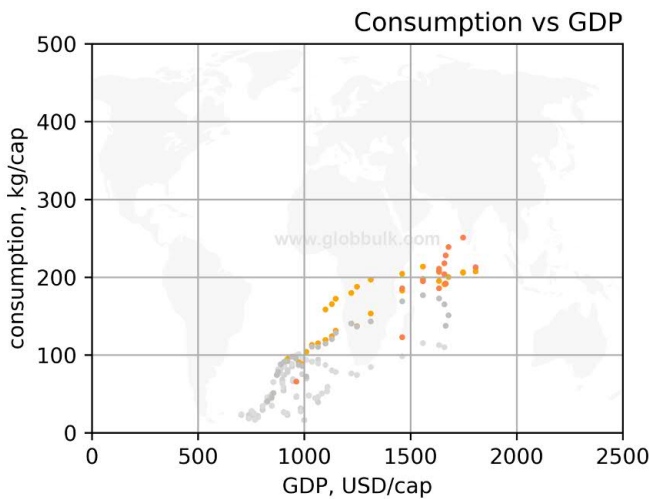
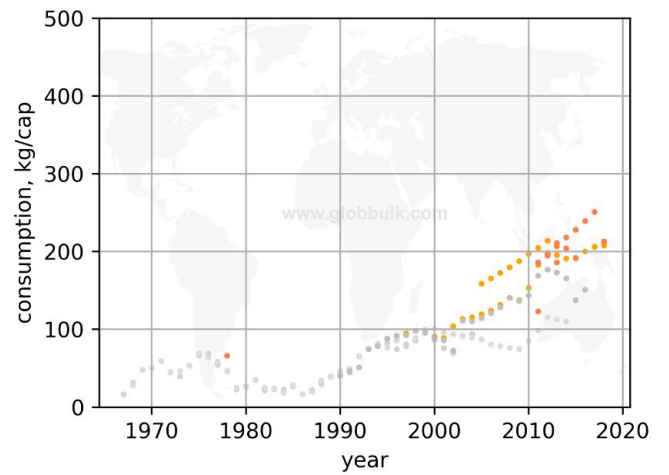
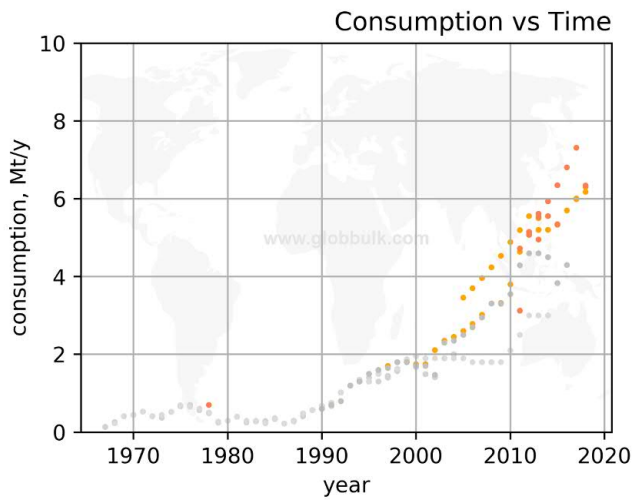
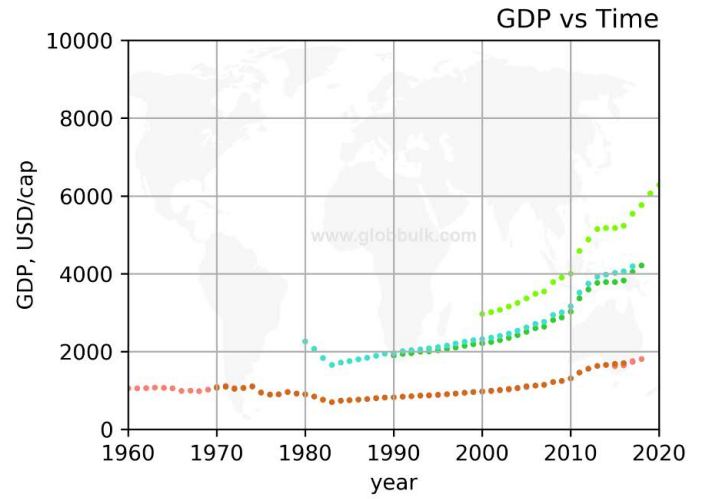
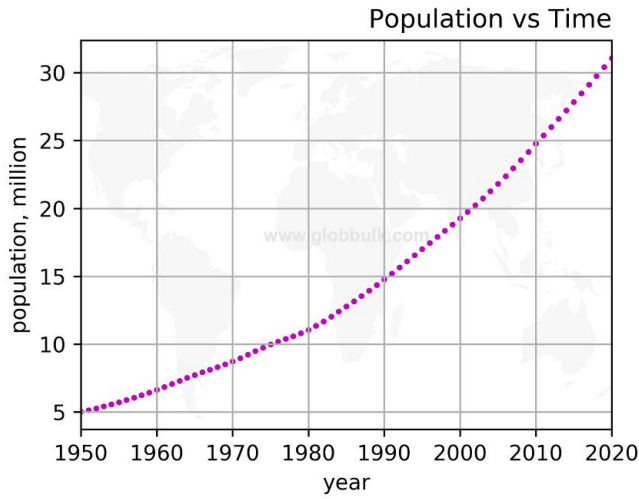


# Germany



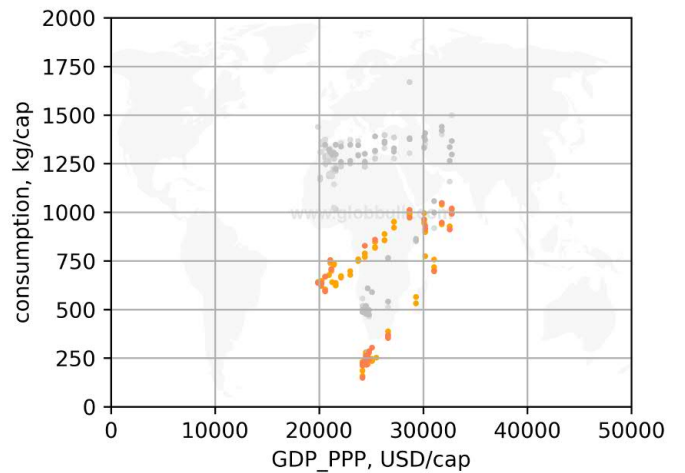
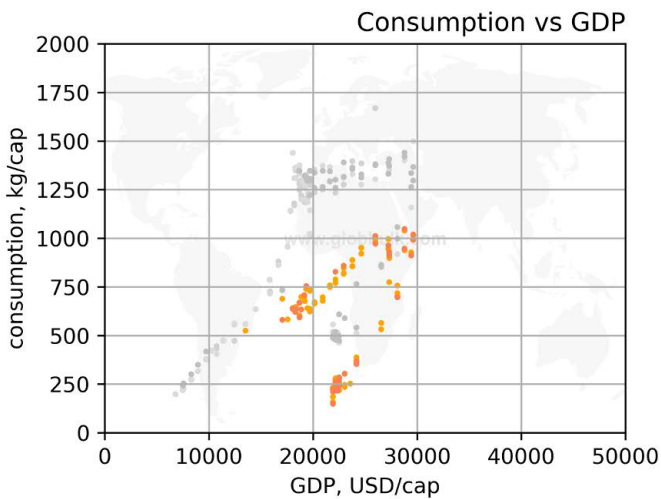
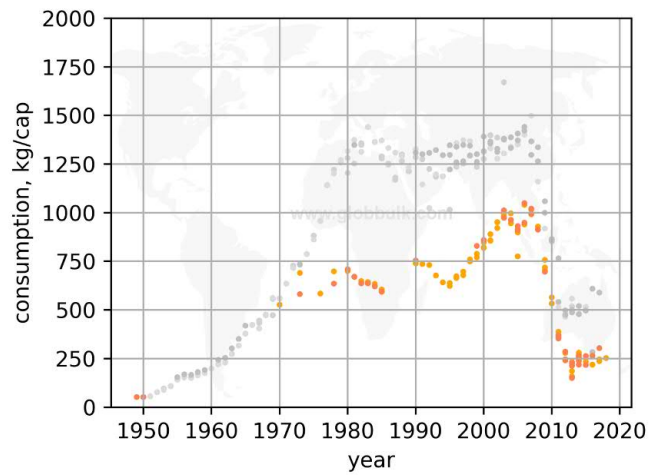
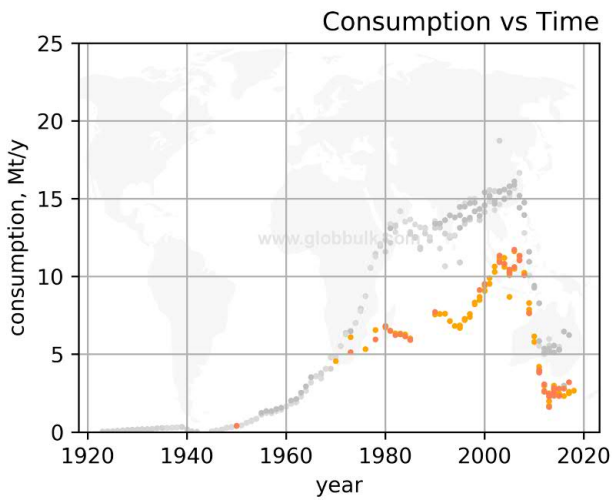
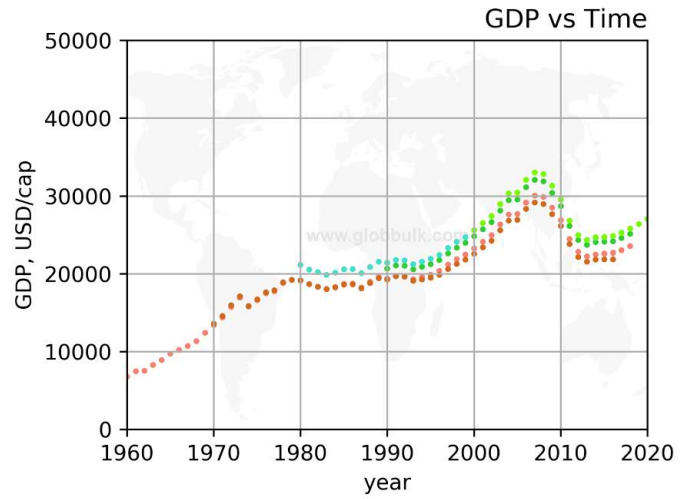
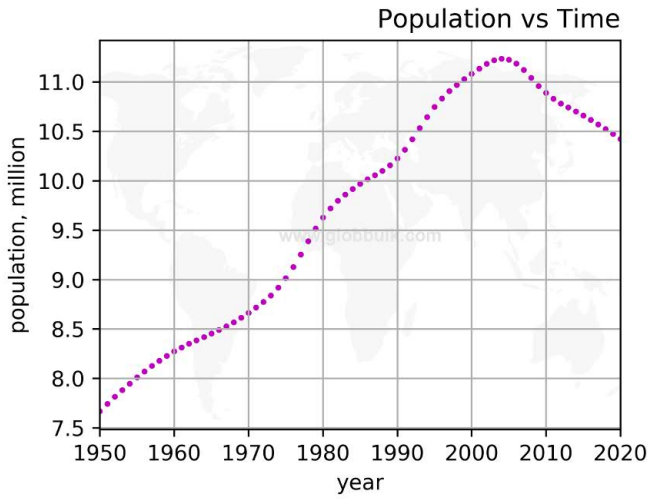


# Ghana



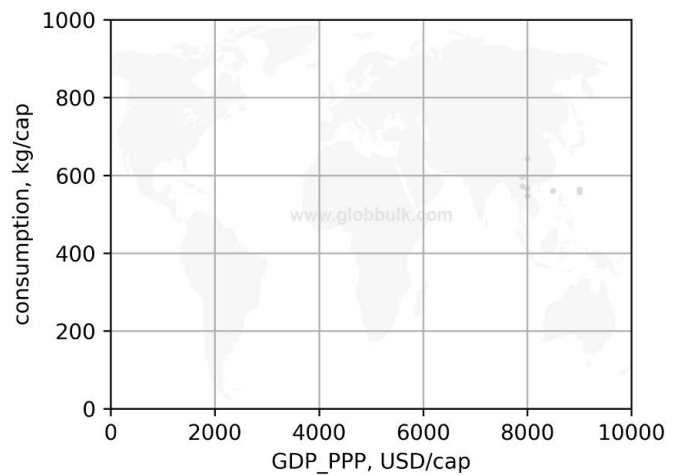
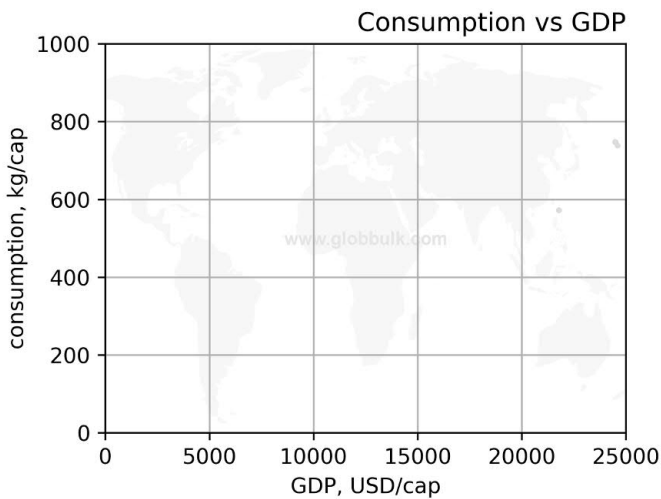
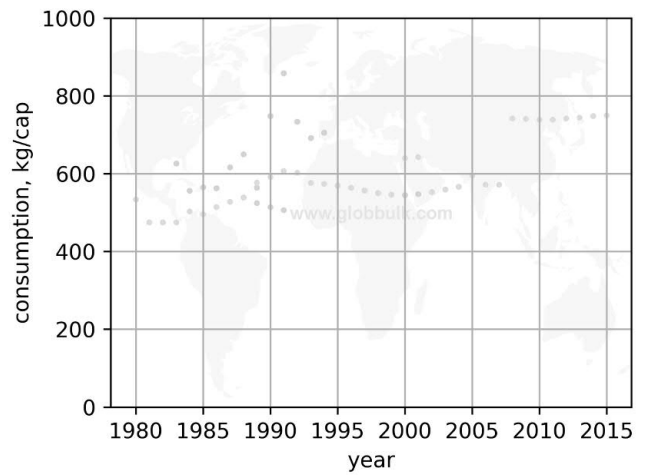
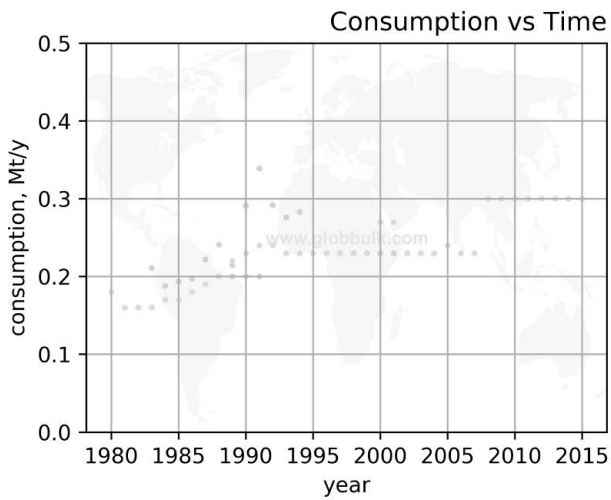
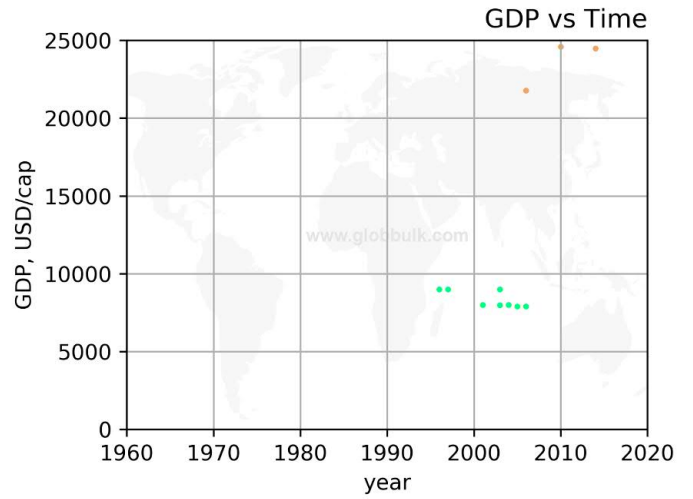
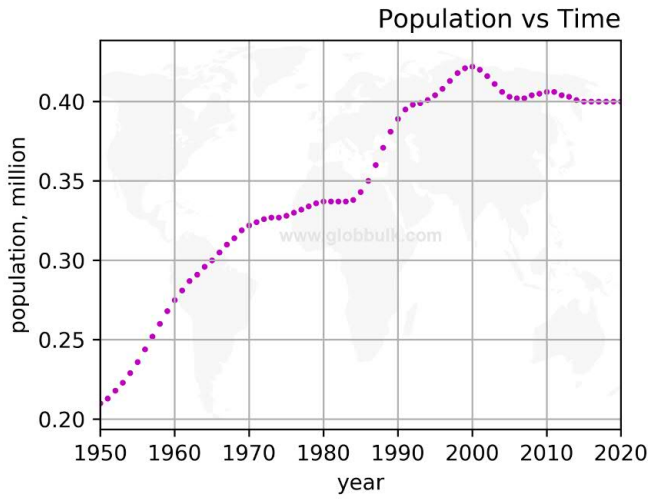


# Greece



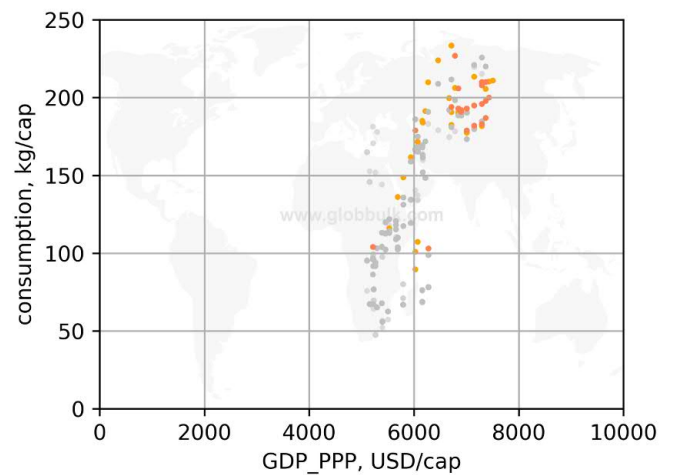
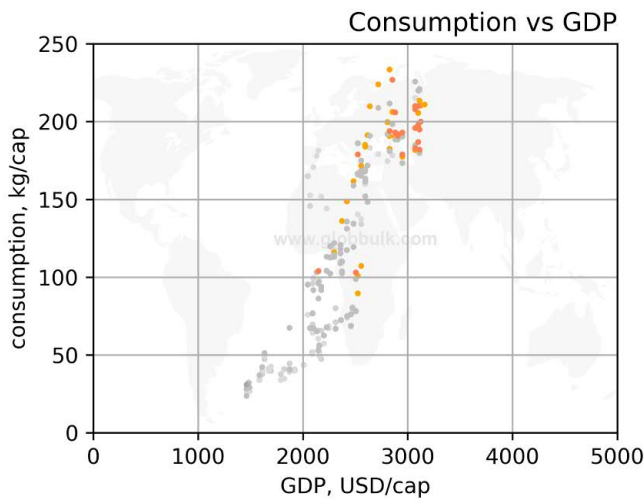
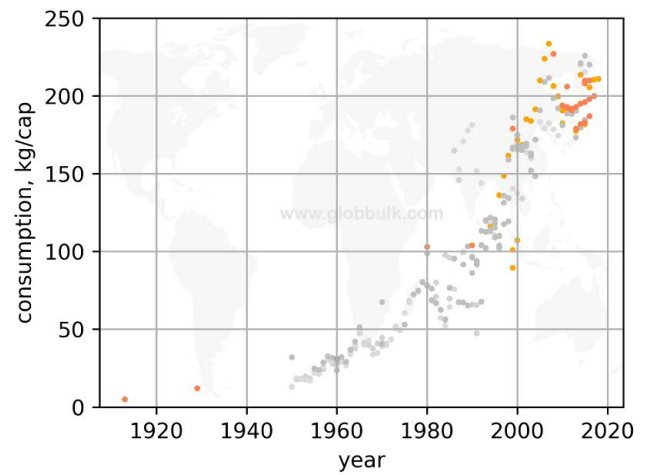
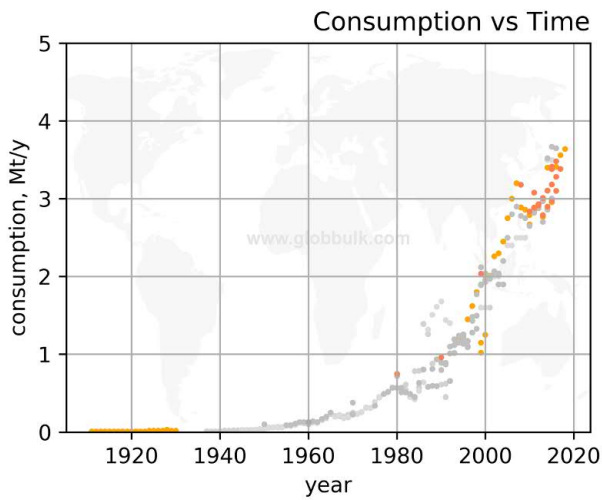
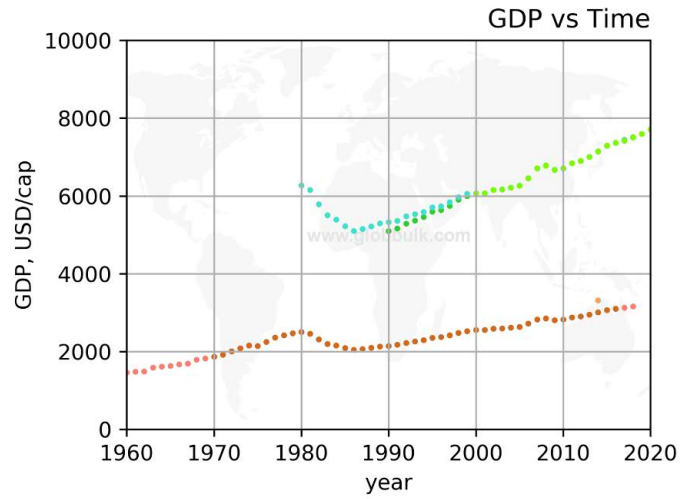
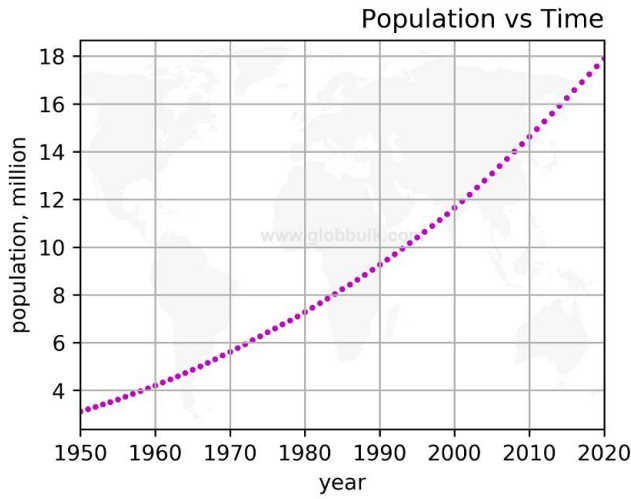


# Guadeloupe





# Guatemala

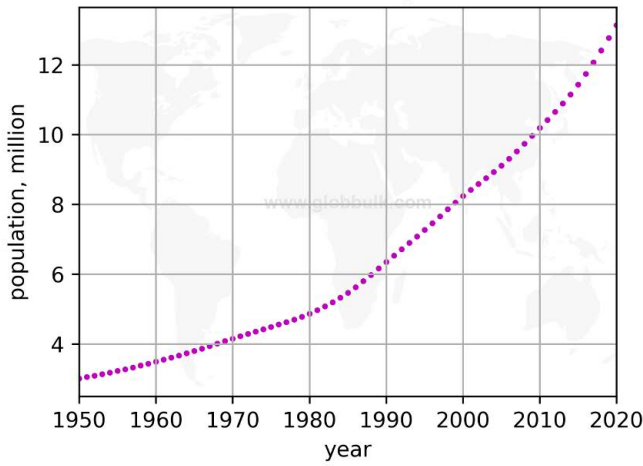




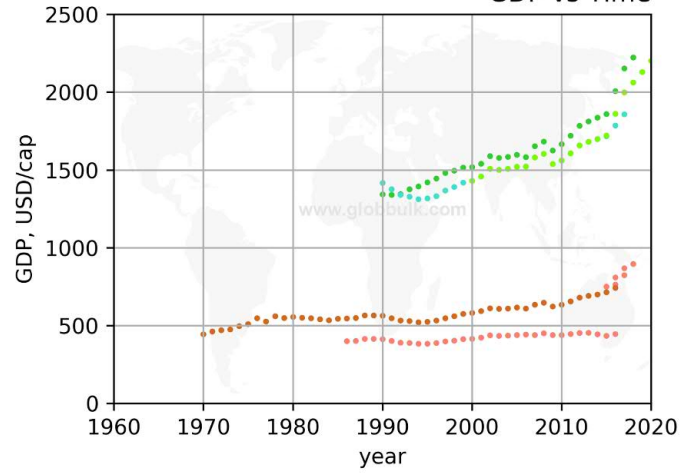


# Guinea

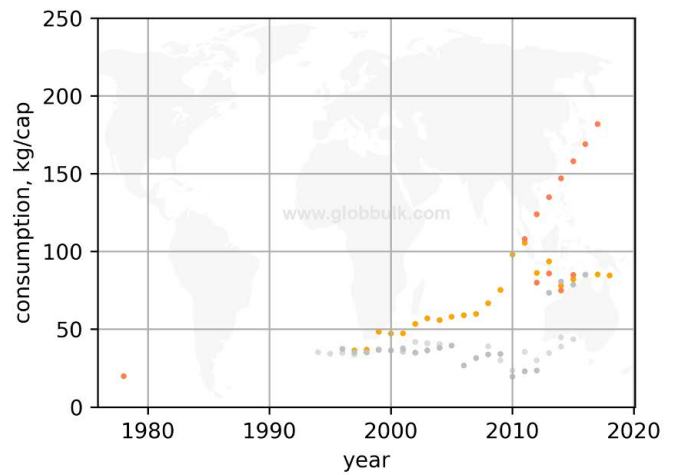
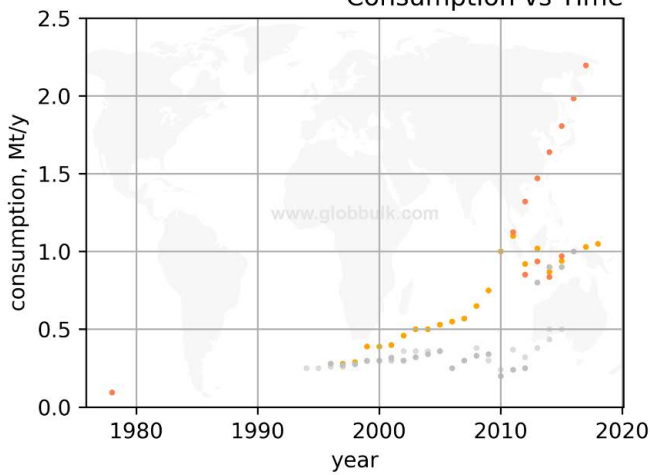
Population vs Time



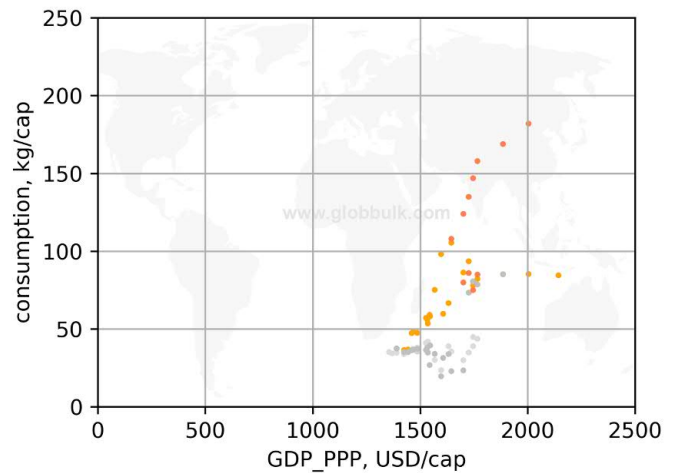
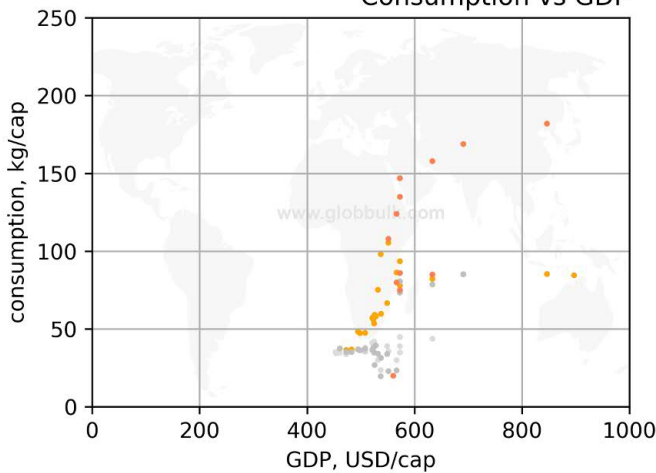
GDP vs Time



Consumption vs Time

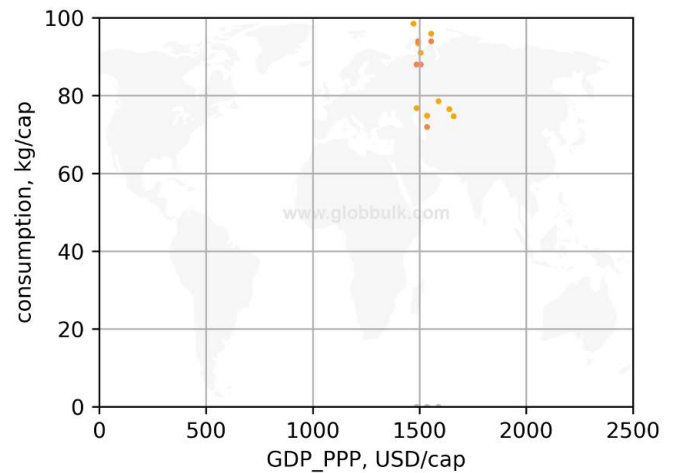
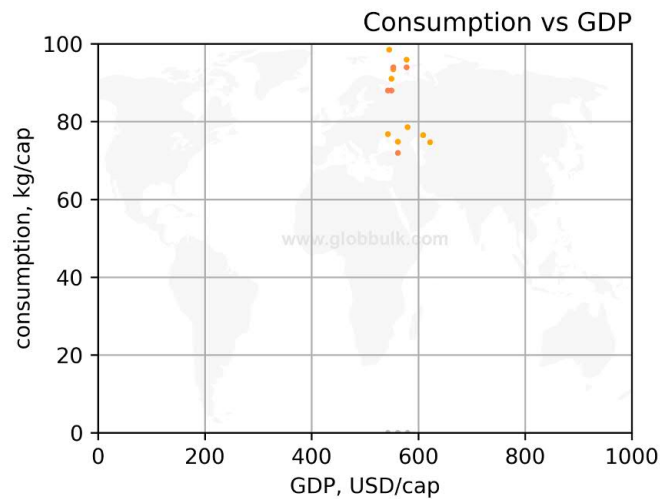
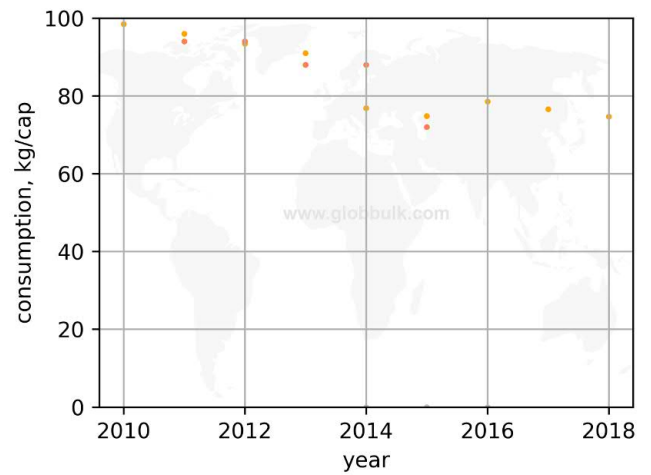
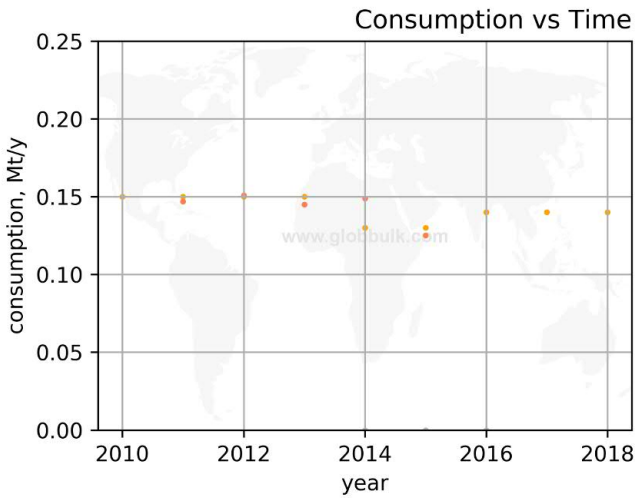
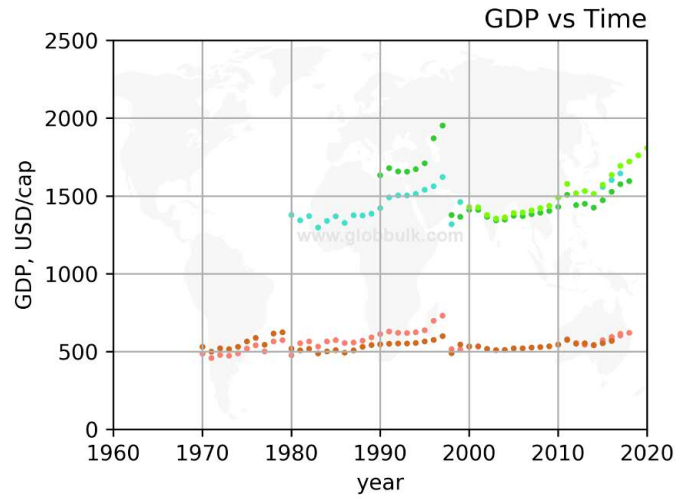
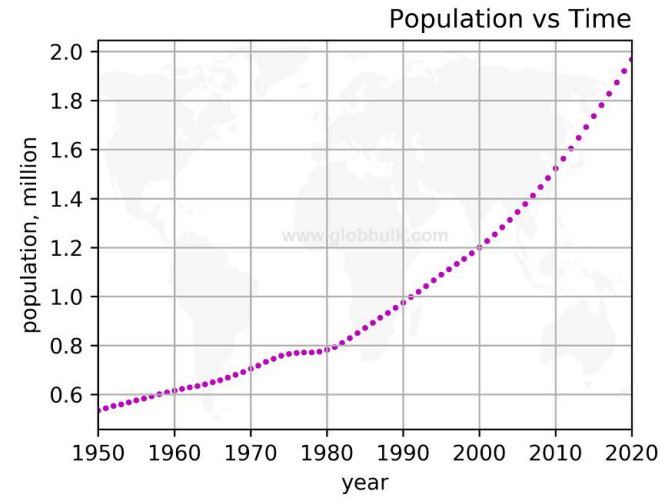


Consumption vs GDP



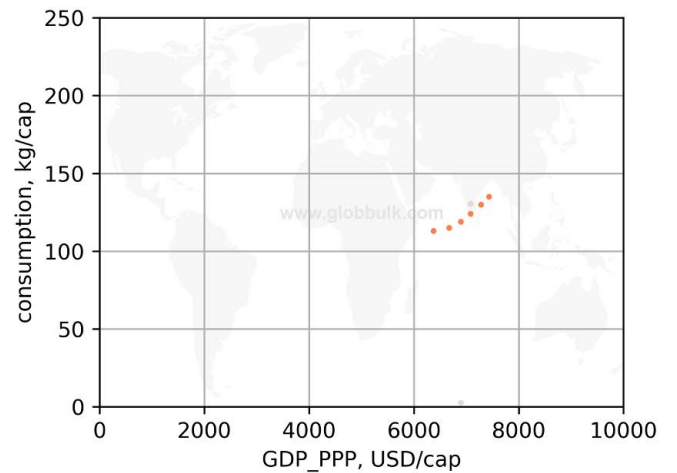
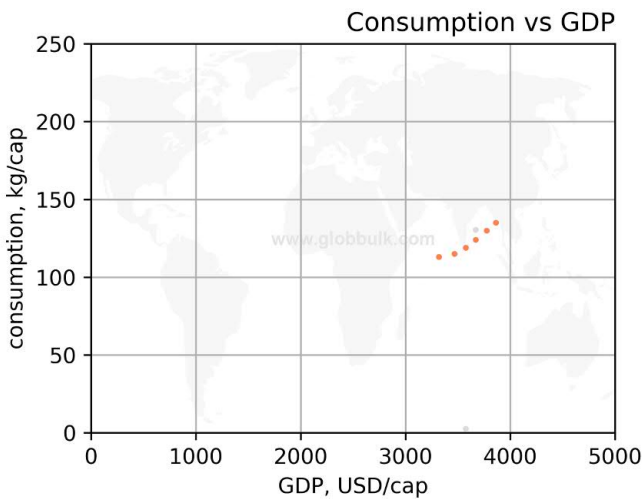
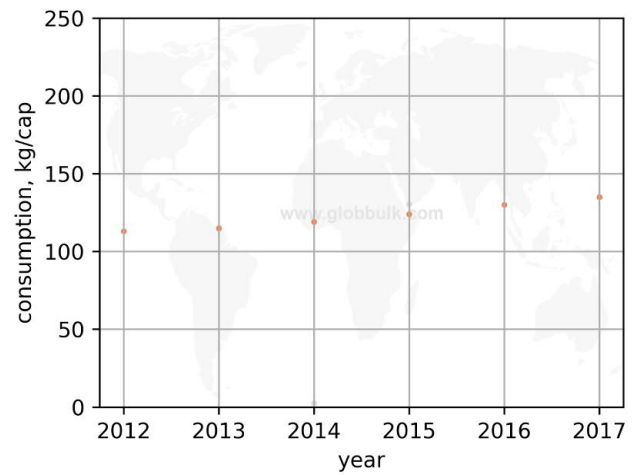
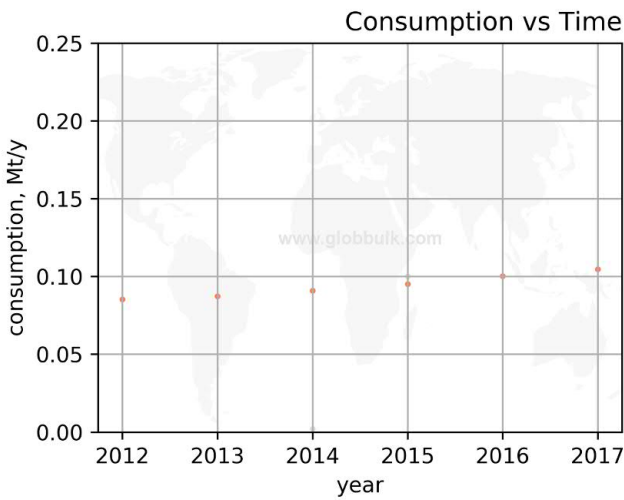
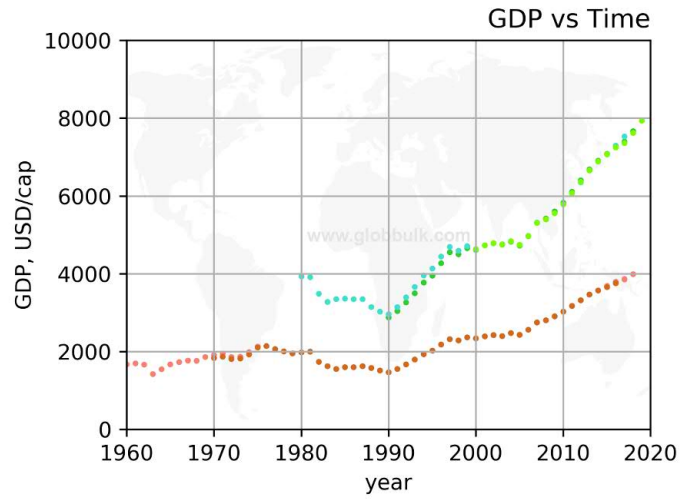
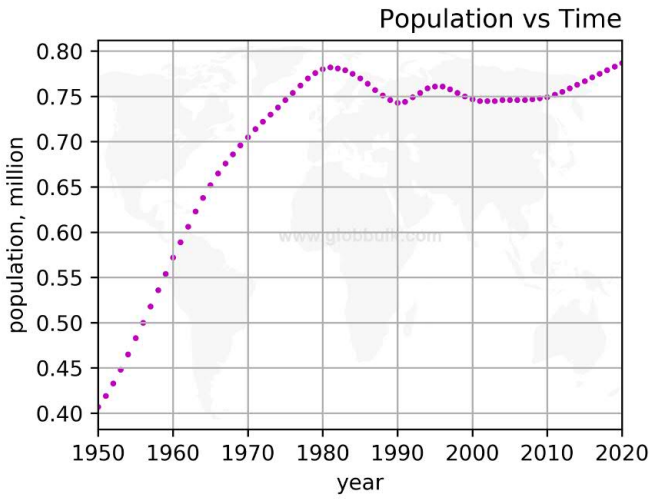


# Guinea-Bissau





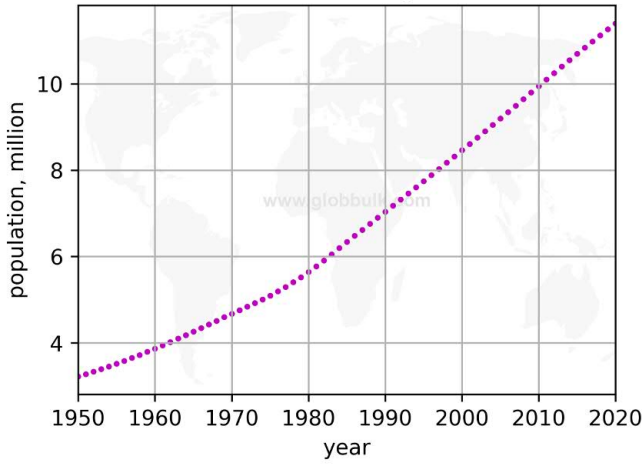
# Guyana



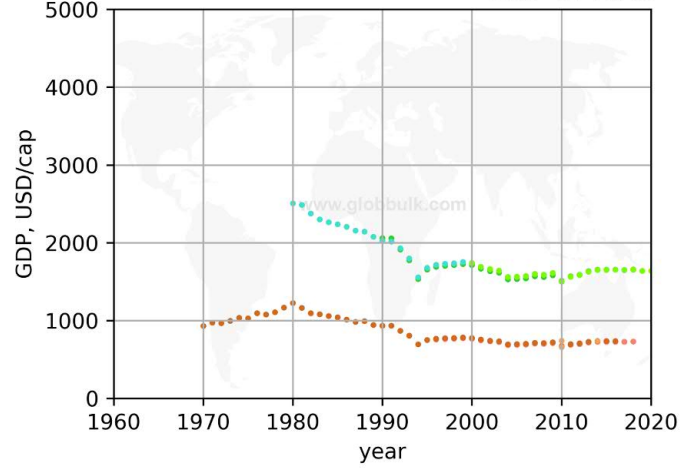


# Haiti

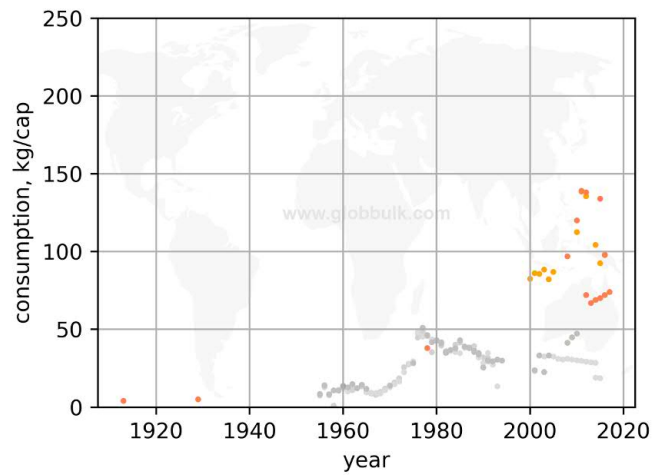
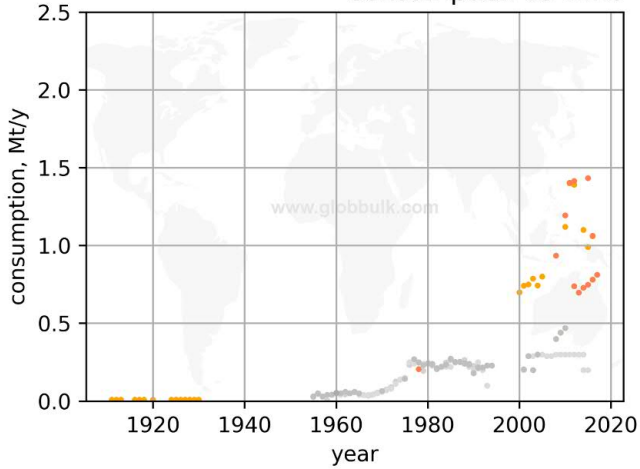
Population vs Time



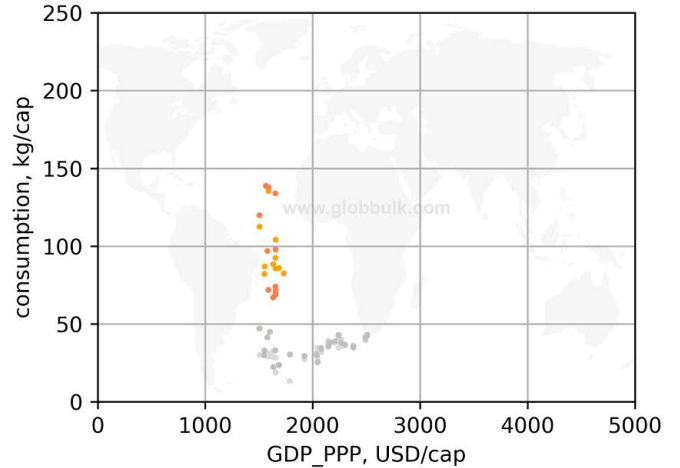
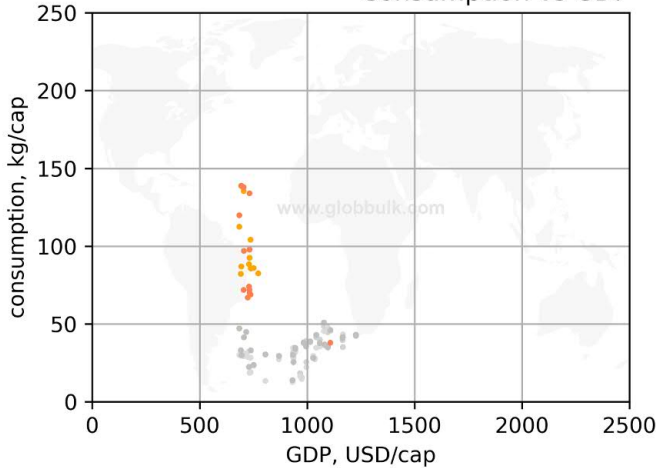
GDP vs Time



Consumption vs Time

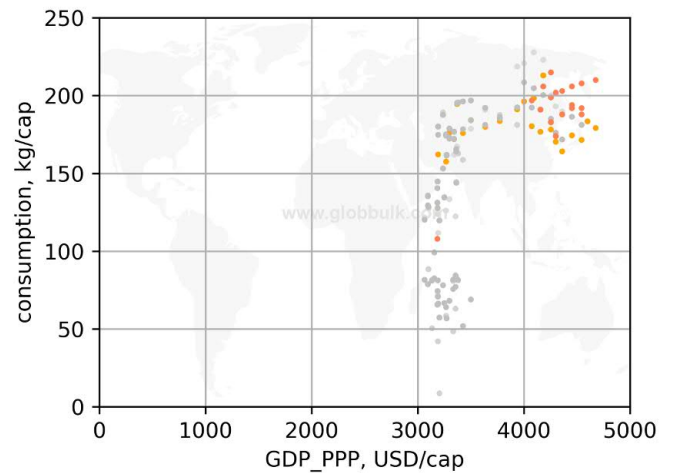
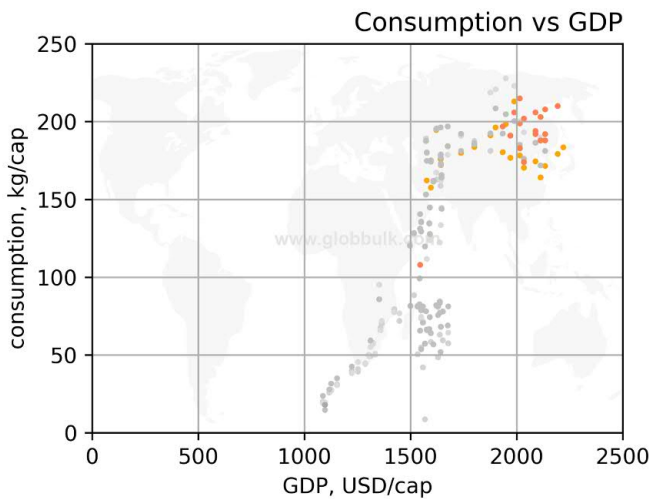
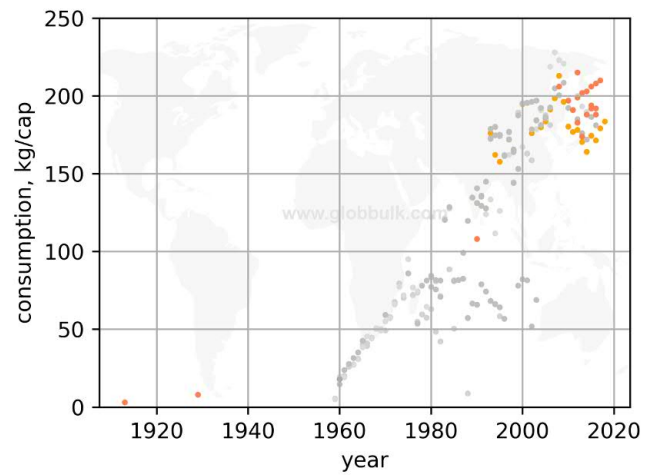
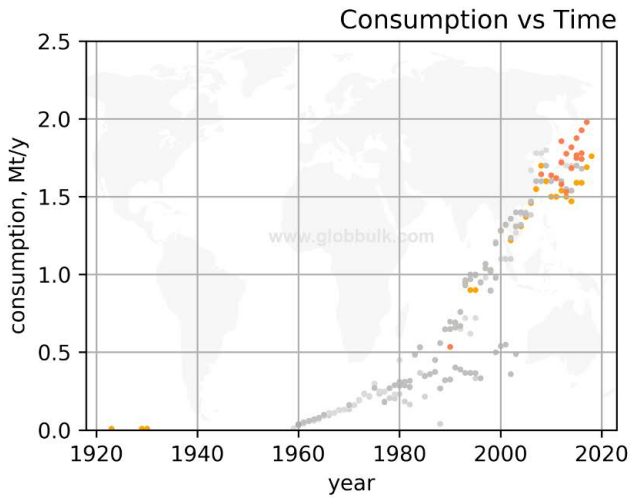
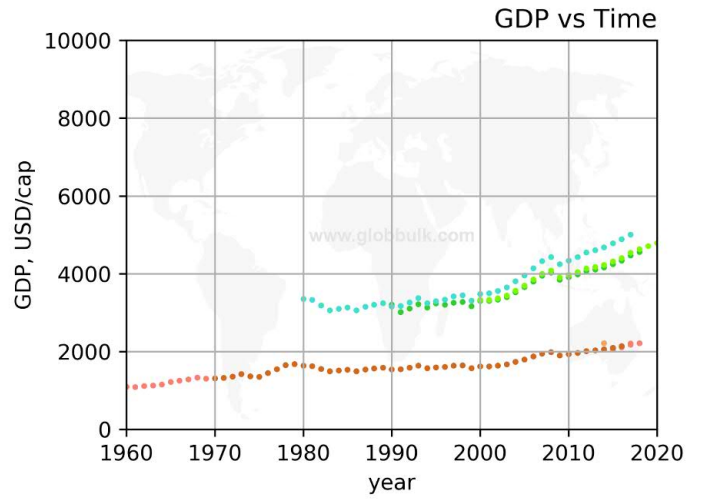
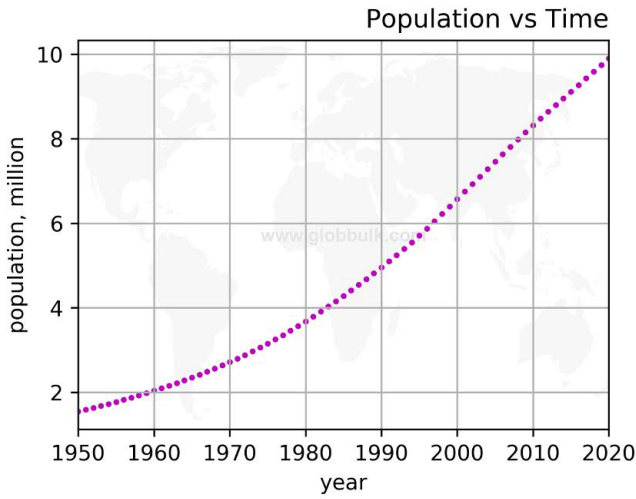


Consumption vs GDP





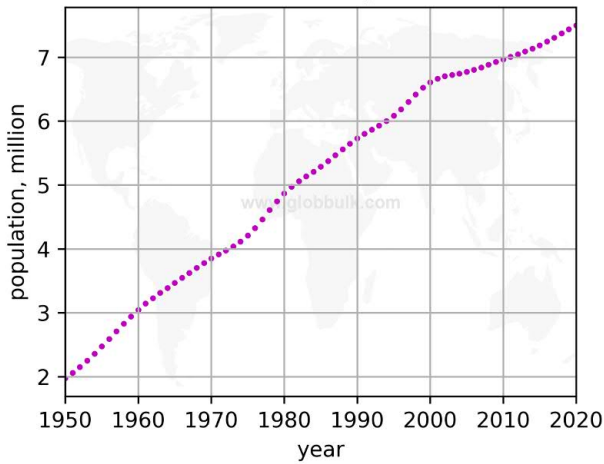
# Honduras



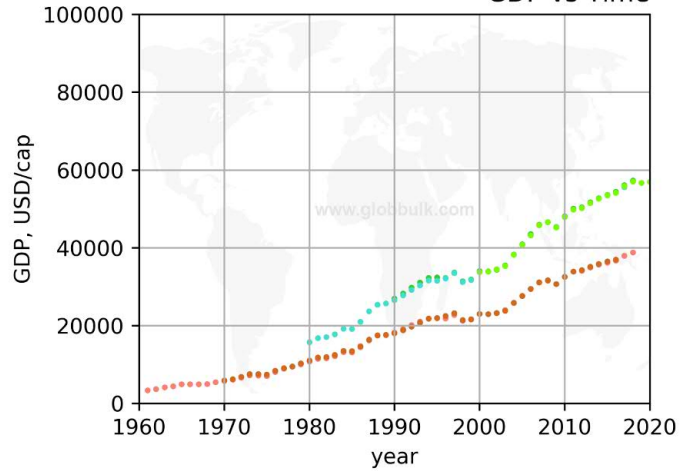


# Hong Kong

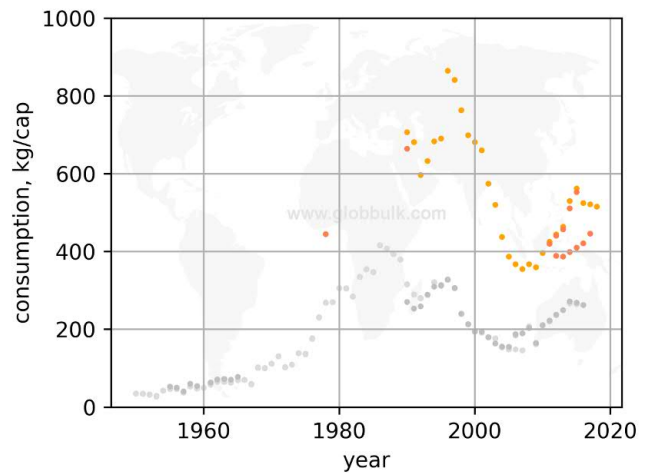
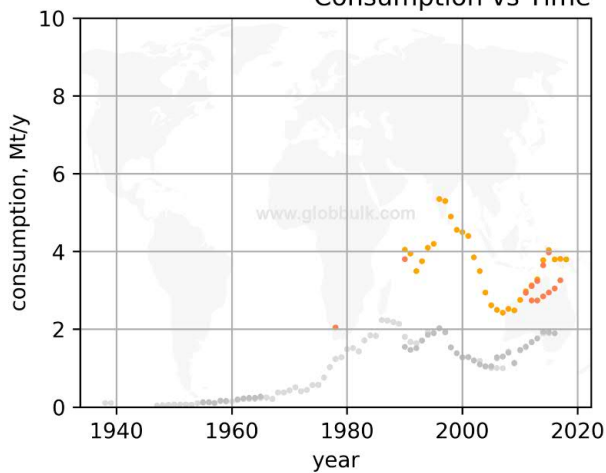
Population vs Time



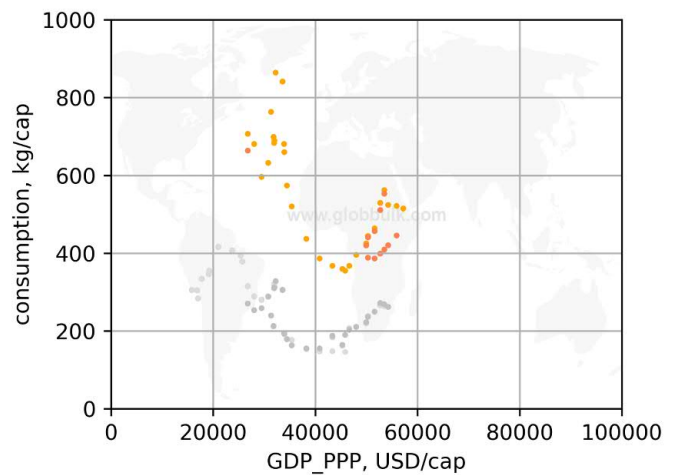
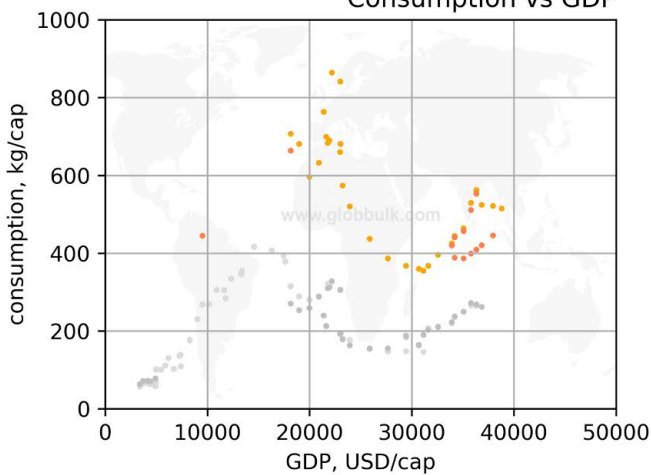
GDP vs Time



Consumption vs Time

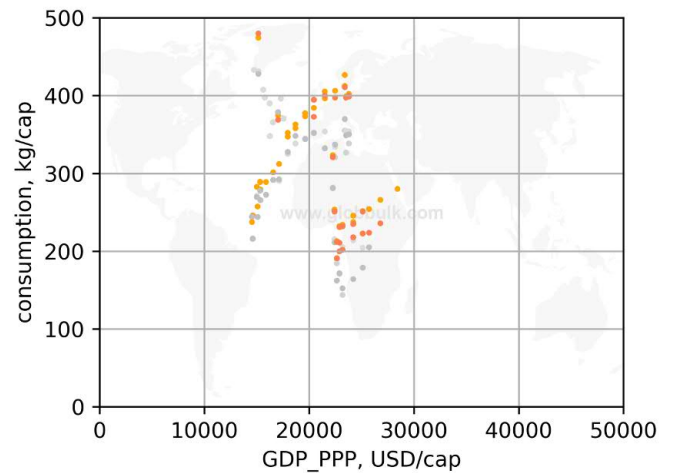
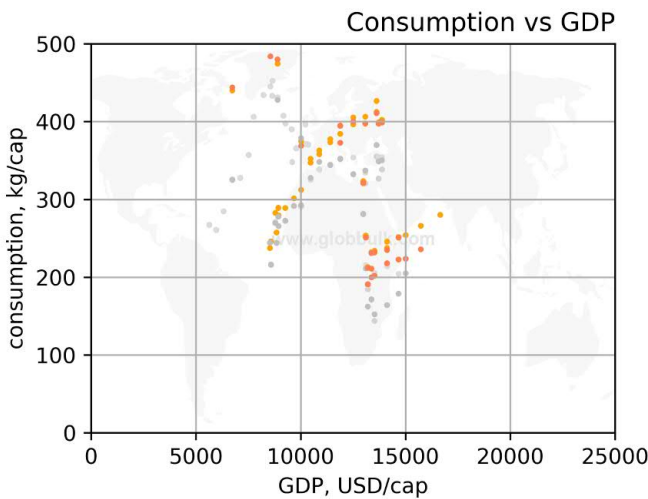
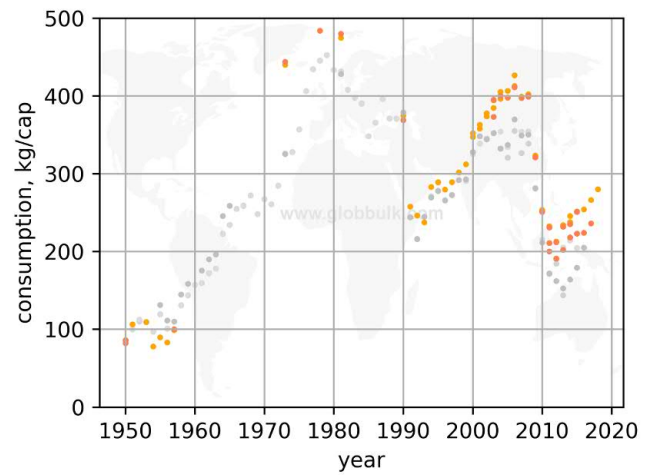
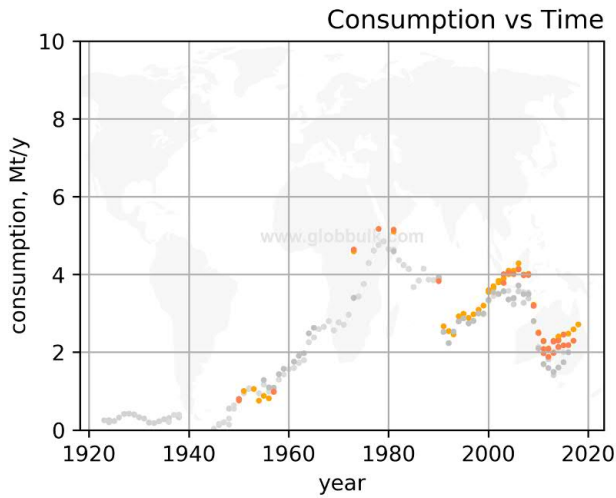
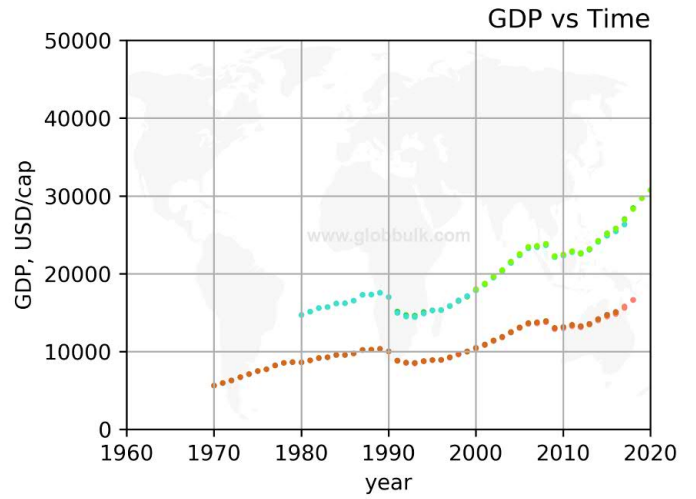
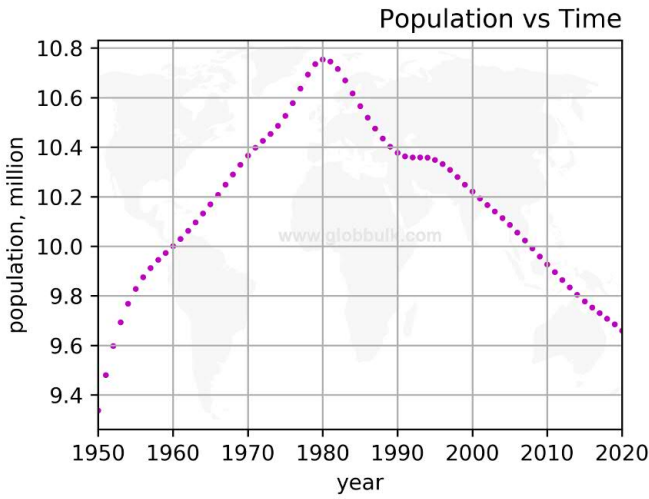


Consumption vs GDP



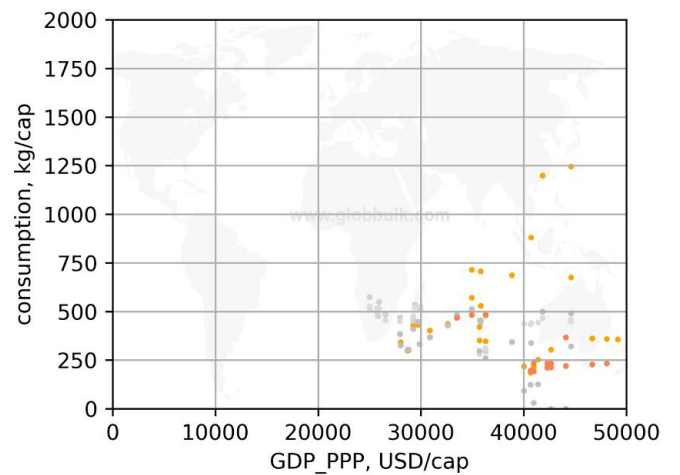
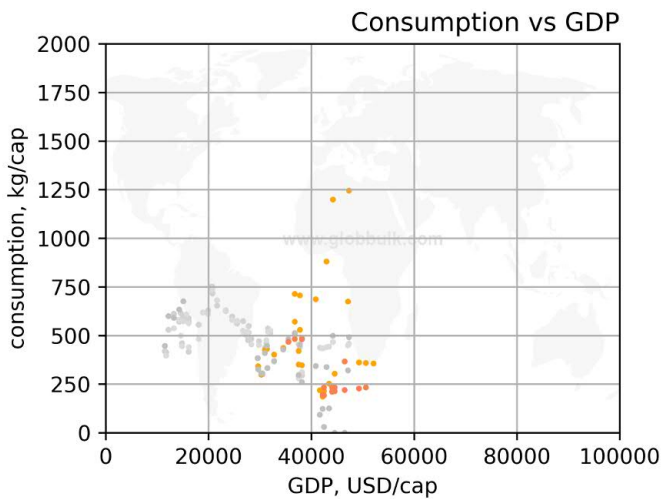
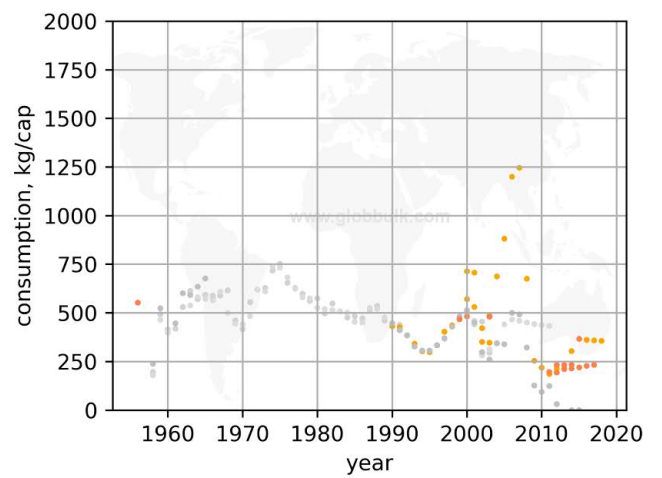
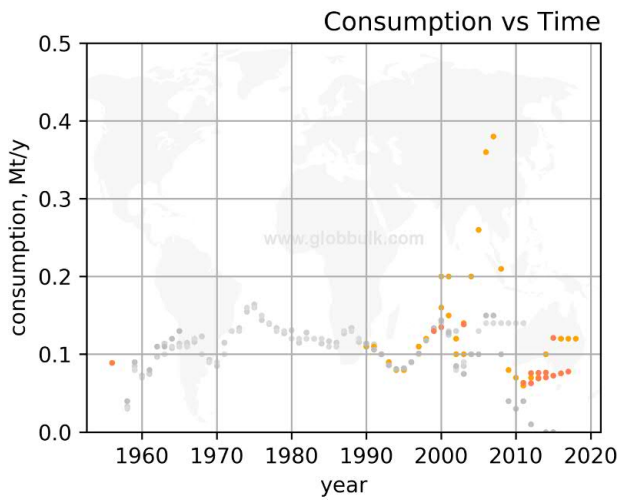
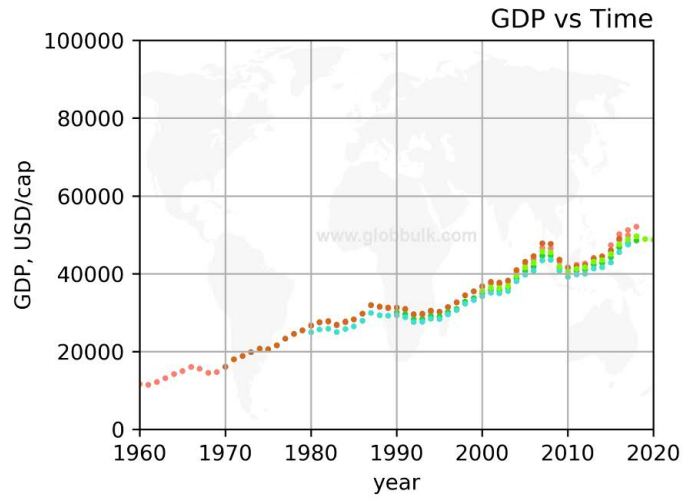
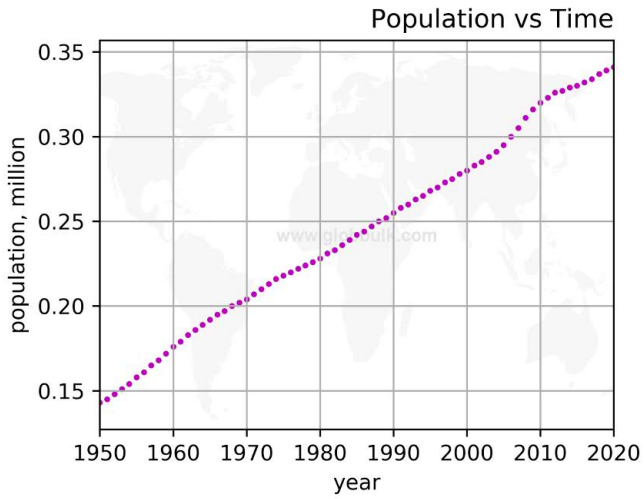


# Hungary





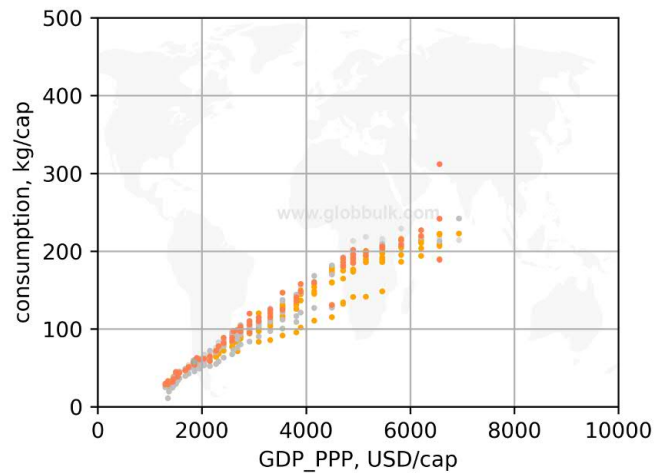
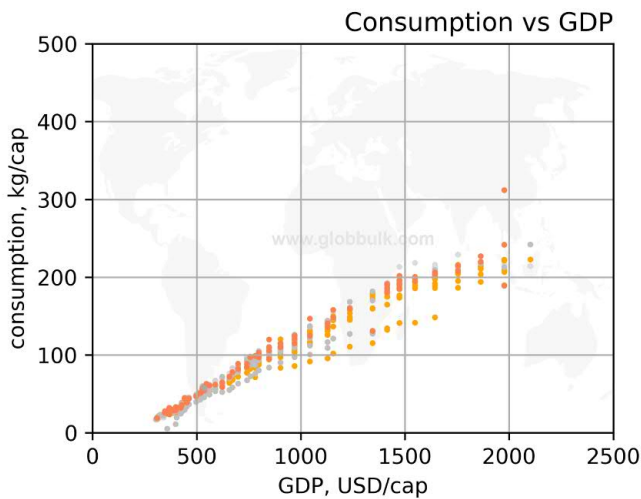
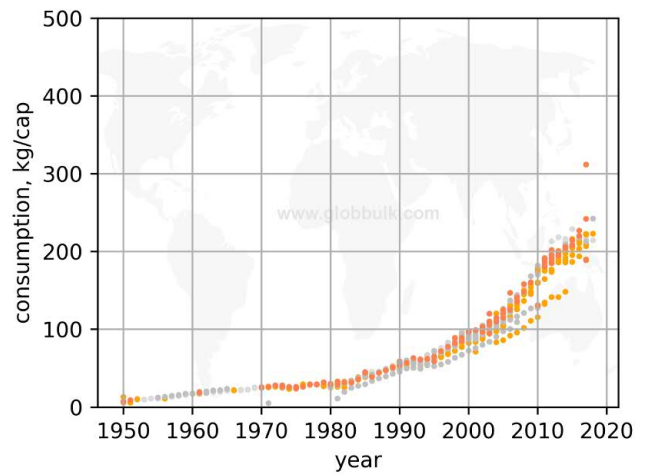
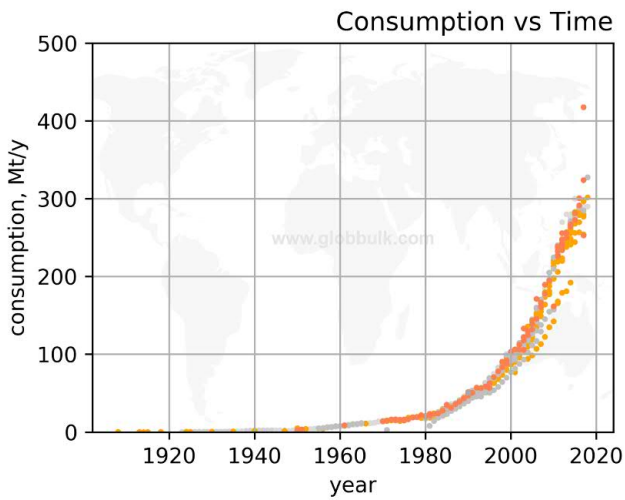
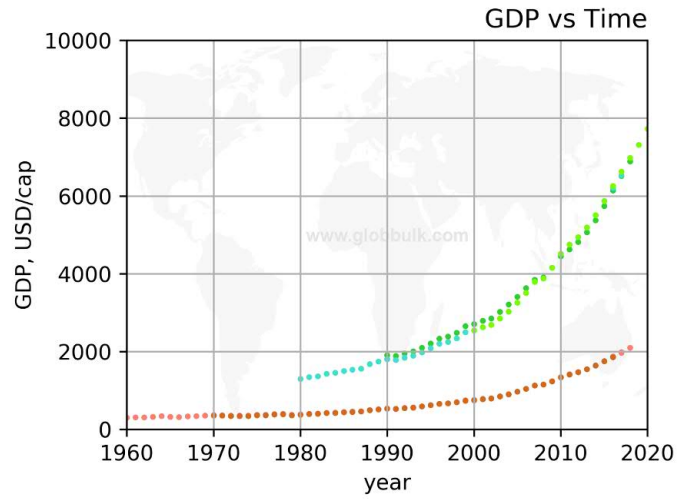
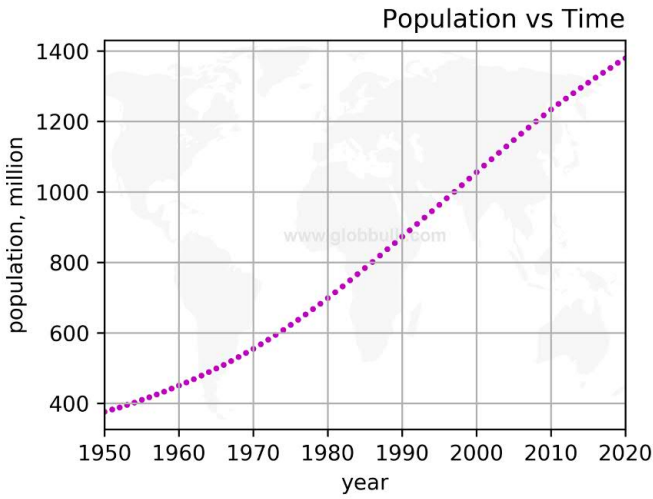
# Iceland





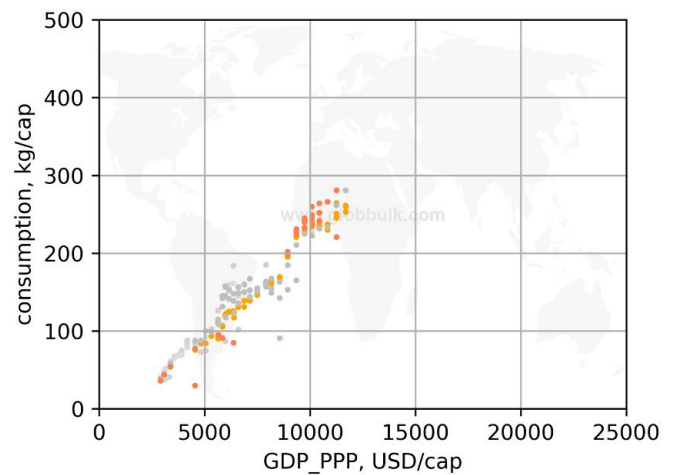
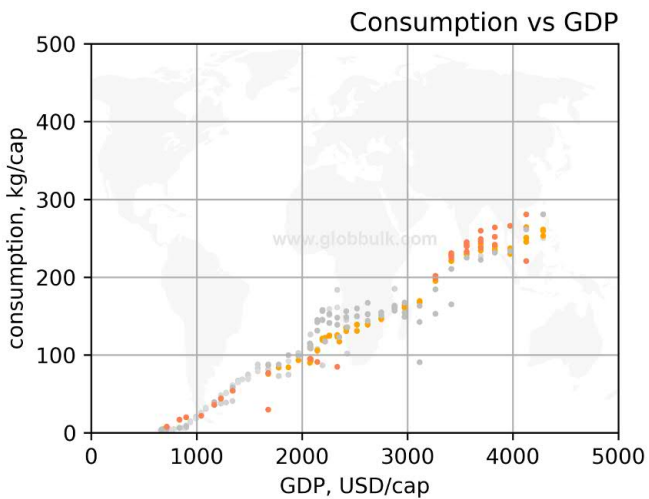
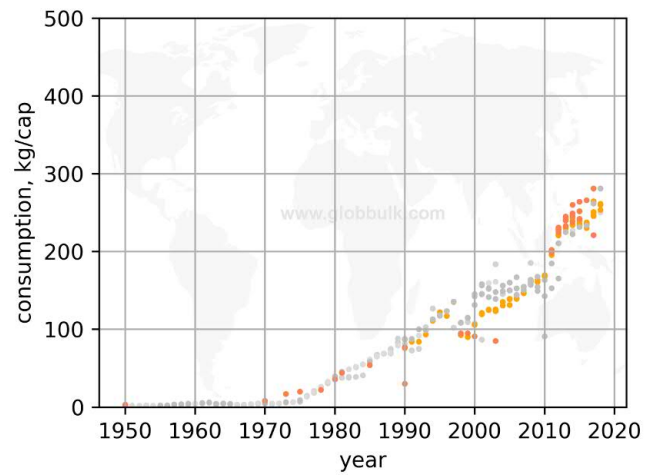
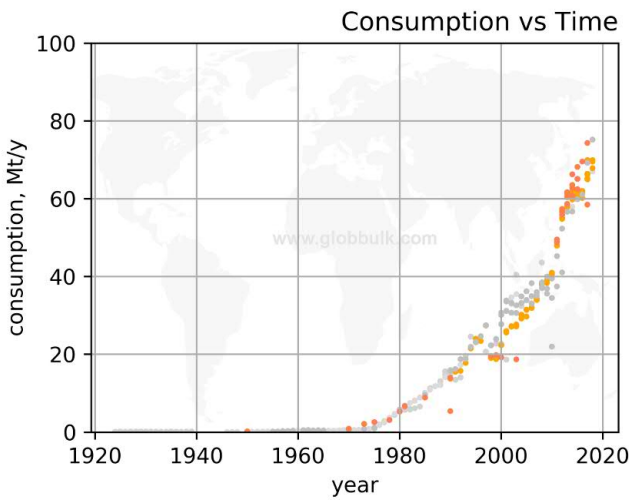
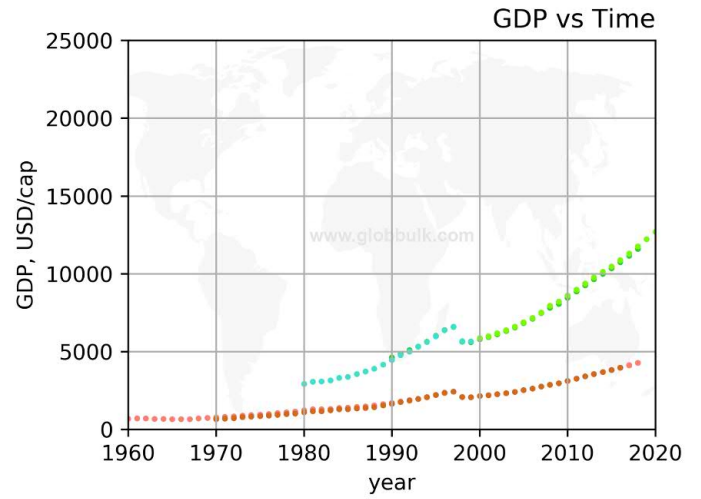
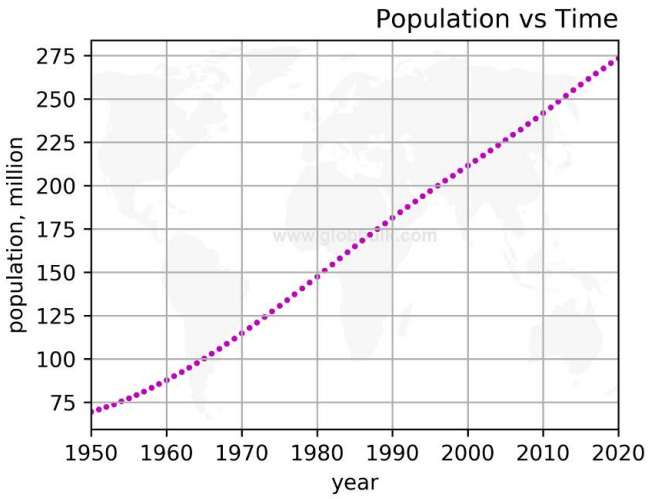


# India





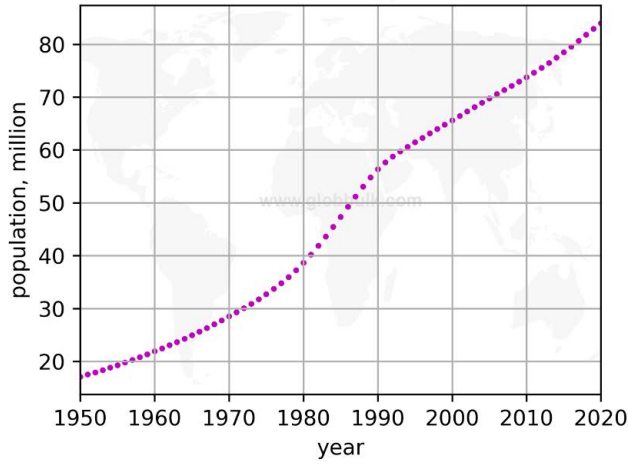
# Indonesia



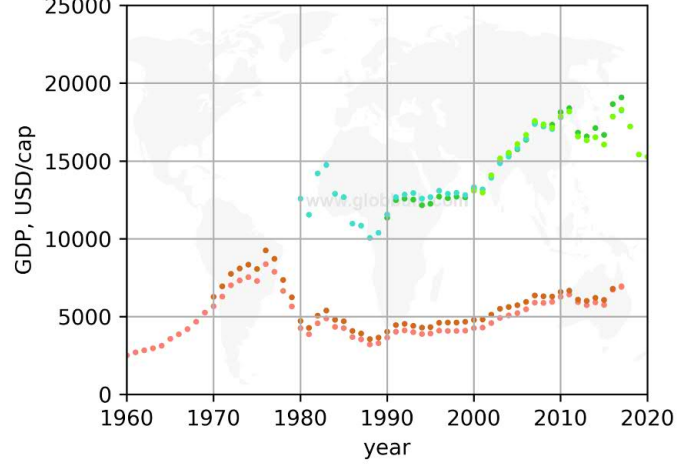


# Iran

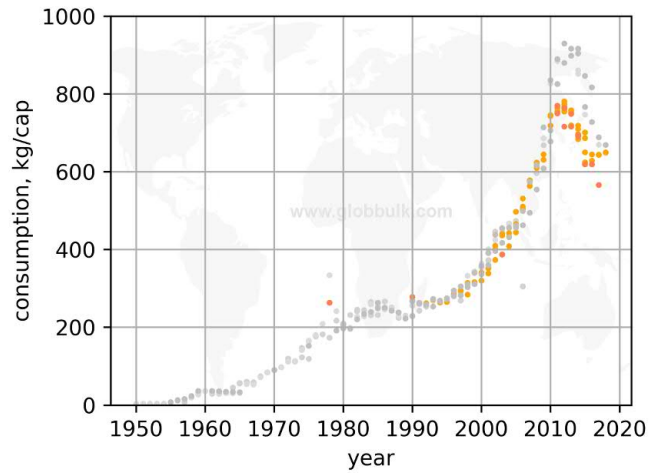
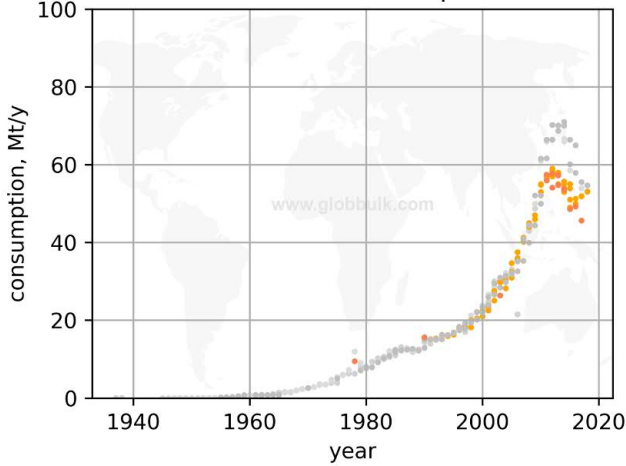
Population vs Time



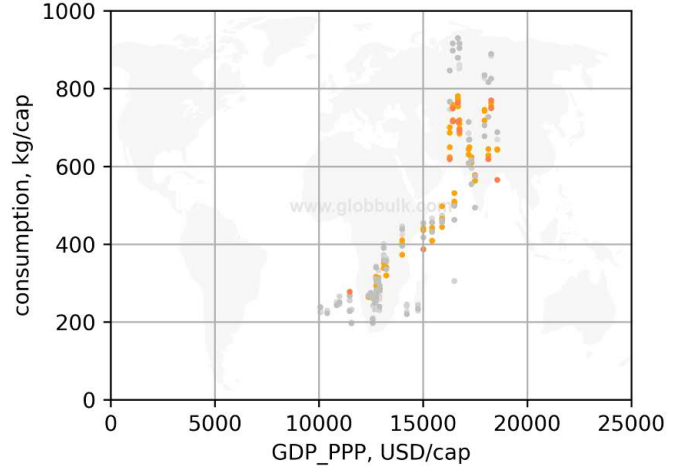
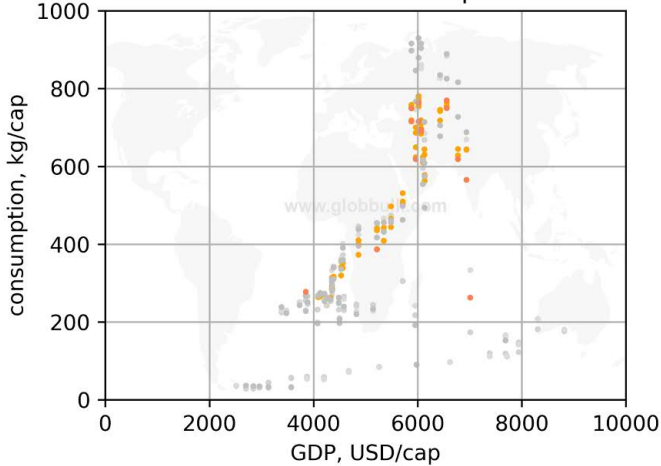
GDP vs Time



Consumption vs Time

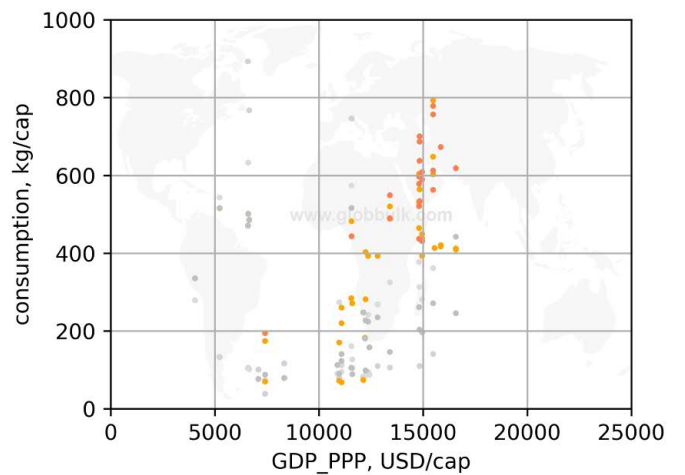
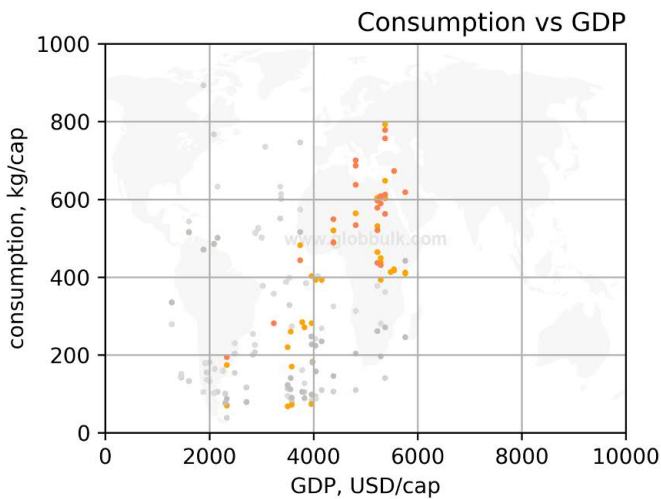
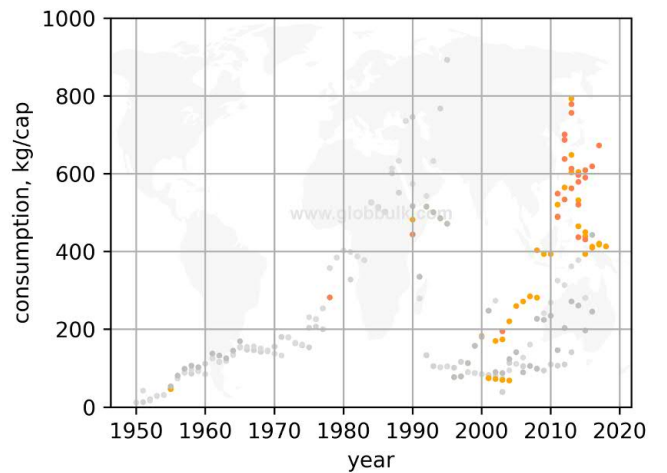
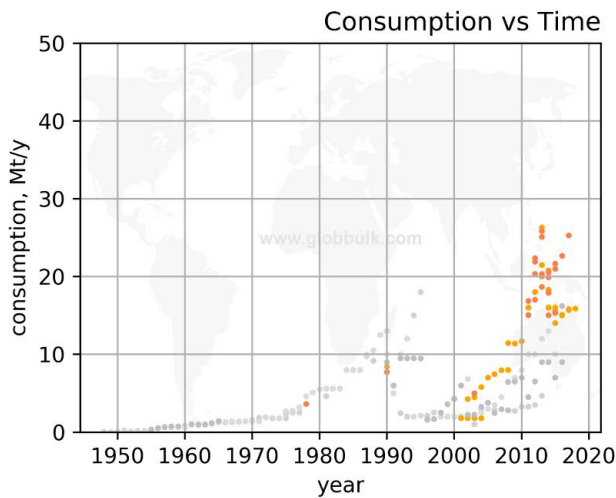
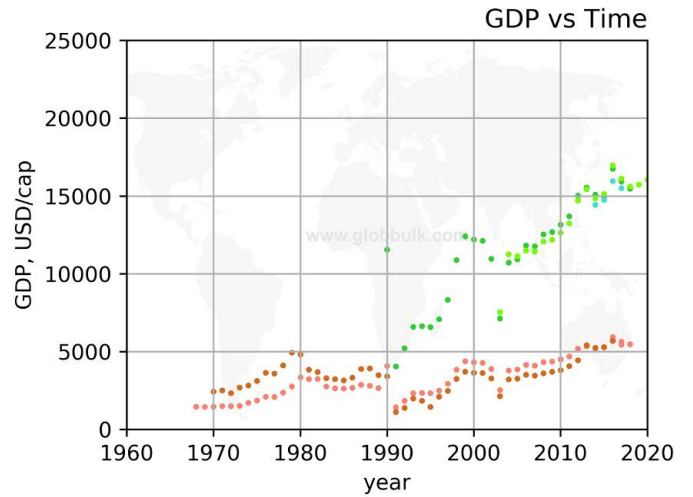
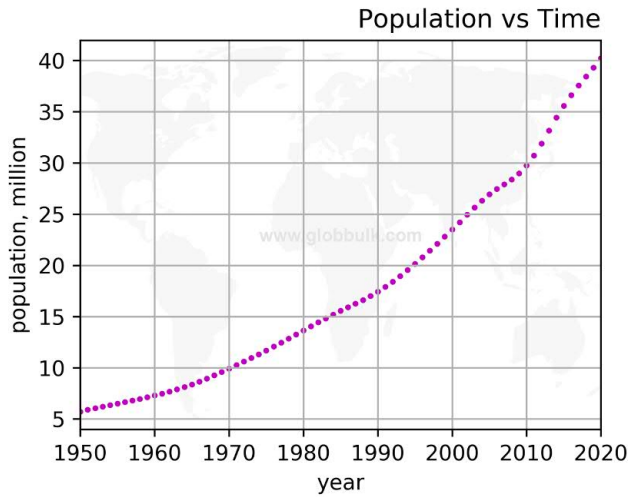


