A Report for Data Story:

The Comparison and Correlation Analysis of the Economic and Trade Between China and the US Based on the 2018 Trade Friction

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1 Introduction

Sino-American relationship is one of the most important and complex bilateral relations in the world today. China is the largest developing country while the United States is the largest developed country. The Trade Friction between the two super countries in 2018 drew the wide attention of the whole world and caused great affects to the global economy.
Based on the background of the past trade friction, this data story starts with real data from global public databases, and aims to proposing comprehensive analysis and evaluation from multiple perspectives of economical and trading capacity and correlations, objectively grasping the economic and trade roles of both sides, and providing suggestions on the current Sino-American relationship.
Existing researches analyzed the trade and investment structure of China and the US from trade balance and comparative advantages, including the trade deficit of goods, the import categories and export added values, as well as the phenomenon of the anti − comparative advantage in the Sino-US trade structure. Further, some researches studied the mutual dependence and profit pattern of Sino-American trade, including the strong complementary trade for both on a whole, the achievement of mutual benefit based on the trade surplus and the interest surplus as well as the decreasing tendency of trading differences and the potential gains from the trade between China and the US. Besides, some researchers analyze the change of regional trade pattern of the increasing influence in Asia of both countries and the tendency of constantly deepening the economical cooperation with the Asian-Pacific region of China.
This data story makes attempt to objectively give a panoramic view of the Sino-American economic and trade comparison and correlation based on the current available economic, trade, investment, production data. Firstly, the story reviews the historical evolution of **the Global Economic Status** of both countries from the aspects of economic aggregate, trade and investment. Secondly, further focusing on the regions of both countries, the story reveals their **Regional Economic Status** in strength and distribution. Then, inspecting the Sino-American associations, the story sorts out the **Sino-American Economy and Trade Correlations** on trade, production, consumption and investment. Finally, choosing various domains and indices, the story figures out detailed and comprehensive comparison on the **Basic Strength and Developing Potential** of China and the US. Finally, the story makes a summary and gives conclusions to the past and future development of China and the US.

2 Research Datasets

Data are essential to a data visualization story, especially in the case of a study on the global economy and trade like this story. Complete data set from authoritative data provenance with accurate data absolutely makes a visualization sensible. In order to cover the economic data in all fields of both China and the US over the years, the data of this story is collected from global public and official statistics, pre-processed with necessary cleaning and fix based on actual need, and transformed to new datasets through integration and calculation. mining potential correlation in the data. Grouped by data provenance, the used data are as below.
Firstly, the **World Development Indicators Database** of the World Bank provides (i) the GDP-related data of all the major economies countries in the world over the past 60 years, including GDP value, the average GDP growth and the proportion in the world economic aggregate yearly, (ii) the add value of different industries of China and the US, giving the proportions in GDP as well, and (iii) the import-export trade data of China and the US from 1978, containing the

basic trade data, the trade balance value, the weights in nation economy, and the major categories of import and export trade and the corresponding proportion.

Secondly, **the World Input and Output Database** provides the World Input-Output Tables, containing industrial data in 56 sectors based on International Standard Industrial Classification and covering 43 countries including China and the US. According to the World Input-Output Tables, the added value of high-tech manufacturing of China and the US, the national consumption structure and its variation of the two countries, as well as the countries that take China and the US as the largest consumption destination and source country is calculated and pointed out.

Thirdly, **the United Nations Conference on Trade and Development Stat** provides the data of international investment of China and the US, including the foreign direct investment flux, the stock outbound direct investment, and the foreign investment received. **The United Comtrade Database** provides overall import and export trade data specifically between China and the US in addition to the WDI Database. It also provides the overall information of international trade over the world, based on which the number of countries that take China and the US as the largest import source and export destination is figured out.

Moreover, **China's National Bureau of Statistics and Bureau of Economic Analysis of U.S. Department of Commerce** provide the domestic economic and developing data in each country. The data covers the key domains of evaluating basic strength and developing potential, containing numerical values such as expressway mileage, per capita carbon emissions, average life expectancy, annual workers' output as well as proportional values such as proportion of military expenditure in GDP, proportion of renewable energy consumption in total energy consumption.

Finally, there are also important data provided by other databases. The World Economic Outlook Database of the International Monetary Fund provides the GDP data based on purchasing power parity of China and the US in the recent 40 years. The World Inequality Database provides the data of proportion of the top 1% income group in total income in major economies from 1980 to 2015. And the official website of WTO provides the data of FTA Protocols related to China and the US.

3 Data Visualizations

In order to fully analysis and compare the economy and trade of China and the United States, the data story goes through four parts, respectively describing the global and regional status of the two countries, analyzing the correlations of Sino-American trade, and making comprehensive comparison on the basic strength and development potential.

3.1 Global Economical Status

In this first section, the data story shows the evolution way of the Global Economical Status of China and the US from the aspects of Economic Aggregate, International Trade and International Direct Investment.

3.1.1 Economic Aggregate

Economic Aggregate represents the overall economic situation of the nation. Drawing the data on the GDP and top 1% share of income of major economies in history, the GDP per capita and share of world of China and the US, and the industry add value of both countries, the data story displays line charts, bar charts, pie charts and distribution to describe the corresponding data.

