

The Impact of COVID-19 on the Manufacturing Industry and Solutions

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Abstract. The COVID-19 outbreak has had a tremendous impact on the manufacturing industry globally. Compared with pre-pandemic time, every step of production, from the supply chain to the production line, from marketing to sales, has been affected by various degrees. This paper discusses the impacts from the aspect of business risk and between different types of manufacturing industries, including clothing processing, automobile making, energy, and food processing. Based on the levered beta formula, companies' business risks are estimated as the unlevered risk and compared between before and during/after the pandemic for each sub-industries. The automotive sub-industry is highlighted because the pandemic has had its most substantial impact. The paper analyzes both short-term and long-term effects. Potential solutions to the governments and the companies for the manufacturing industry to maintain a healthy and stable state are also discussed.

Keywords: COVID-19, manufacturing industry, business risk.

1. Introduction

For the first time since the 1918 flu pandemic, the unexpected pandemic of COVID-19 has dramatically affected the world's economy from different aspects and lasted for years. The COVID-19 has a negative impact on the relation between supply and demand. It also hurt people's healthy and made companies in crisis. As one of the most devastated industry, manufacturing industry has been facing a huge challenge since then. Shortages in the upstream supply chain increase the cost of raw materials. Factories' lockdown and quarantine policies slowed down the production rate and further increase the cost. Inflation and decreased income made it even harder to sell. Although some sub-industry may see increase in their sales because people have saved money with less travelling, the rest must struggle to survive the economic winter.

The beta of an investment security is a measurement of a company's sensitivity to market volatility. It quantifies the relationship between a company's risk and the expected return in the widely applied Capital Asset Pricing Model (CAPM). The higher the beta is, the larger the risk of a company is. Specifically, there are two types of beta: unlevered beta or asset beta, and levered beta or equity beta. The former measures the business risk. As the name indicates, it depends on a company's asset and is associated with operating risk. The later measures both the business risk and financial risk. Besides what asset beta measures, it also includes the risk factor from net income including cash flows and debts. Comparing the two risk components, business risk is more representable for companies of the same type, while financial risk varies more for different companies. This paper focuses on the business risk to better estimate the impact on the industry rather than the companies in the analysis only.

There have been research on the impacts of COVID-19 in different countries. Different methodologies were used. Golubeva collected companies' operating conditions from thirteen countries. Researcher uses the OLS regression model and the traditional data analysis. Three factors — firm, financial sources, country are included in the model. Under the coronavirus pandemic period equity contributions, followed by firms' cash balances and debt are the stable financing means [1]. Hu et al. investigated the influence on Chinese business from various sub-industries in manufacturing. Sales of masks, medical devices, thermometer, disinfectant, and medical protective clothing showed better performances. They also concluded that a company should have a flexible response system and be sensitive to market demand [2]. Ren and Zhang compared the operating conditions of companies

in different provinces of China. By analyzing the stock market data they found that though the strict epidemic prevention policies had negative impact on the economy, but it is just a temporary phenomenon. The governments should provide short-term financial assistance to overcome the crisis. And the companies performances are stable in a long term [3].

Gil-Alana and Claudio-Quiroga used the three Asian stock markets' statistical properties (Korean SE Kospi Index, the Japanese Nikkei 225, and the Chinese Shanghai Shenzhen CSI 300 Index) to estimate the impact of COVID-19 on Asian stock market. By fractional integration methods, the data shown the impact to the Asian stock market are permanent [4]. Sun et al. explores if the news and the economic policy of the government in China, Korea, Japan and U.S. would influence the market and the investor. Using the conclusions from the literature and giving five hypotheses, they prove the validation of the model through reduction. In the end, the result shows the news and the announcements gave a positive signal to the medical stocks. And it is not a short-term and unreasonable decision [5]. Henrietta said COVID-19 exacerbated the crisis in Britain. While revitalizing the economy worldwide, the government must focus on health and well-being. The industrial strategy can unite private, public, and third sectors to lift the economy [6].