Consumption vs GDP



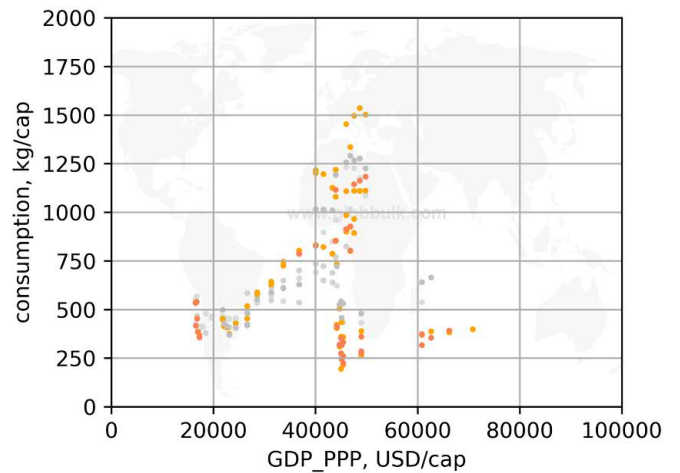
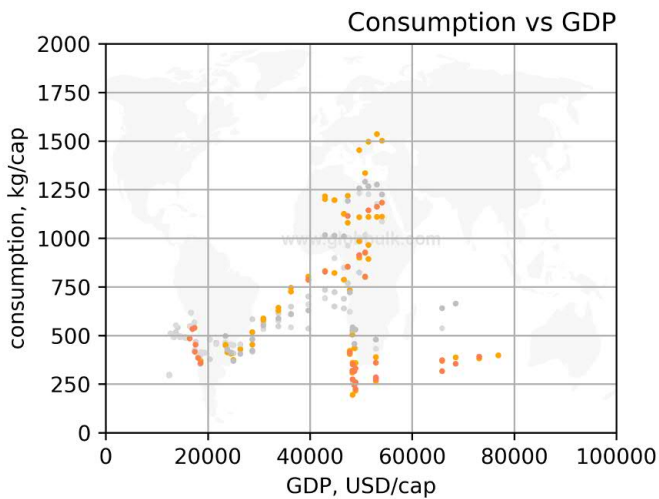
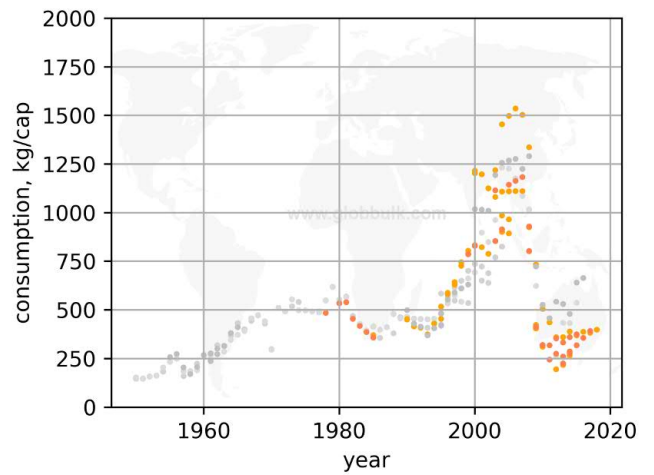
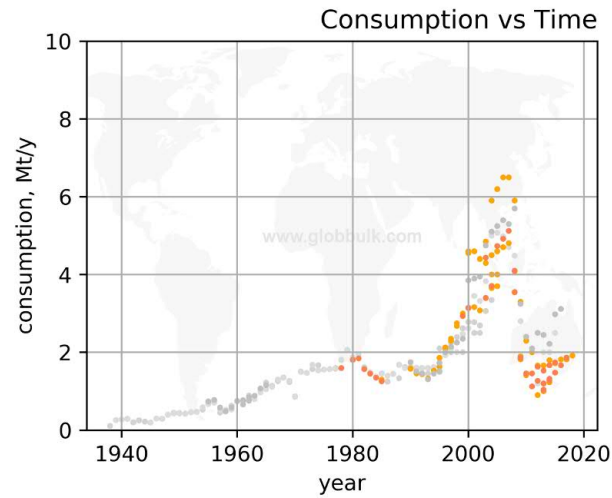
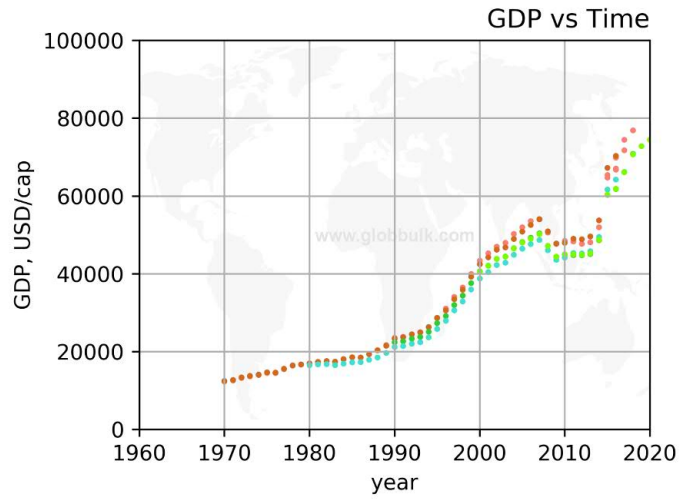
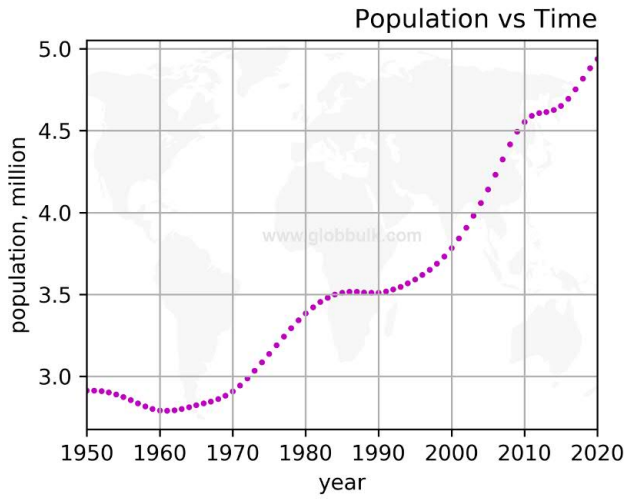


# Iraq



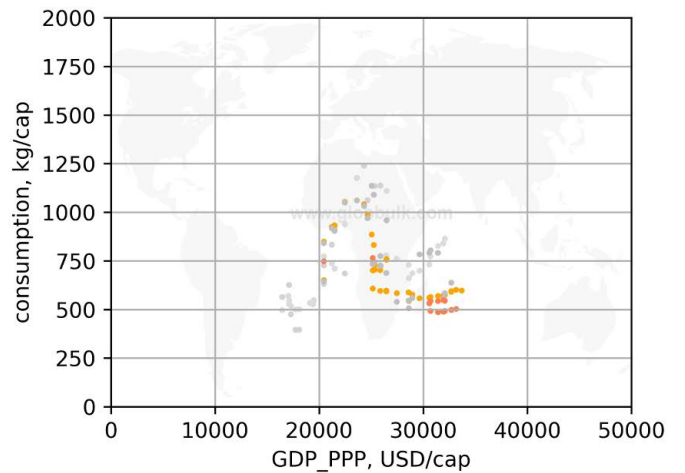
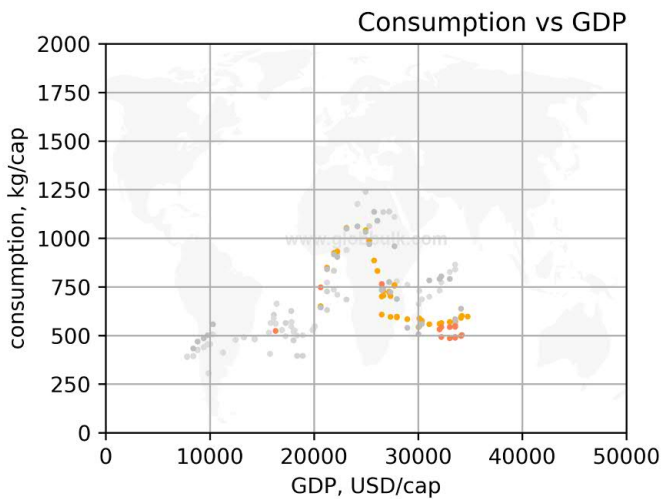
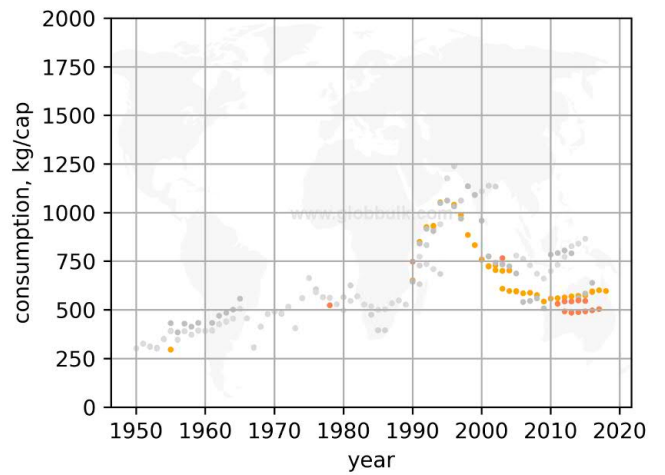
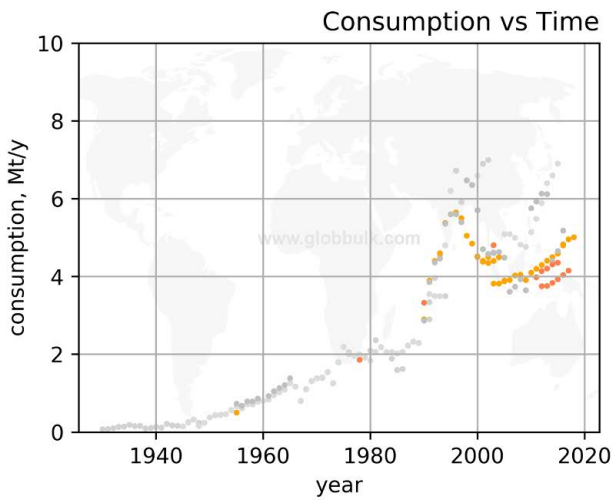
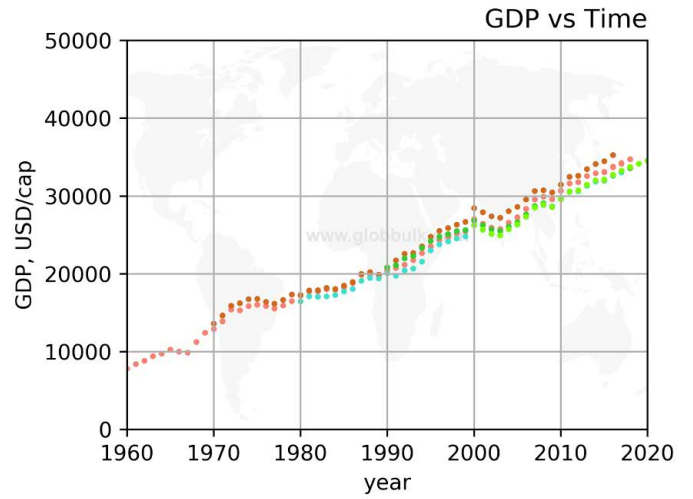
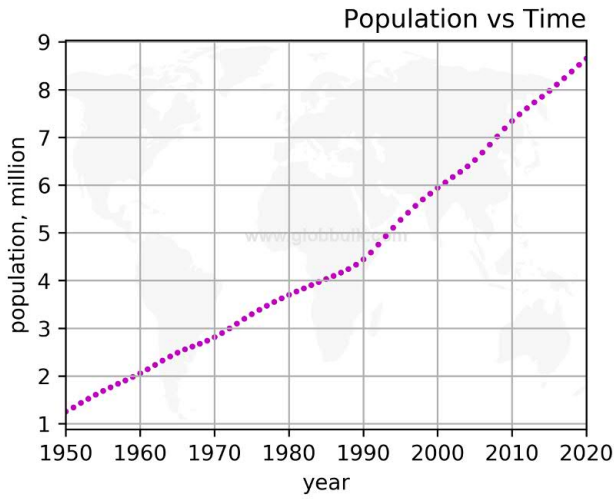


# Ireland





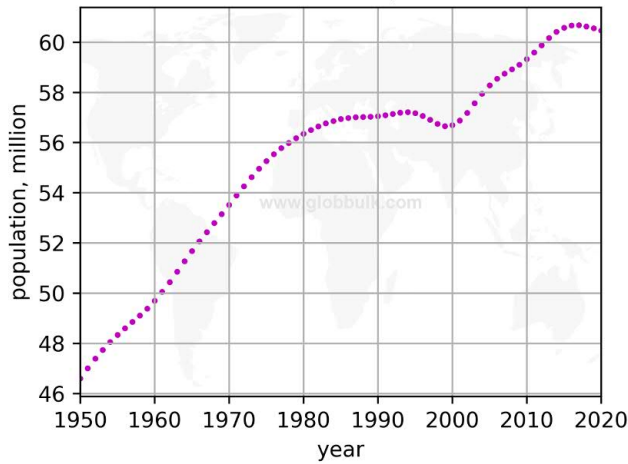
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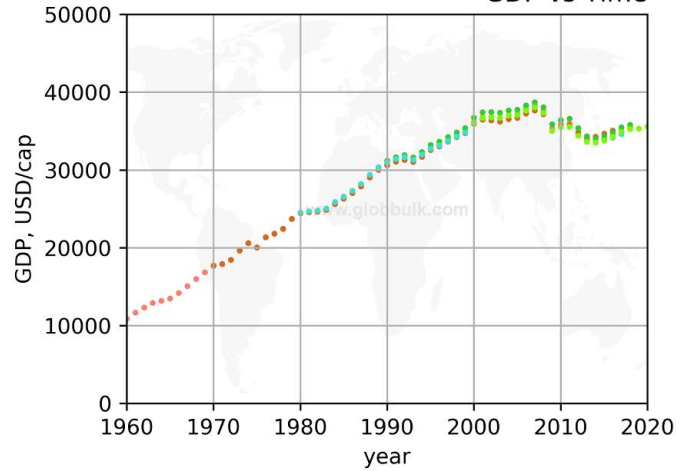


# Italy

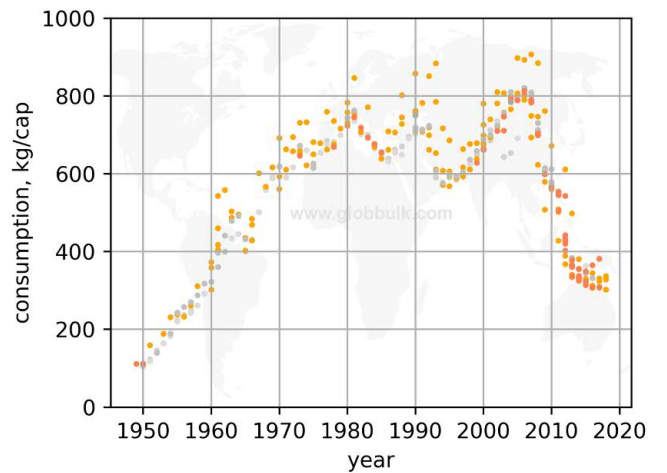
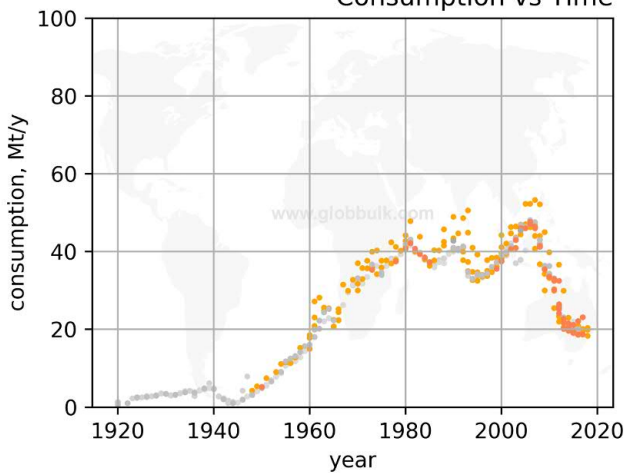
Population vs Time



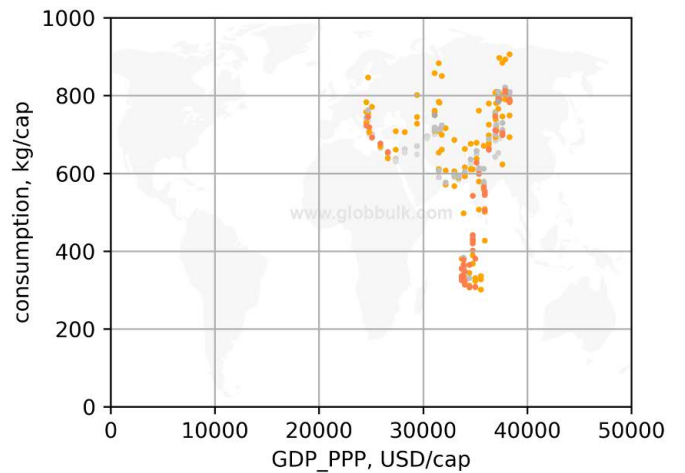
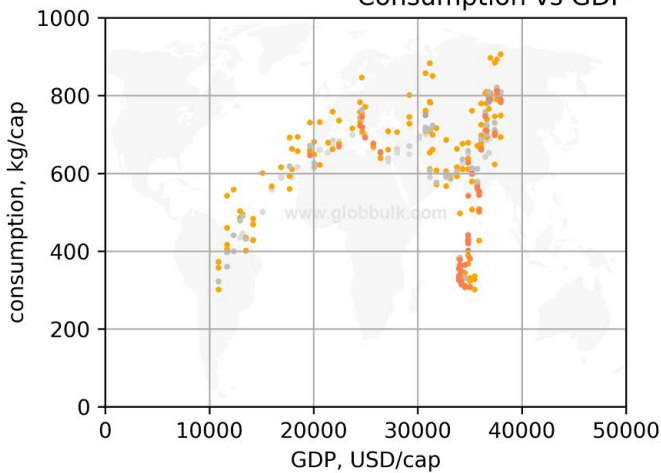
GDP vs Time



Consumption vs Time

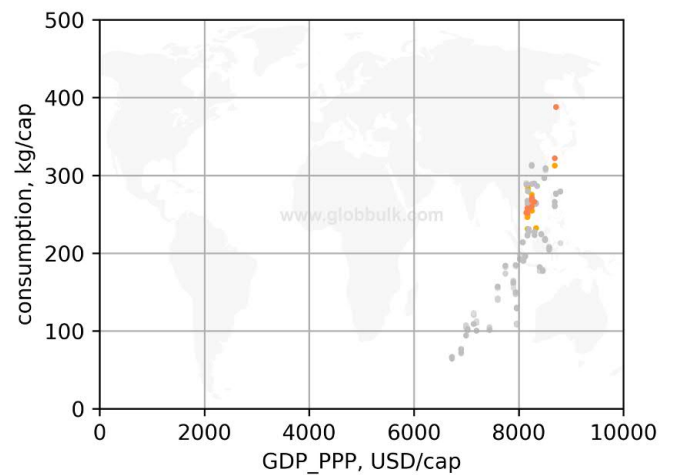
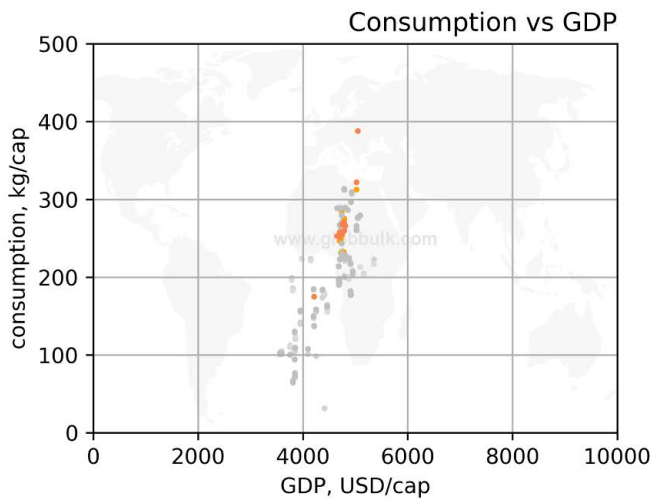
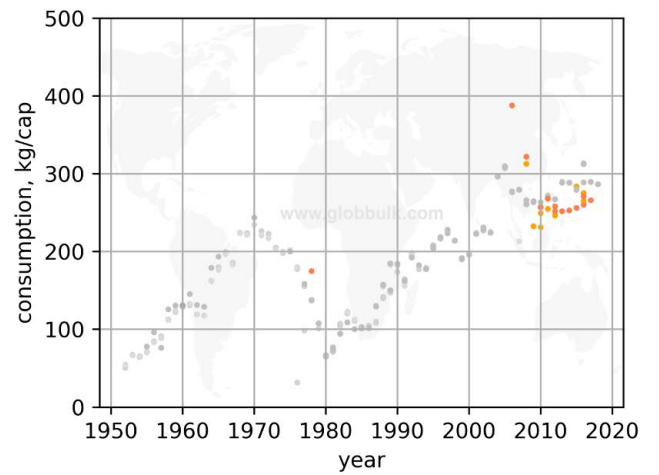
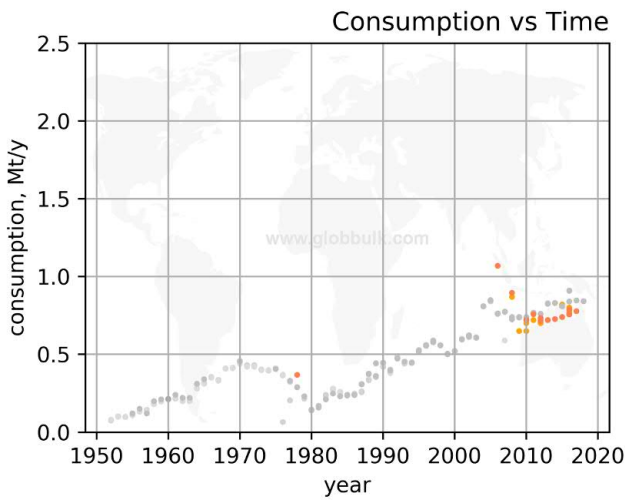
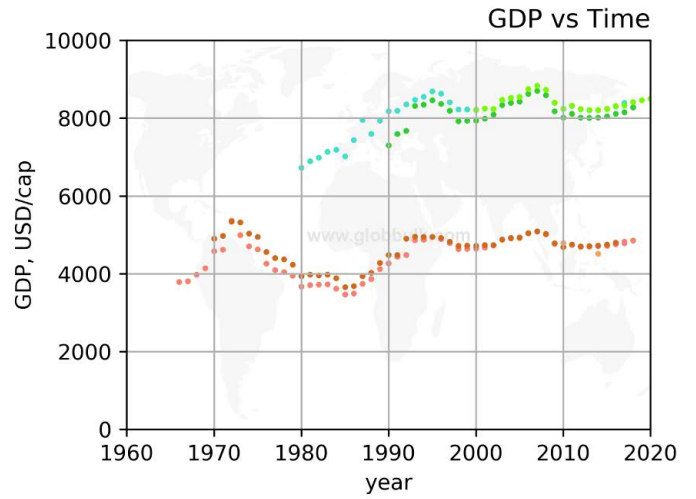
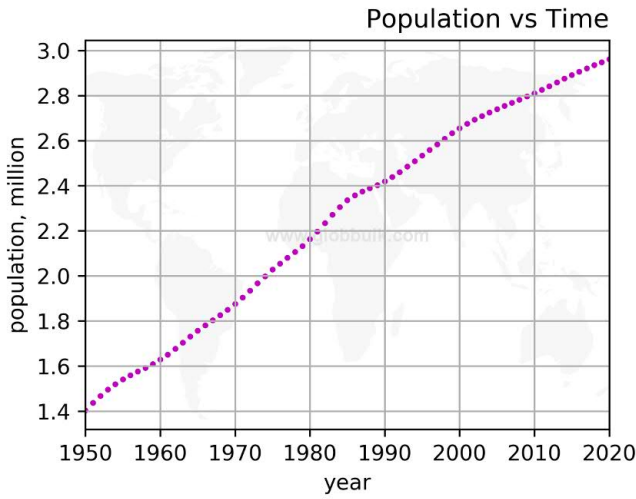


Consumption vs GDP





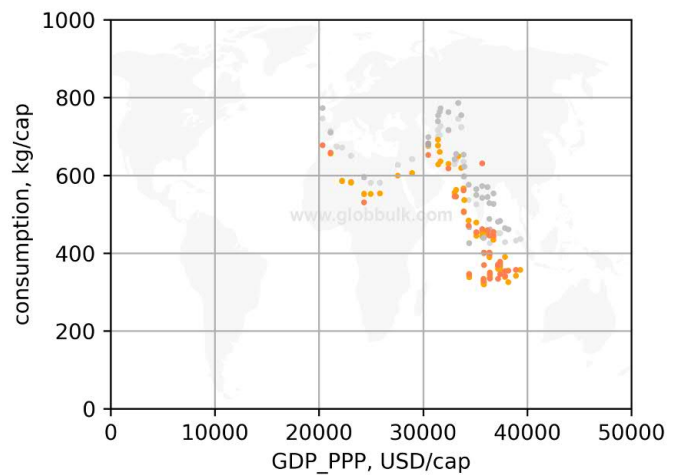
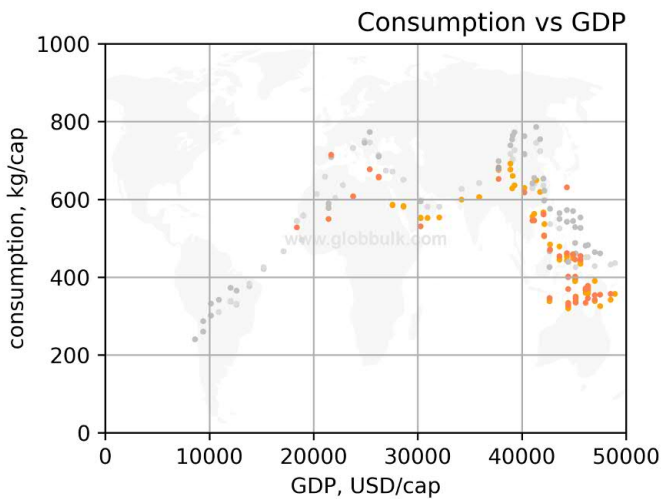
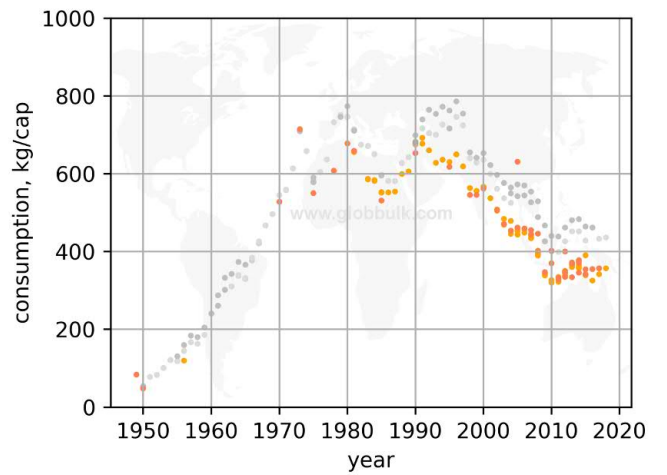
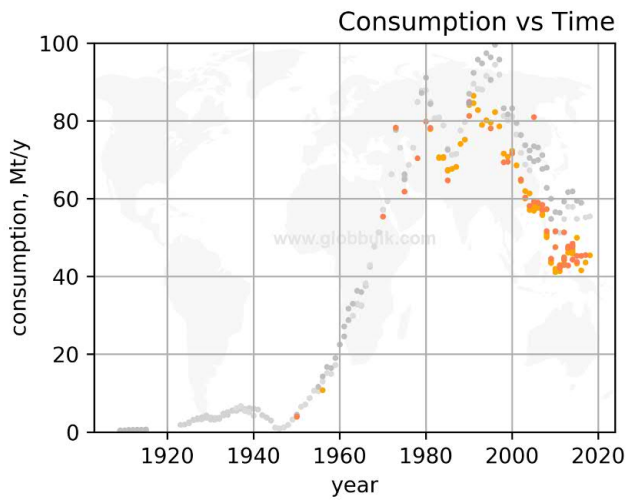
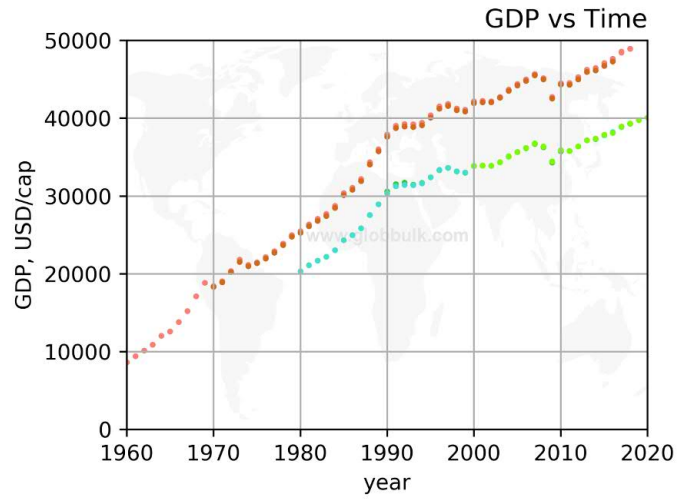
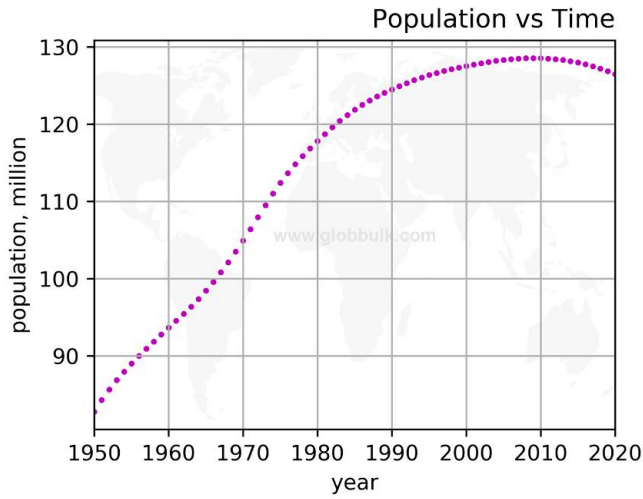
# Jamaica





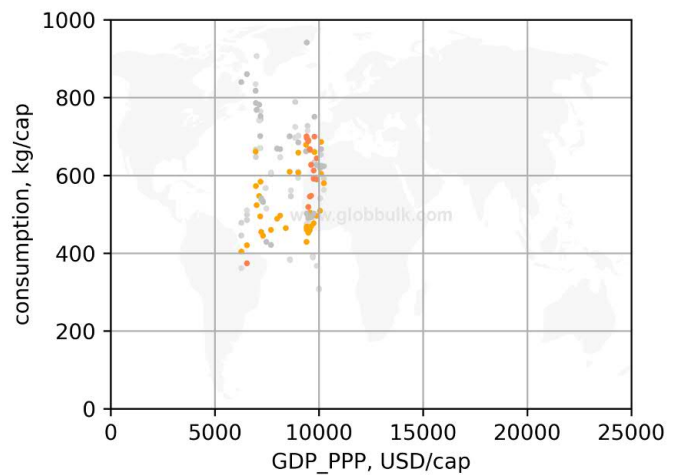
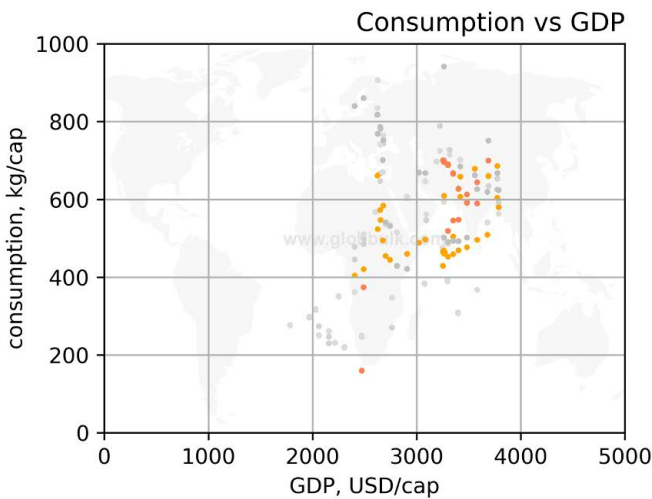
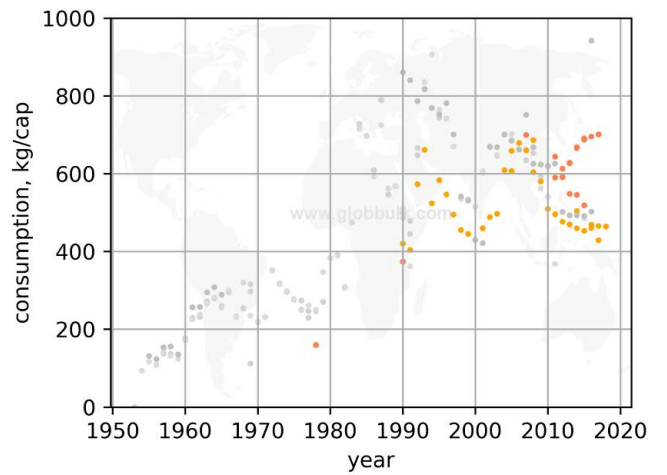
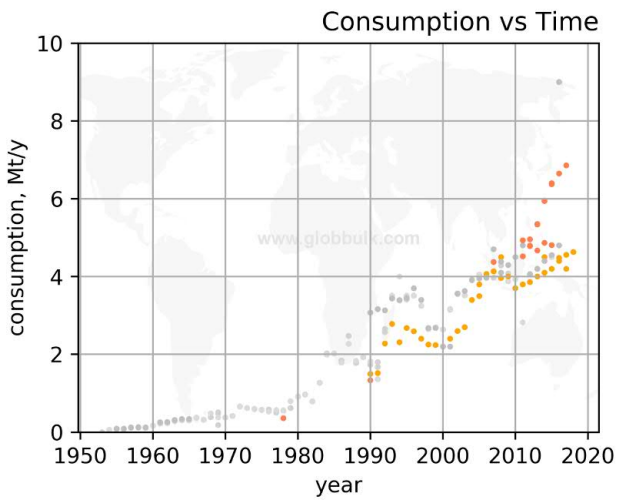
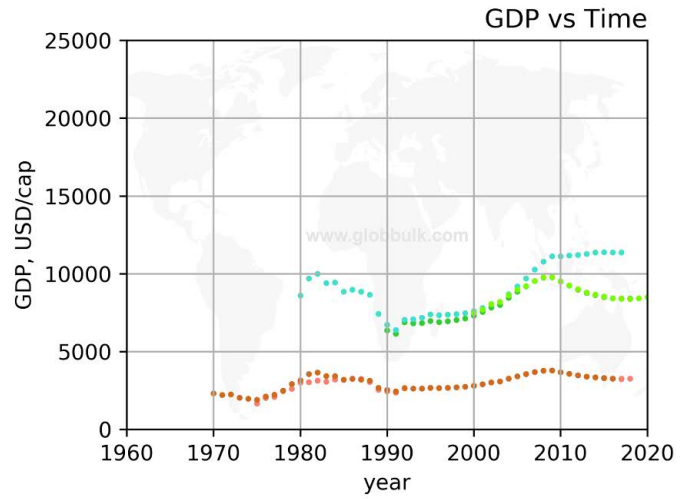
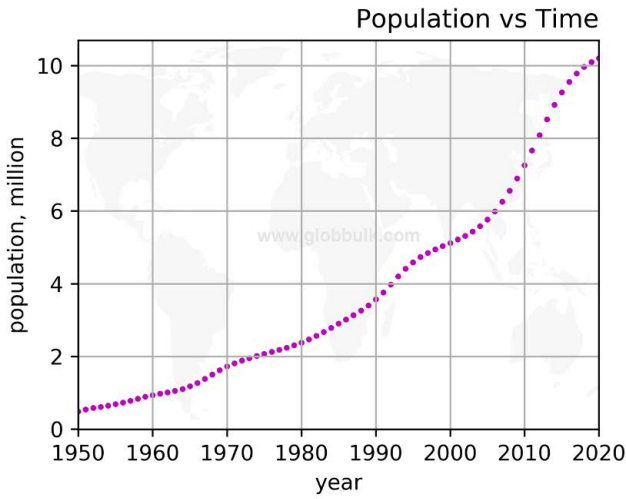


# Japan



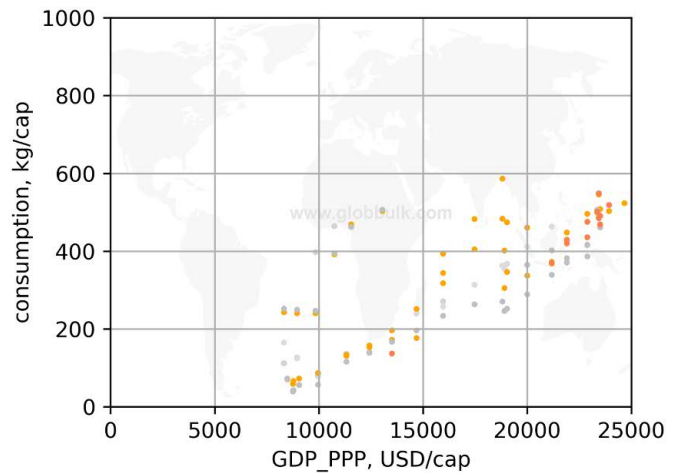
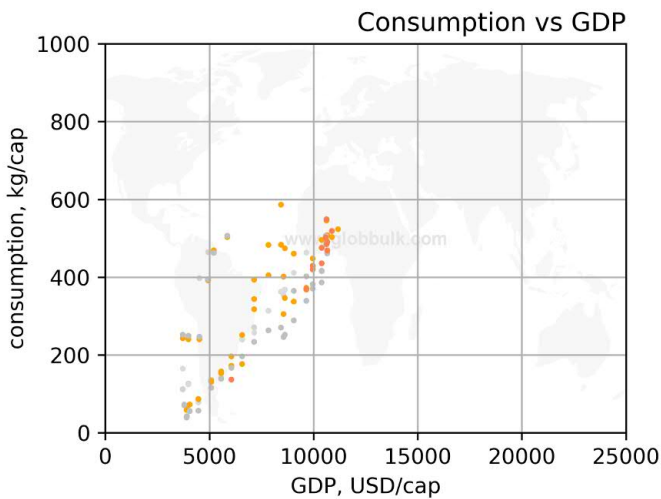
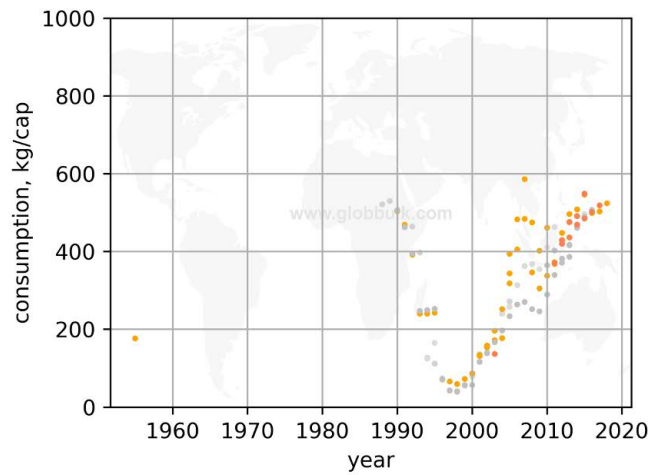
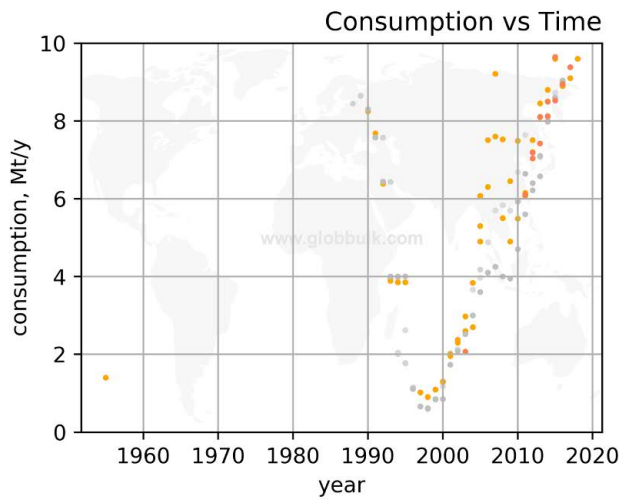
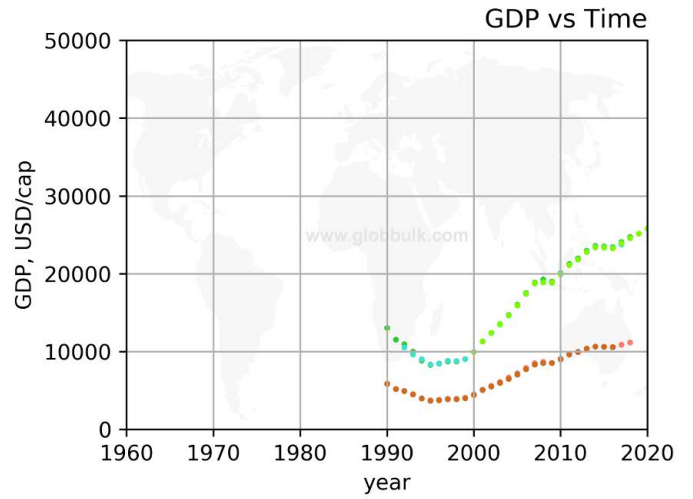
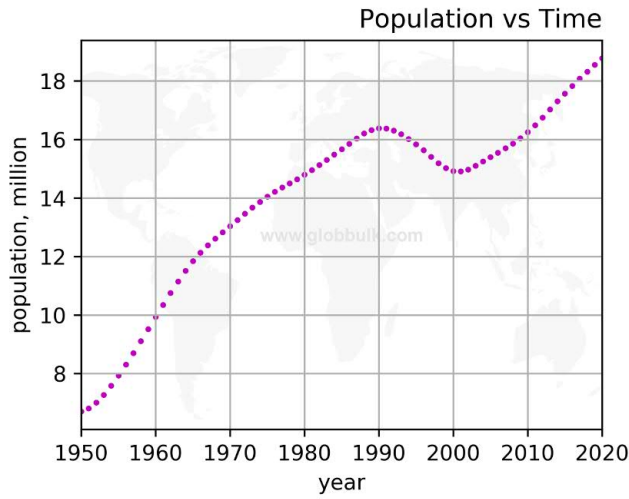


# Jordan





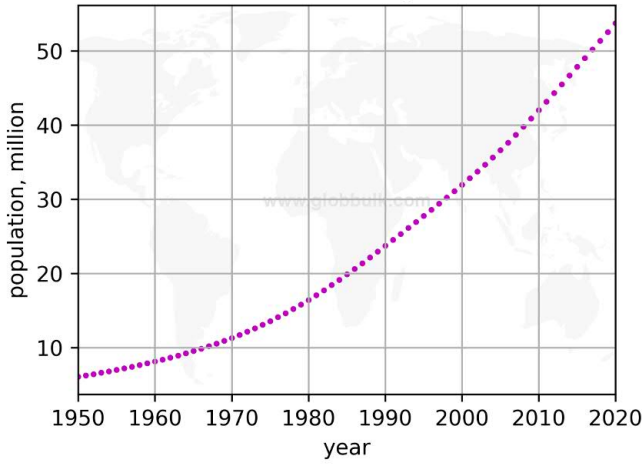
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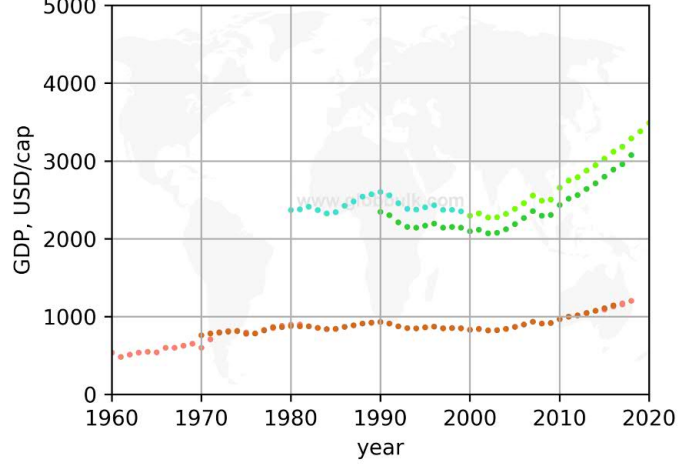


# Kenya

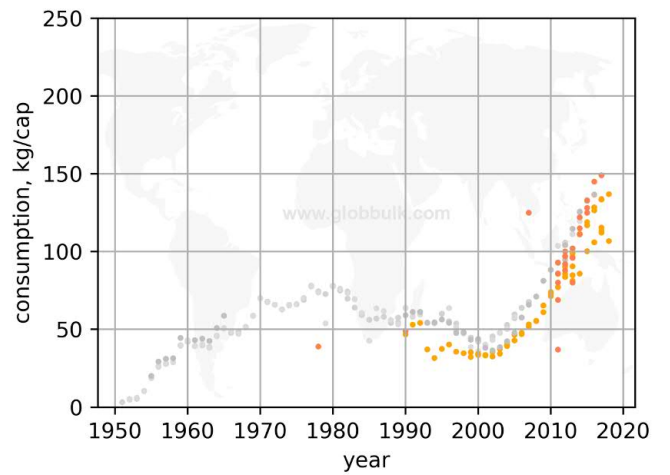
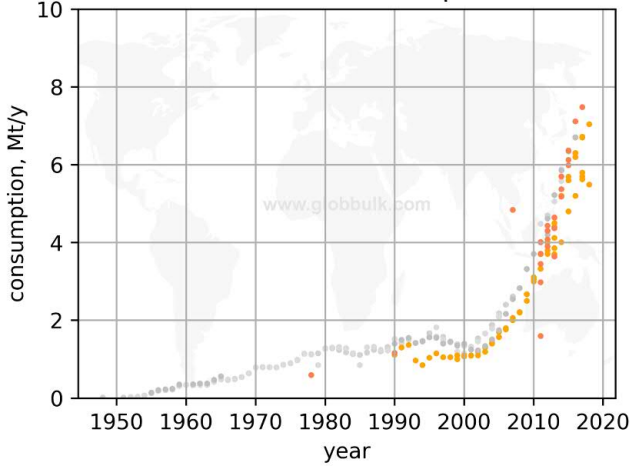
Population vs Time



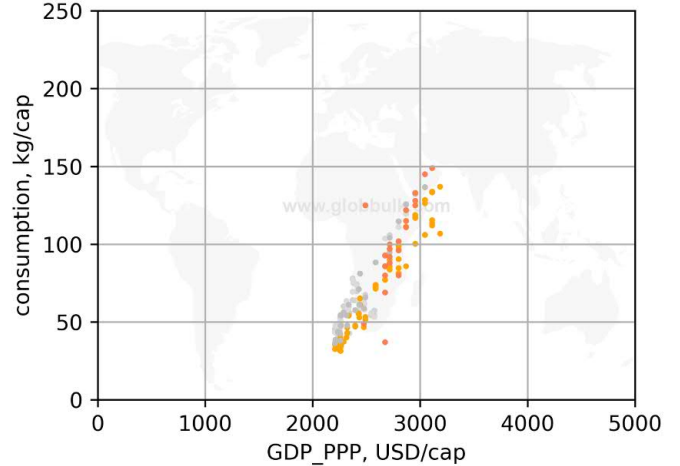
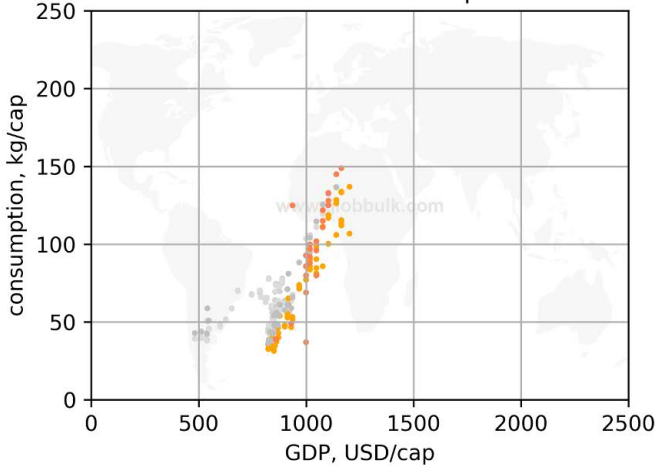
GDP vs Time



Consumption vs Time

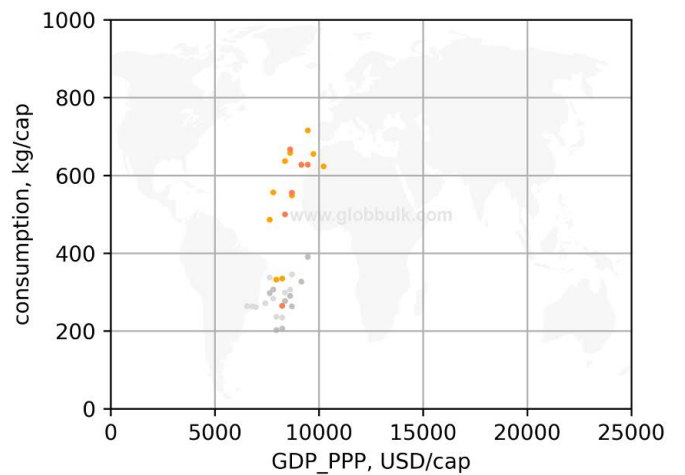
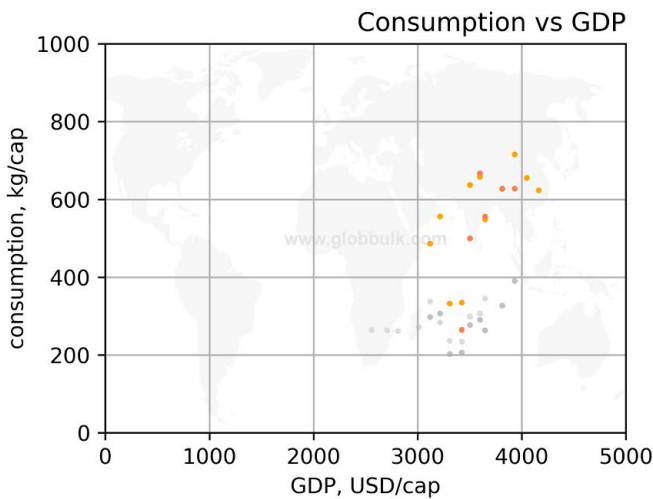
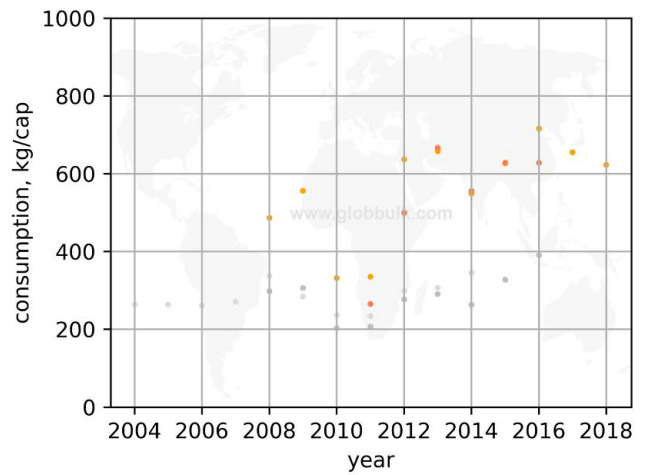
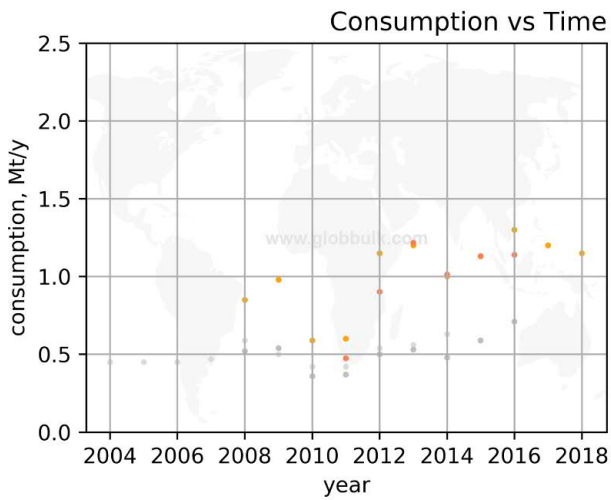
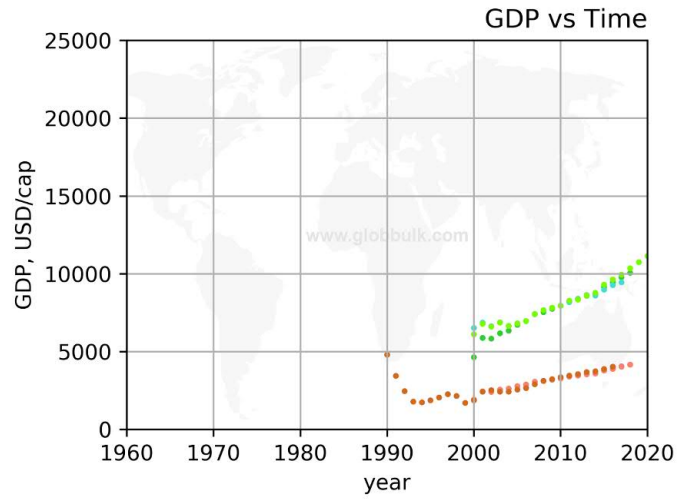
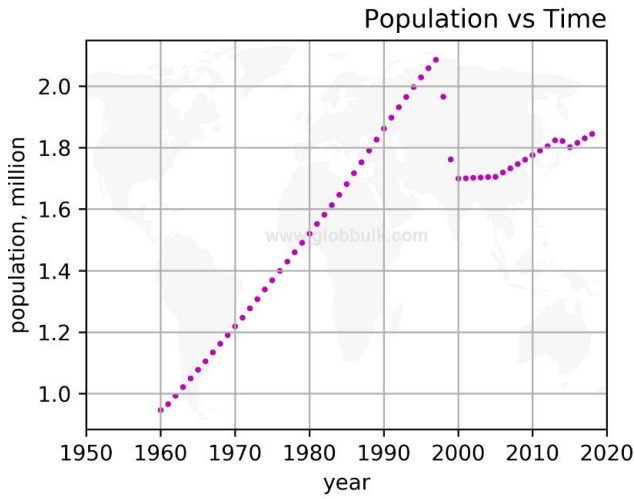


Consumption vs GDP



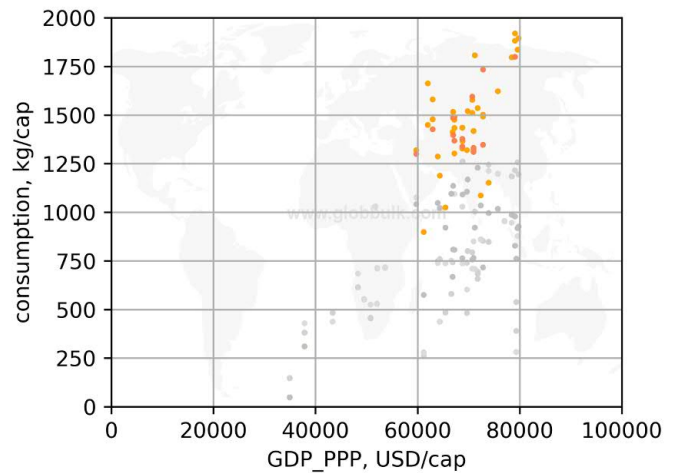
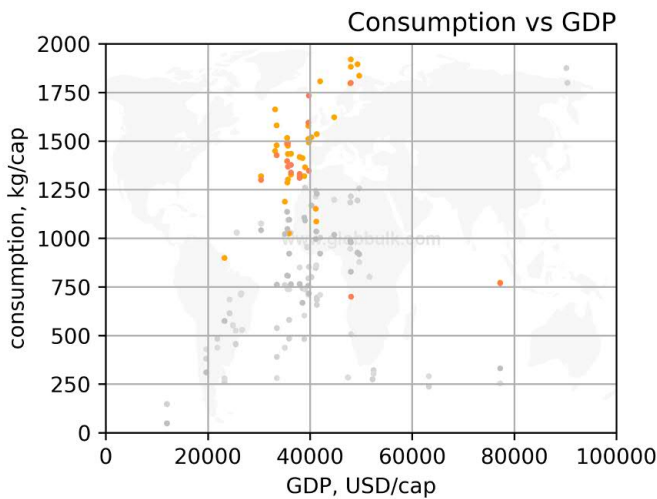
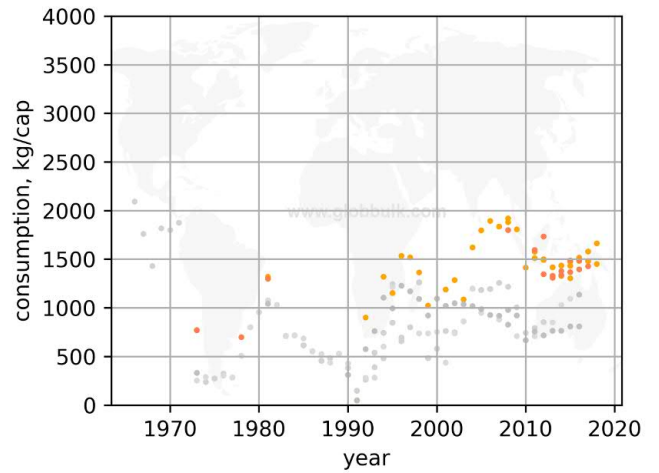
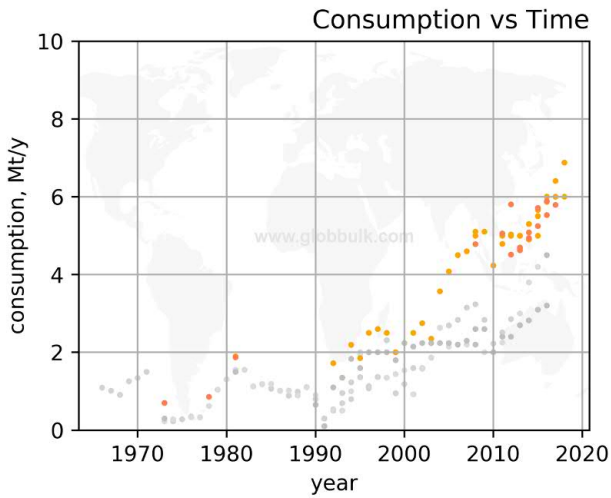
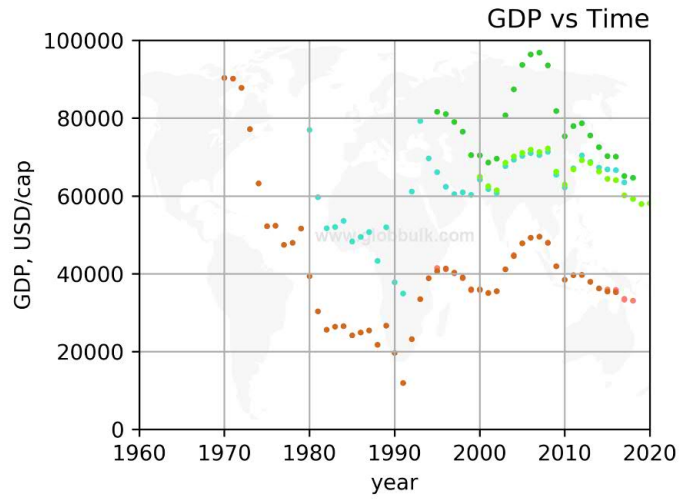
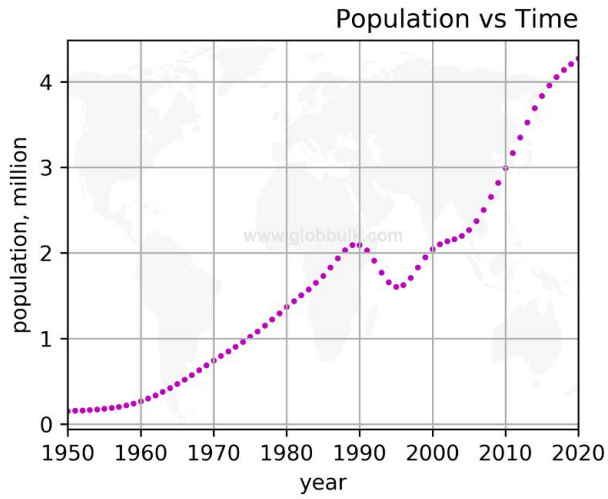


# Kosovo





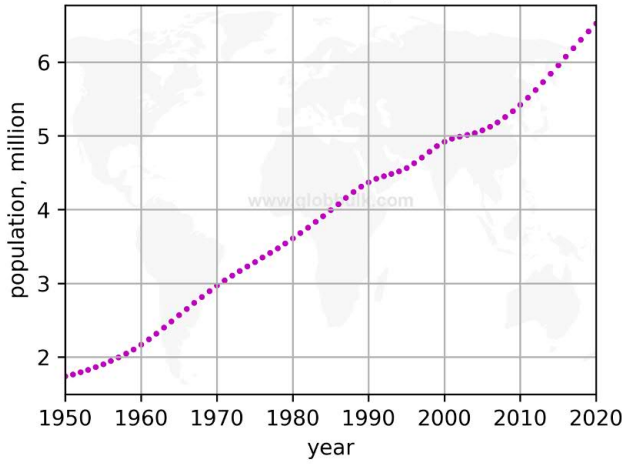
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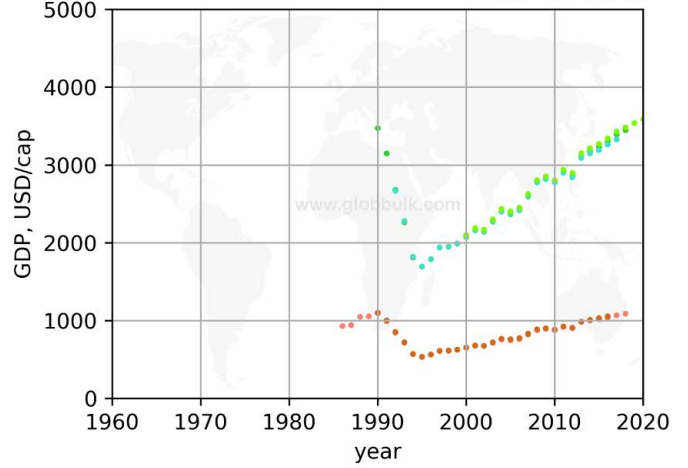


# Kyrgyz Rep.

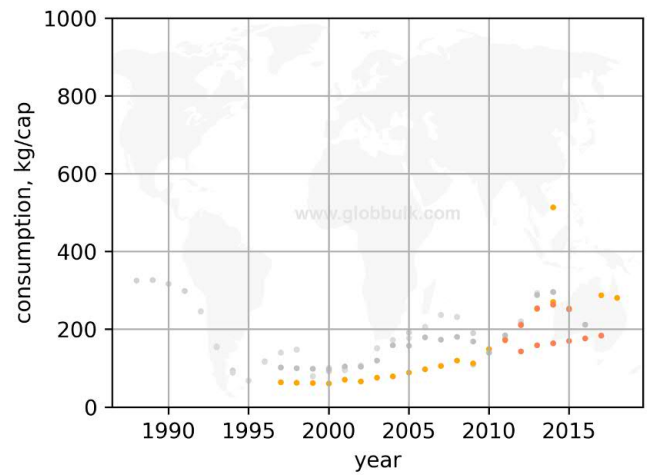
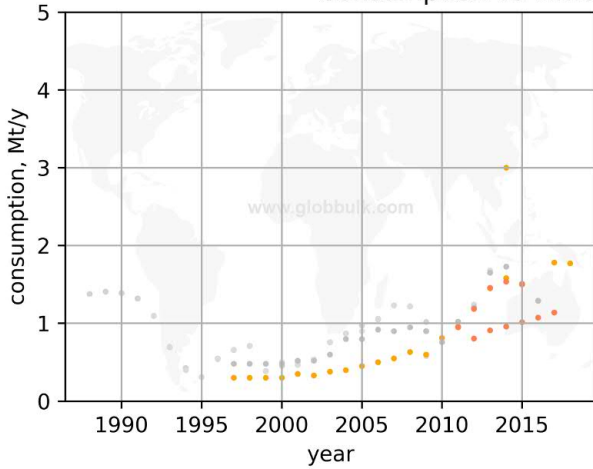
Population vs Time



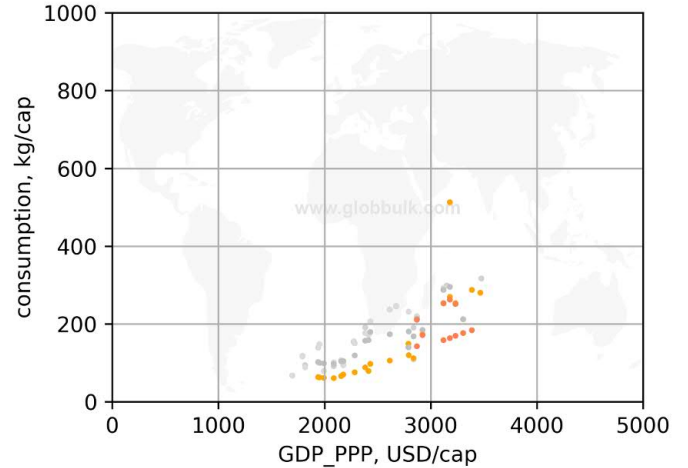
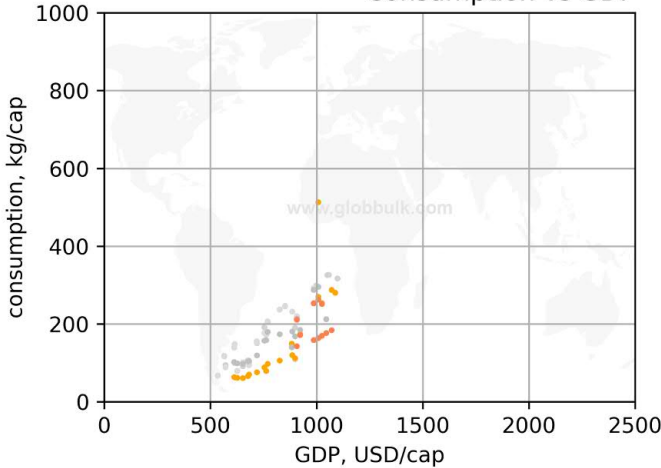
GDP vs Time



Consumption vs Time



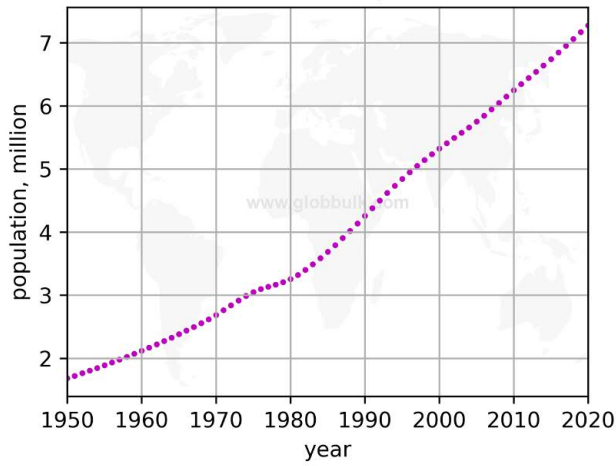
Consumption vs GDP



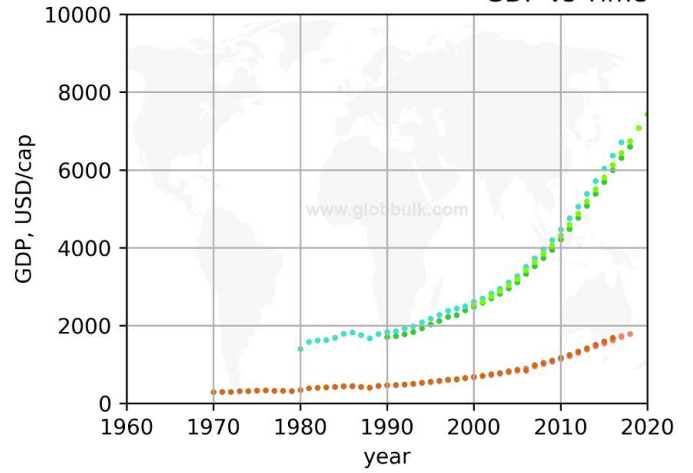


# Laos

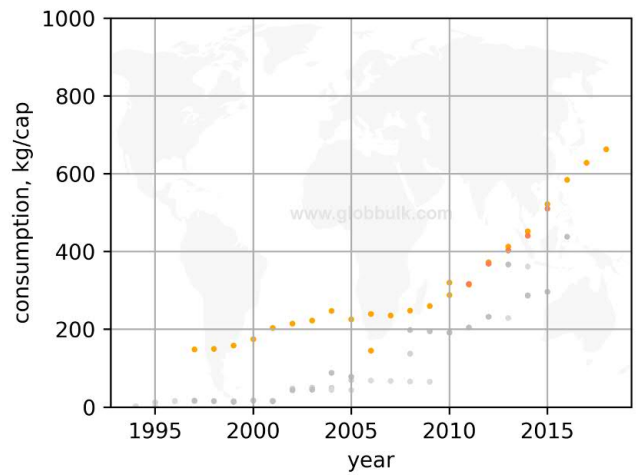
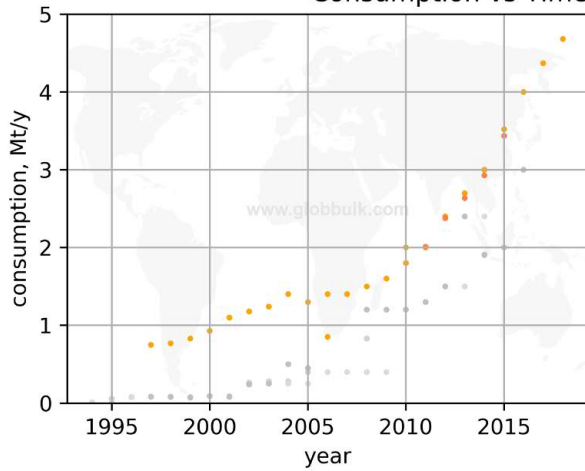
Population vs Time



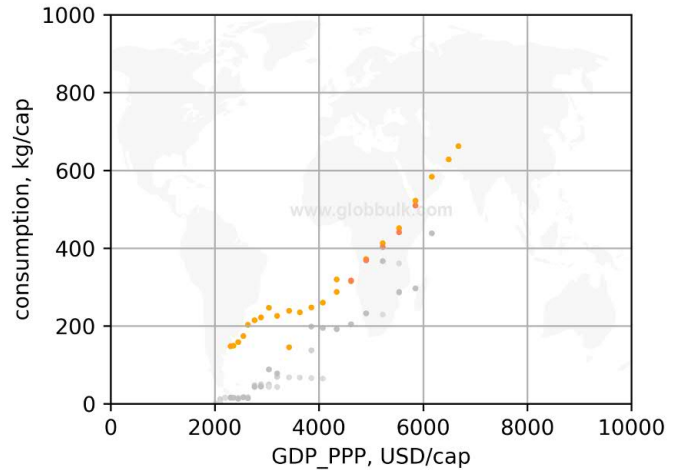
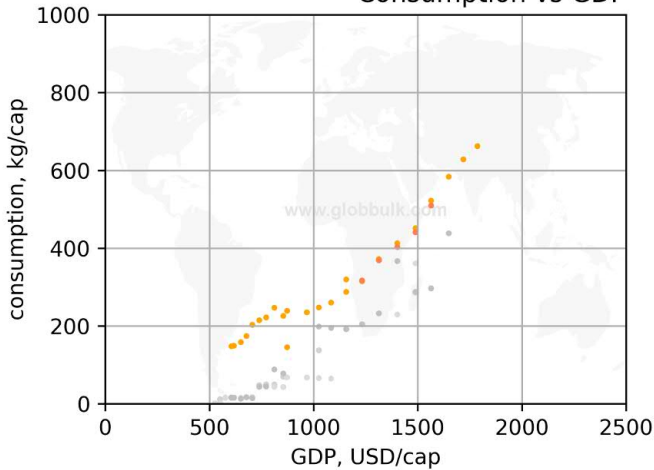
GDP vs Time



Consumption vs Time



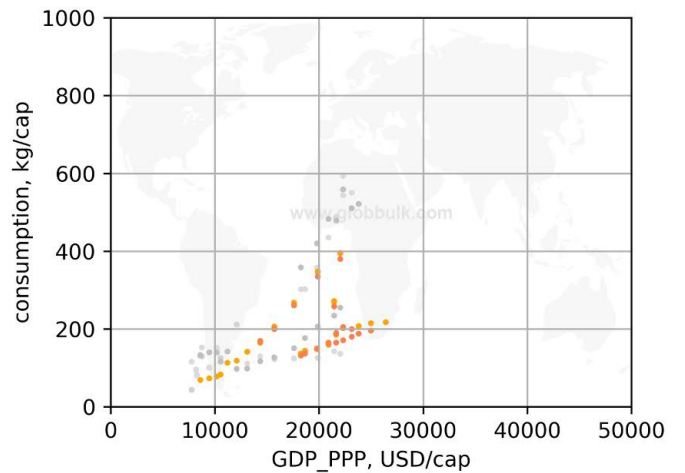
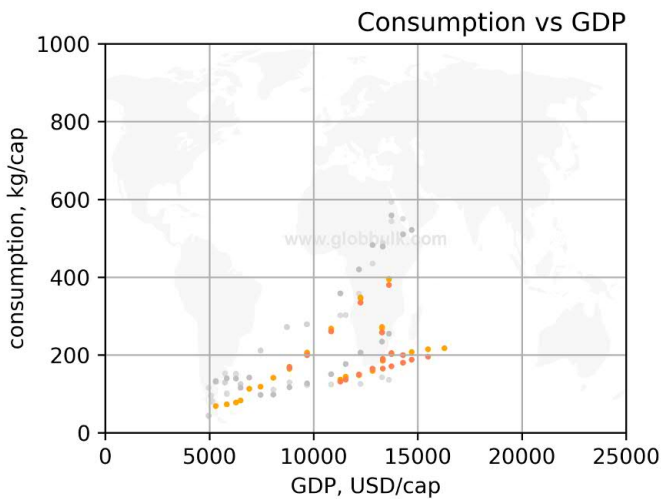
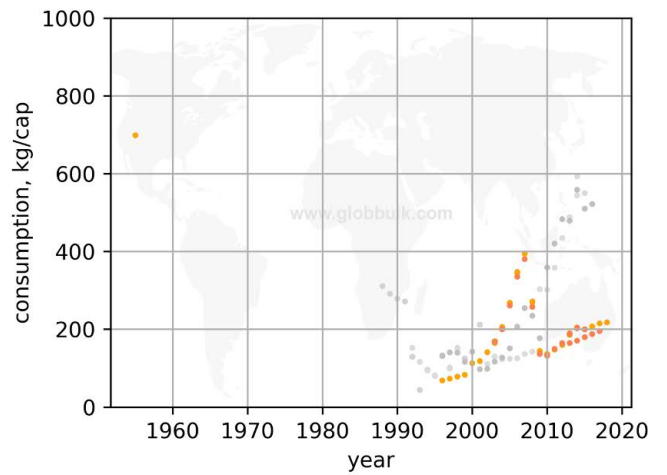
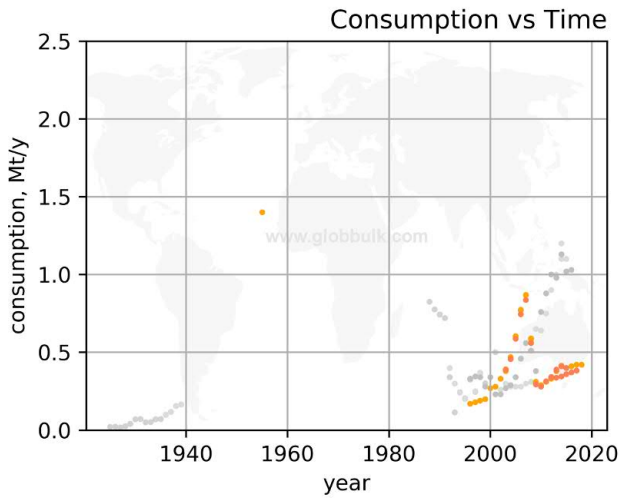
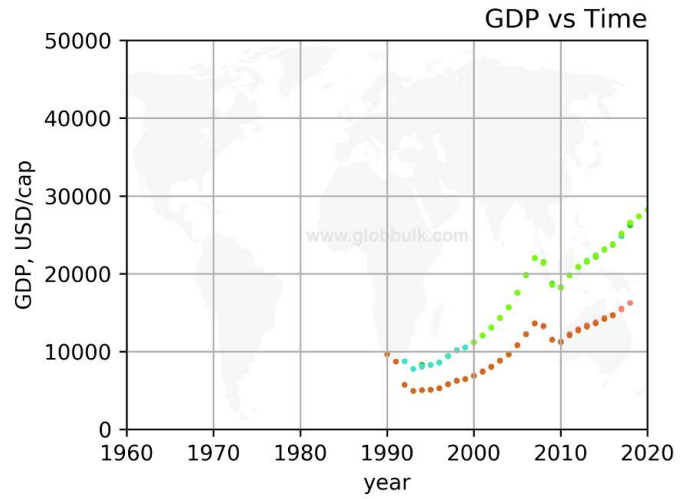
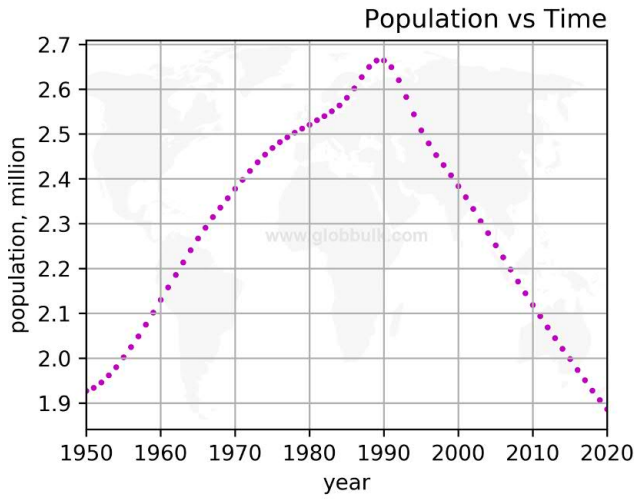
Consumption vs GDP





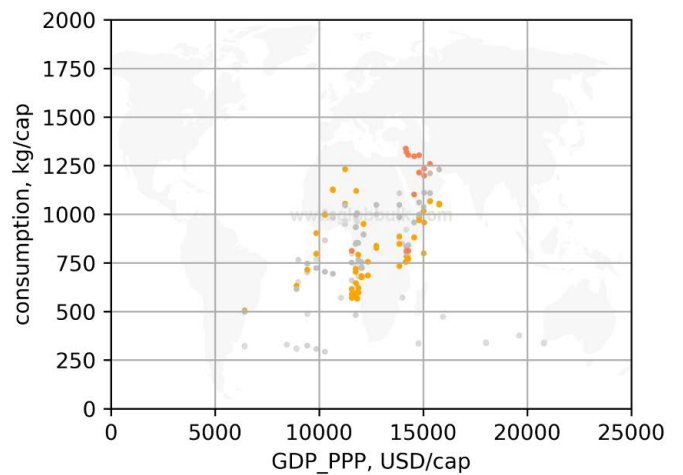
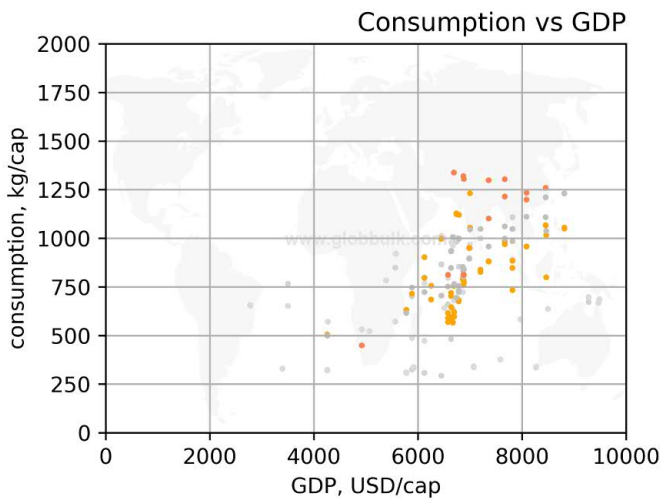
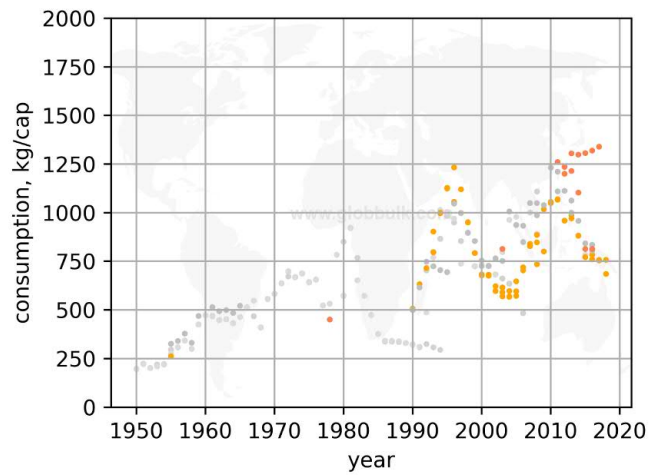
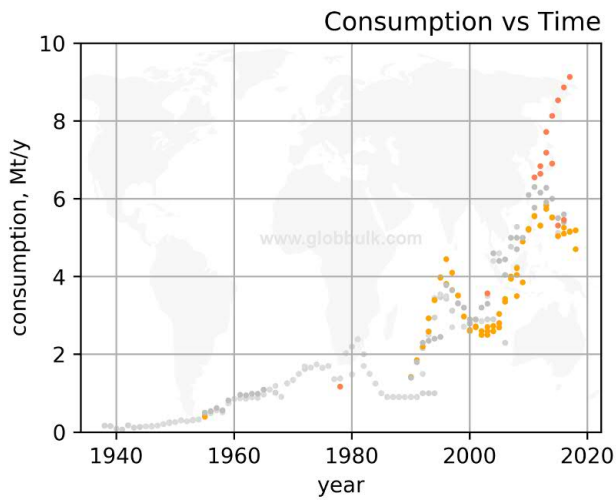
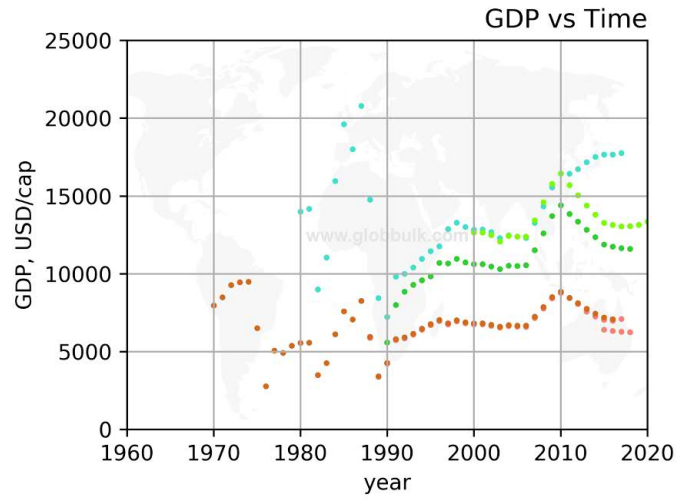
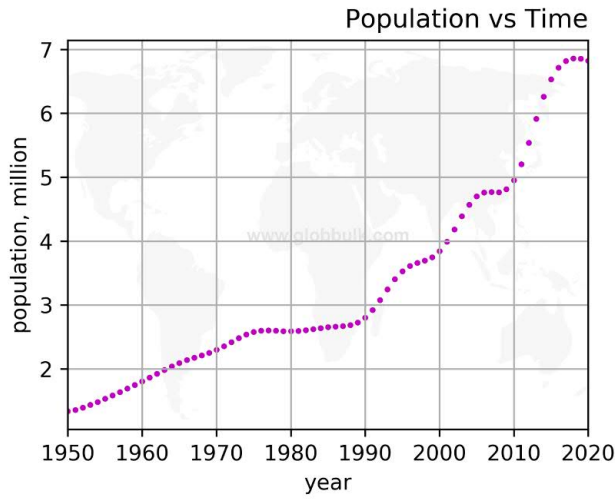


# Latvia



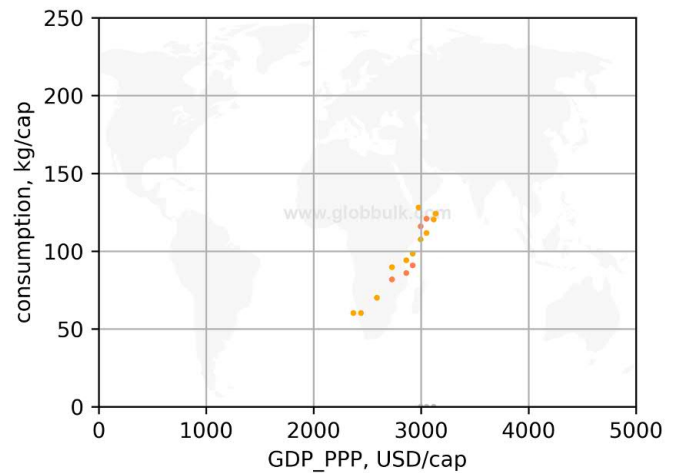
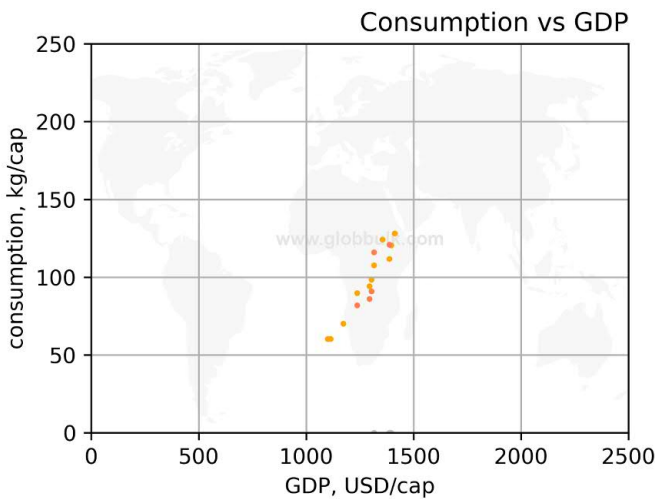
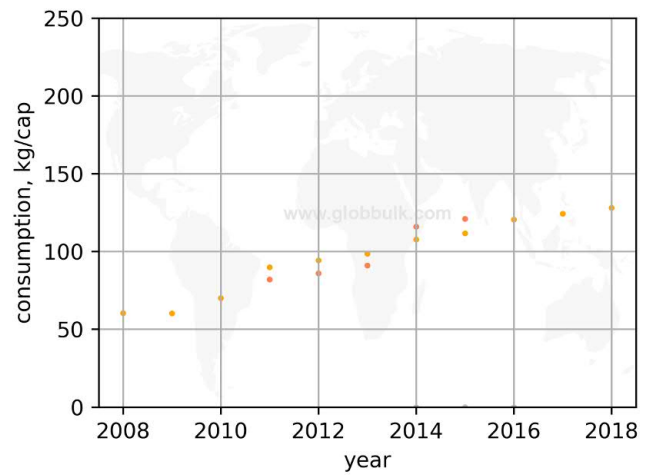
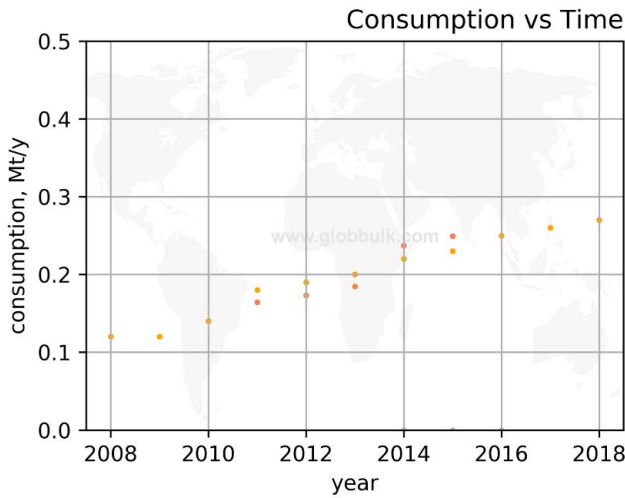
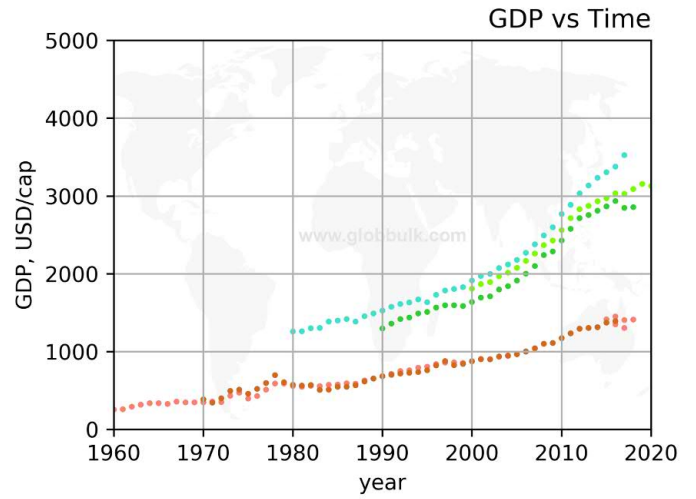
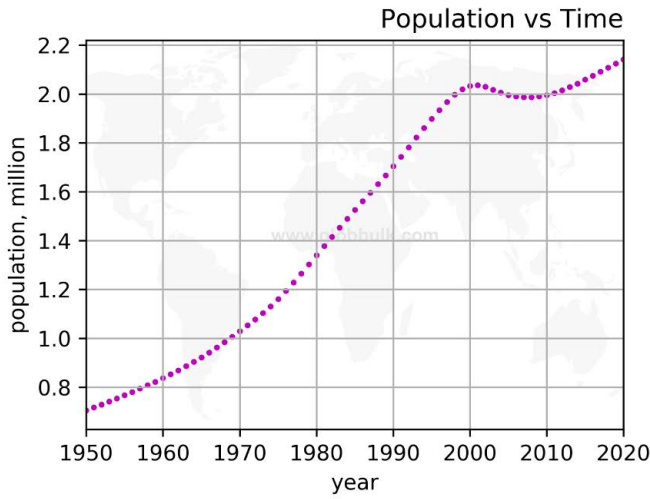


# Lebanon





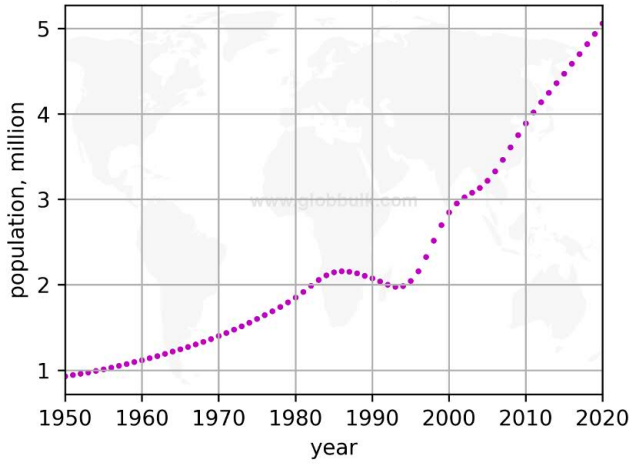
# Lesotho



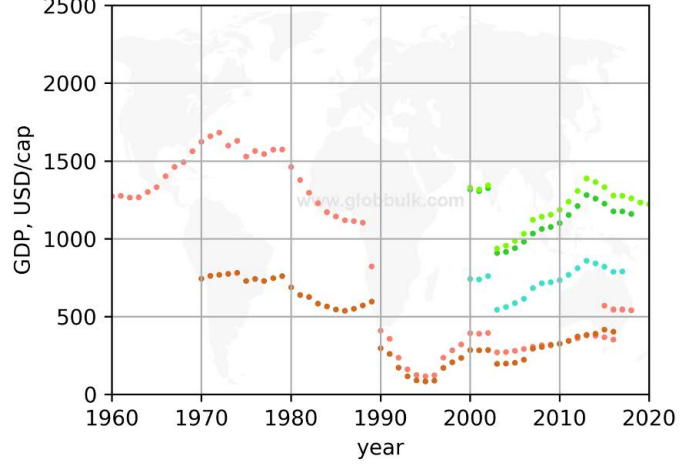


# Liberia

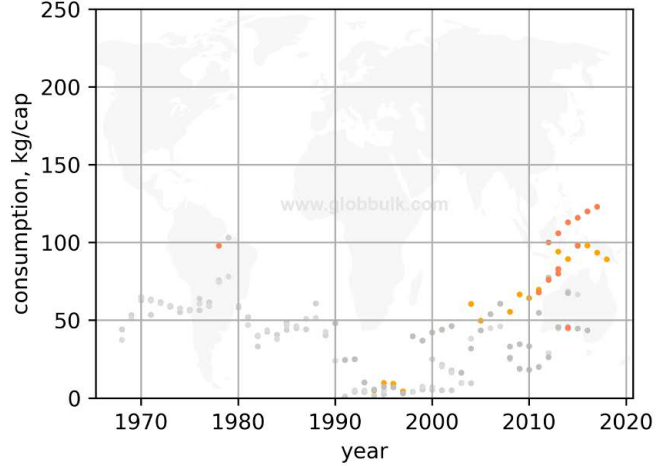
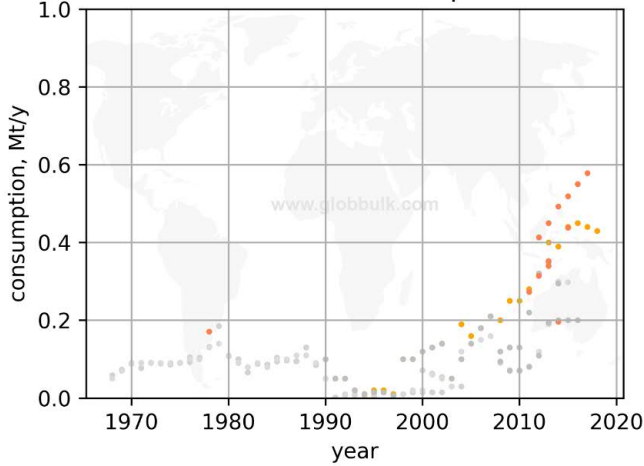
Population vs Time



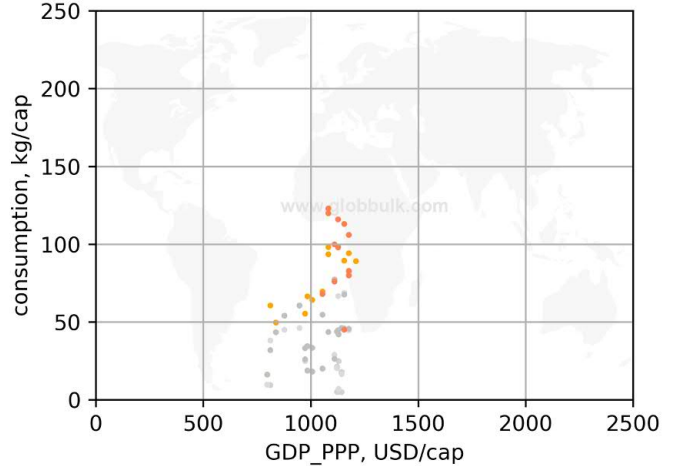
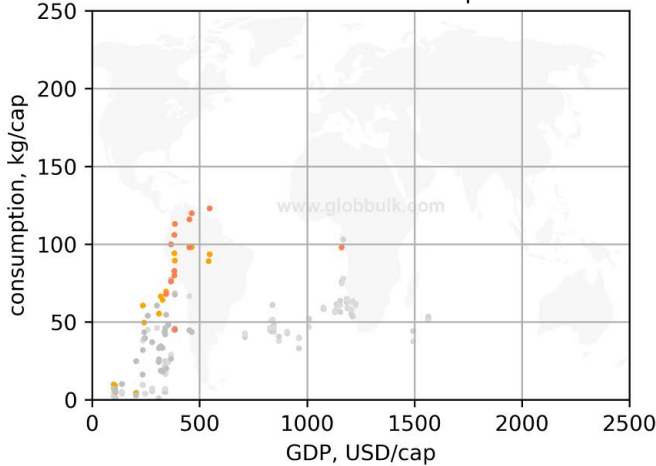
GDP vs Time