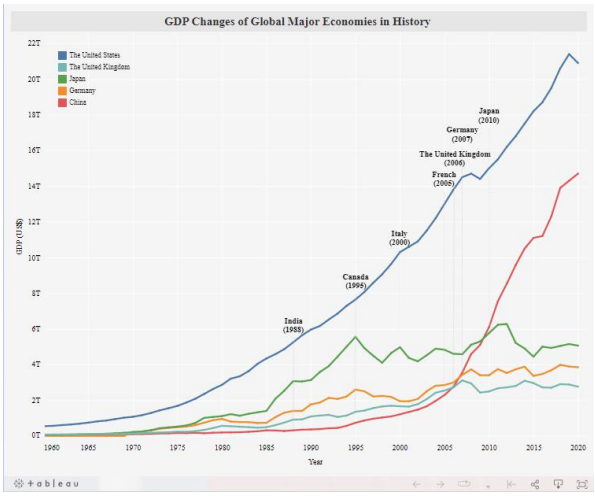

Figure 1. GDP Changes of Major Economies in History

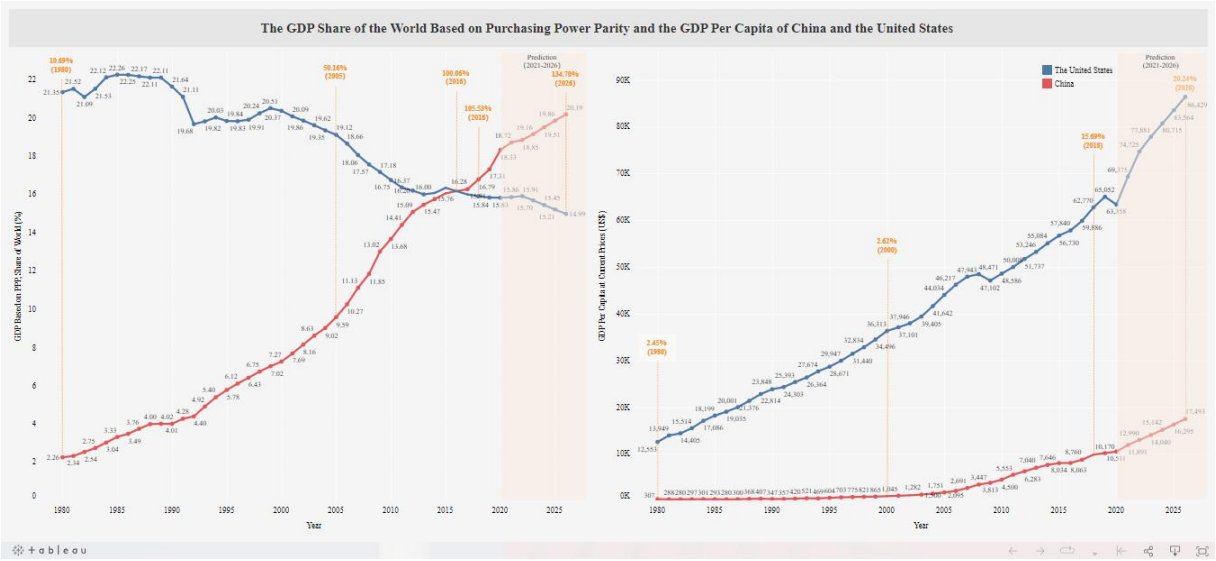

Figure 2. GDP Changes of China and the United States

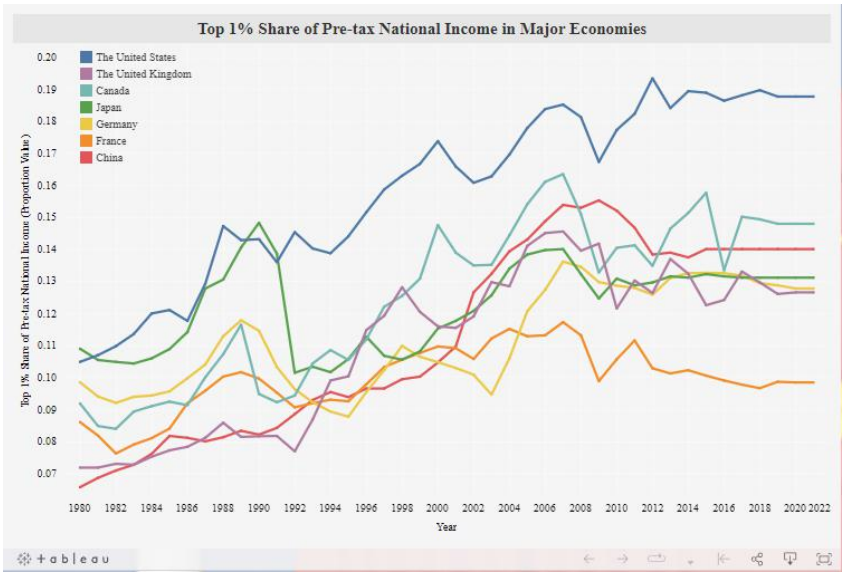

Figure 3. Historical Changes of Income Inadequate

The three line charts are mainly aimed at showing the historical change of GDP and the income inequality of target economies which totally make up of continuous numerical data and making comparison at the same time, thus are the best choice. The potential audience could learn about the change through observation, get the detailed information contained in each data point and make the comparison. Also, both the first two visualizations emphasize key data points by labels with reference lines and differentiated colors.