Nicolas et al. rated the impact on the entrepreneurship sector in Romania during the epidemic situation. By researching the running conditions of the small and medium-sized enterprises, they found about forty percent corporation were facing the serious difficulties. That shows the government should pay more attention on the small company, so that the country can get out of the difficult position sooner. It can release society conflicts, and also give other developing countries some object lesson [7]. After searching the datas of listed company, Hsiao et al. Used fuzzy-set Qualitative Comparative Analysis to determine the relationship between system risks and corporate management during COVID-19. Here are some findings. Better corporate governance means less system risk, and state-owned enterprises company shows a better performance in the risk. In addition, if a company has suitable ownership structures and a soundboard can release the system risk by announcing business reports on time or maintaining smooth communication with stakeholders, on the other hand, it will increase their business risk. Third, if board members have good qualities in the academic field and management level, it is not good to give the independent directors more proportion. The research shows that higher or lower shareholding gives back a more inadequate system risk ratio. Yan et al. gave the companies ways about how to overcome COVID-19. It seems necessary for the government to give market some positive policies, and national macroeconomic regulation also can reduce risks [8]. Ardolino et al. reviewed the researches about COVID-19 and manufacturing industry in a systematic view. The relationship among three factors process technology and management are be discussed. they found the most significant impacts of the COVID-19 are the epidemic situation attacked the relationships between supply and demand, workers need to work online and the interpersonal relationship becomes loose [9].

In recent years, the Fourth Industry Revolution has become increasingly concerning. Dean et al. rated the future after COVID-19, and found some reliable ways to promote the economy after epidemic situation in Manufacturing, innovation and sustainability. Most research people and organizations are looking forward to more ambitious policies and decisive intervention from the government of Australia. Many researchers and associations in Australia hope their government will build a bridge between work in the future, the environment, and industrial structures. So that the developed countries can get out of the impact from the COVID-19 quickly, and by adopting these national macroeconomic regulation the developed countries can finish the Fourth Industry Revolution earlier [10].

From the related research, three kinds of to deal with epidemic found had been found: self-regulation of the companies, government intervention and equity contributions. Two quite different views are mentioned in the related research. One thinks the impact of COVID-19 is a short-term phenomenon, the other supports the impact to companies is permanent. To analyze whether the impact on the industry is temporary, one should put a long-term view to compare the of companies from 2016 to 2022. This paper divides the manufacturing industry into automobile making, clothing

processing, tobacco processing, the energy industry, and food processing to find out how the “business risk” changed in different sub-industries for both short and long terms. Possible reasons are analyzed. Finally, a best solution is proposed to overcome the impact.

2. Method

2.1. Equations

The relation between asset beta and equity beta is as follows

$$\beta_E = \beta_A + \frac{(\beta_A - \beta_D)(1-T)D}{E} \quad (1)$$

Where, β_E is equity beta; β_A is asset beta; β_D is debt beta; T is company’s tax rate; D is market value of debt; E is the market value of equity.

In practice, it is common to assume the debt is sufficiently risk-free so that $\beta_D = 0$. By replacing $\frac{D}{D+E}$ with L, financial leverage, we can rewrite the relation as

$$\beta_A = \beta_E \div \frac{1-TL}{1-L} \quad (2)$$

The asset beta can be then calculated from the public equity beta, tax rate and leverage.

2.2. Data

Yearly equity beta and leverage from 13 companies from 2018 through 2021 are collected from the companies’ financial statements. Note that equity beta has been averaged for each year. Annual effective tax rate is read from Google finance [11].

3. Results

A summary of the calculated asset beta is listed in Table 1.

Table 1. Calculated Asset Beta for the companies in investigation

Asset Beta	2021	2020	2019	2018
Nike	0.31	0.24	0.39	0.38
Li Ning	0.75	0.65	0.63	0.70
Under Armour	0.13	0.38	0.39	-0.23
Anta	1.00	0.98	0.99	0.98
Honda	0.49	0.50	0.43	0.61
Geely	0.54	0.41	0.54	0.54
GM	0.44	0.37	0.25	0.27
Sinopec	0.53	0.57	0.56	0.60
Exelon	0.13	0.26	-0.48	-0.41
Duke Energy	0.08	0.06	0.05	0.01
Pepsi	0.13	0.10	0.13	0.08
Unilever	0.03	0.13	0.13	0.20
Mondelēz International	0.31	0.32	0.32	0.25

As can be seen from Table 1, all companies’ asset betas are greater than 0 and less than 1, except for a few that have negative asset betas for some years. This means that, no matter before and after the pandemic, the manufacturing industry is more stable than the market. Among all companies, Duke Energy, the largest electric power company in the US, has the lowest business risk in general.