Consumption vs Time

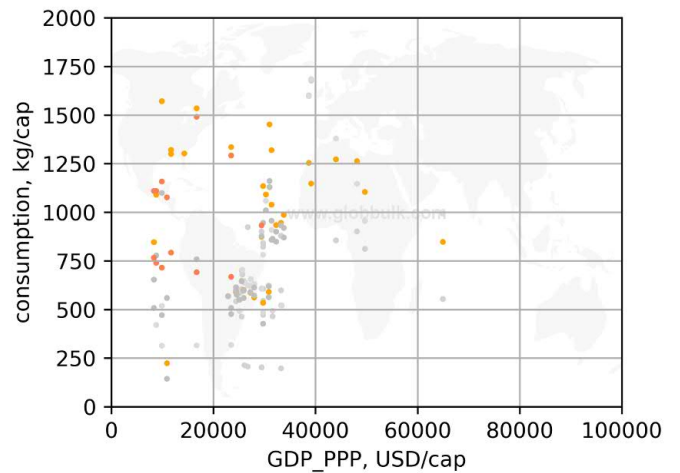
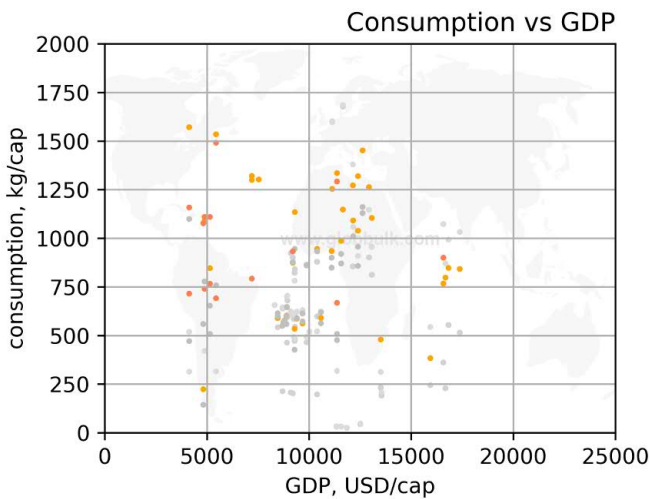
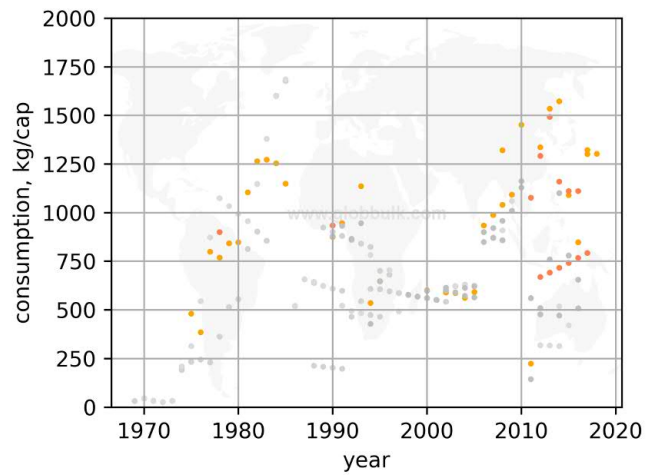
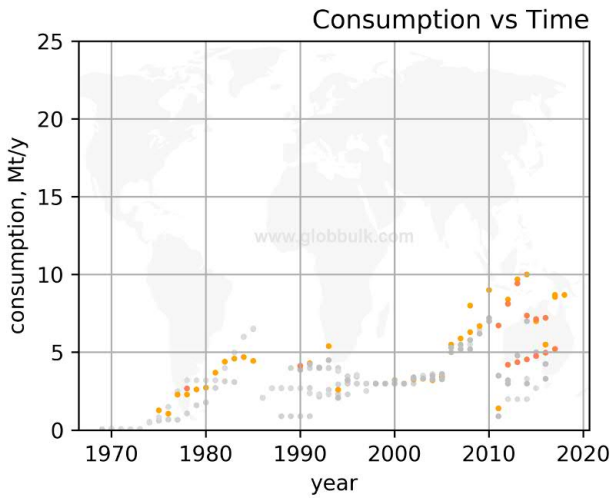
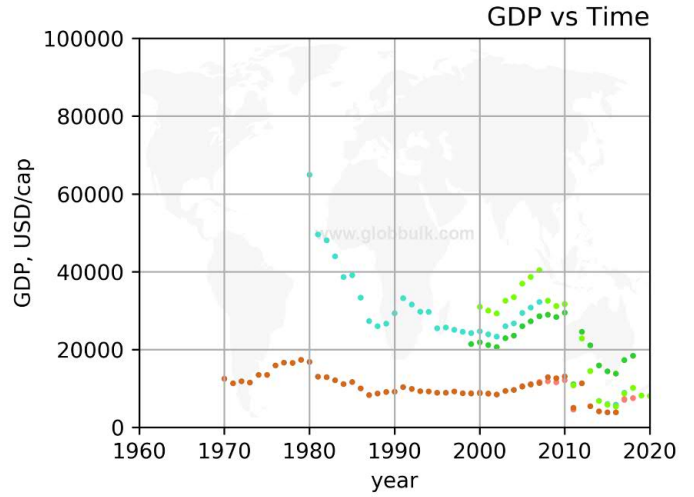
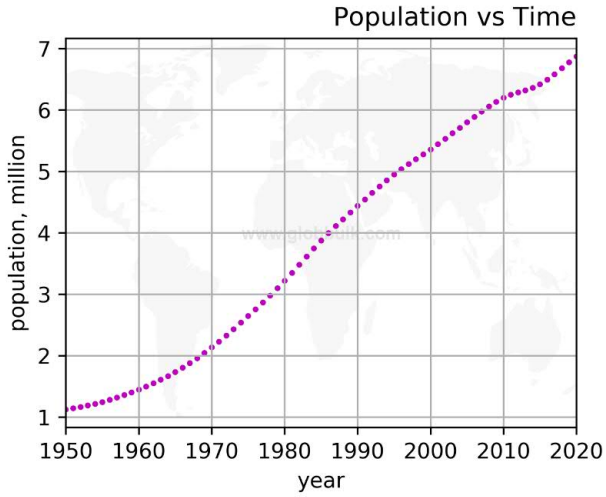


Consumption vs GDP





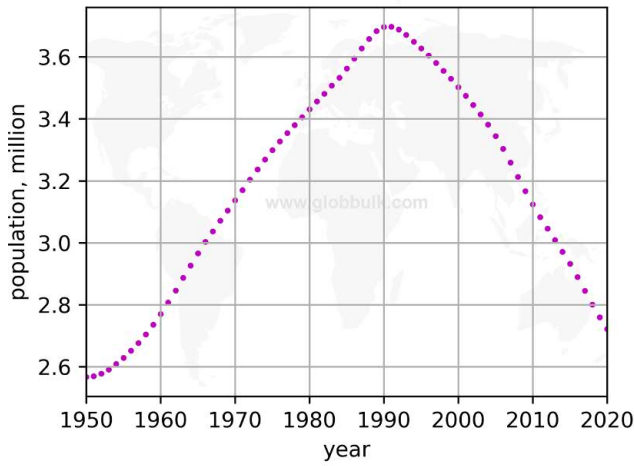
# Libya



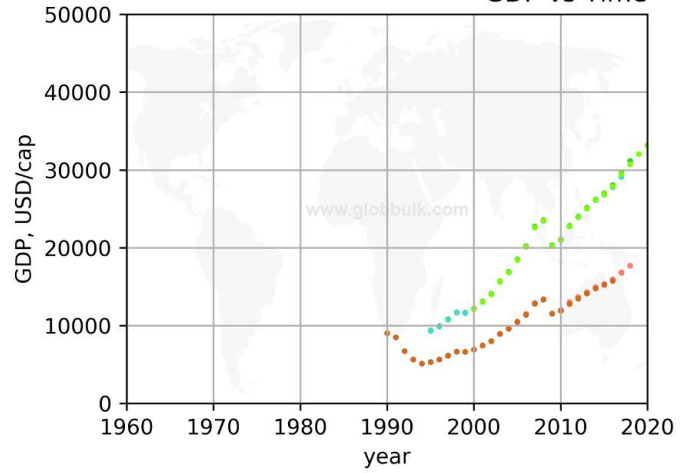


# Lithuania

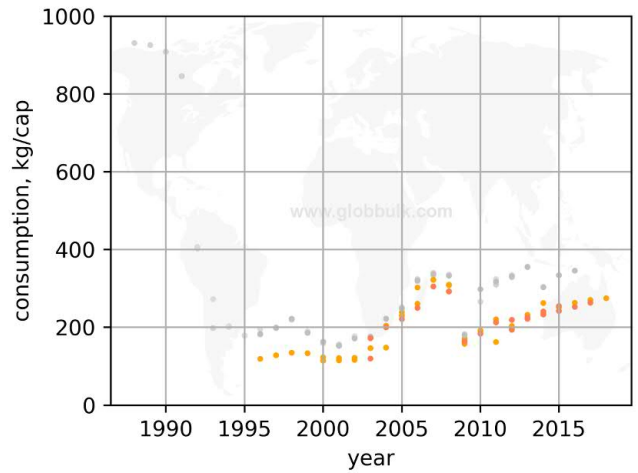
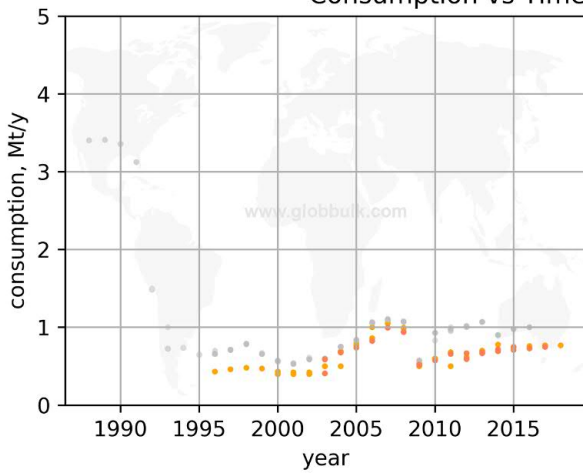
Population vs Time



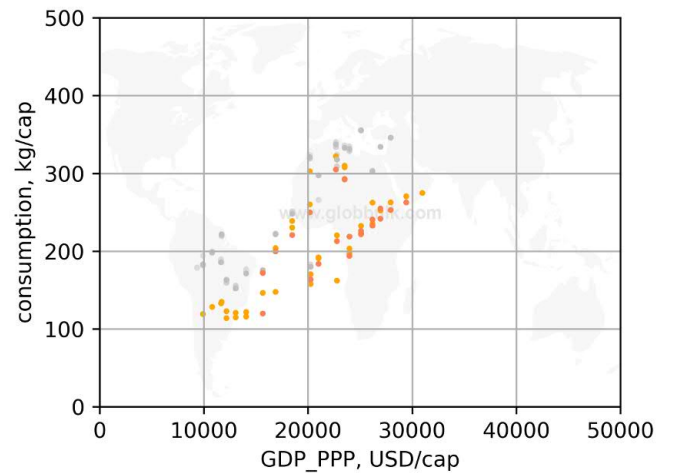
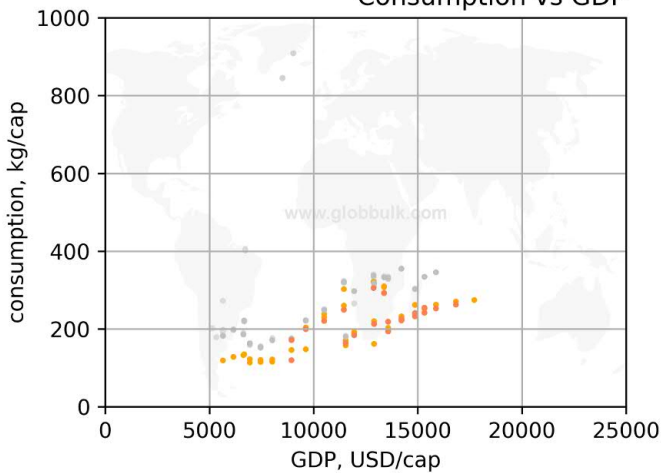
GDP vs Time



Consumption vs Time

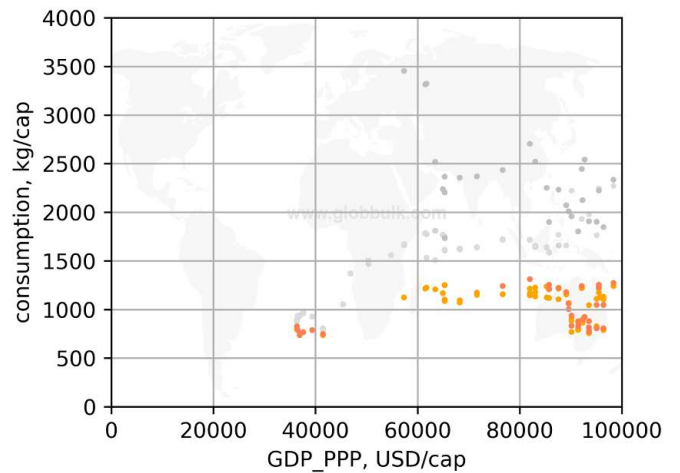
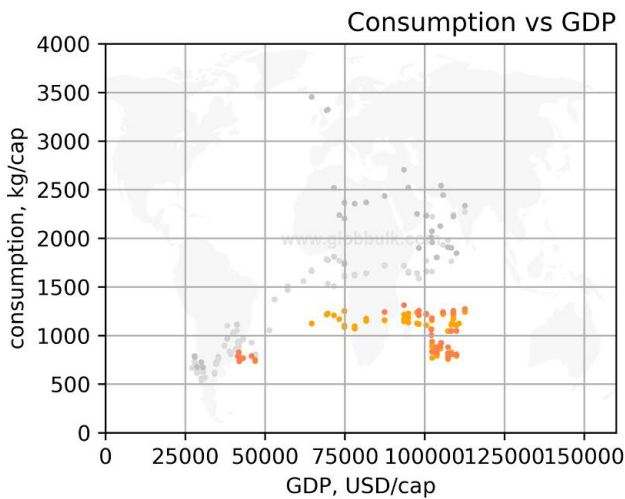
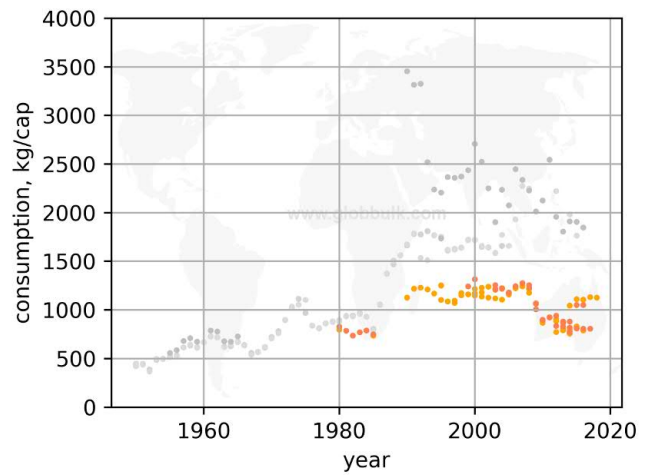
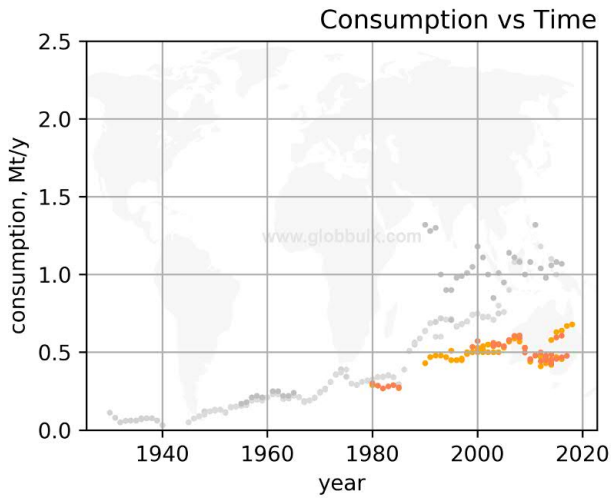
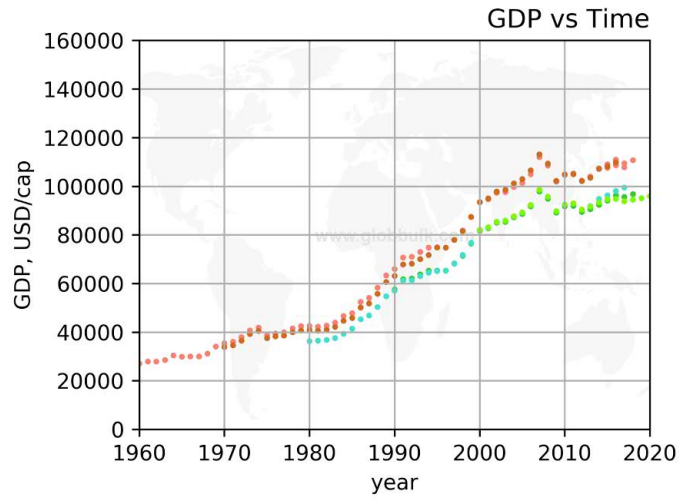
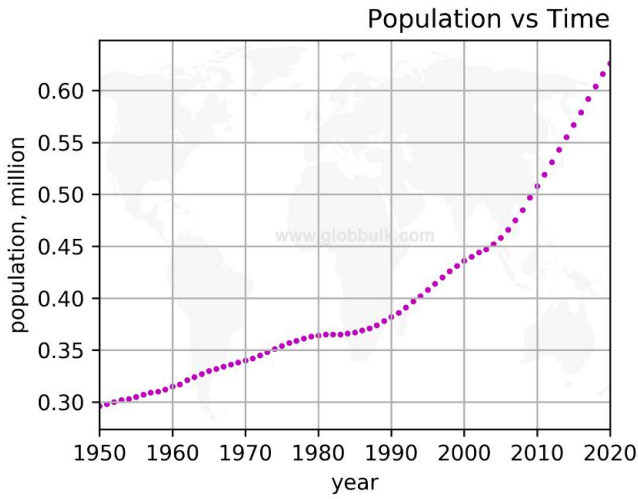


Consumption vs GDP



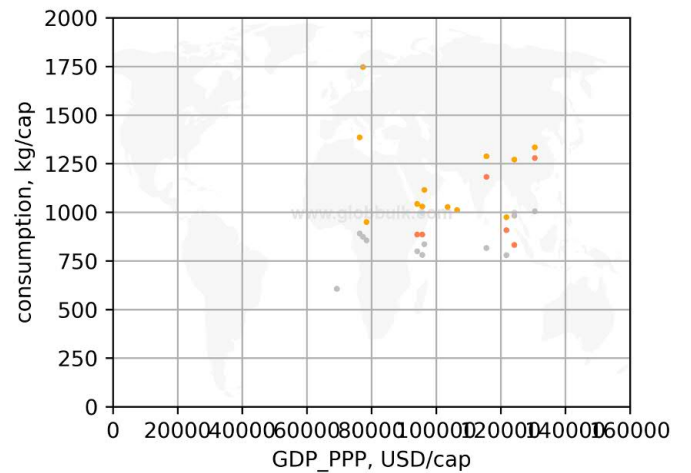
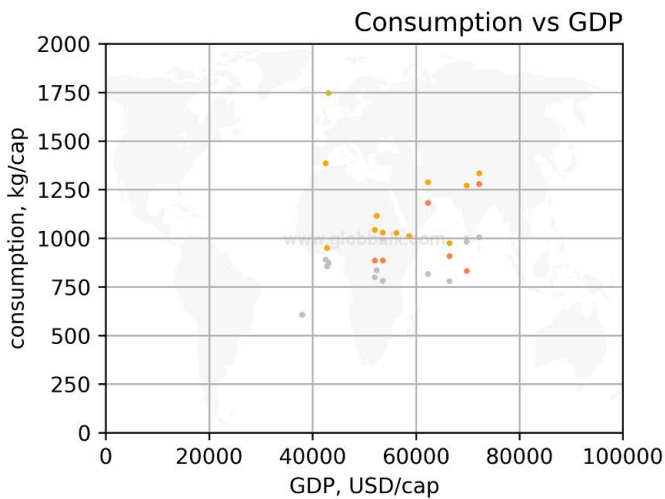
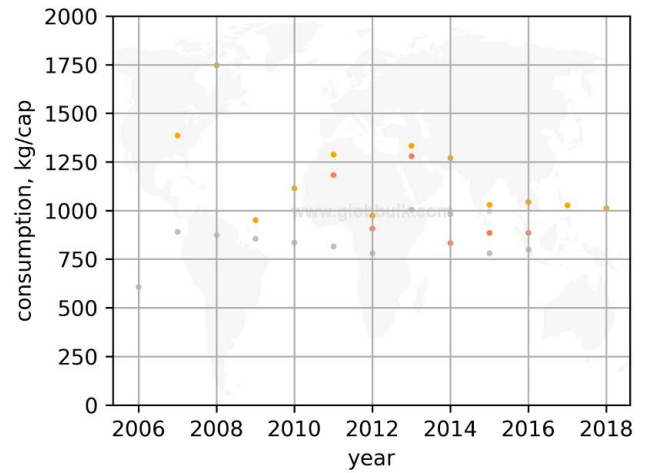
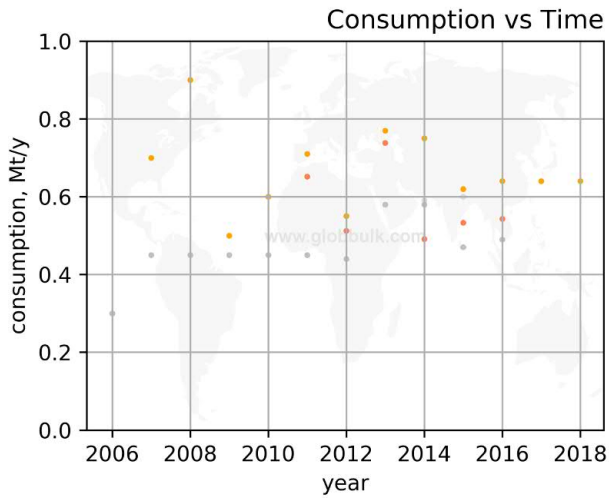
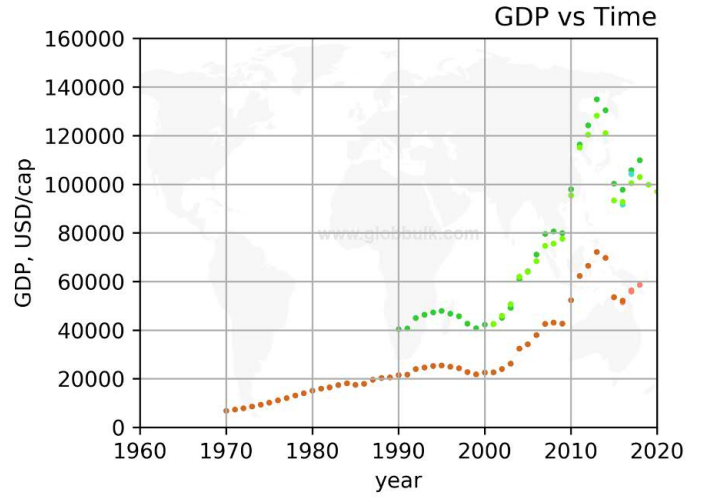
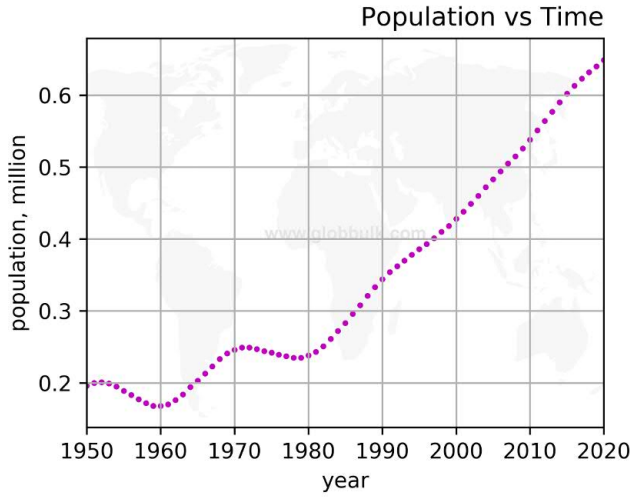


# Luxembourg





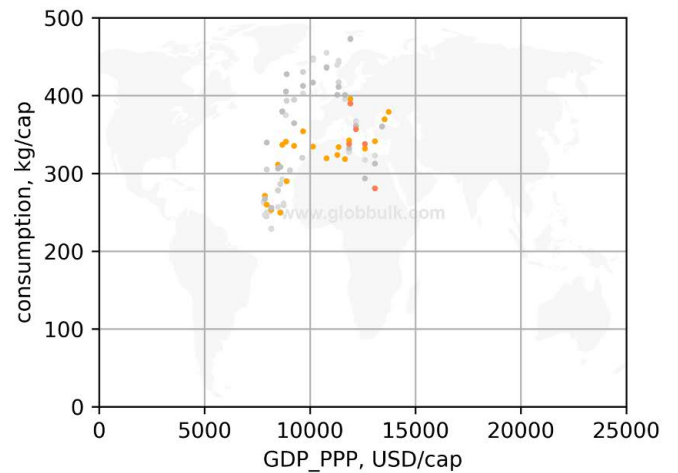
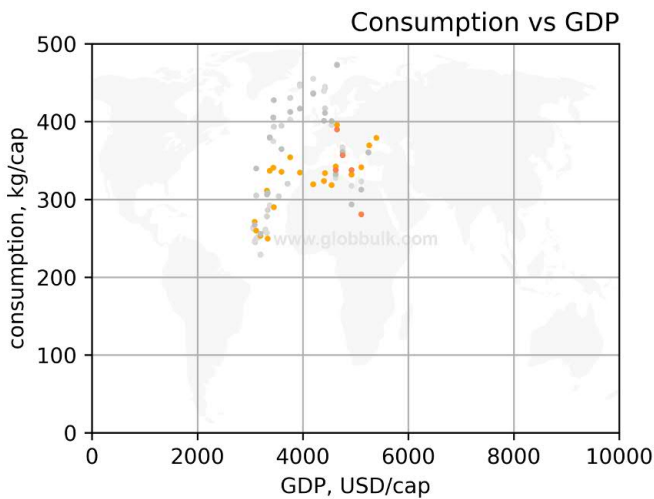
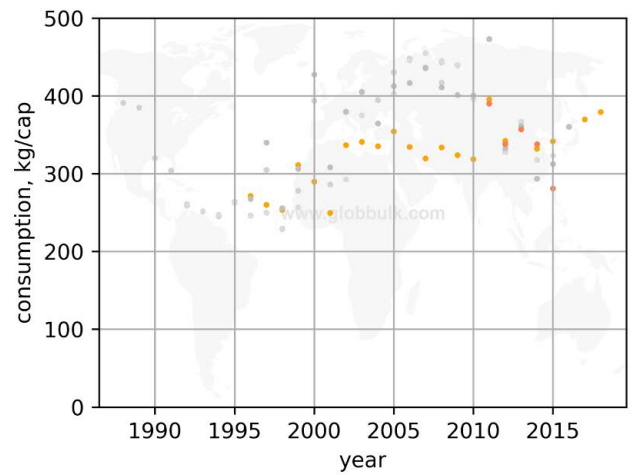
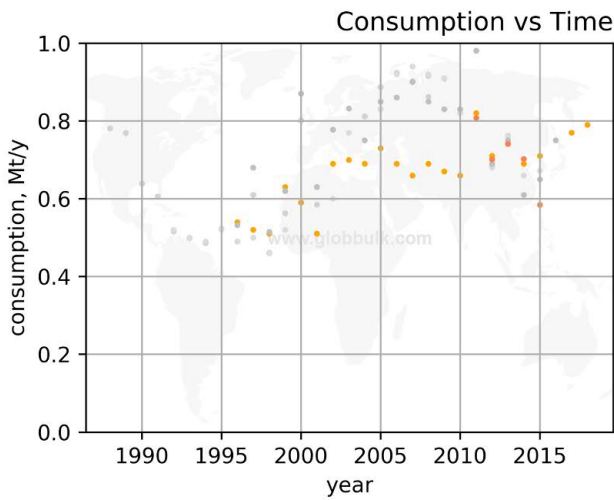
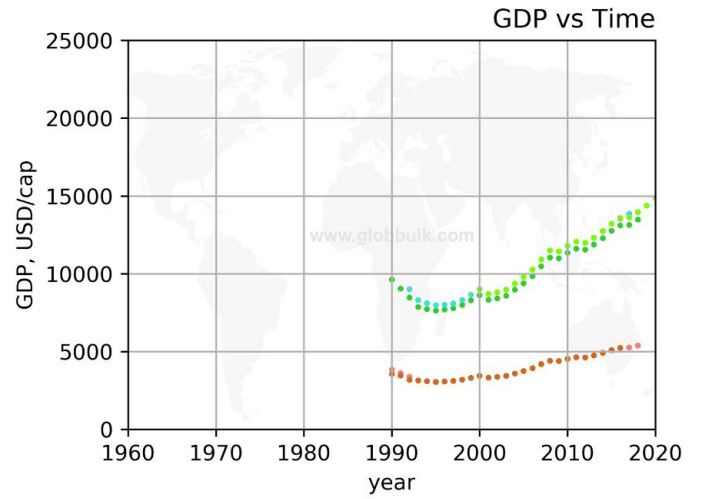
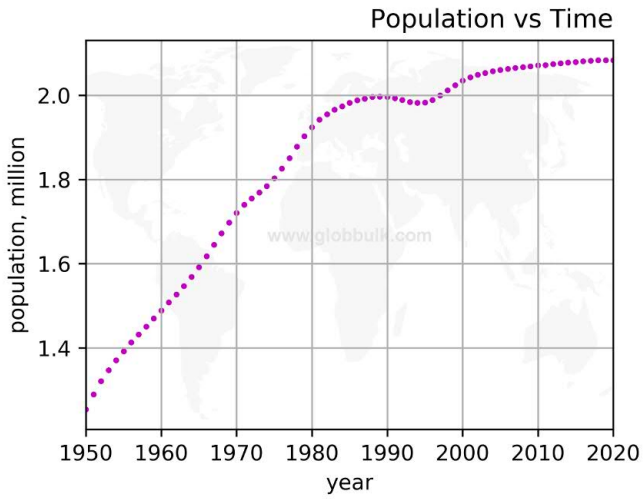
# Macau







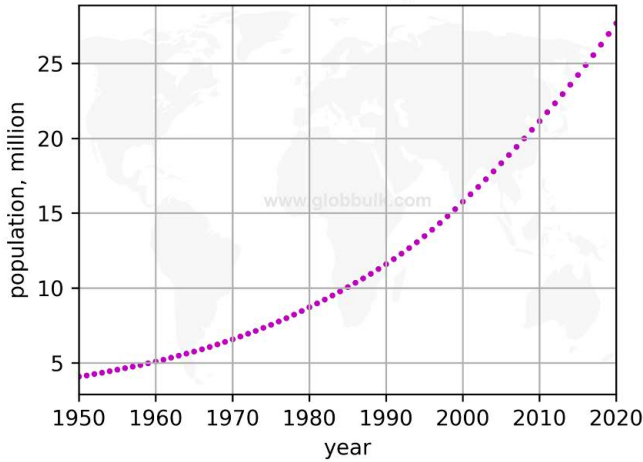
# Macedonia



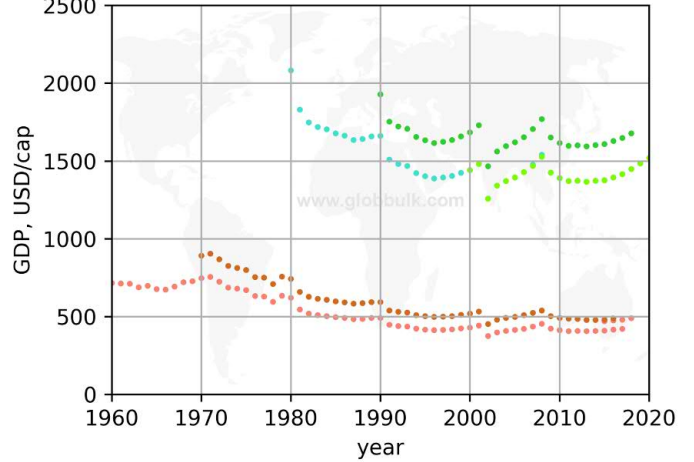


# Madagascar

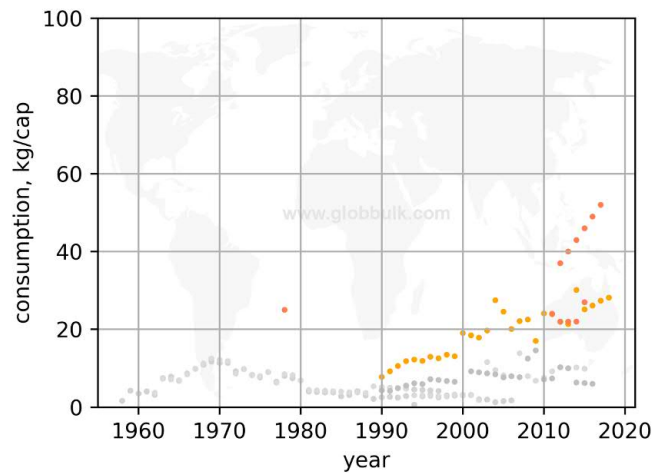
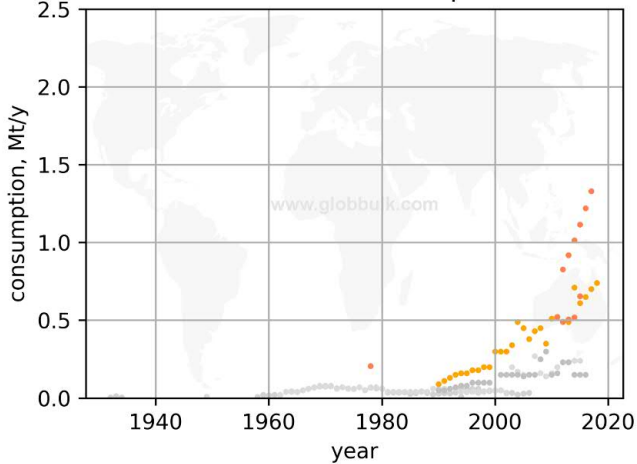
Population vs Time



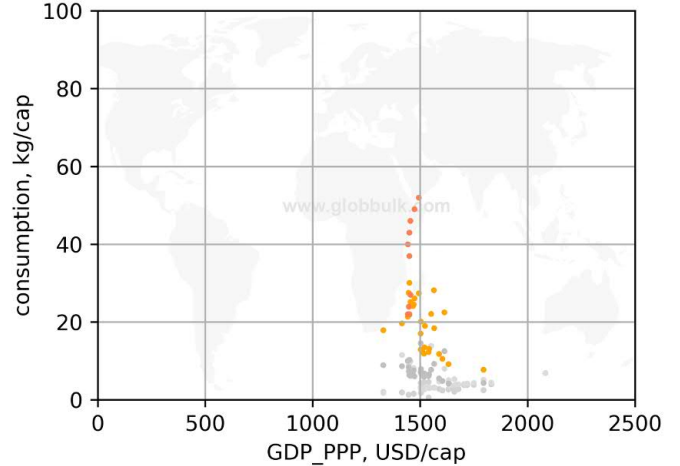
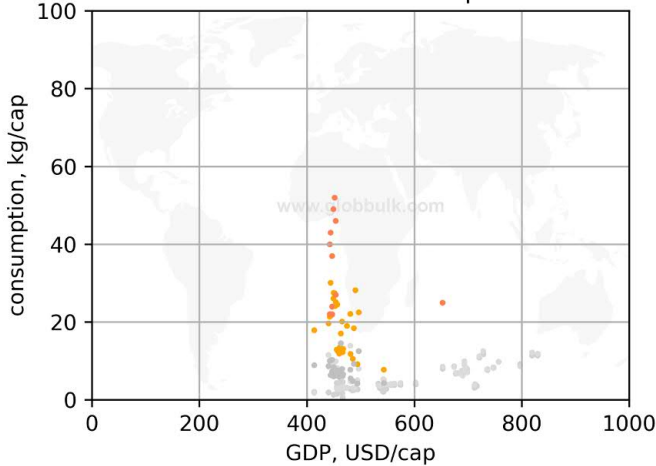
GDP vs Time



Consumption vs Time



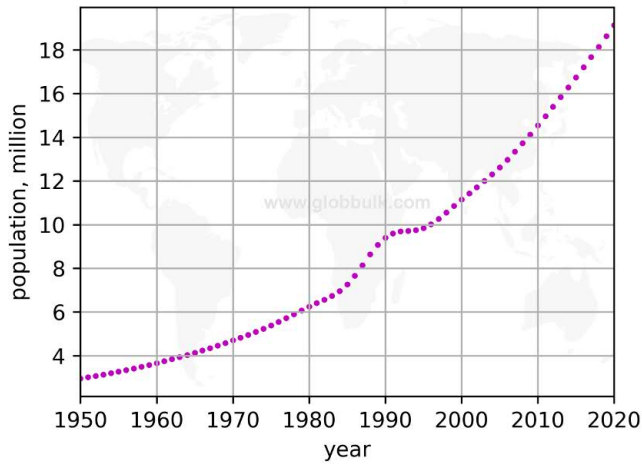
Consumption vs GDP



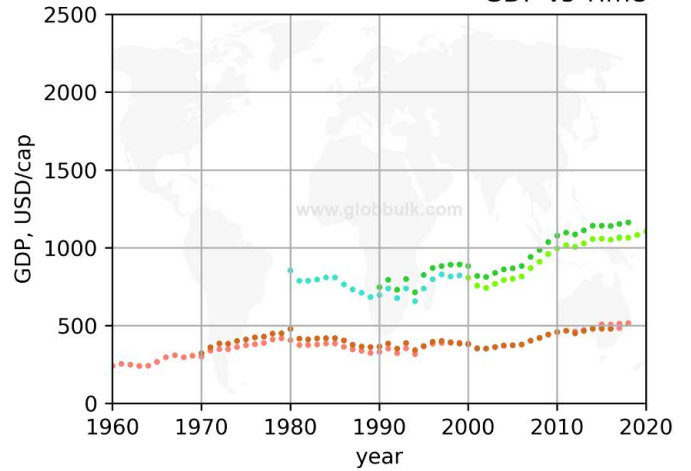


# Malawi

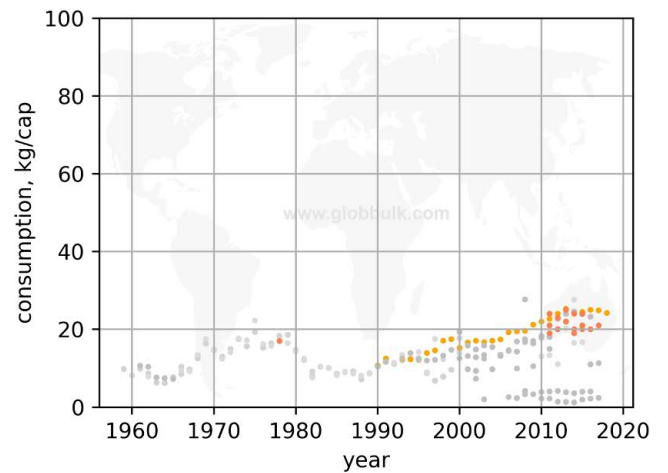
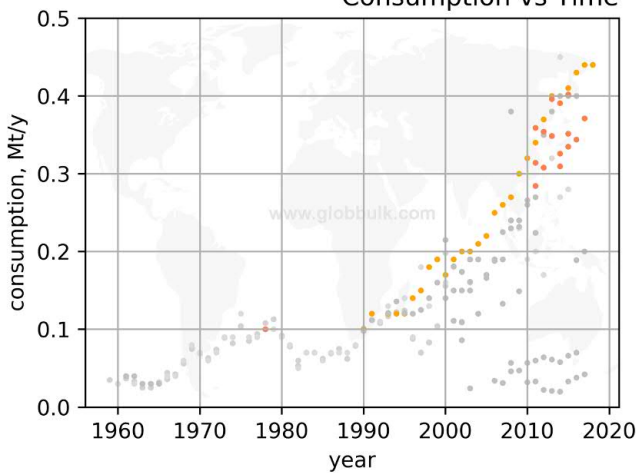
Population vs Time



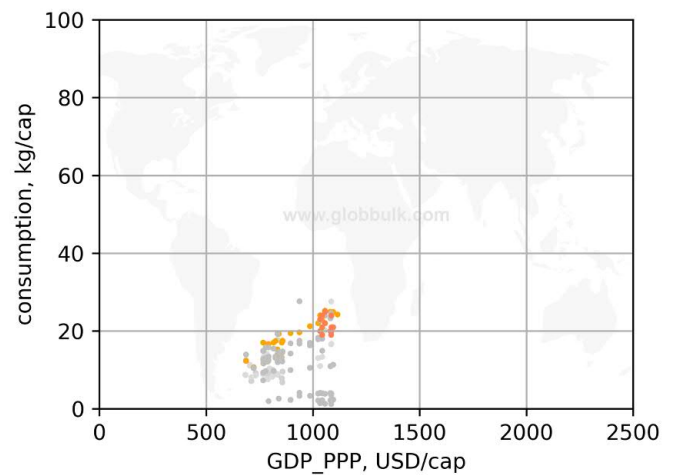
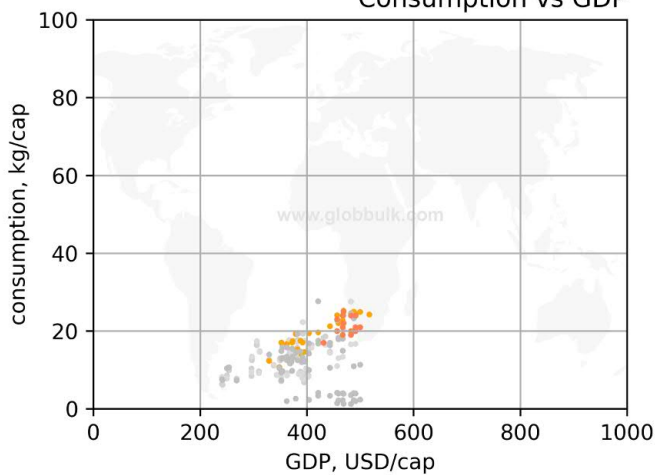
GDP vs Time



Consumption vs Time

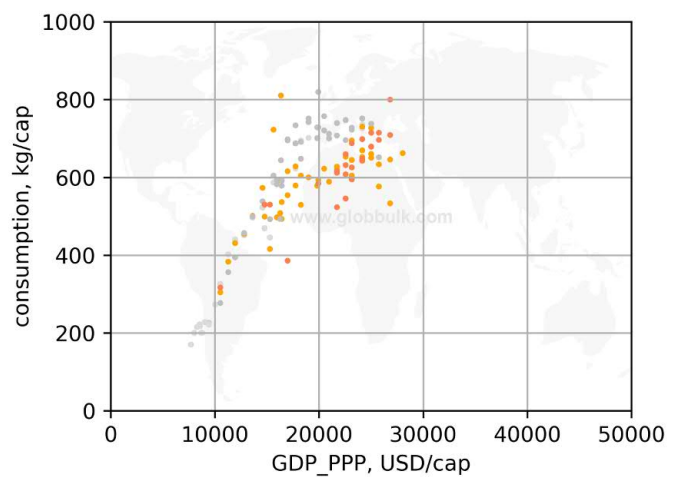
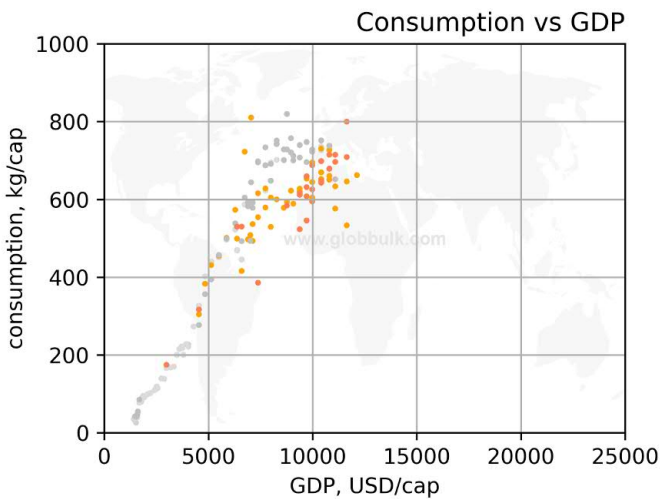
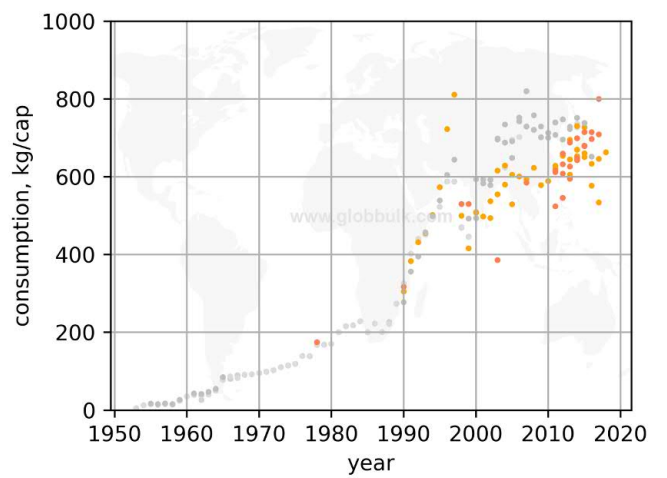
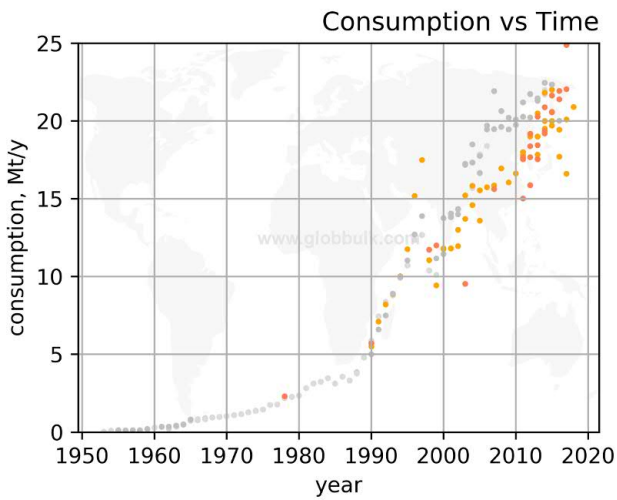
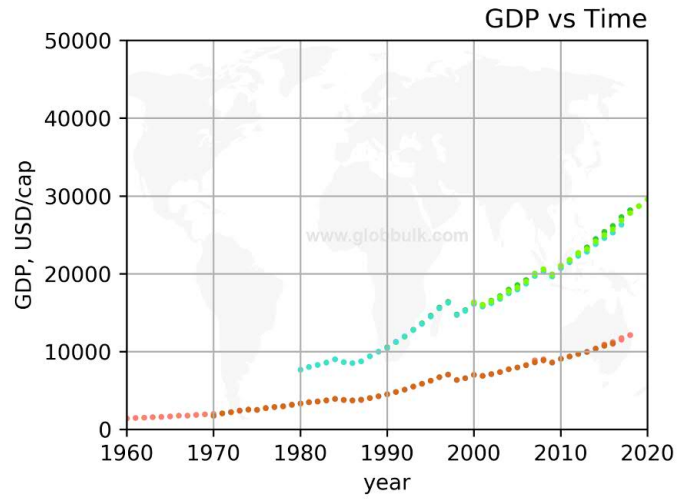
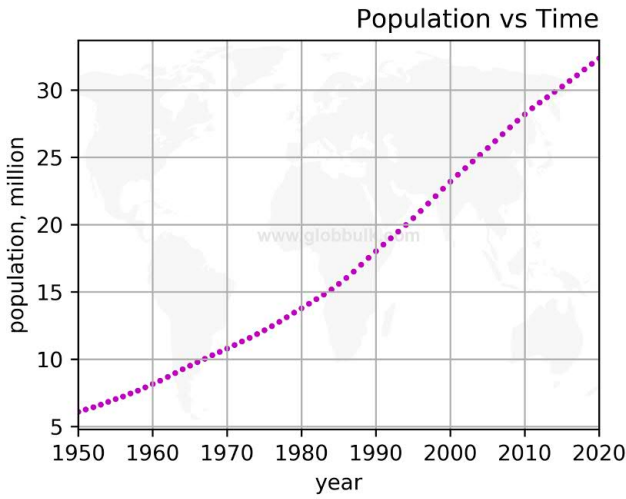


Consumption vs GDP



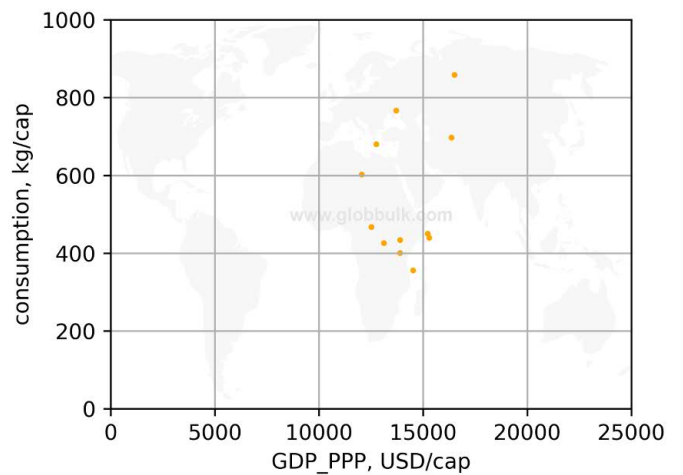
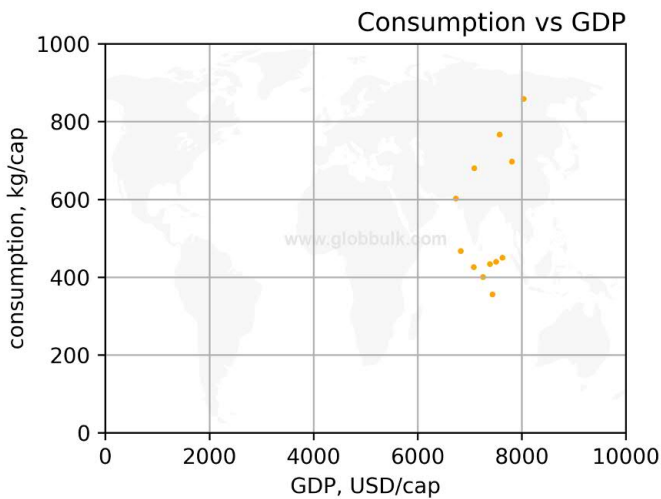
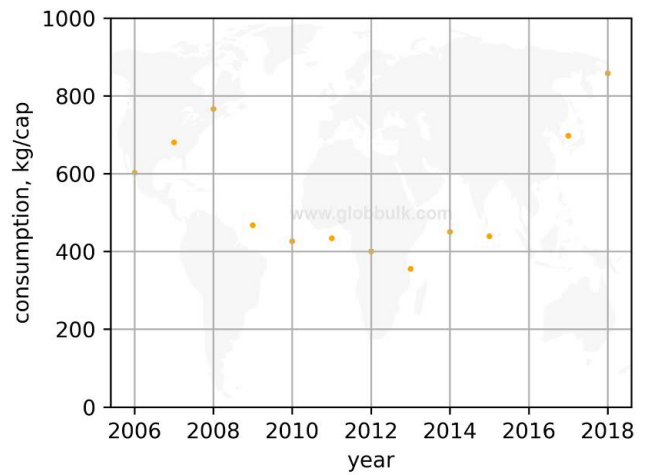
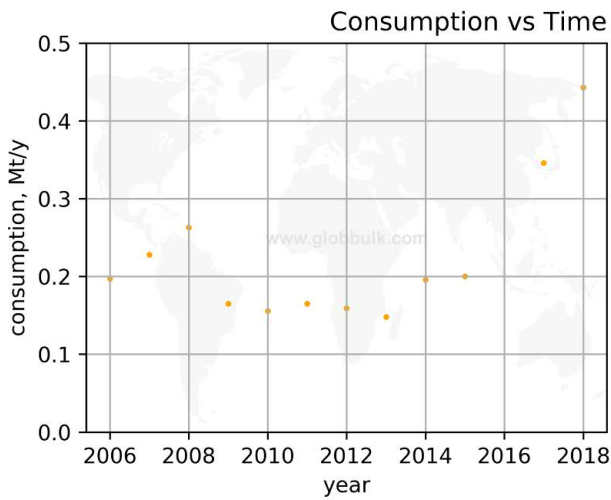
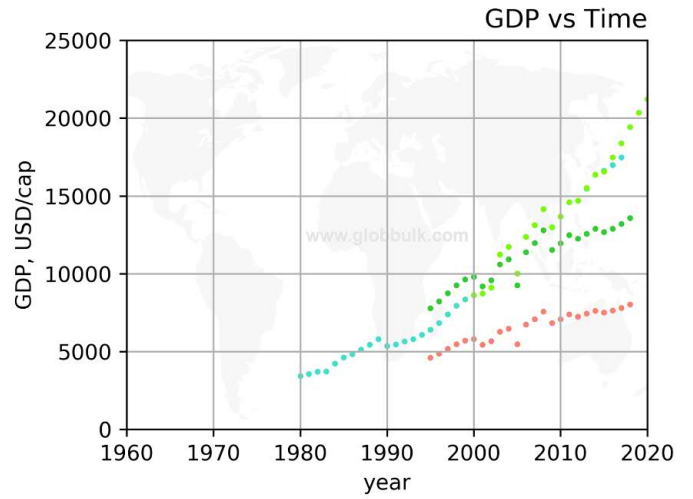
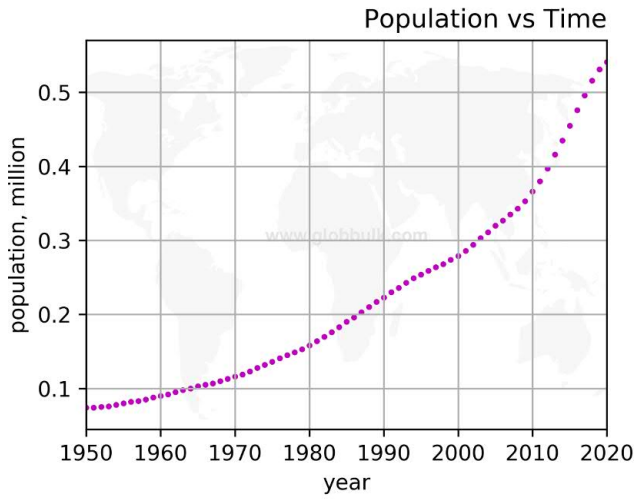


# Malaysia



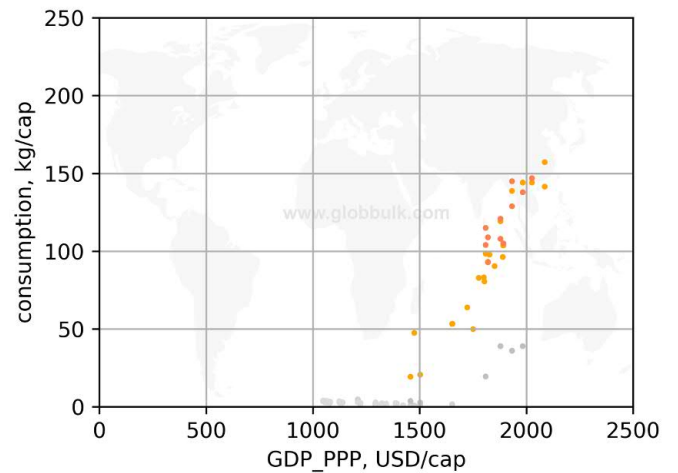
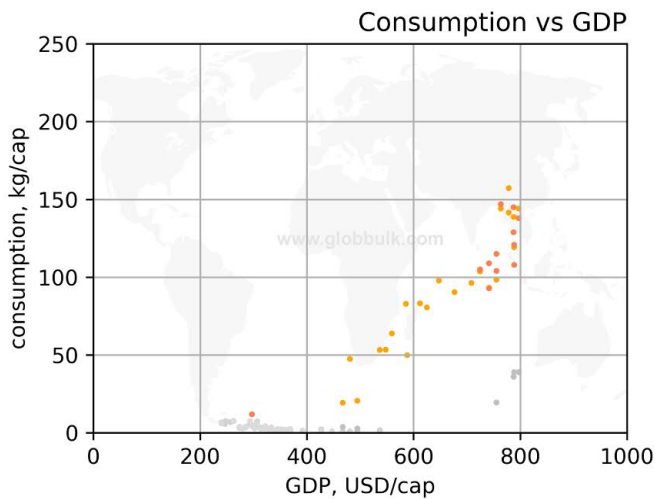
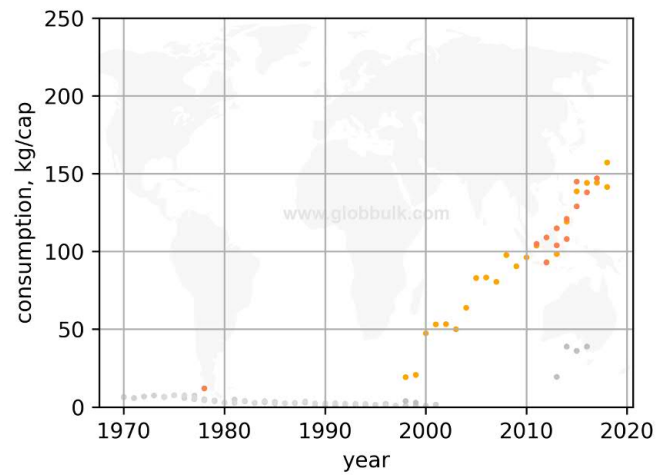
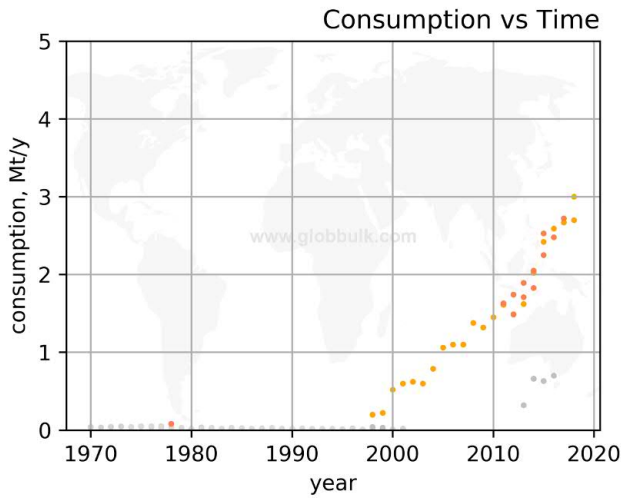
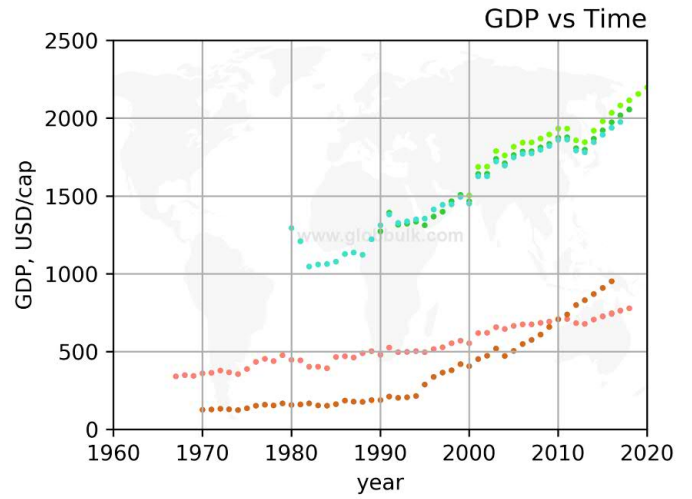
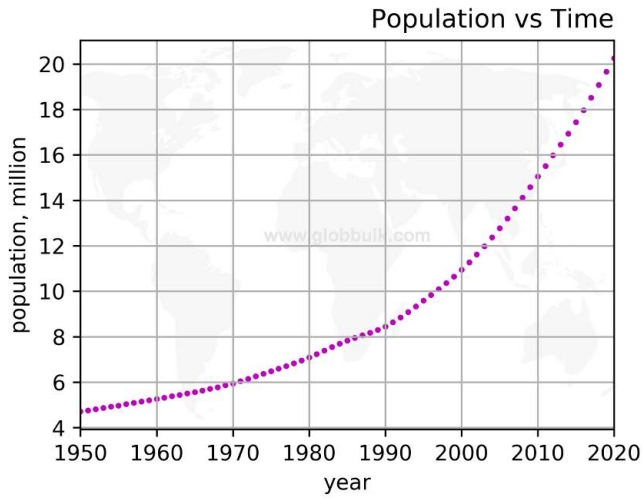


# Maldives



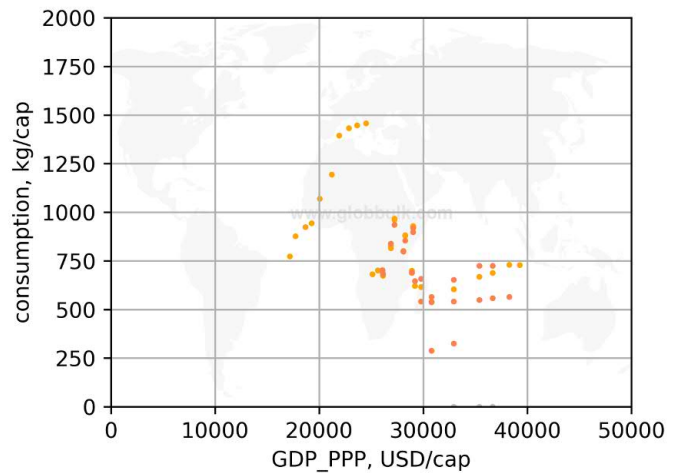
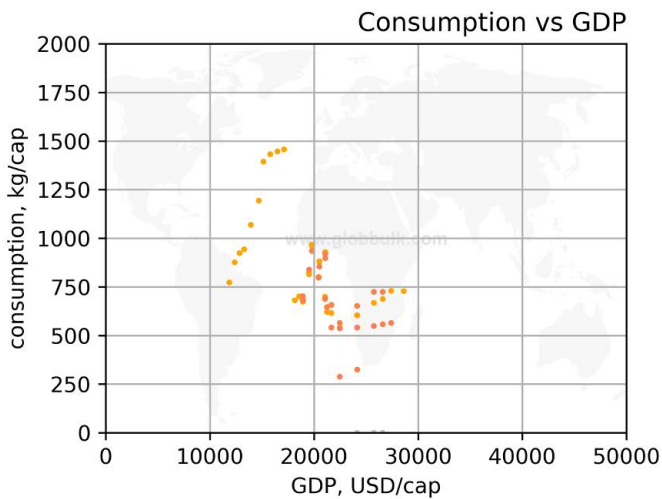
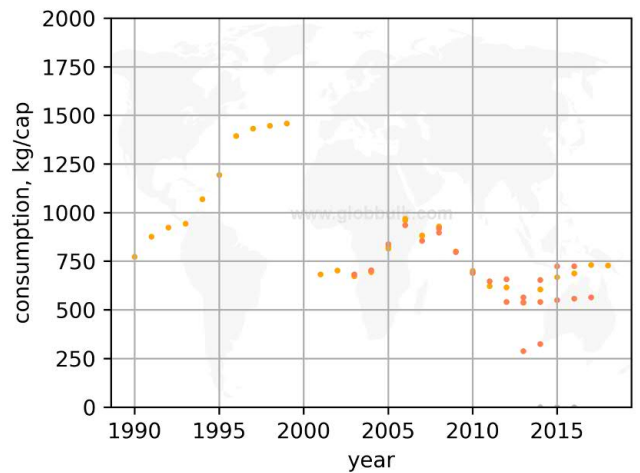
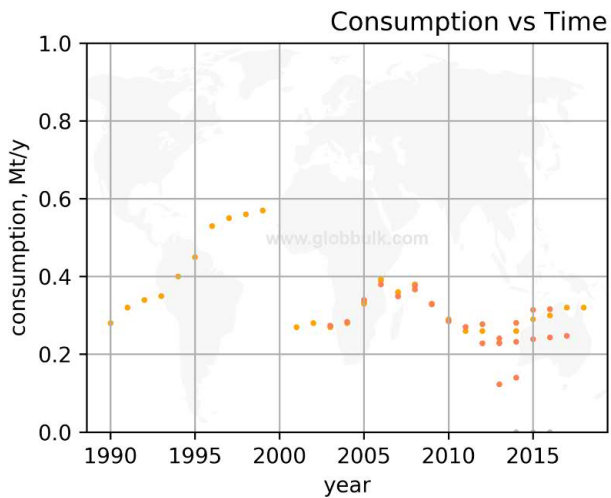
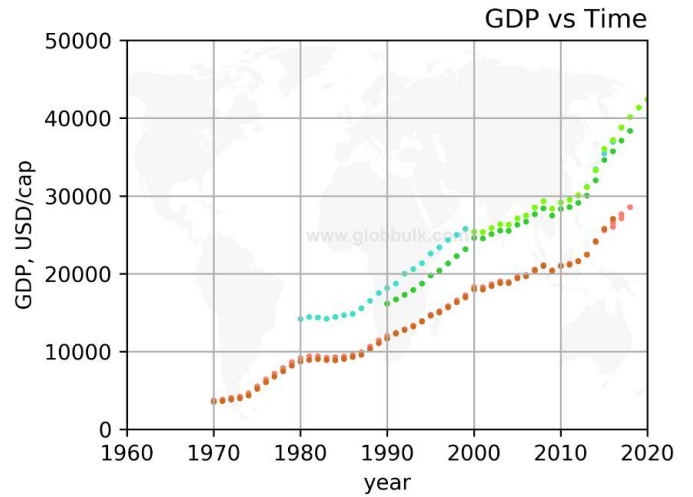
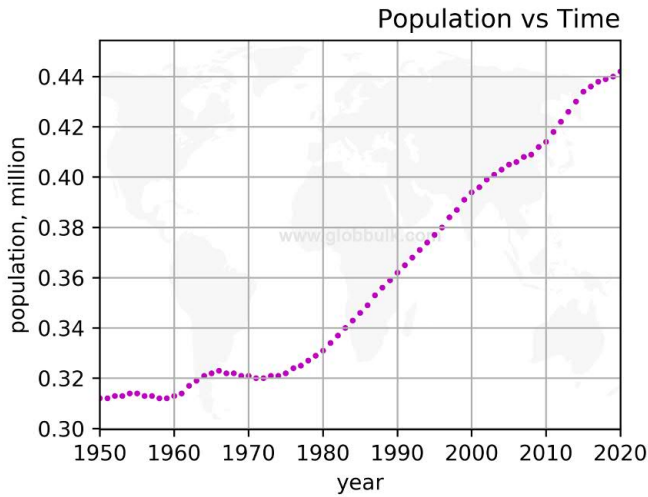


# Mali



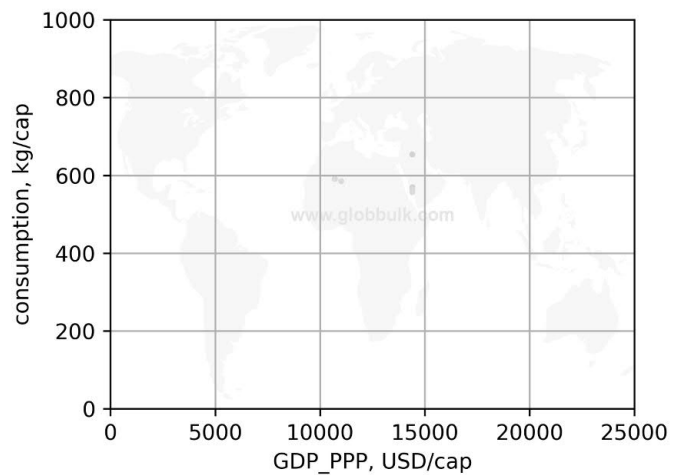
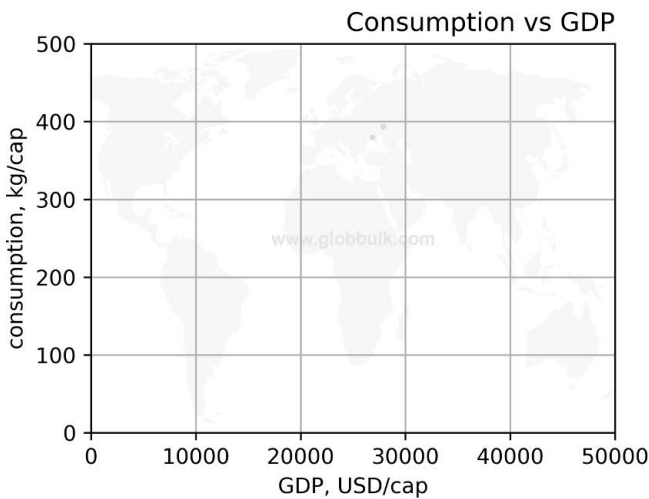
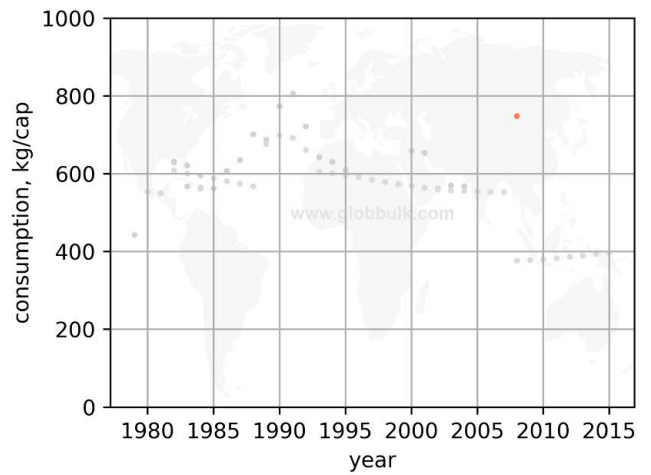
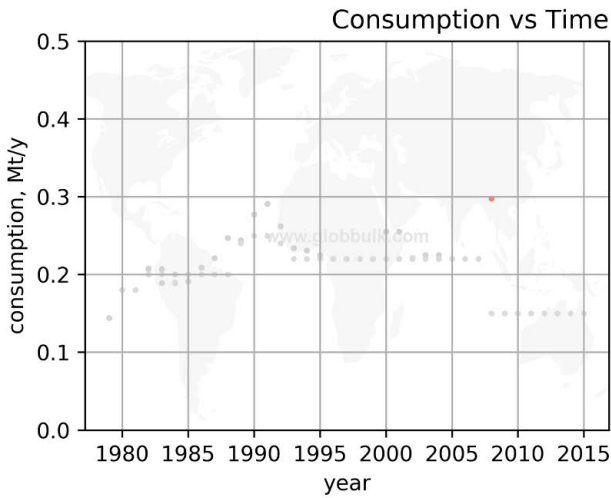
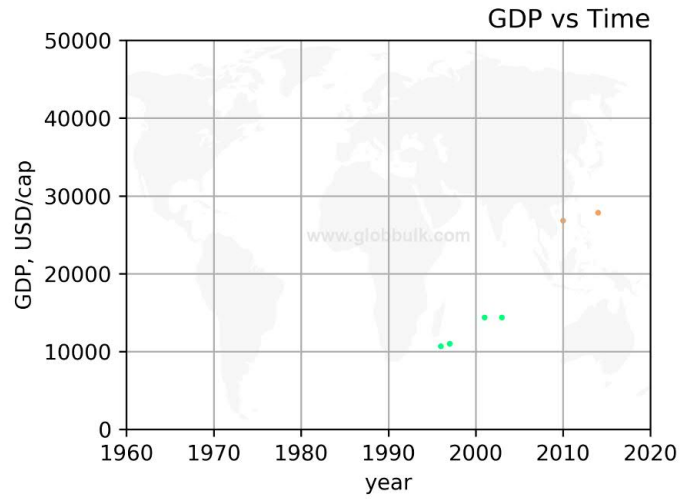
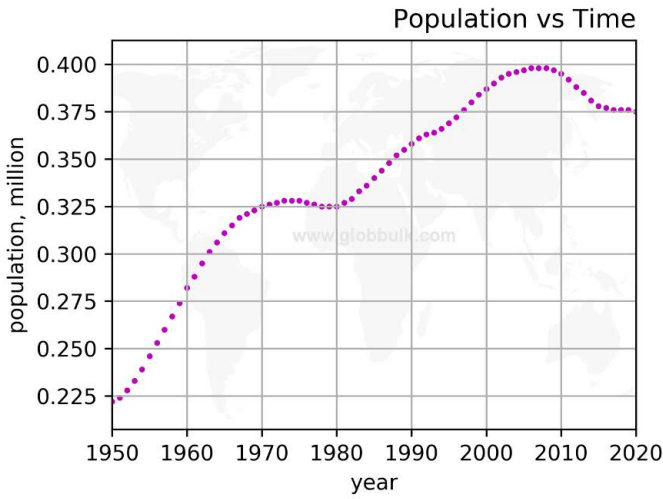


# Malta





# Martinique

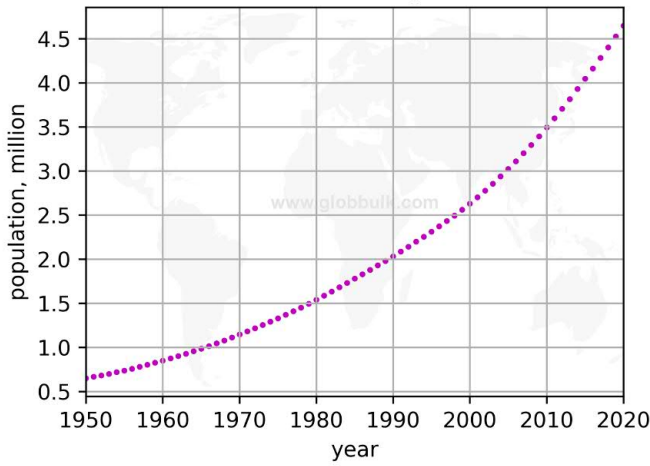




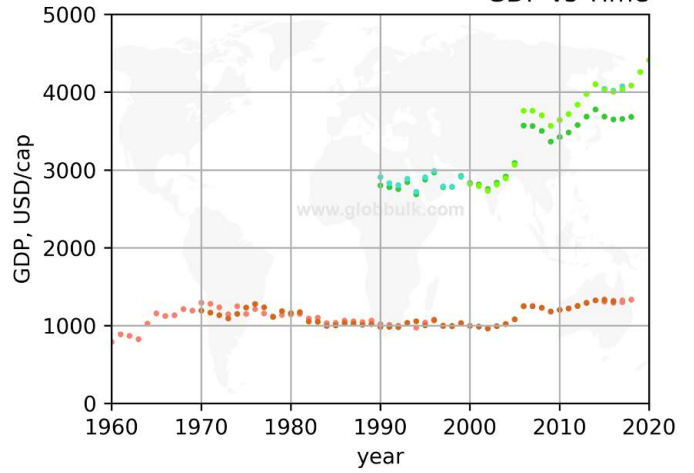


# Mauritania

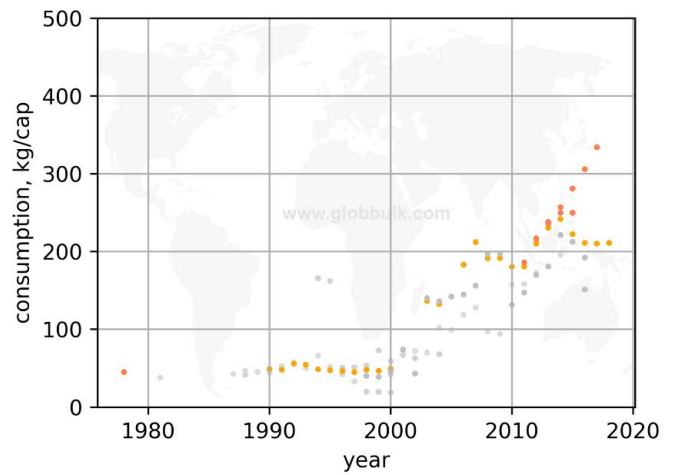
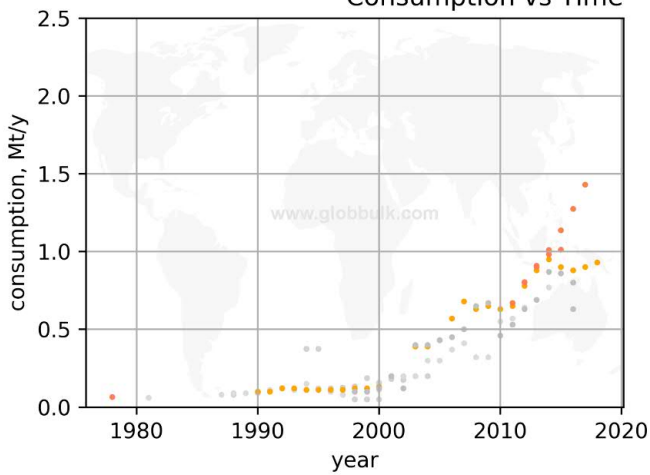
Population vs Time



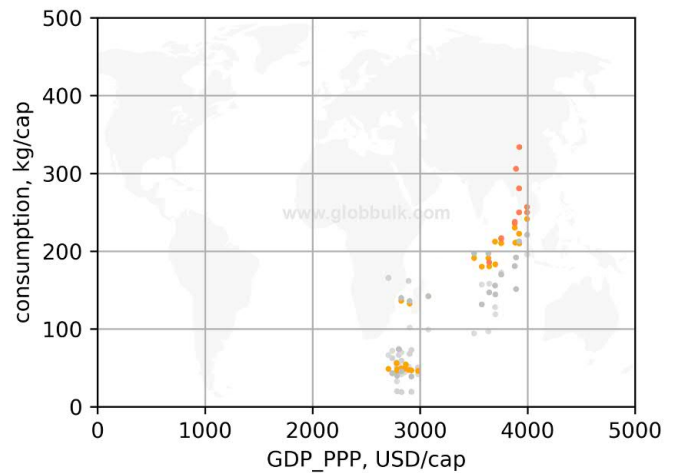
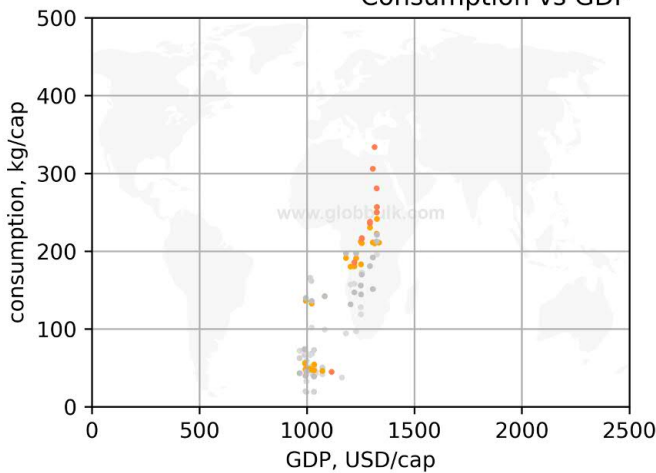
GDP vs Time



Consumption vs Time

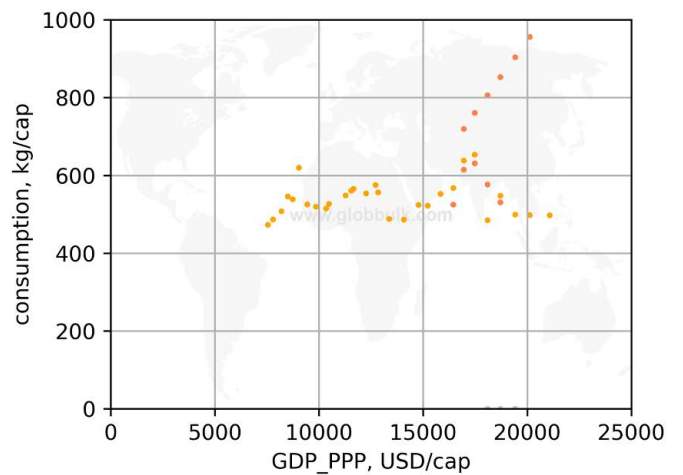
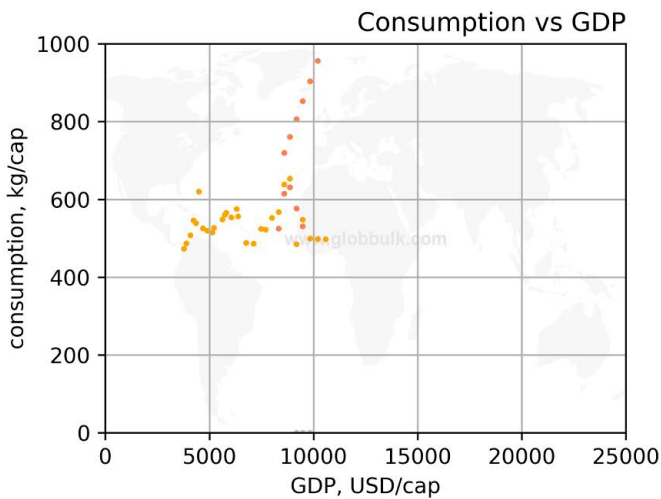
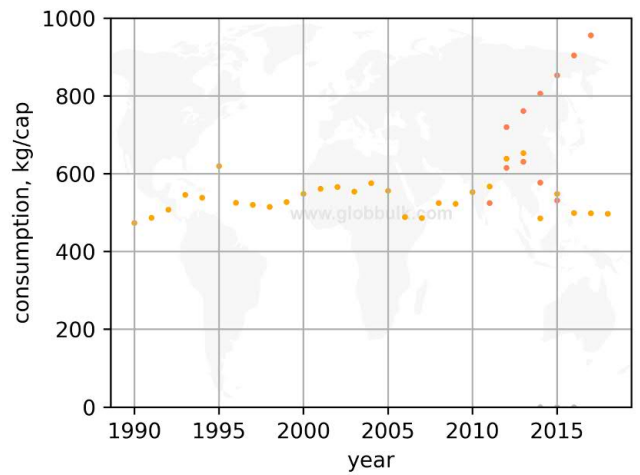
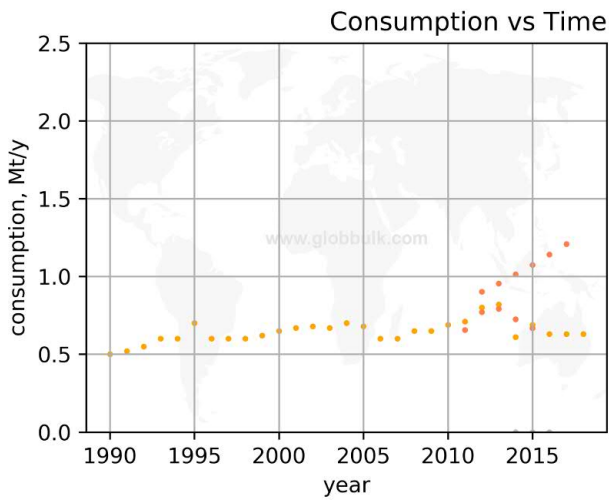
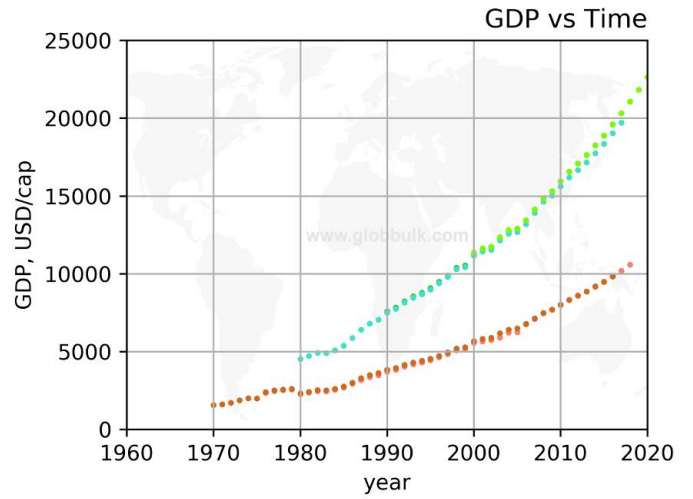
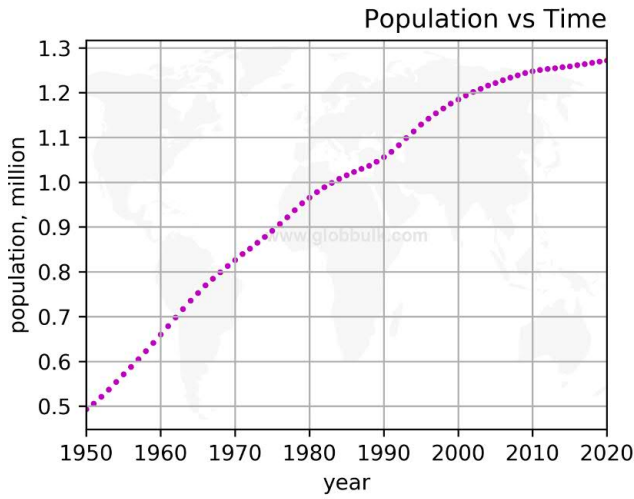


Consumption vs GDP



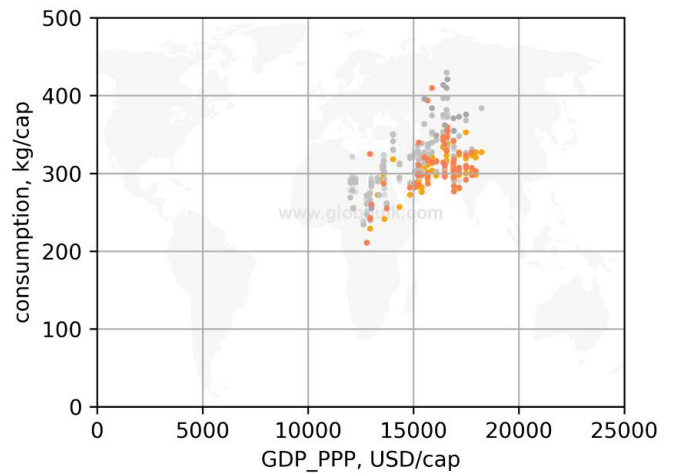
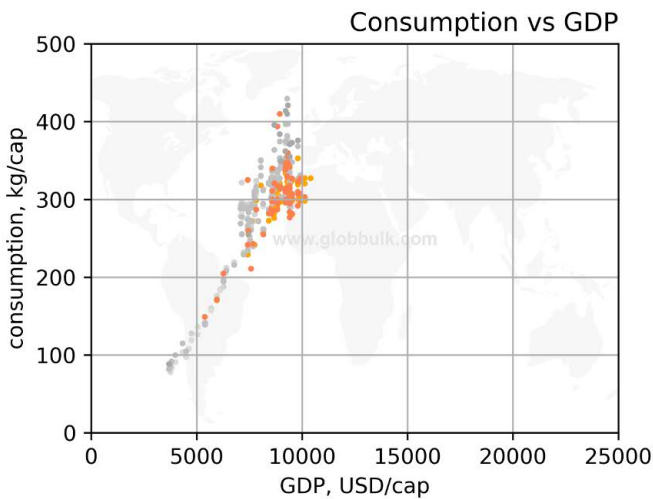
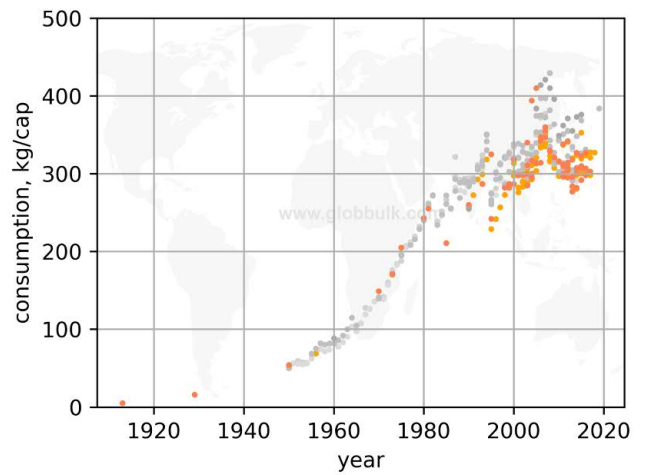
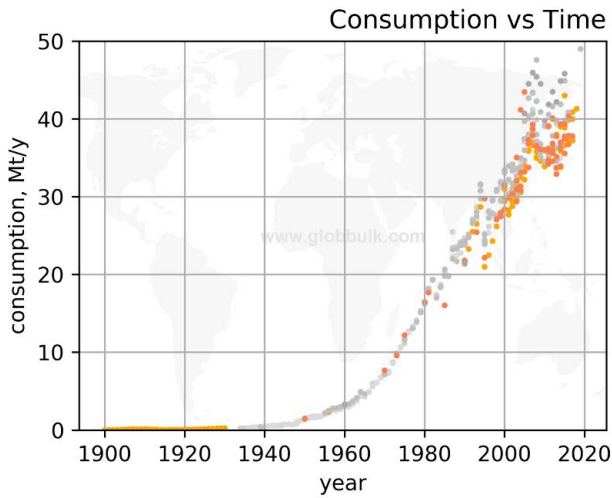
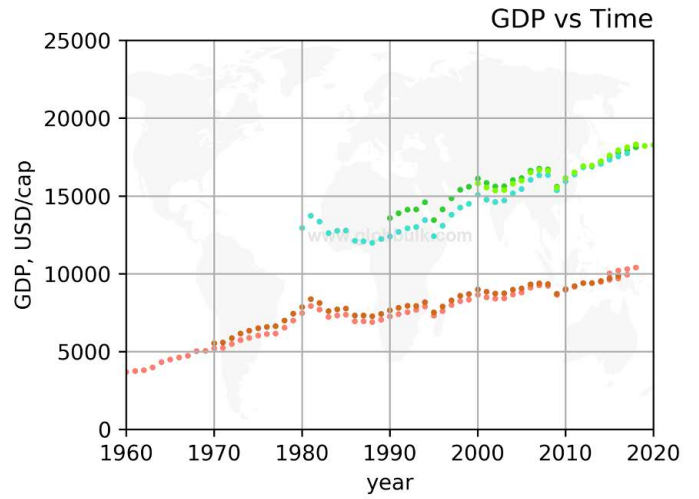
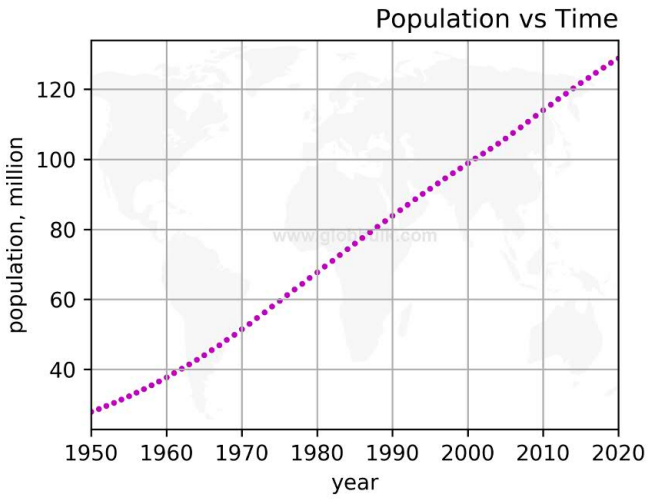


# Mauritius



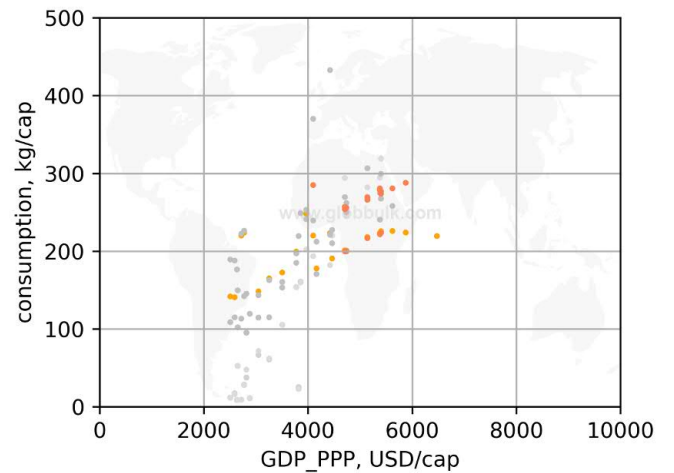
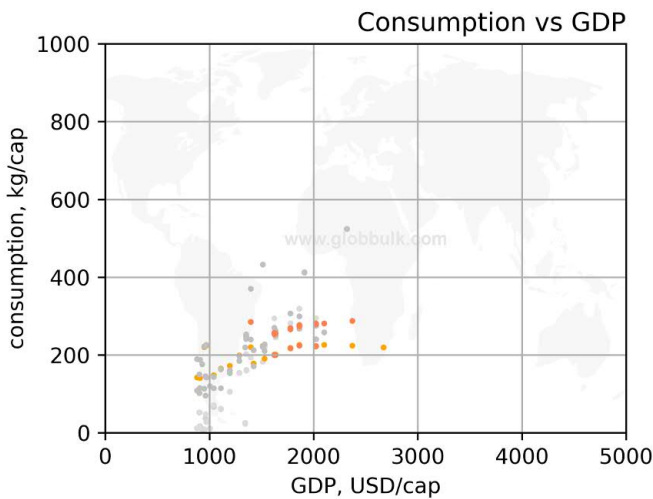
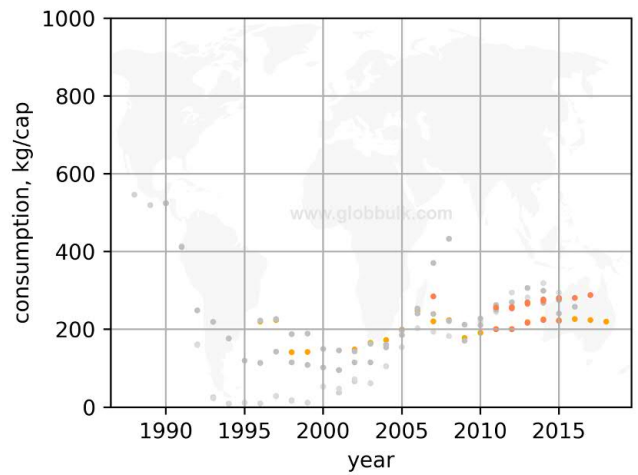
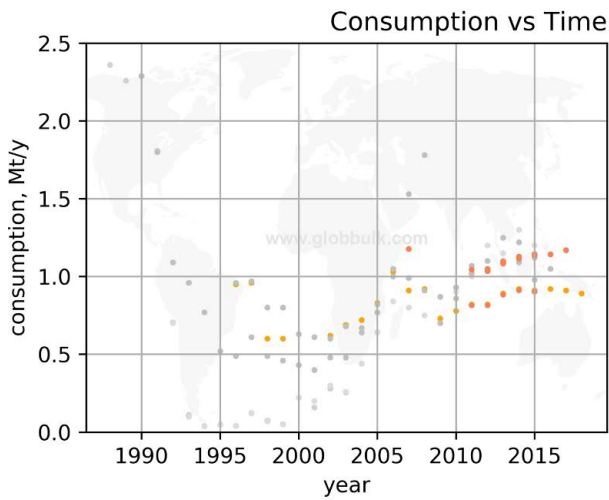
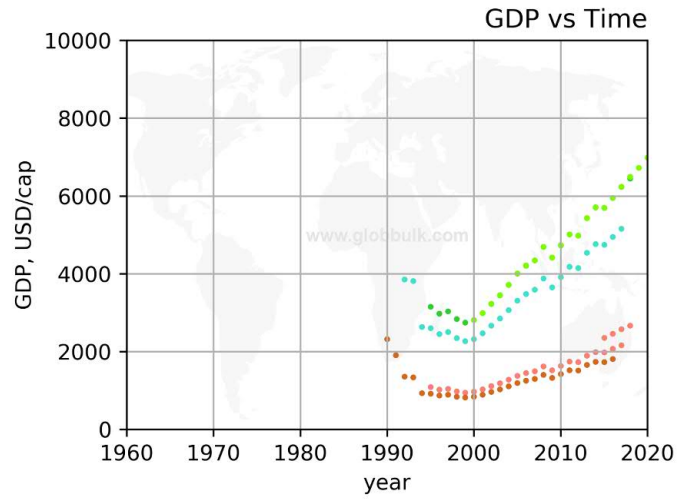
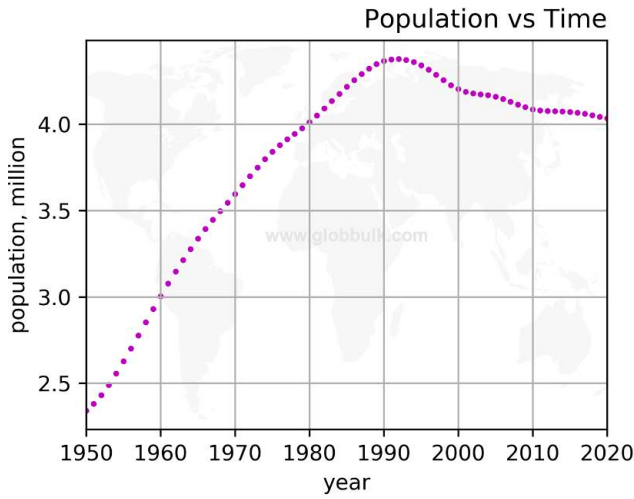