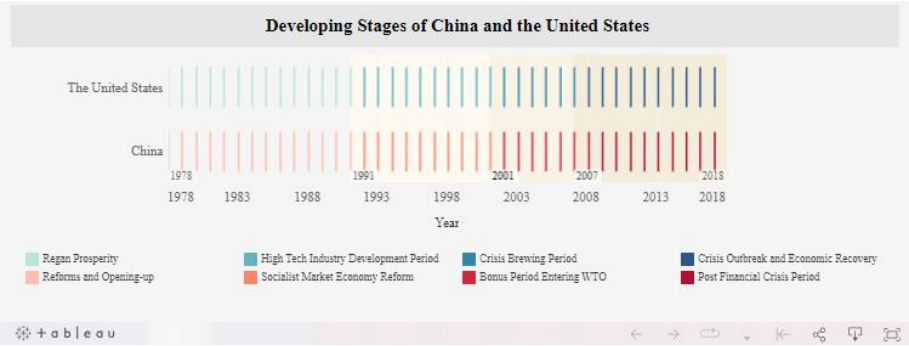

Figure 4. Developing Stages of China and the US

In addition to the line charts, the distribution adds the development stages and makes a comparison between China and the United States. It is used mainly to illustrate the developing phases and additional text data.

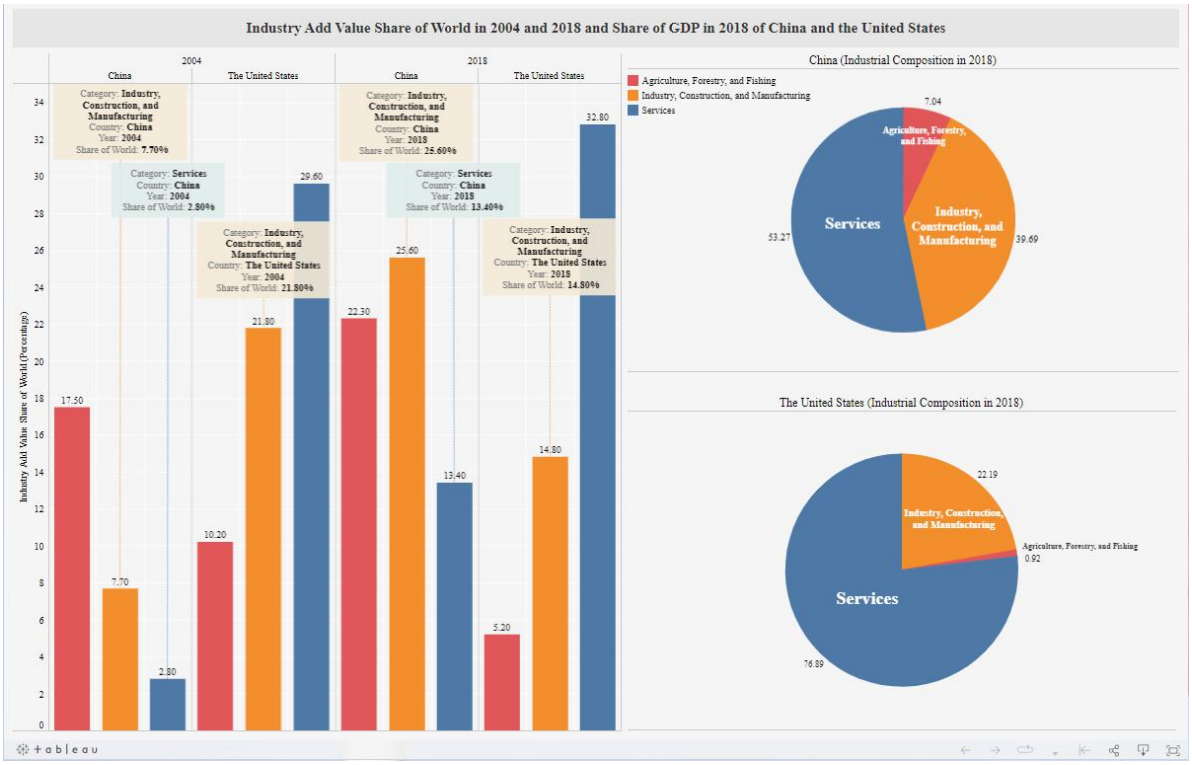

Figure 5. Industry Add Value of China and the US

Here, the proportions data of industry add value of China and the United States are displayed with the combination of bar charts and pie charts, which respectively are used to make comparison between both countries in two different times, and show the industrial composition in a specific year. Audience could make comparison between countries or years, and could look at detailed industrial composition with categories and data as well. Key data points when dramatic changes take place and of significance to compare are also emphasized with labels.

In this part, with both enough numerical and categorical data, the data values are encoded to points on lines, length of bars, angle of wedges, and label text in all the figures and actually meet the expected narrative patterns of argument and flow to indicate changes, make comparison and show compositions and distributions. Visual encoding of color is also used to differentiate variables. With the help of the figures, the situation of the Economic Aggregate of China and the United States is clearly shown in the story. To make an improvement, the data on Sino-American developing stages are needed to make the distribution more detailed.

3.1.2 International Trade

International Trade represents the global relation development of the nation. With the data on goods trade, service trade and external trade balance of China and the United States, the story displays the line charts, the pie charts and the combination charts.