To learn the trend before the pandemic, we can compare the year of 2018 with 2019 (Figure 1). It is found that Li Ning, Nonda, GM, Sinopec, Unilever decreased their business risk, while Nike, Duke

Energy, Pepsi and Mondelēz International experienced the increase of their business risk to various degree.

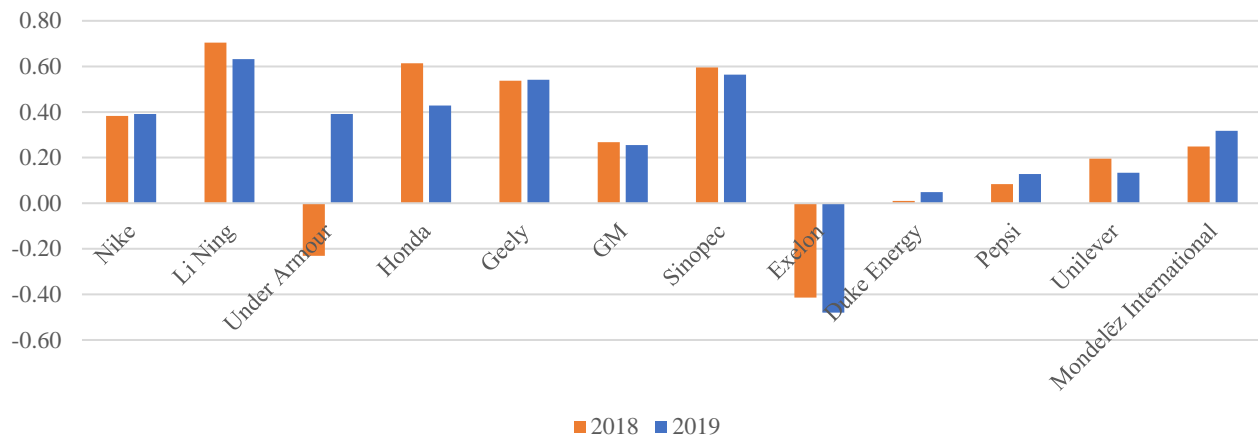


Fig. 1 Asset Beta of All Companies

Ignoring the companies with negative asset equity, sub-industries' asset equities are calculated as the mean of all companies belonging to them (Figure 2). Food processing and energy companies have less business risk than clothing processing and automobile making companies. It makes sense because food and energy are the most basic needs for people to live. Besides, energy companies are normally either controlled by the government, or regional monopolies, making them hard to beat. An exciting trend is that while the food processing and energy industries have fewer business risks, the risks increased in 2019 compared to 2018. On the contrary, clothing processing and automobile-making industries experienced risk decreases. As of all, the manufacturing industry was on the way to more prosperous before the outbreak of COVID-19.

