Section 4. Economics and management

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UNDERSTANDING THE IMPACT OF COVID-19 ON THE GLOBAL ECONOMY

Abstract. Since the outbreak of COVID-19 in 2020, the world is now struggling with the pandemic. As an important aspect that cannot be ignored at present, it has been affecting us all the time, and many researchers and surveys also focus on it. This study also focuses on COVID-19's recent spread to different continents, the latest cases, and the economic impact. Most of the GDP of Asia and North America are evenly distributed and similar, except that six countries in Asia are higher than all North American countries. The number of new vaccinations is the same in Asia and North America, with the exception of four Asian countries. Overall, the previous assumptions are not applicable to most countries, there is not enough evidence to prove their rationality, and individual exceptions can not explain anything.

Keyword: COVID-19, GDP, economy, impact, correlation, R square.

Introduction

Since the outbreak of COVID-19 in 2020, the world is now struggling with the pandemic. As an important aspect that cannot be ignored at present, it has been affecting us all the time, and many researchers and surveys also focus on it. This study also focuses on COVID-19's recent spread to different continents, the latest cases, and the economic impact. The hypothesis of this study is that there is a weak correlation between the new cases recorded per day and the GDP.

The outbreak of the new virus began in China and spread to many parts of the country in many ways. For example, at the beginning of the outbreak, people did not realize its potential power. So some infected persons were identified as ordinary asthmatic patients and traveled to all parts of the country. Some asymptomatic patients have no obvious symptoms, but carry the virus and can infect others. We therefore assume that at the beginning of the virus outbreak, the number of new cases and deaths in Asia increased, and the economic losses also increased. However, with the gradual development of technology and awareness in the process of fighting COVID-19, China has made great contributions to the more stable epidemic situation. According to the data, on April 4, there were 30 newly confirmed cases in China. At present, novel coronavirus pneumonia cases have exceeded 1 million 200 thousand cases. It has greatly curbed the emergence of new cases, and the economy has gradually recovered from the depression. However, the situation in the Americas continues to deteriorate. The peak number of new cases in a single day in the United States reaches

210000, with an average of 130000 new cases. At the same time, the growth rate of the death toll is amazing. The average death toll is 683 per day. We can't say that the United States has insufficient technical strength to fight the pandemic. Objectively, with the rapid increase of new cases, the United States can't save such a large number of patients at once. Therefore, the number of local deaths will increase with the increase of new cases, and it may improve in the later stage.

I hypothesize that I will observe a weak correlation between the new cases recorded per day and the GDP. This is because countries with stronger economies will be better prepared to implement effective public health measures and their health care systems are more advanced. I also hypothesize that North America has more newly confirmed cases than Asia. As a result, Asia has fewer new vaccinations than North America.

Method

I used R (a programming software that can integrate data and draw considerable charts) to perform data analysis and research on different countries.

I obtained recent COVID-19 data from the online data repository *Our World in Data*. Given the difficulty in downloading the full dataset, my academic consultant provided me with the most recently updated version. This form includes all the data of all continents and countries affected by COVID-19. I focused on a subset of variables for my research. Specifically, I extracted the names of the continents, the number of newly confirmed cases since the outbreak, the number of vaccinations, and GDP from the full dataset.

I then calculated the maximum value for newly confirmed cases and vaccinations administered per day to better understand how the virus was spreading and how well mitigation efforts such as a vaccination program was working.

I read these data into R and built a custom code to obtain relevant statistics and plot three charts. They are: the distribution of the number of newly

confirmed cases on all continents, which is in the form of box chart; The relationship between the number of newly confirmed cases and the GDP of each continent is shown as a linear graph; The relationship between the number of newly confirmed cases and the number of vaccinations is shown as a linear graph.

Result

The first box chart (relationship between continents and newly confirmed cases) reflects the newly confirmed cases in six continents. According to the abscissa axis, Africa, Asia, Europe, North America, Oceania and South America are in turn from left to right. First of all, there are almost no cases in Africa in the first column, and the median is close to zero. The upper limit of newly confirmed cases can reach about 400, and there are the most abnormal countries on all continents. Their cases are mainly arranged within 1000, and one is as high as more than 4000. The upper limit in Asia can reach more than 1000, accounting for 50% of the countries with low cases, and there are still two cases as high as 2000 and 3000. All countries in Europe have outbreaks, compared with almost all countries in Oceania. The upper limit in North America is slightly lower than that in Asia, and the distribution is concentrated in 0 ~ 1000 cases.