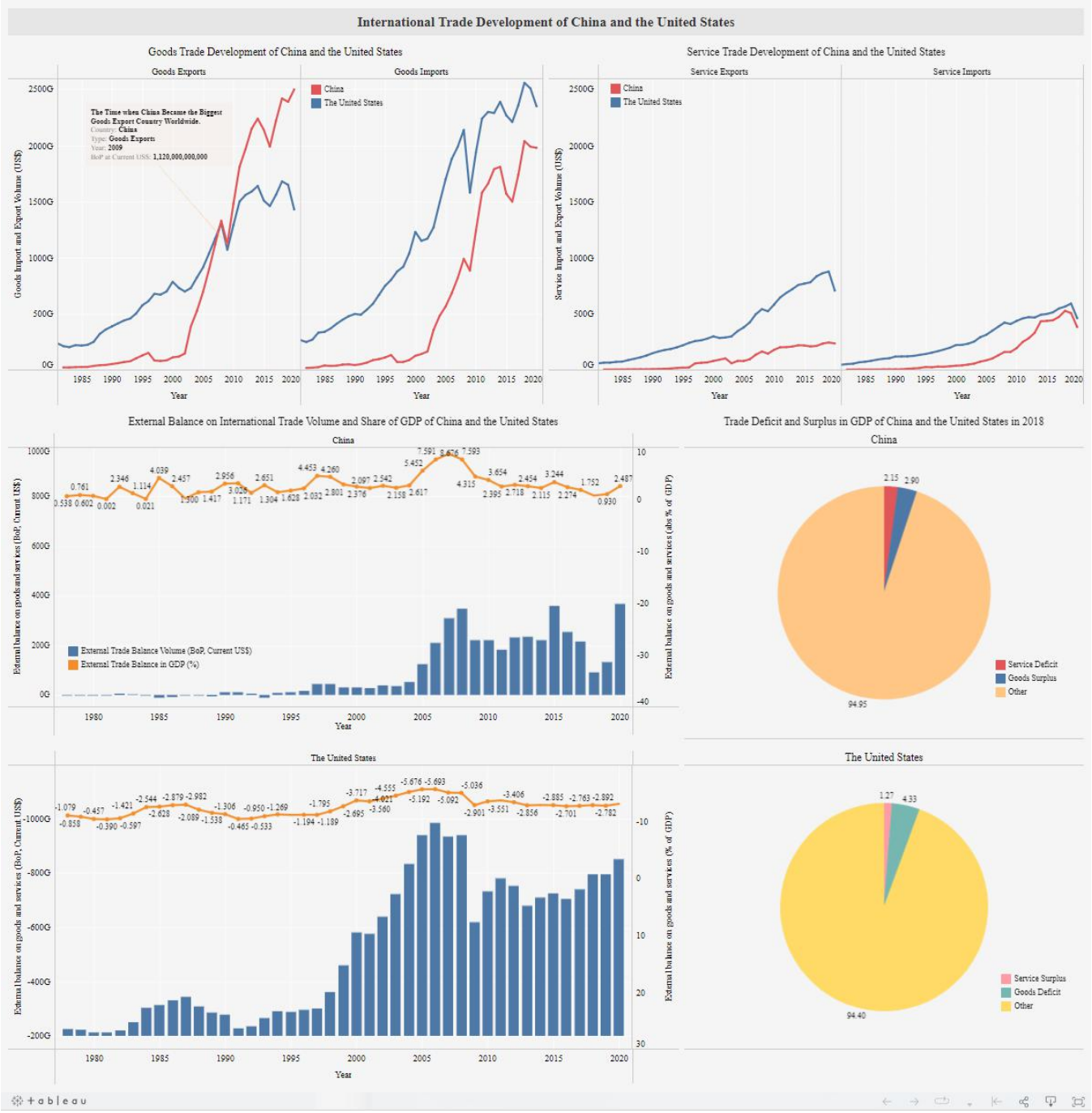

Figure 6. International Trade Development of China and the United States

The line charts here are mainly used to show the change of international trade and make comparison between China and the United States. The key point is emphasized with a label and the scales of the two charts are unified to show the actual situation of data and avoid bias. The combination charts are mainly aimed to show change of value of external trade balance and the corresponding proportion in GDP at the same time, and make comparison between two countries. Because of the constant negative value of the US external trade balance, the combination chart below is sorted in descending order and set to the same scale to avoid comparison bias. The pie charts simply shows the trade deficit and surplus proportion in GDP of the two countries.

In this part, with enough continuous numerical data of trade data and time and discrete data of proportion, the data values are encoded to the elements in the above figures. The visualization gives the development of International Trade, the change of External Balance and the proportion in GDP of China and the United States, makes the comparison between them, and specifically displays the current situation of the deficit and surplus of the two countries, generally gives a narrative pattern of argument, flow and engagement. To make an improvement, data from other aspects can be drawn to make the pie charts more detailed, ample and able to make comparisons domestically.

3.1.3 International Direct Investment

International investment represent the financial influence of a nation globally, including key values of investment flow as well as investment stock. With the investment data over the past twenty years, the story displays the combination charts of area charts and scatter plots.