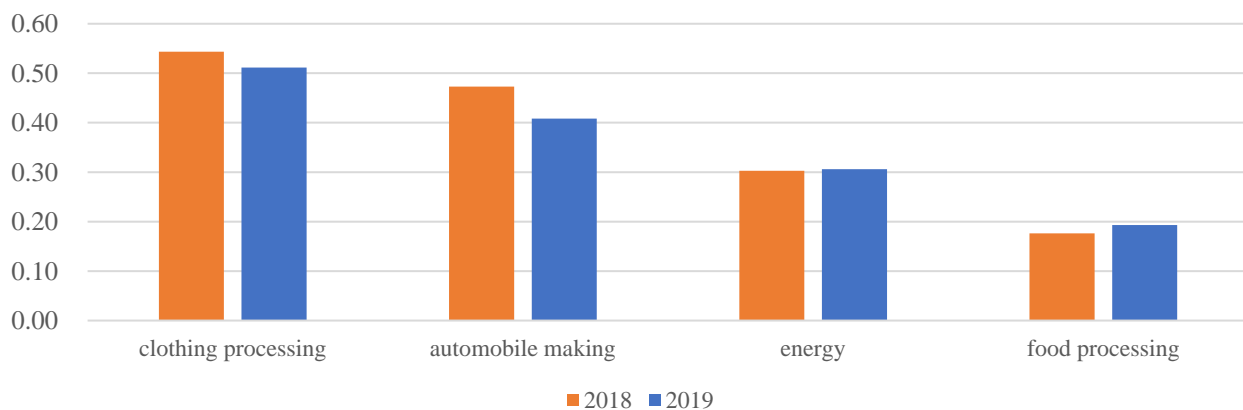


Fig. 2 Asset Beta of Sub-Industries 2018-2019

The change between 2019 and 2020 indicates the short-term impact of the pandemic (Figure 3). As the following figure indicates, automobile making, and energy industries face the increasing of risks. Especially for the automotive industry, as a contrast to the prosperous trend from 2018 to 2019, the increase of risk is the most among the four sub-industries. There are multiple reasons. The disruption in OEM parts transportation and exports, large scale manufacturing interruptions, and the closure of assembly plants all contributed to the rising in cost, which therefore narrowed down the profit margins. A proof supporting this explanation is that among the three automotive companies, Geely was the only one which experienced a decrease in business risk (Figure 3). Based on Zhejiang province, China, the Chinese automotive company mainly reply on domestic upstream supplies, which was not affected by the OEM parts exports.

Surprisingly, the clothing processing industry, specifically the sportswear industry was not impacted by the crisis (Figure 3). All companies in this economic sector continued the business risk.

In fact, instead of being impaired by the crisis, Nike benefited from it. More than 6 million deaths globally and long-term side effects including difficulty thinking or concentrating, headache, sleep problems, dizziness and loss of smell or taste made people more aware of the importance of health and increased the needs for sportswear. The two US companies benefit more than Chinese company Li Ning, probably due to the more deaths and impacts on medical resources in the US than in China. Moreover, compared to Under Armour, Nike put greater efforts in marketing and promotions.