# Mexico



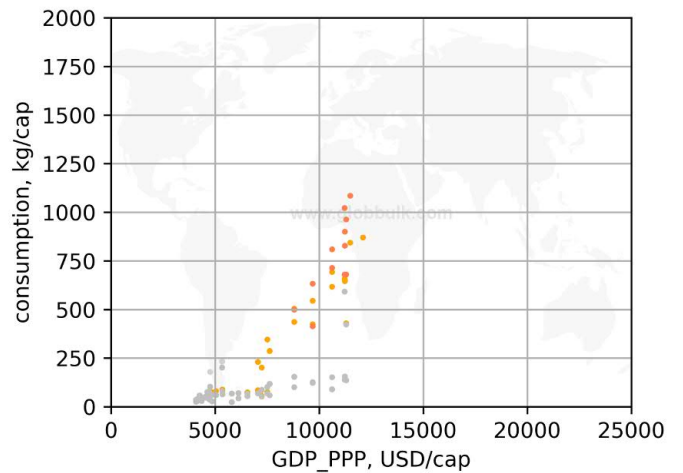
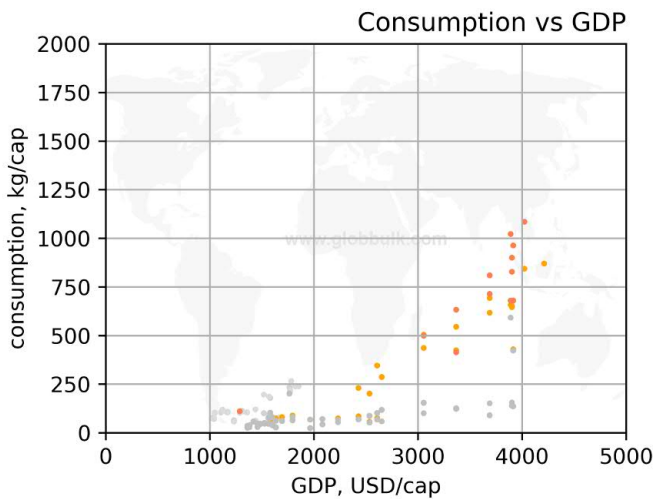
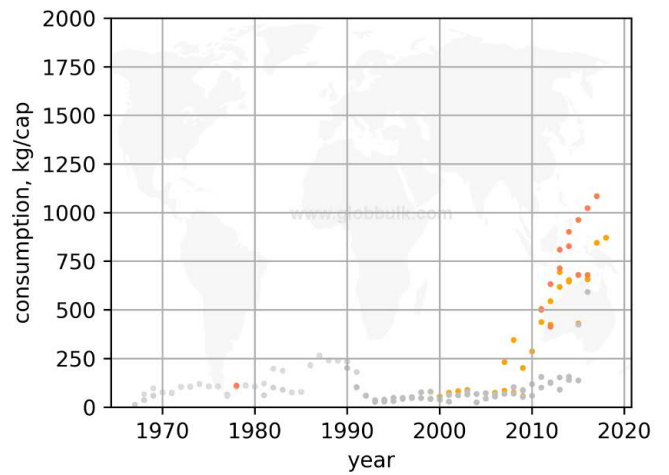
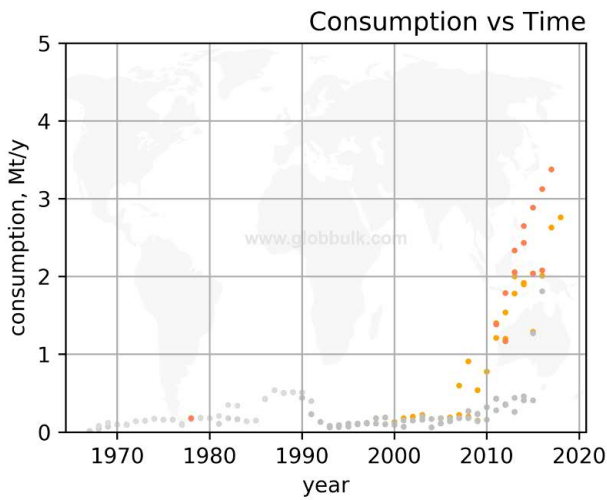
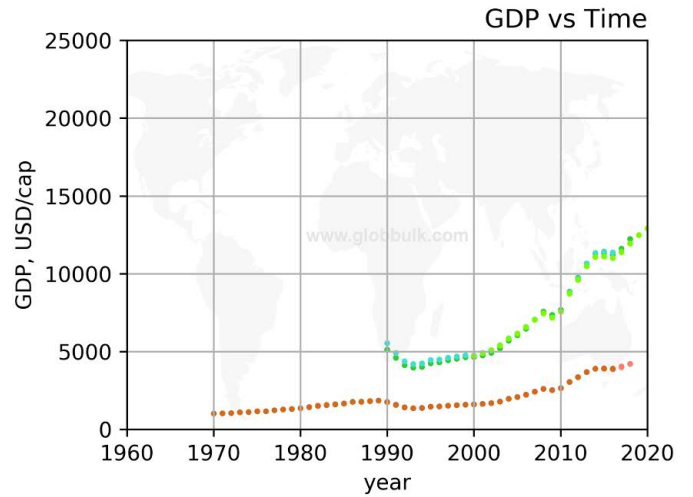
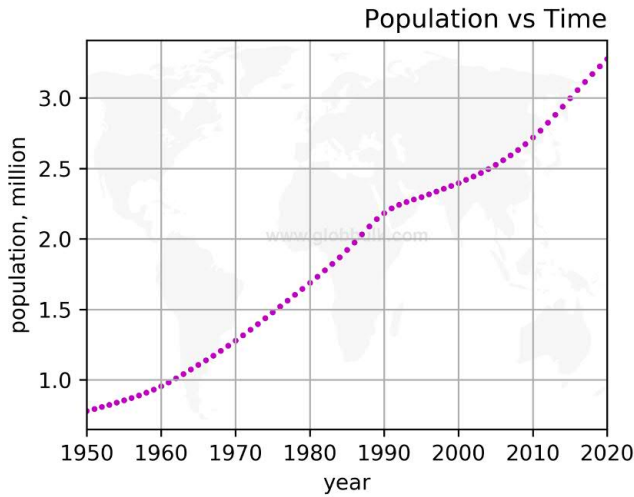


# Moldova



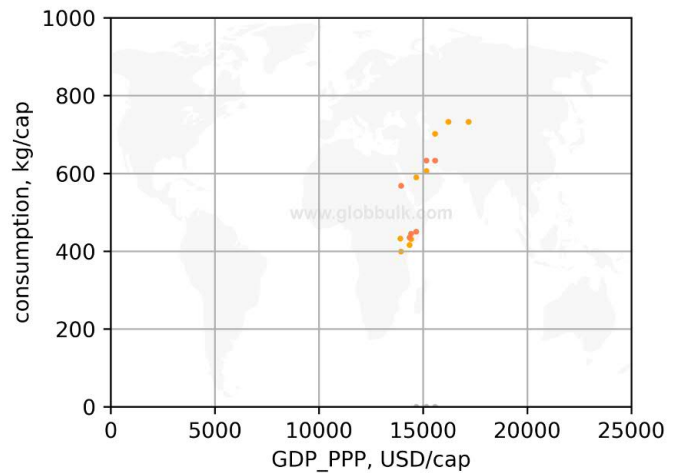
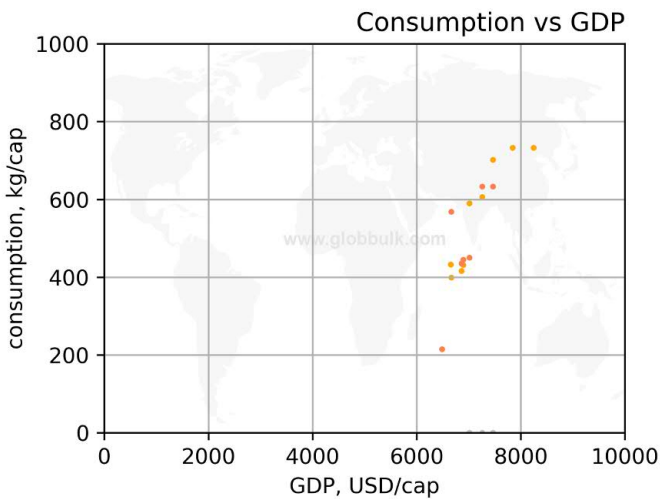
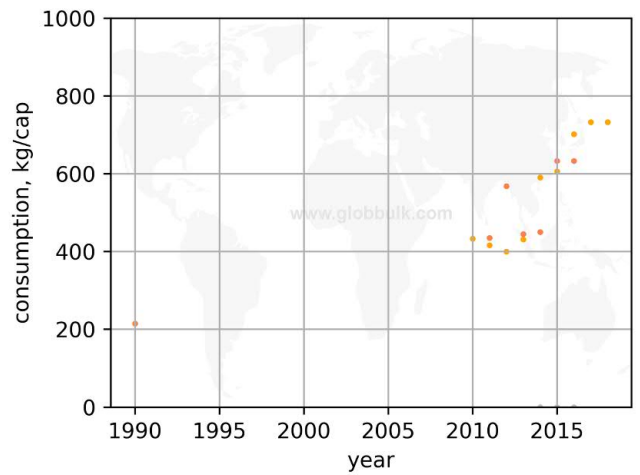
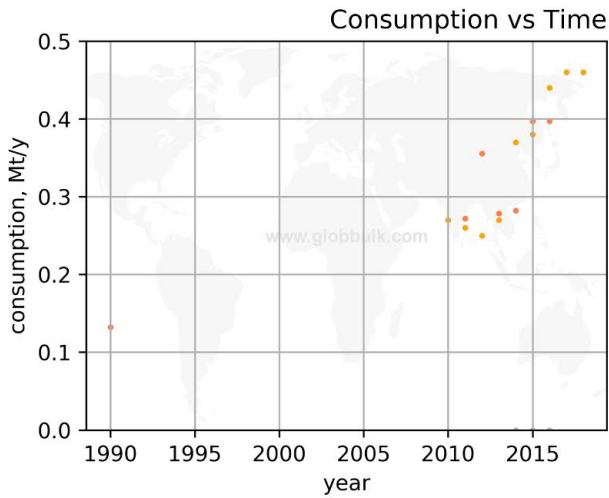
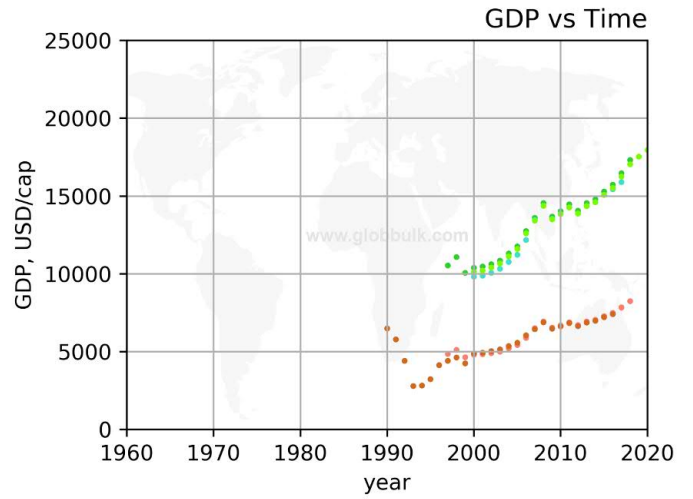
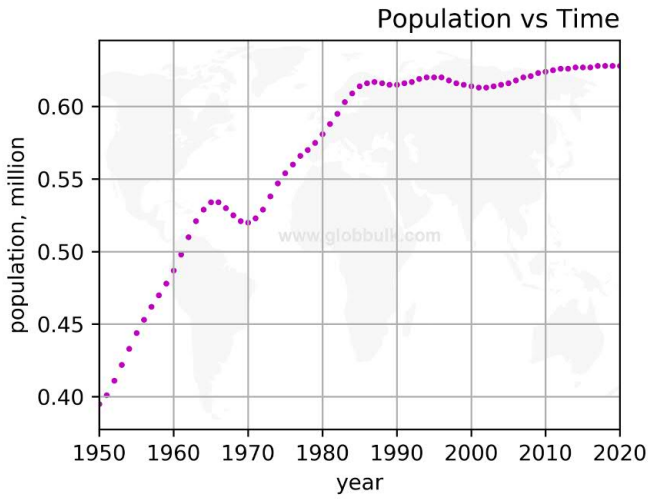


# Mongolia





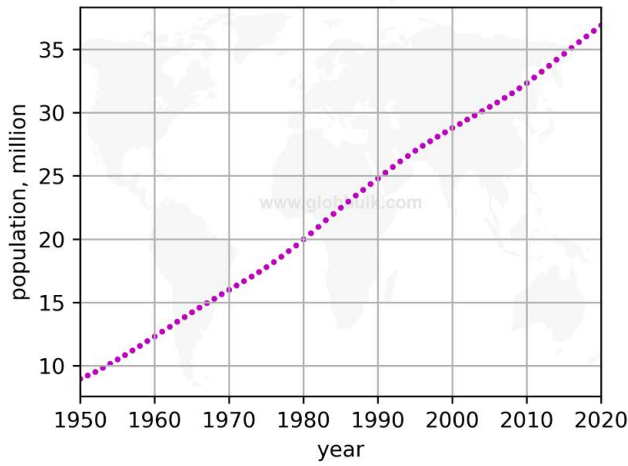
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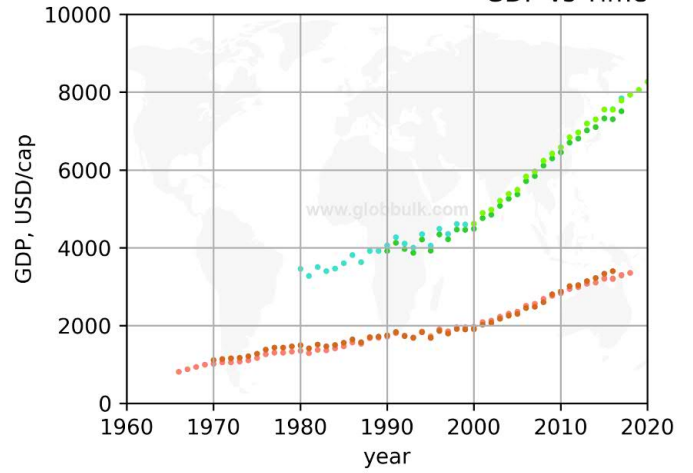


# Morocco

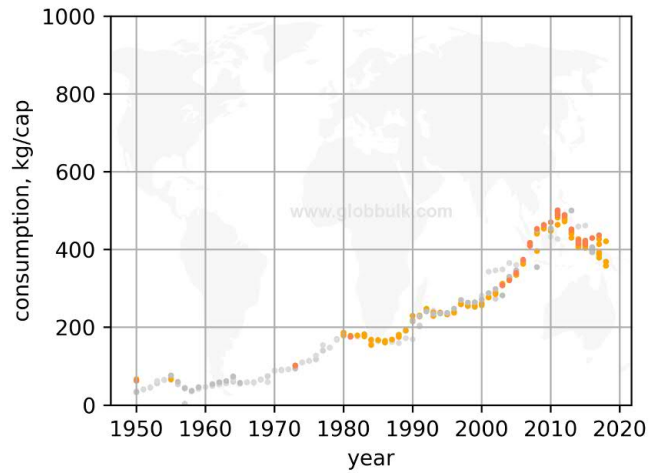
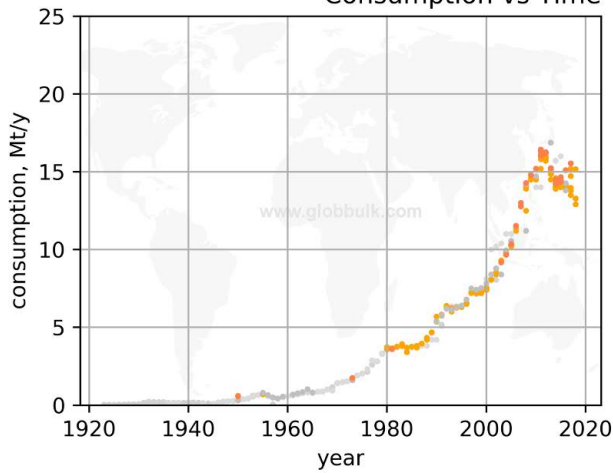
Population vs Time



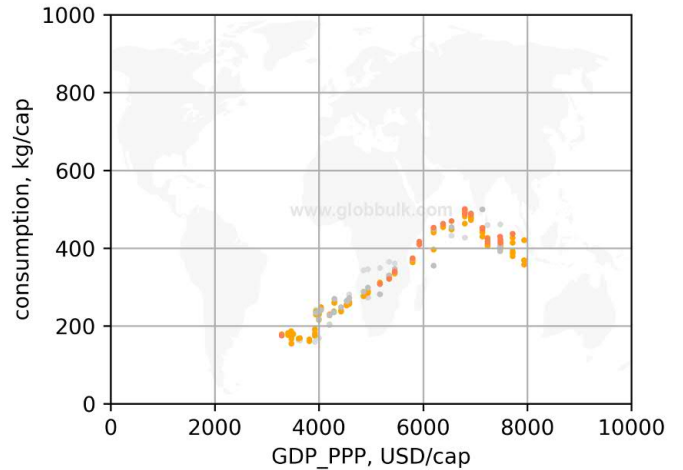
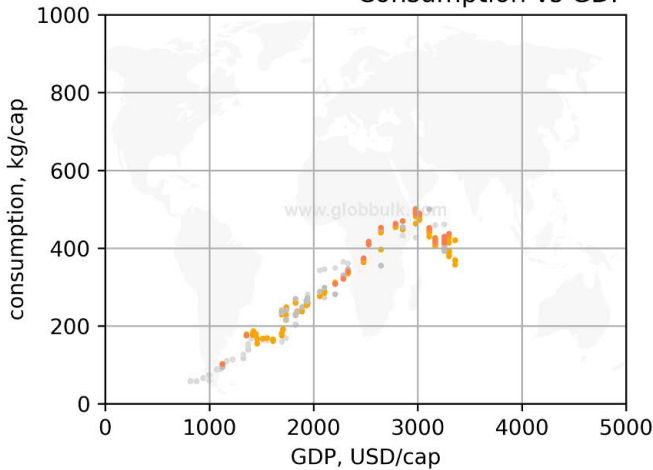
GDP vs Time



Consumption vs Time



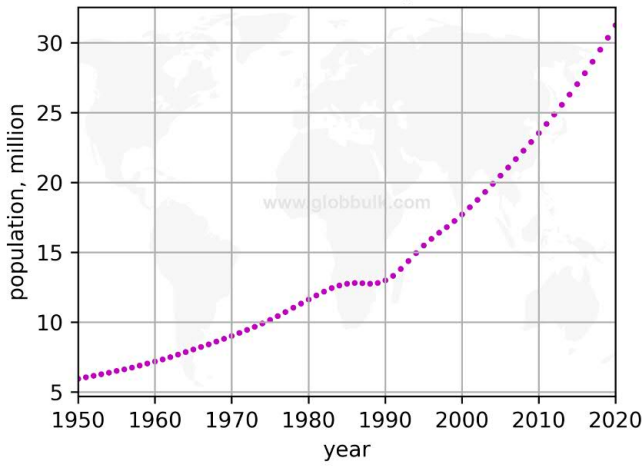
Consumption vs GDP



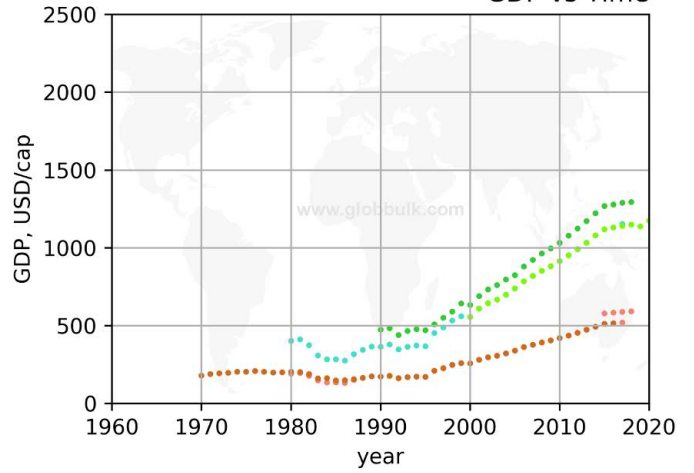


# Mozambique

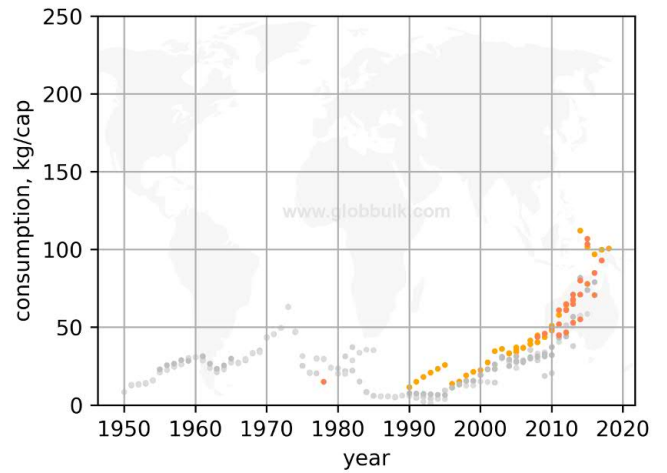
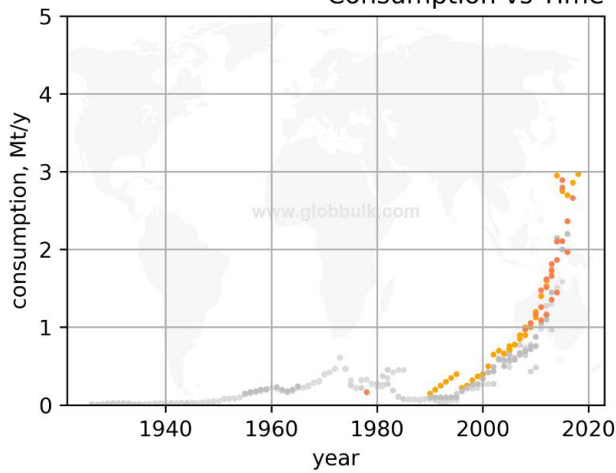
Population vs Time



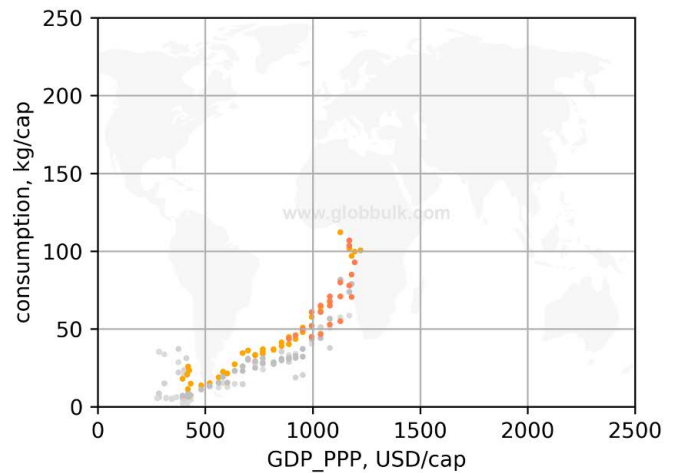
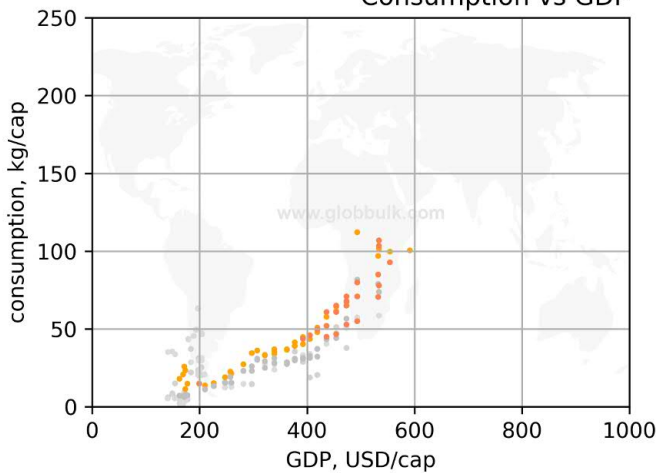
GDP vs Time



Consumption vs Time



Consumption vs GDP

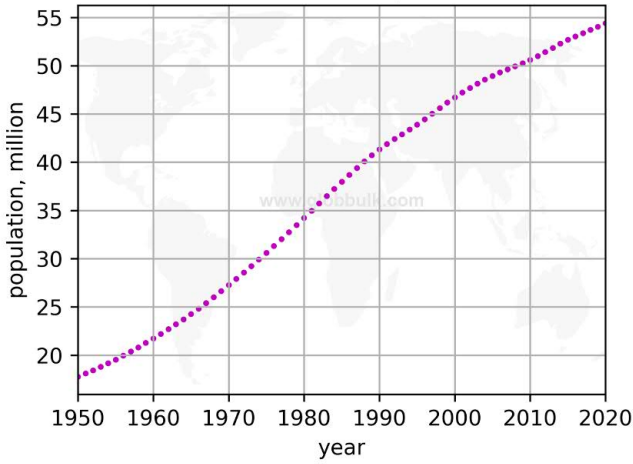




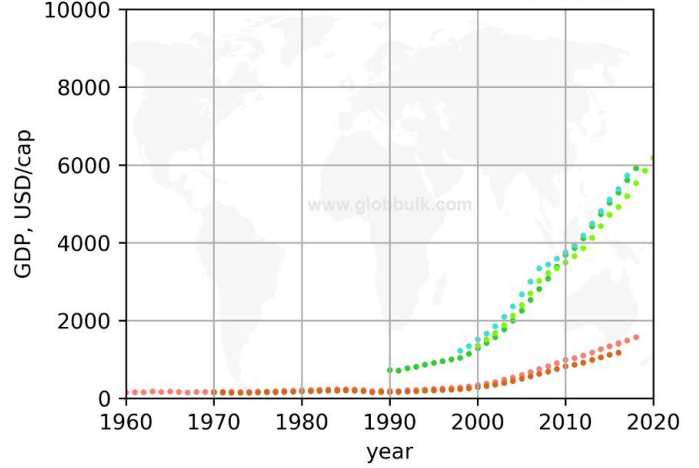


# Myanmar

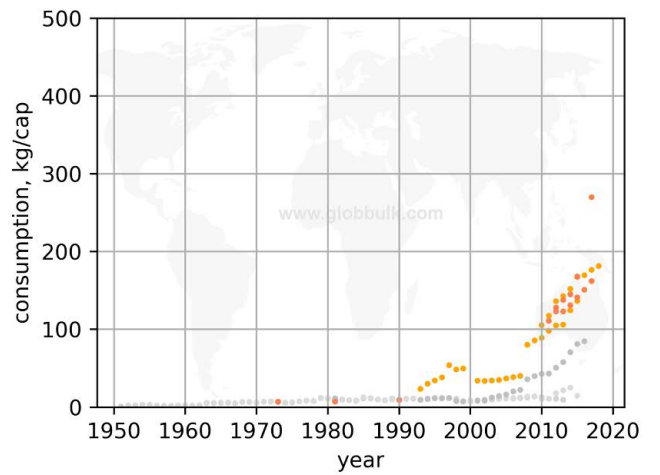
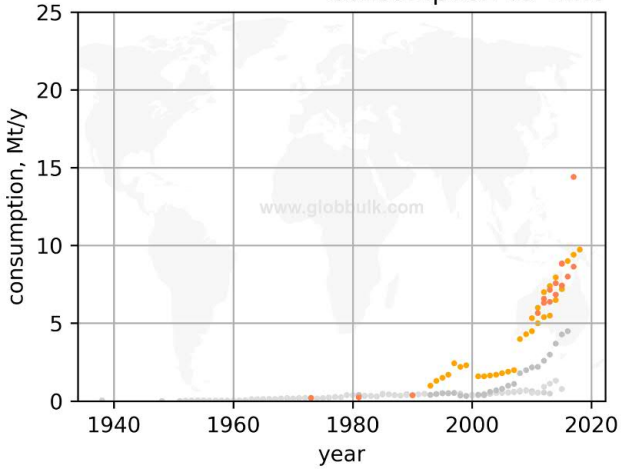
Population vs Time



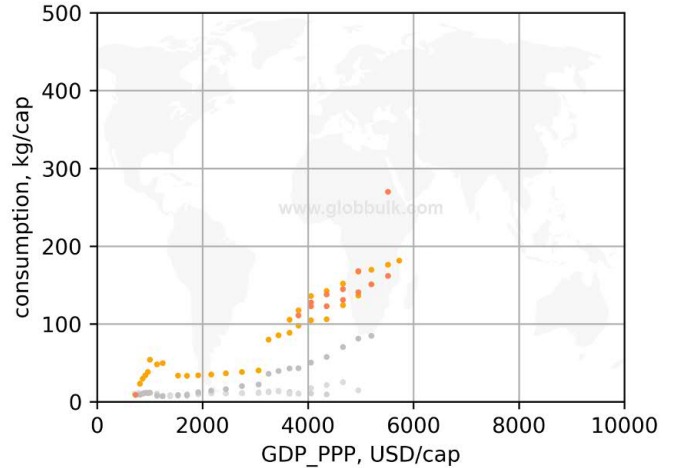
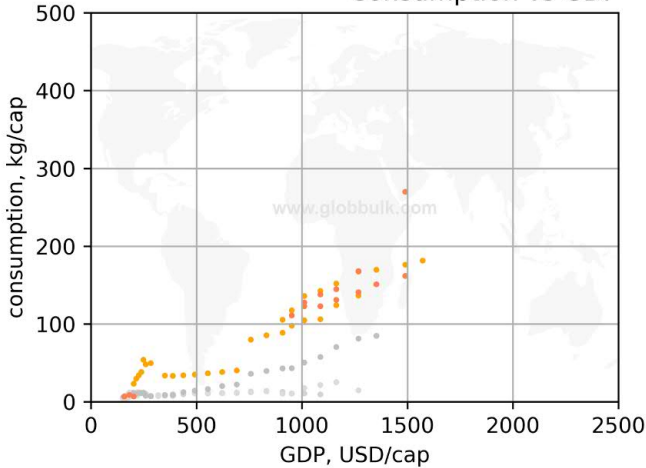
GDP vs Time



Consumption vs Time

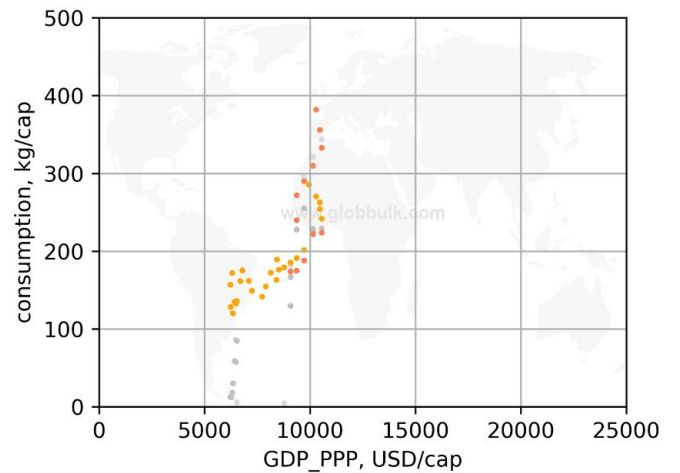
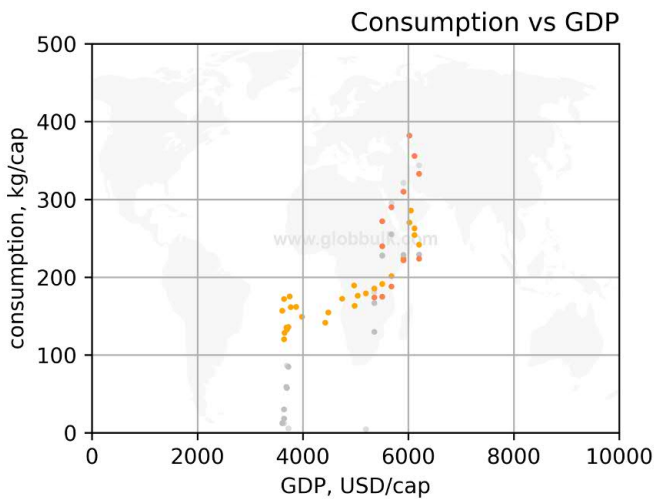
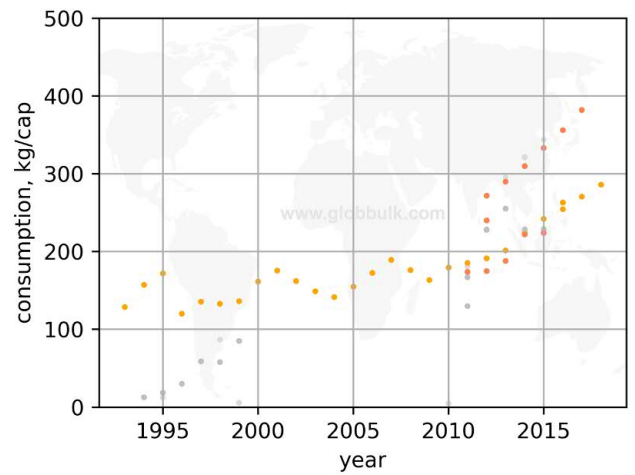
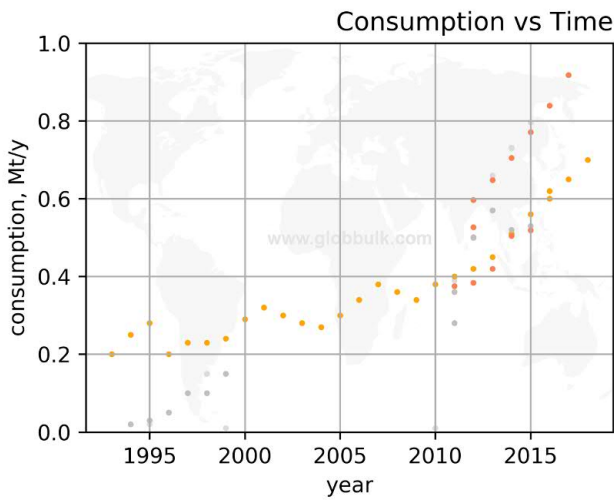
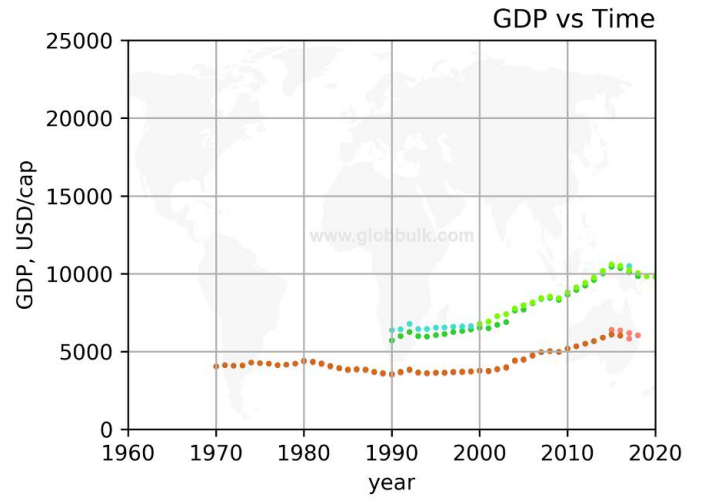
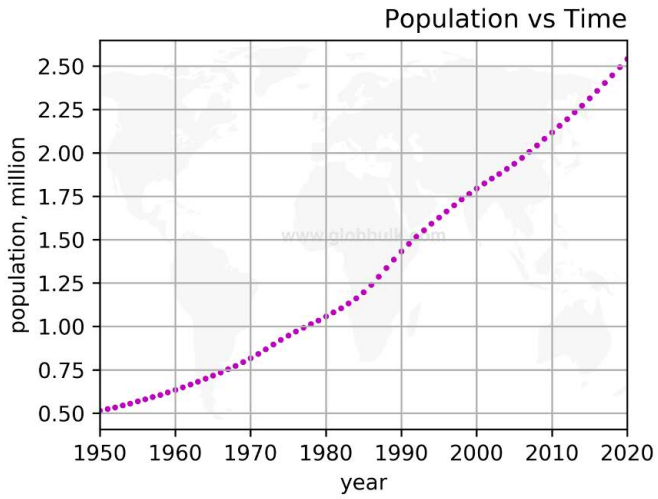


Consumption vs GDP



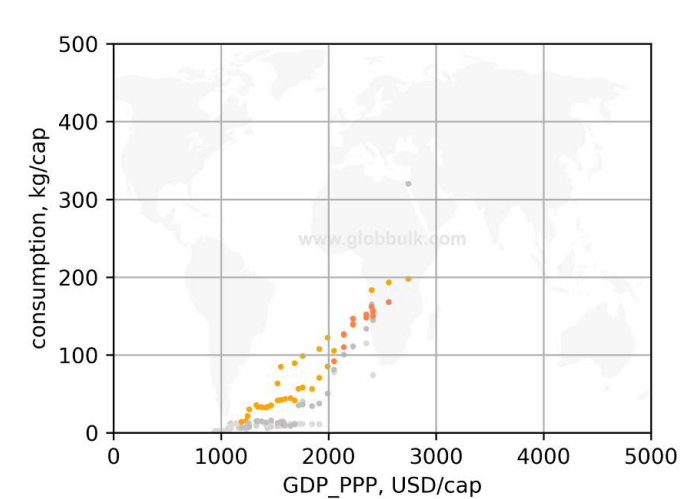
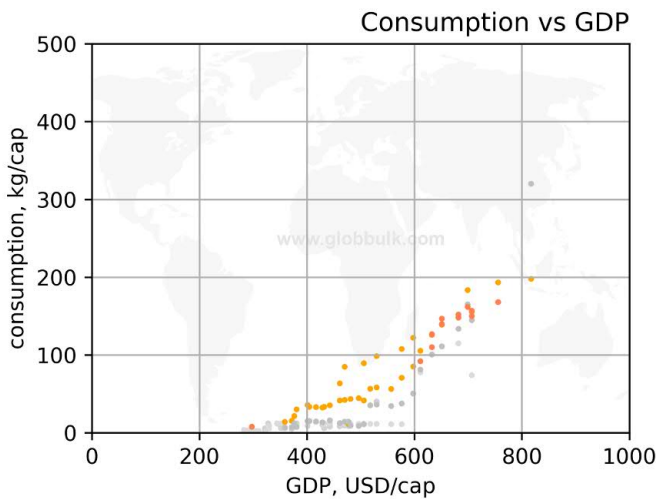
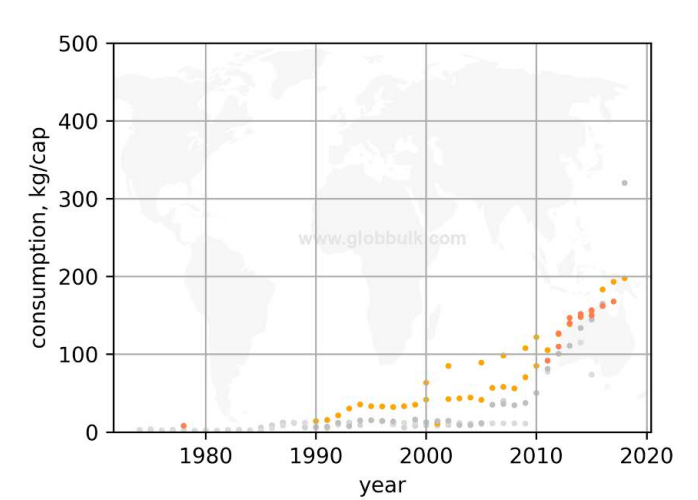
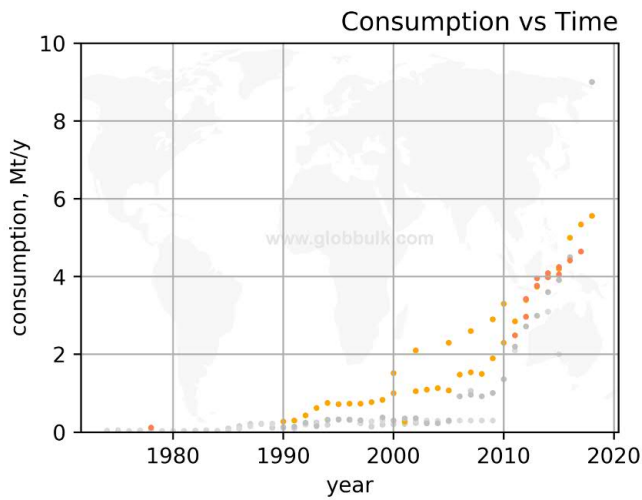
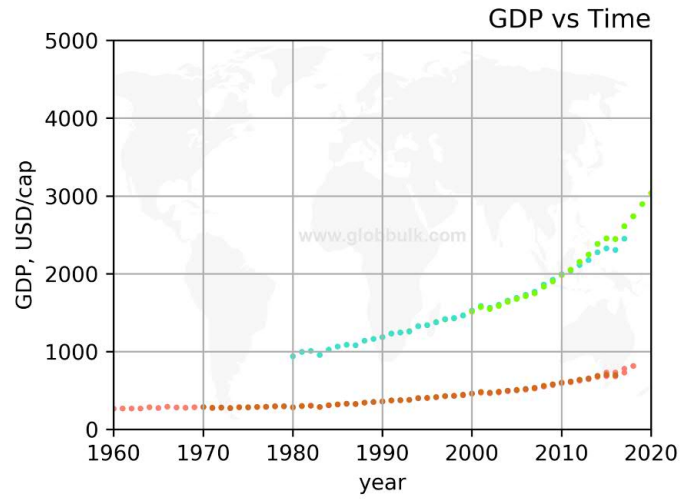
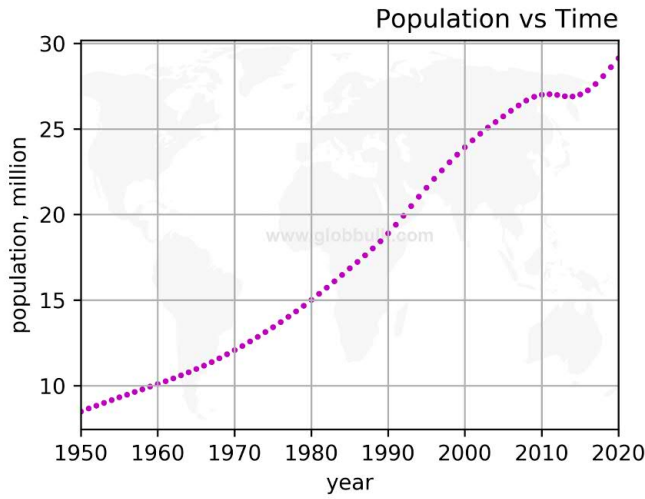


# Namibia



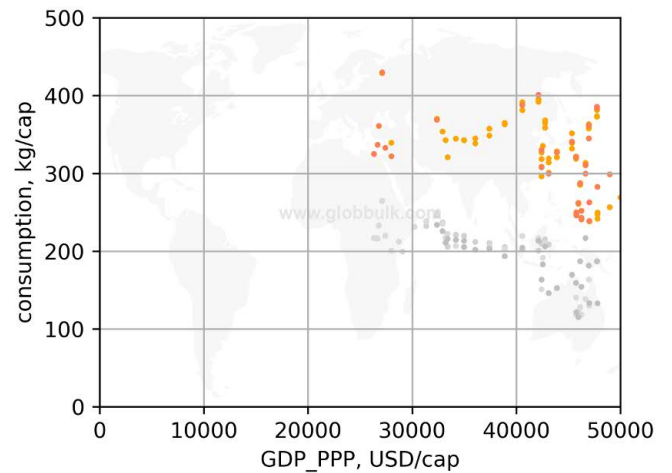
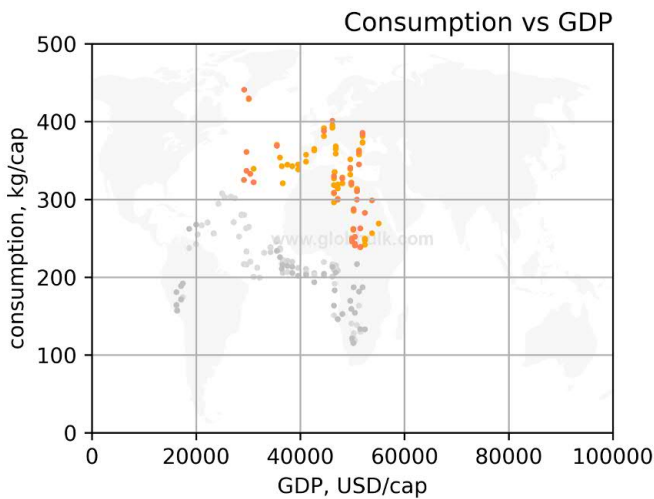
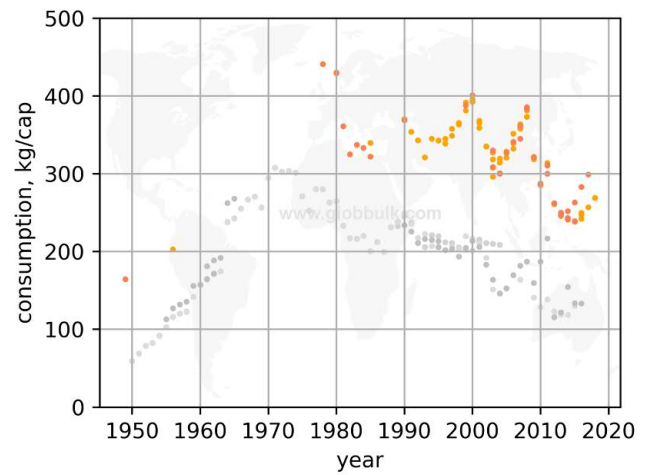
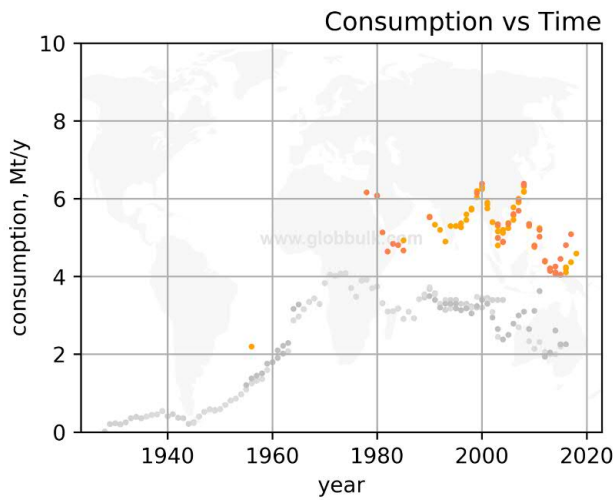
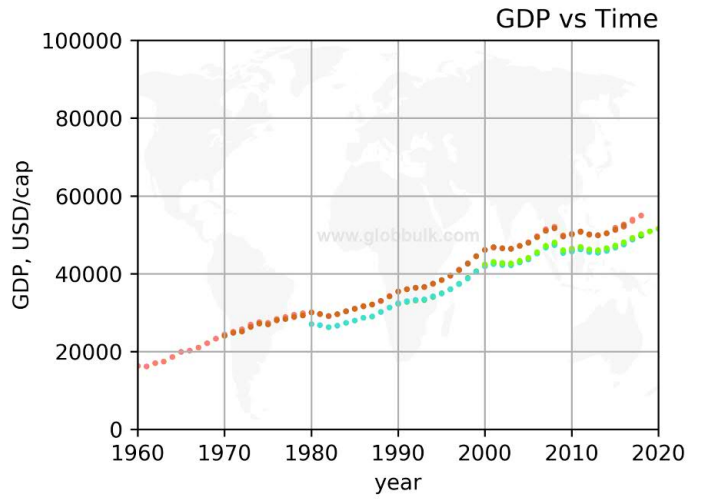
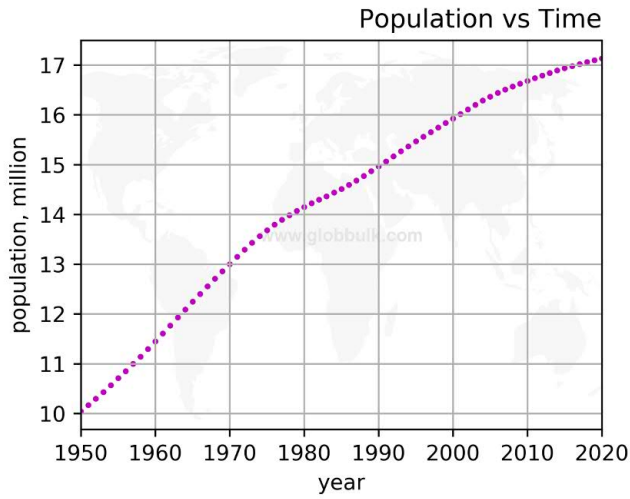


# Nepal



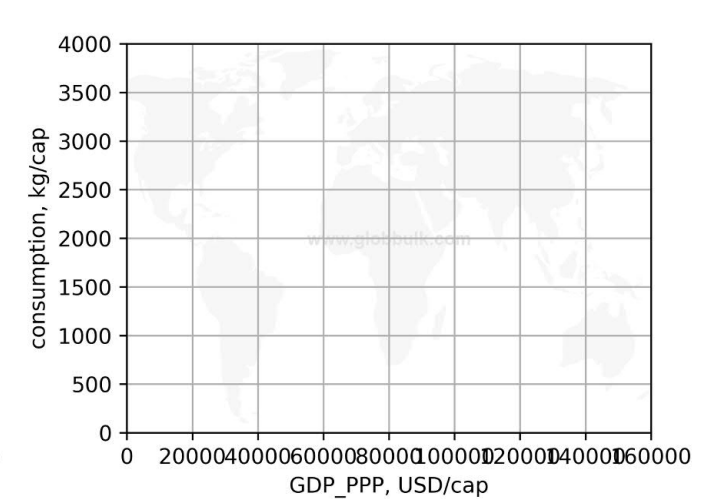
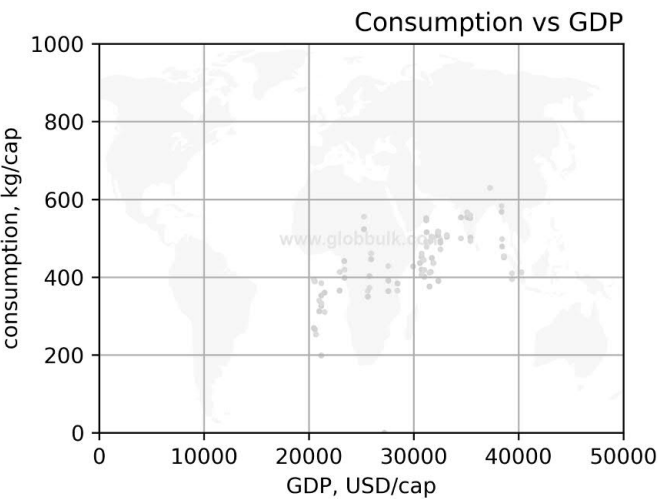
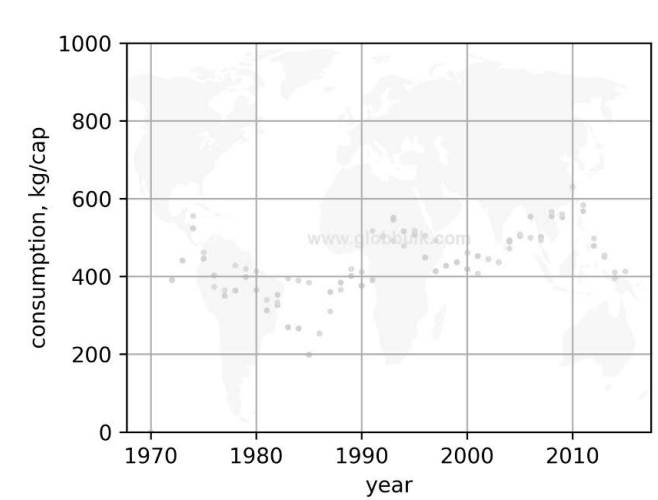
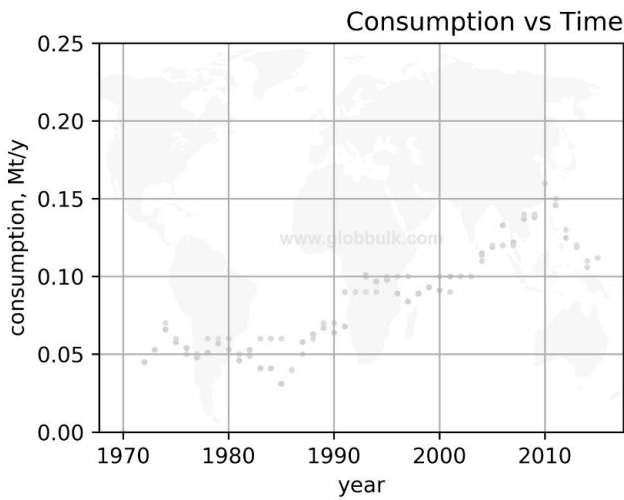
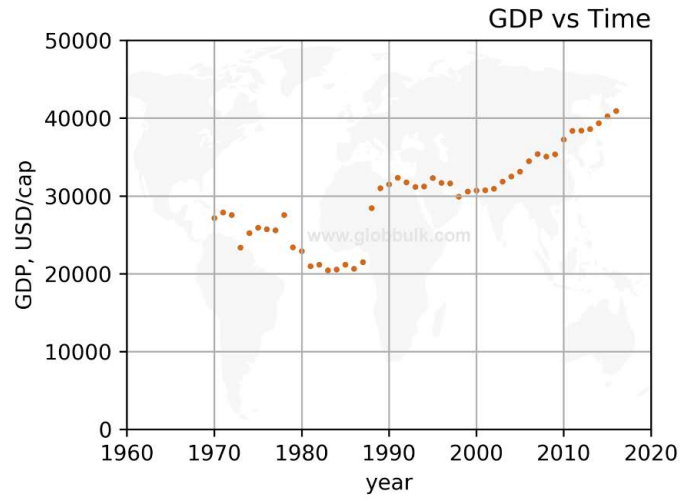
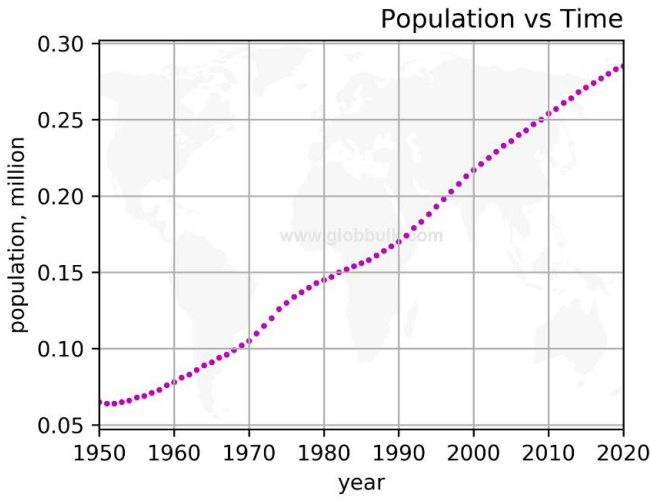


# Netherlands





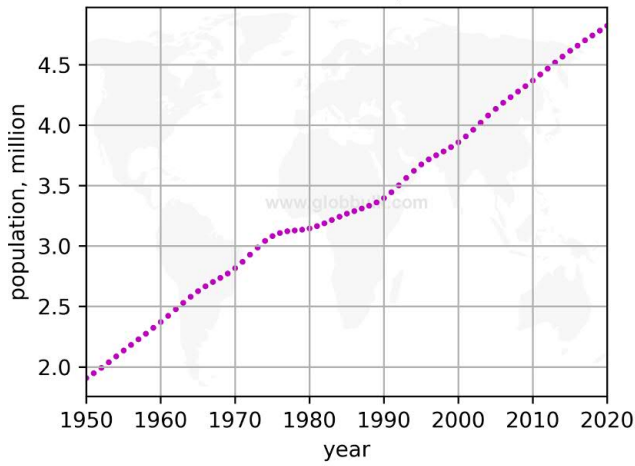
# New Caledonia



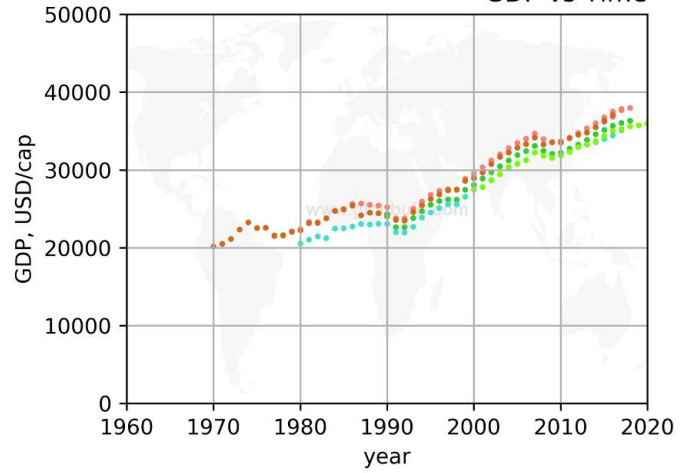


# New Zealand

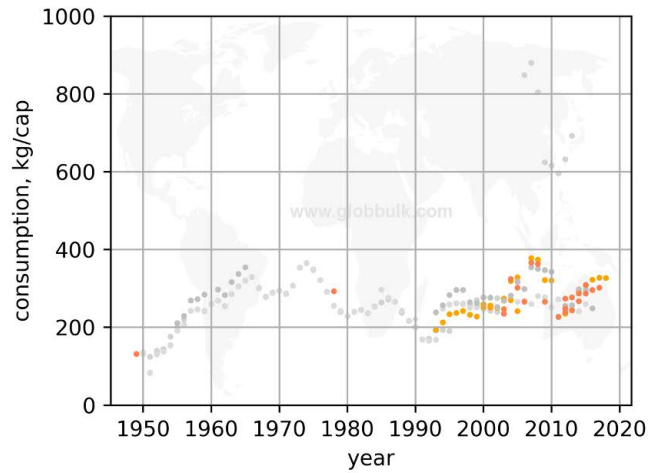
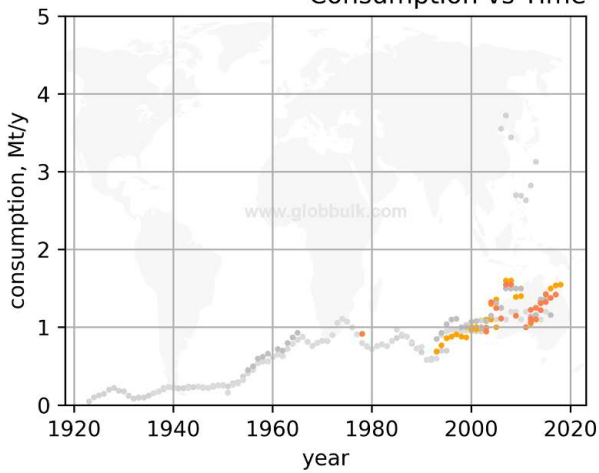
Population vs Time



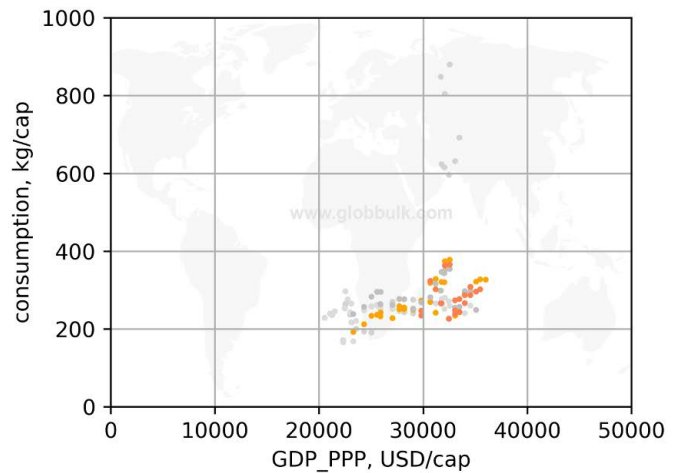
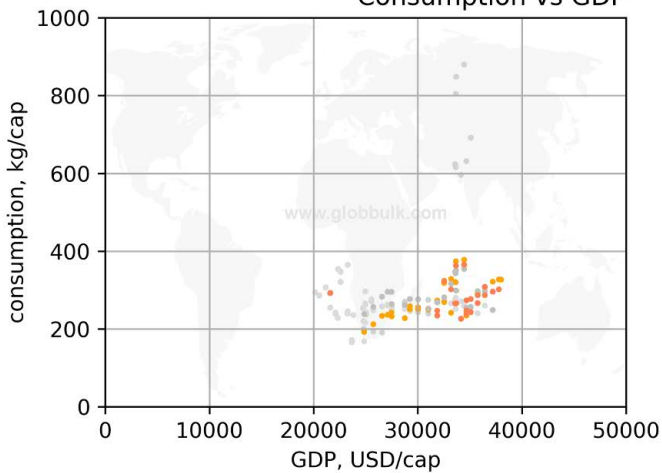
GDP vs Time



Consumption vs Time



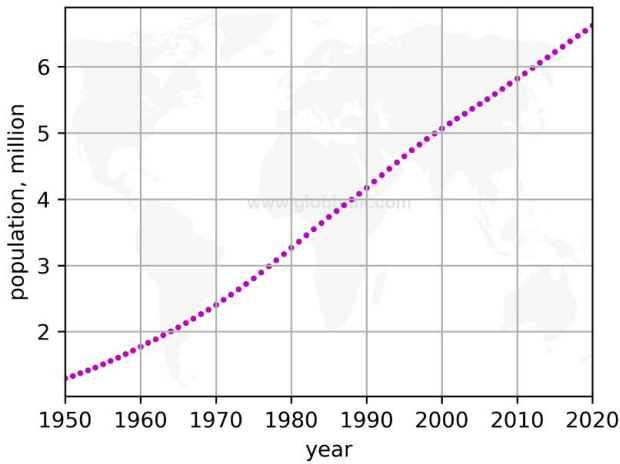
Consumption vs GDP



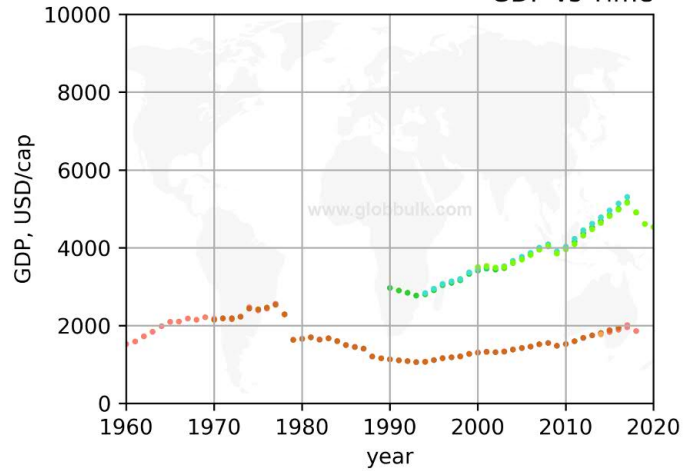


# Nicaragua

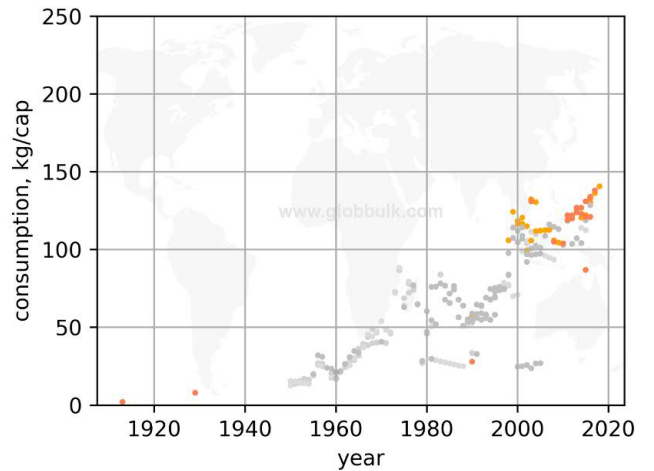
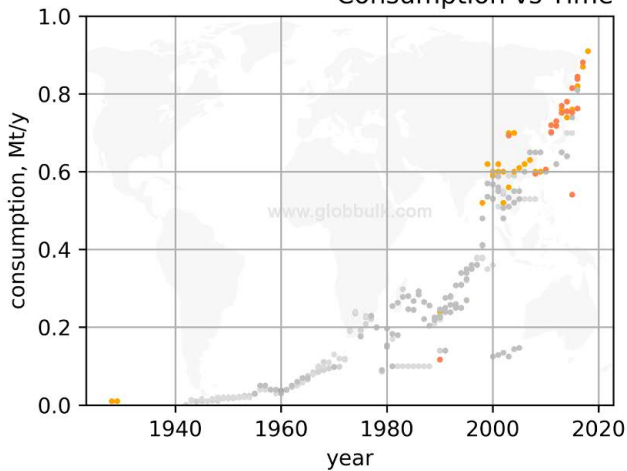
Population vs Time



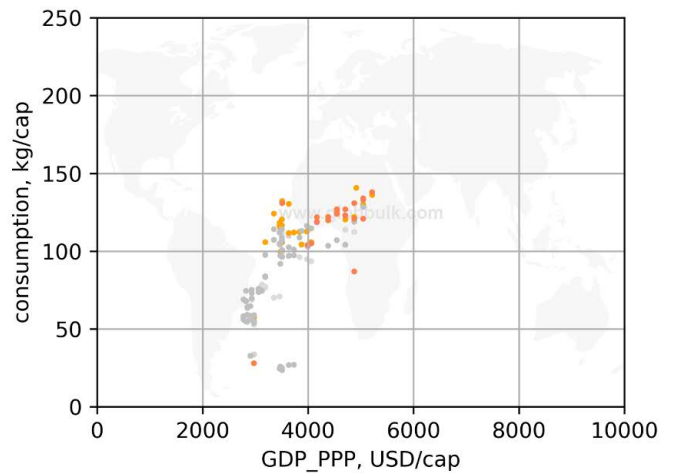
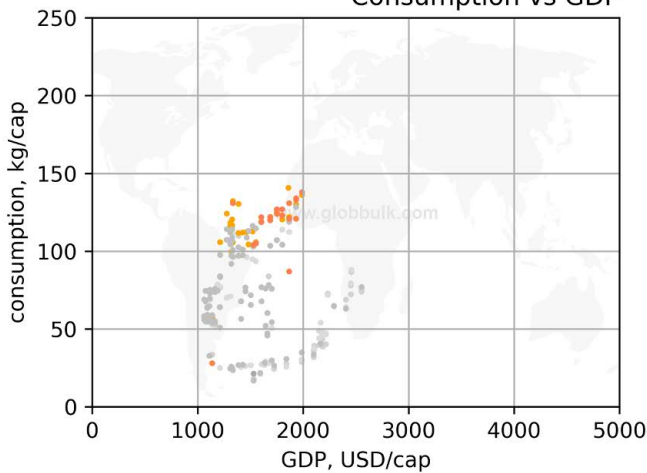
GDP vs Time



Consumption vs Time

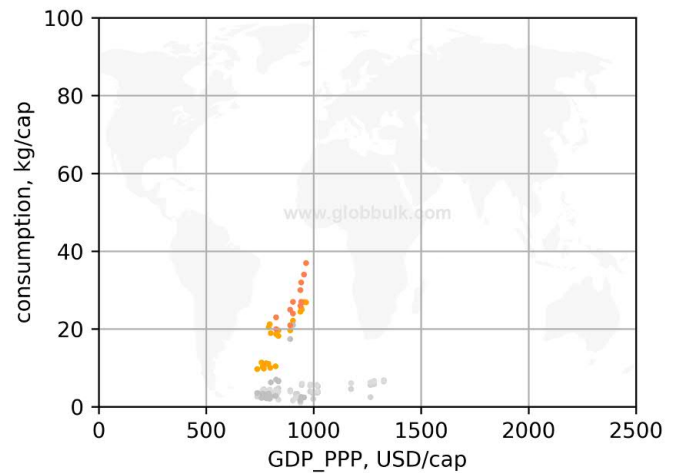
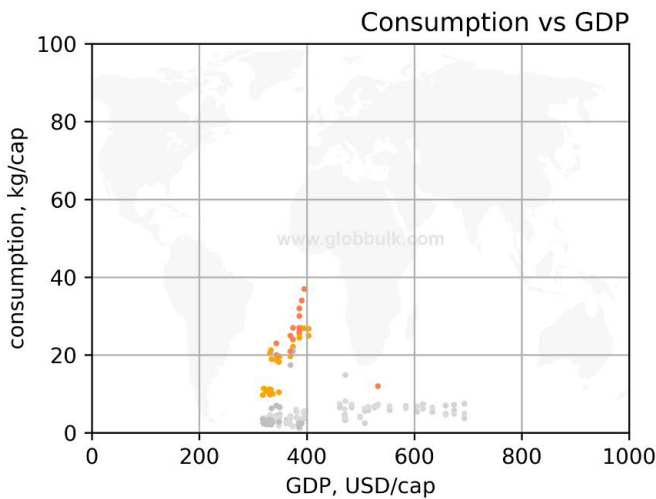
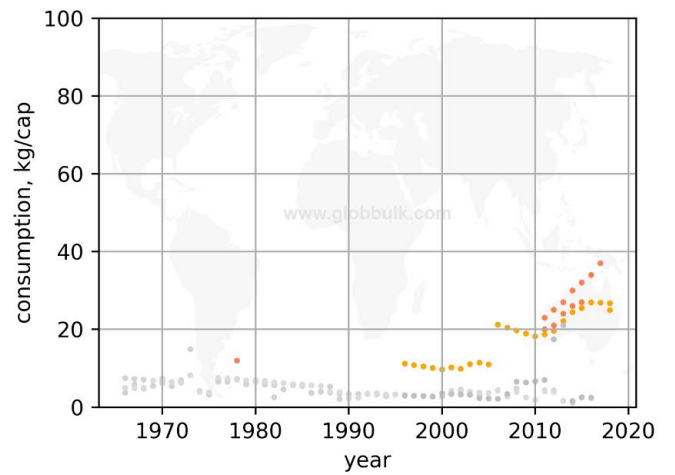
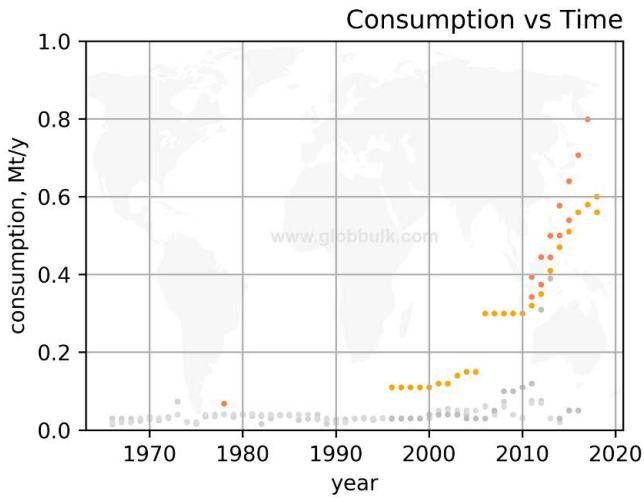
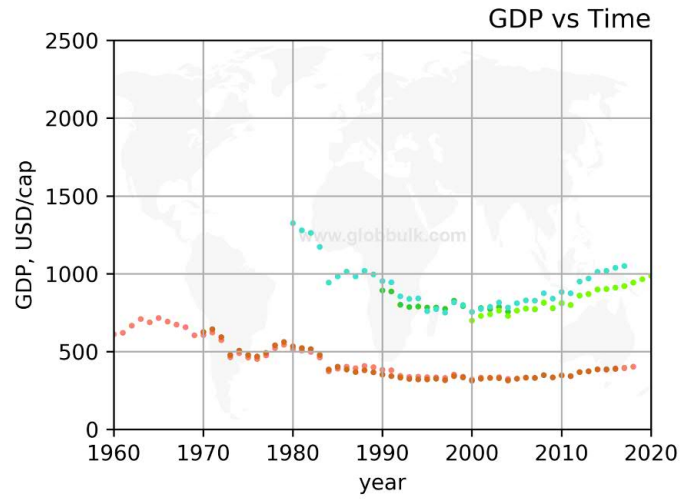
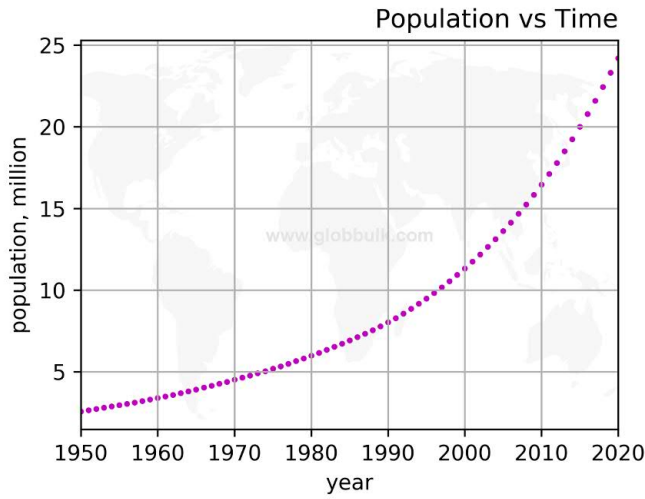


Consumption vs GDP





# Niger

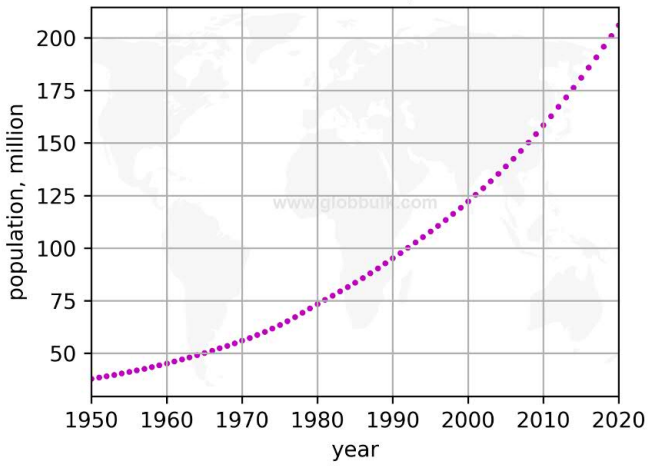




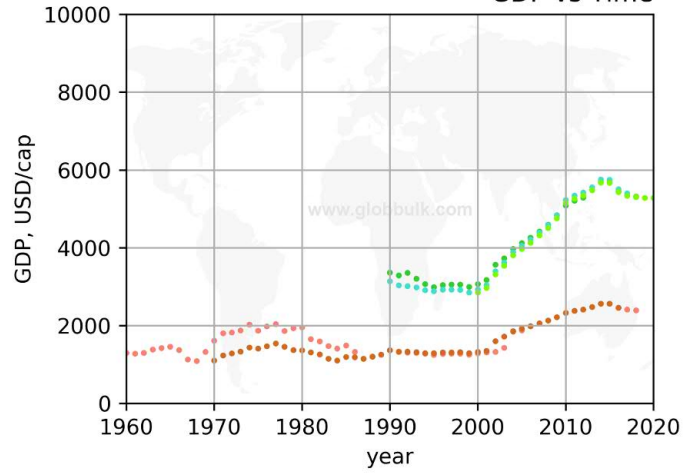


# Nigeria

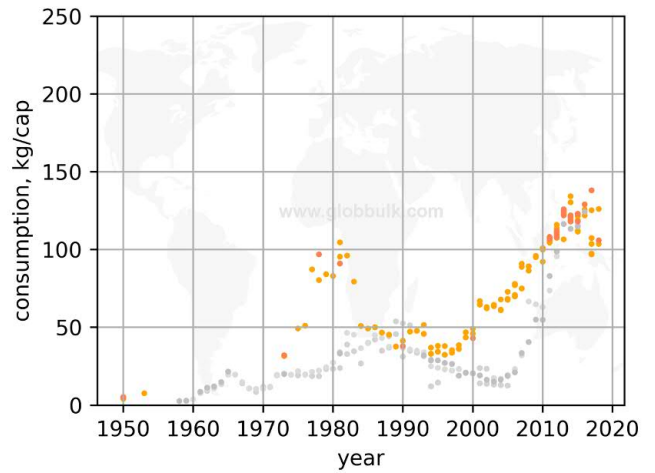
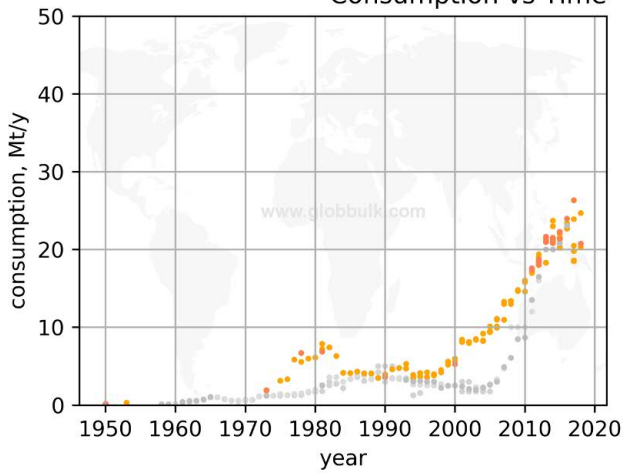
Population vs Time



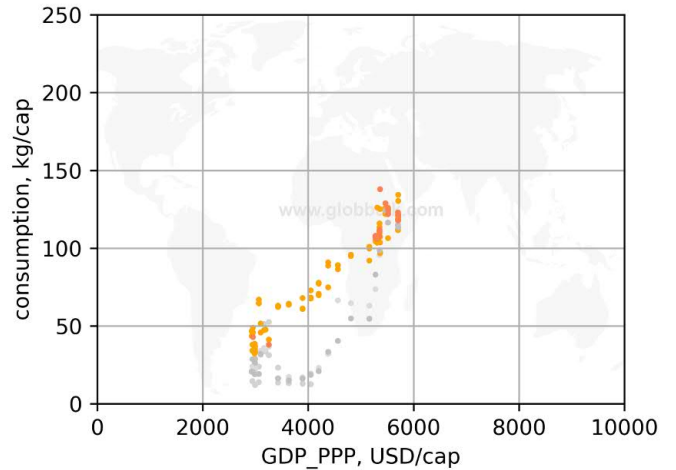
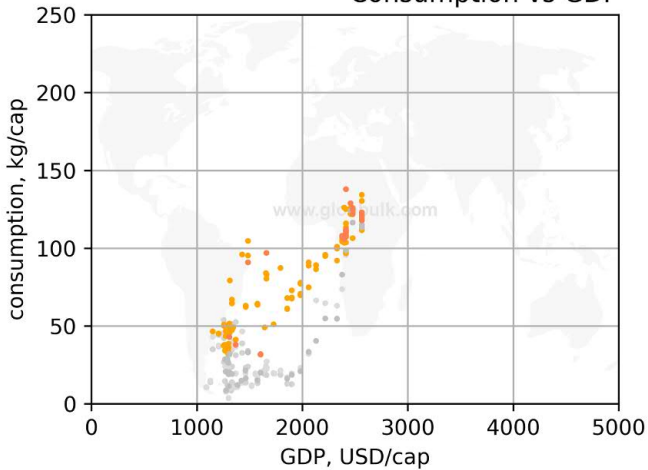
GDP vs Time



Consumption vs Time



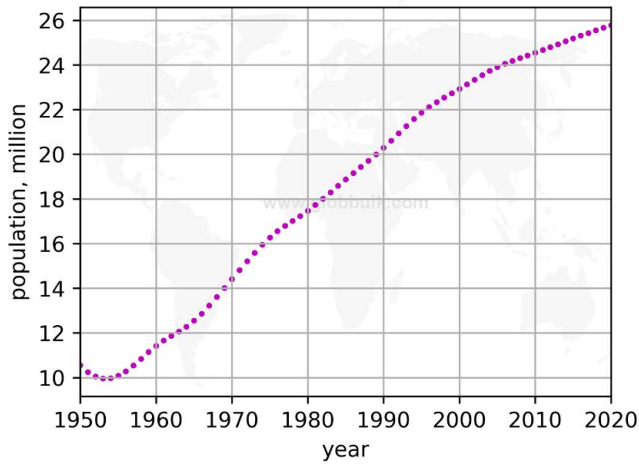
Consumption vs GDP



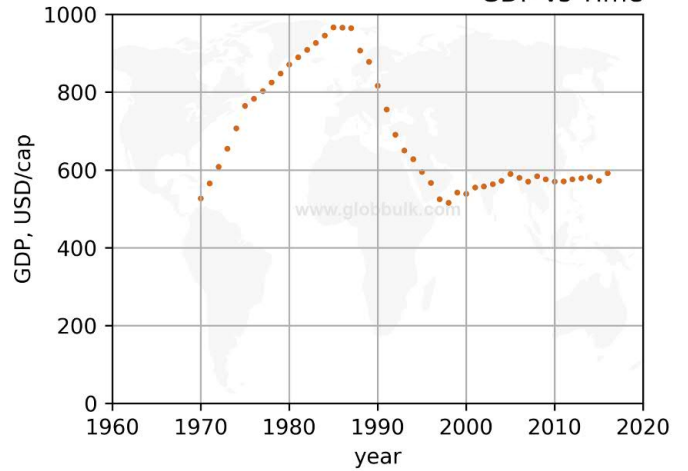


# North Korea

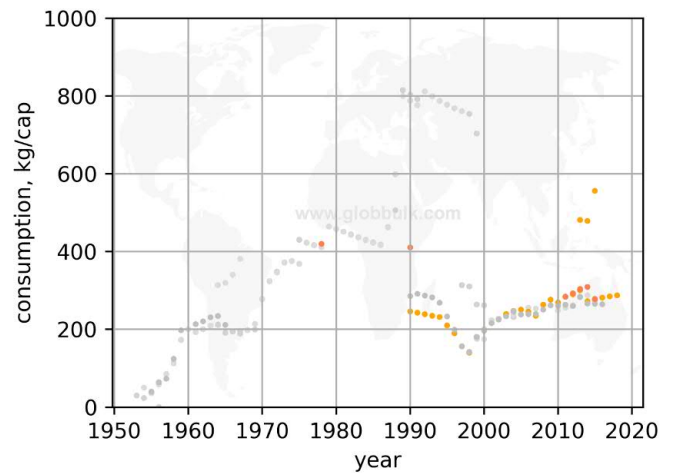
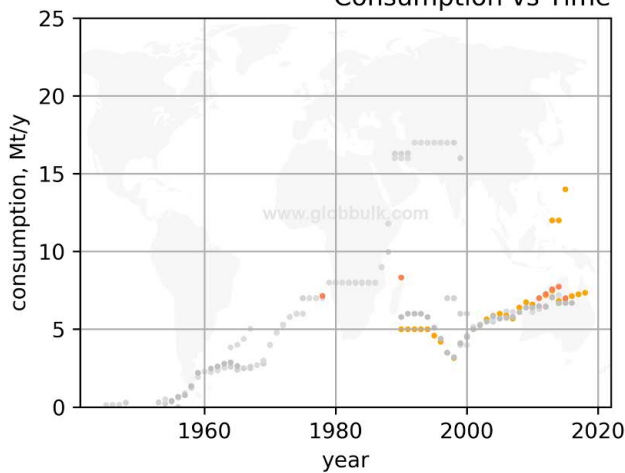
Population vs Time



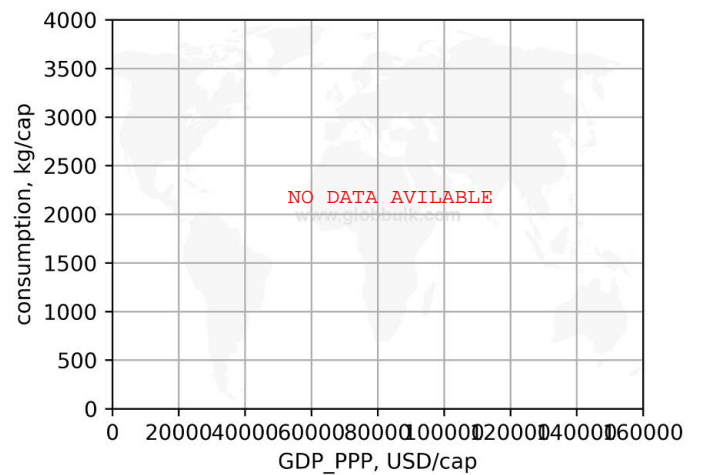
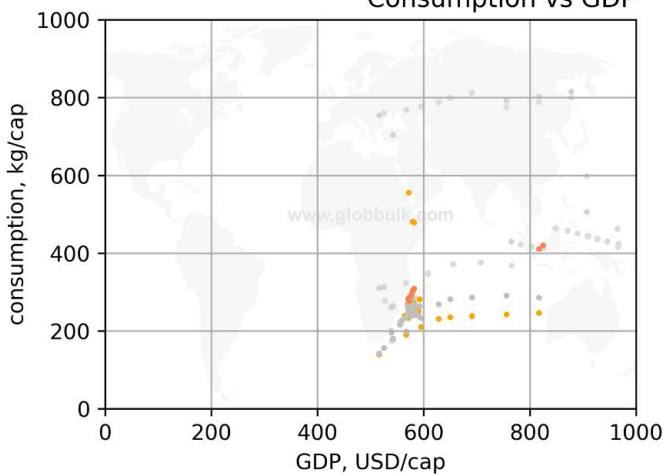
GDP vs Time



Consumption vs Time

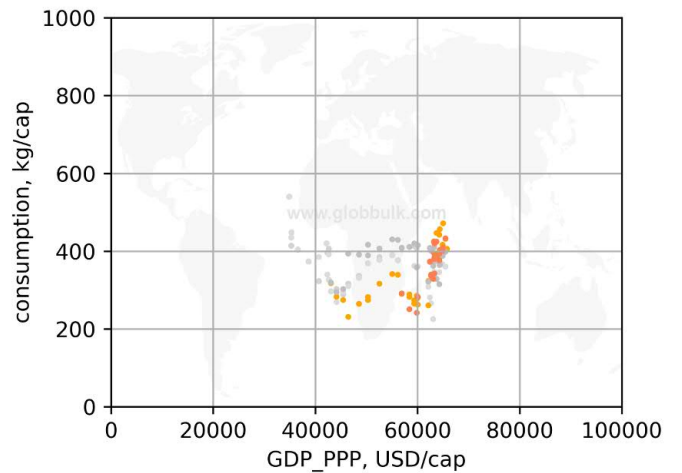
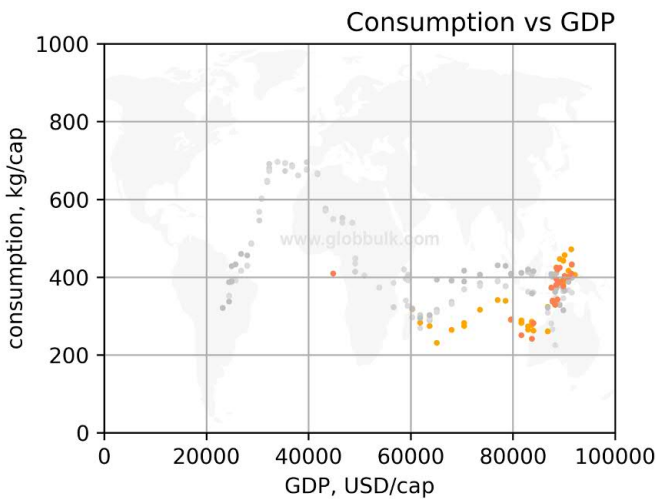
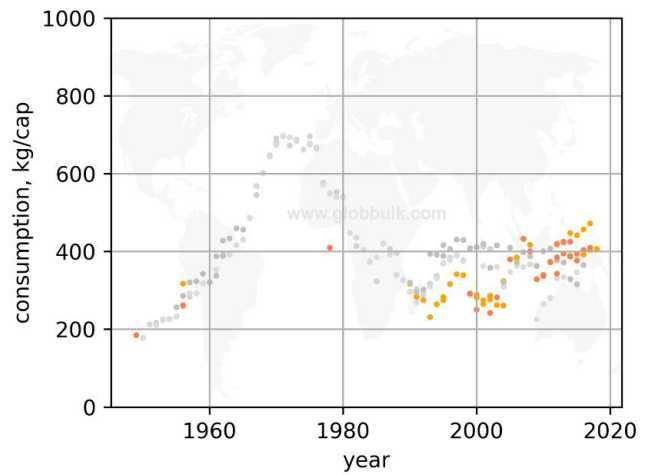
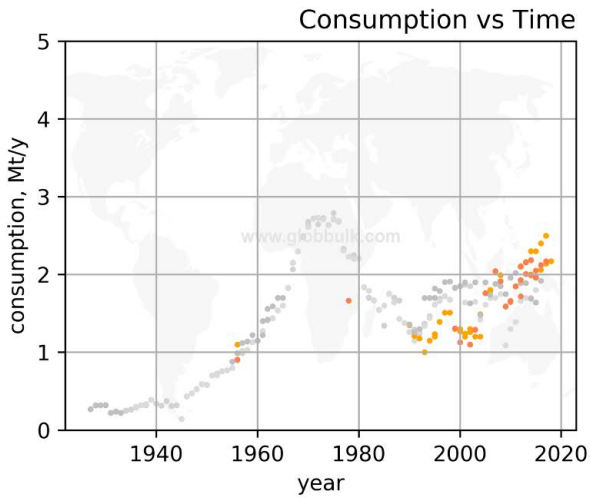
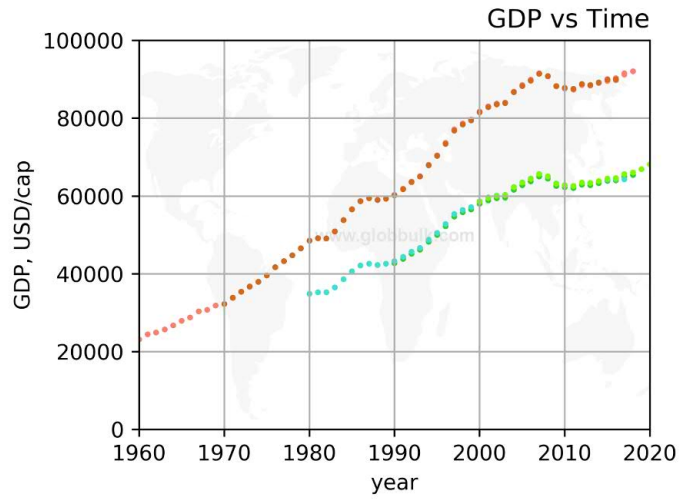
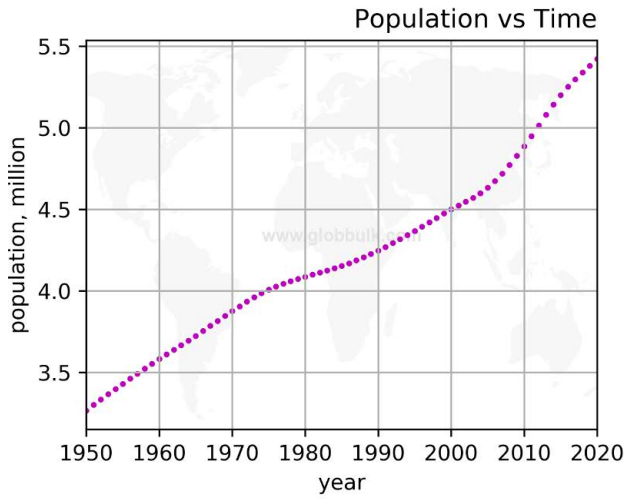


Consumption vs GDP





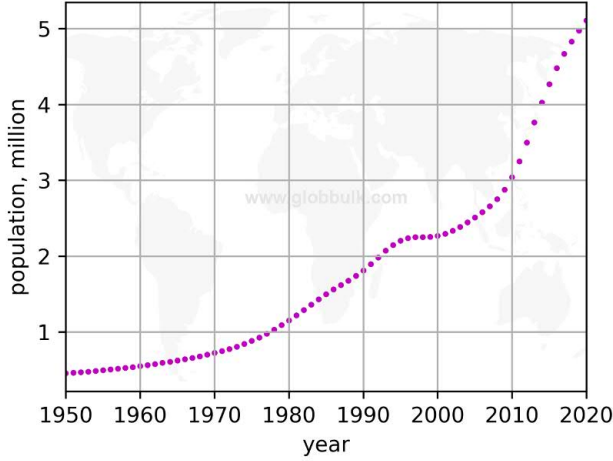
# Norway



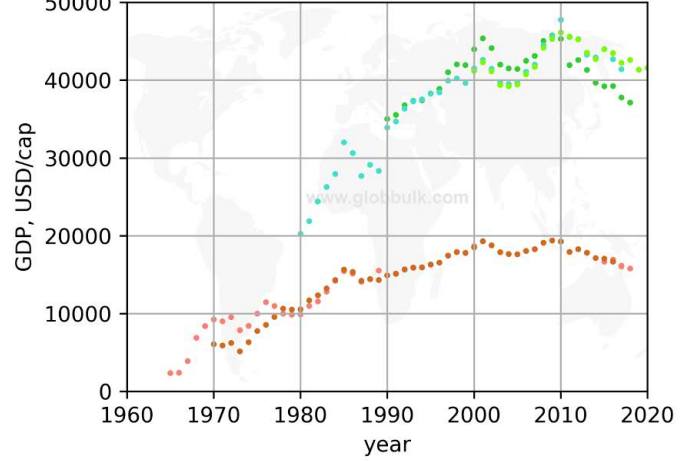


# Oman

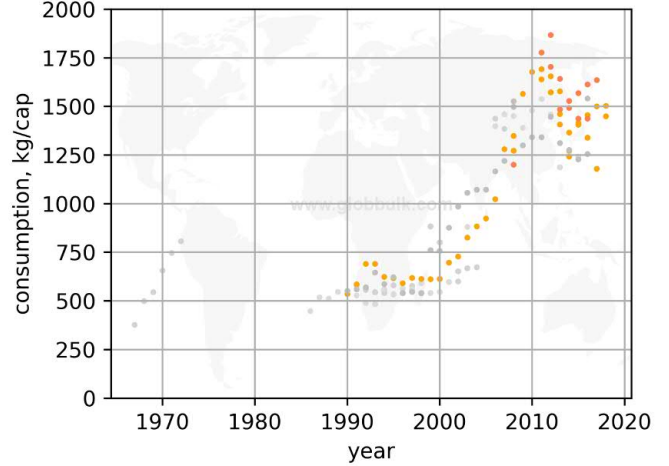
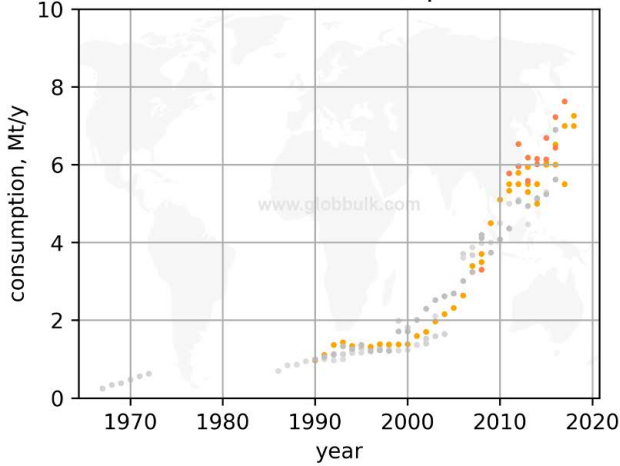
Population vs Time



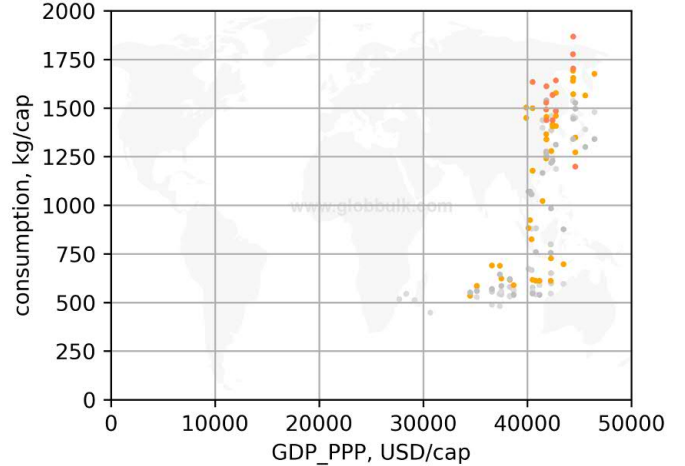
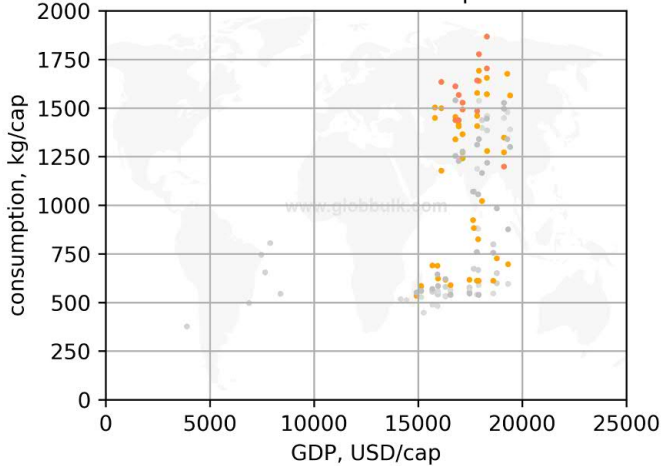
GDP vs Time