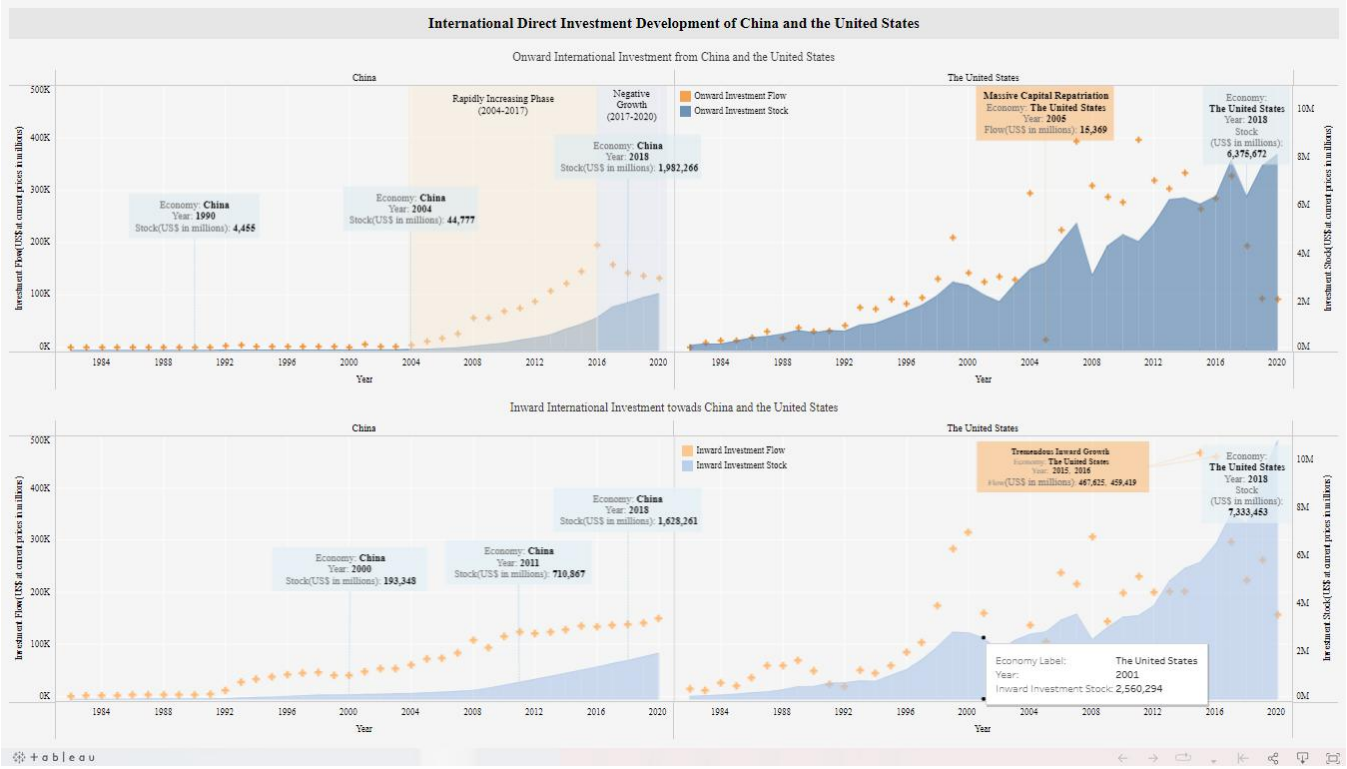

Figure 7. International Direct Investment Development

The scatter plots here are mainly drawn to show the value of investment flow and its developing tendency, while the area charts correspond the accumulation of investment stock based on the current investment flow. Considering the continuous feature of data and the relationship between the variables, the combination charts are the best choice. Audience could learn about the data value from the general observation of the area and the scatters height, and could go to the detailed information of a specific time as well. Further, key data points and important developing period is emphasized with colorful labels as reminders to make important comparisons and all the figures are in same scale to make observation comparison meaningful.

In this part, with enough numerical data of investment flow and stock, the values are encoded to point elements and area in the figures above. The visualization shows the overall of investment flow of both countries and the accumulating process of investment stock. Making comparisons between countries at the same time, audience could explore the differences and thus the International Investment Development is able to support the differences between countries in the story. To make an improvement, the visualization could be dynamically demonstrated to acquire better effect.

3.2 Regional Economic Status

In this section, the data story will focus on the economic status of China and the US in their respective regions, particularly from the aspects of Regional Importance, Regional Tendency, Regional Influence Distribution and FTA Networks.

3.2.1 Regional Importance

Regional Importance indicates the general status of a nation. With the importance index data on the share of regional aggregate of China and the United States in GDP, Trade, Consumption and Investment, the story displays multiple line charts to show the variables.