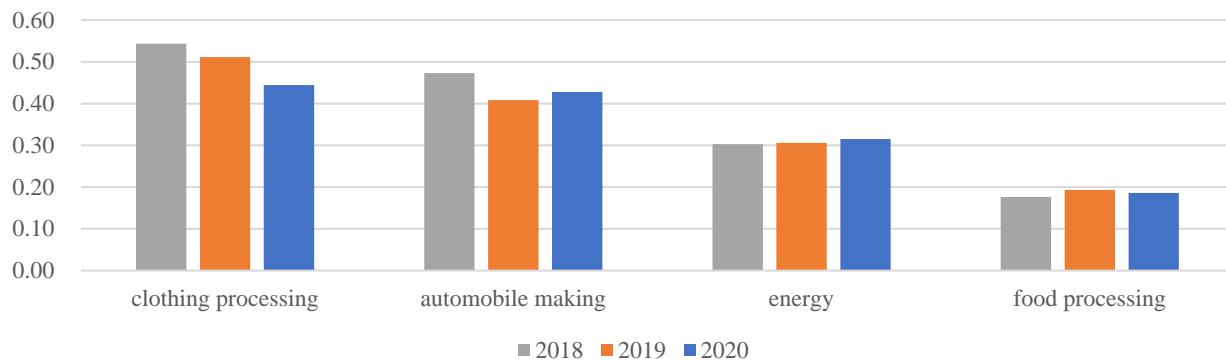


Fig. 3 Asset Beta of Sub-industries 2018-2020

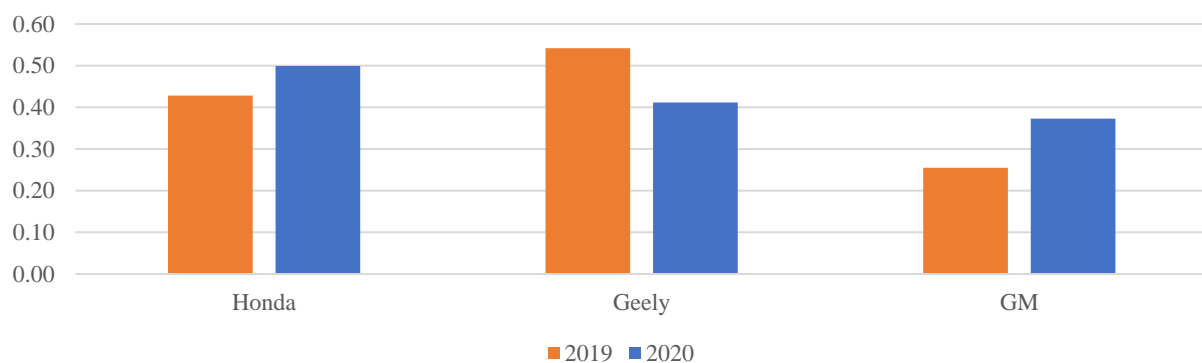


Fig. 4 Asset Beta of Automotive Industry 2019-2020

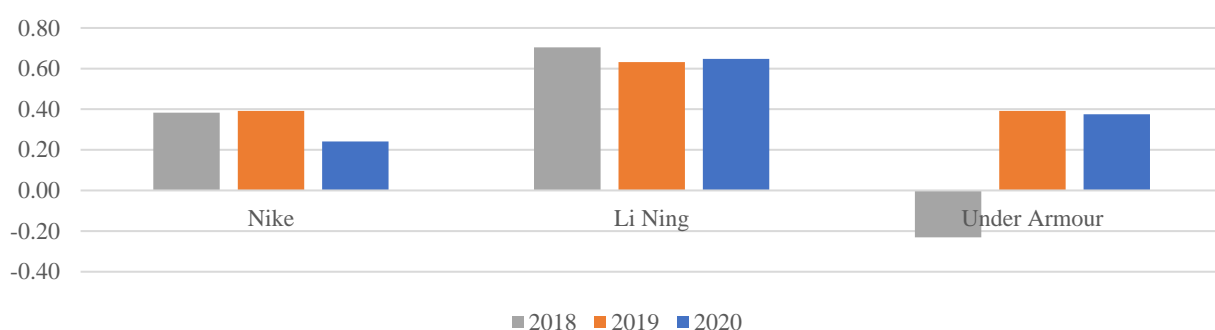


Fig. 5 Asset Beta of Sportswear Industry

The long-term COVID-19 impacts can be analyzed by evaluating the trend from all four years (Figure 6). Among the four sub-industries, energy is the most stable industry. Besides the aforementioned reasons of government stakeholders or regional monopolies, energy companies also benefit from government's compensation during the pandemic. The compensation could either be form of fund support for the companies or credits to residents. With the impact of COVID-19, the business risk only increased by 3% in 2020 and then quickly dropped to the level of 2019 in the following year. As the sub-industry of lowest business risk, food processing companies also have good performance. It is the only sub-industry that keeping improving the business risk even during the pandemic in 2020. The automotive industry was the most affected sub-industry. There is not only

a short-term business risk impairment in 2020 but also a continuous impact in the long run. The decrease of business risk in clothing processing industry in 2020 is mainly caused by Nike, which took advantage of people's hope for health and marketing strategies to increase profit margin. Although this benefit was not as great in 2021, Nike's business risk was still better than before the start of pandemic. In general, the impact on clothing processing is relatively short-term, if any (Figure 7). The abnormal negative asset beta of Under Armour in 2018 and the increased risk of Li Ning in 2021 are rather company specific. Now Nike has won a great reputation and a lot of fans. In the other hand, Nike is a tycoon brand in sportswear industry, it aims to take up the globe market. Decides running its own business, Nike also operates with other bands. Compared with Nike, Anta is a sports brand in China, which main concentrates on manufacture footwear and clothing. It had a remarkable development in these years. One of Anta's success is it's accurate brand positioning. Anta focuses on occupying the middle and low-end markets. It owns 13.27% (2021) of the footwear and clothing market in China (7.2% higher than Lining). The successful brand promotion policies also increased Anta's influence. From 2004 to 2012, Anta provided sports equipment for CBA. Some NBA players such as Garnett, Thompson, Hayward chose to endorsing Anta. And it has close cooperation with the Chinese Olympic Committee. As a result, Anta has boosted its reputation both at home and abroad. Anta's low business risk benefits from the vast market in China and high recognition in the middle and low-end markets. The Chinese government also gives it tax benefits. Gradually, Anta has become one of the best-selling sports brands in China. But its poor technology level and investment maybe restrict its development. And Anta also needs to explore the international market and try to enter the high-end market. All in all, Anta showed an outstanding performance to overcome the stock during the COVID-19.

