

# Statistical Study on the Impact of the New Crown Epidemic on the Supply and Demand Market of Macau Hotel Industry

Yan Zheng\*

Guangzhou College of Commerce, Guangzhou, 511365, China

\*Corresponding author: zyan0728@hotmail.com

**Abstract:** This paper conducts a systematic study of the market development of the hotel industry in Macau under the influence of the epidemic, and statistically analyzes the changes in supply, demand and prices of the hotel industry from 2020 to 2022. It is found that despite the severe decline in the number of inbound tourists to Macau due to the epidemic, the hotel industry in Macau has maintained a relatively stable situation, as evidenced by a small increase in the number of hotel and room operations and an occupancy rate that basically remains at the only major decline was in hotel prices. By analyzing the reasons for the changes in the Macau hotel market in various aspects, a supply and demand equilibrium structure of the Macau hotel market is constructed based on the price equilibrium theory, which can provide a reference for the rapid recovery of the hotel economy in various regions in the post-epidemic era.

**Keywords:** Macau Hotel Industry, "Tourism+Conventions", The post-epidemic era, Hotel Market

## 1. Research Background

The novel coronavirus epidemic has had a serious impact on the global tourism and hotel and other service industries, especially the decrease in people's willingness to travel and the number of trips they take, which has directly led to a sharp decline in the demand for hotels. Macau, as an international tourist city, has a gaming industry that is widely sought after by travelers around the world. According to statistics, the number of tourists around the Chinese New Year in 2020 dropped by 90% compared to the previous year. the number of tourists and gaming revenue in Macau dropped by more than 60% during the peak of the epidemic from 2020-2021. According to the market equilibrium price theory, when the supply and demand of a commodity changes, the price of the commodity will be subject to fluctuations. The hospitality industry is one of the key commodities for tourism, and room revenue usually accounts for the majority of overall hotel revenue, so fluctuations in hotel prices reflect changes in hotel business conditions.

Many scholars have studied the impact of epidemic on hotel economy. Lai & Wong found that epidemic prevention and control measures must be the highest priority among hotel crisis management strategies, followed by pricing strategies [1]. Le & Phi refined the hotel crisis management model in three aspects, such as epidemic warning, multi-stage strategy, and hotel scale, and gave related countermeasures [2]. Borovcanin et al. studied the role of cultural and sports activities on the recovery of the hotel industry in the post-epidemic era and found that national sports events such as marathons can drive up the local hotel economy [3]. Koh et al. modeled and calculated the average daily rate volatility index and found that competitors, macroeconomic environment, and internal reasons can have a volatile impact on hotel prices [4]. Mohammed et al. found that hotel price volatility [5]. Chica-Olmo applied regression analysis to study the influence of historical monuments on hotel prices and found that the geographical distance and aggregation of attractions have a negative effect on hotel prices, and different grades of hotels have different degrees of influence on prices [6]. Hung et al. similarly regression analysis method studied the effect of factors such as the number of hotel rooms, infrastructure, number of service staff, and internationalization on different grades of hotels [7]. This paper analyzes the supply and demand market of Macau hotel industry and its price changes under the influence of the epidemic, which will help to gain insight into the business situation of the hotel industry in Macau and provide a reference guide for the recovery of the hotel industry around the world in the post-epidemic era.

2. Macau Hotel Industry Market Statistics

2.1. Introduction to the City of Macau

Macau, known as the Macau Special Administrative Region of the People's Republic of China, is located on the west side of the mouth of the Pearl River, at the intersection of land and water between mainland China and the South China Sea, 60 km from Hong Kong and 145 km from Guangzhou. Macau has a land area of 32.9 sq. km. The total resident population of Macau was 682,100 in the 2021 census. Macau is an international free port, a world center of tourism and leisure, one of the four major gambling cities in the world, and one of the most densely populated areas in the world. Its renowned gaming, tourism, hotel and casino industries have made Macau one of the most developed and affluent regions in the world. At the same time, the collision of eastern and western cultures over the centuries has made Macau a city with a unique style in China and shaped a large number of tourist and cultural attractions.