We performed an Analysis of Variance (ANOVA) to uncover any statistical differences among continents. We found a significant difference (F = 8.309; P = 4.15e-07), indicating some continents recorded statistically different maximum case numbers. Indeed, after performing a Tukey's honest significant different test (Tukey HSD), we found Europe reported the highest number of cases per day of any continent, and this was greater when compared to Asia (P = 0.0162), and North America (P = 0.0237). However, we do find any evidence to suggest that the outbreaks in Asia and North America were statistically different (P = 1).
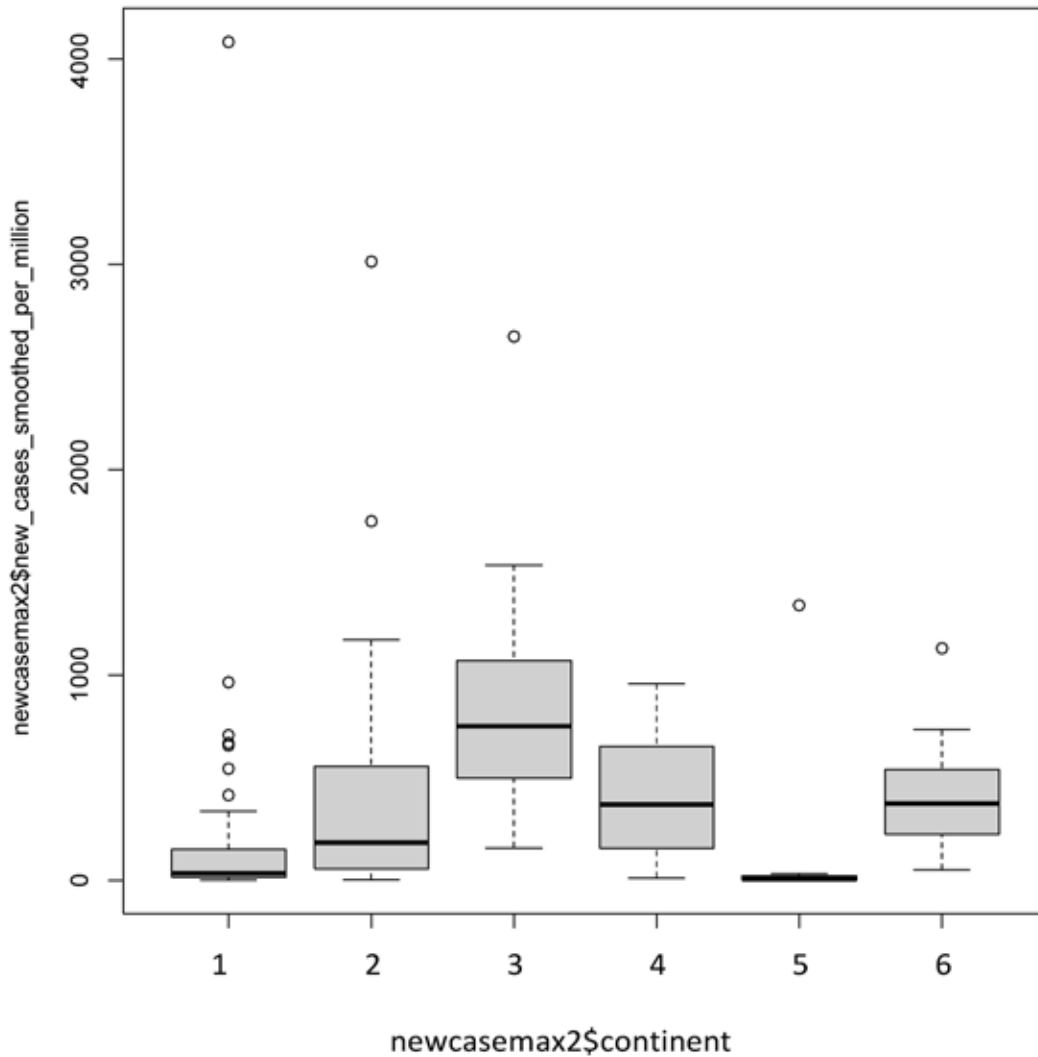
Figure 1. Boxplot of maximum number of cases for each continent. 1, Africa; 2, Asia; 3, Europe; 4, North America; 5, Oceana; 6, South America