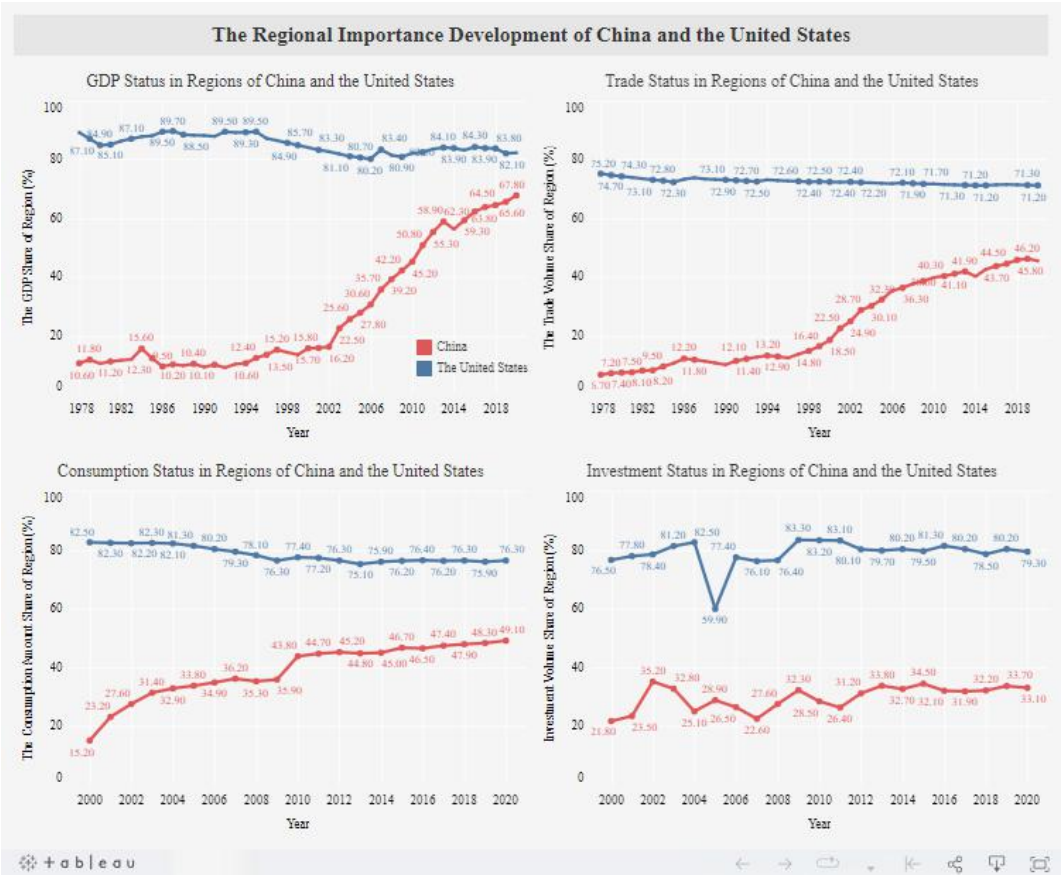

Figure 8. Regional Importance

The line charts here are mainly aimed at showing the developing tendency of the variables and making comparison between countries at the same time. The audience could observe the line trend and read the detailed data from the figure. Also, all the figures are in same scale in order that the comparison between the importance of different indices is available as well. In this part, the enough numerical data are encode to data points on the line and together show the historical trade of both countries, building the patterns of development and comparison. Visual encoding is used to divide country categories as well.

3.2.2 Regional Tendency

Regional Tendency indicates the investment skewness of a nation. With the data on the import and export data of China and the United States, the story displays scatter plots showing the proportion change in specific years.

Figure 9. Regional Tendency

In this part, the data are encoded to scatters and visual encoding is used to classify trade categories and countries. It draws the connections of the points, showing the change of the proportion and enabling audience to make the assumption of the constant increasing regional skewness of both countries. The visualization gives a narrative pattern of

comparing development and explore associations.

3.2.3 Regional Influence Distribution

Regional Influence Distribution indicates the global influence in different regions of a nation. Drawing the data on the biggest Trade Partner of all the 240 countries in statistics, the story displays maps, pie charts, and bar chart to describe the data.