Consumption vs Time

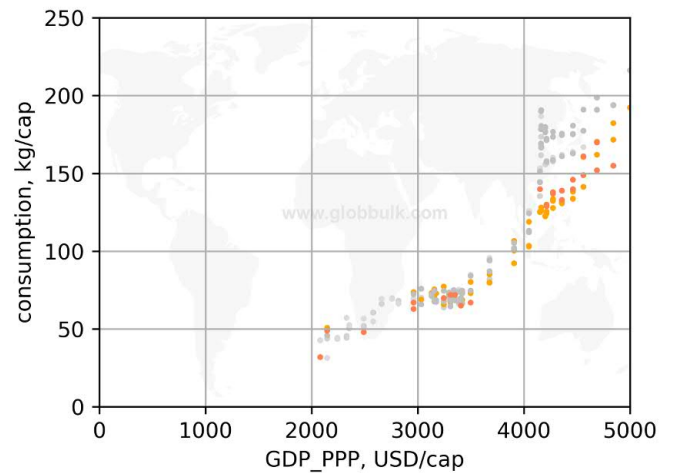
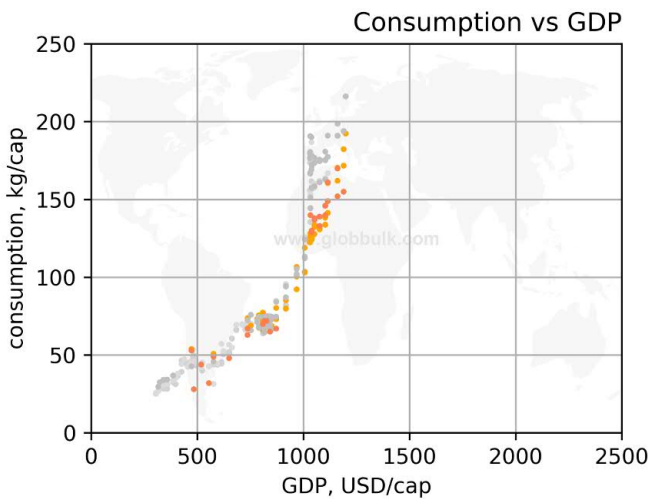
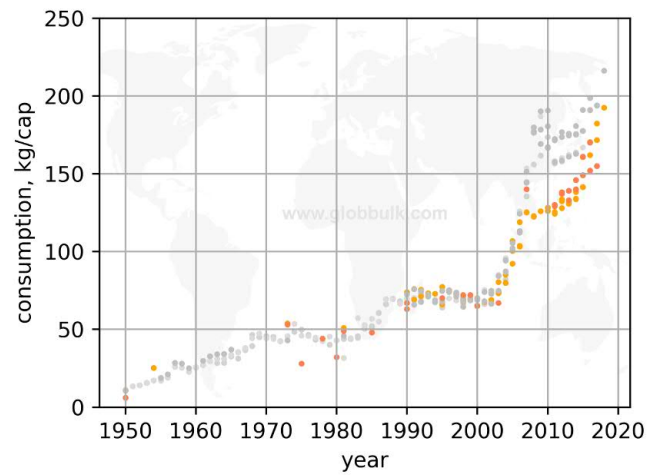
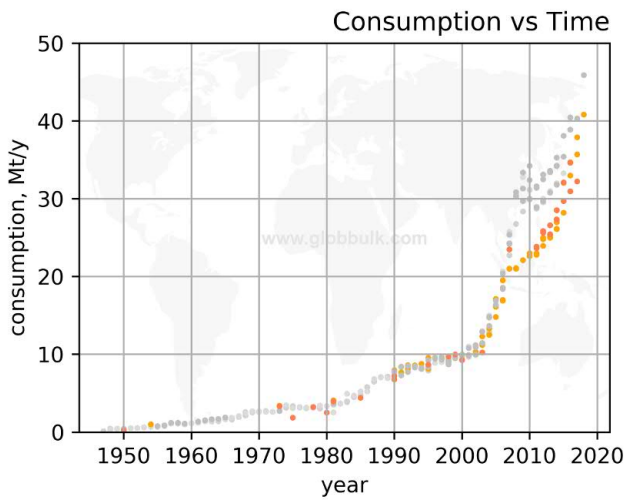
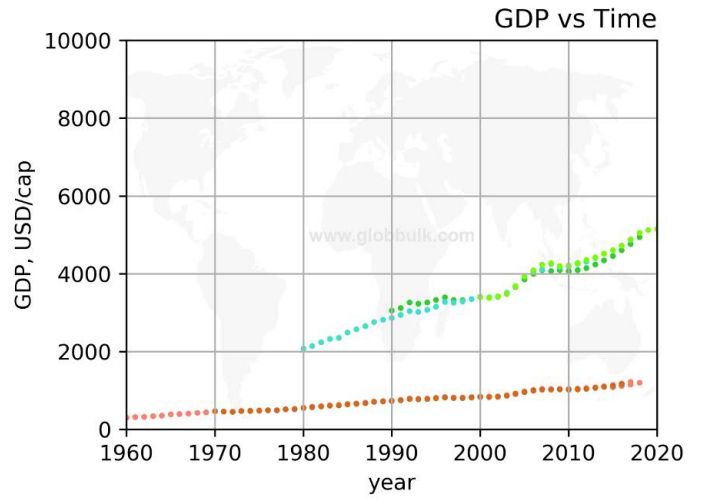
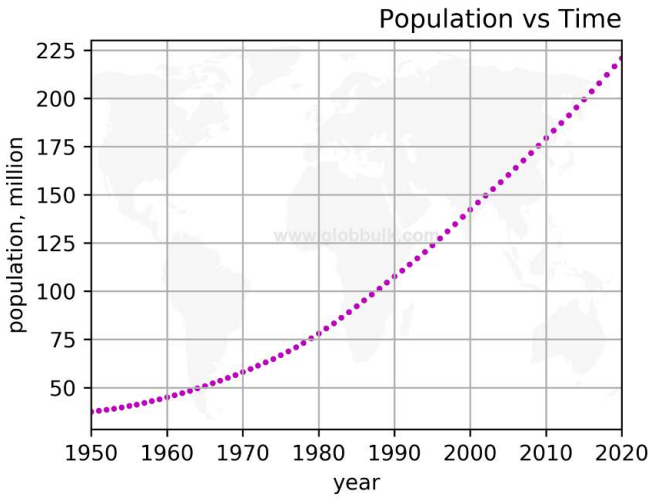


Consumption vs GDP





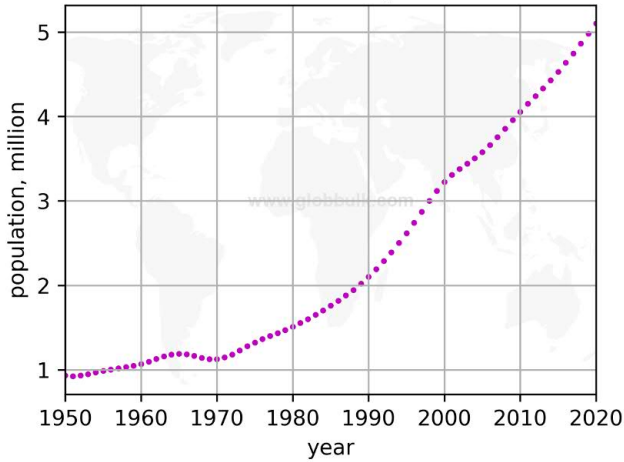
# Pakistan



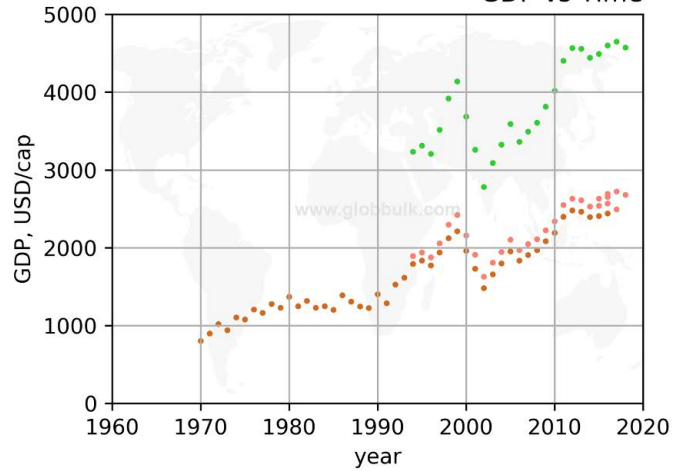


# Palestine

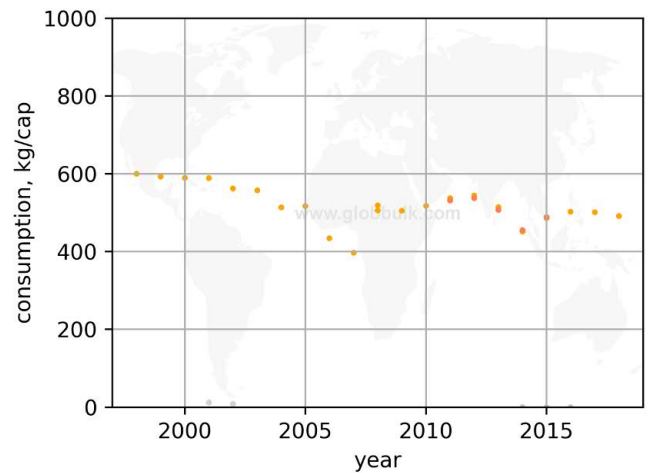
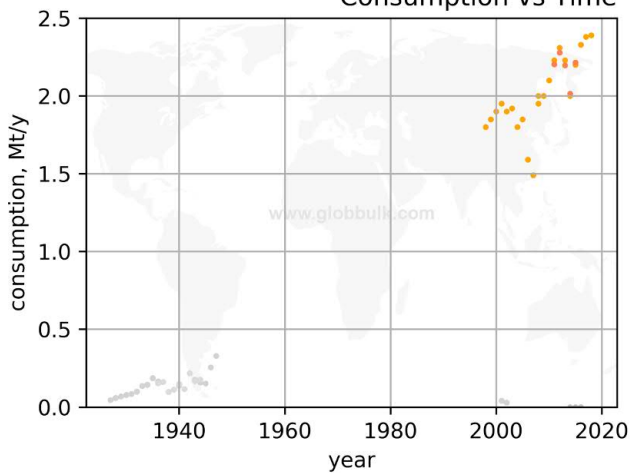
Population vs Time



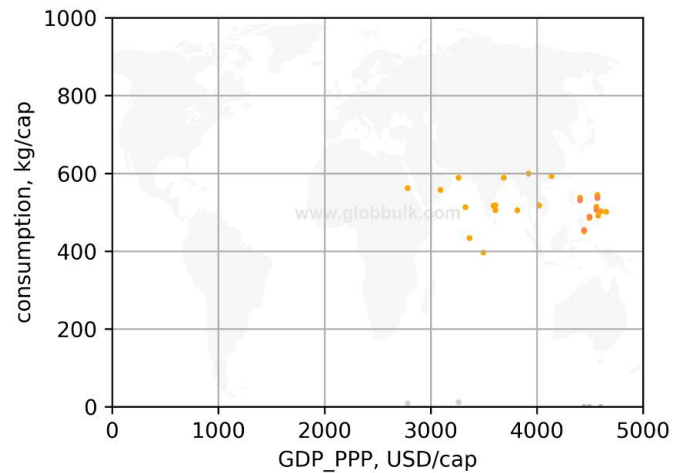
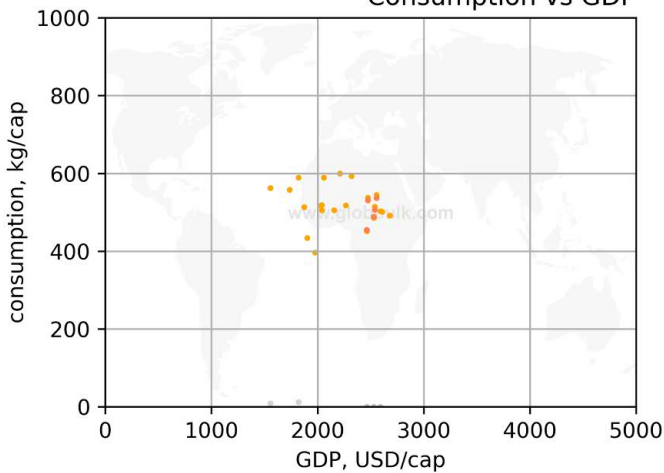
GDP vs Time



Consumption vs Time

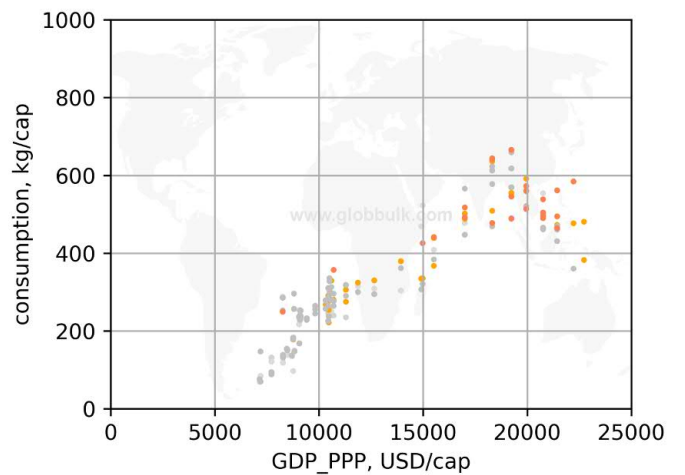
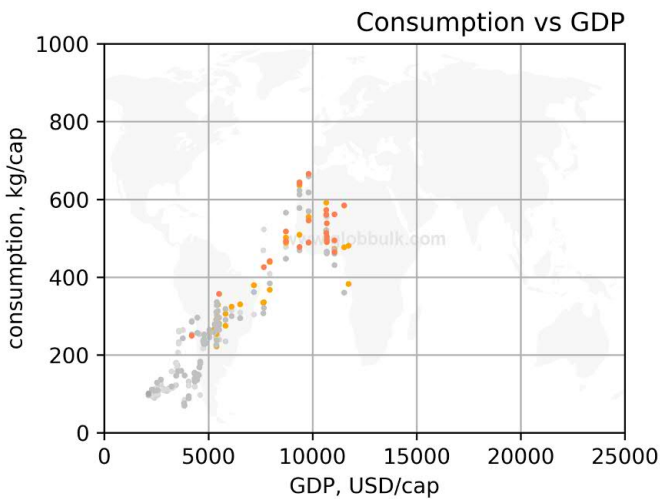
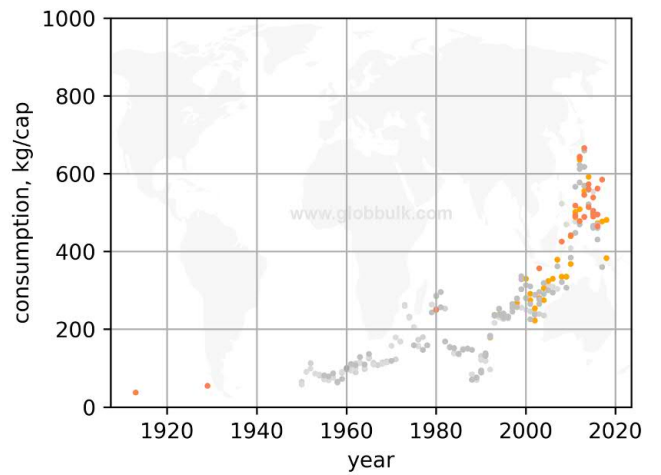
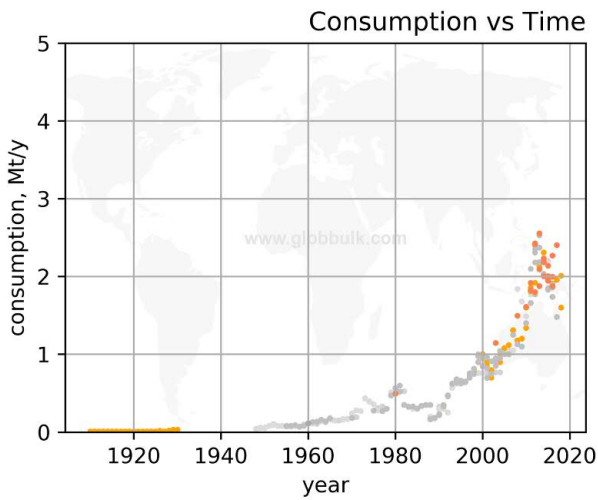
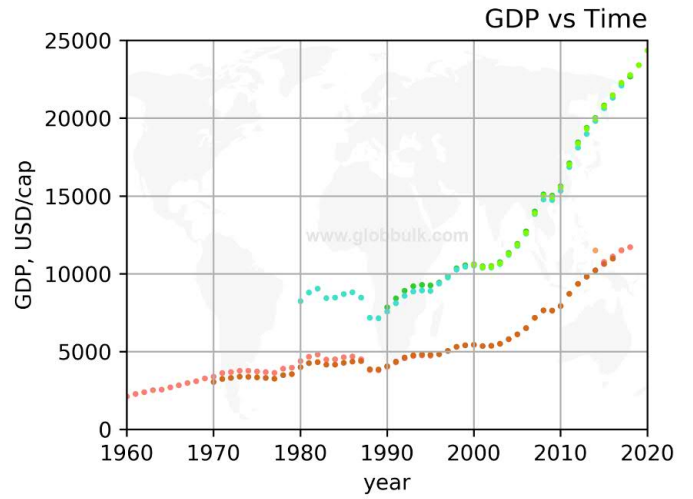
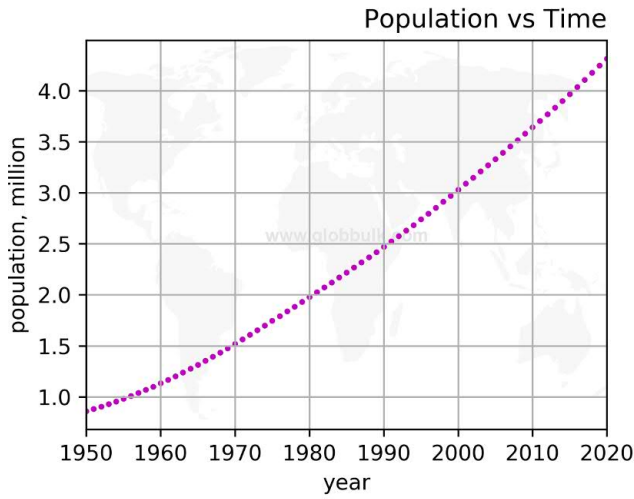


Consumption vs GDP





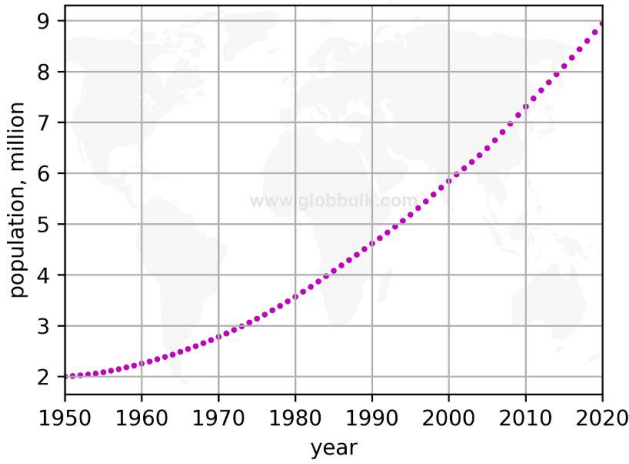
# Panama



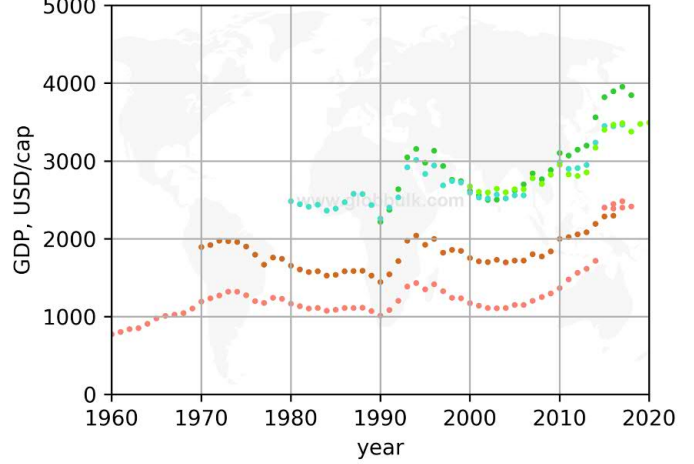


# Papua New G.

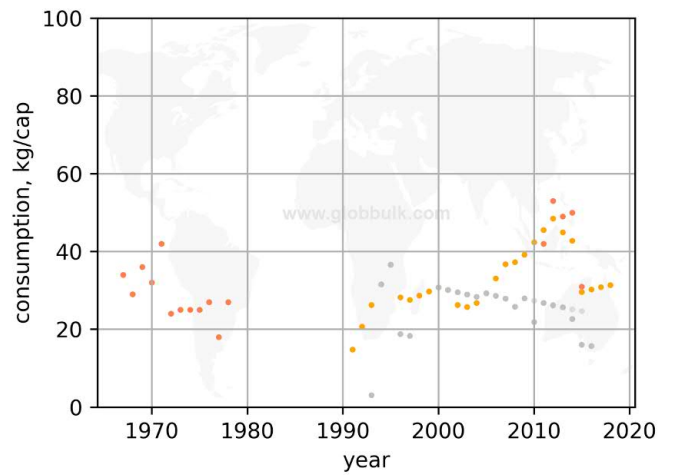
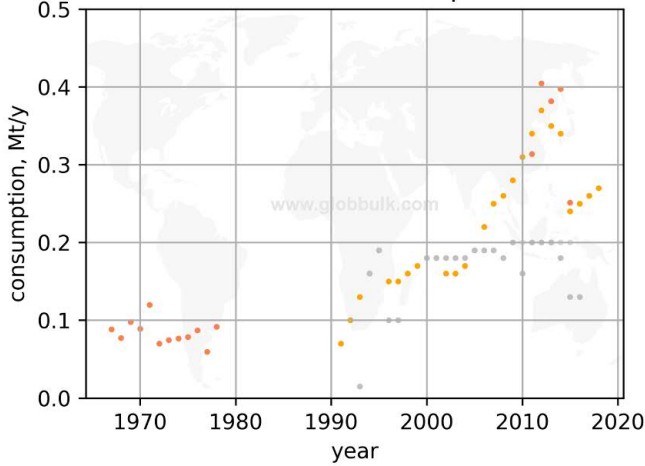
Population vs Time



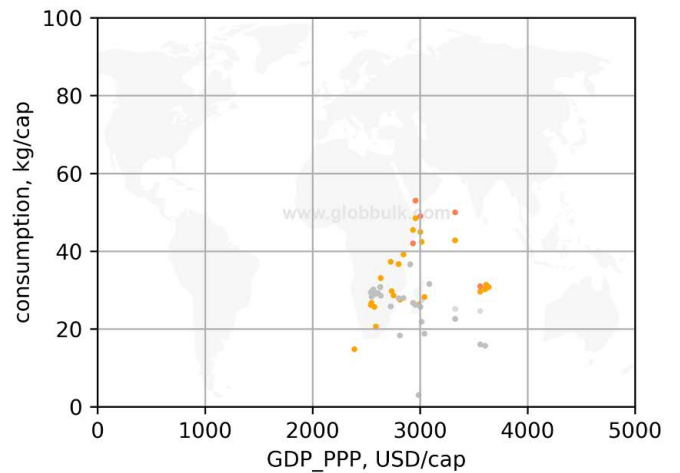
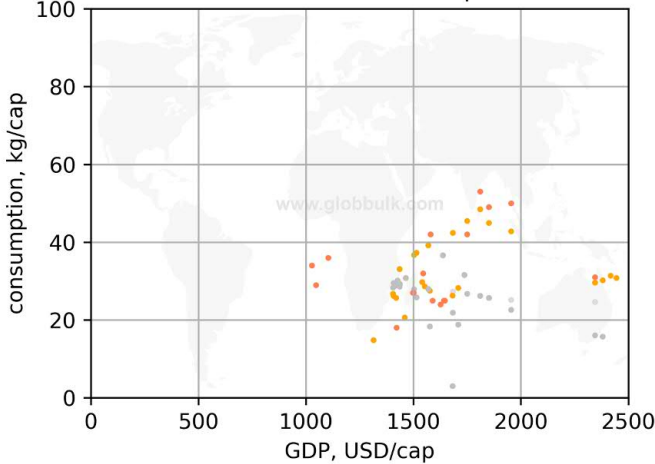
GDP vs Time



Consumption vs Time



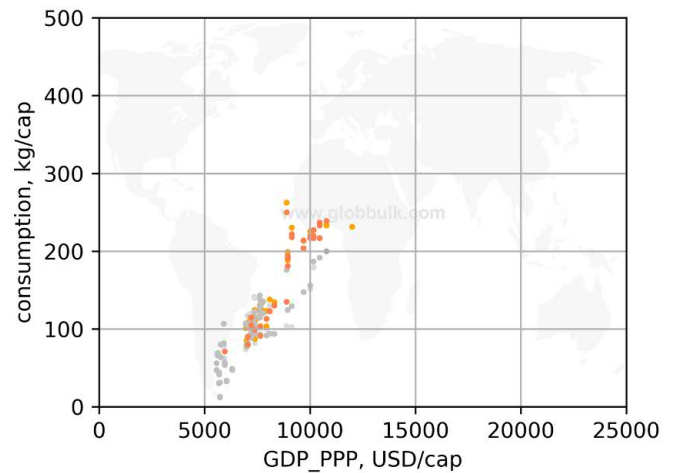
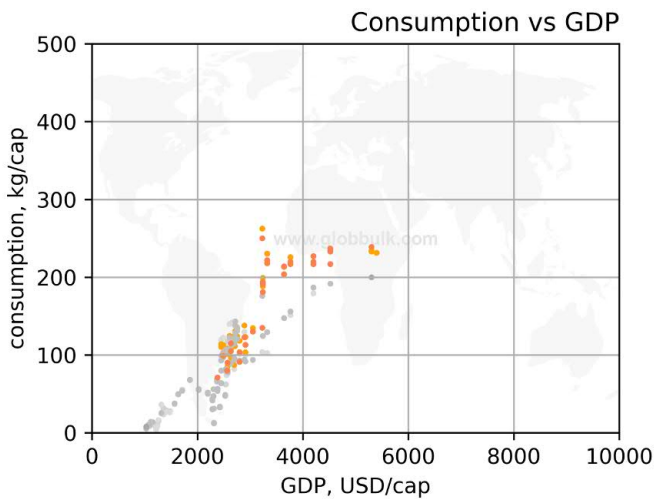
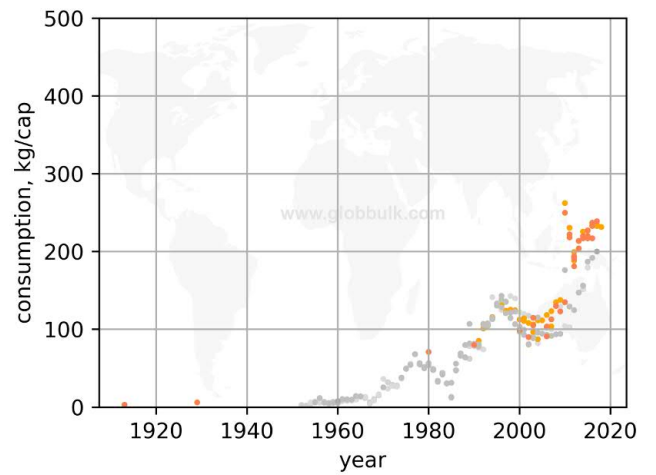
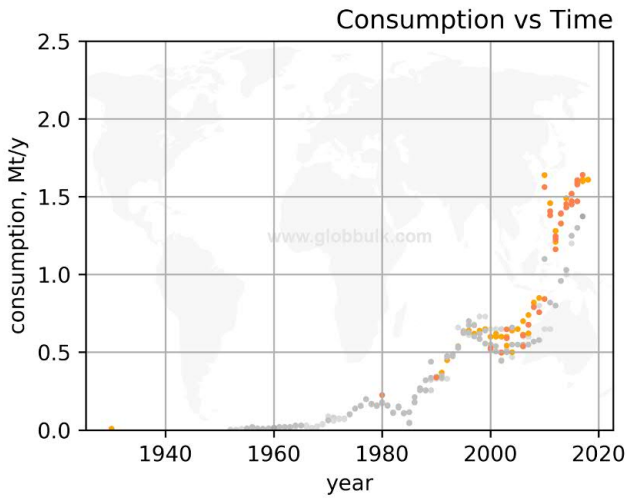
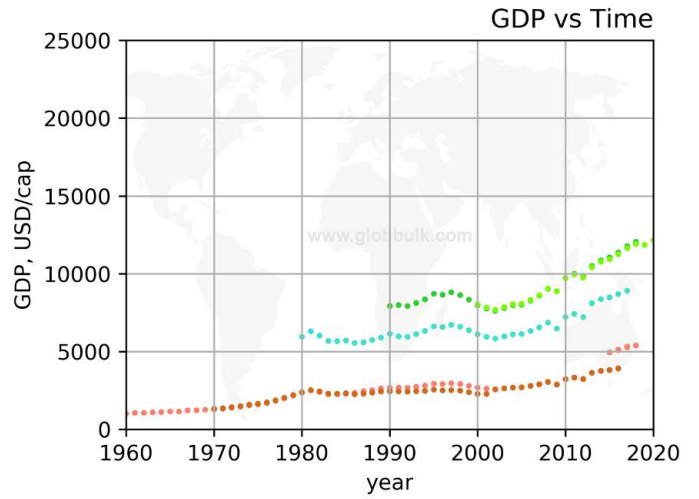
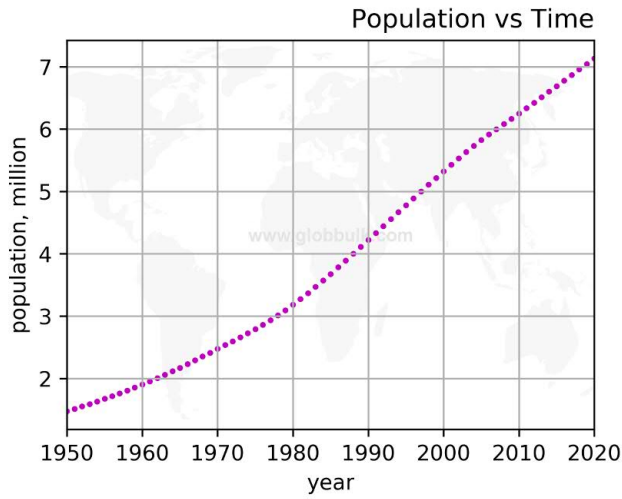
Consumption vs GDP







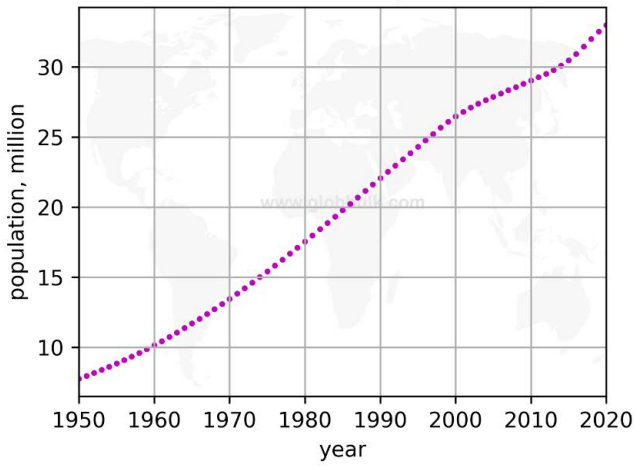
# Paraguay



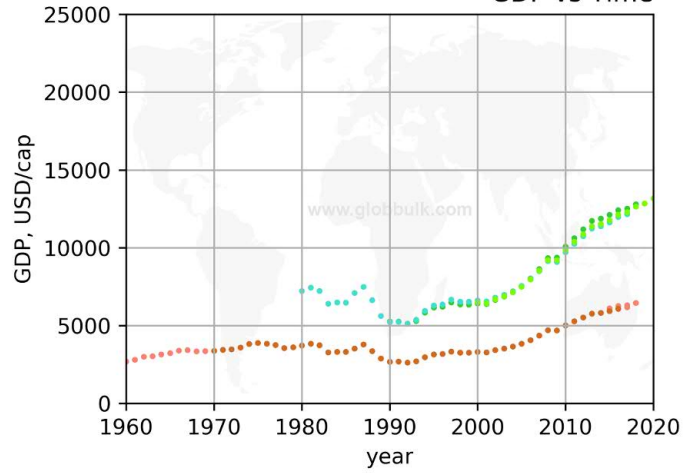


# Peru

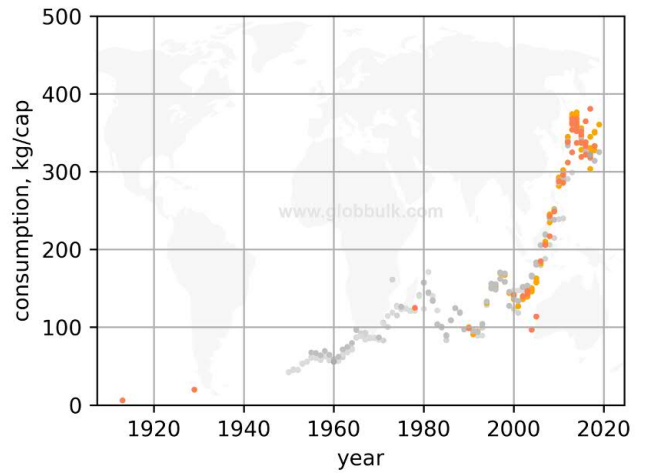
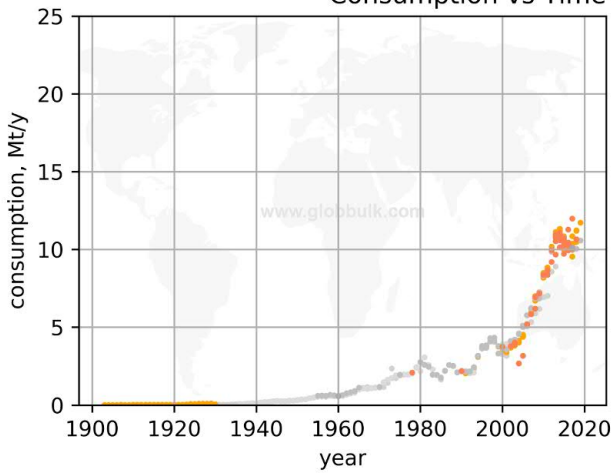
Population vs Time



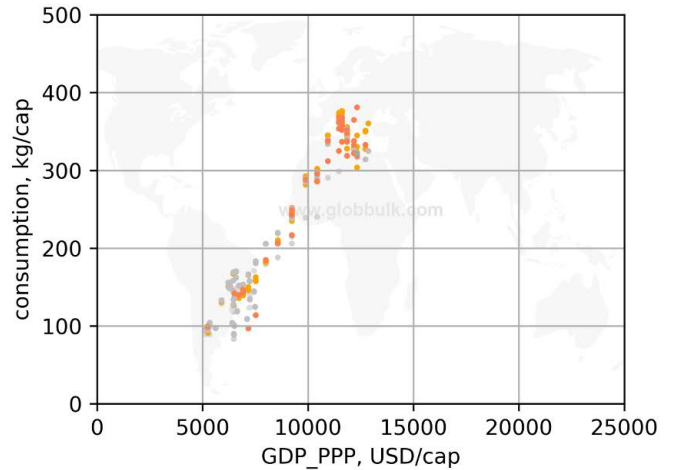
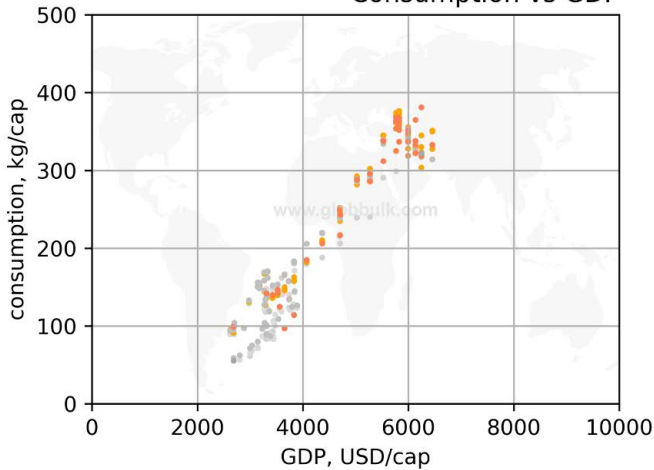
GDP vs Time



Consumption vs Time



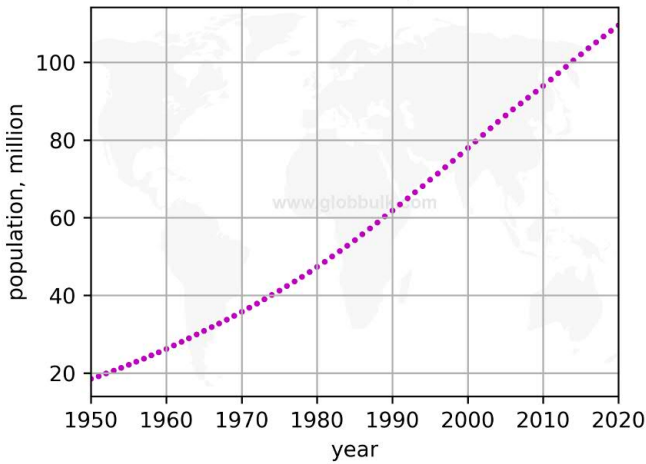
Consumption vs GDP



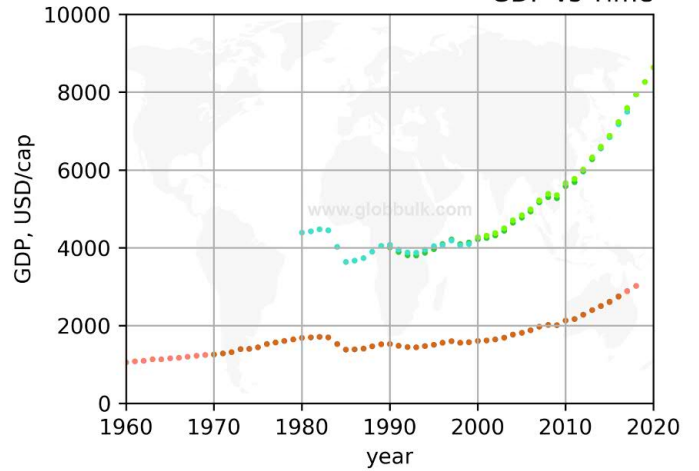


# Philippines

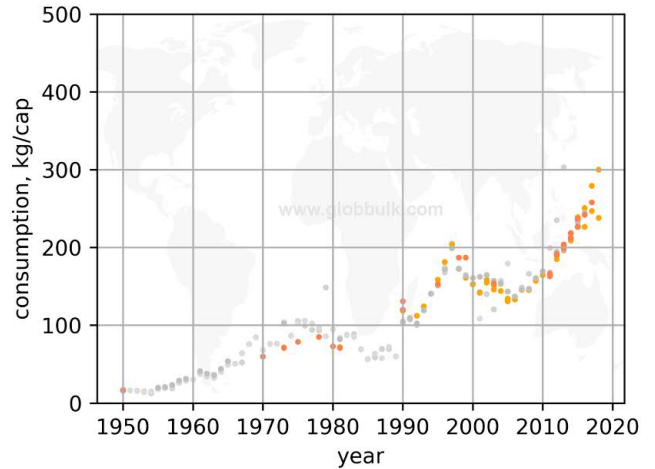
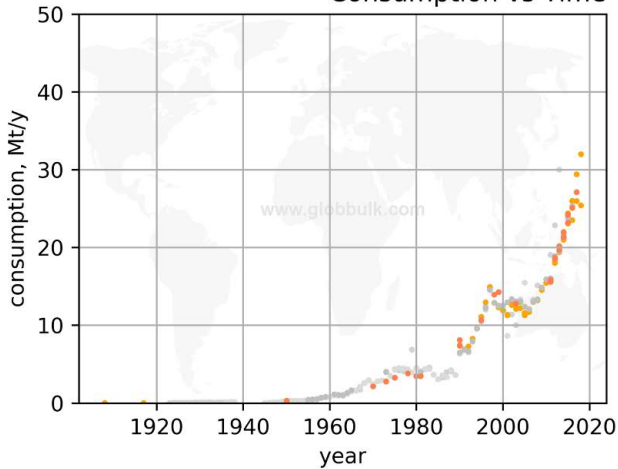
Population vs Time



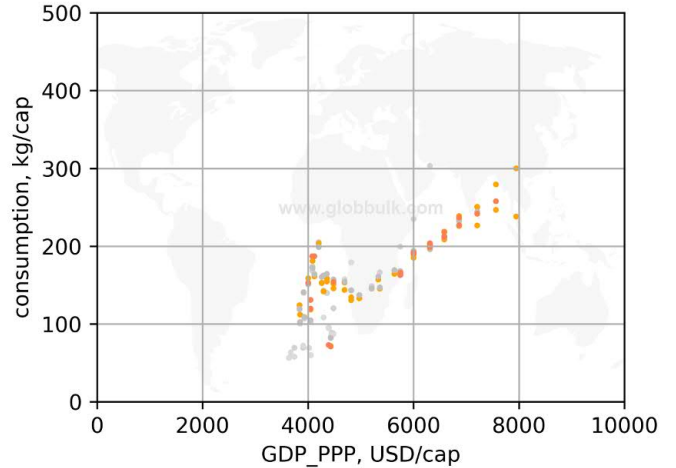
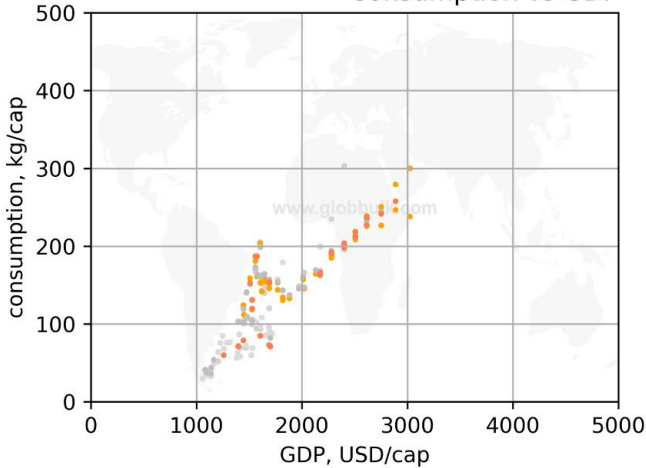
GDP vs Time



Consumption vs Time



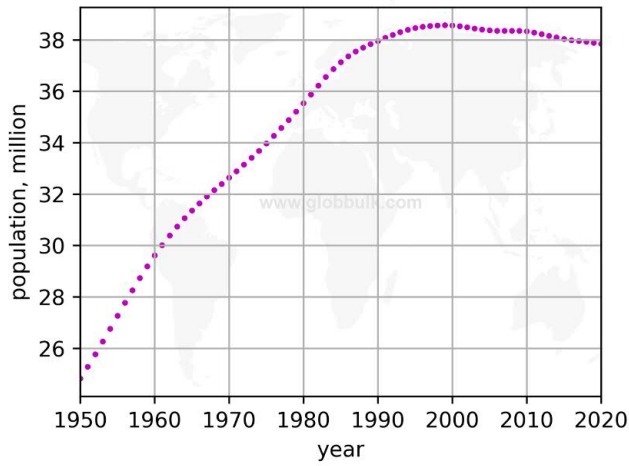
Consumption vs GDP



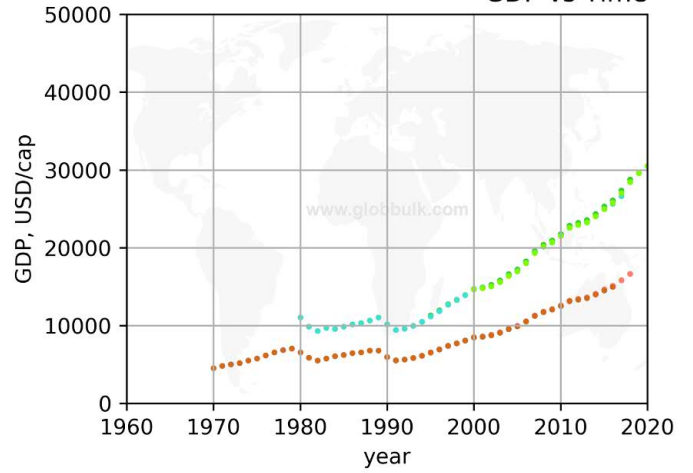


# Poland

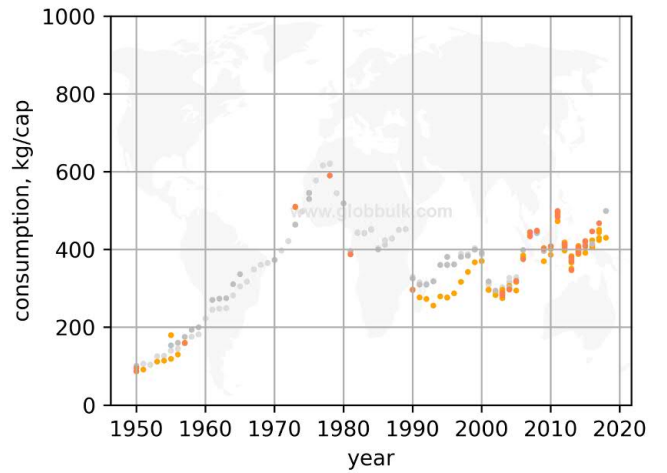
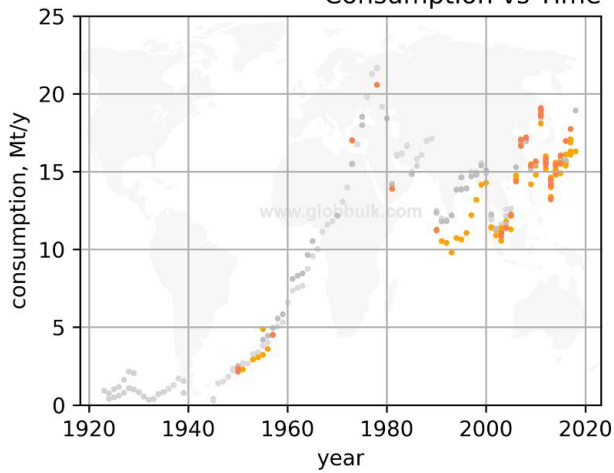
Population vs Time



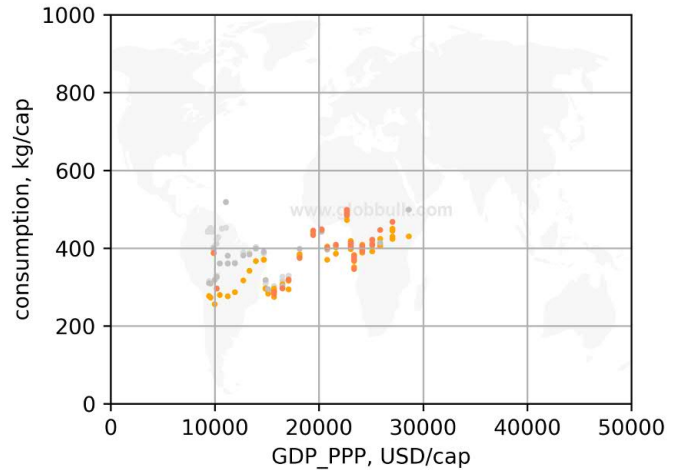
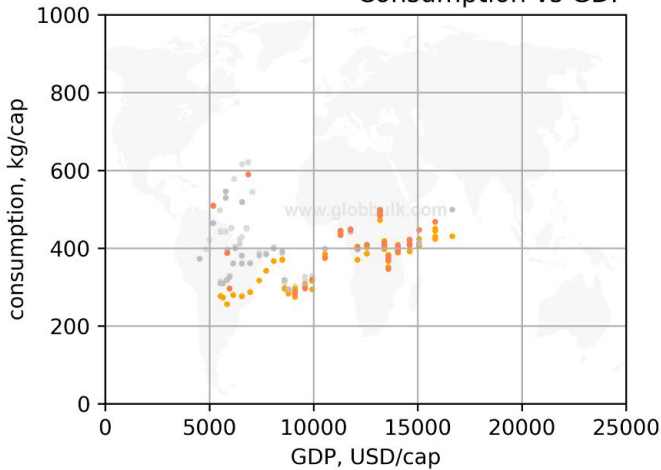
GDP vs Time



Consumption vs Time

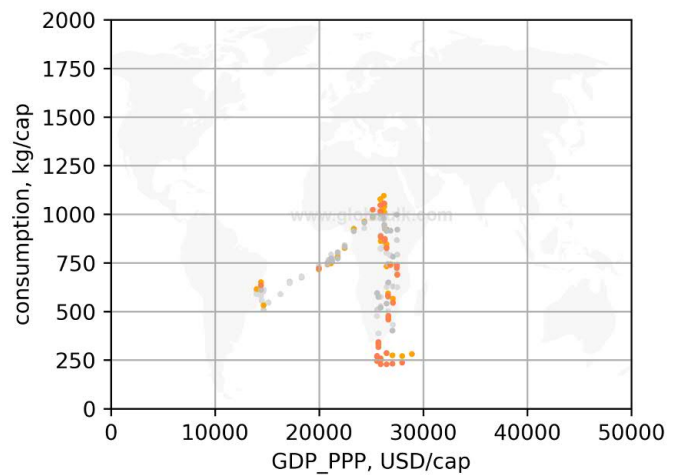
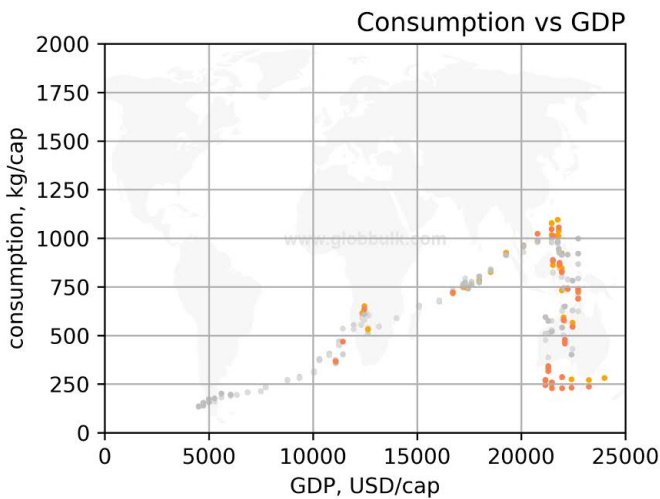
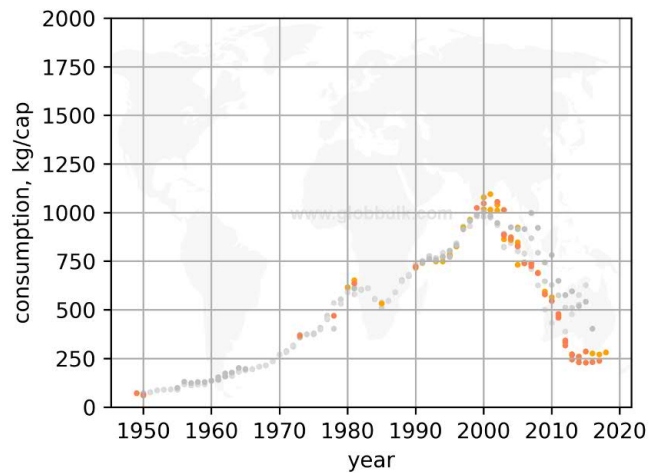
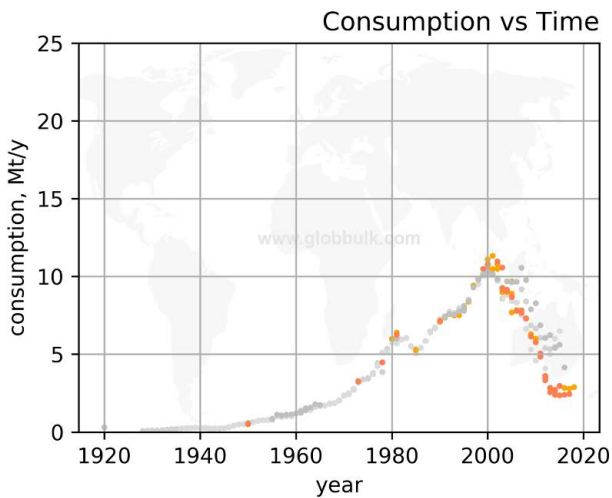
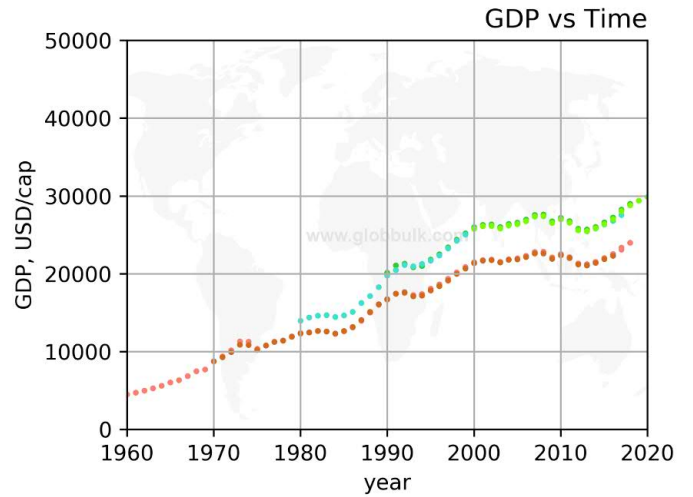
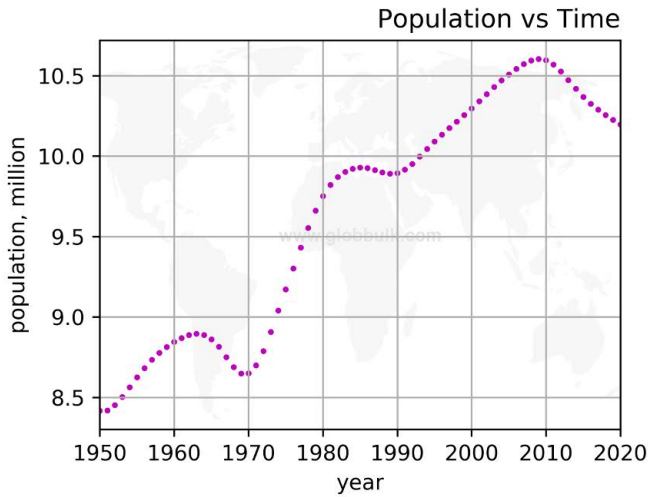


Consumption vs GDP



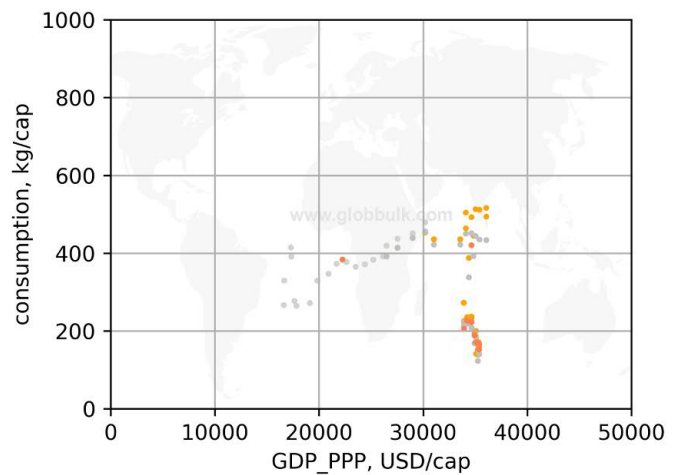
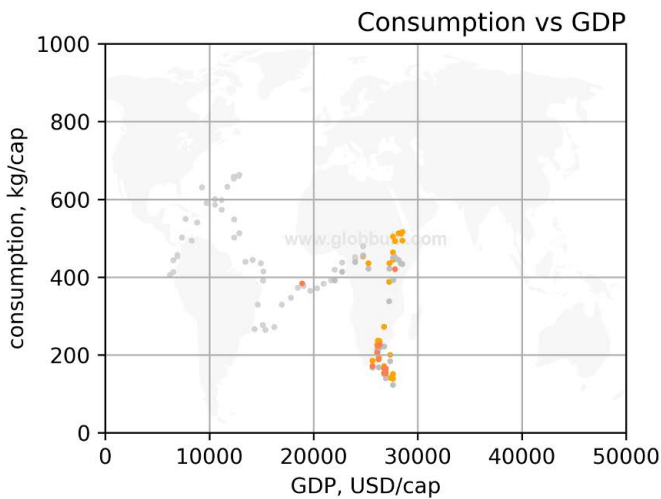
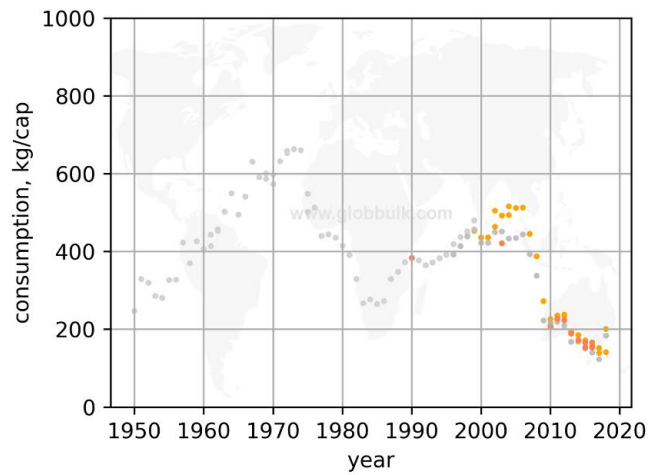
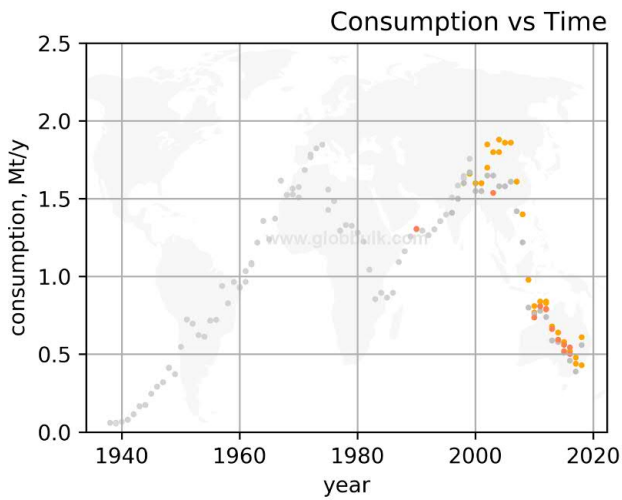
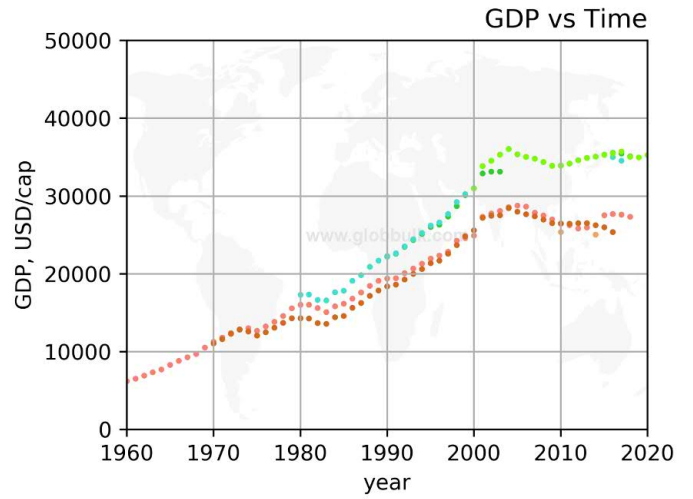
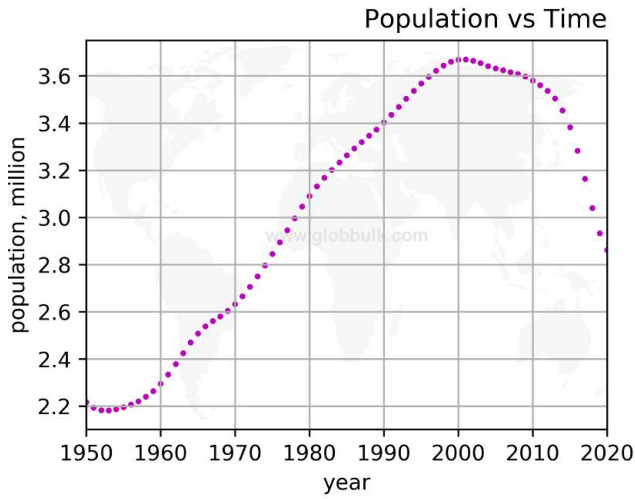


# Portugal



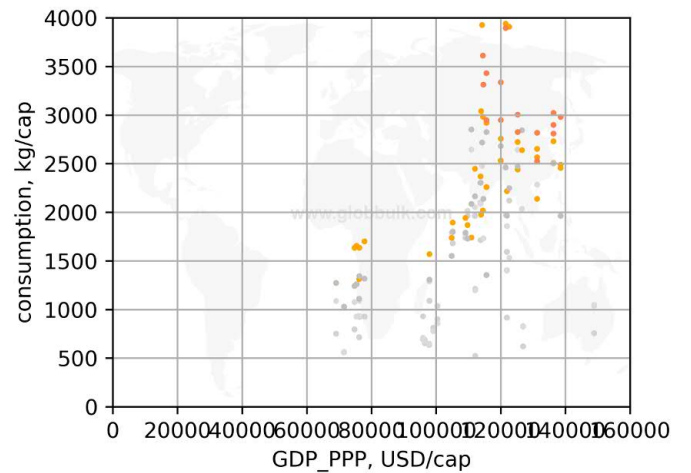
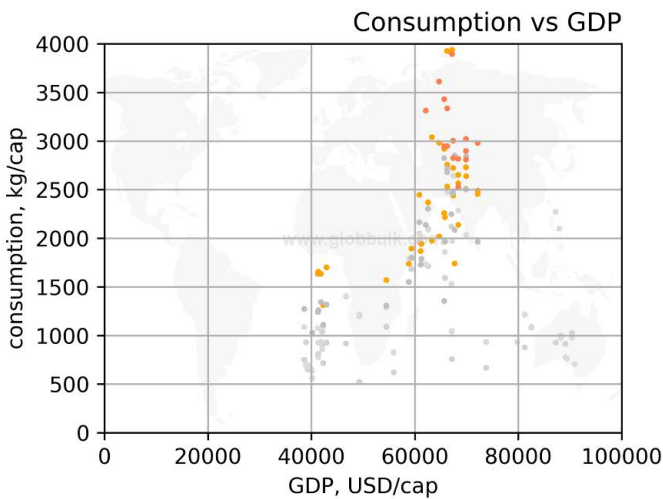
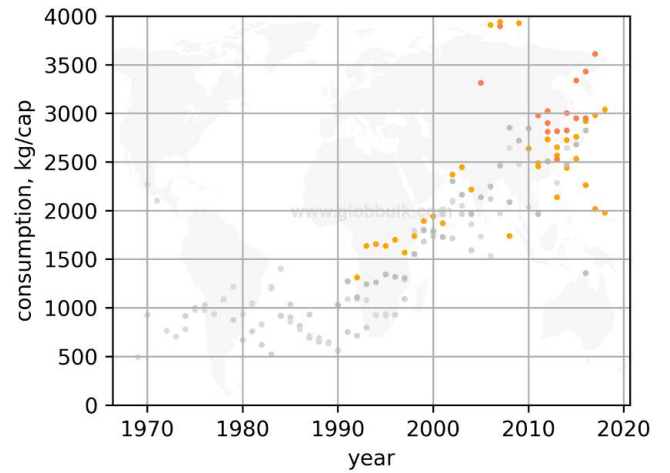
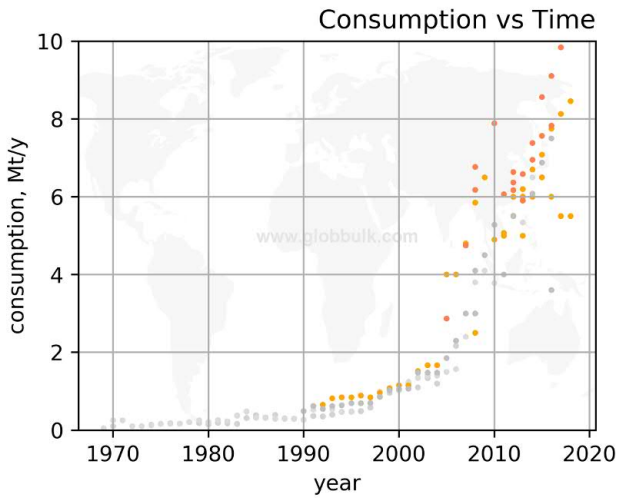
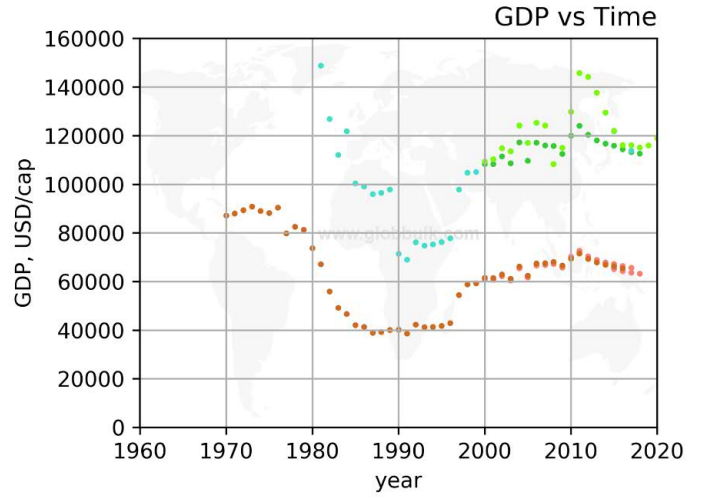
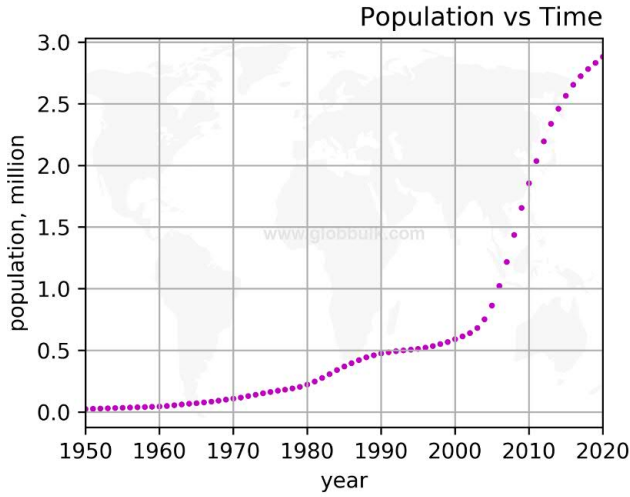


# Puerto Rico



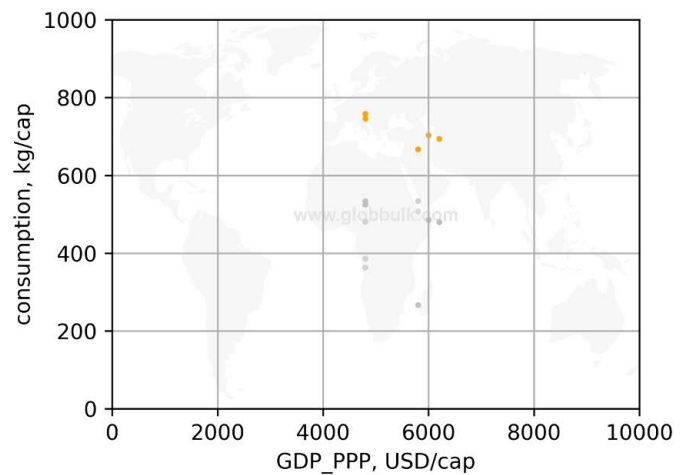
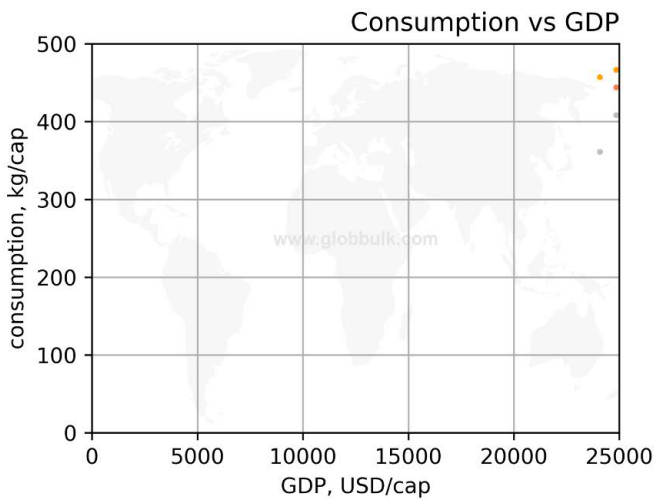
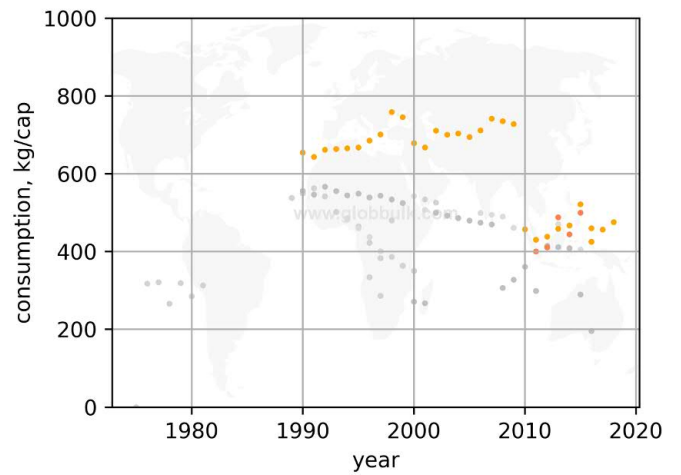
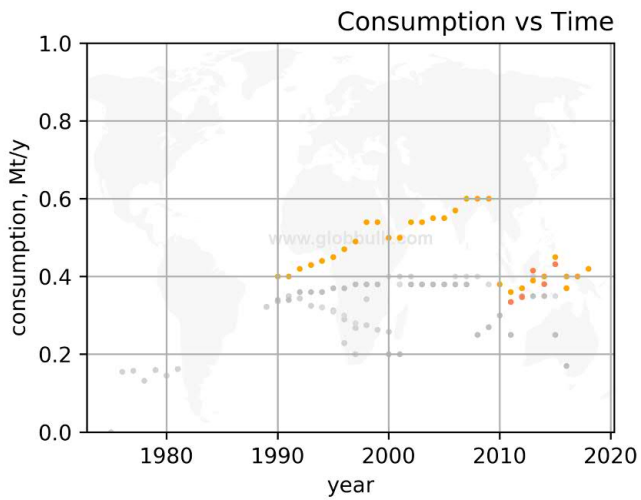
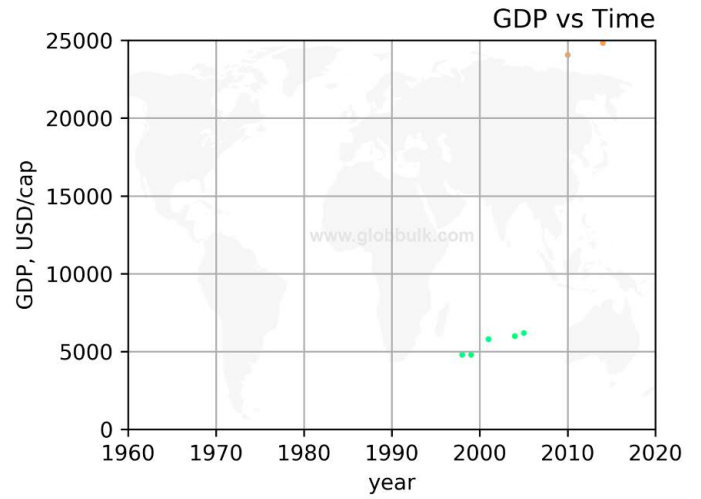
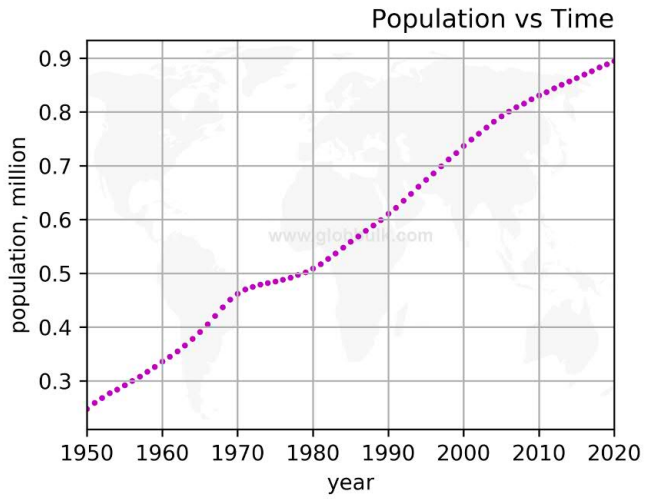


# Qatar





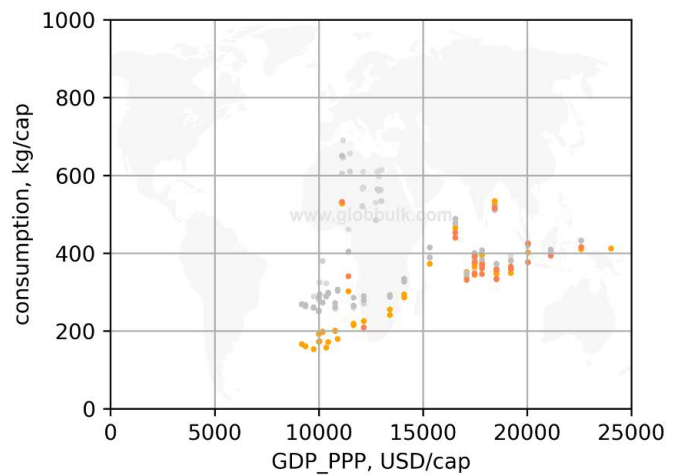
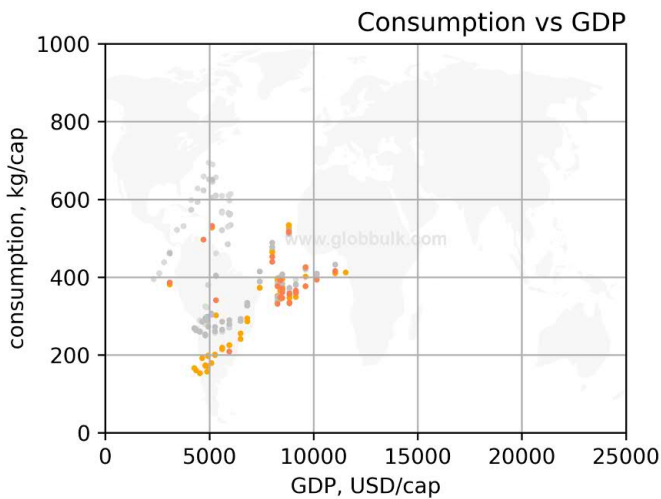
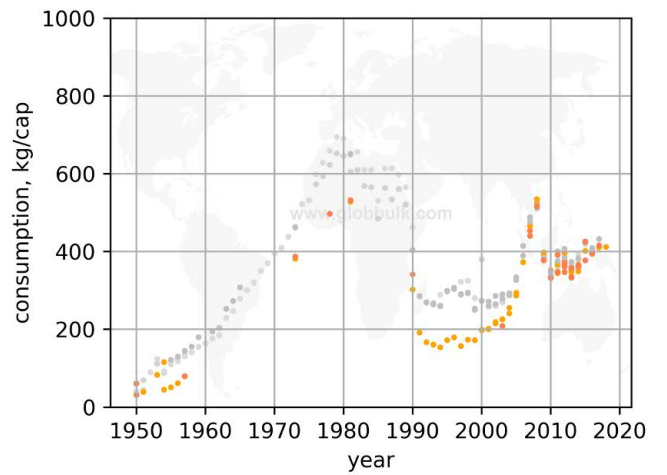
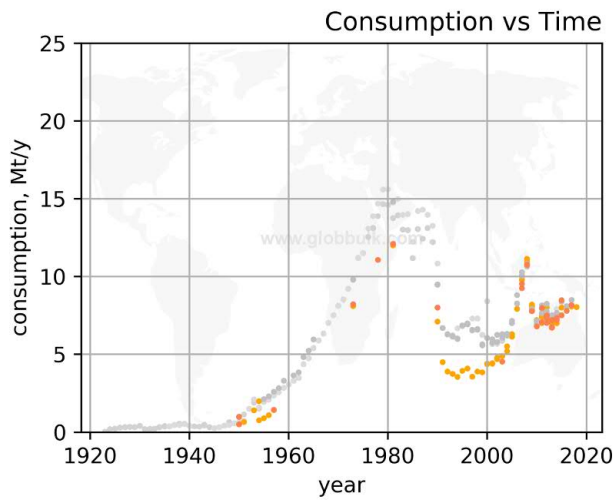
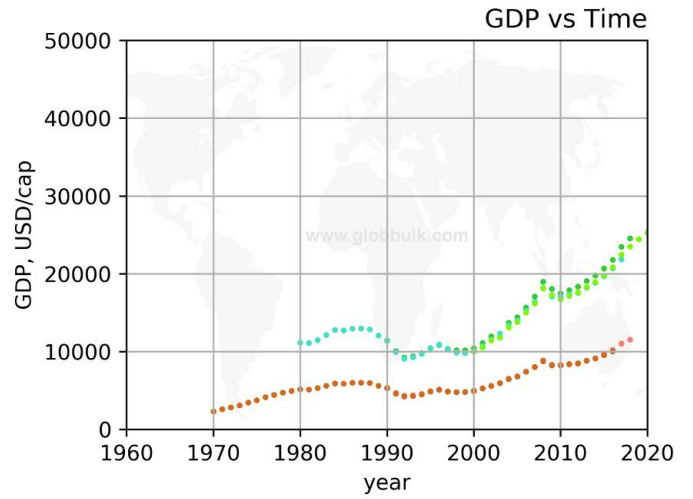
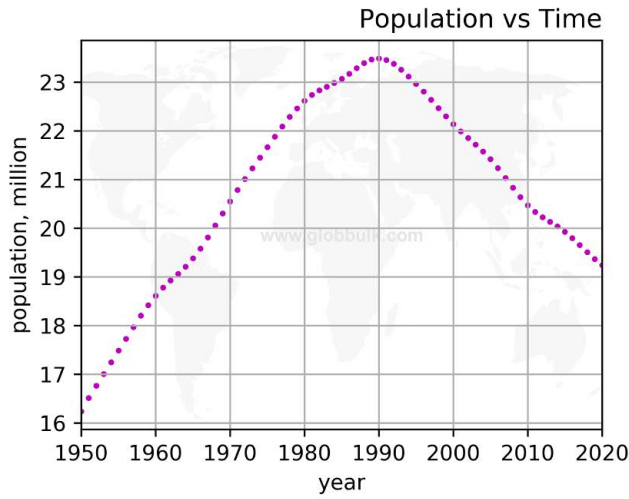
# Reunion







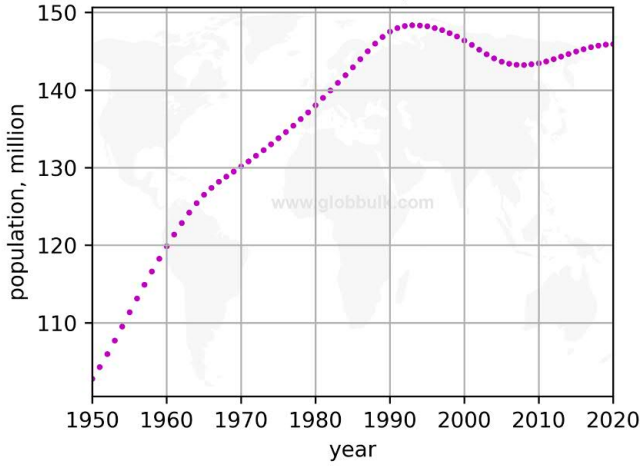
# Romania



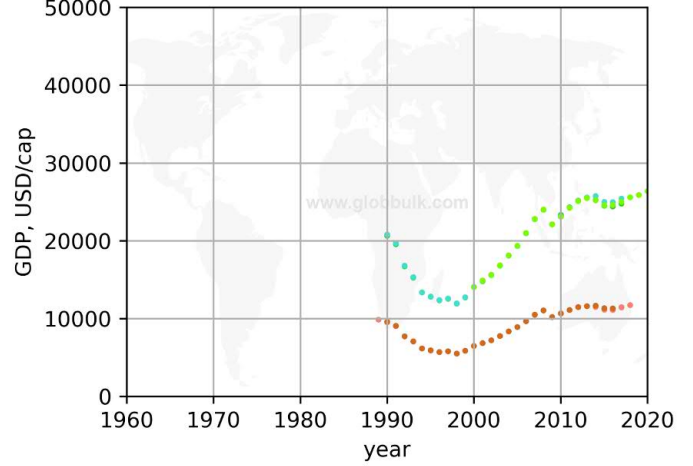


# Russia

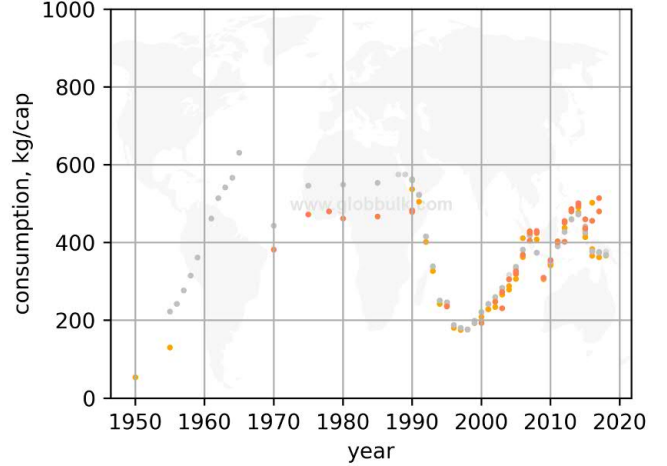
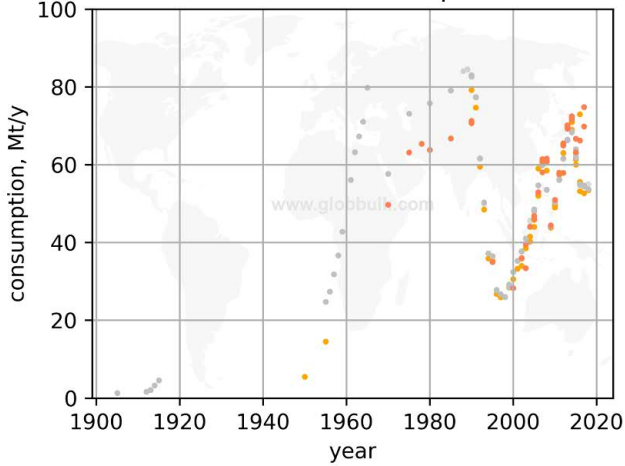
Population vs Time



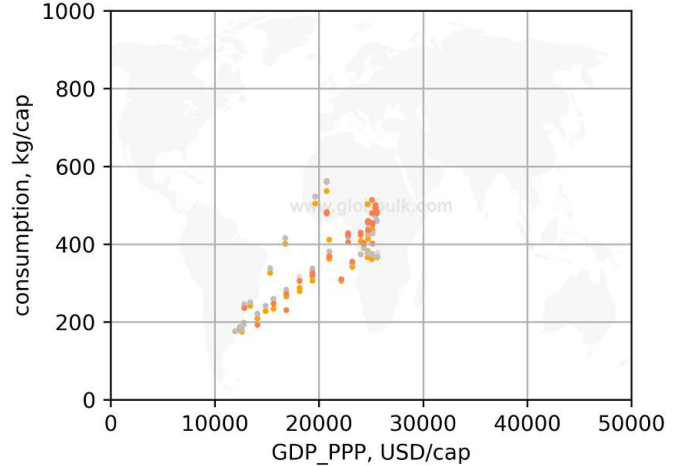
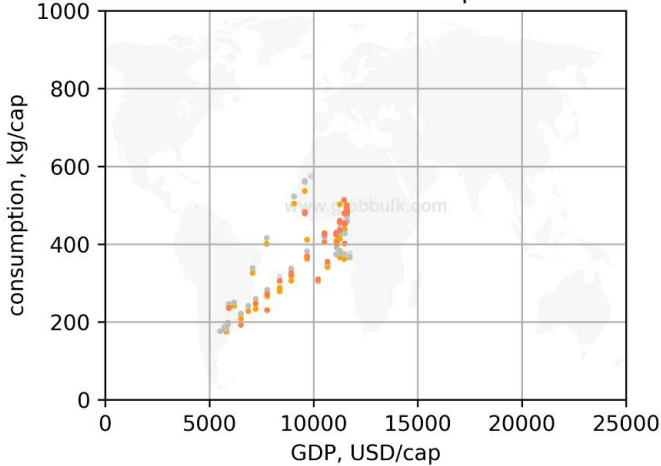
GDP vs Time



Consumption vs Time



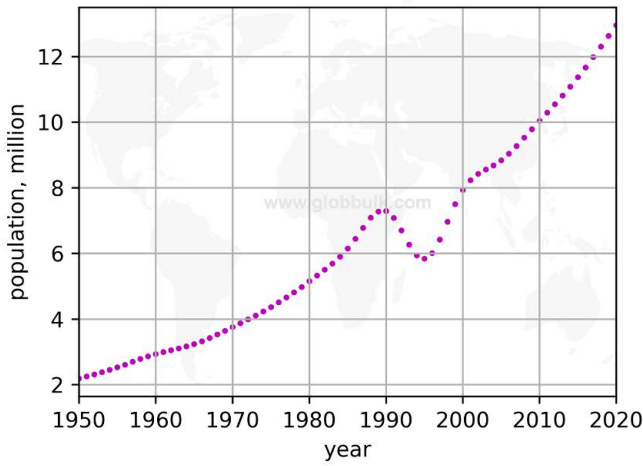
Consumption vs GDP



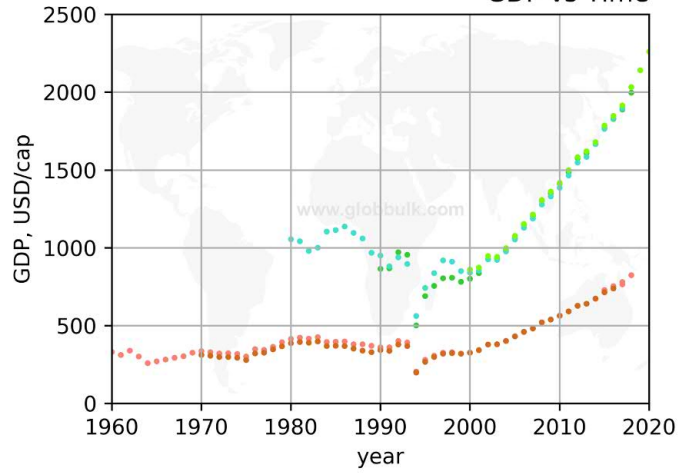


# Rwanda

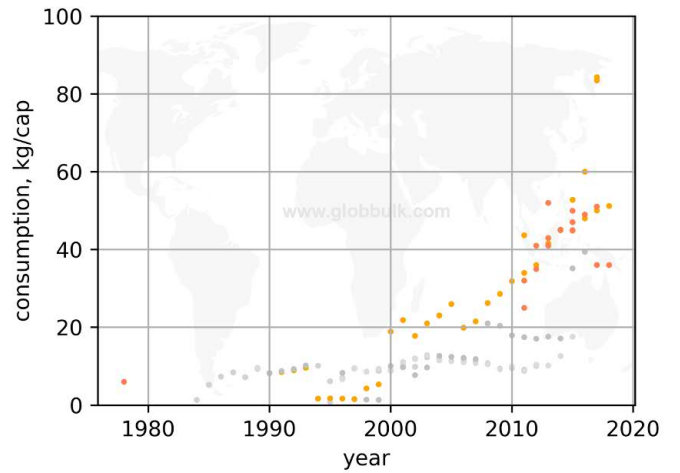
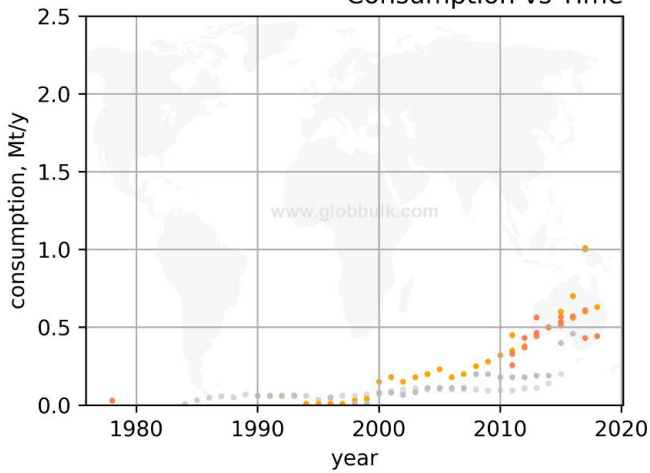
Population vs Time



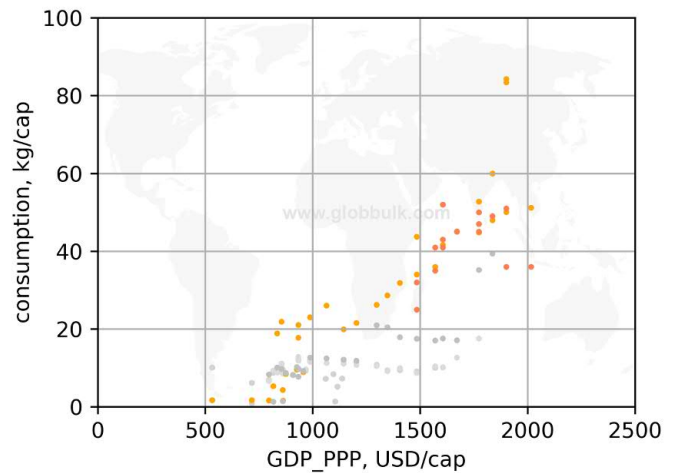
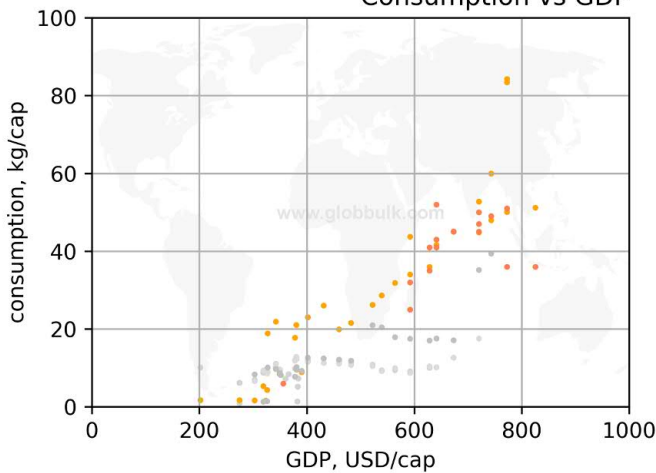
GDP vs Time



Consumption vs Time

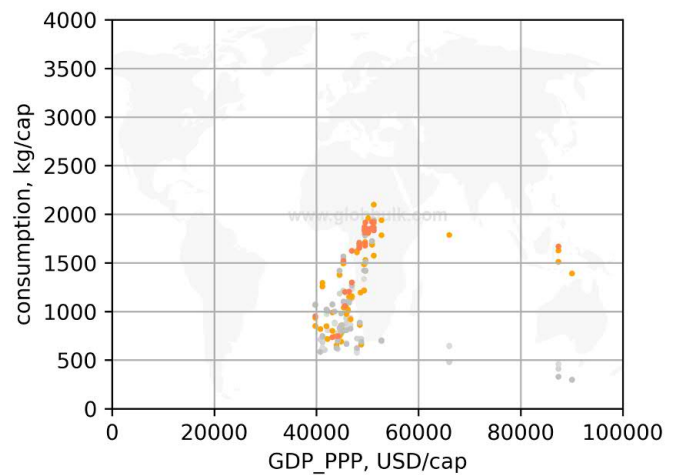
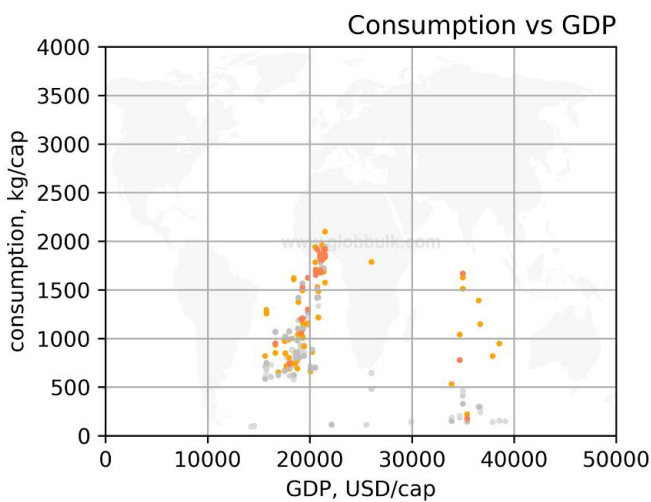
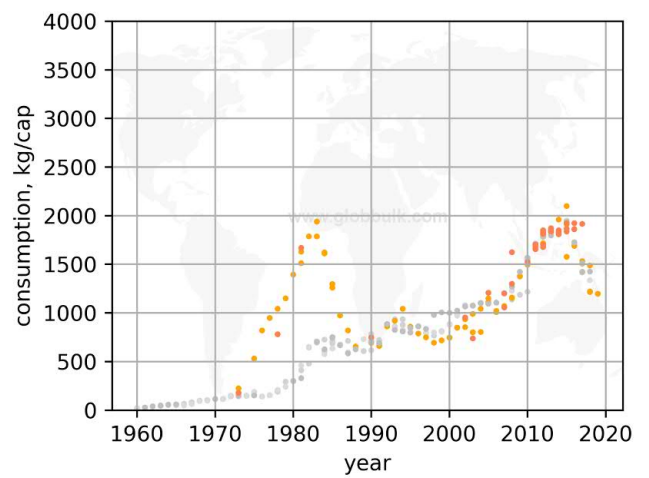
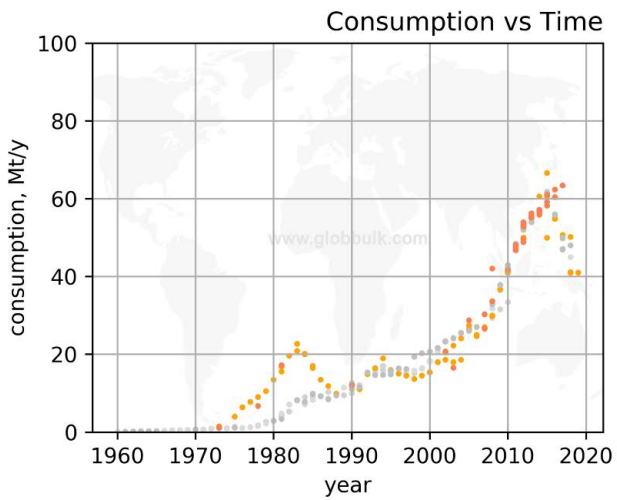
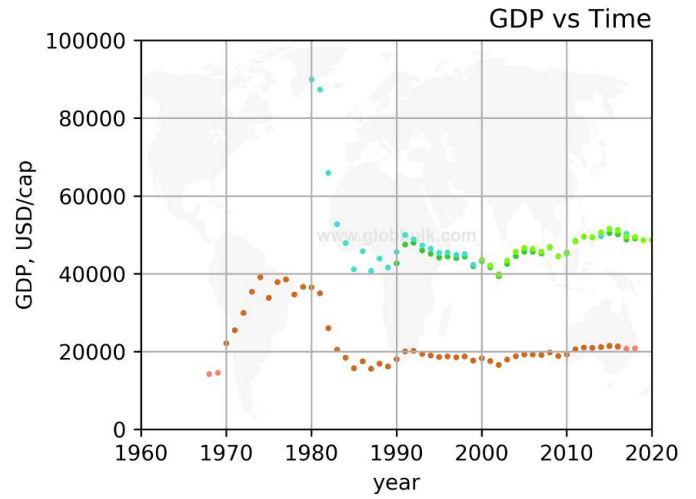
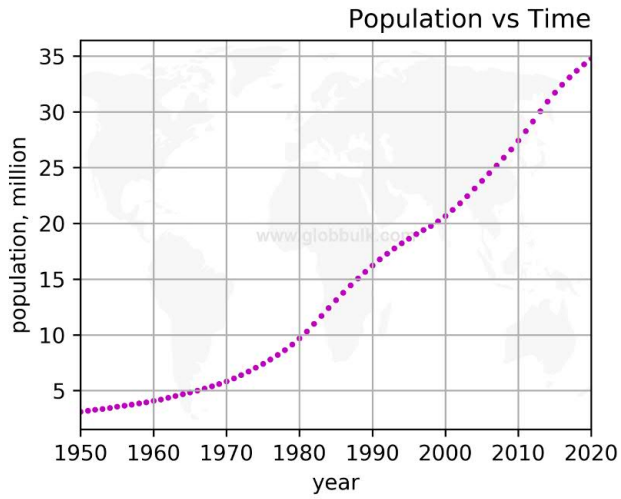