The second linear chart (relationship between newly confirmed cases and GDP), six colors: red, blue, black, green, purple and orange. They correspond to six continents: Africa, Asia, Europe, North America, Oceania and South America. The best-fit line follows an upward trend, indicating a positive correlation between cases and GDP ($r^2 = 0.24$; P = = 0.0012). It does not mean that the new cases will lead to the increase of national GDP. On the contrary, the actual situation may happen to be the opposite. In fact, countries with higher GDP have the ability to detect and provide more confirmed people. Other factors are not considered for the time being. The first

thing you can see is that there are a large number of points at the bottom left, accounting for most of the points in the whole picture, mainly red, which represents Africa. The number of newly confirmed cases in these regions is less than that in most regions of other continents, ranging from 0 to 1000, and the GDP remains between 0 and 20000. It is striking that the point on the far right is from the Republic of Seychelles, which has a staggering number of confirmed cases of more than 4000, but its GDP remains around 20000. In Asia (blue dots), the distribution is scattered, mostly on the left. It can be seen that the GDP of Asian countries is uneven and fluctuates greatly.

However, the newly diagnosed cases are controlled within 1000. There are more than 1000 in some areas, but most economically developed areas have well controlled the epidemic, such as Singapore, Hong Kong and so on. North America (the Green Point) is also within 1000 cases on the whole. The U.S. GDP is close to 60000, which is the leader in GDP compared with Asia. However, the newly confirmed cases are the largest in other countries in North America and higher than most Asian countries.
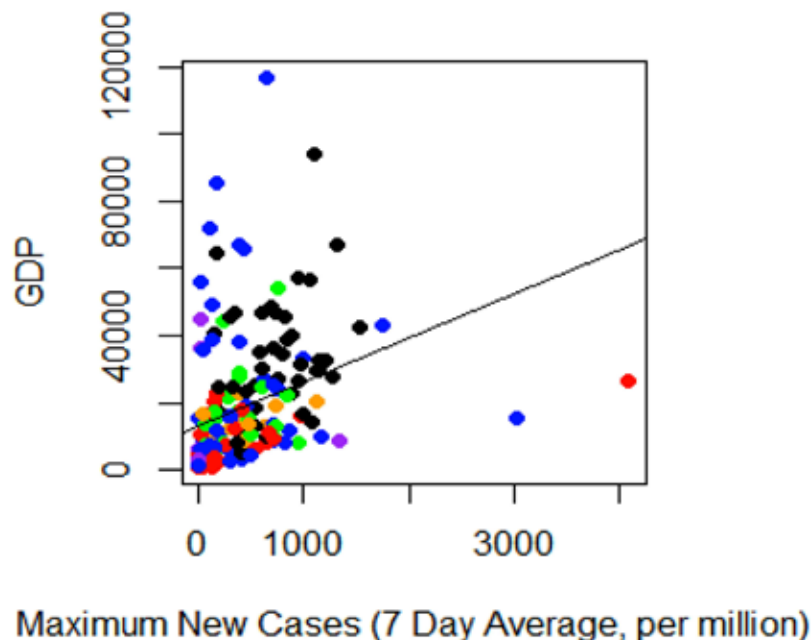