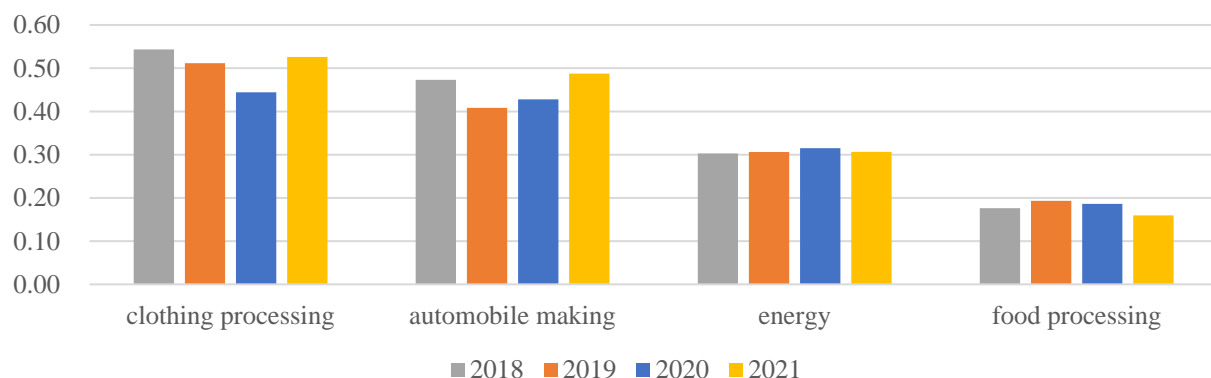


Fig. 6 Asset Beta of Sub-industries 2018-2021

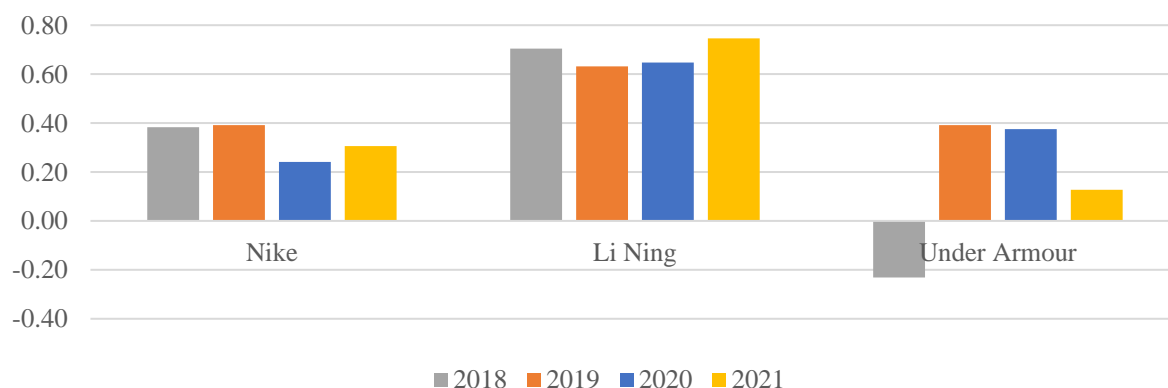


Fig. 7 Asset Beta of Sportswear Industry 2018-2021

4. Conclusion

The COVID-19's impact on four different manufacturing industries of 12 companies is investigated. Two sub-industries are highlighted. The automotive industry gets the greatest shock, which continues through 2021. The energy industry is the most stable industry. The impact is rather ignorable in 2020 and quickly drops back.

Comparing the sub-industries/companies that are impaired most with those that aren't, it is found out that supports from government, the development of trend in human thoughts, and flexible strategies are the main factors that help corporates' stabilities and health.

The epidemic situation is not only a crisis but also an opportunity. This paper support that governments all over the world should offer short-term loan, set favorable economic policies, and have robust national macroeconomic regulation for the companies in their countries. In this way, national economic development will be more smooth and faster. Companies should keep improving innovation and management levels to be more stable and competitive. For individuals dealing with changing situations, everyone should improve themselves and enhance competitiveness. In this paper, this study found the attack from COVID-19 is severe but not a long-term barrier. If the government and the companies take some positive ways to overcome the impact of the epidemic situation, industrial restructuring can be sped up. And the high-technology industry welcomes opportunities. The epidemic situation has promoted industrial digitalization. It makes high-quality economic development.

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