Consumption vs GDP





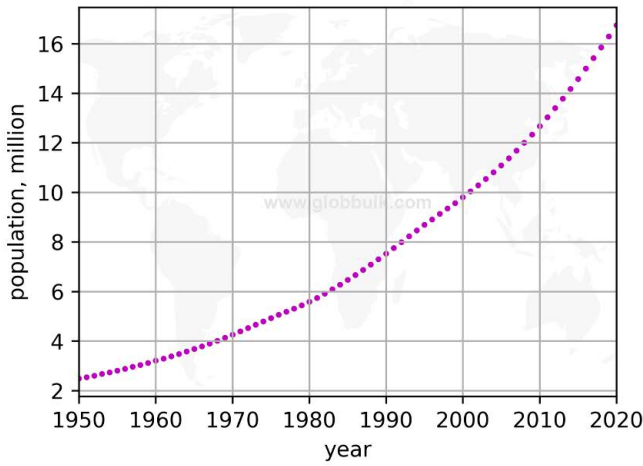
# Saudi Arabia



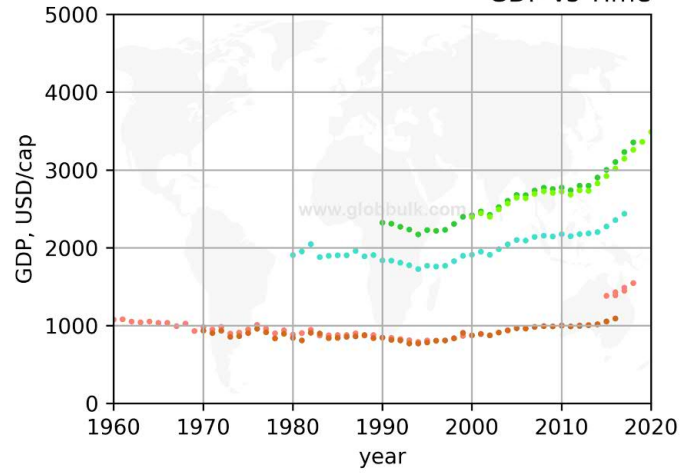


# Senegal

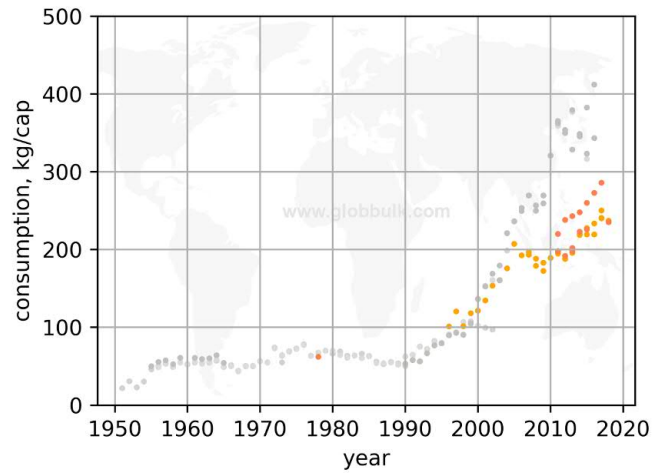
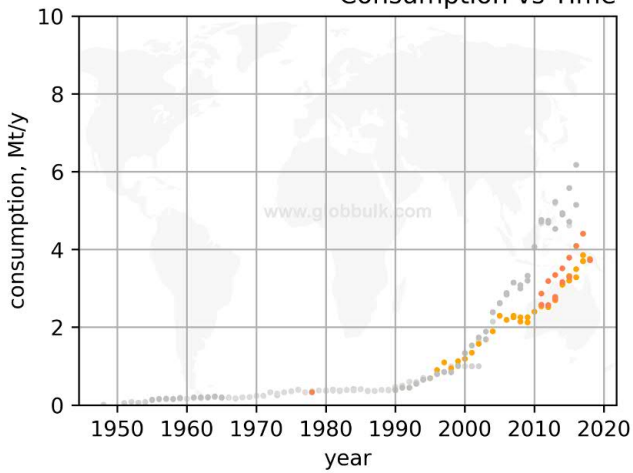
Population vs Time



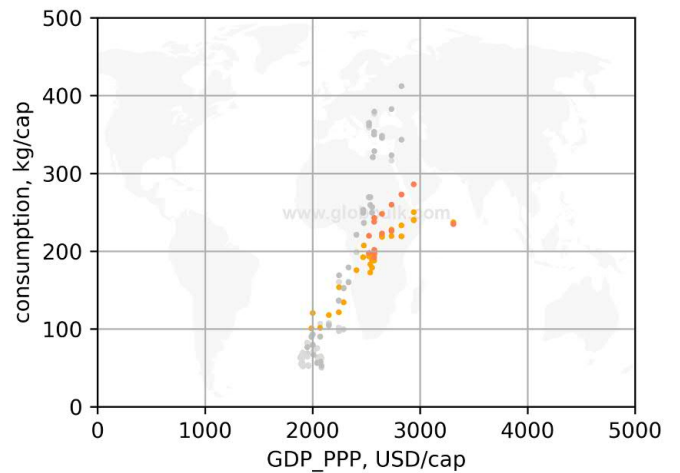
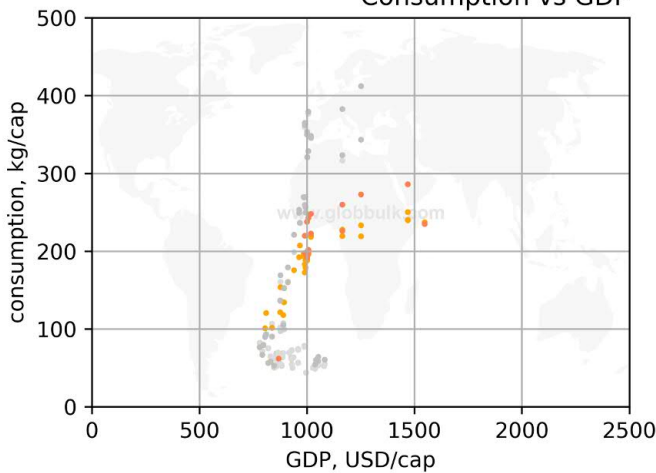
GDP vs Time



Consumption vs Time

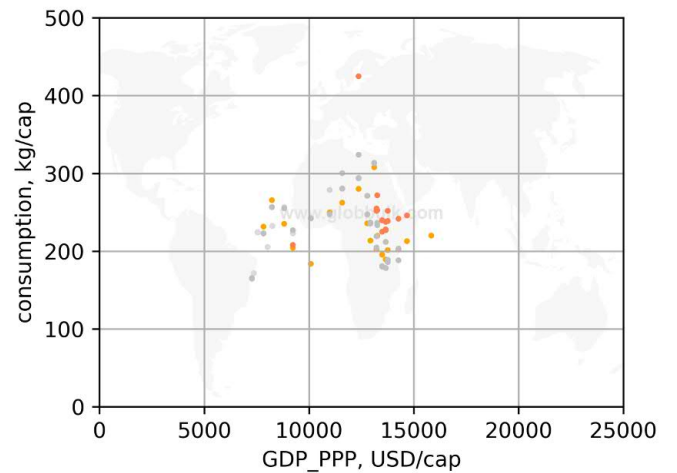
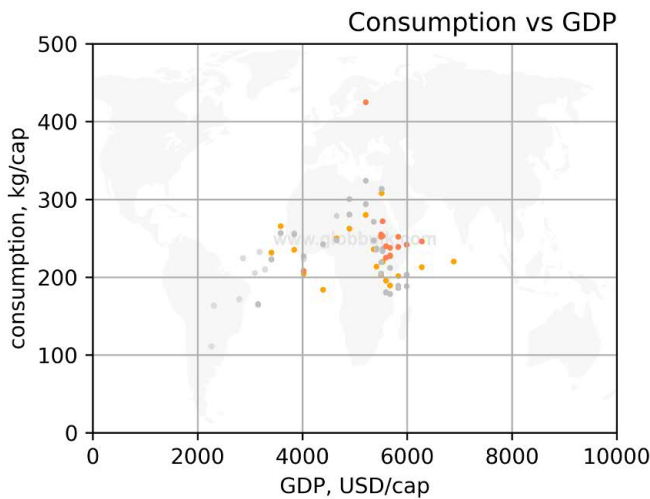
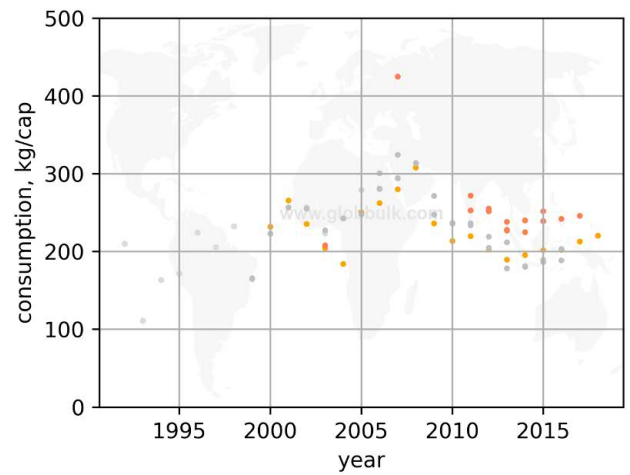
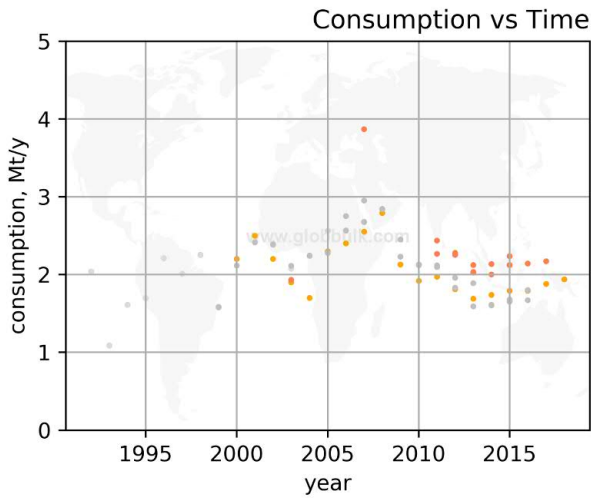
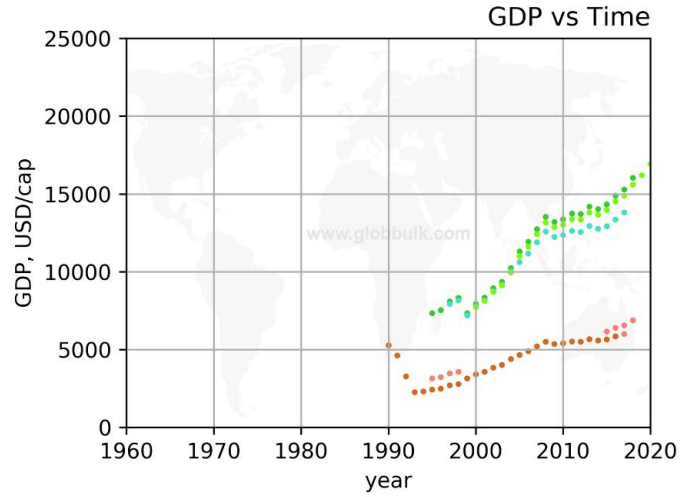
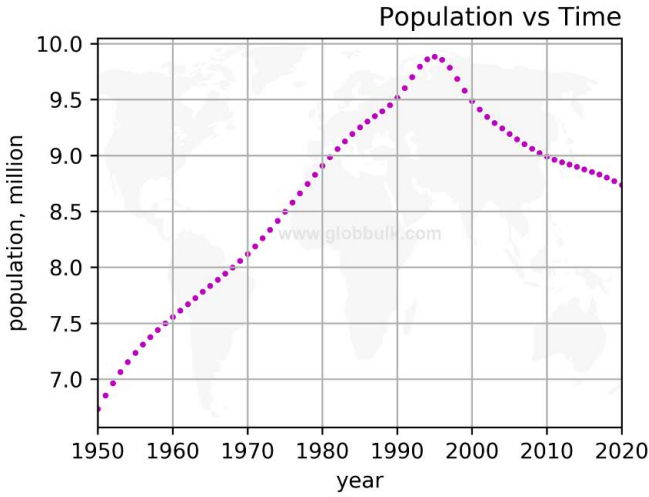


Consumption vs GDP





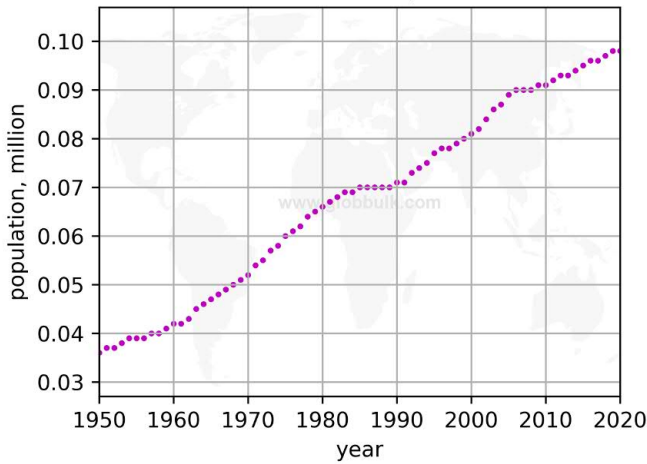
# Serbia



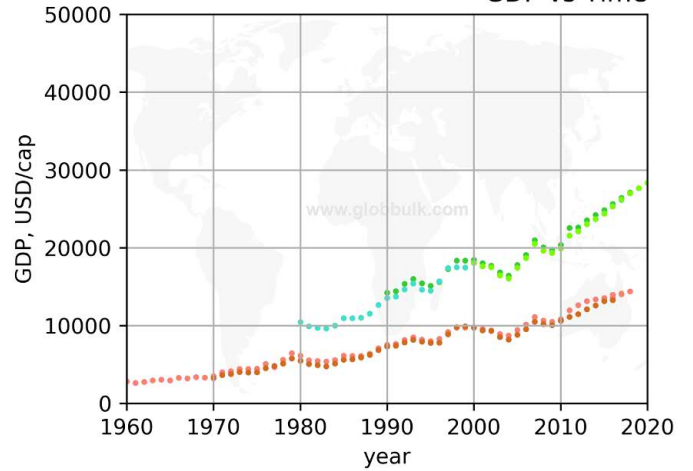


# Seychelles

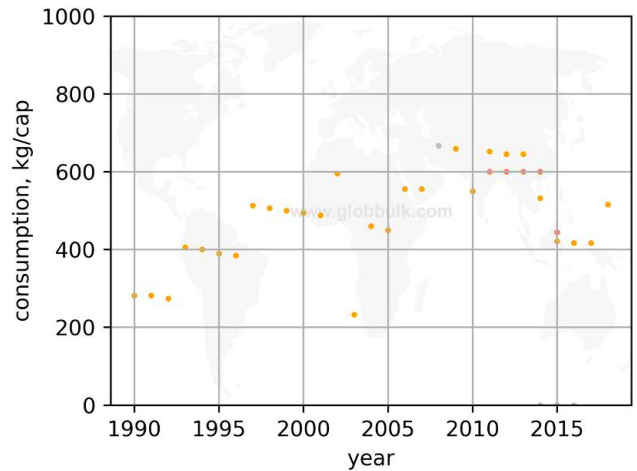
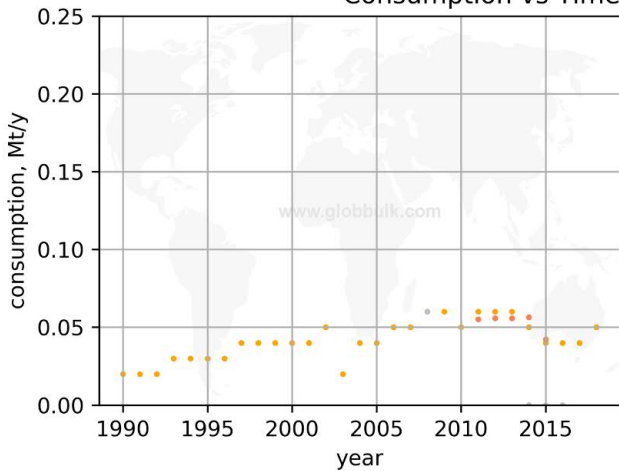
Population vs Time



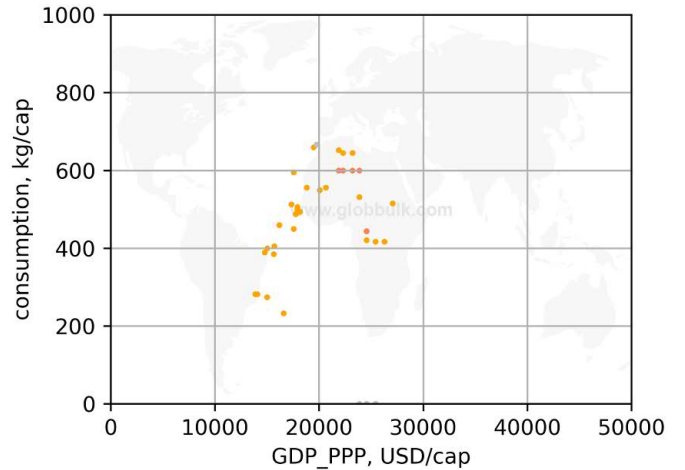
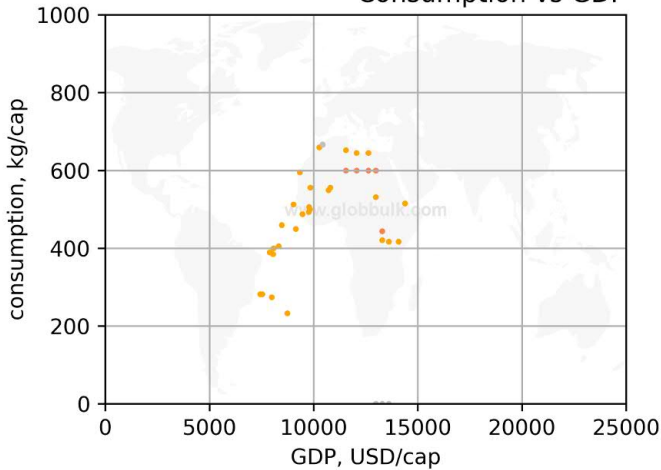
GDP vs Time



Consumption vs Time



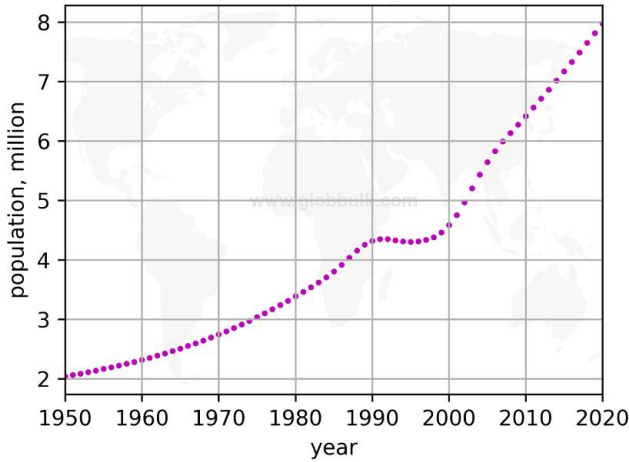
Consumption vs GDP



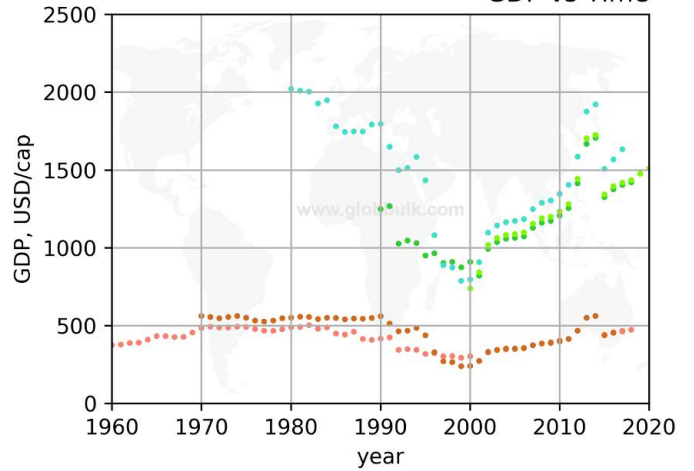


# Sierra Leone

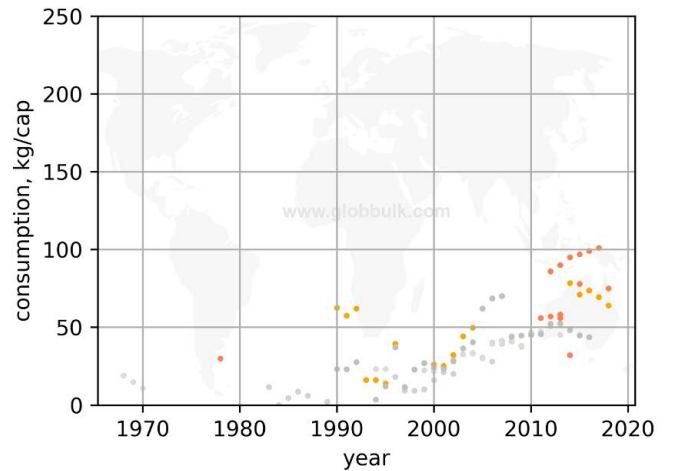
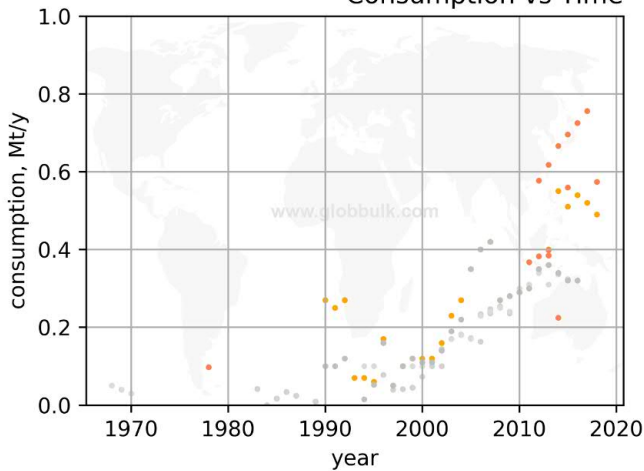
Population vs Time



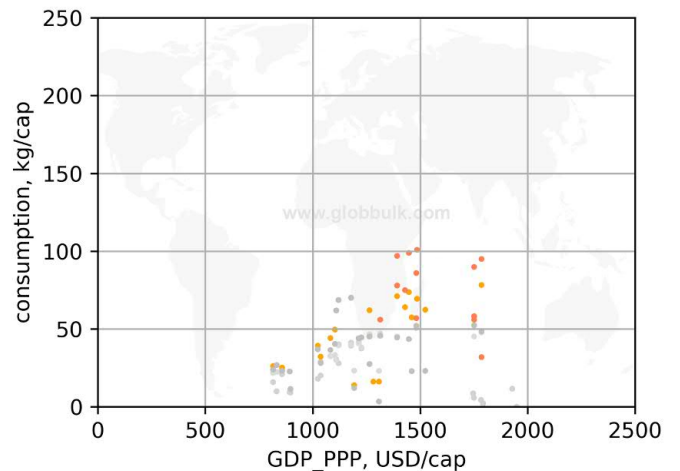
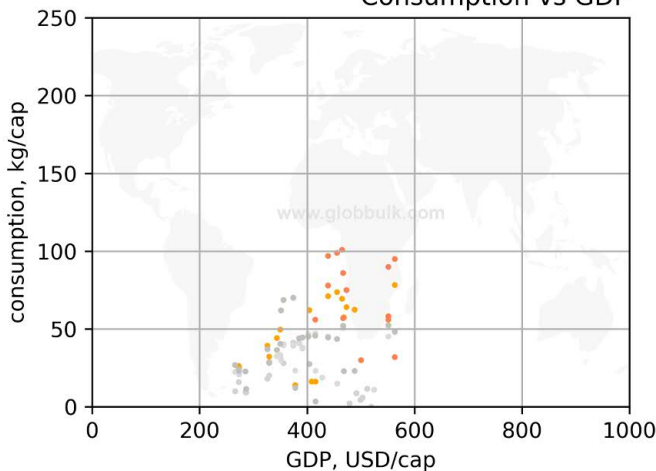
GDP vs Time



Consumption vs Time



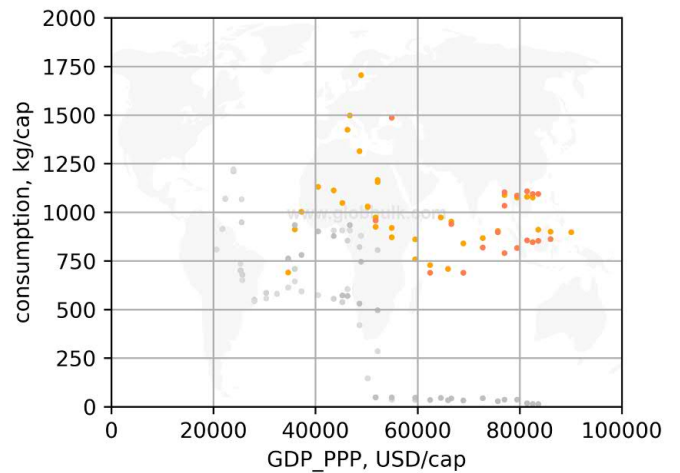
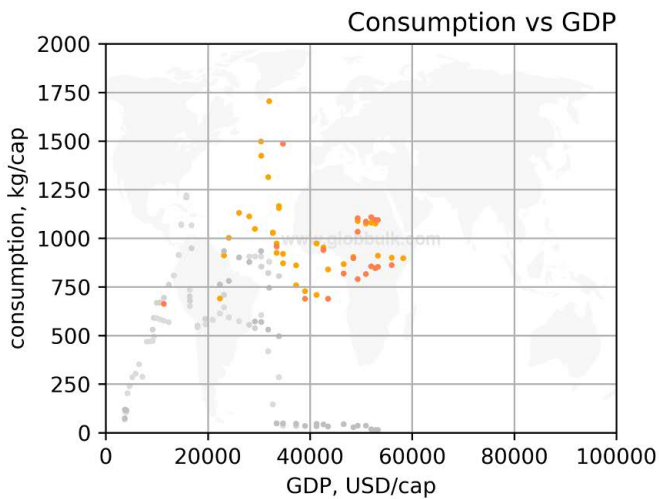
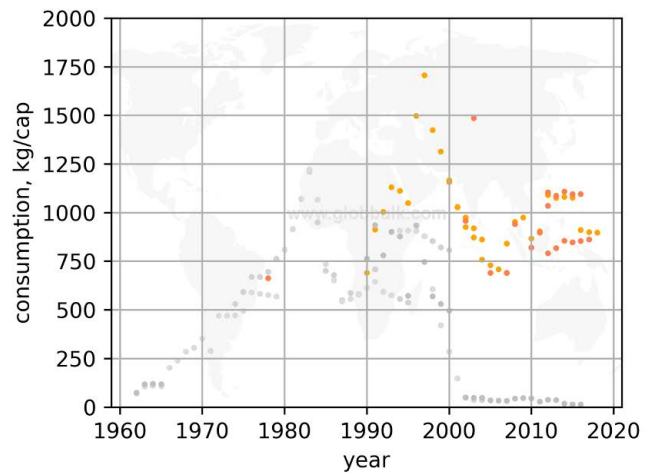
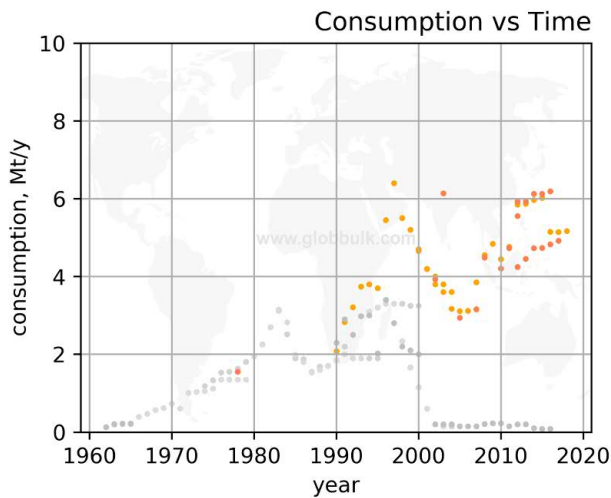
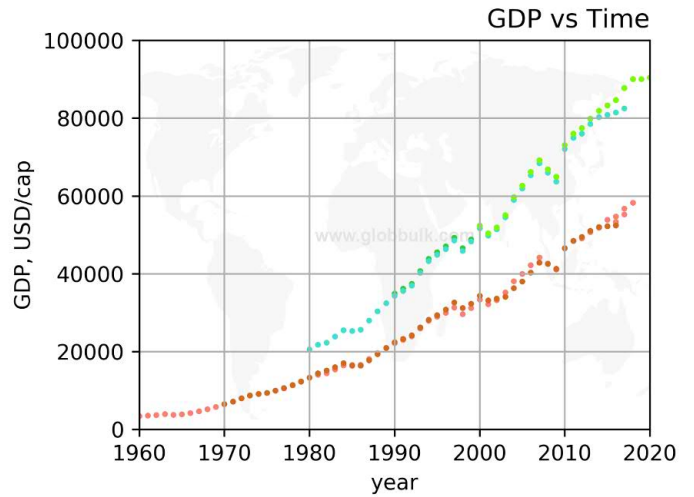
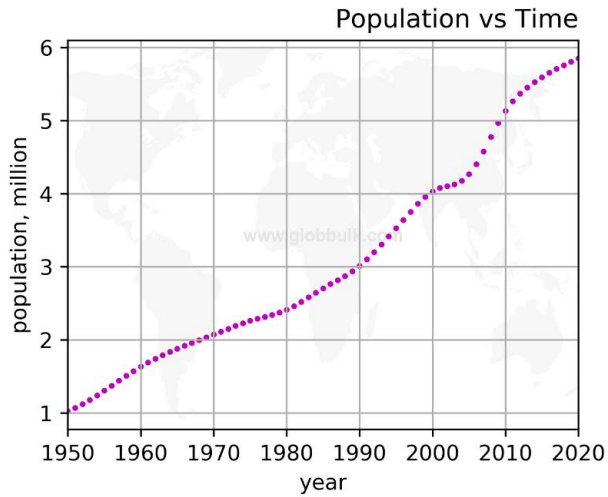
Consumption vs GDP





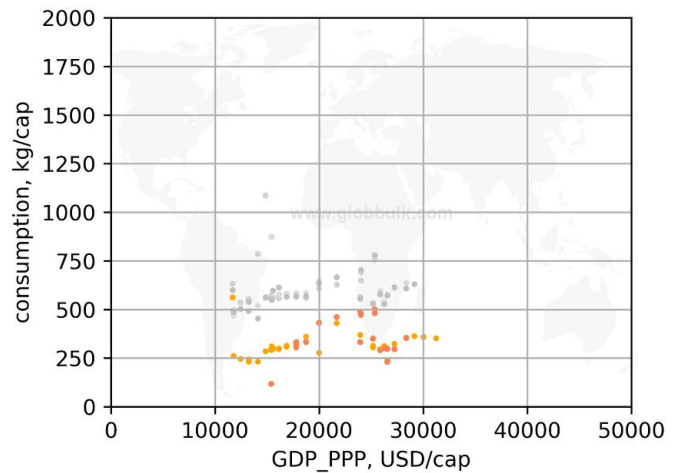
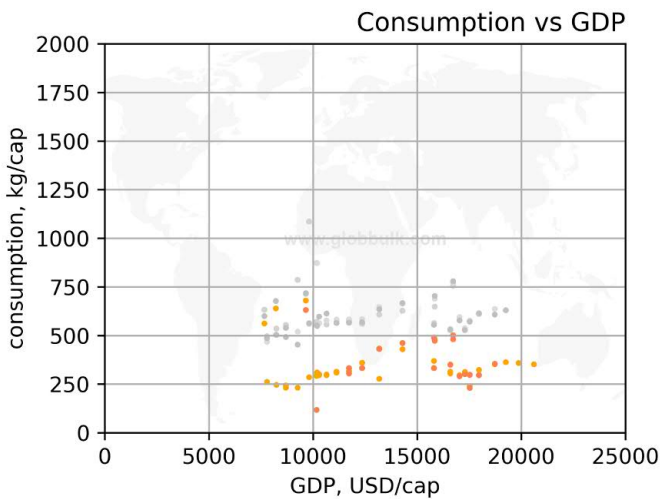
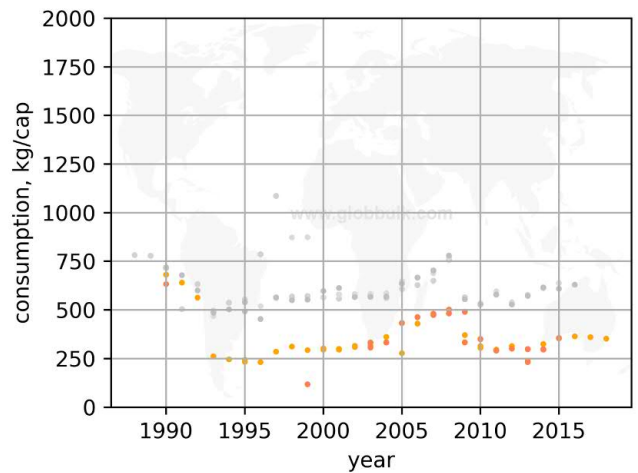
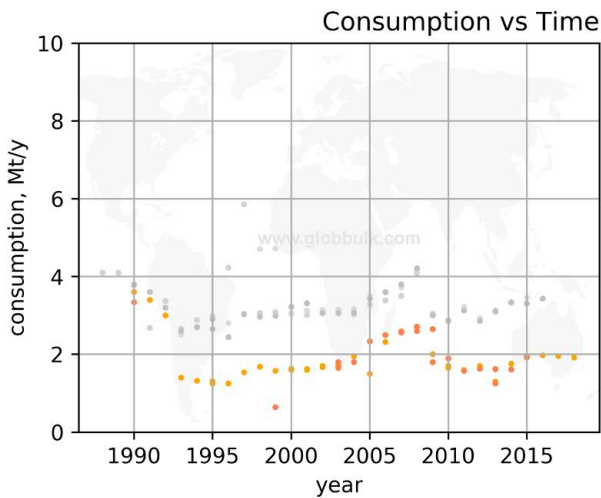
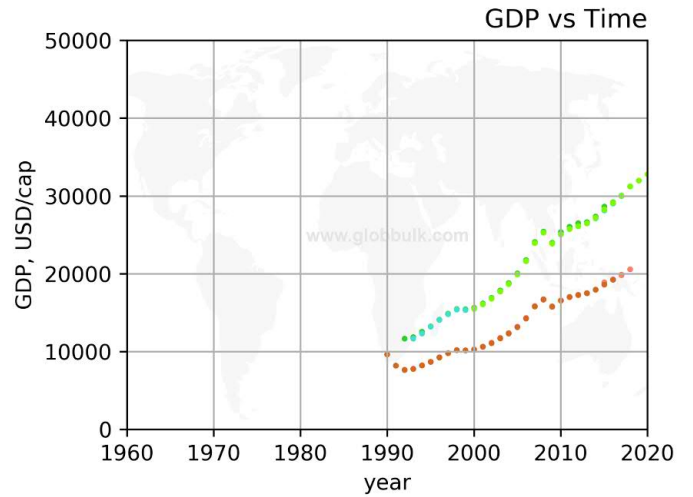
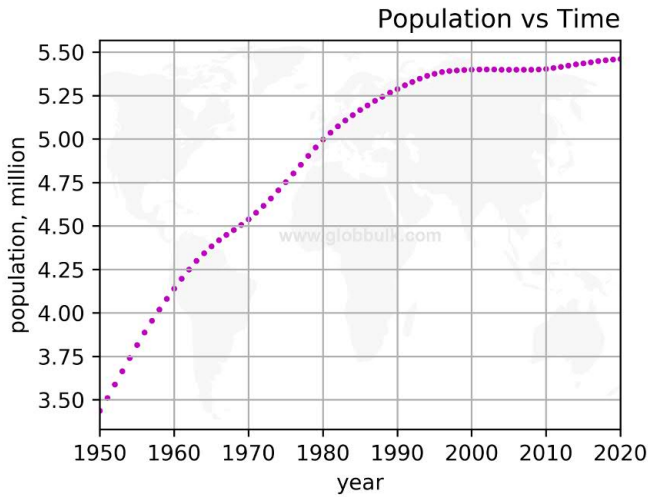


# Singapore



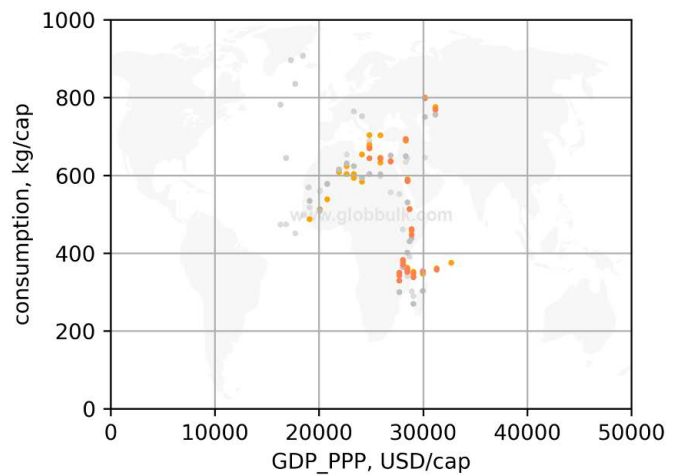
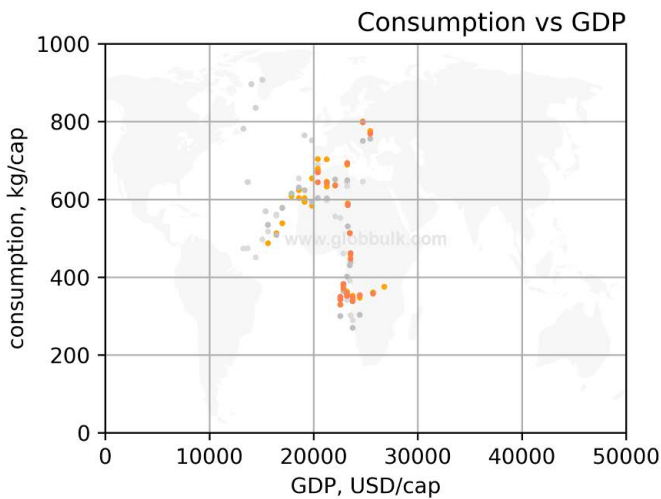
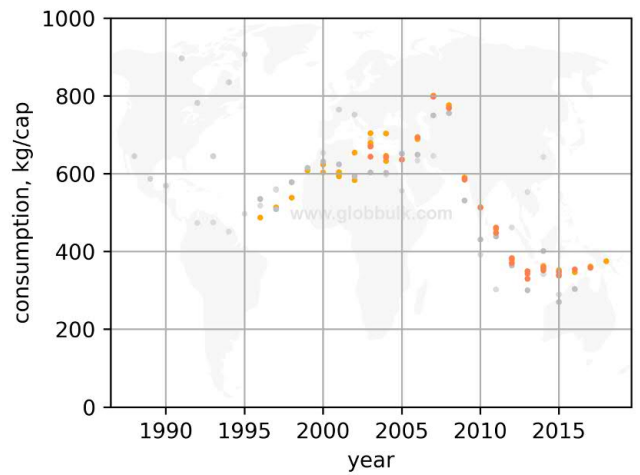
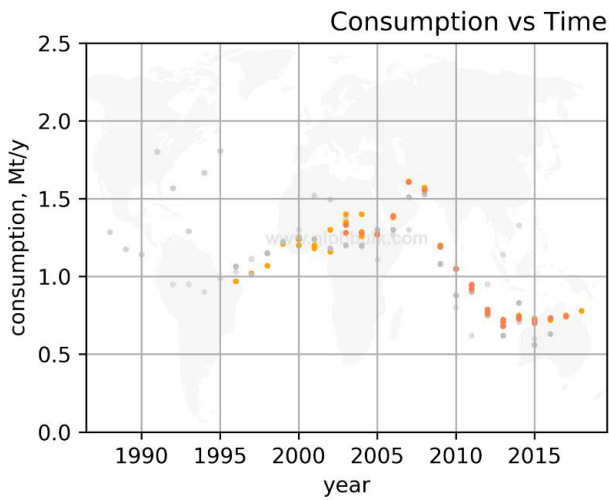
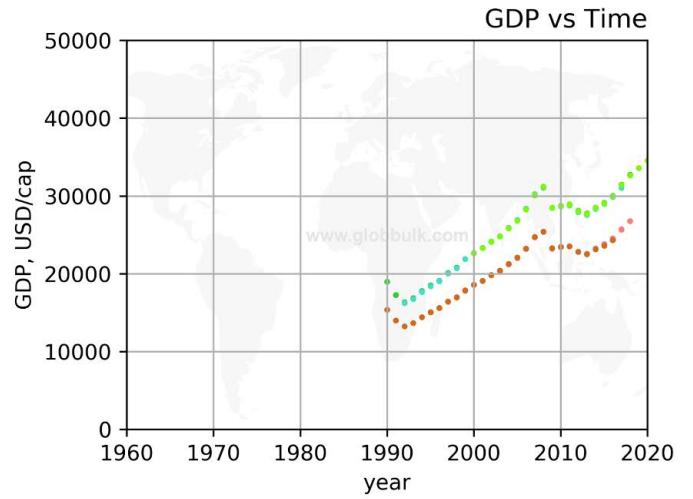
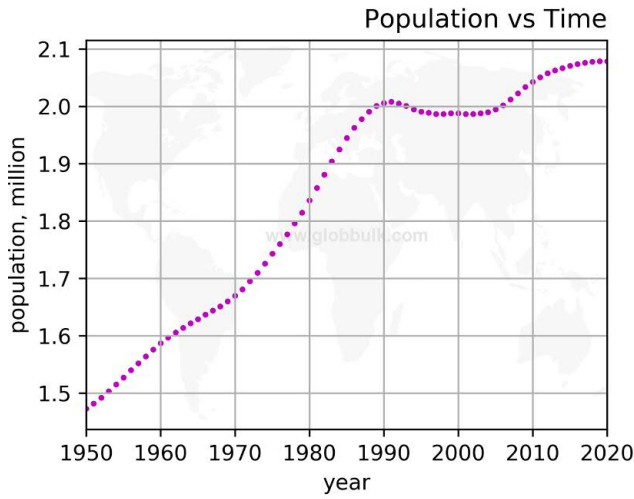


# Slovakia



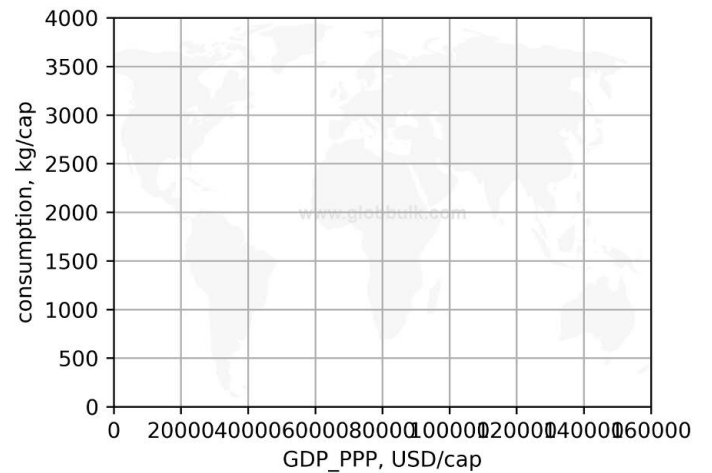
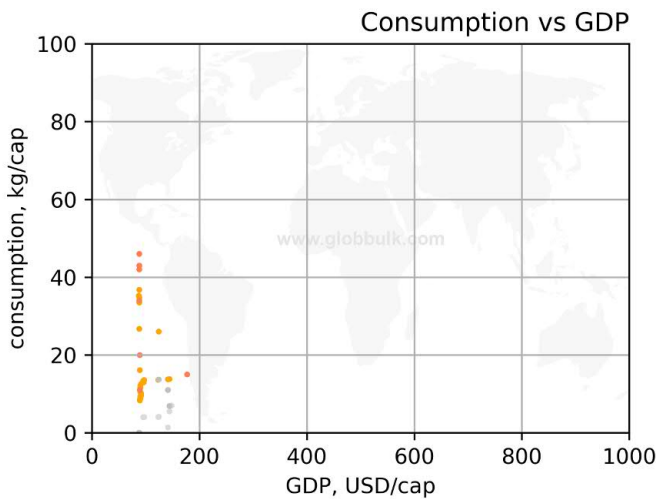
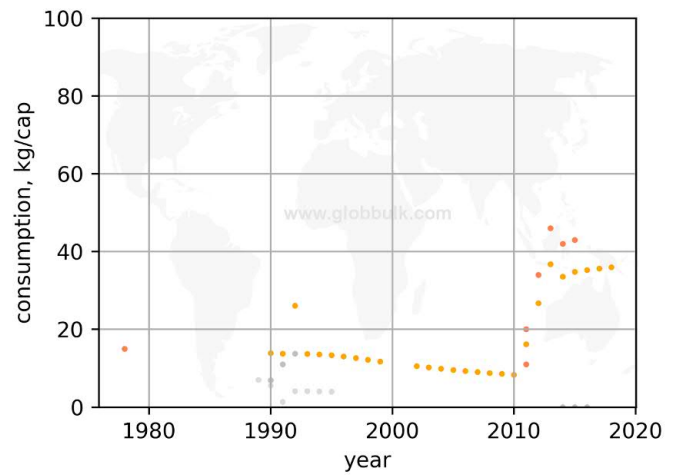
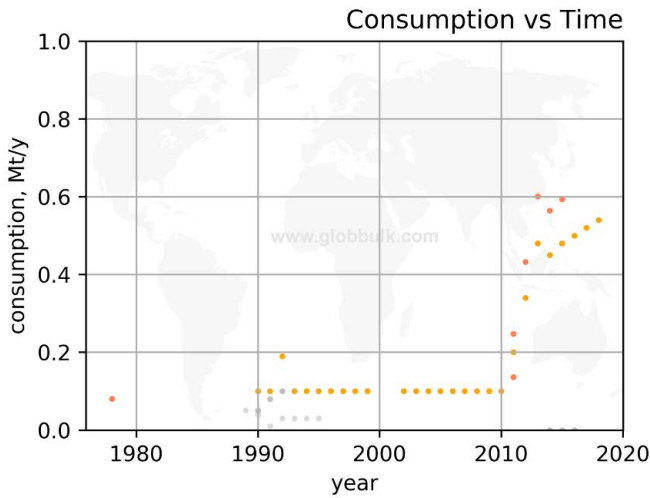
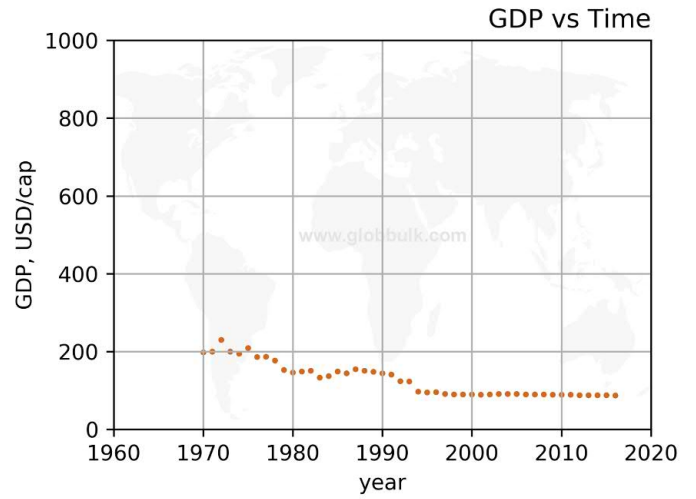
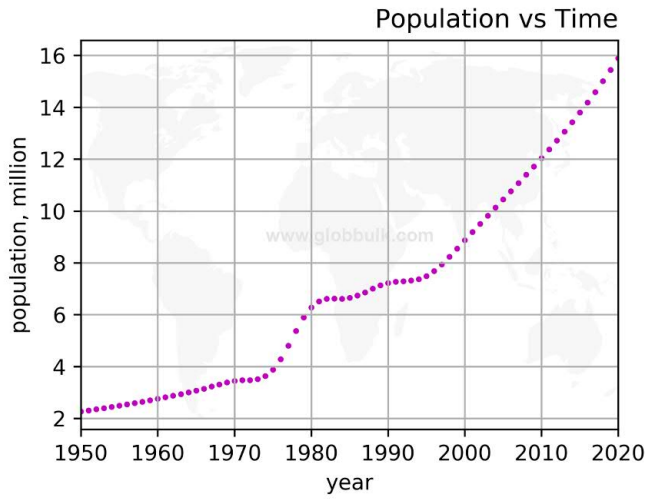


# Slovenia



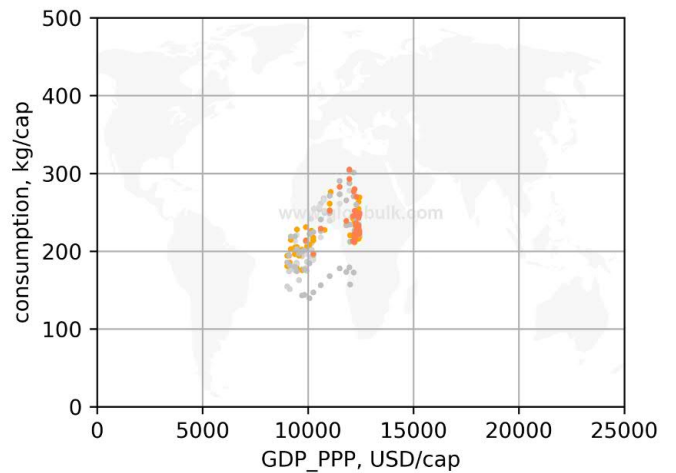
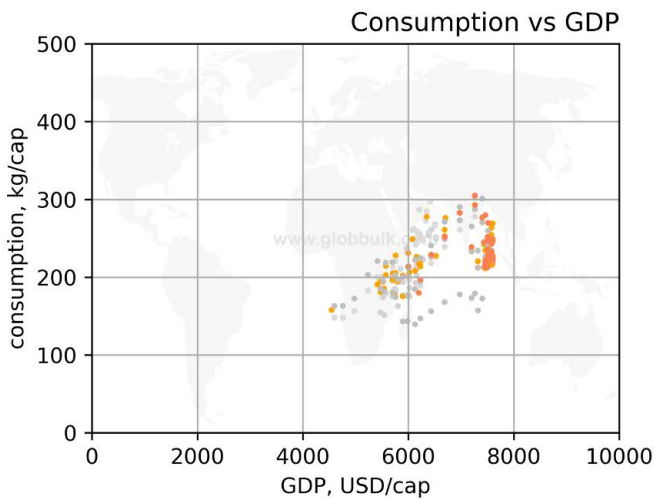
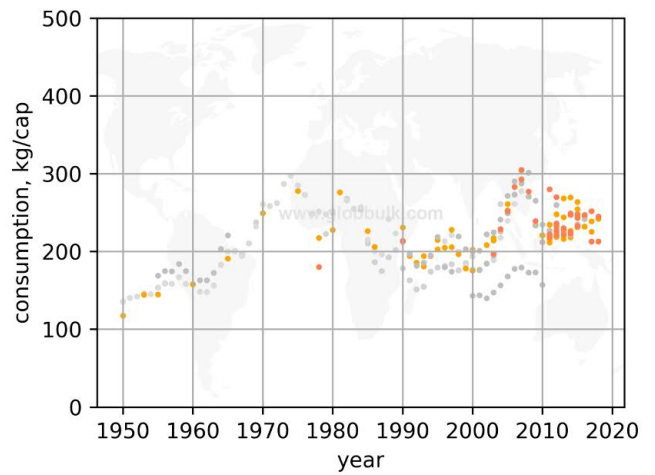
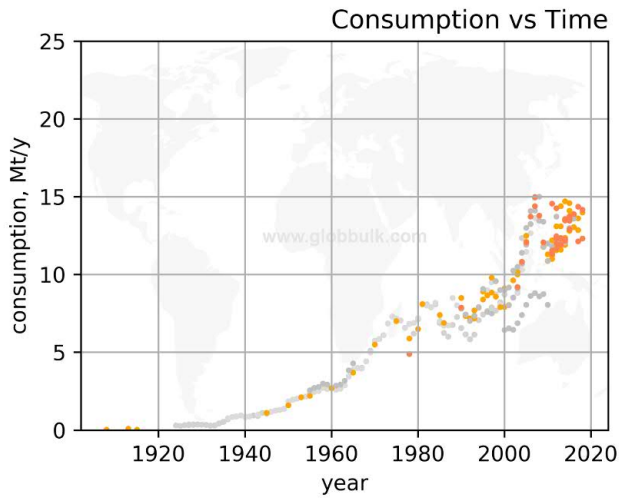
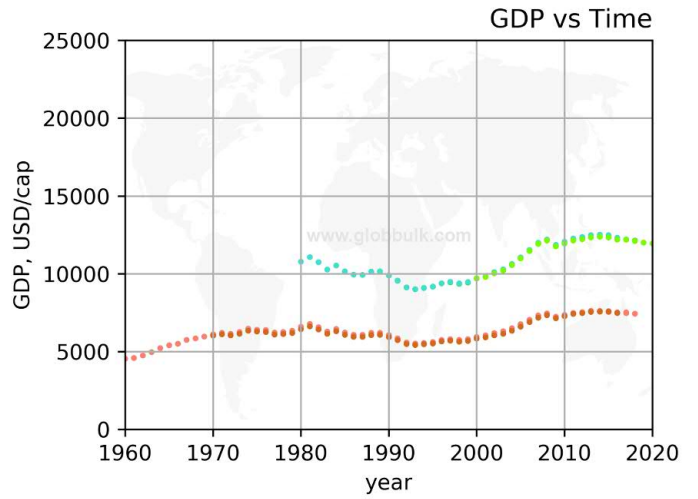
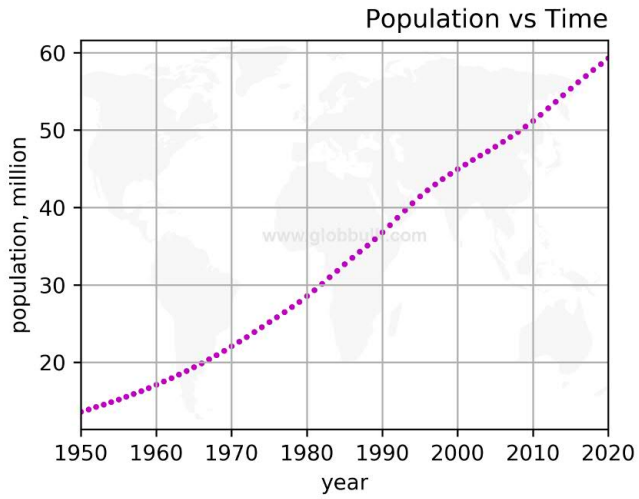


# Somalia





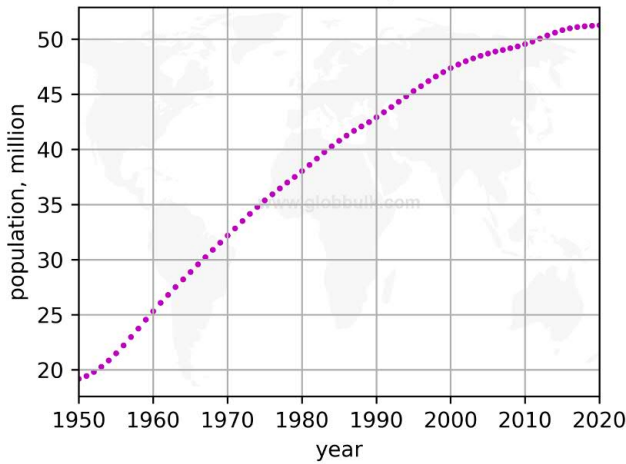
# South Africa



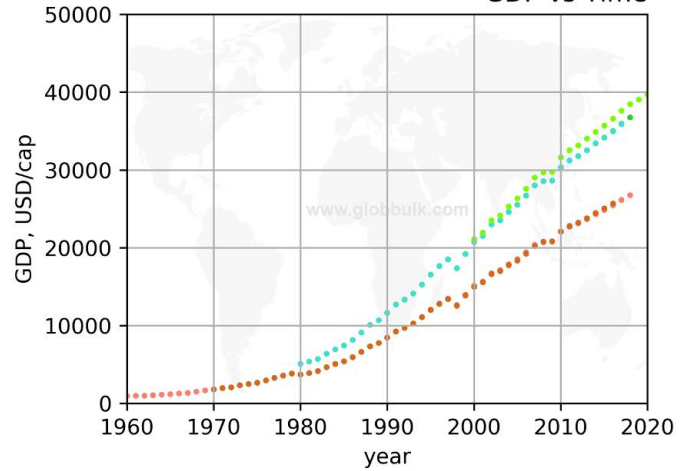


# South Korea

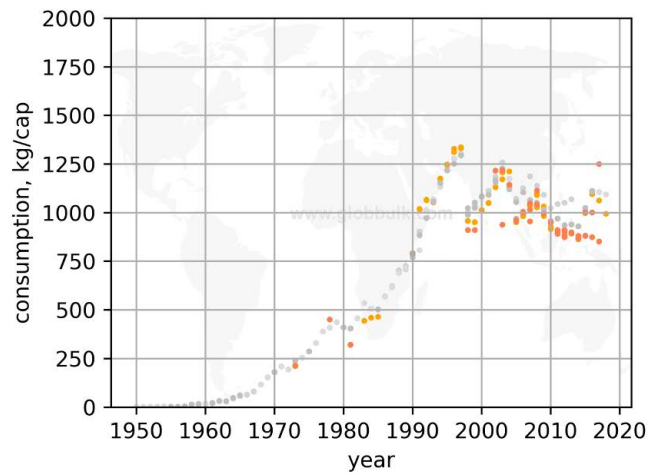
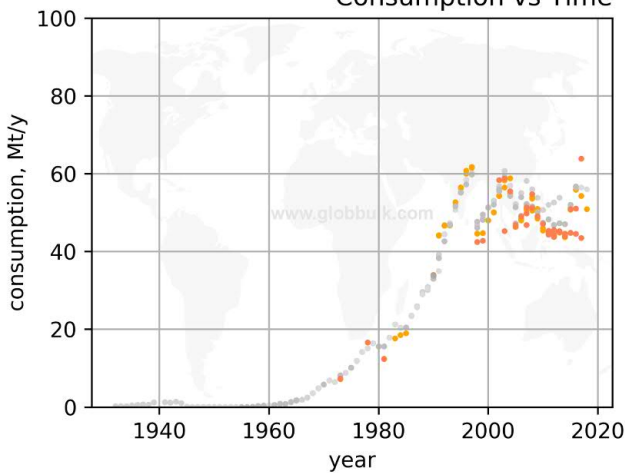
Population vs Time



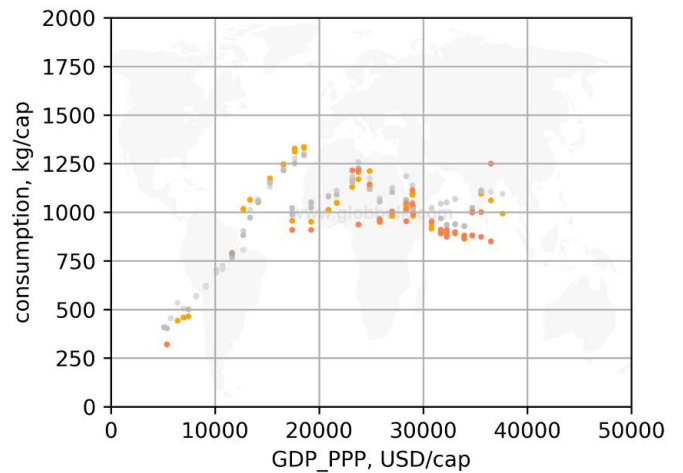
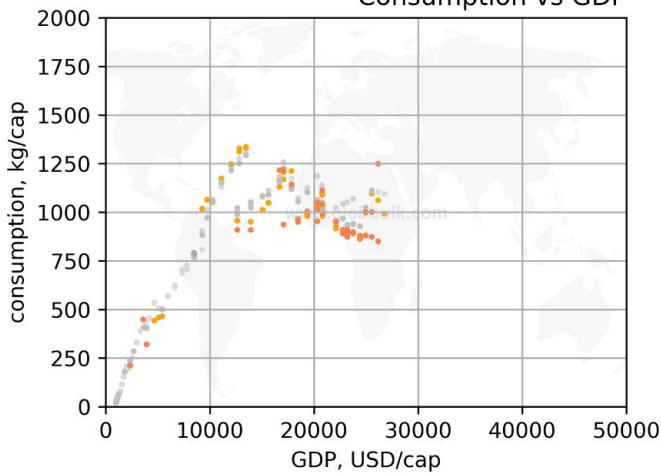
GDP vs Time



Consumption vs Time



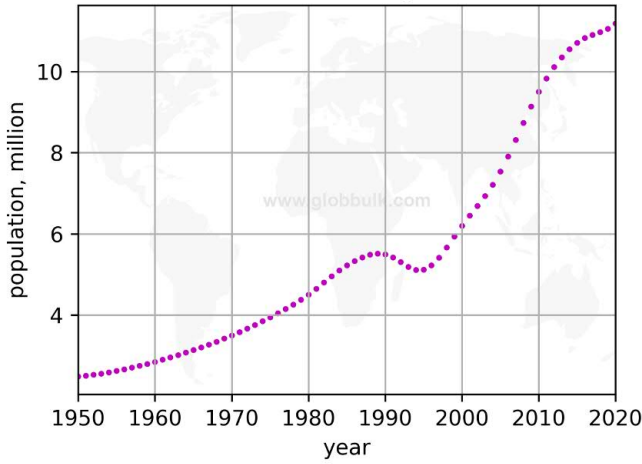
Consumption vs GDP



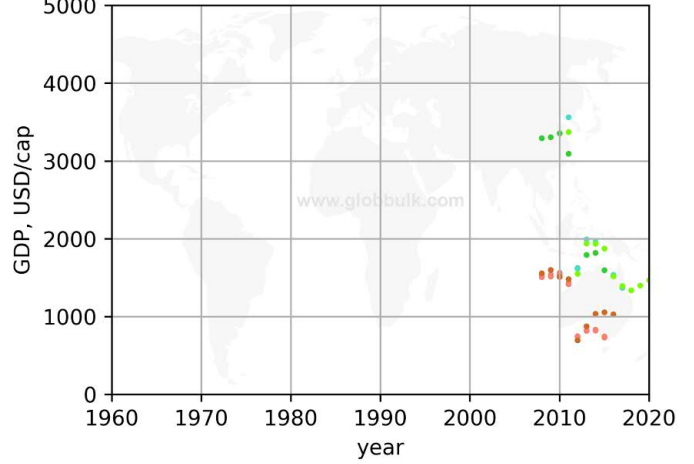


# South Sudan

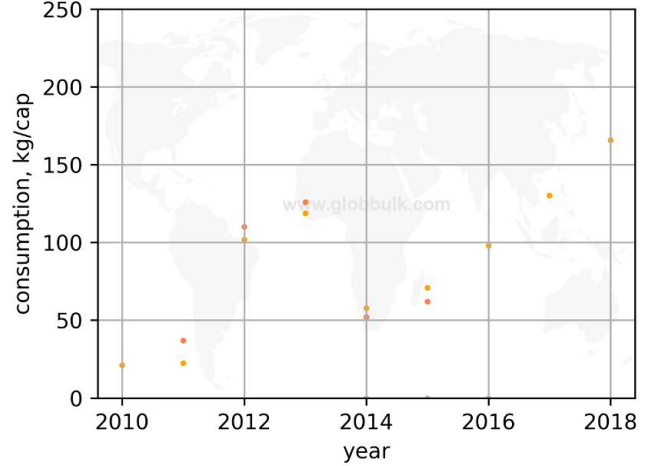
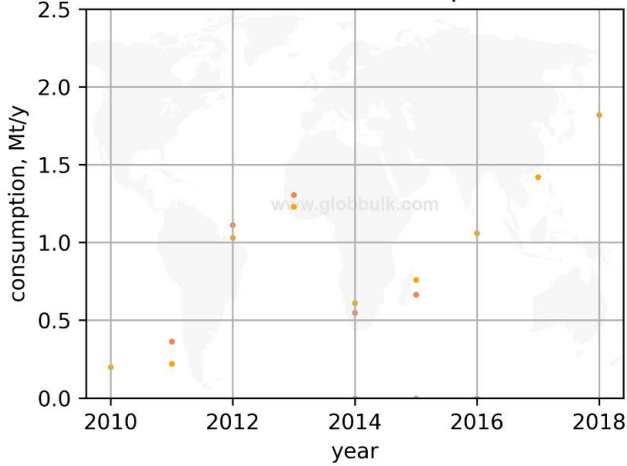
Population vs Time



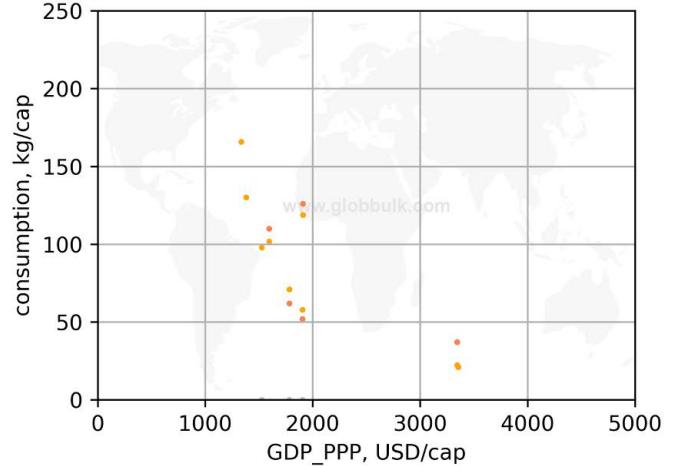
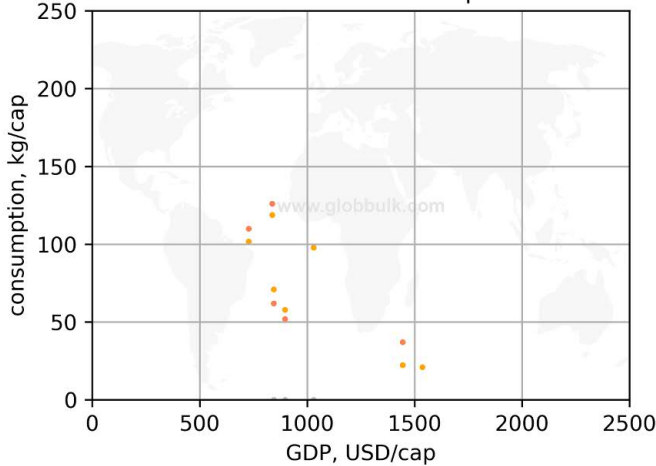
GDP vs Time



Consumption vs Time

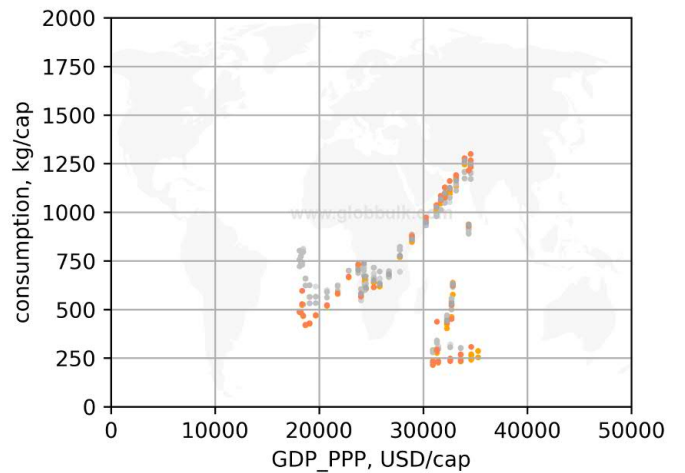
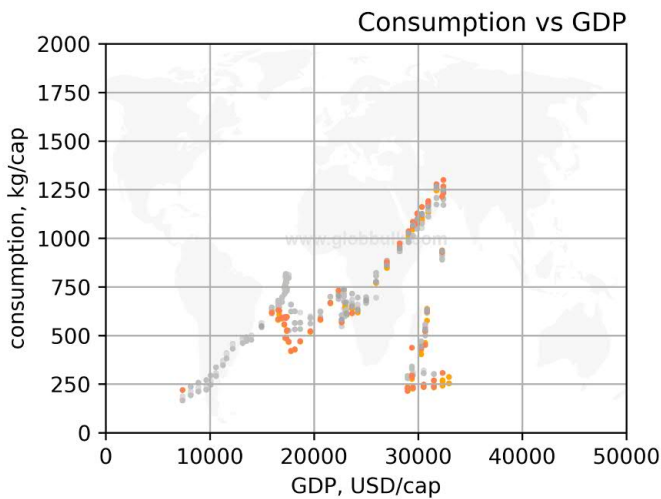
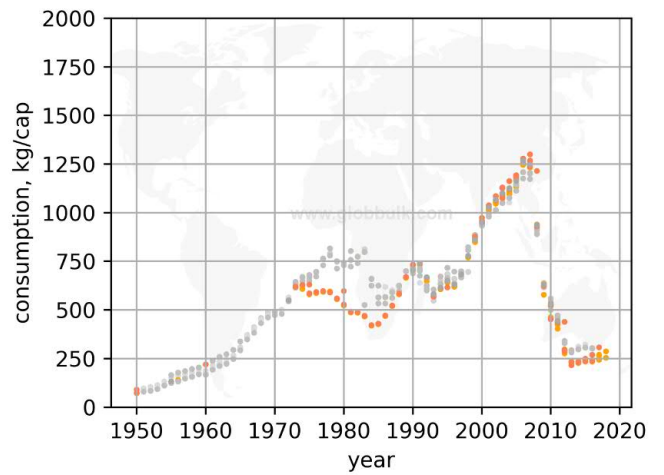
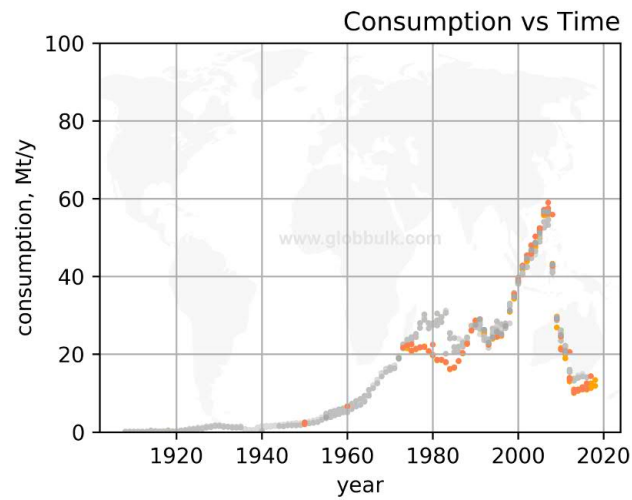
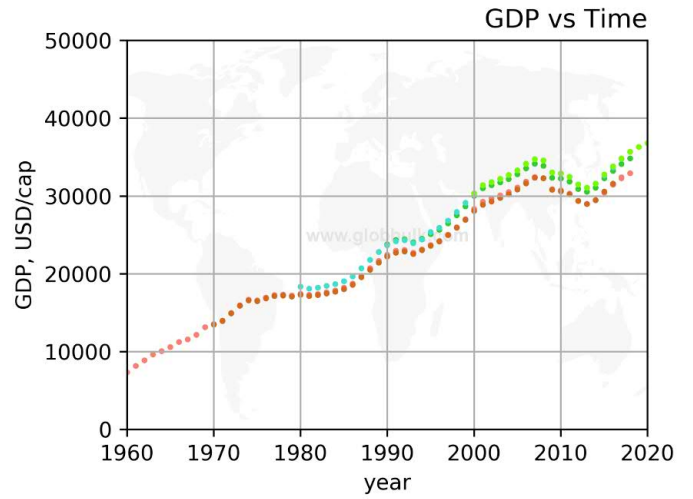
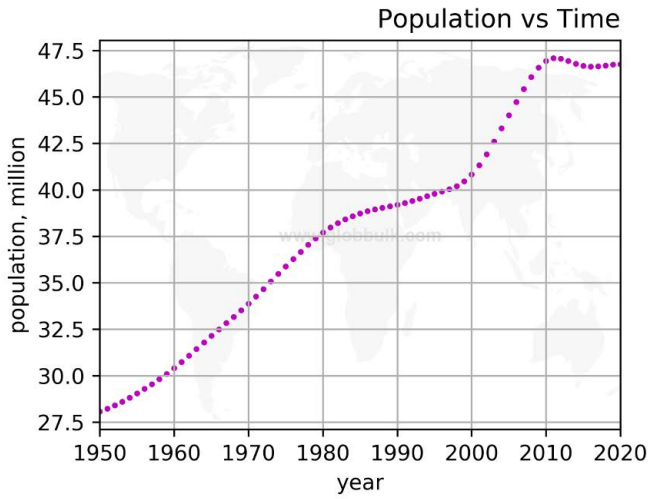


Consumption vs GDP





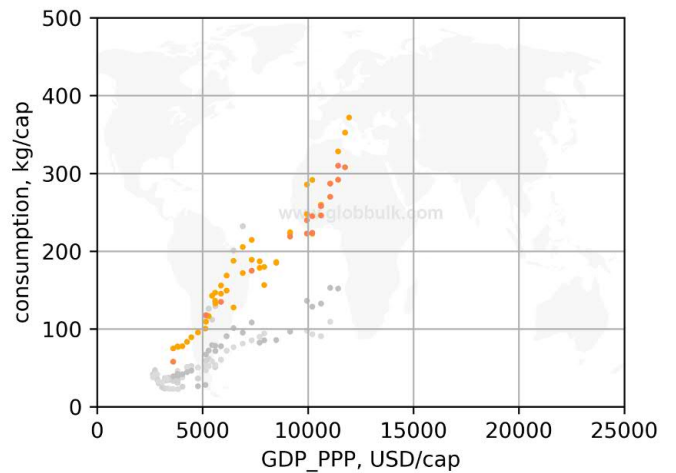
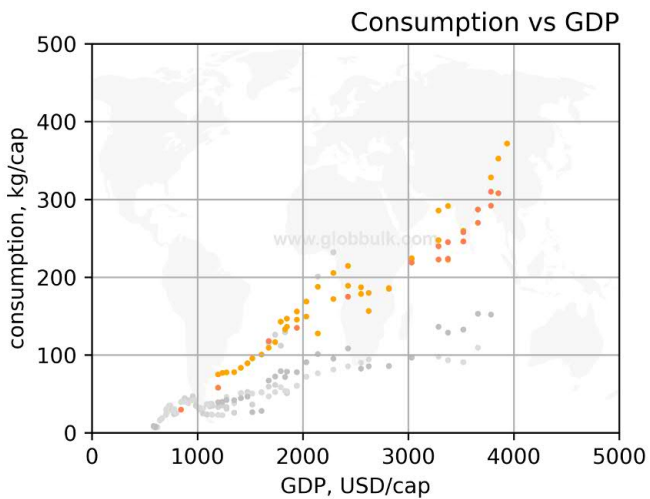
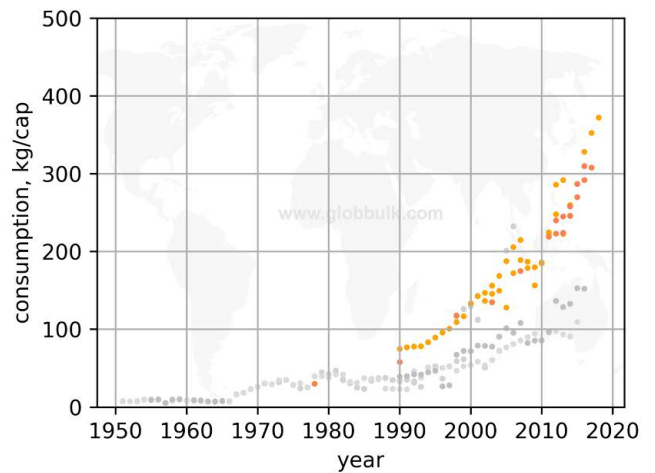
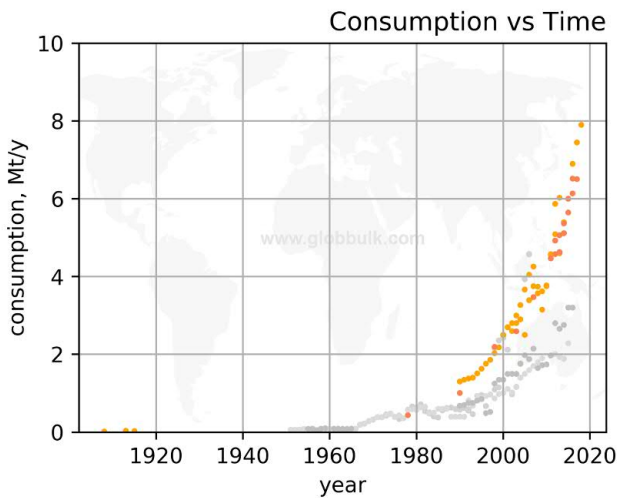
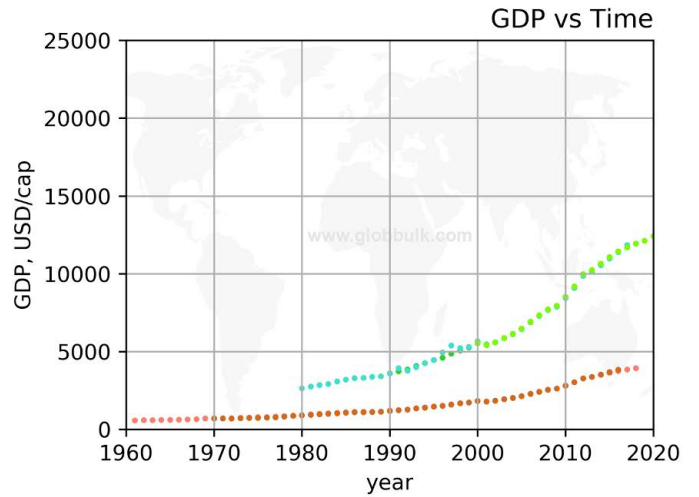
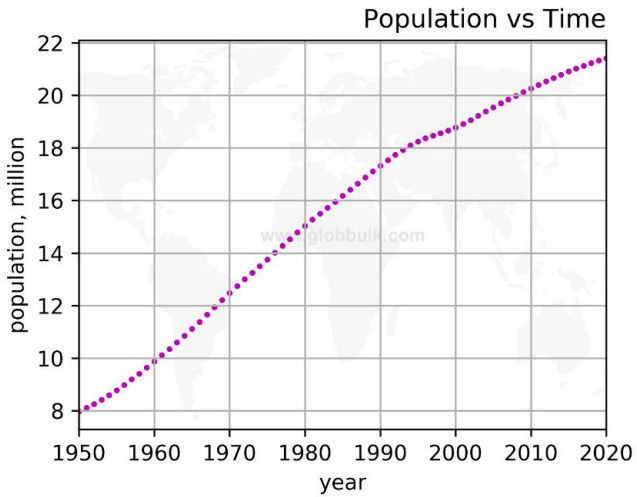
# Spain





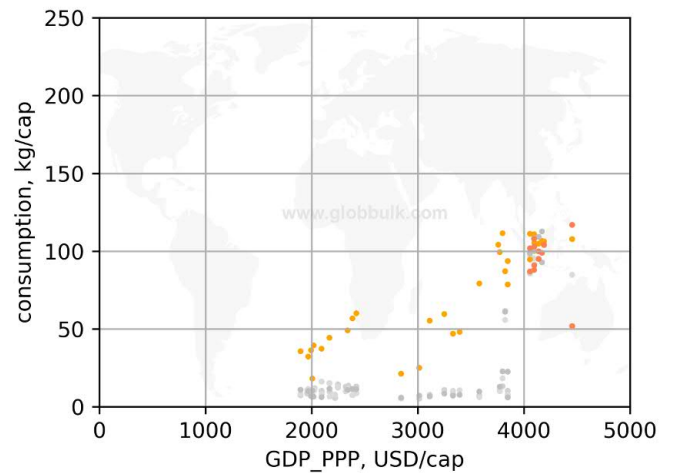
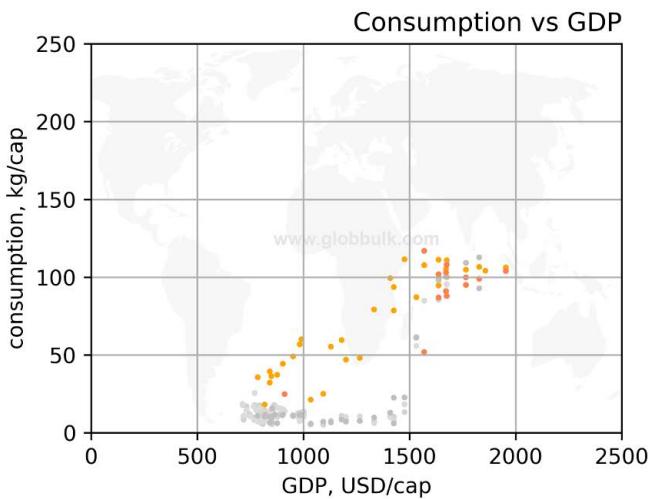
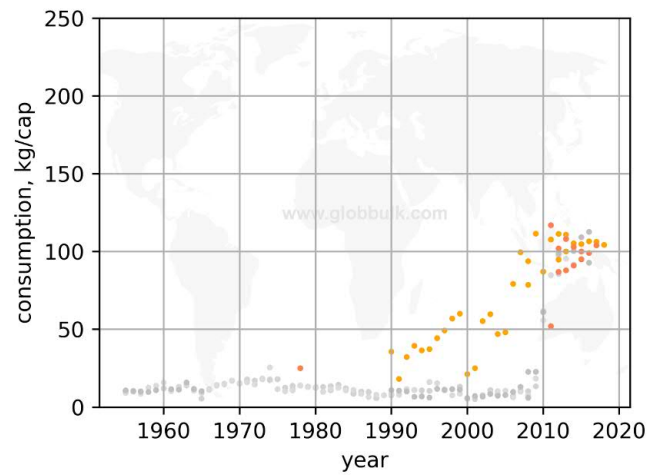
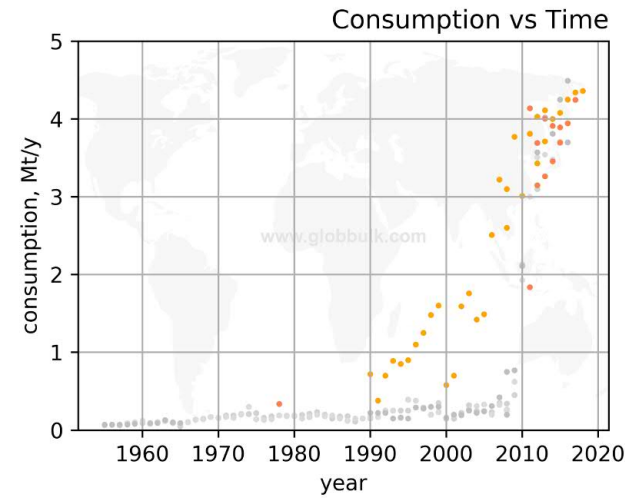
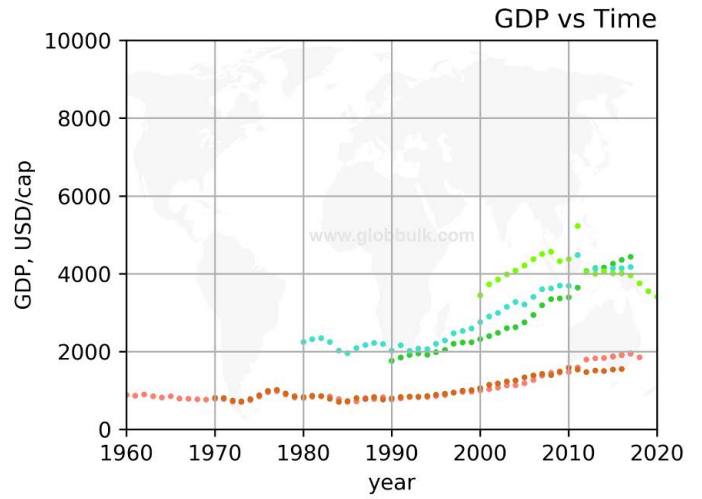
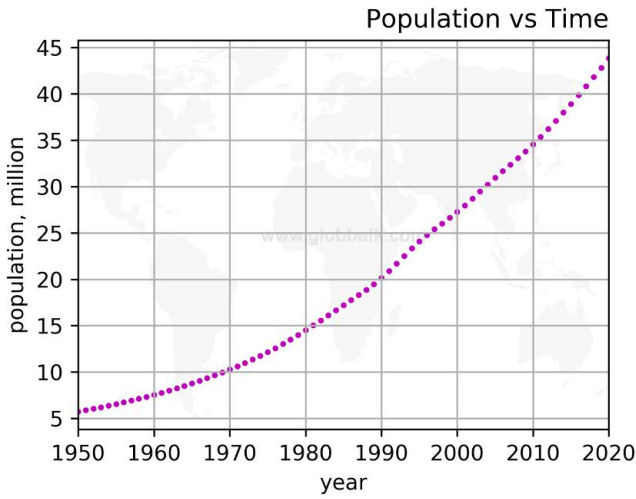


# Sri Lanka



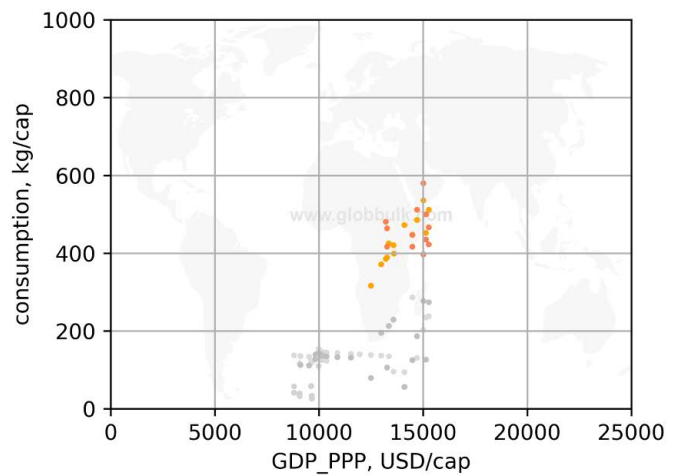
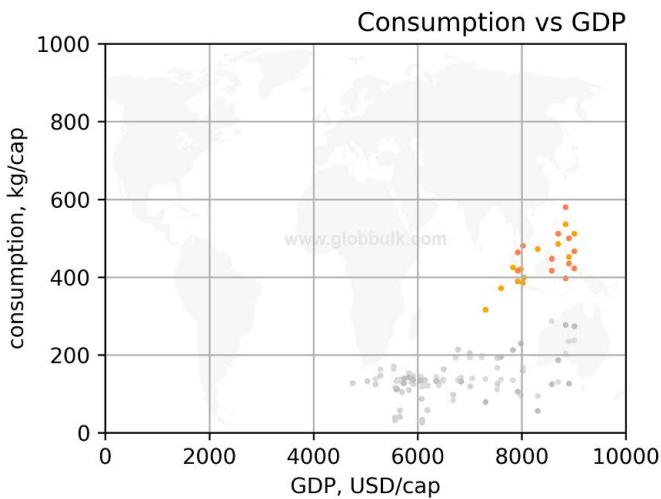
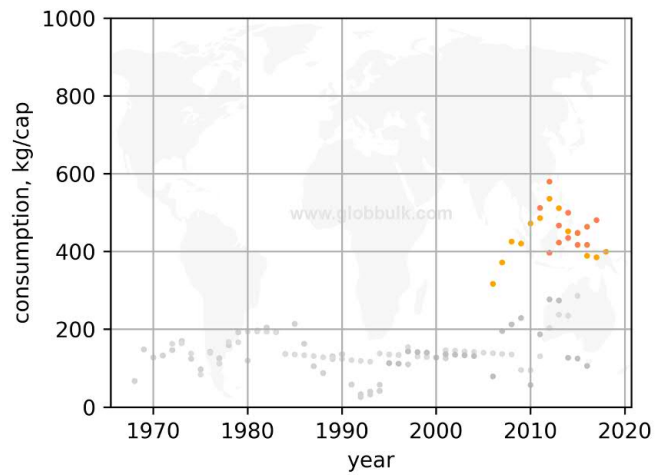
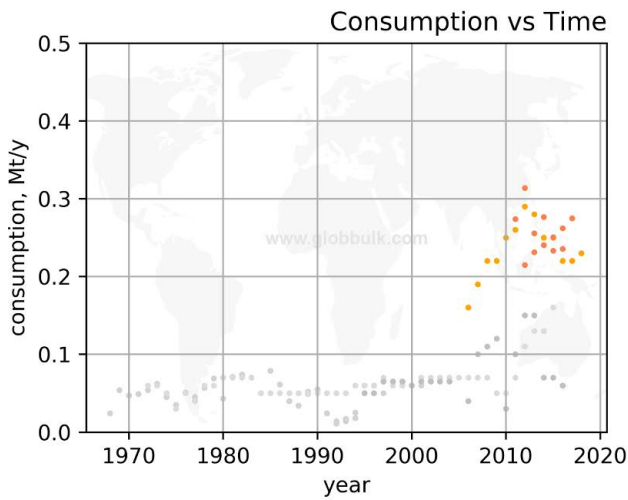
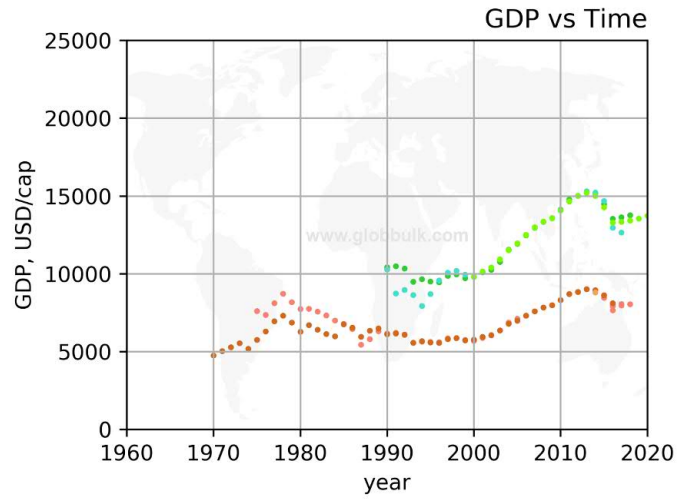
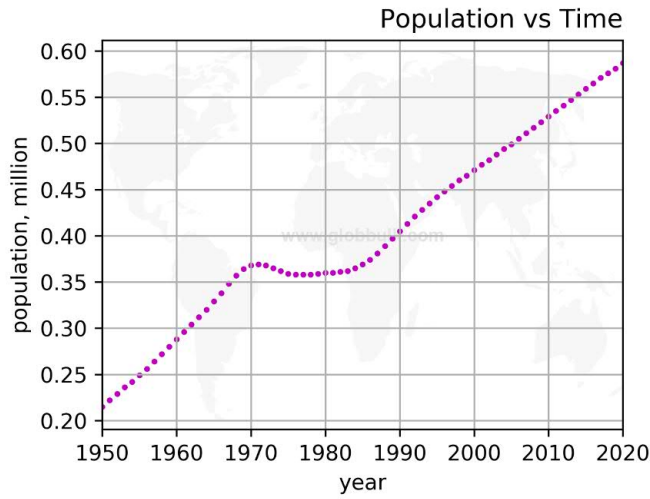


# Sudan



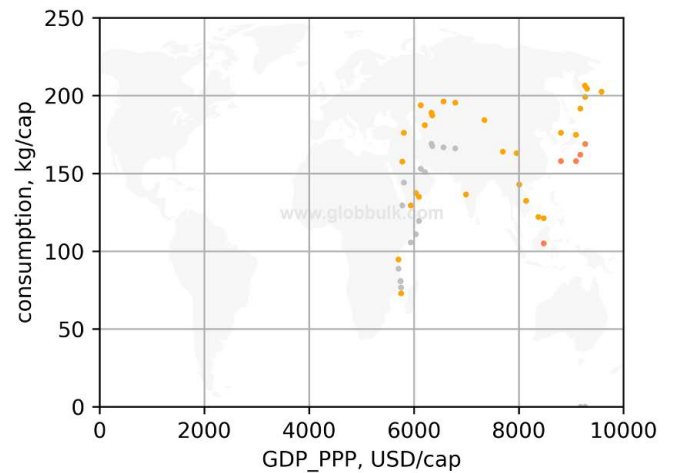
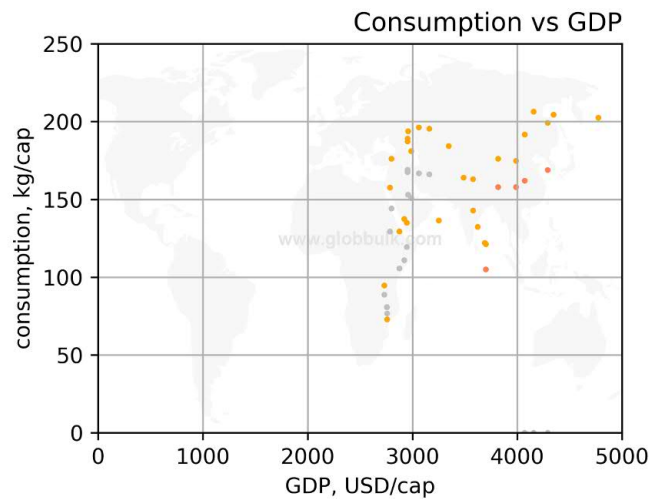
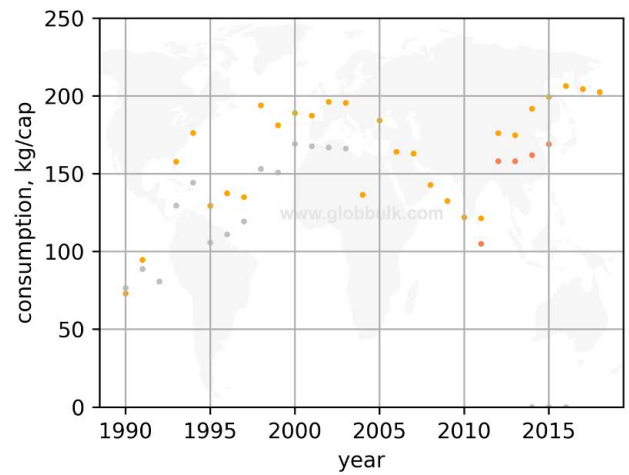
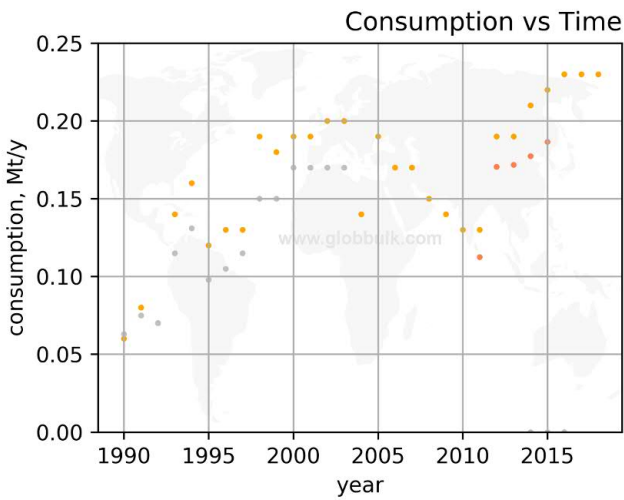
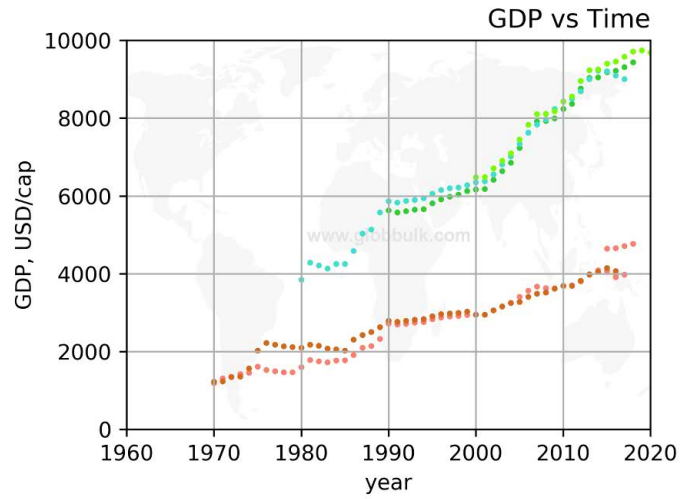
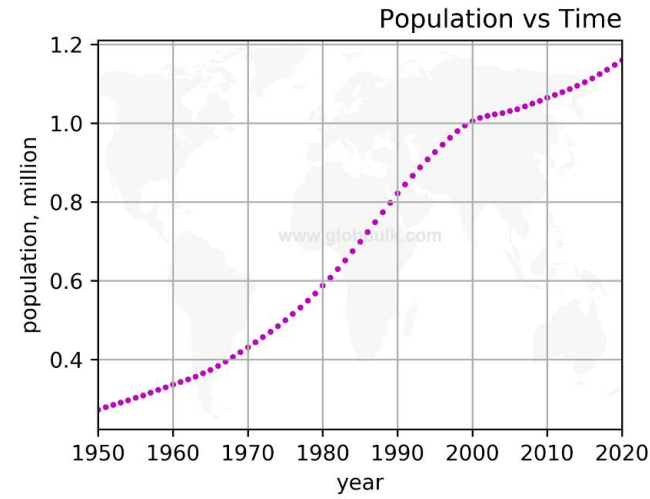