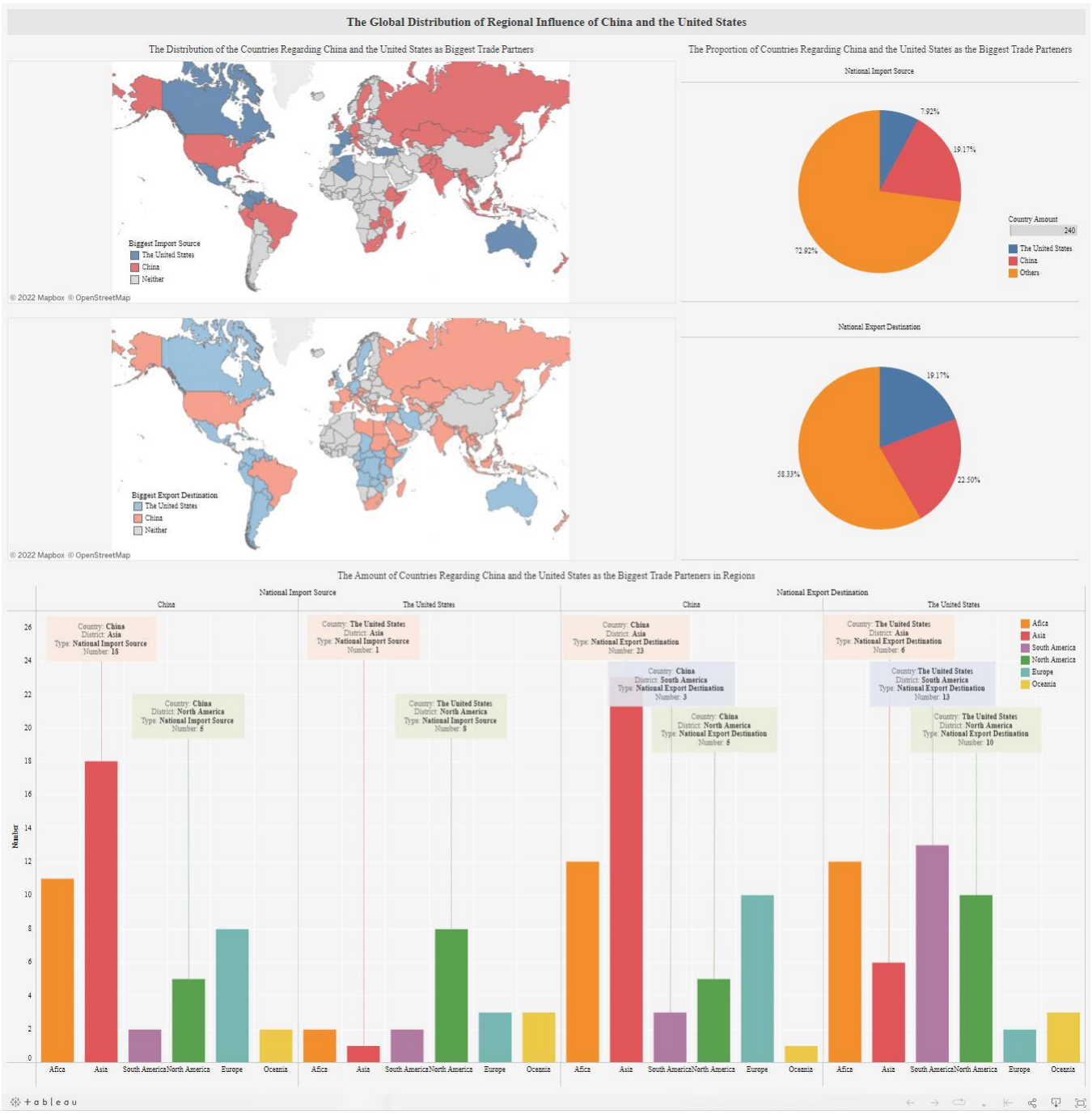

Figure 10. Regional Influence Distribution

Here the maps are used to show the distribution of the countries globally. The pie charts are drawn in addition to the maps, giving the accurate amount of countries regarding China or the United States as the biggest Trade Partners and the corresponding proportion. And the bar chart shows the detailed aggregation number of the global distribution of partners divided by countries and trade categories. The combination of the three charts together fully shows the distribution, proportion as well as the aggregation details to the audience, which is a comprehensive visualization choice in this case. Key data points are also emphasized with colorful labels to make necessary comparisons between regions and countries.

In this part, the categorical Trade Partner data are encoded to colors on maps, aggregated to amount and proportion and

encoded to angles of pie charts as well as length of bars. The corresponding visualizations all meet the features of data and together support the theme of this section by giving whole narrative patterns of comparing, observing and exploring distribution, composition and comparison. To make an improvement, the charts could be coded to related to each other through shared variables.

3.2.4 Free Trade Agreement Network

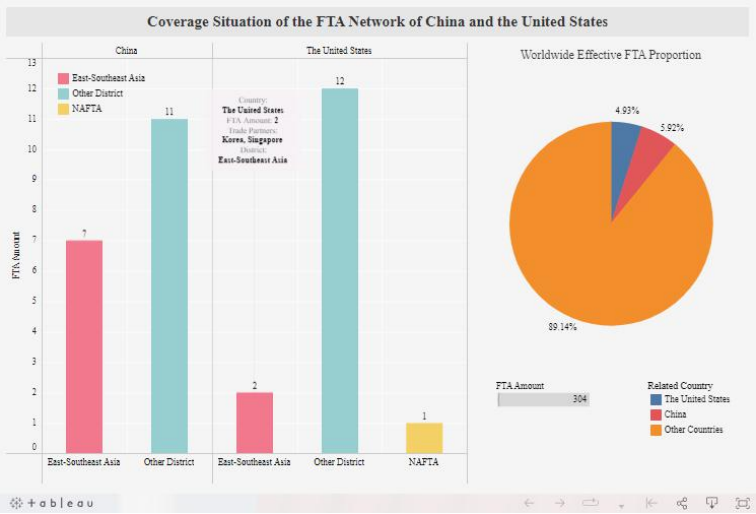

Figure 11. FTA Network

In this part, visualizations are aimed at showing the participating situations of Free Trade Agreements. With the data on the list of countries with region attributes that have FTA with China and the United States, it is aggregated and encoded to elements in bar charts and pie charts and gives the comparison of the two countries.

3.3 Sino-American Economy and Trade Correlation

In this section, the data story focuses on the Economic and Trade Correlation between China and the US, mainly displaying data from Trade, Production and Consumption associated with the two countries.

3.3.1 Trade Correlations

Trade Correlation represents the trade dependence extent of China and the United States. Drawing the data on the products that are greatly dependent on the market and production of the other side, the story displays maps to describe the overall situation.

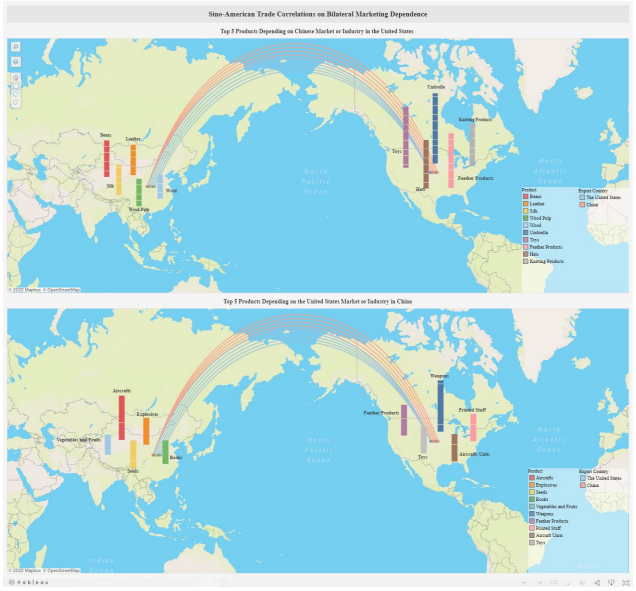

Figure 12. Sino-American Trade Correlations

As the visualization background, the maps here are mainly as the indicators of national locations and gives the space for the combination of multi variables. Audience could learn about the trade flow direction from the figure and go through the detailed information of the top products. The general situation of trade flows and the dependence extent of specific products can be acquired on direct observation. To avoid bias, the maps as well as the internal elements are built in the same scale.

In this part, the discrete country and category data of the products, and the corresponding numerical proportions are encoded to map locations, visual colors and height of bars. Building the connections between the points to represent the inward and onward trade flow directions and bars representing the product dependence weight, the visualization gives a narrative pattern of comparison and exploration of the association and supports the section theme of Sino-American Trade Correlations. Visual encoding of color is also used to identify product categories and countries. To modify this visualization, improvements could be carried out on building more clear and dynamic demonstration as well as increasing product data volume to show the tight associations between the two countries from more aspects.