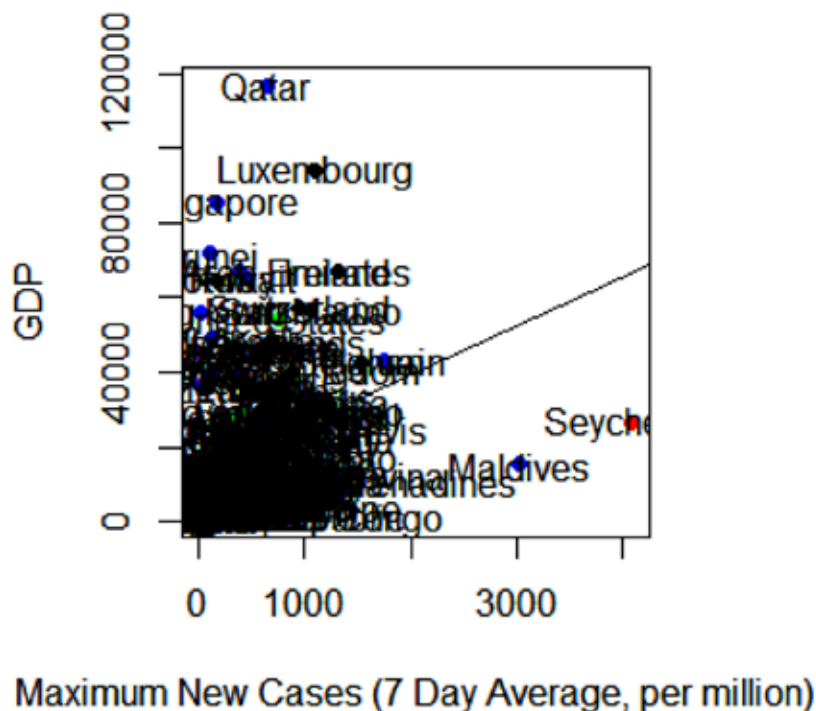Figure 2a. Maximum new cases regressed against GDP

Figure 2b. Maximum new cases regressed against GDP with countries noted

In the third linear chart (the relationship between newly confirmed cases and the number of newly vaccinated vaccines), the change is also positively correlated (r^2 = 0.21; P = 0.0134). Gathered in the lower left area, Africa still has the lowest number of vaccinations and confirmed cases, with new confirmed cases maintained at 0 ~ 1000 and almost zero number of new vaccinations. However, there are still three African countries, especially the Republic of Seychelles. The distribution in Asia is scattered, mainly in the square area composed of 0 ~ 1000 newly confirmed cases and 0 ~ 20000 newly vaccinated vaccines. There are still four exceptions, especially Bhutan. The distribution of North American countries is more concentrated in the square area composed of 0 ~ 1000 cases and 0 ~ 20000 vaccination numbers. The situation in the United States is more prominent, which is close to the upper right corner of the square area.

Discussion

According to the data results, there is not enough evidence to prove that there are fewer newly confirmed cases in Asia than in North America. Most of them are within 0 ~ 1000. There are no outlier cases in North America, but there are two outlier cases in Asia. There is no significant difference between the two. Let's look at GDP. Most of the GDP of Asia and North America are evenly distributed and similar, except that six countries in Asia are higher than all North American countries. Finally, the number of new vaccinations is the same in Asia and North America, with the exception of four Asian countries. Overall, the previous assumptions are not applicable to most countries, there is not enough evidence to prove their rationality, and individual exceptions can not explain anything. The main reason for this is that the GDP gap between Asia and the Americas is not large. The data show that Asia has the largest economic aggregate, and the gross domestic product (GDP) of 49 countries or regions in Asia is about US.

$28.63 trillion. The GDP of 37 countries or regions in North America in 2017 was US $27.002

trillion@4. This is why, on the whole, there is little gap between North America and Asia. The amount of GDP largely determines the average development level of the continent, whether the medical equipment and scientific and technological development are advanced or not. This is why in terms of GDP, the countries with several extreme cases are mostly Asia. The GDP is related to the country's ability to produce more vaccines. The higher the GDP, the more developed the national economy is, the stronger the vaccine R & D ability is, and the more vaccines can be developed. This is why the GDP is directly proportional to the number of new vaccines, and most extreme cases appear in Asia. As for why the higher the GDP, the more new confirmed cases in continents, and many extreme cases appear in Asia, this is because the higher the economy, the more capable the continent is to survey population and take care of the majority of citizens. On the contrary, Africa has a very small number of newly confirmed cases, and the average case is close to 0, because in many small countries in Africa, the government does not have enough economic capacity to test for COVID-19. It may be true that the disease is not so serious in some places, but the less economically developed countries in Africa account for the majority. Many people are ill, have no ability to receive vaccines, have not been tested, or even die directly, resulting in the lack of some data. On the contrary, there are extreme countries in Asia, such as Hong Kong, Singapore and Qatar countries. As can be seen from the figure, its GDP value stands out from many countries, especially Qatar. Due to its rich oil resources, it has become one of the richest countries in the world. Its country is small, with a population of only 2.88 million, but its cases exceed most African countries, and its case reporting is more accurate. However, the country is not particularly prominent in vaccination, which may be caused by the weak national awareness. China has such a large population and such a complex number of national conditions. In order to establish an effective defense line for epidemic prevention and control, the number