# Suriname



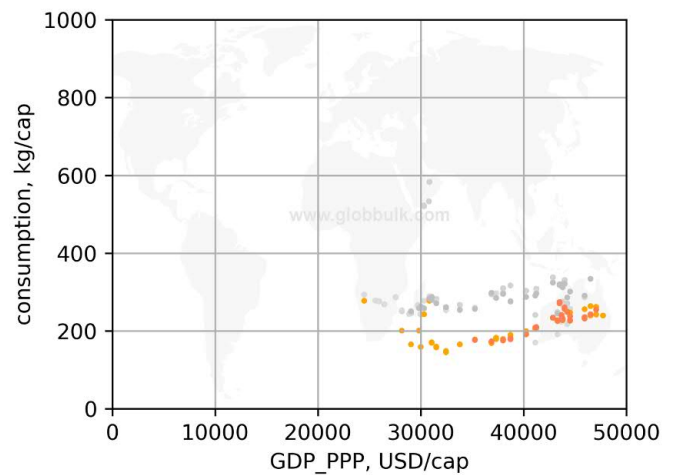
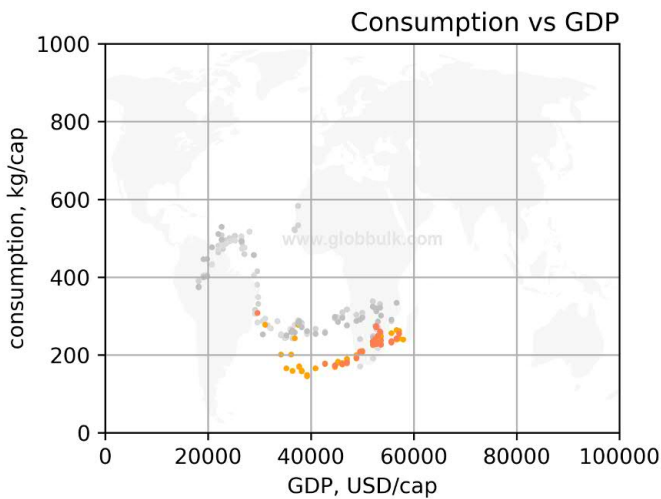
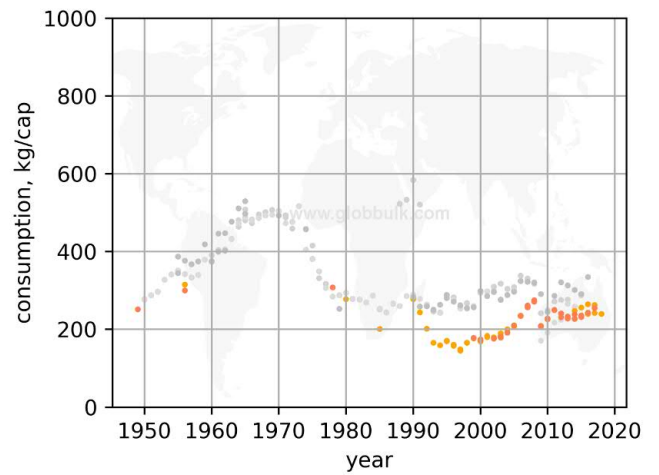
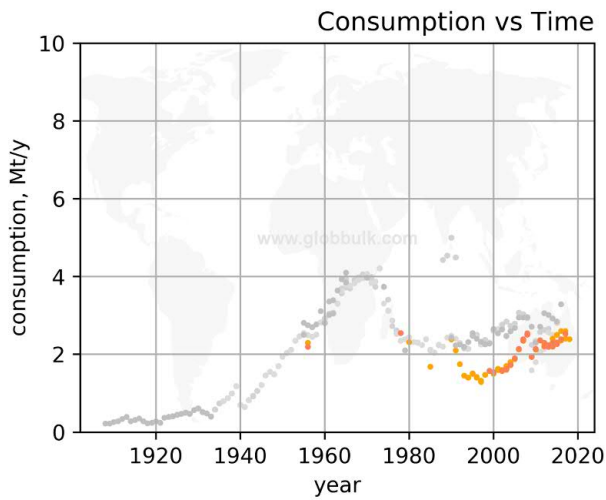
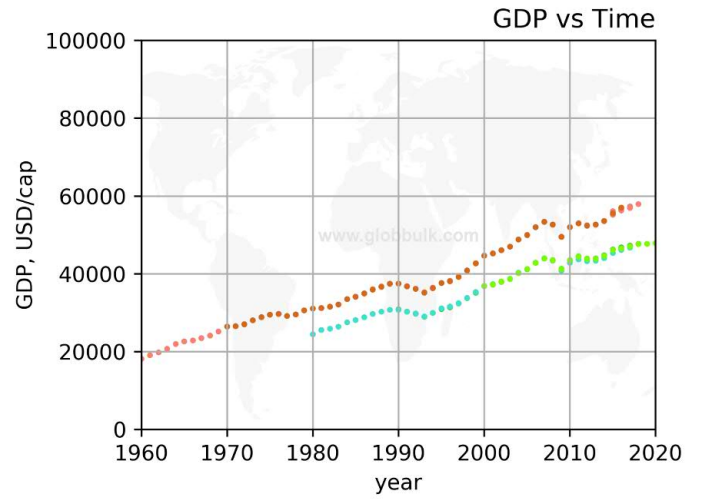
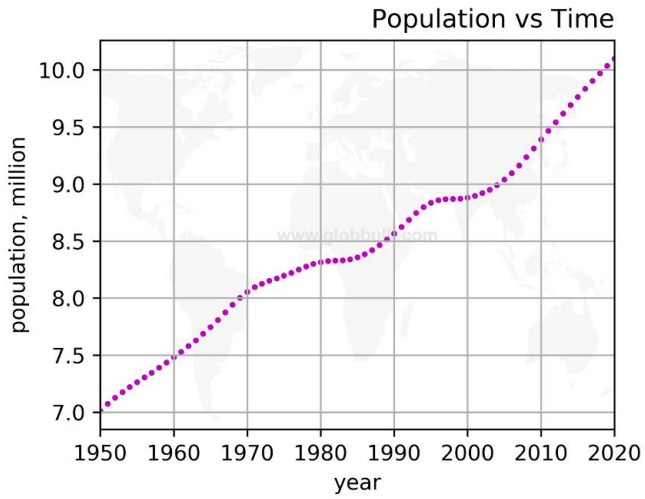


# Swaziland



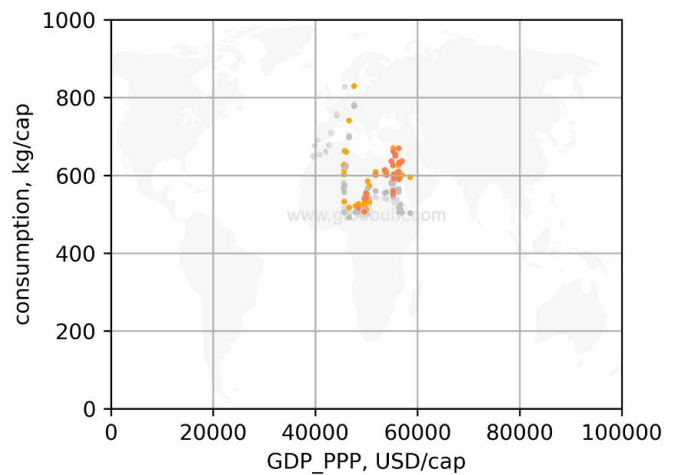
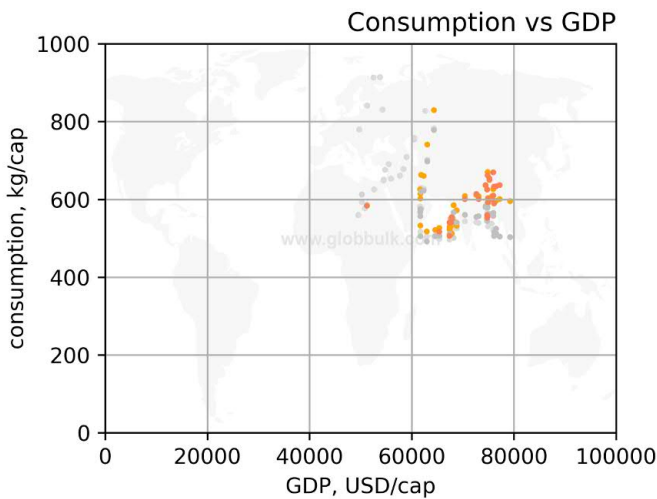
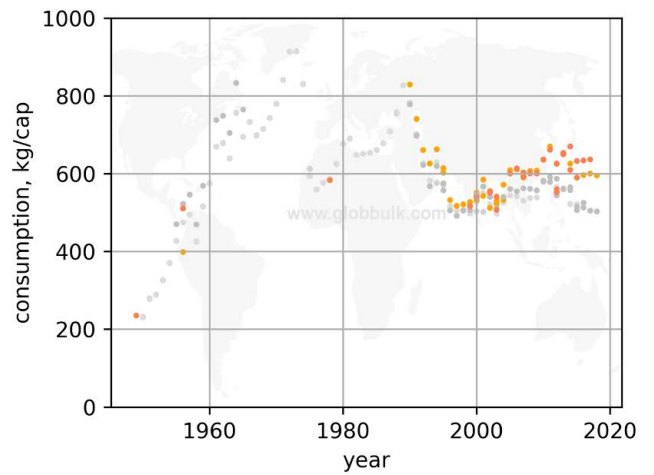
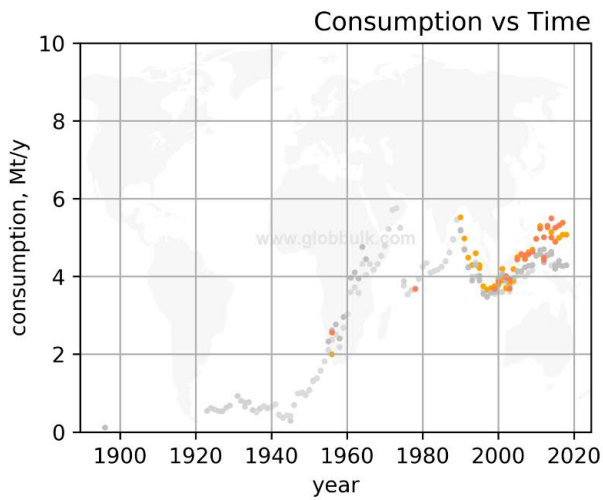
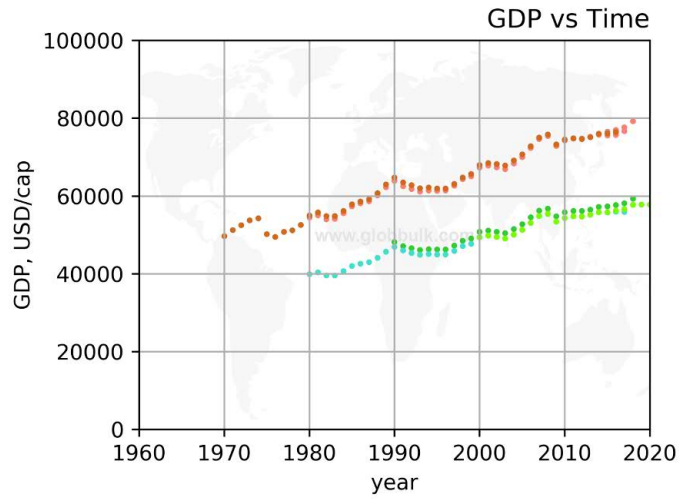
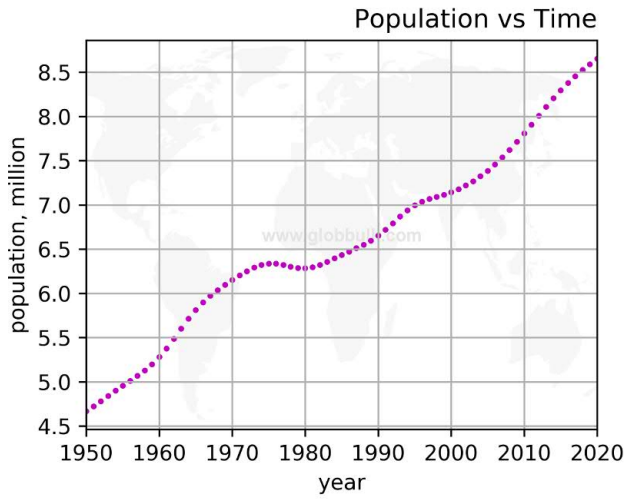


# Sweden



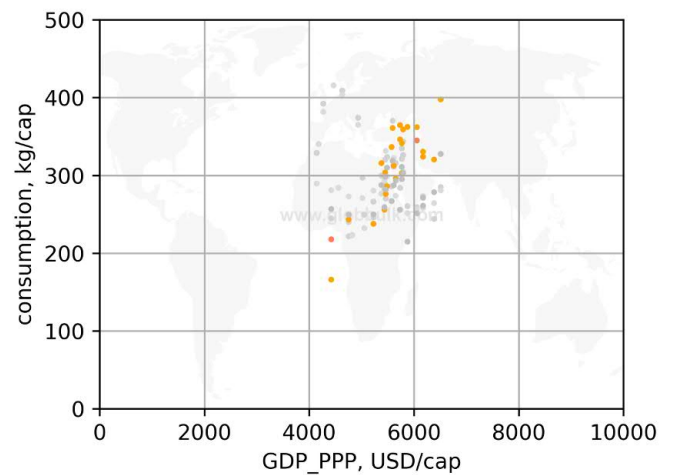
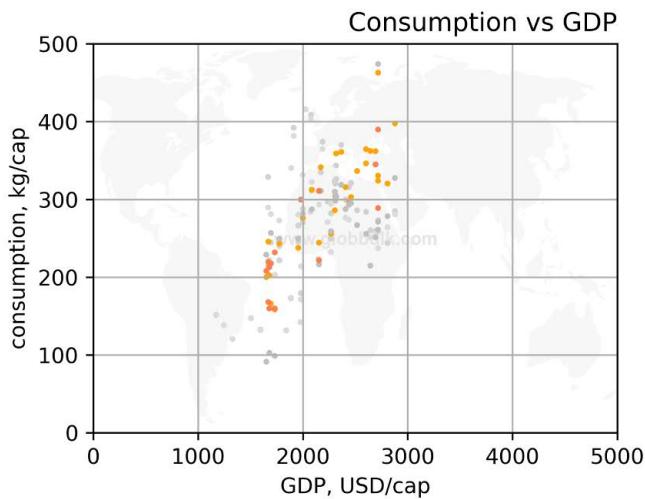
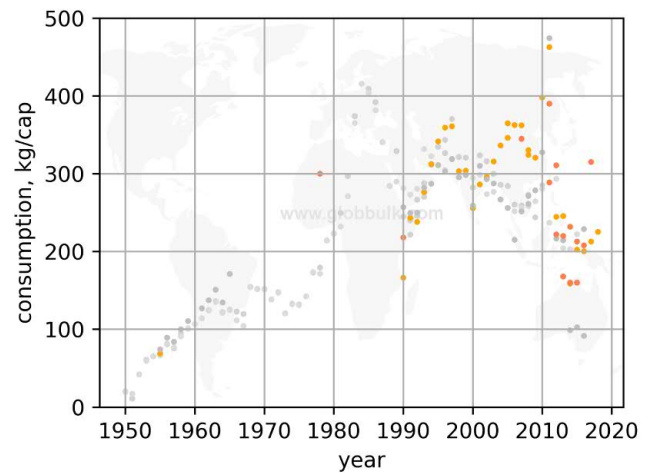
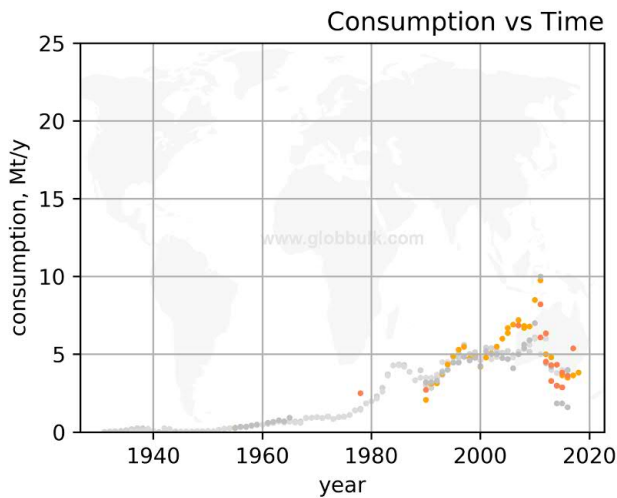
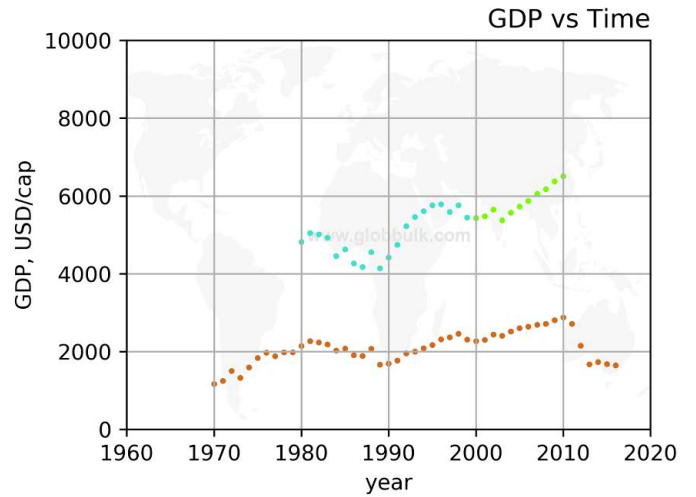
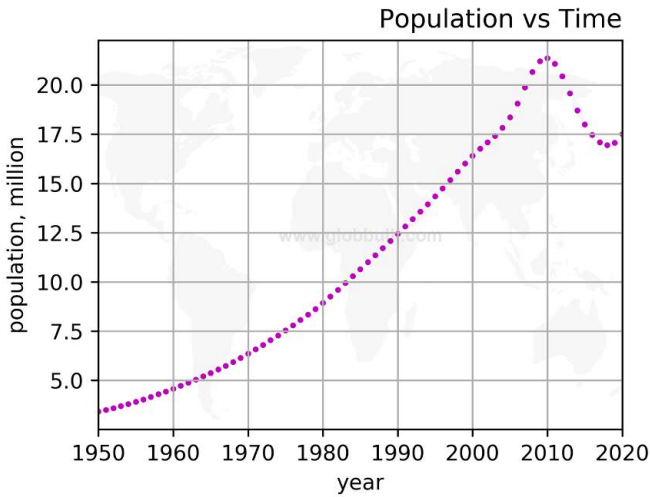


# Switzerland



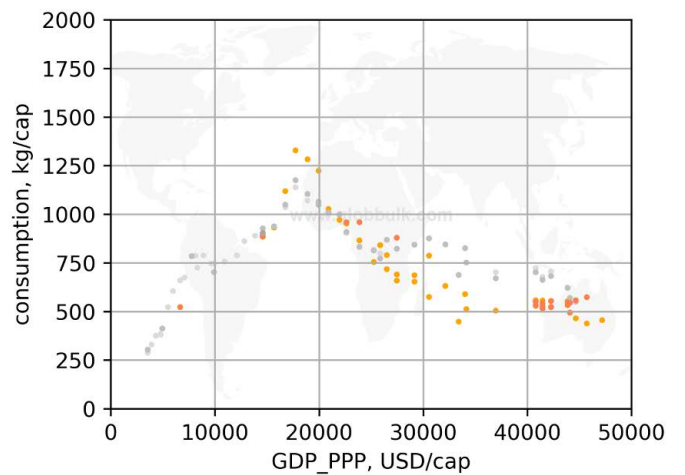
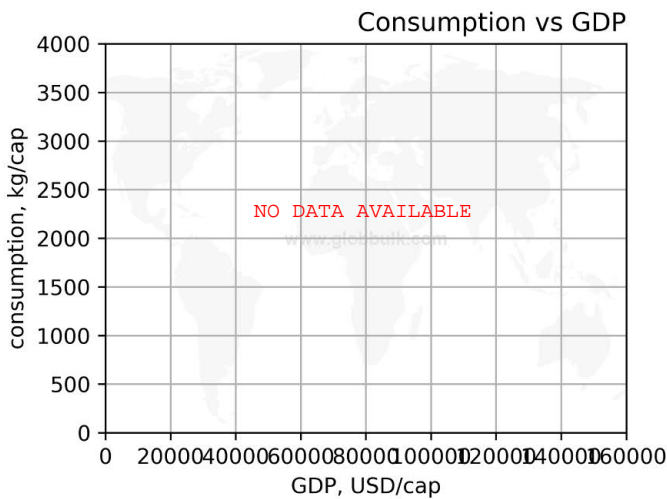
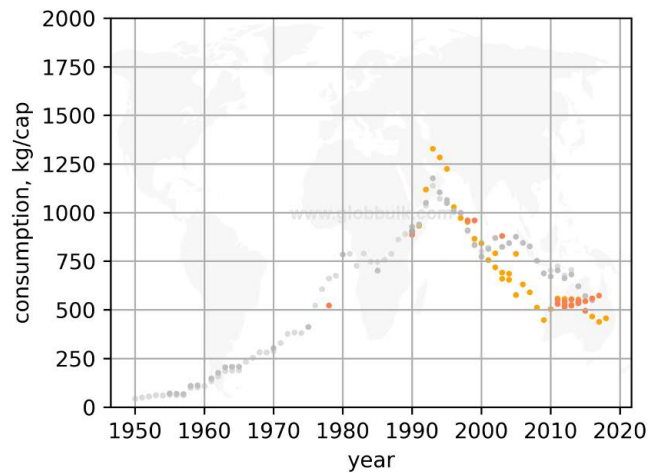
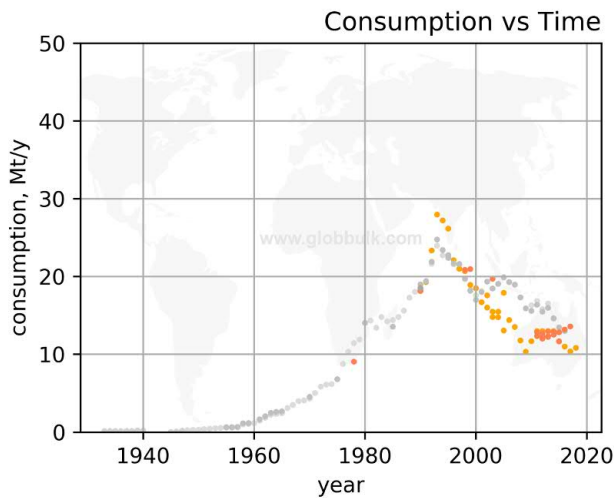
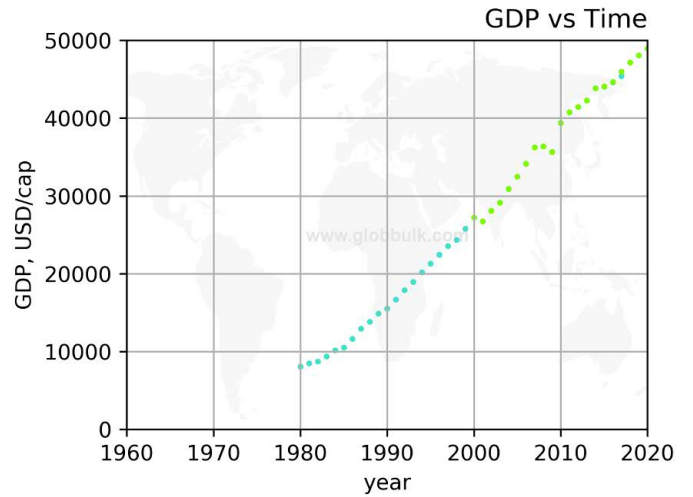
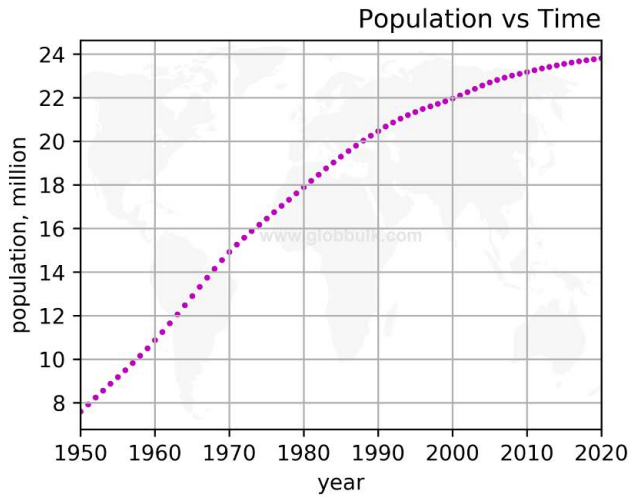


# Syria





# Taiwan

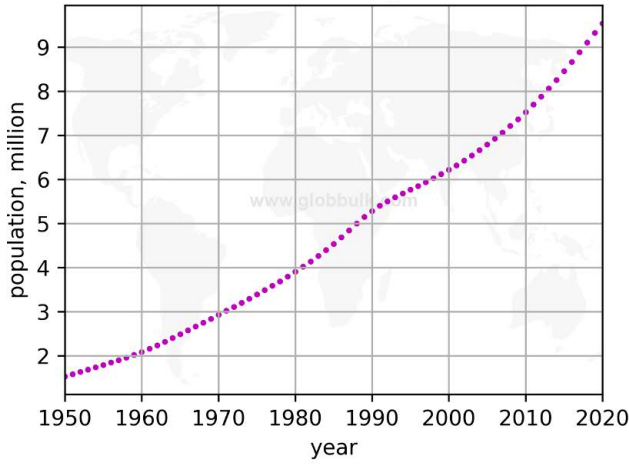




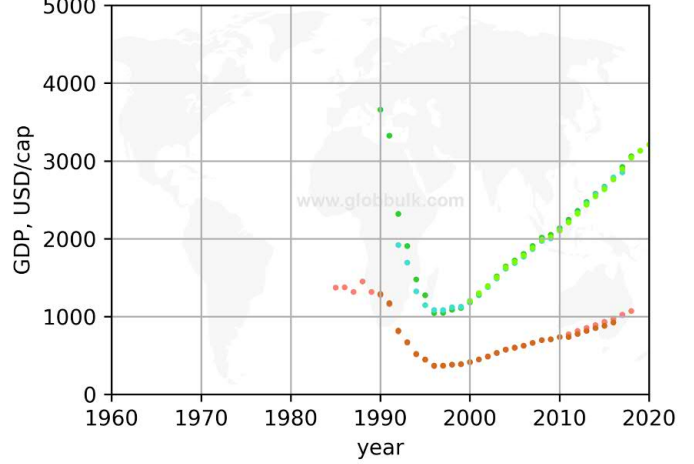


# Tajikistan

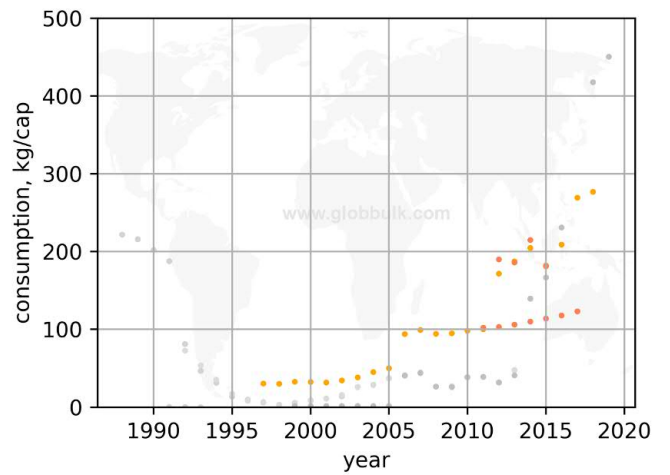
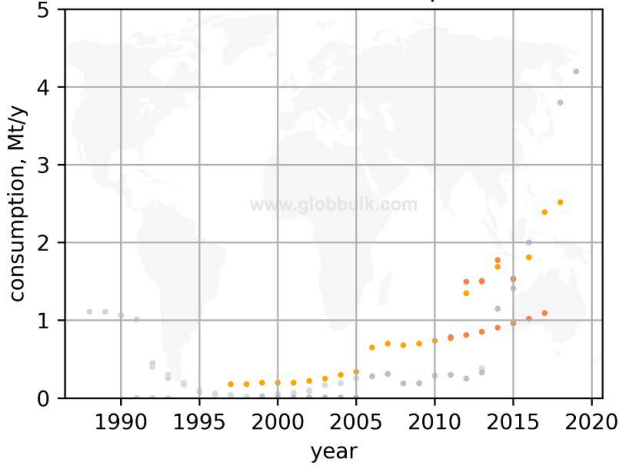
Population vs Time



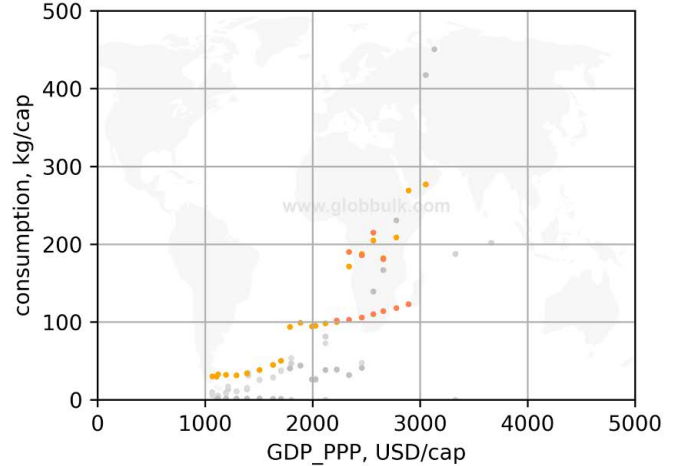
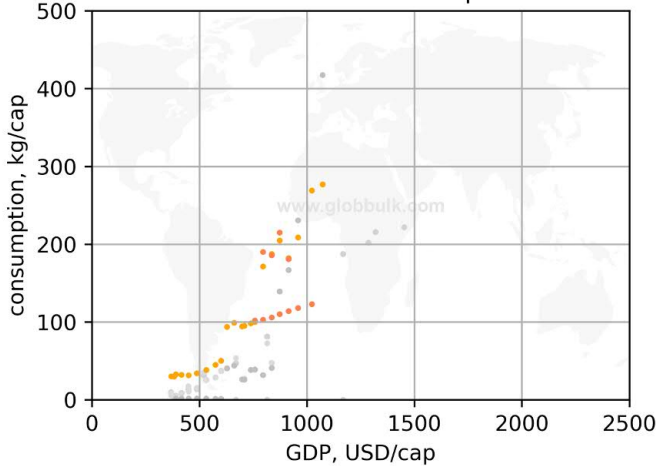
GDP vs Time



Consumption vs Time



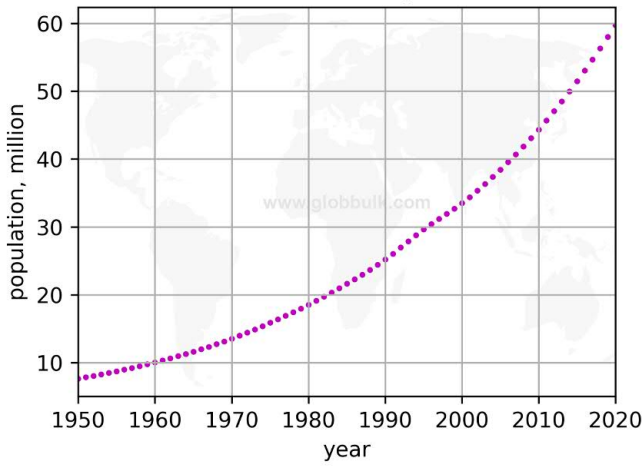
Consumption vs GDP



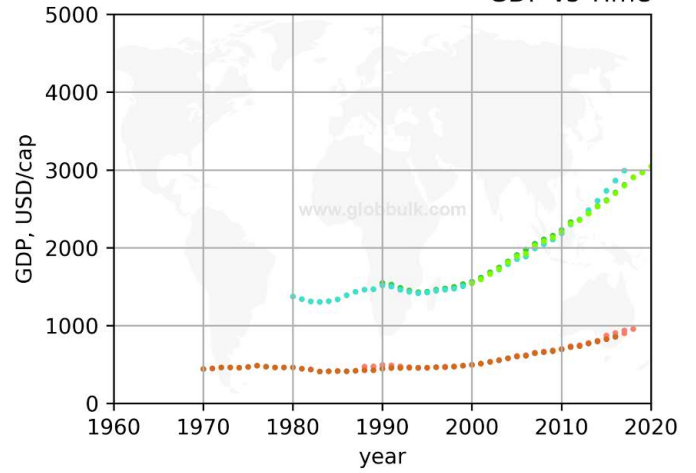


# Tanzania

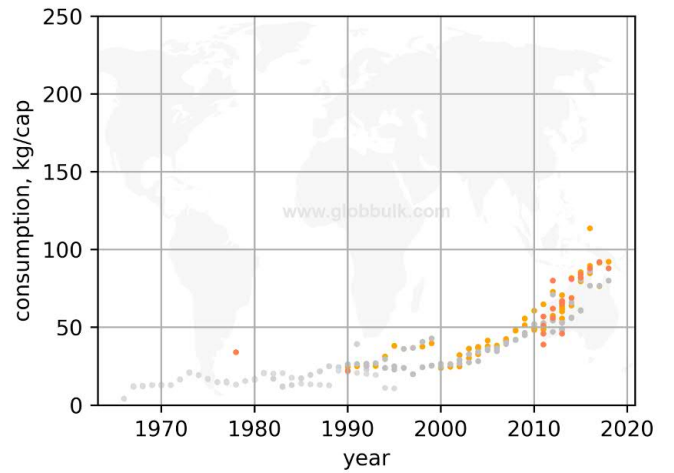
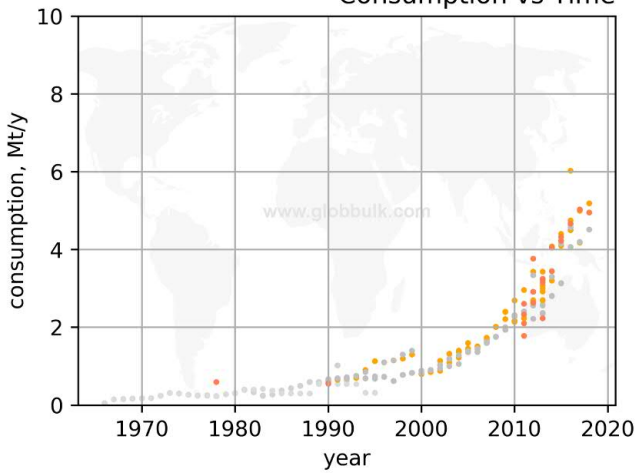
Population vs Time



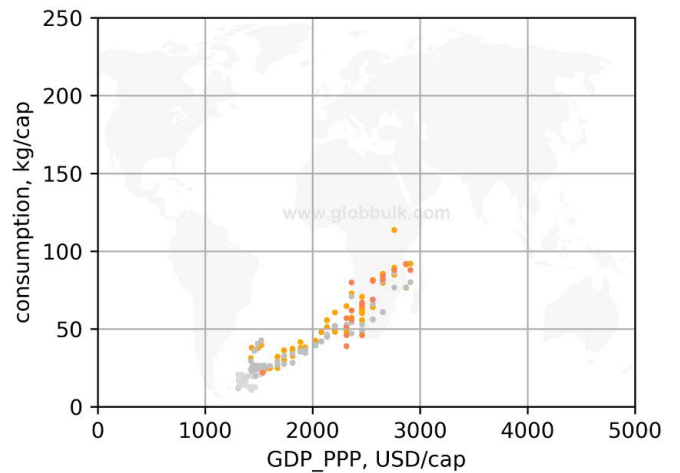
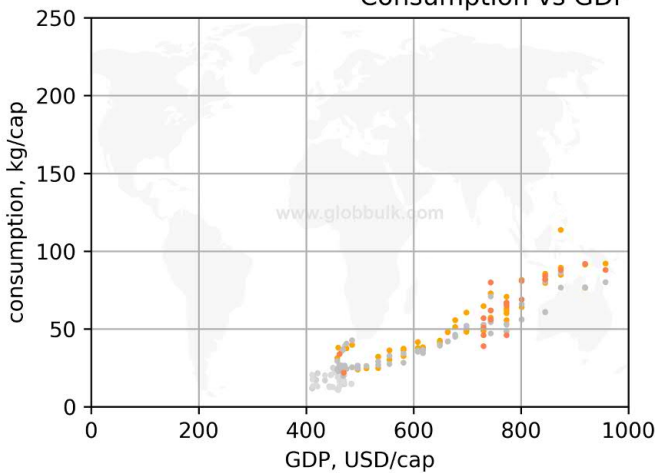
GDP vs Time



Consumption vs Time

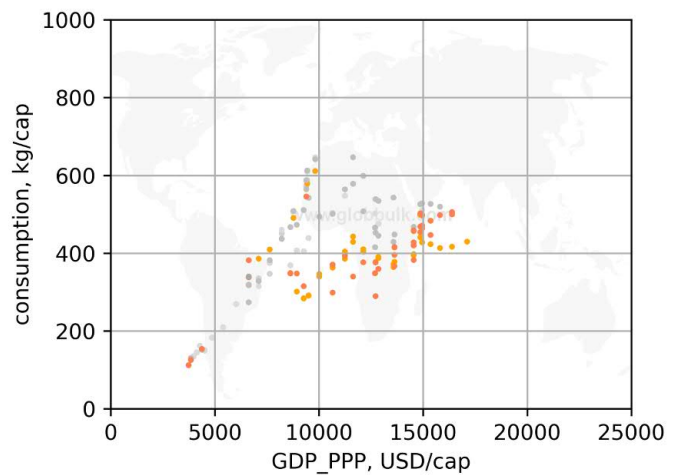
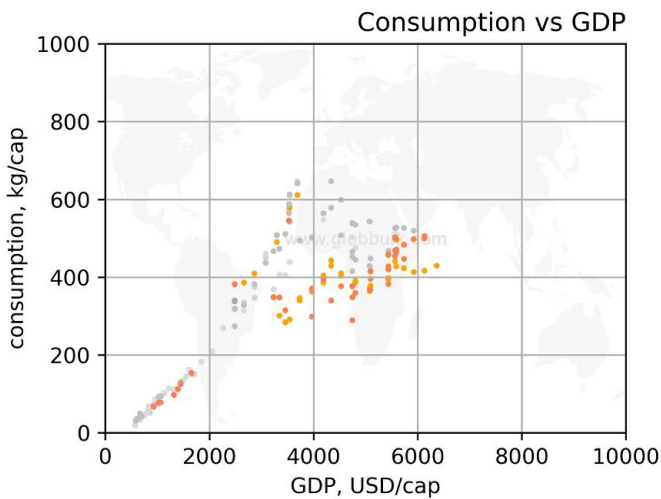
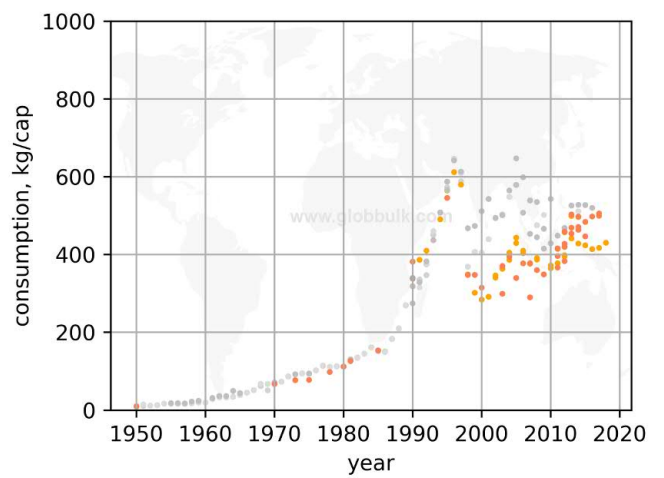
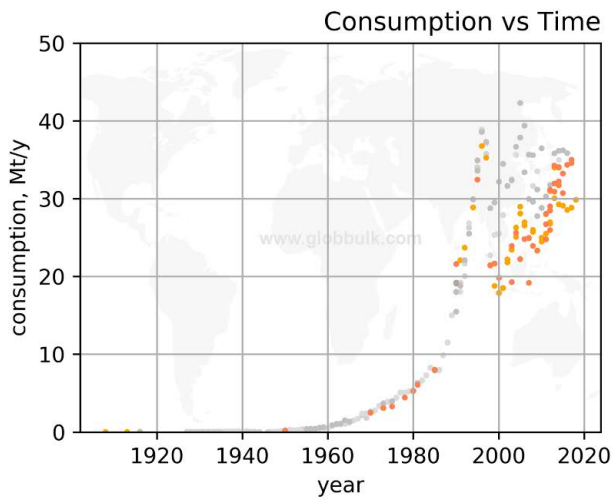
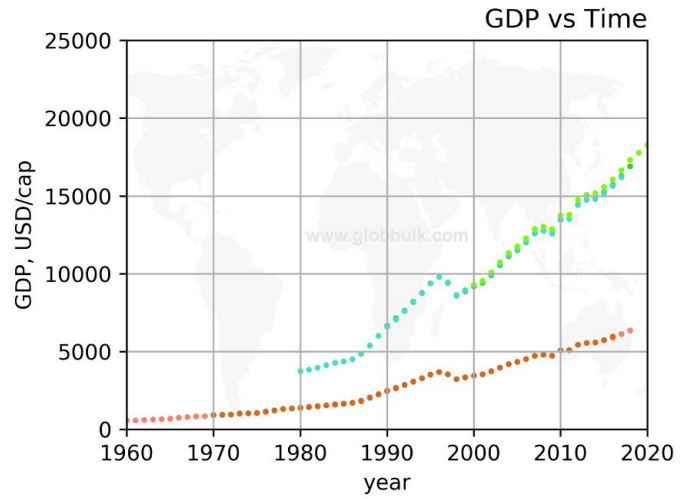
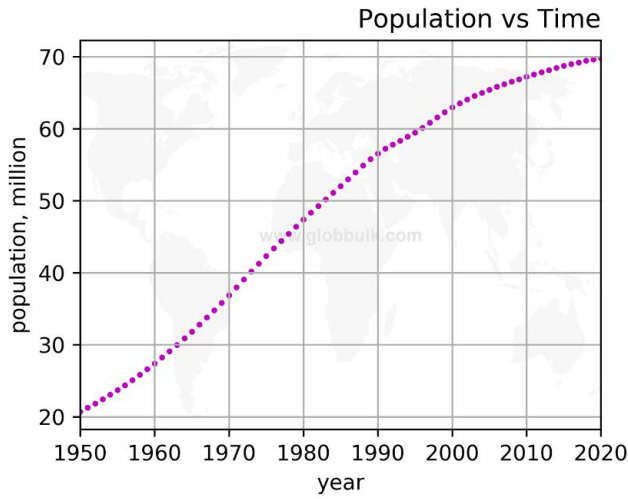


Consumption vs GDP





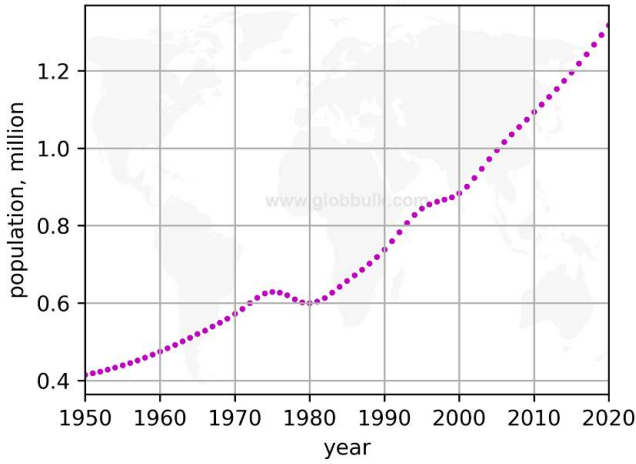
# Thailand



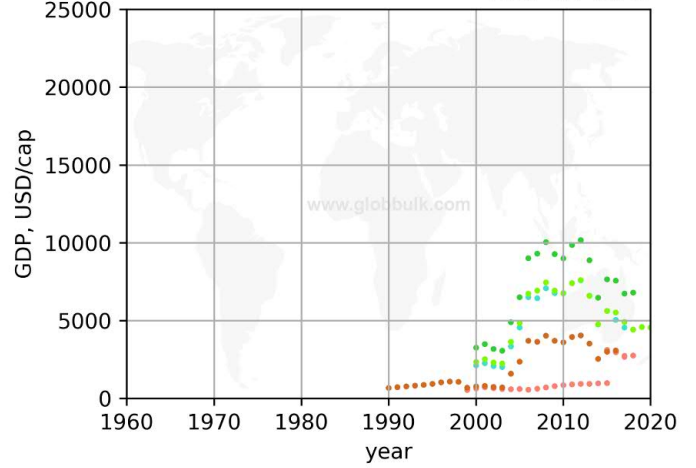


# Timor-Leste

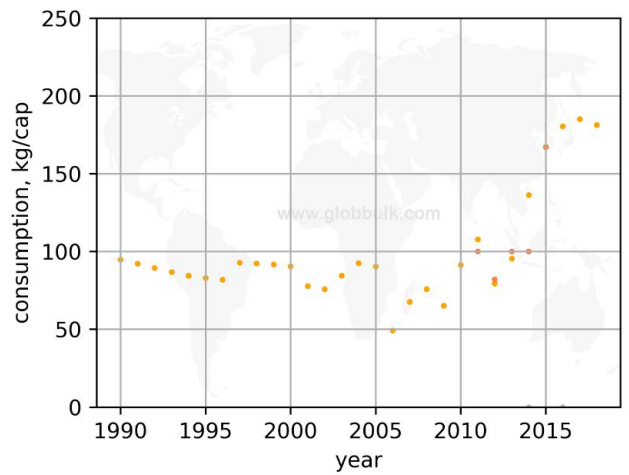
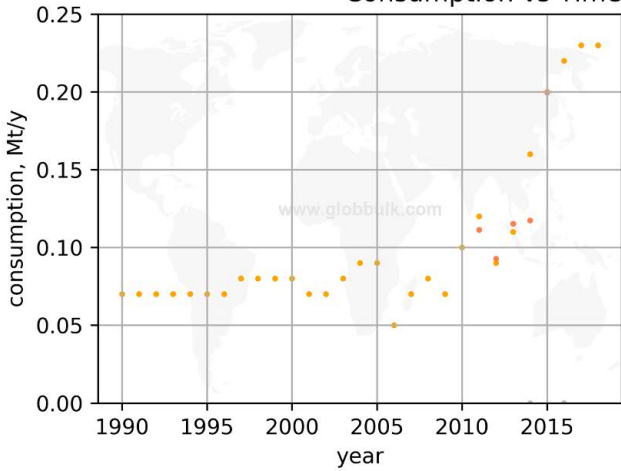
Population vs Time



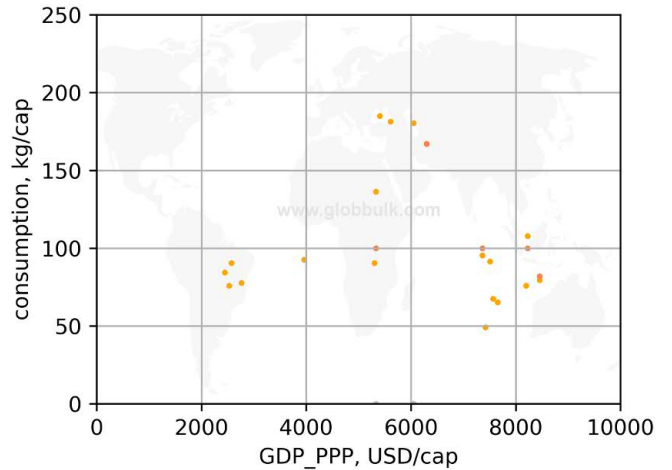
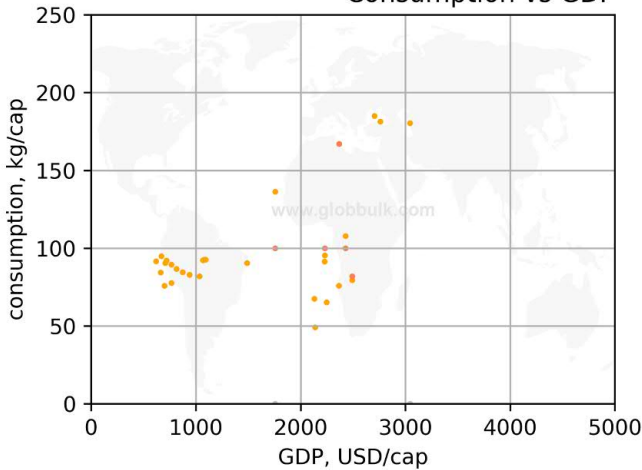
GDP vs Time



Consumption vs Time



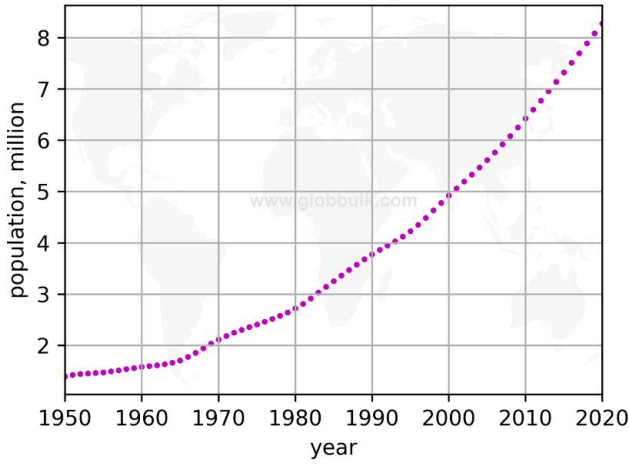
Consumption vs GDP



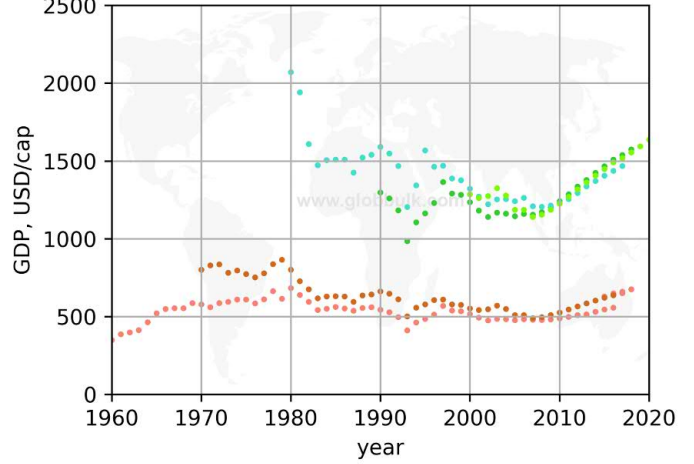


# Togo

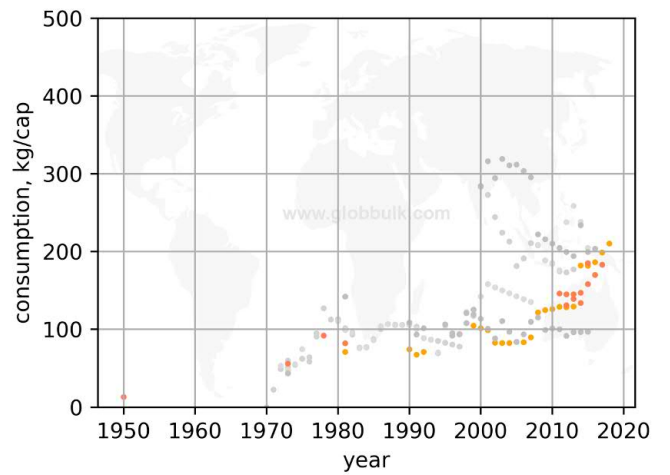
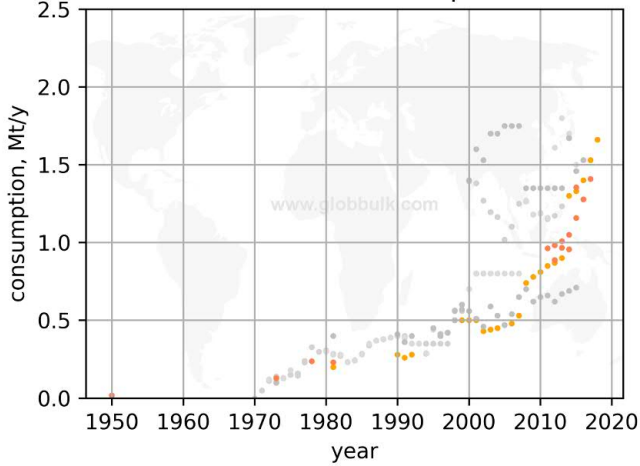
Population vs Time



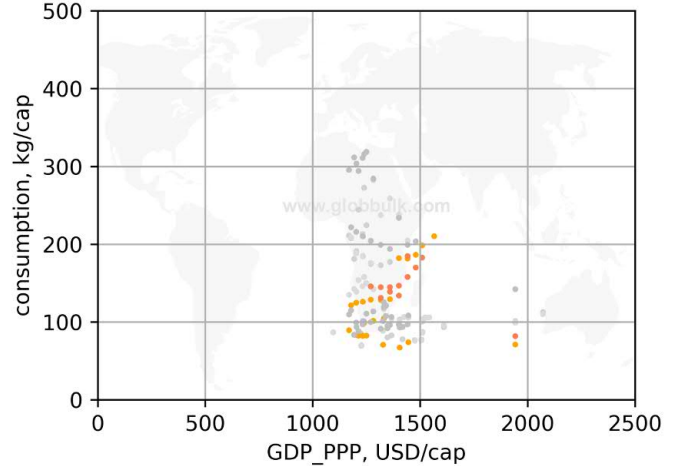
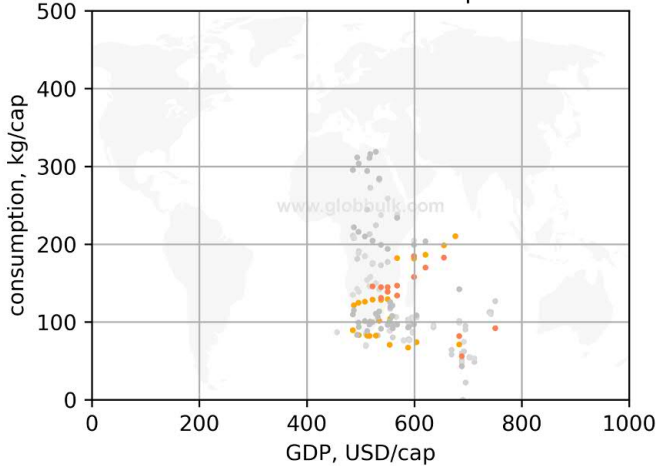
GDP vs Time



Consumption vs Time

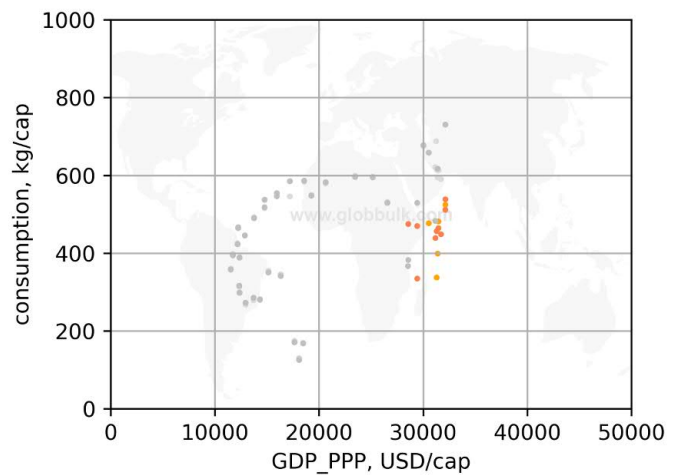
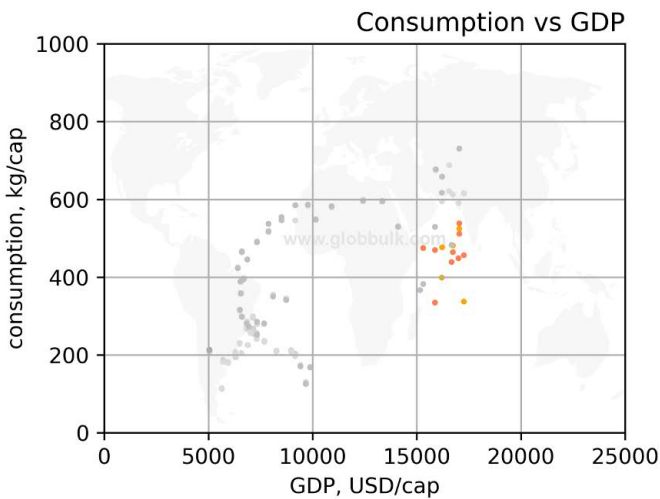
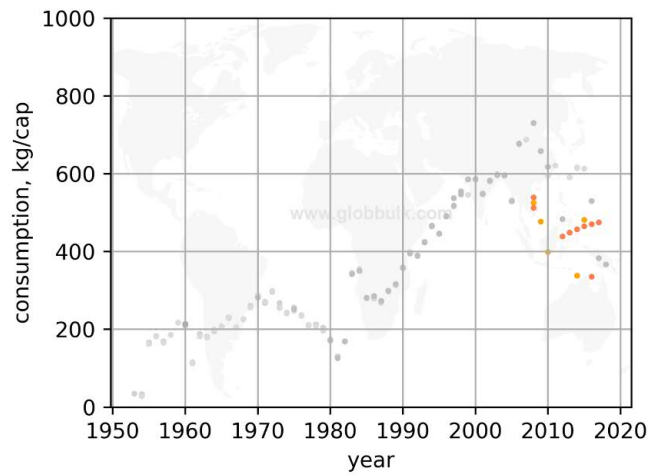
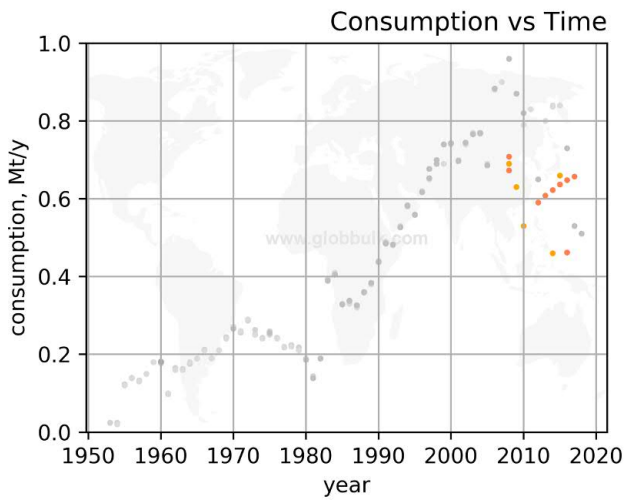
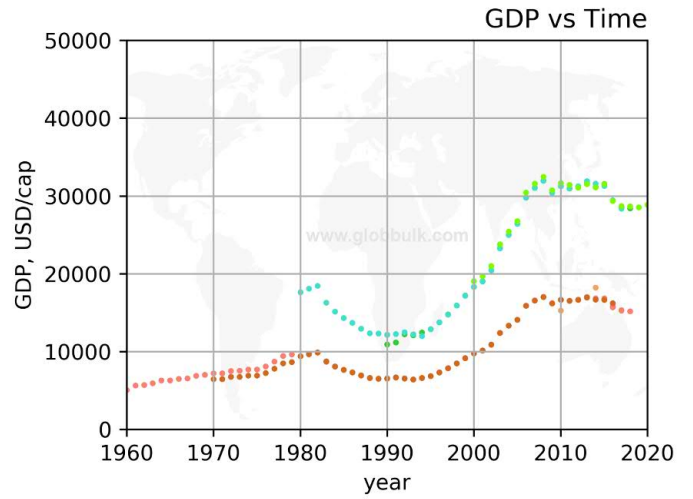
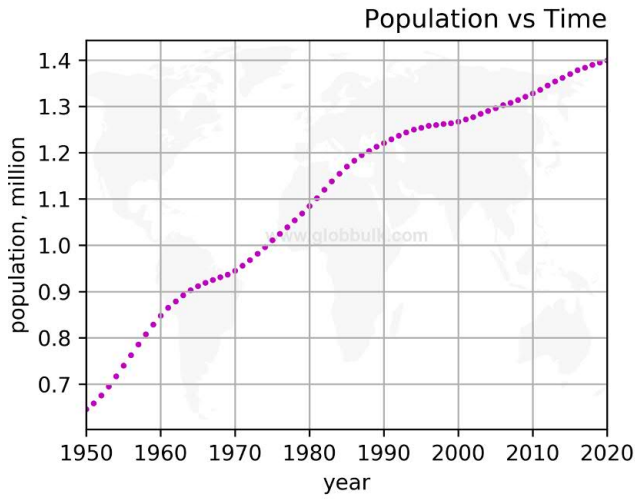


Consumption vs GDP



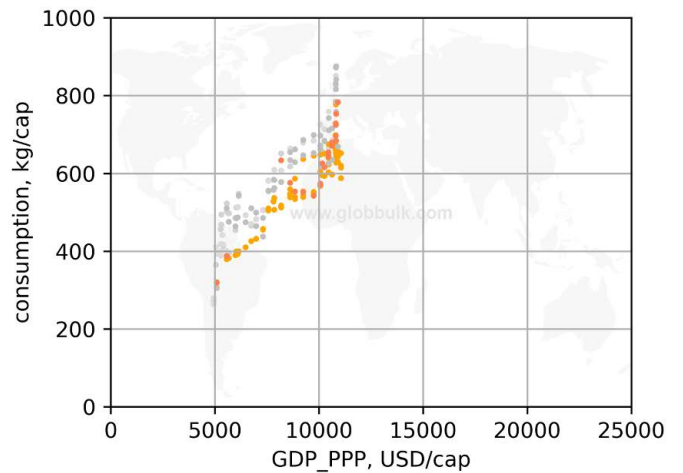
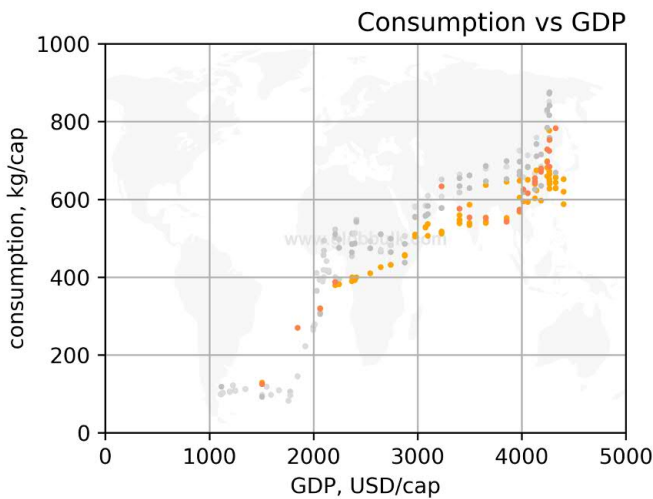
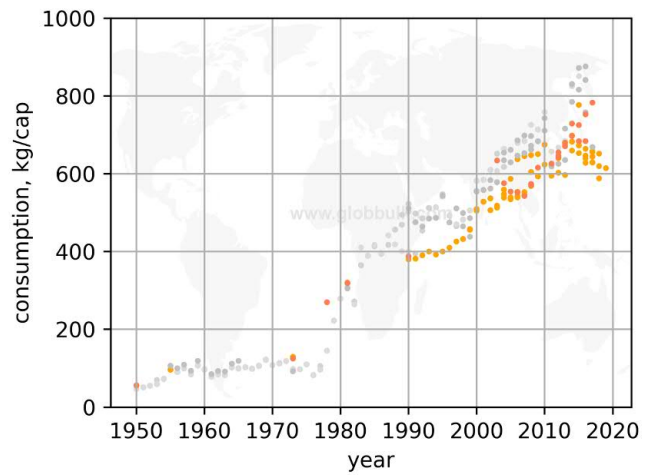
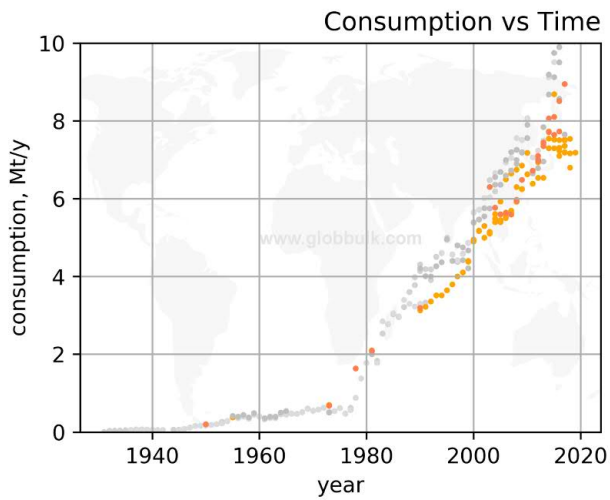
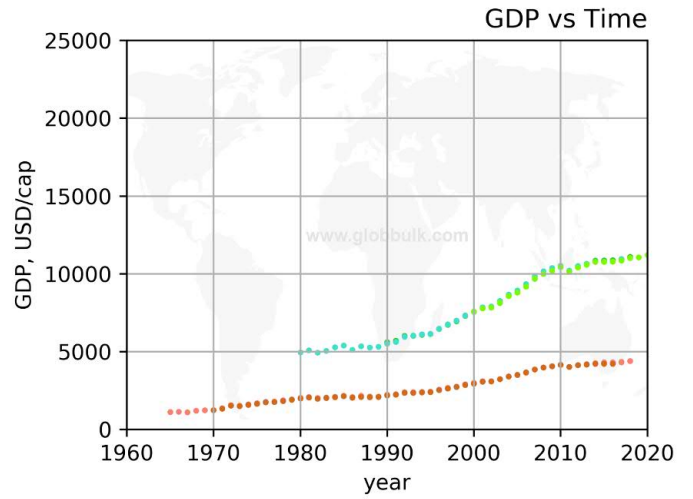
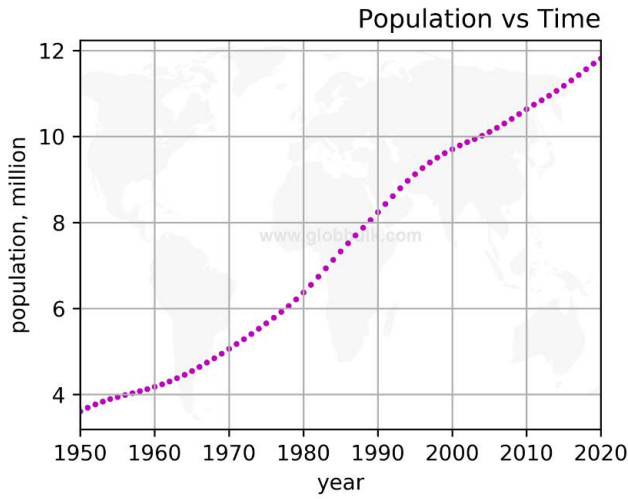


# Trinidad & T.





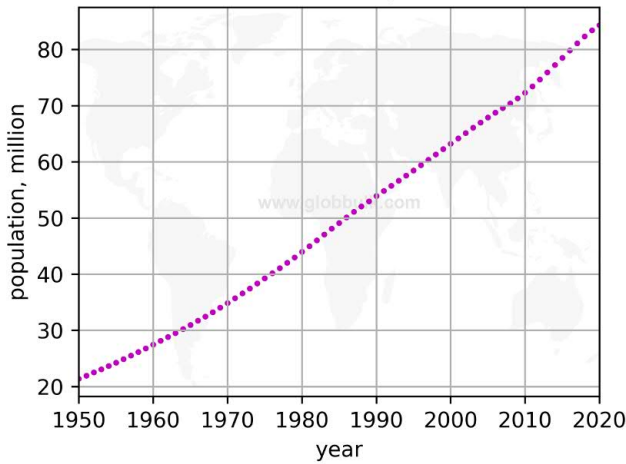
# Tunisia



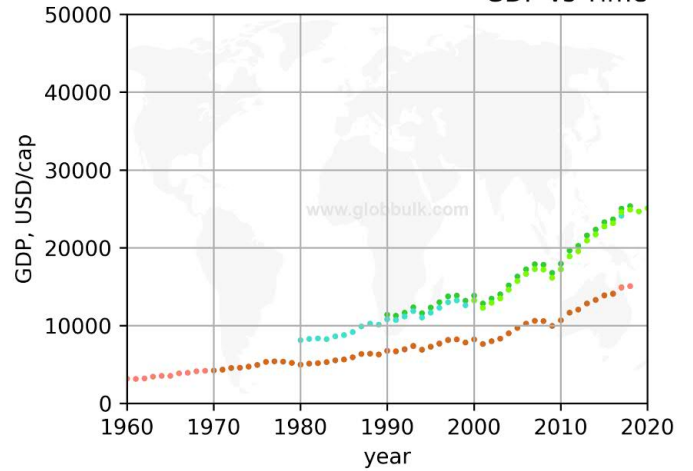


# Turkey

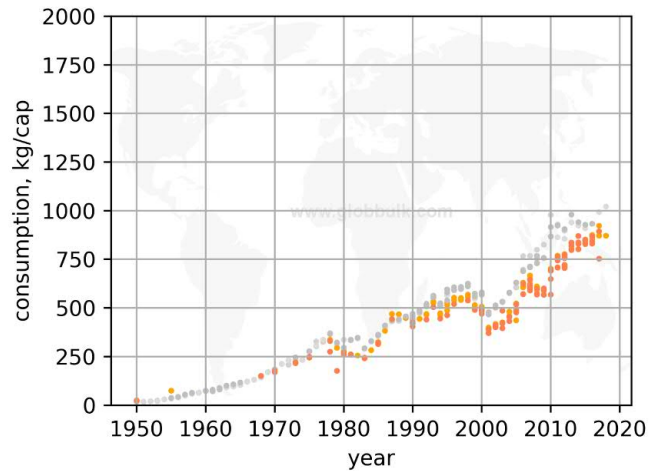
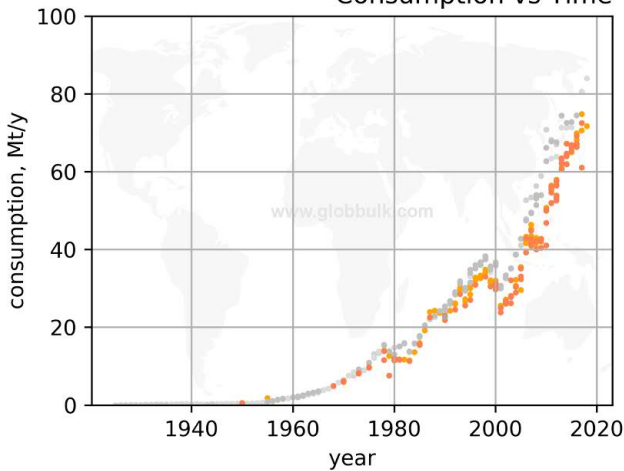
Population vs Time



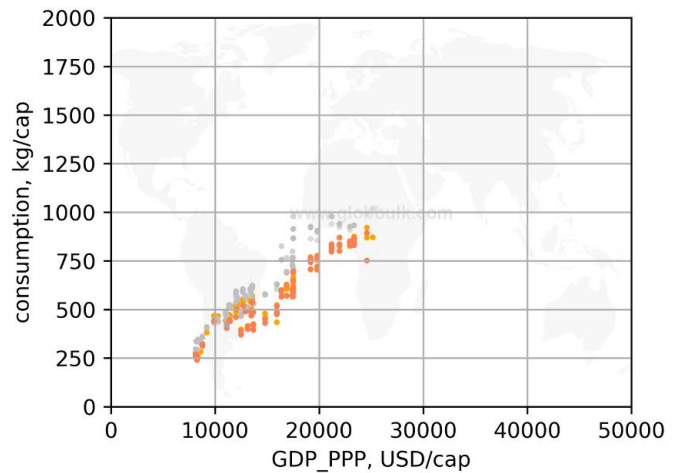
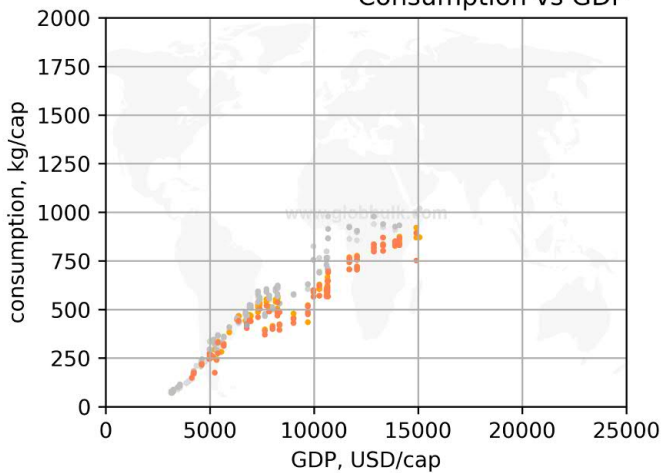
GDP vs Time



Consumption vs Time



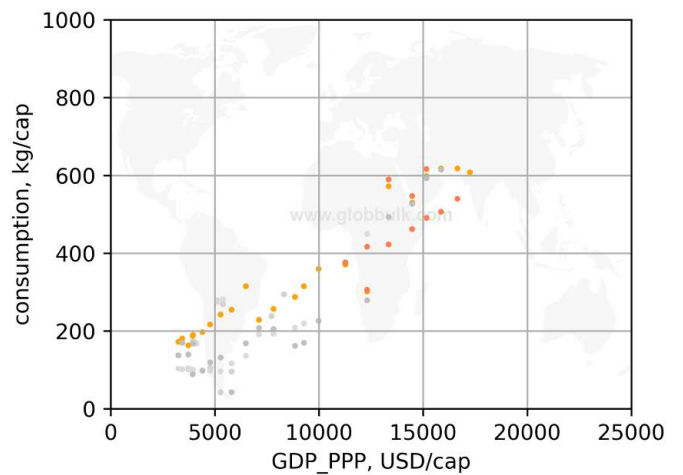
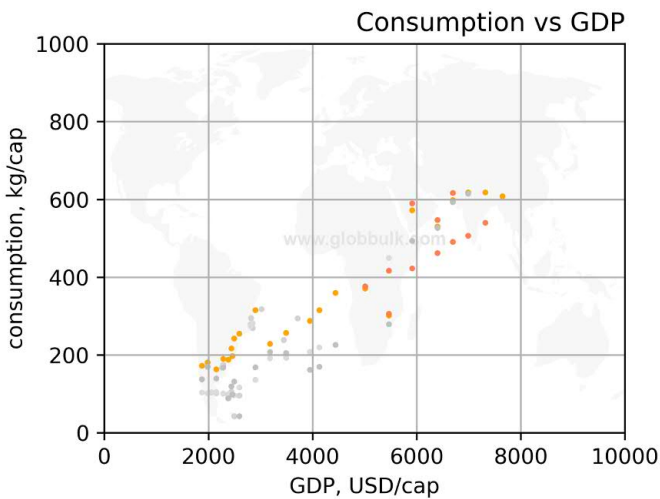
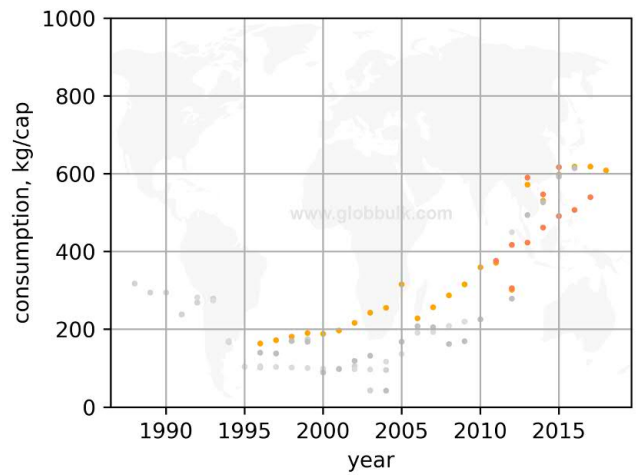
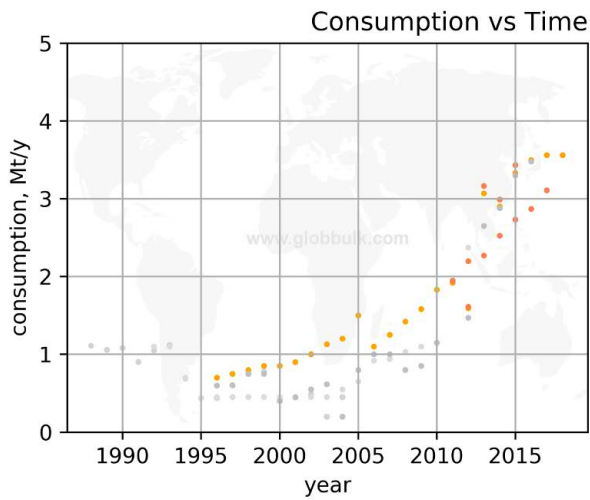
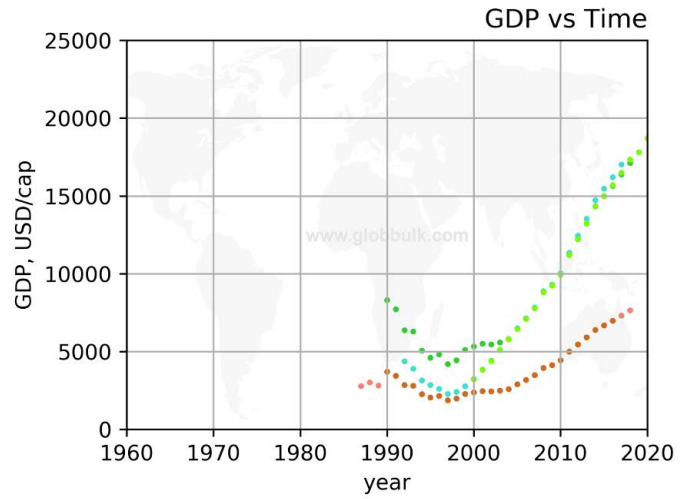
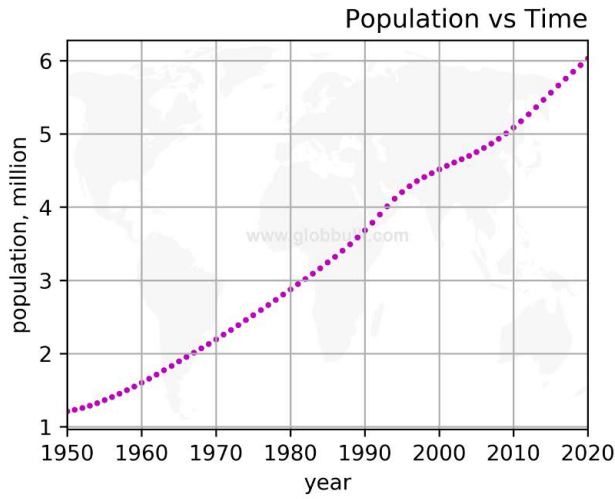
Consumption vs GDP







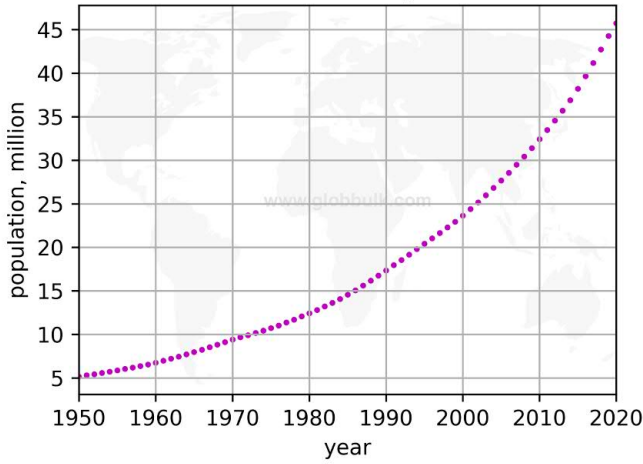
# Turkmenistan



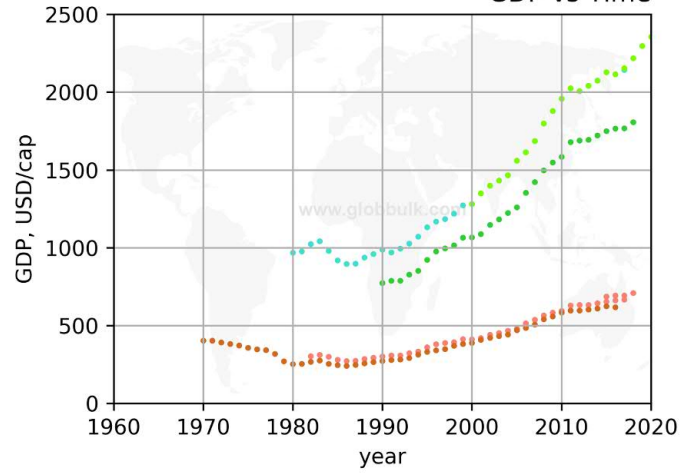


# Uganda

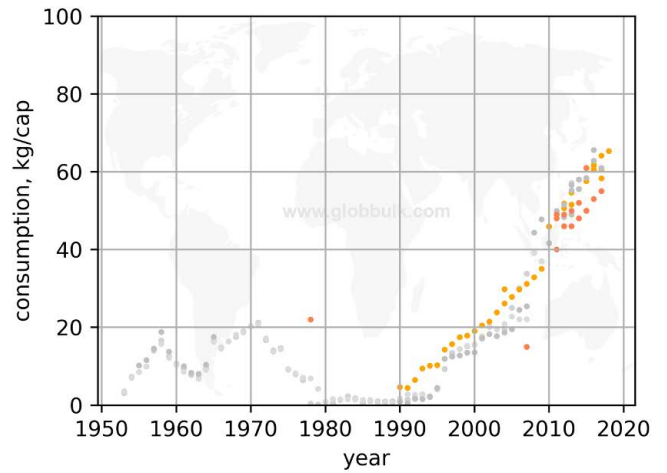
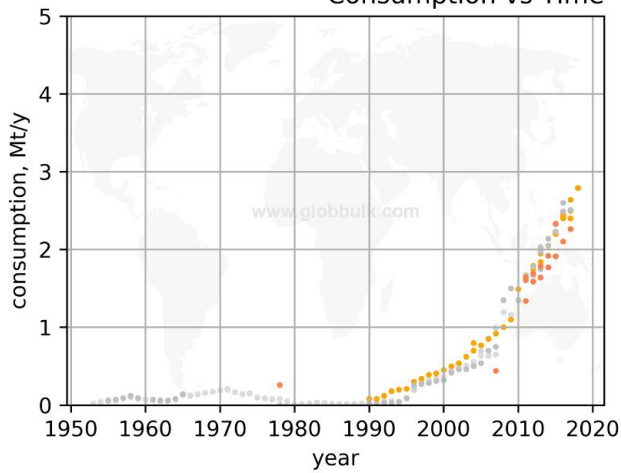
Population vs Time



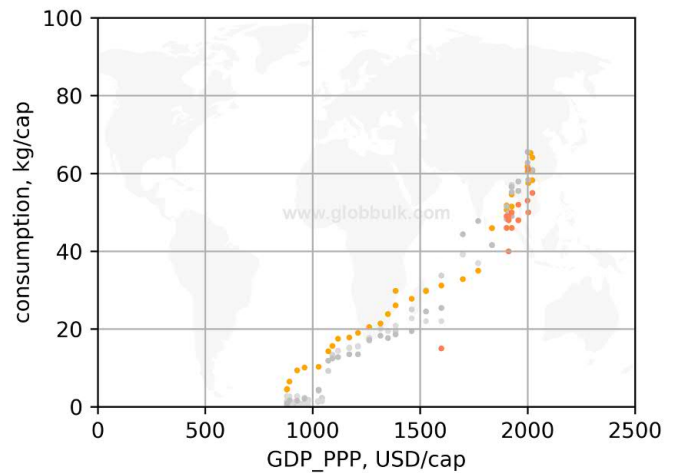
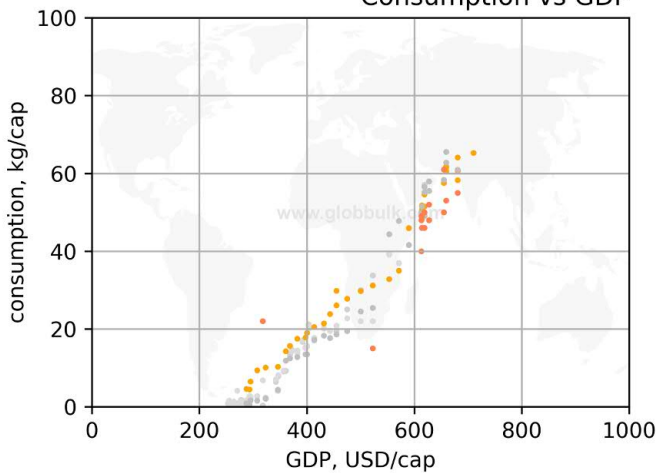
GDP vs Time



Consumption vs Time

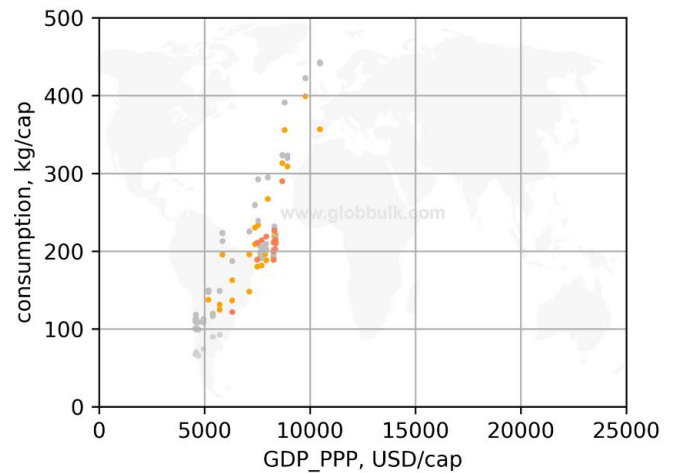
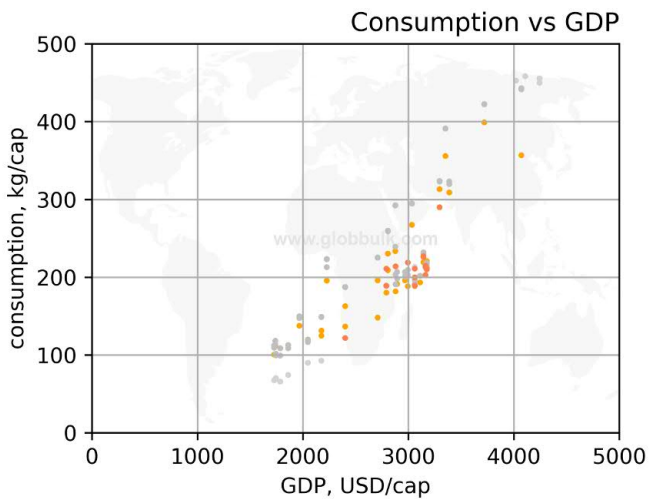
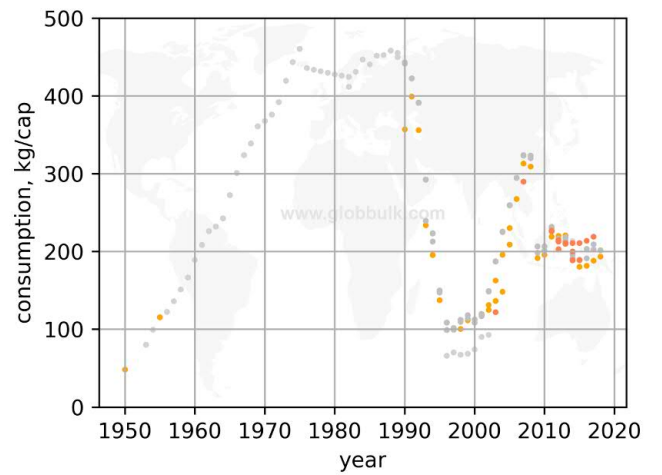
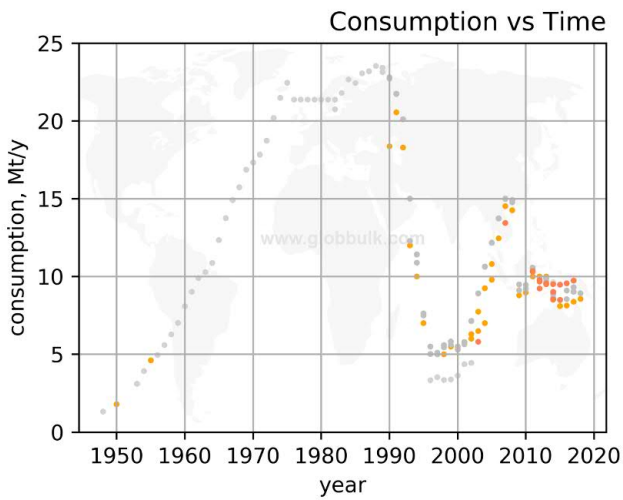
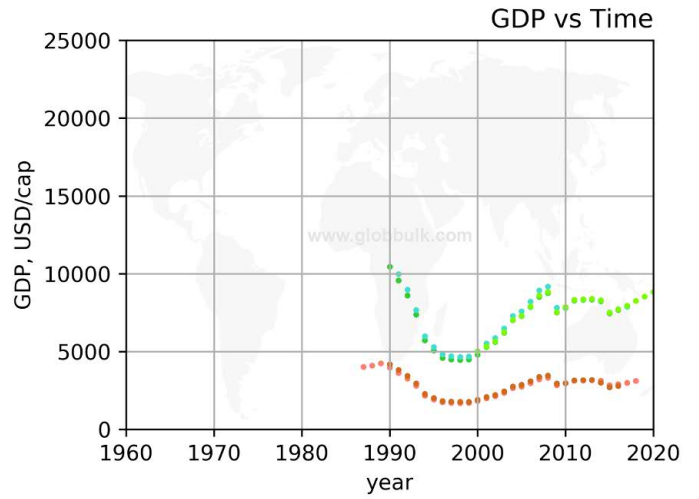
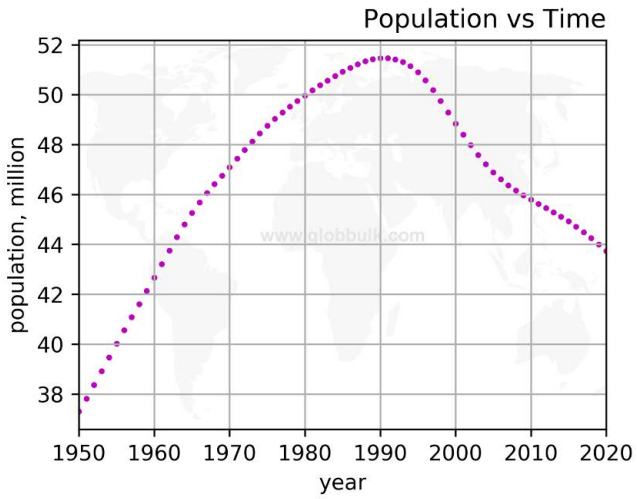


Consumption vs GDP



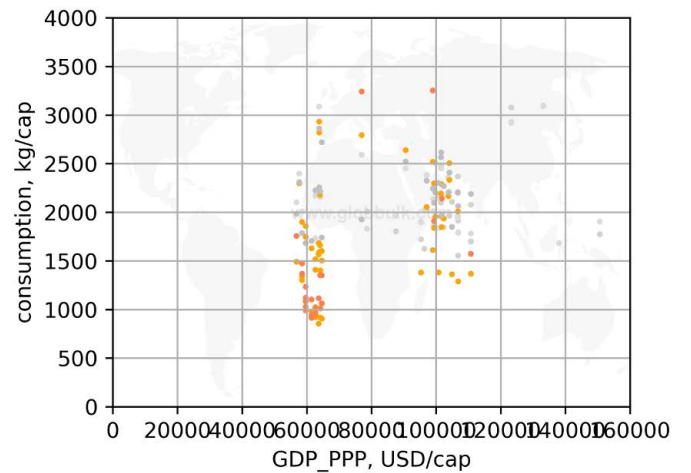
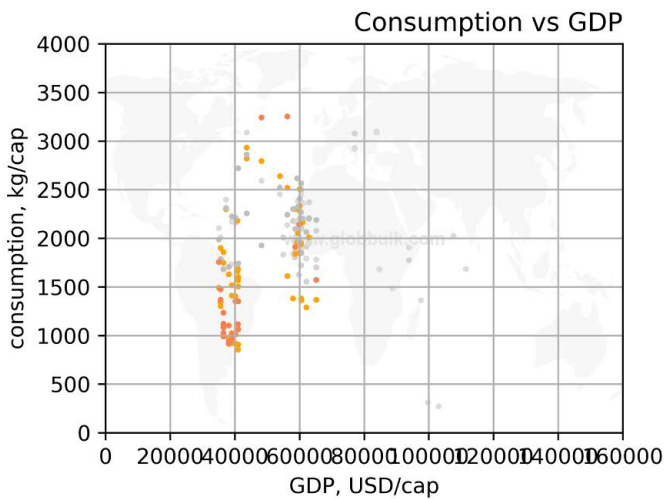
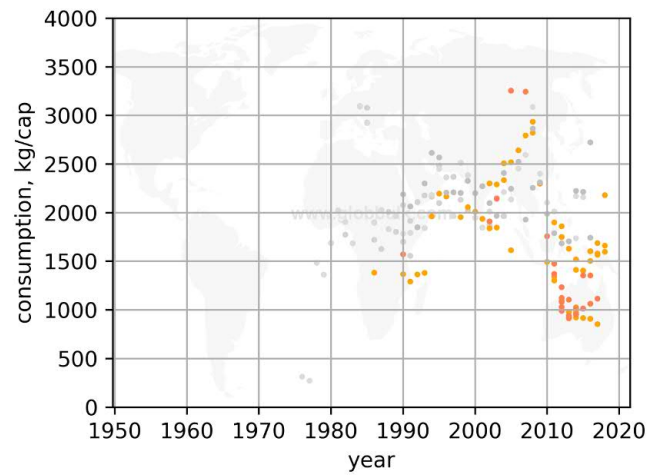
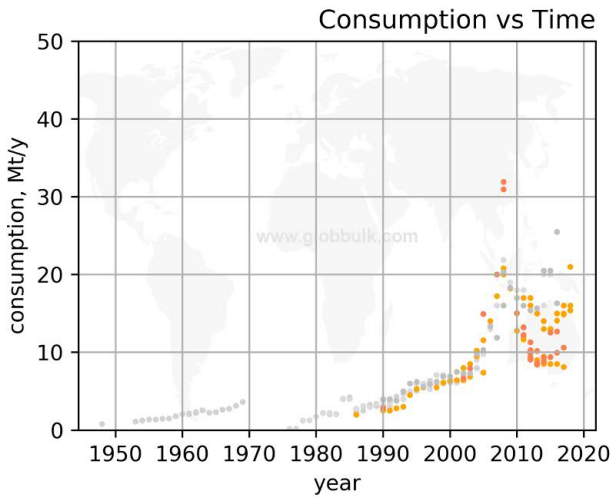
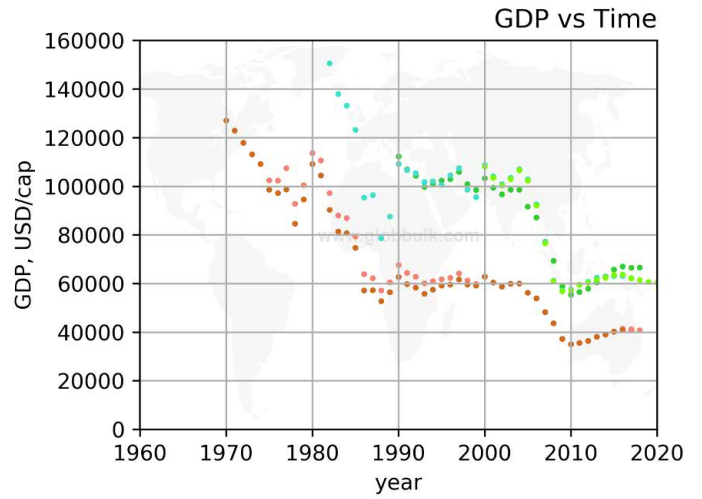
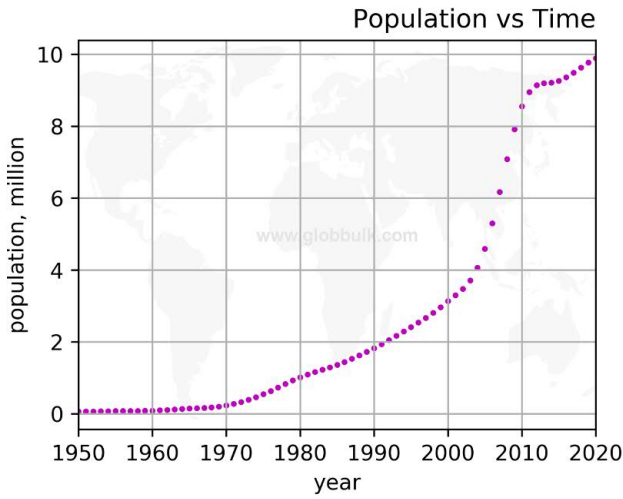