3.3.2 Production Associations

Production Associations represents the the dependence extent of the industrial production concerning intermidiate trade products of China and the United States.

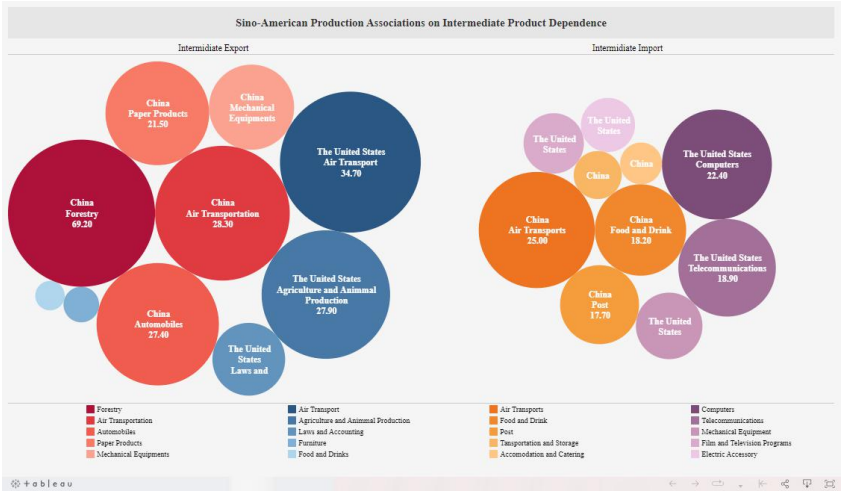

Figure 13. Sino-American Production Associations

In this part, the story displays filled bubble diagram to visualize dependence extent. The data on product categories and market shares are encoded to colors and size of the bubbles, which can directly showing the dependence extent of each kind of products, and audience could make comparison, imagination or go through the detailed data in the bubbles as wish. To make an improvement, there could be additional data on more intermidiate products to make the visualization more convincing on supporting the production associations between the two countries,

3.3.3 Consumption Correlations

Consumption Correlations represents the dependence extent of the final product consumption of China and the United States.

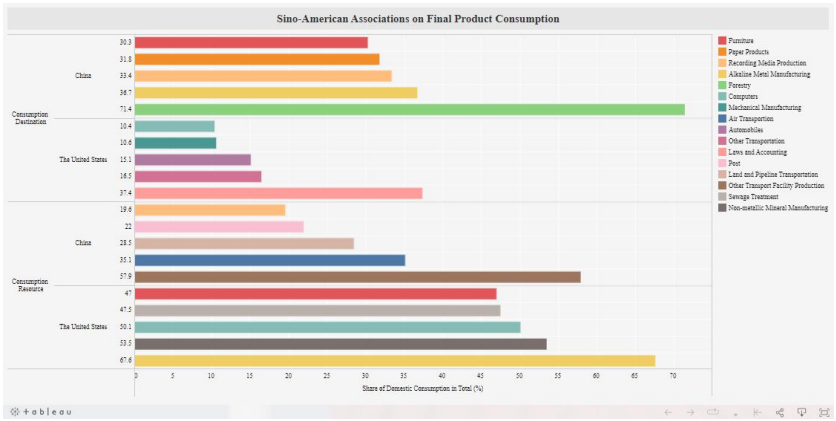

Figure 14. Sino-American Consumption Associations

In this part, the story displays horizontal bar charts to visualize the dependence extent of final product consumption. The data on product categories and market shares are encoded to color sequence and size of the bubbles. Similar to the Production Association, the visualization is directly visible for audience but is more clearly showing the different extent shares of market of a product in the countries, based on which the comparisons of the dependence extent of the products could be made through observation. The consumption correlations With the base of final product consumption statistics, the consumption correlations is more accurately evaluated than the production association with intermidiate trade data, and is thus meaningful to carry out numerical comparisons to a greater extent, respectively corresponding the different usage of bubble diagrams and bar charts. To make an improvement, there could be more data on the national consumption in history to show the development of the countries' consumption correlations.

3.4 Basic Strength and Development Potential

In this last section, the data story further focuses on various subdivided indicators, and form a relatively comprehensive visualization on the economic and trade strength as well as the development potential of China and the US. The data are transformed into tables and audience could go through all the details freely and make comparison.

4 Conclusion

In terms of the global economic status, China and the US are shown to be close in economic aggregate and trade scale, but different in development stages. In terms of international investment, China has considerable developing potential, but still needs to continue catching up with the total amount. From the perspective of regional roles, both countries occupy a key status in their respective regions; in contrast, the importance of the US in NAFTA region is relatively stable but declining, while China's importance in East-Southeast Asia region is increasing. On economic and trade relations, China and the US are largely closely linked in trade, production and consumption. As for the basic strength, both two countries have their own strengths and weaknesses, and there is great room for development in the future.

Willing to lead the audience go through all the data concerning the economic and trade of China and the United States, this data story gives a full view of the situation at present and in history. The story combines many kinds of visualization methodologies from simple charts to complex maps, mapping all the features of the presenting data. The author hopes that all the audience of this data story could learn about a comprehensive Sino-America Economic and Trade Relationship.

At present, the US, the EU and China all provide strong economic support for the region. As two big countries with similar strength and close ties, China and the United States are bound to share cooperation and competition in economic exchanges. It is always the right way to properly handle the economic and trade relations between the two countries, solve the frequent economic and trade frictions at this stage and achieve reciprocal and win-win development.

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