of vaccinated population must reach at least 1 billion, that is, the vaccination rate of 1.4 billion people must reach more than 70%, so as to establish an effective defense line for epidemic prevention and control. can be seen from the figure, there are not enough examples to confirm the original hypothesis.
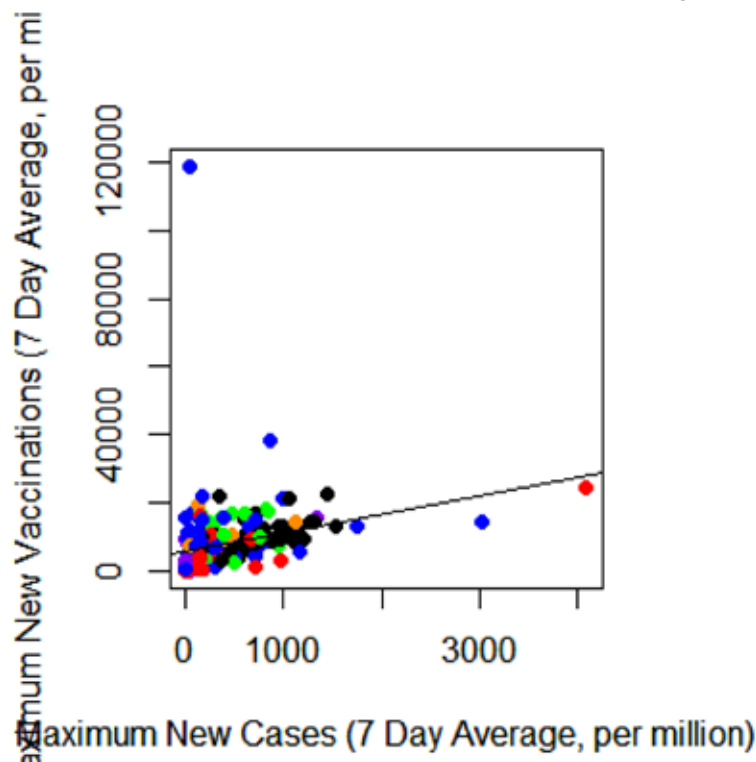

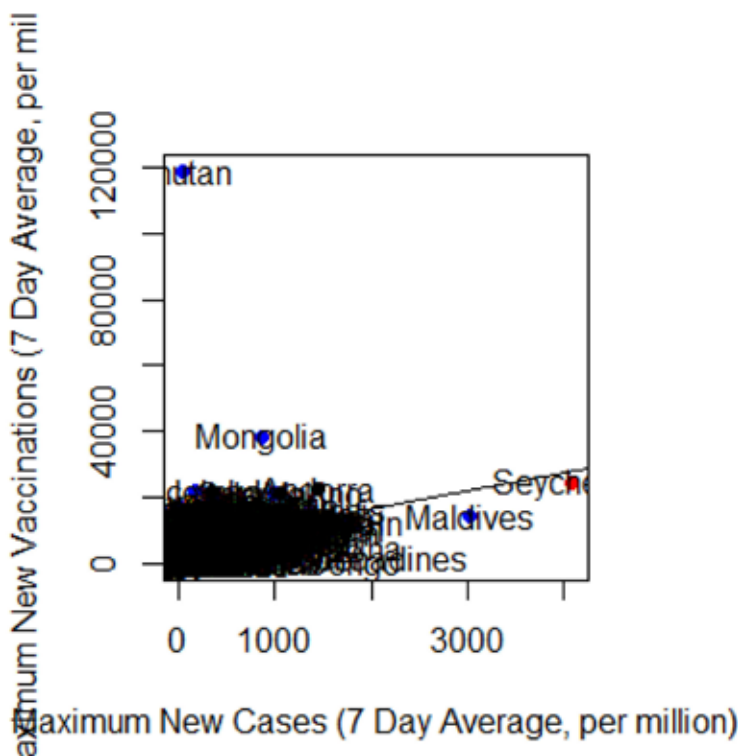Figure 3 a. Maximum new cases regressed against maximum new vaccinations

Figure 3 b. Maximum new cases regressed against maximum new vaccinations with countries noted

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