# Ukraine



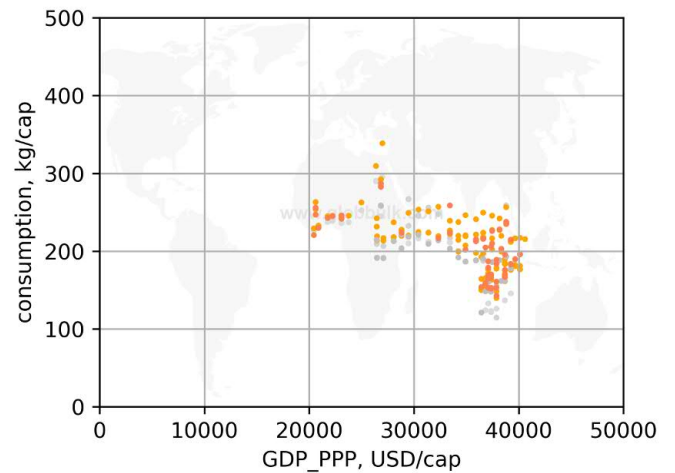
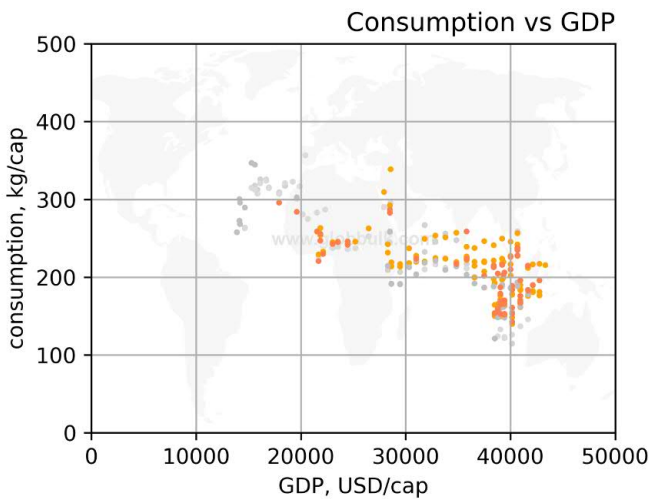
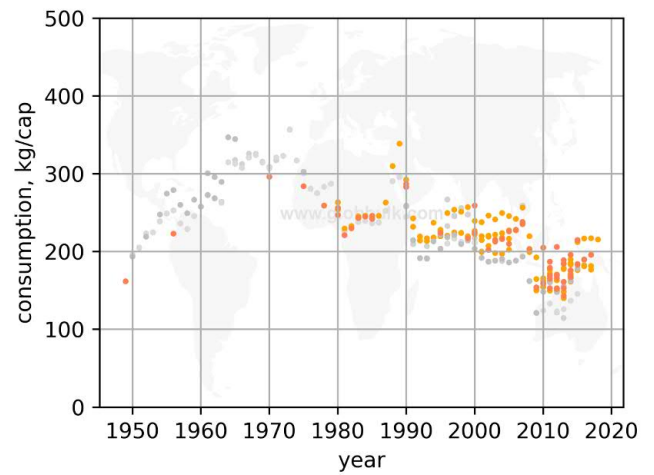
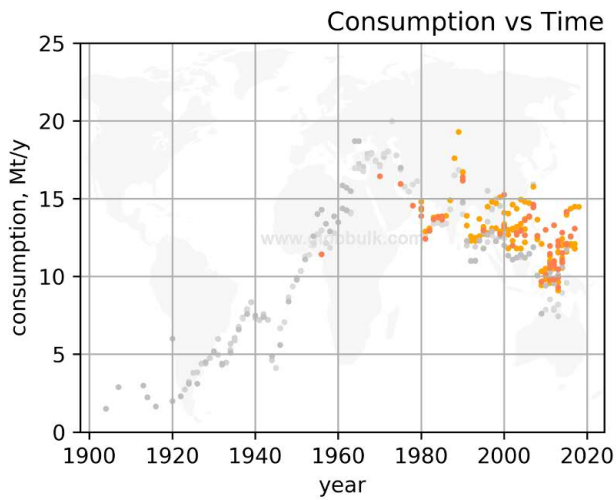
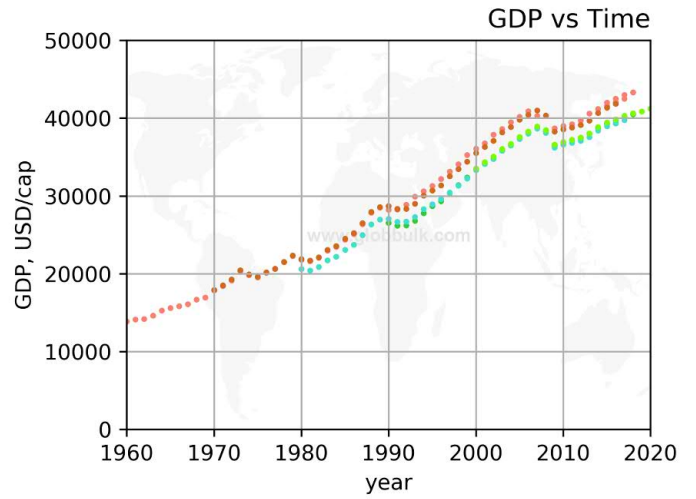
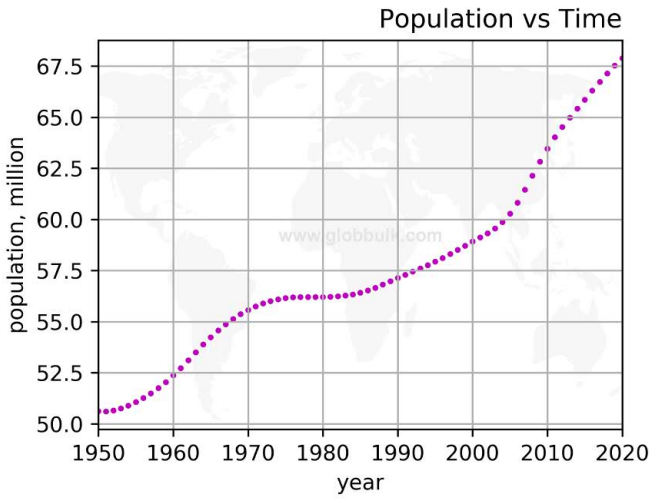


# United Arab Em.





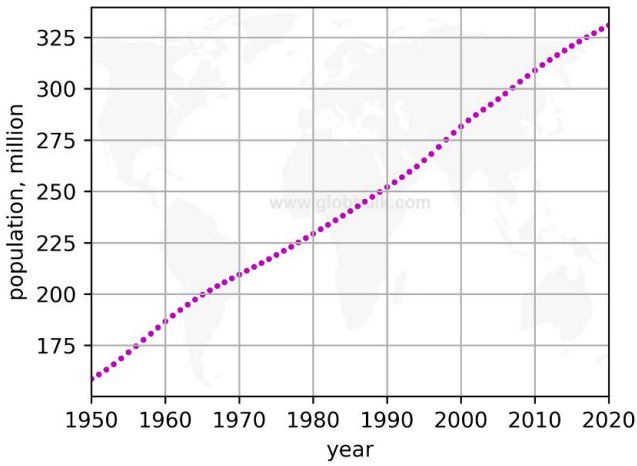
# United Kingdom



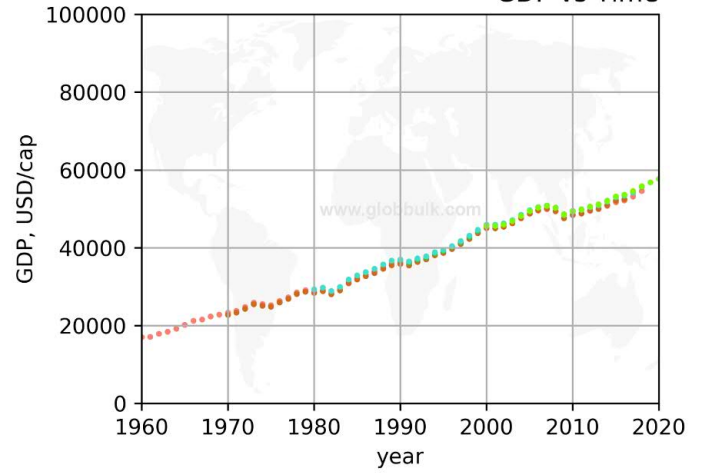


# United States

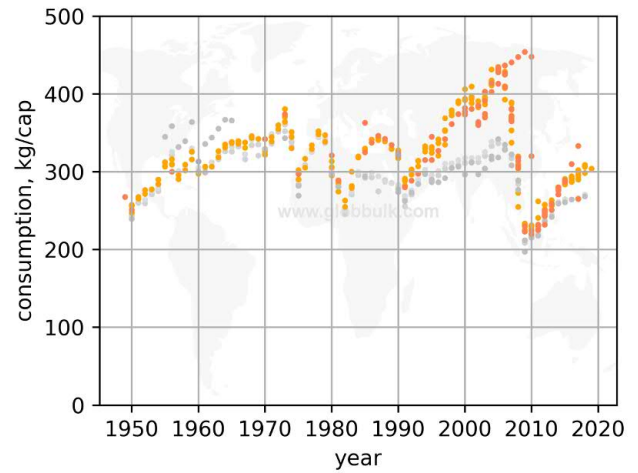
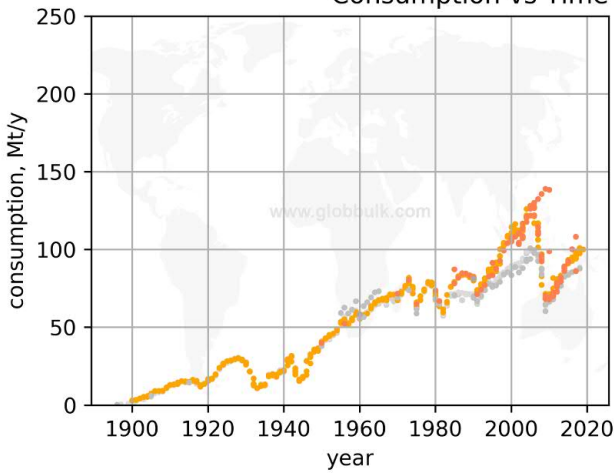
Population vs Time



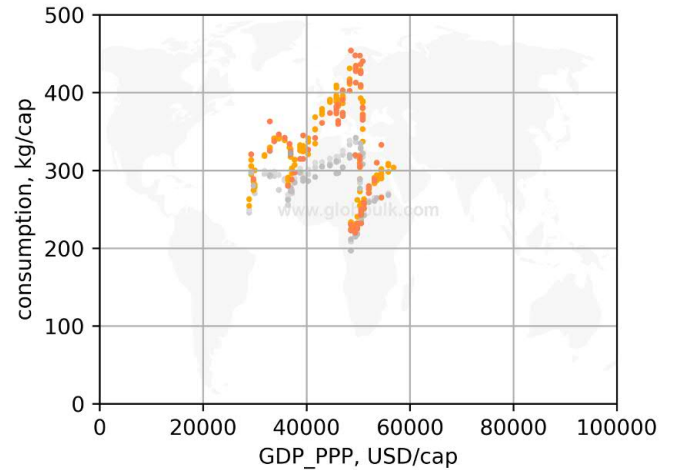
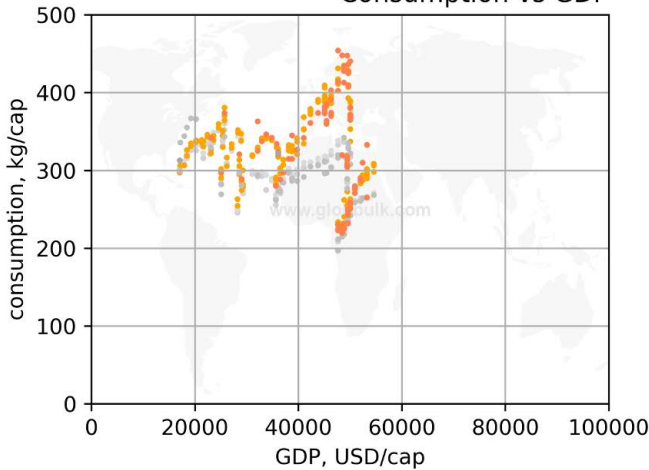
GDP vs Time



Consumption vs Time

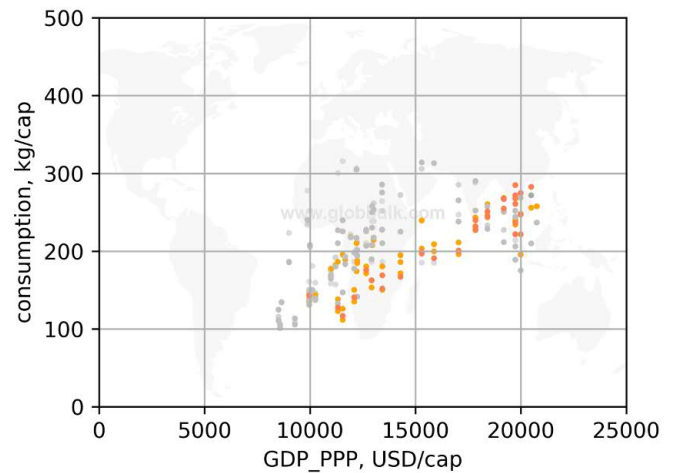
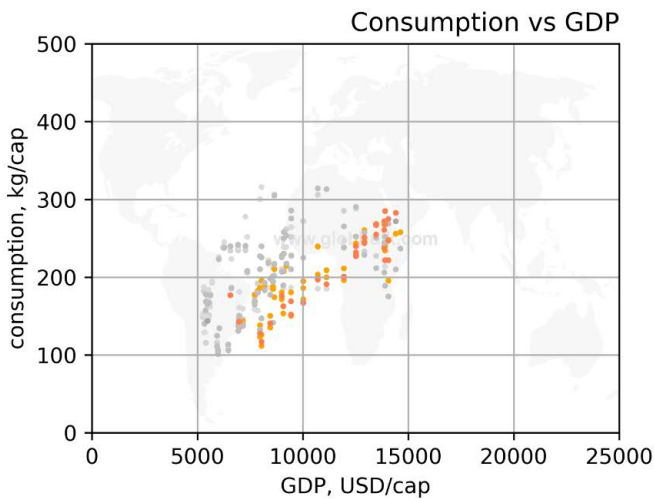
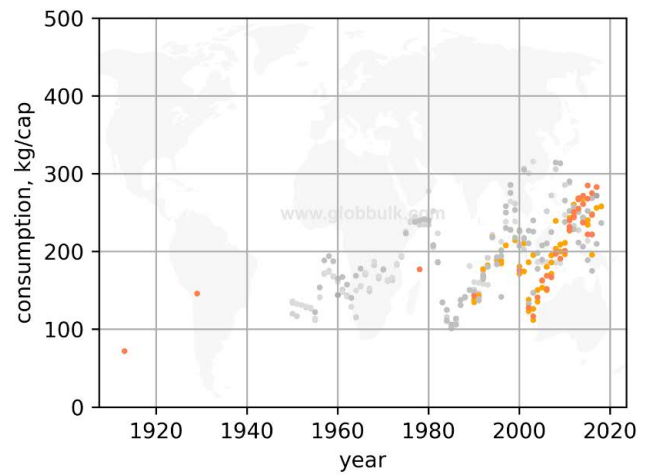
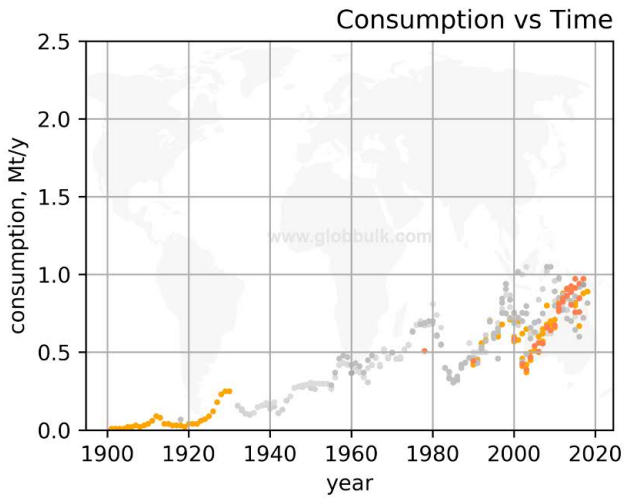
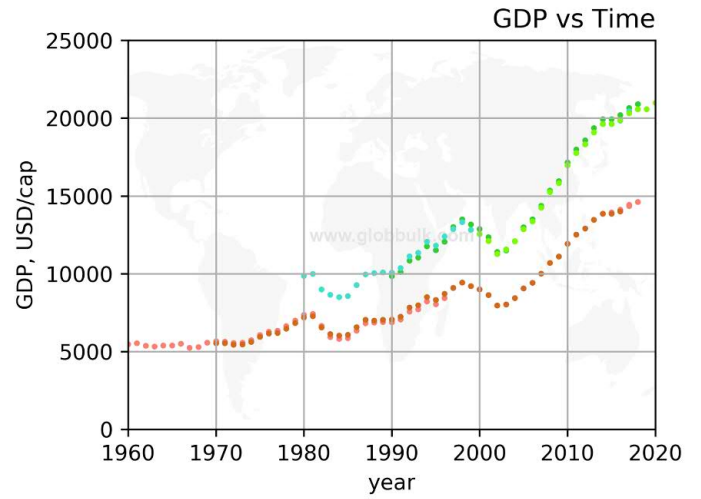
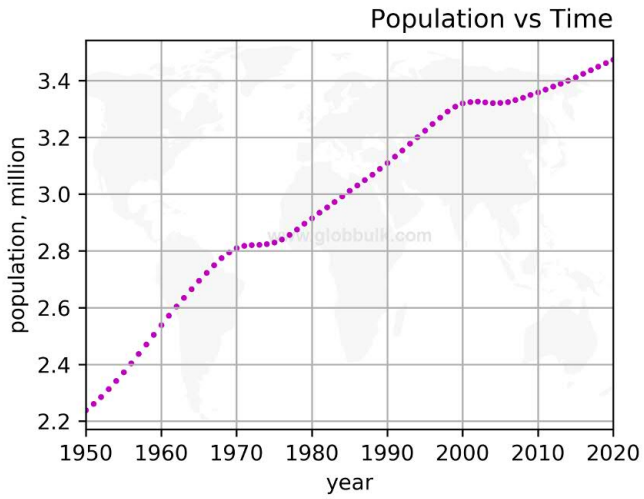


Consumption vs GDP





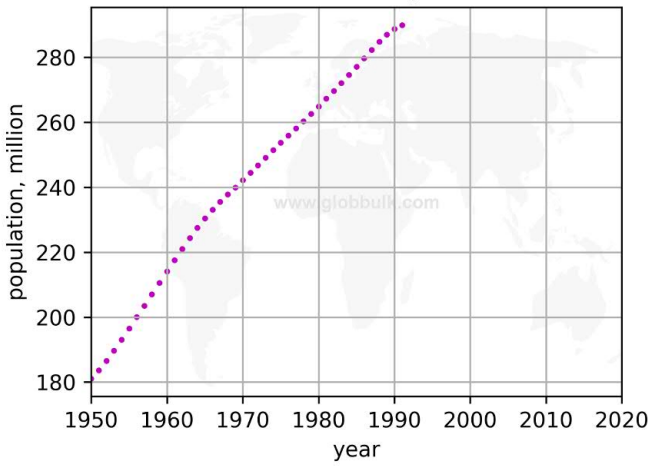
# Uruguay



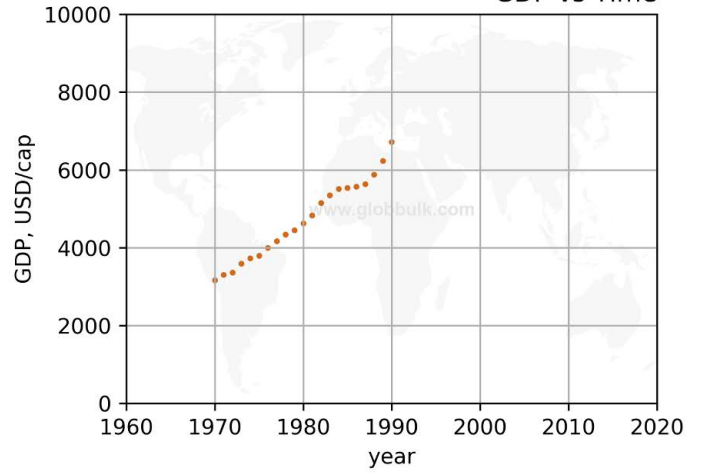


# USSR

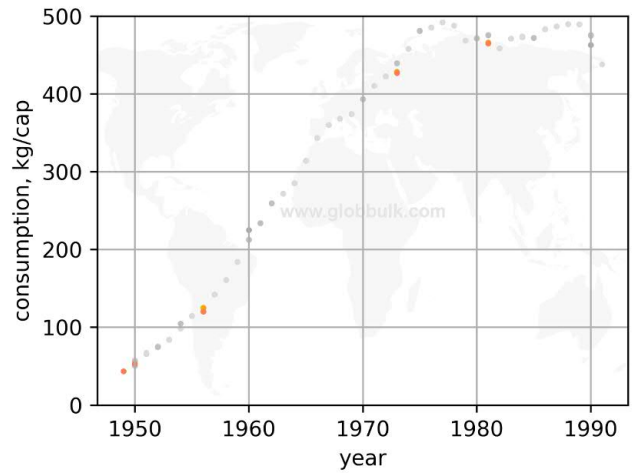
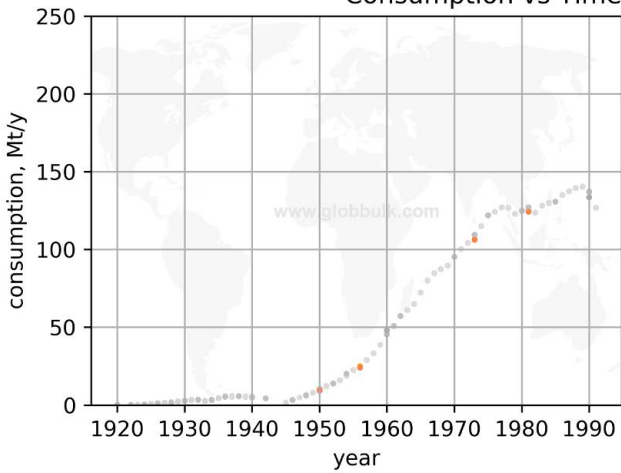
Population vs Time



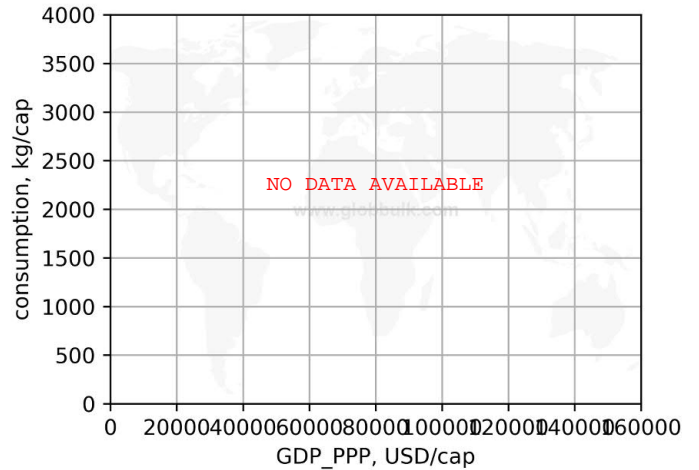
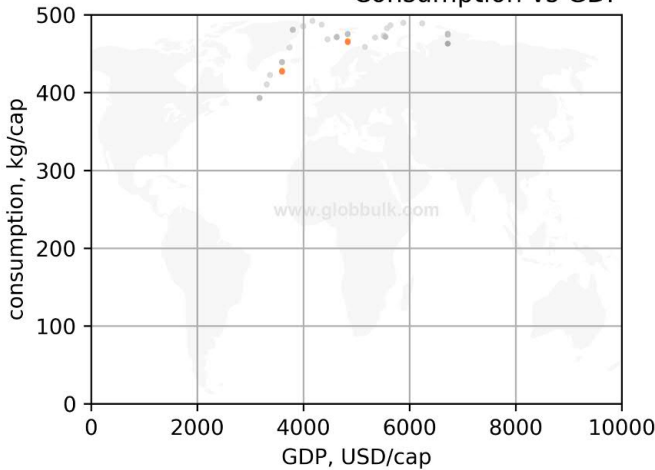
GDP vs Time



Consumption vs Time



Consumption vs GDP

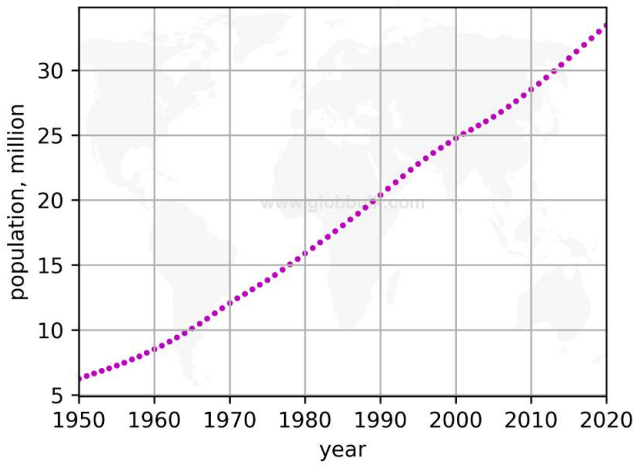




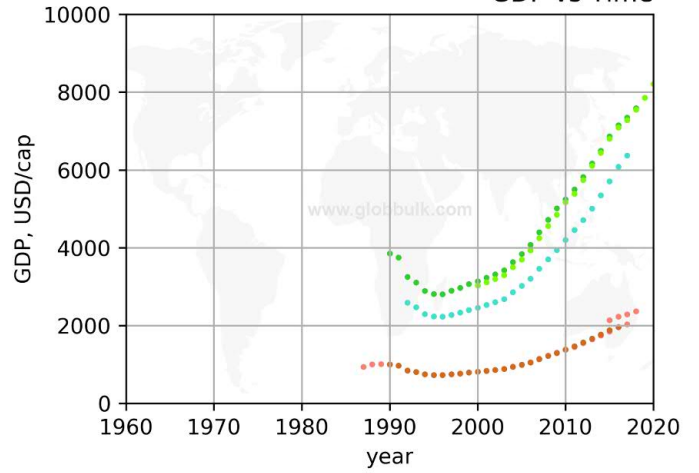


# Uzbekistan

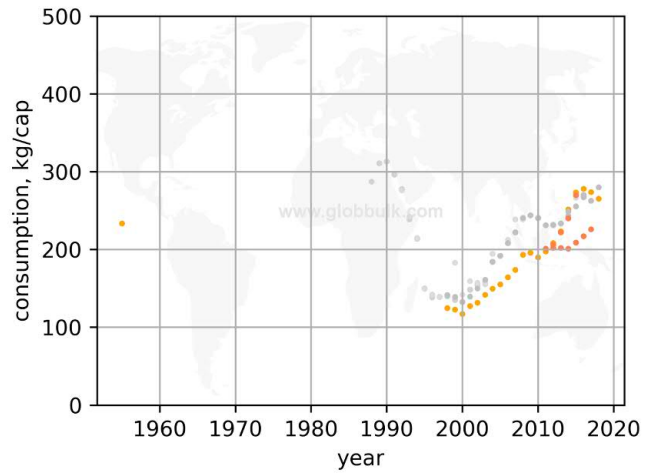
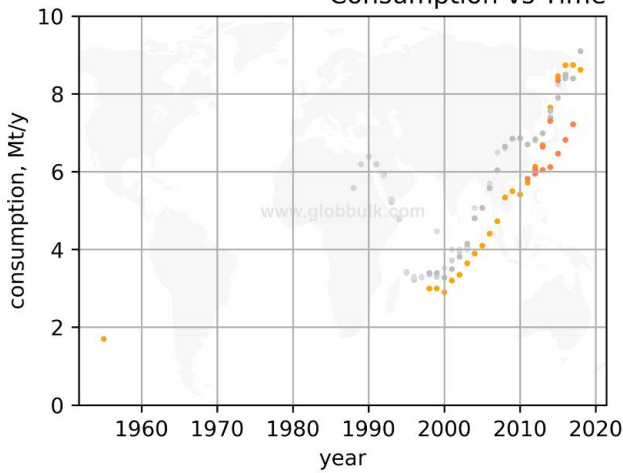
Population vs Time



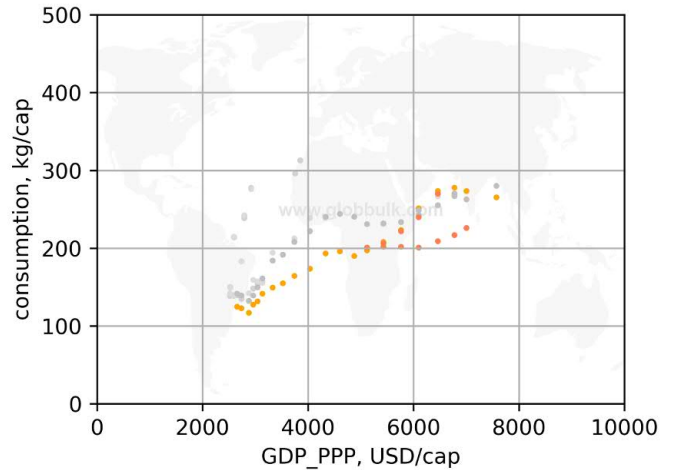
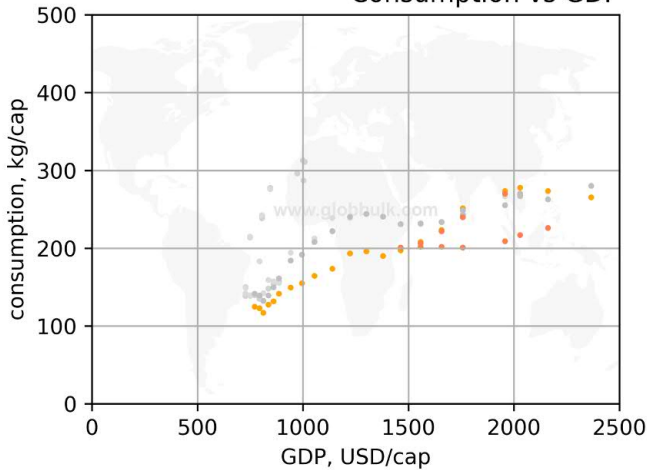
GDP vs Time



Consumption vs Time

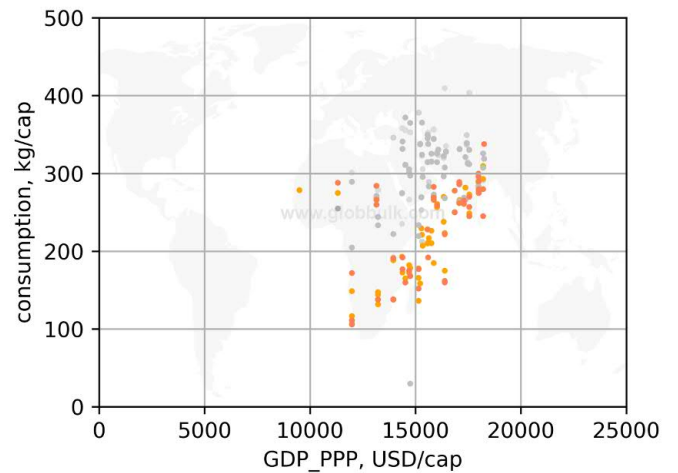
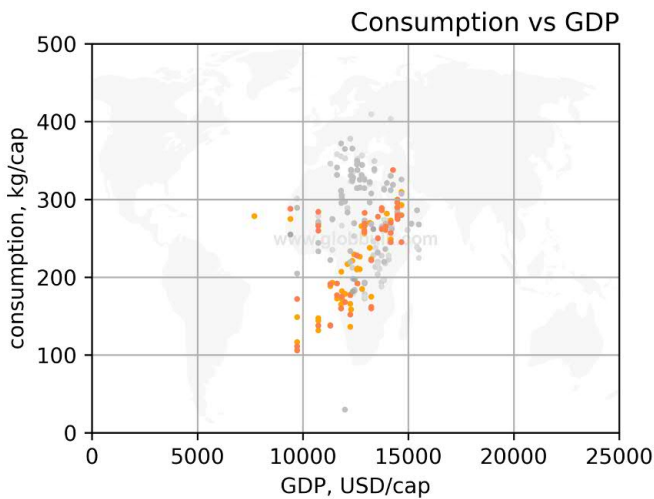
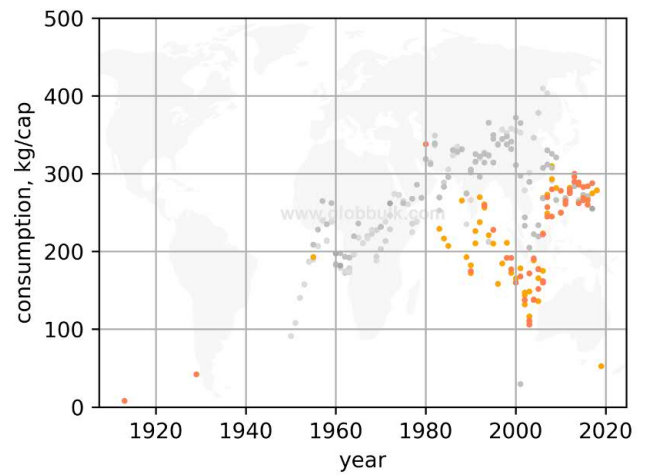
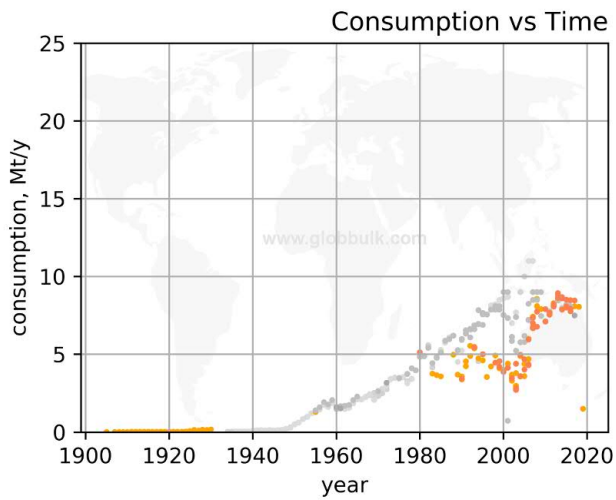
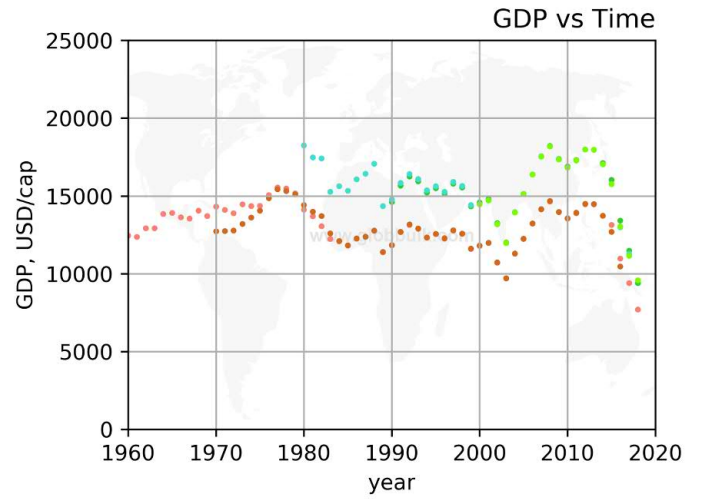
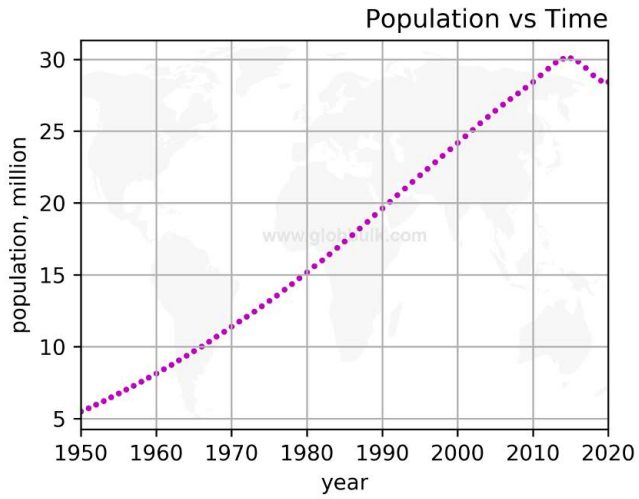


Consumption vs GDP



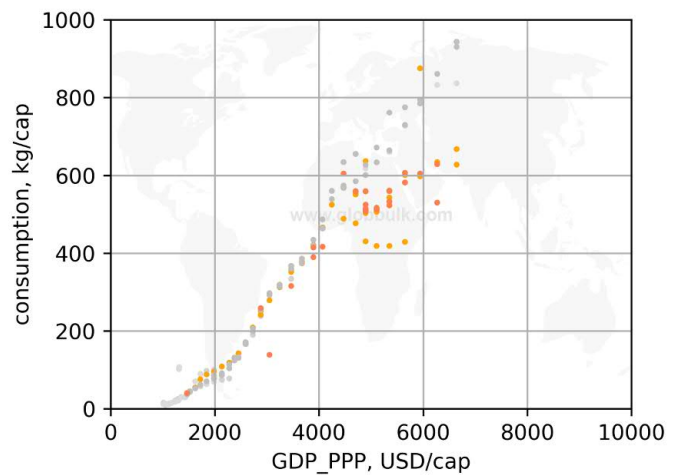
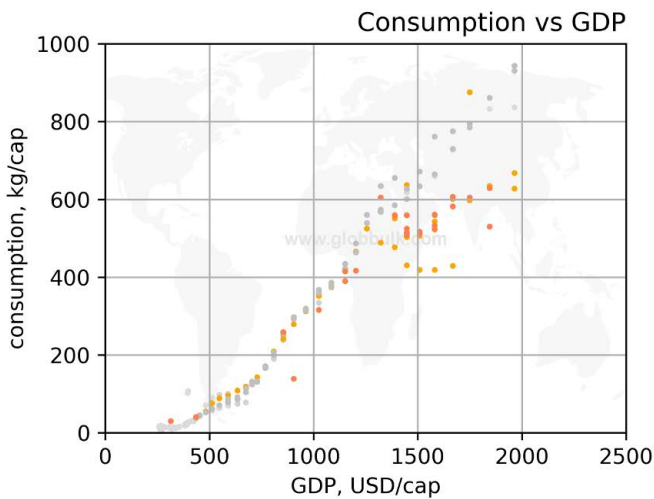
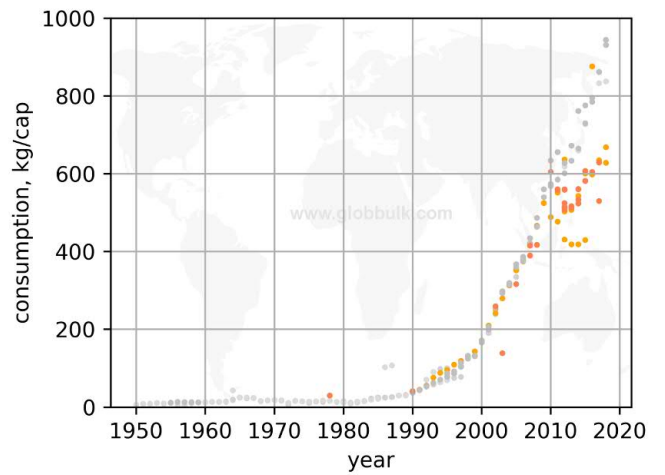
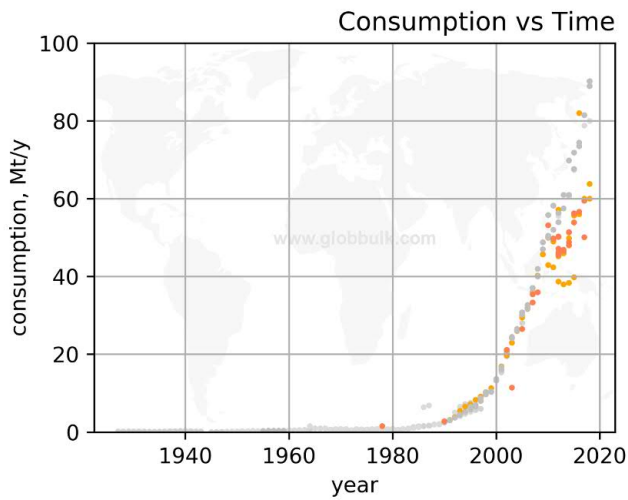
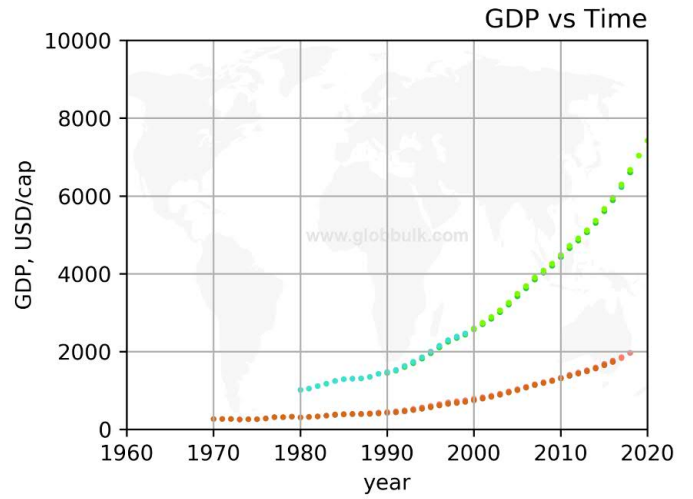
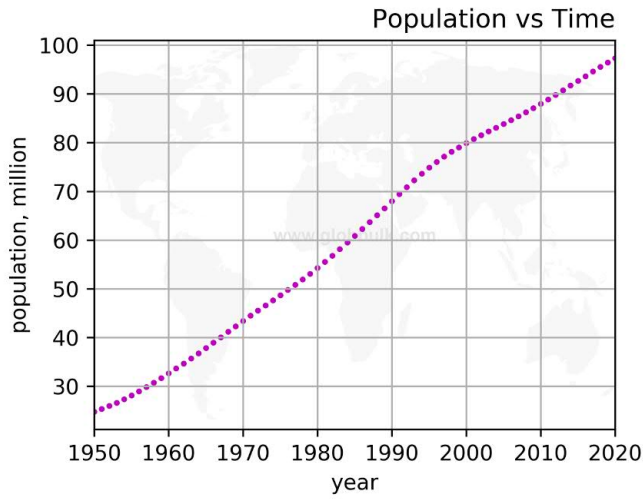


# Venezuela





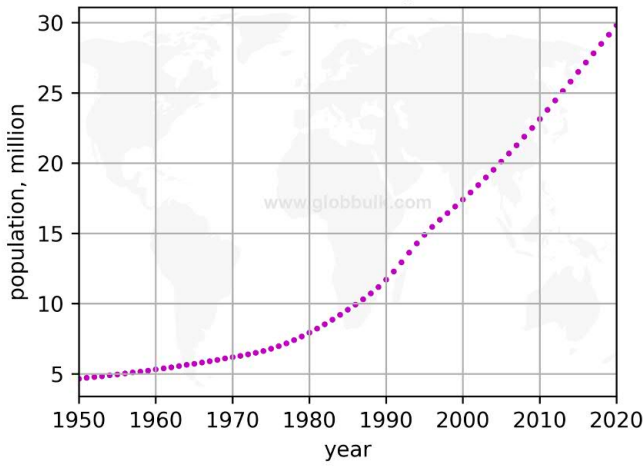
# Vietnam



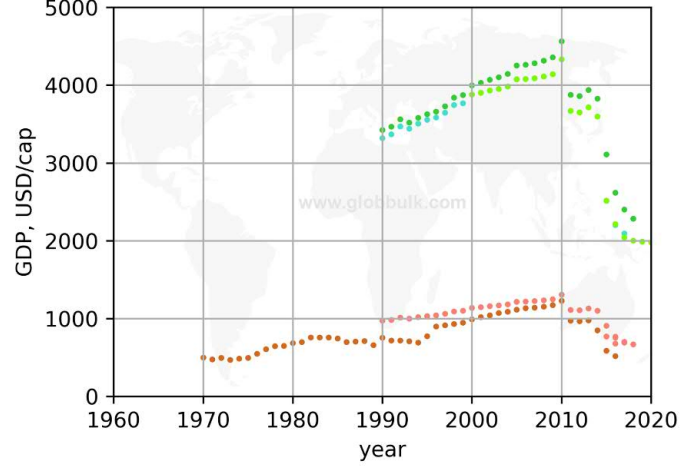


# Yemen

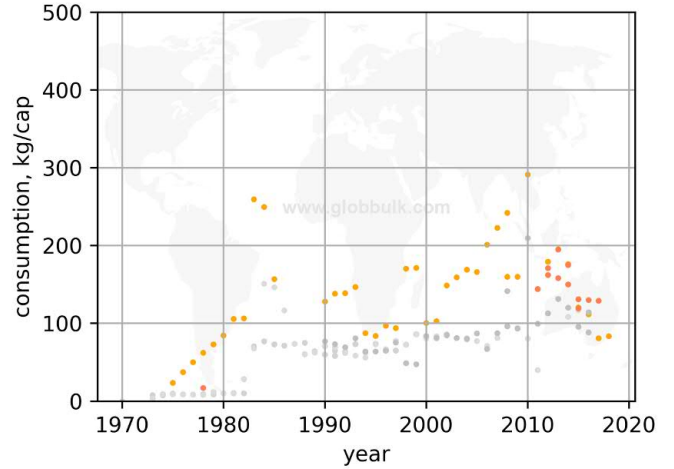
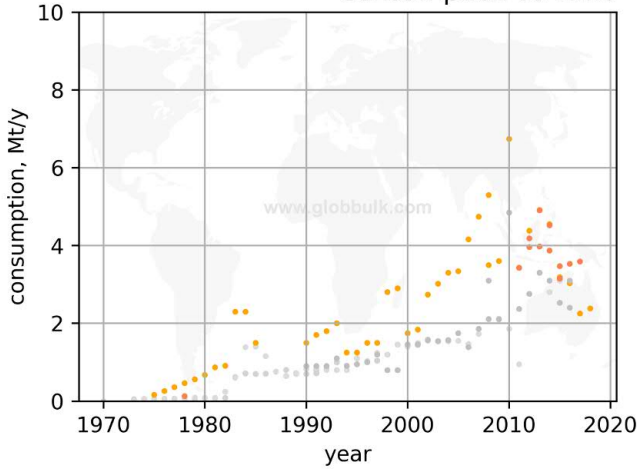
Population vs Time



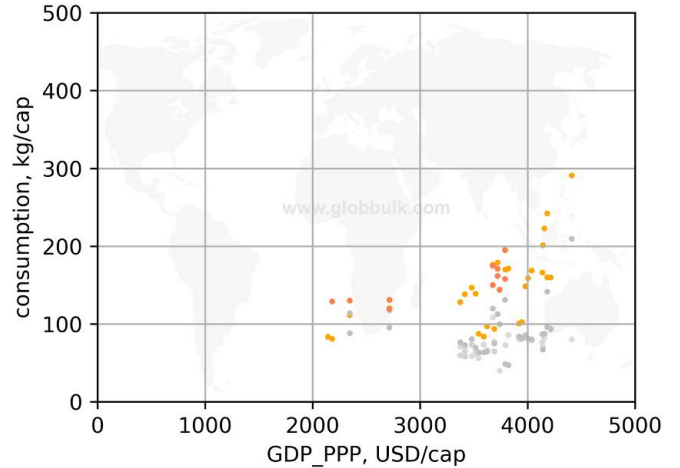
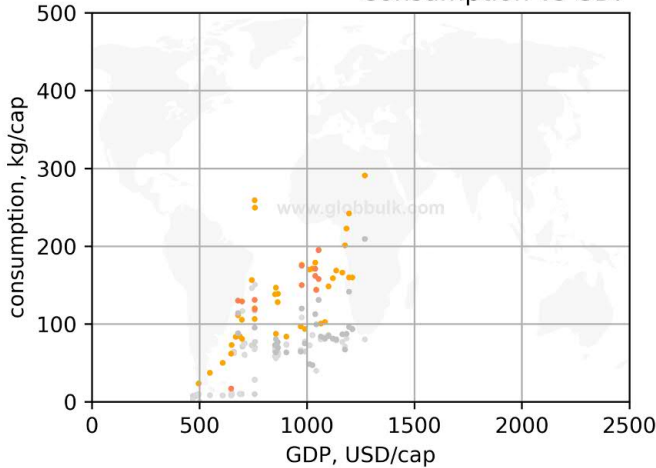
GDP vs Time



Consumption vs Time

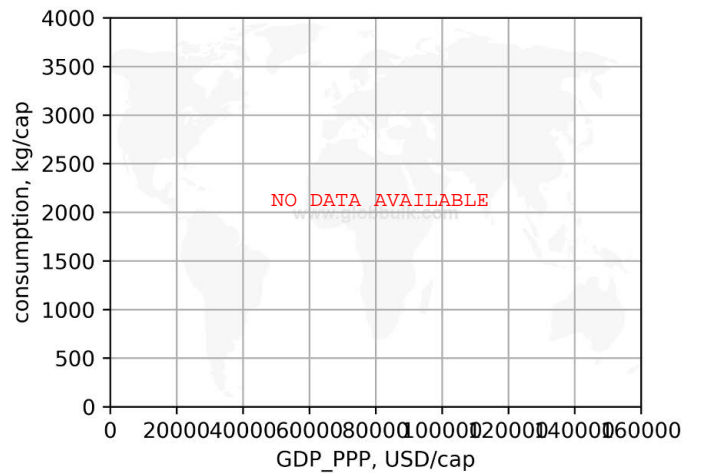
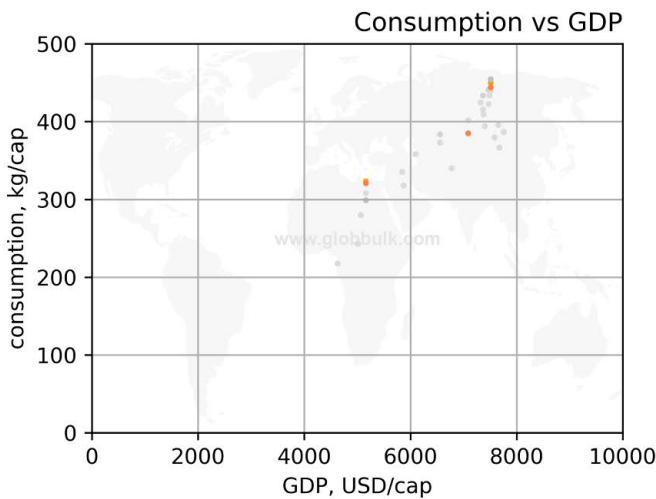
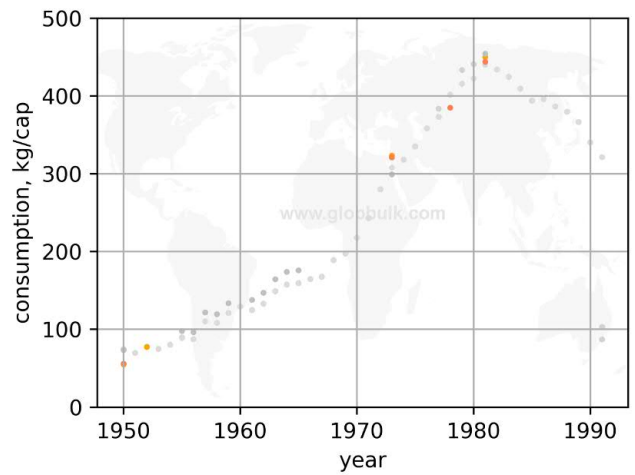
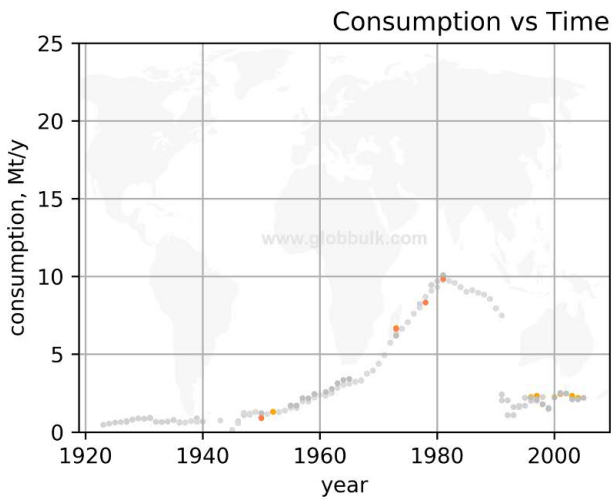
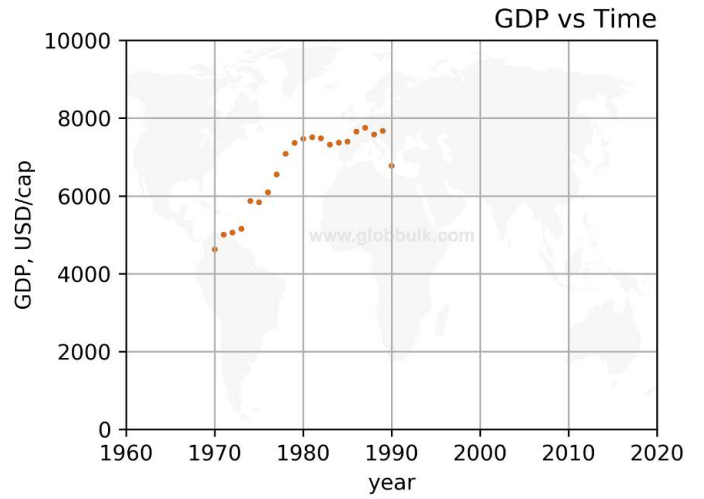
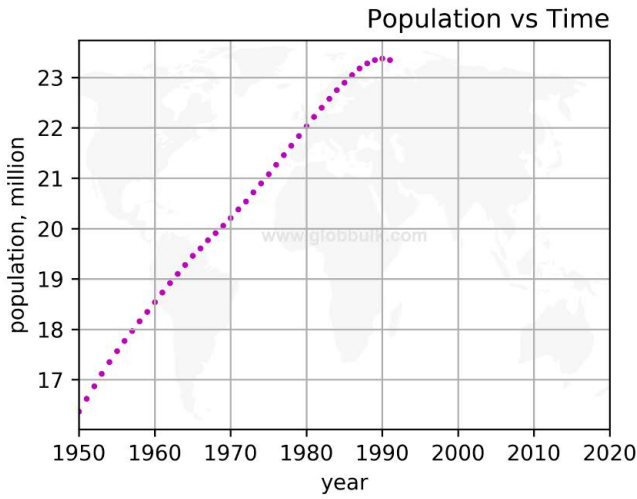


Consumption vs GDP



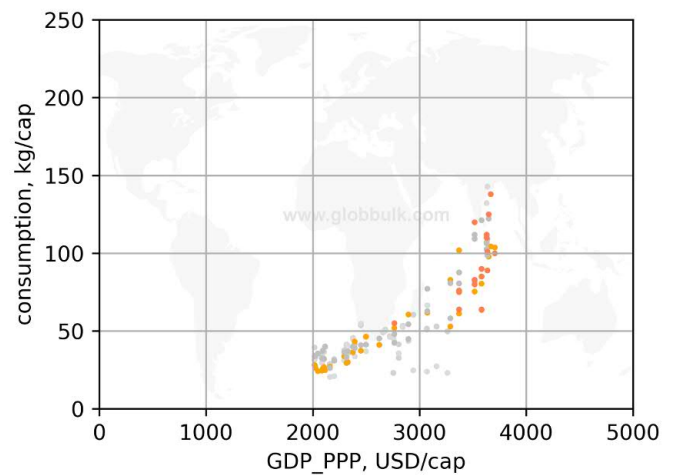
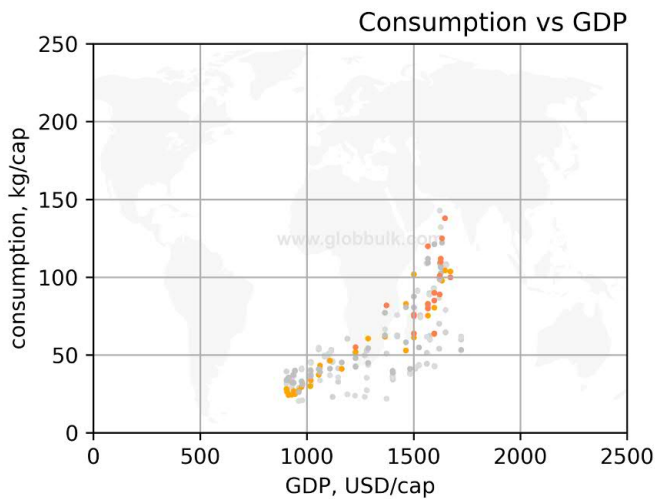
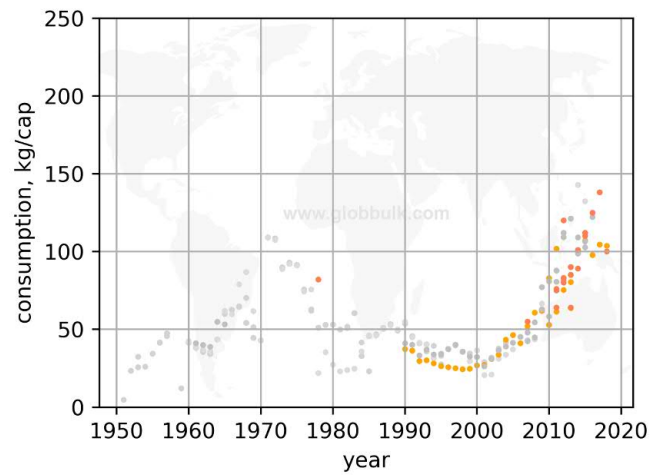
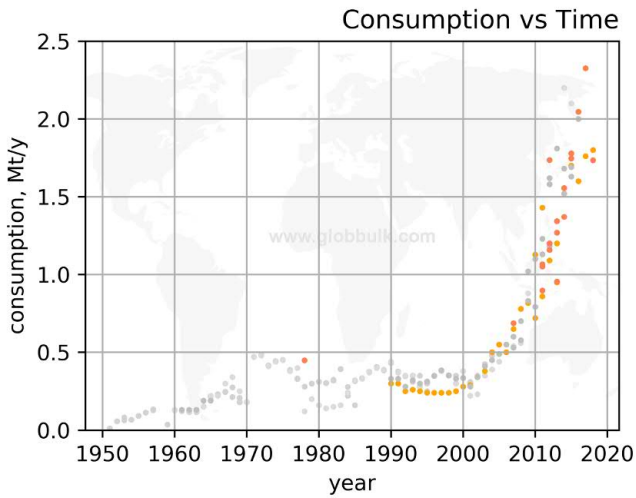
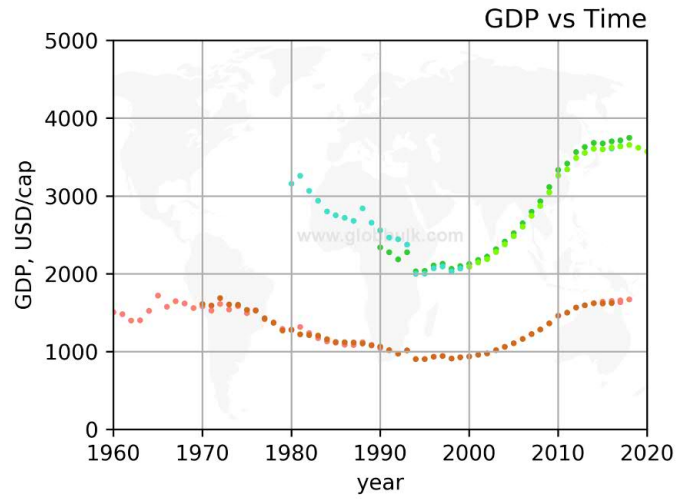
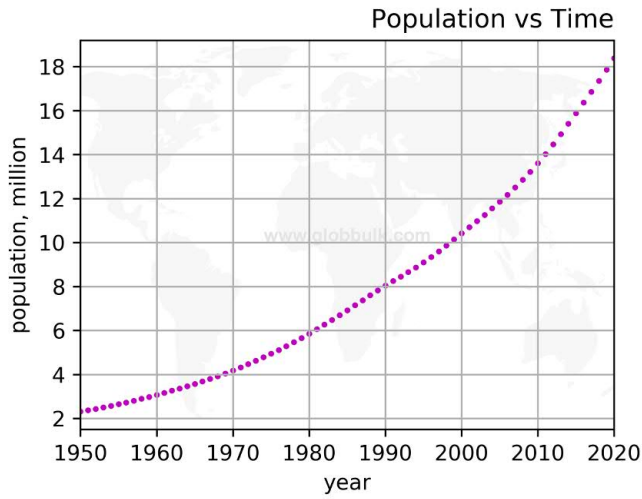


# Yugoslavia





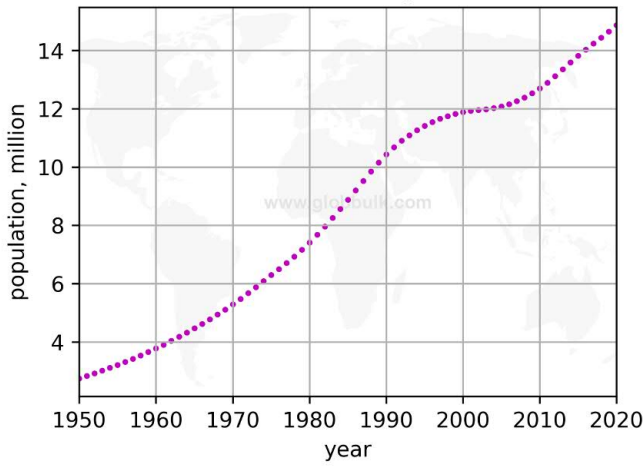
# Zambia



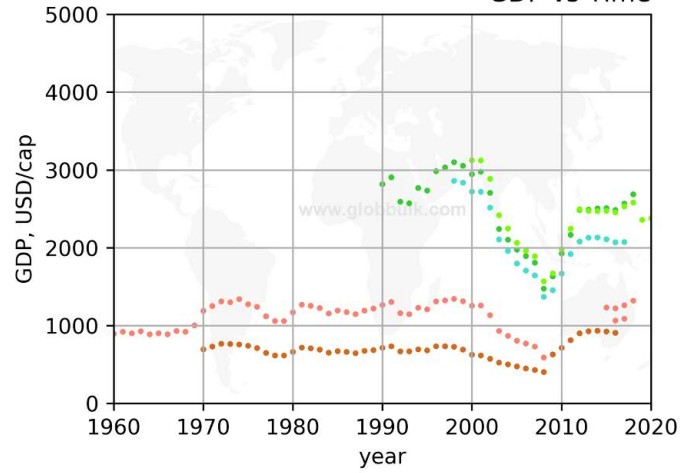


# Zimbabwe

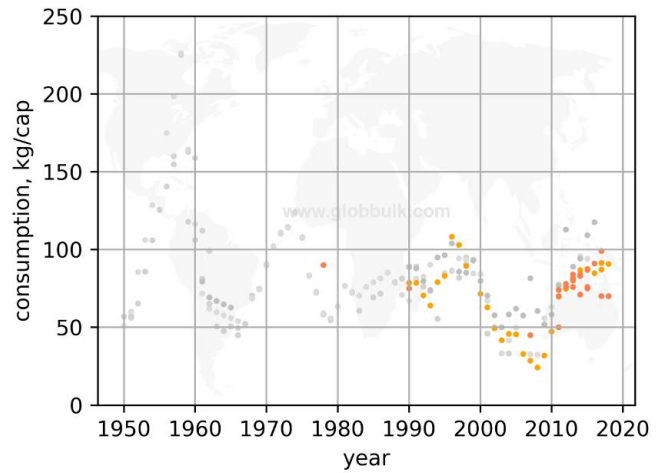
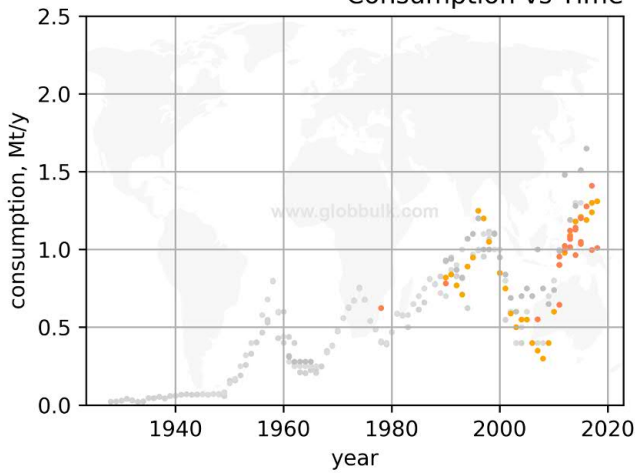
Population vs Time



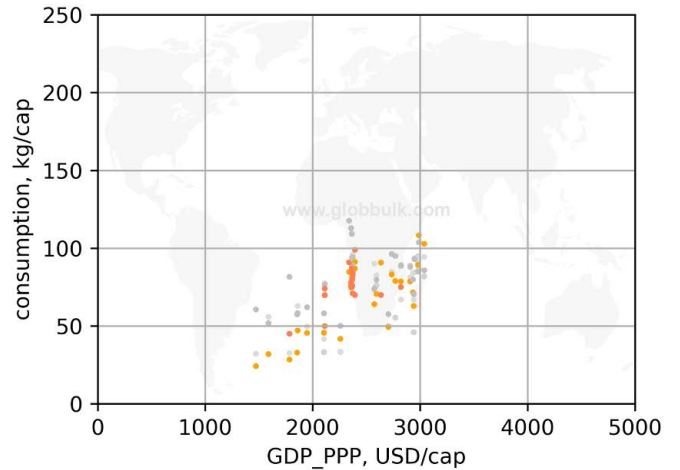
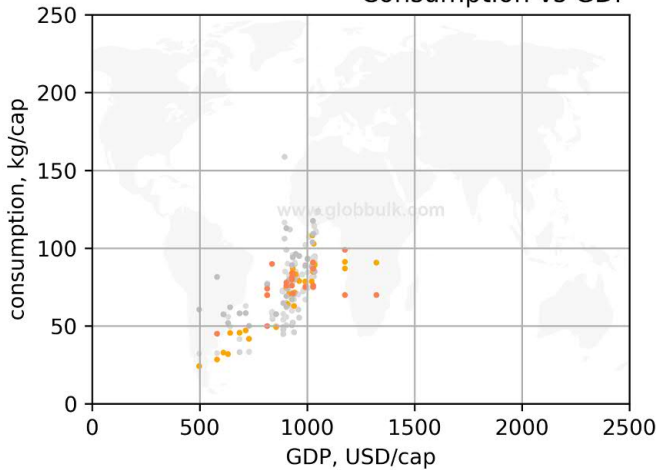
GDP vs Time



Consumption vs Time



Consumption vs GDP



## CEMENT CONSUMPTION vs GDP PER CAPITA: A REVIEW

### 1. GDP and Cement Consumption

It is common that the description of a country's cement industry, feasibility studies and industry assessments include a reference to the relationship between cement consumption and GDP, both on a *per capita* basis. According to the established understanding, these two variables would be related by an inverted U curve, with the following features:

- At low GDPs, countries would have low cement consumption;
- As the country develops, the cement consumption grows with the GDP;
- But beyond a certain consumption rate, saturation or peak, further economic development is achieved with a decrease in the cement consumption.

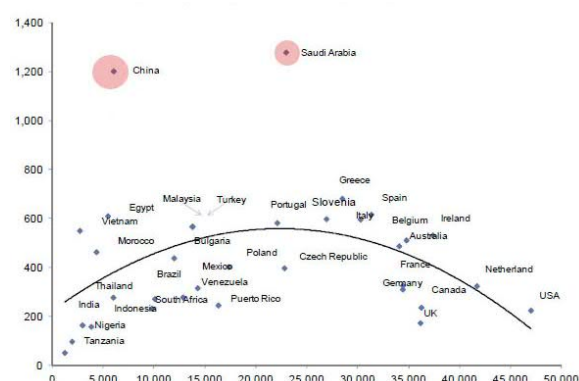
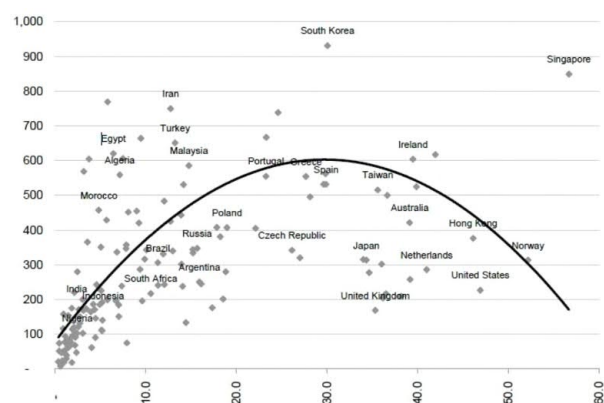
There is economic and technical logic behind this: cement needs to be manufactured, so the starting point must be 0 kg/capita by necessity. Economic development requires heavy investment in physical capital, which since the beginning of the XX century pulls cement consumption: housing, ports, roads. And once the main infrastructure is built, the incremental additions and maintenance works require much less cement: the country can still grow, but not by its continuous large investment in bulky infrastructure, but through lighter or less tangible assets; eventually, the cement may be substituted by other products, and technological progress also reduces the unit consumption rate.

In fact, this set of arguments is applied in general industrial and ecology economics, not only in cement. But despite this apparently clear reasoning there are some aspects which are not always properly interpreted.

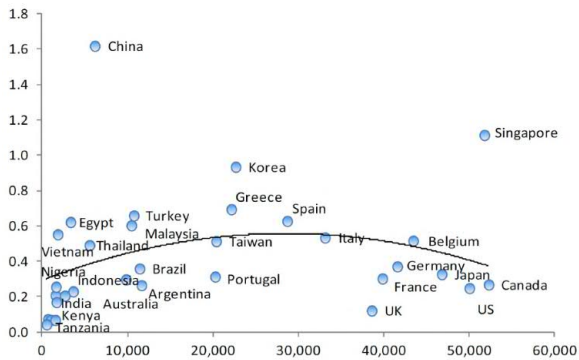
### 2. Some Cherry Picking

In statistics “cherry picking” is the selection of data that suits one’s preferences. It is well known that enough manipulation of data can yield almost any desired result: let me copy some instances of this tendency.

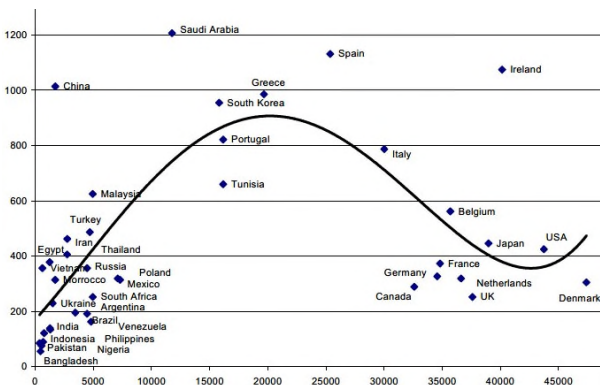
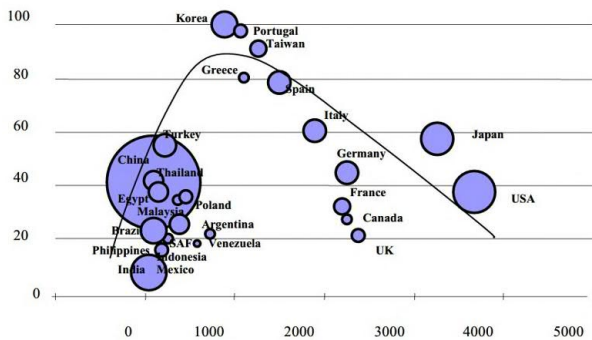
The following three images present “consumption vs GDP” charts taken from professional sources. They all show the GDP (in USD or kUSD) vs the cement consumption (kg or ton), all *per capita*, for the years 2010 (top), 2011 and 2012 (bottom)







My personal favorites are the following two, from 2001 and 2008, the first from an international strategist (but all figures need to be multiplied by 10), the second from a top American investment bank.

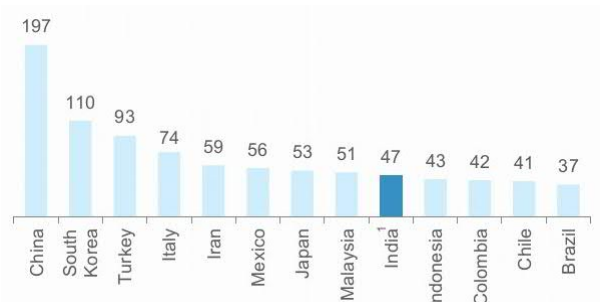


As a report from a Ministry of Industry stated, this type of charts is “a striking visual representation of a country’s stage of development”. Or, as another report to a Ministry of Industry affirmed: “History shows that demand for cement rises rapidly when GDP takes off from a low base”.

If reality was so easy!

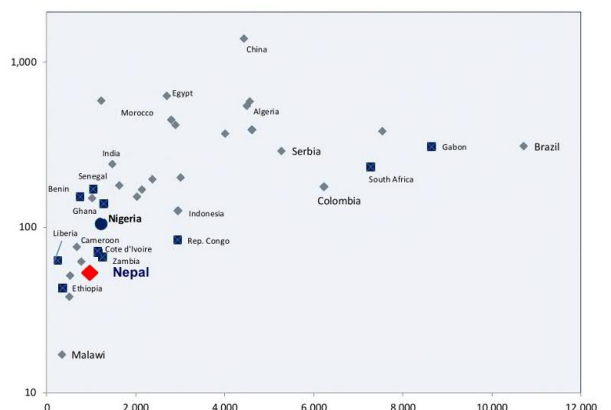
### 3. Sophisticated Variations

It is always possible to take one derivative more, as in this chart from a financial analyst report:



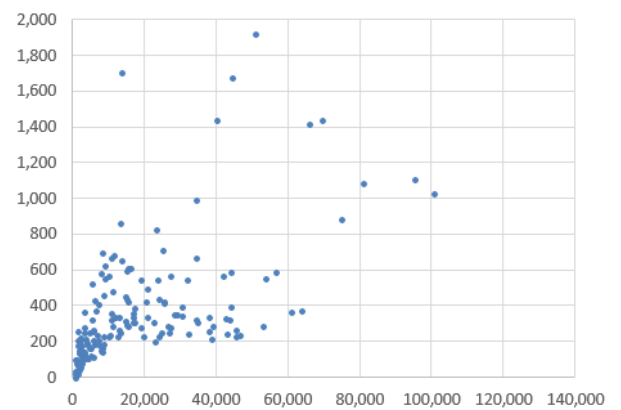
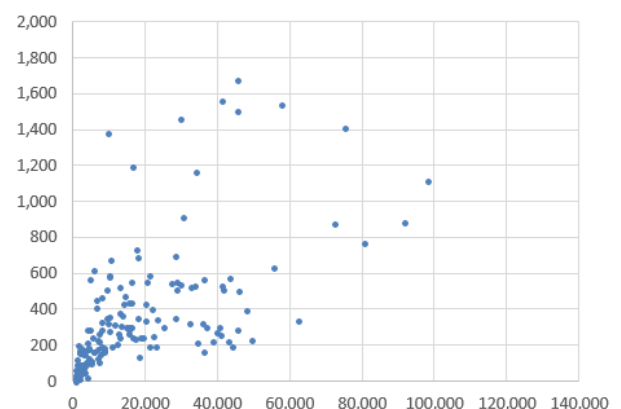
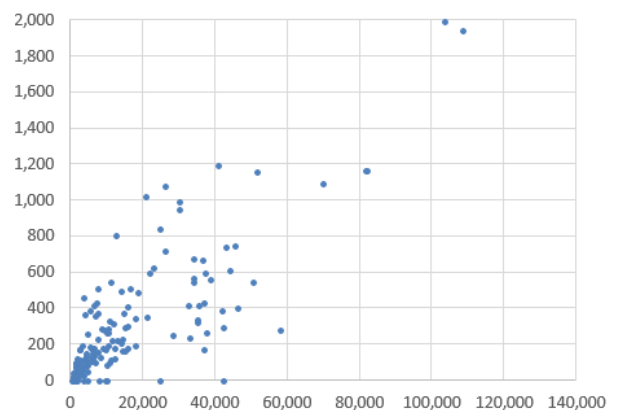
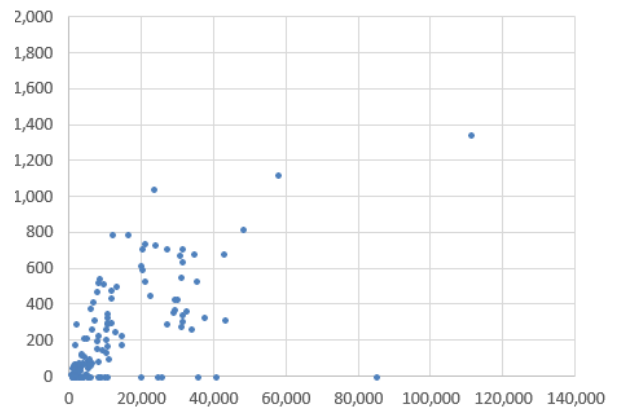
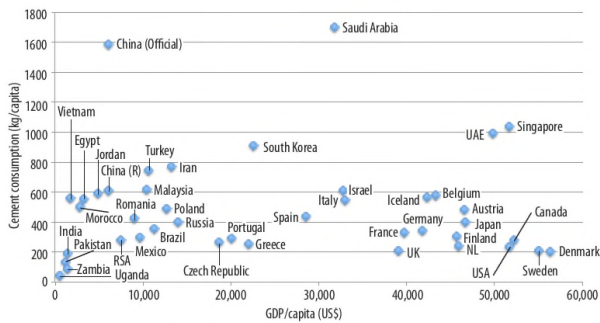
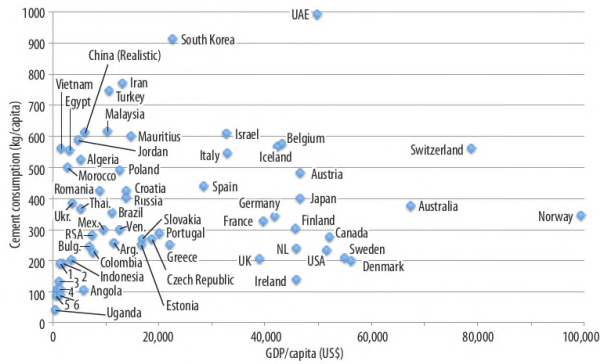
It represents the “cement intensity”, or grams of cement per USD of GDP. This happens to be the slope (the derivative) of the position of each point in the consumption/GDP chart. It is a surprising chart because points in the growing side of the “trend line” will have a similar slope, regardless of their actual development. The slope (the tangent) is also an asymptotic curve, and as such not a particularly good indicator.

The opposite approach is to use a logarithmic function, which will unevenly compress the actual scales, and things will seem more similar than they actually are.



### 4. The non-Flamboyant Facts

Other authors are less choosy in their selection of data, or their manipulation, and the results are less attractive, messier:



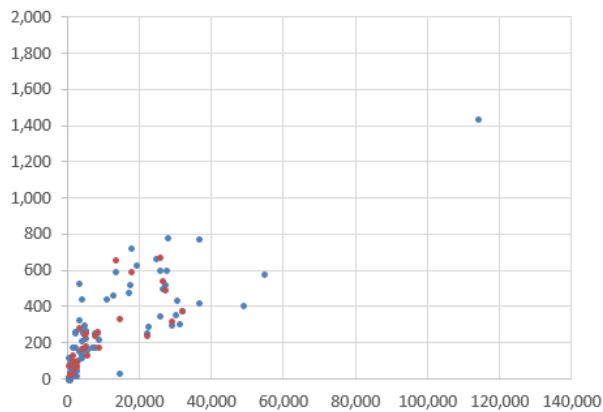
But these non-attractive plots show something closer to what seems to be the factual reality.

The next four charts present the results for ~170 countries in the years 1990 (top), 2000, 2010 and 2015 (bottom). Units are kg of cement per capita, and GDP in USD.

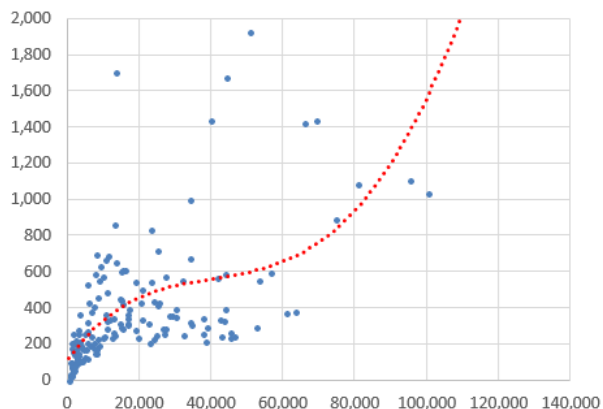
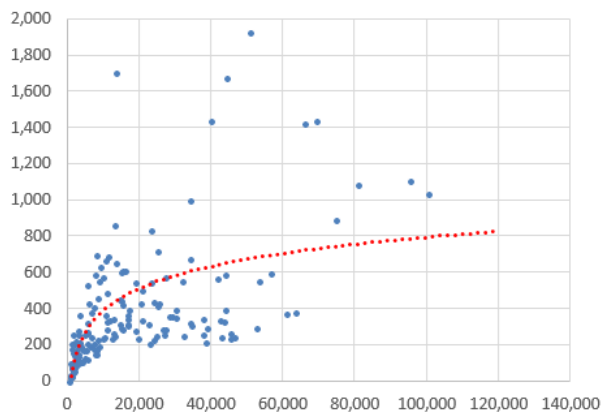
Four remarks on the data:

- The dataset is homogenous: consumption from ICR ([www.cemnet.net](http://www.cemnet.net)), population from UN, and GDP from the World Bank.
- The vertical axis measures domestic cement consumption, not production.
- The horizontal axis measures GDP (not GNP), and it is expressed as PPP (Purchase Power Parity) in constant US dollars of 2011.
- There is one country (Qatar) with a consumption above 2,000 kg/ca, not shown in the charts.

And for 1980 also <sup>1</sup>:

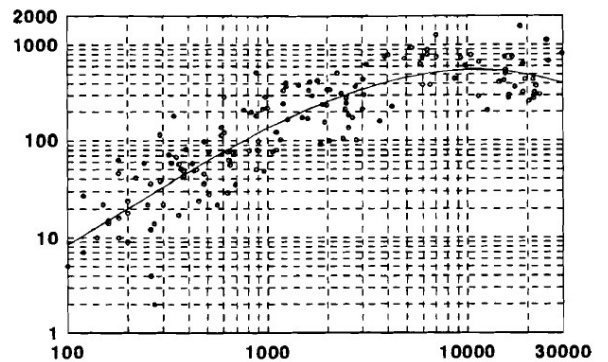


Unless one removes a considerable number of data (“cherry picks”), there is no obvious fitting curve with the pattern of an inverted U that can be observed in the last 40 years: the fits show a growing pattern and their fitting degree is low, as shown for 2015 with different curves:

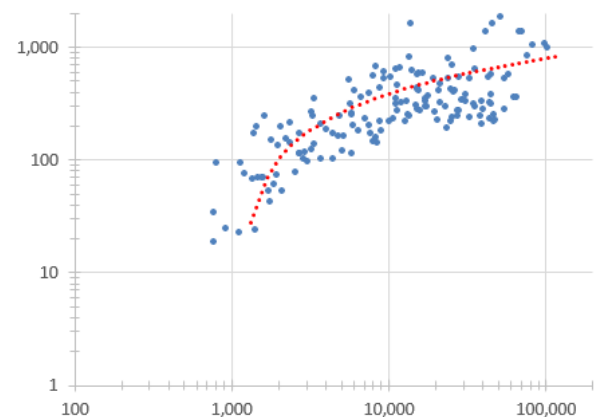
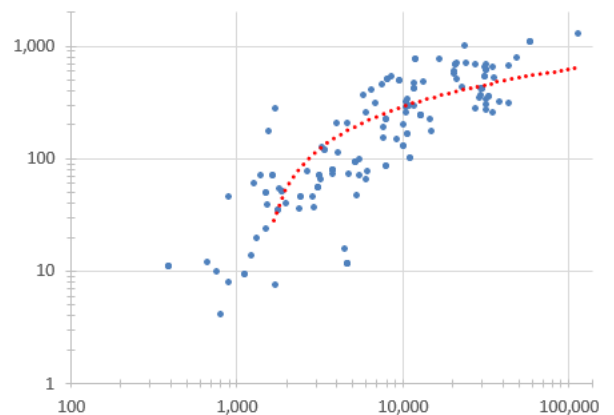


A document from 1994 reported a fitting for 1990, based on GNP (note the log-log scale):

<sup>1</sup> In this latter chart, GDP is not expressed as PPP, but as constant 2010 US, as standard PPP series often



However, the full set of data used for this article is not showing that pattern, neither in 1990 (above) nor in 2015 (below):

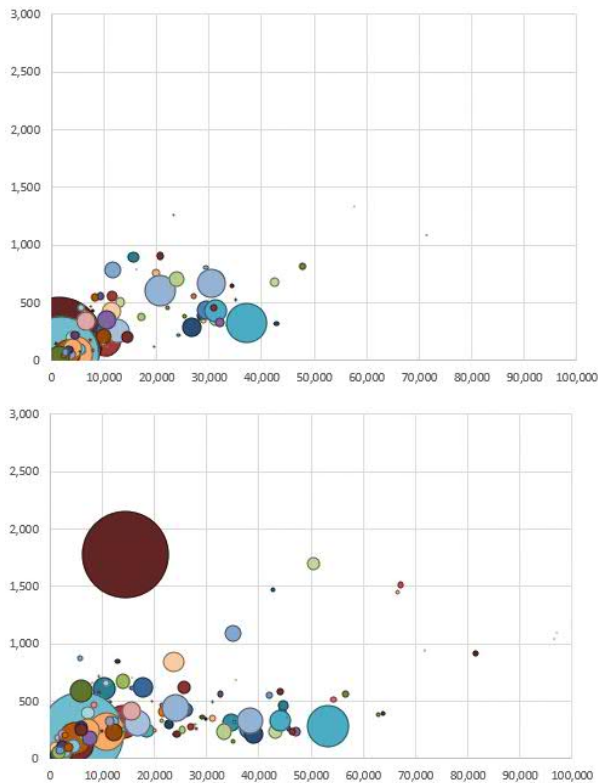


It is necessary to remove a number of “outliers” to make the charts look like an inverted U-shape. But, what is an “outlier” here?

First, allow me one step back. While it is possible to fit curves to the dot charts presented above, it is important to note that not all dots have the same importance: India or

start in 1990. The coloured dots represent various sources of data.

China far outweigh Lesotho or Lichtenstein. When these weighs are introduced, the fitting requires even more “cherry picking”, especially after the year 2000 (bubble charts for 1990 and 2016):



Despite these drawbacks, the inverted-U curve is not only mentioned in technical documents, as shown above: it is also often used in scientific reports assessing CO2 emissions from the global cement industry.

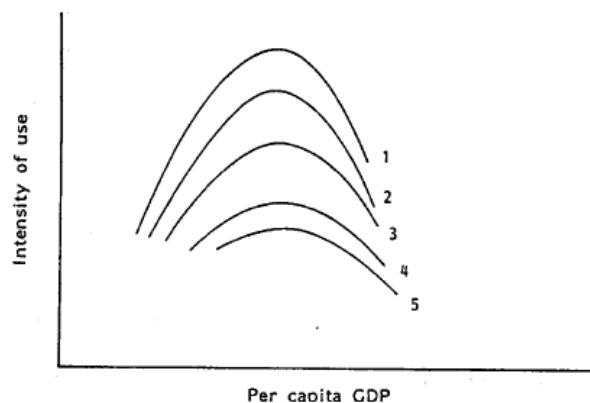
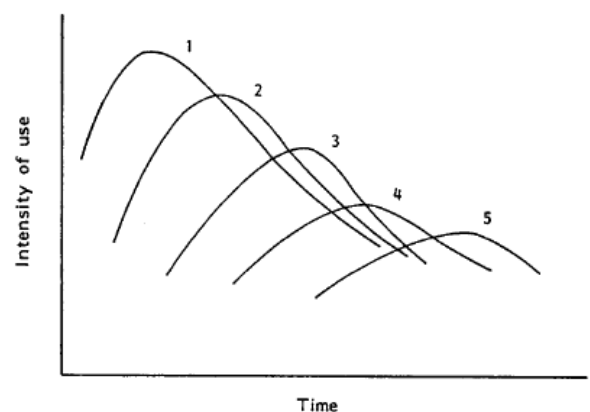
So, is this supposed relationship between cement consumption and GDP just common and established nonsense? Is it used because there is nothing better?

There are two complementary answers to this question:

- *Massaging* the data is dangerous and can create illusionary constructs. A single, inverted U-shaped curve that fits all countries at once seems to be an abstraction, and its factual support appears to be based on partial data; but

- There is some value in the consumption/GDP relationship, although not where/how it is normally shown.

The use of these consumption/GDP curves dates from the late 70s, but a relevant original aspect seems to have been lost since then: the fact that **technical progress may prevent countries to follow the same path**. This hindsight was represented in the following charts from 1978, and it seems to have been forgotten.

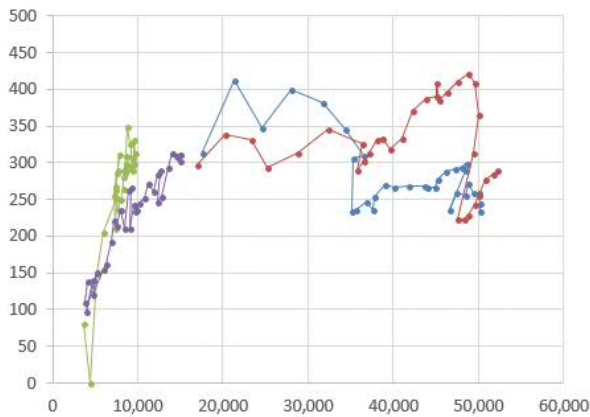


## 5. Comparison of Time Series

The sequence of charts presented above, from 1980 to 2015, raises the possibility of looking at how countries behave along time.

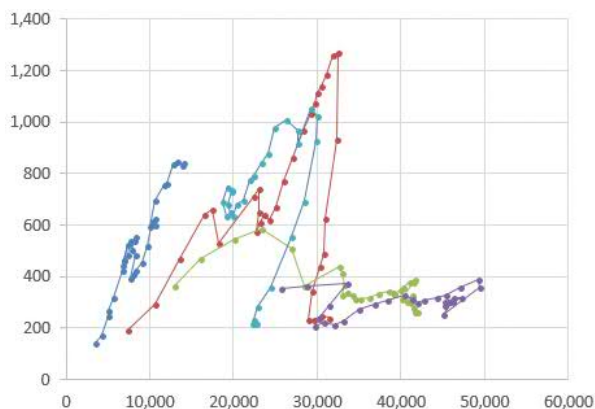
Although each country has its own history, there are certain similarities which may be of relevance. They are only semiquantitative; and they are not general: **there does not seem to exist a single law applicable to all countries**.

The following chart is a “cherry picking” of four American countries: Mexico (green), Chile (purple), USA (reddish), and Canada (blue). It presents consumption vs GDP from 1960 to 2016.



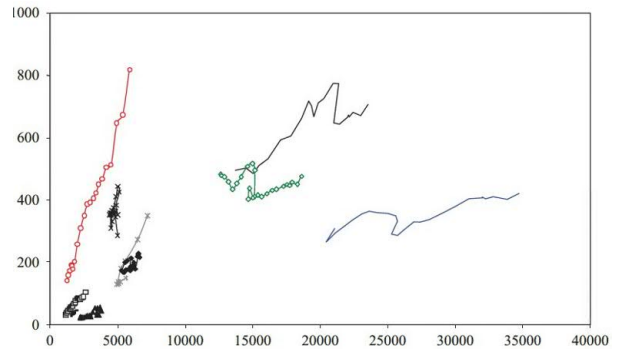
This is probably close enough to the best that can be achieved without entering into historical data researching for data prior to 1960. Joining the pattern described by the four countries seems to yield the U-shaped curve, on a time-series basis.

However, it is important to remark that the previous chart is a construction in which the countries have been carefully picked. One similar counter-example can highlight this:

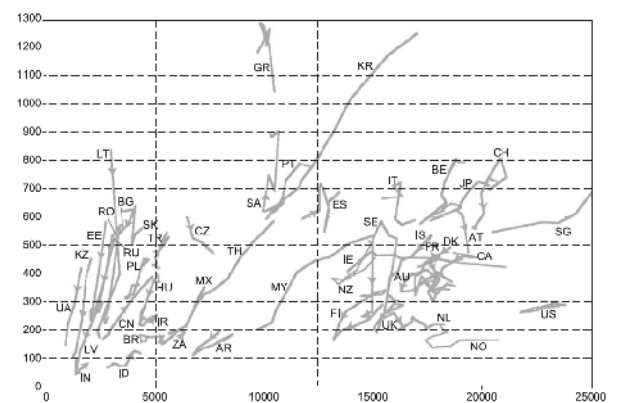


This latter diagram shows the same relationship for Turkey, Spain, France, Finland and Greece. Here, the “path of the U-shaped law” is much more difficult to ascertain, if it exists at all, and it is far from obvious that the same “law” is behind these observed behaviours.

A similar result is presented in the following chart, for different regions (red = China; green = Europe-33; blue = North America).



Or for some countries:



(Both latter charts have the per capita GDP expressed in international 1995-USD).

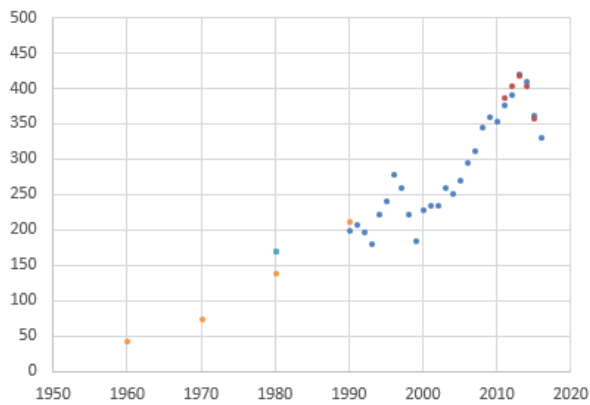
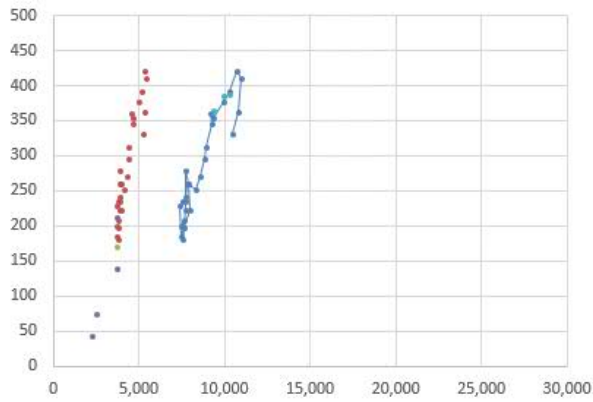
There is hardly any visible cross-country trend in these factual time-series – other than a general difference in slope!

## 6. Clusters for Comparison

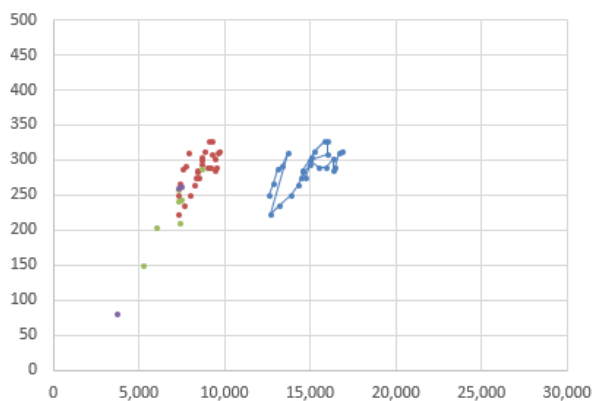
While it is actually difficult to find a common fitting curve which is meaningful for all countries, it is possible to find clusters of countries with similar behaviour. In the case of the Americas at least four such groups can be identified.

Panama, Ecuador, Peru and even Brazil or Colombia show a steep and rather uniform link between consumption and GDP, with a reduction after the last global crisis, which is

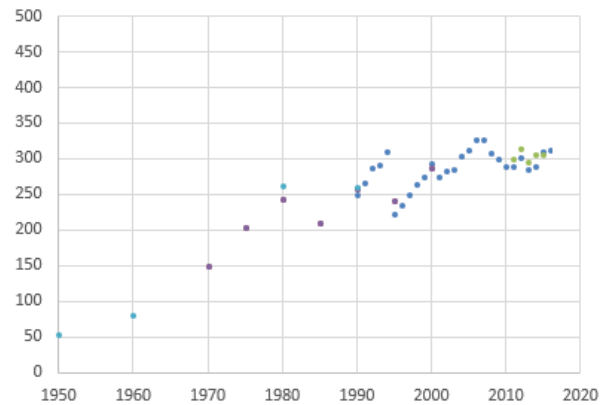
deeper on milder depending on the country.  
For Ecuador<sup>2</sup>:



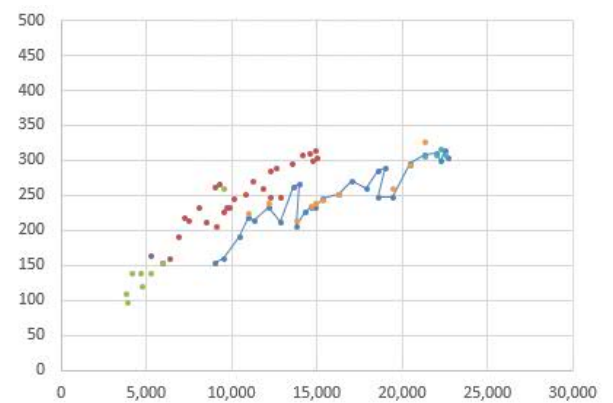
Countries like Mexico or Guatemala seem to have found a ceiling related to the financial crisis, longer but less intense that the previous group. For Mexico:



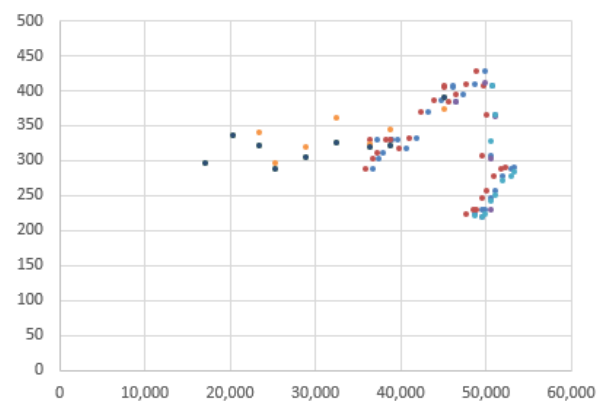
<sup>2</sup> In this set of charts, the sources are more heterogeneous and are identified with different colours.



Chile seems to have found its own rather smooth growth pattern:



Finally, Canada and the USA come from a stable or steadily diminishing consumption, and have gone through “adjustments” in the latest crisis, very large in the case of USA:



The GDP is in PPP (blue, always to the right of the chart) or expressed as 2010 USD (other colours).