2.2. Analysis of the supply structure of the hotel industry market in Macau

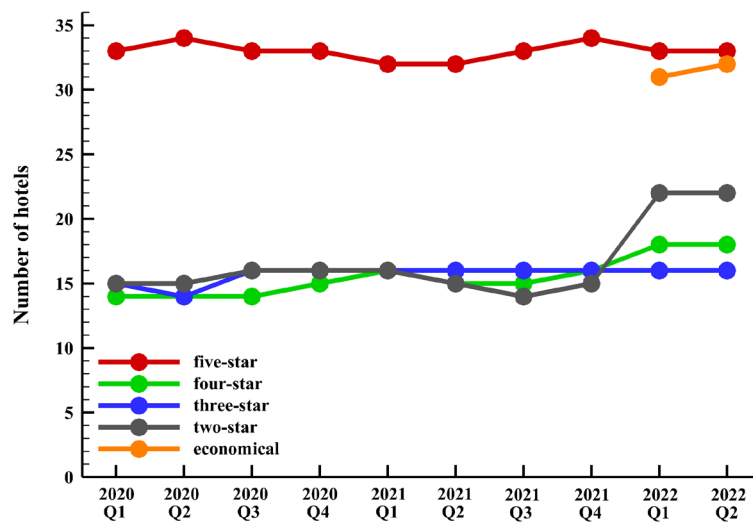


Figure 1: Macau Hotel Statistics 2020-2022

Table 1: Comparison of Macau Hotel Room Data

Period	Number of rooms (rooms)				
	5 stars	4 stars	3 stars	2stars	Economical
1st quarter of 2020	20,992	5,886	4,949	970	0
2st quarter of 2020	21,827	6,158	4,781	967	0
3st quarter of 2020	21,672	5,886	4,957	1,239	0
4st quarter of 2020	21,684	6,174	4,997	1,239	0
1st quarter of 2021	21,376	6,743	5,225	1,239	0
2st quarter of 2021	21,320	6,434	5,225	1,193	0
3st quarter of 2020	21,902	6,437	5225	1,095	0
4st quarter of 2021	24,521	6,735	5,225	1,200	0
1st quarter of 2022	23,974	7,243	5,226	1,561	729
2st quarter of 2022	22,032	7,550	5,226	1,561	784
Average number of rooms	22,130	6,525	5,104	1,226	757
Percentage of rooms (%)	61.92%	18.26%	14.28%	3.43%	2.12%

According to the data published by the Statistics and Census Bureau of Macau [8], as of the 2nd quarter of 2022, there are 121 hotels in Macau (accommodation-type apartments are not considered here), including 33 five-star hotels, 18 four-star hotels, 16 three-star hotels, 22 two-star hotels, and 32 budget hotels. As shown in figure 1, From 2020 to 2022, there is little change in the number of upscale and midscale hotels in Macau, and a sudden increase in the number of 2-star hotels and budget hotels (temporarily attributed to low-grade hotels) starting in the 4th quarter of 2021, with budget hotels entering the Macau market from 2022 with a similar number share as the always dominant upscale hotels. Table 1 compares the change in the number of rooms in each star hotel, and it can be seen that five-star hotels

have the largest number of rooms, accounting for 61.92% of the size of hotel receipts in Macau; the number of rooms gradually decreases as the star rating of hotels decreases; budget hotels, although there are 32 hotels, have the smallest share of capacity to accommodate guests (2.12%). This shows that in the past three years, despite the impact of domestic and international epidemics, the market supply structure of Macau's hotel industry has maintained a relatively stable state. Upscale hotels still dominate in size and have the largest capacity, with a growth rate of 5.4% in the number of rooms (within 3 years), while low- and mid-range hotels are small in size but also maintain a steady growth.

### 2.3. Analysis of the market structure of demand for the hotel industry in Macau

The market demand of Macau's hotel industry is closely related to the development of the tourism industry. Analyzed from the characteristics of the market demand of Macau tourism source, it can be roughly divided into the following five categories of tourists: Category 1 is the gaming and entertainment tourists with strong consumption ability, and these tourists mainly choose to stay in medium and high-grade hotels; Category 2 is the gaming tourists with average consumption ability, and the main purpose of these tourists to come to Macau is to participate in gambling. In terms of choosing a hotel, they will have a relatively large change according to the gambling situation, high school and low grade hotels are possible to stay; the third category is the strong spending power of leisure vacation guests. These guests are mostly business elites, and their main purpose of visiting Macau is for leisure and vacation, so they usually choose mid-range and high-grade hotels with beautiful scenery and good environment to stay; the fourth category is sightseeing and vacation guests with average spending power. Their main purpose of visiting Macau is sightseeing and leisure, and their vacation time is usually short, so most of them will choose low- to mid-range hotels to stay, mainly for sightseeing and entertainment. The purpose of these visitors is to attend business activities or meetings, and their spending power is based on the size of the company and the level of business activities, mostly in medium and high-end hotels, but also in order to save money and choose to stay in low-grade hotels.

Table 2 shows the changes in the number of inbound visitors to Macau from 2020 to 2022. It can be seen that the number of inbound visitors to Macau dropped sharply from the beginning of the global outbreak of the New Guinea virus in early 2020, with the rate of decline reaching -98.46% in the second quarter only. Since then, the number of arrivals has remained at 2,000,000, with the rate of change of arrivals fluctuating from -16.52% to 25.94%, and by the second quarter of 2022, the number of arrivals has decreased by more than a factor of one compared to the pre-epidemic period. This shows that the epidemic has greatly impacted the Macau inbound tourism market and weakened people's willingness to travel in the post-epidemic era. In addition, the number of mainland Chinese individual visitors decreased nearly three times compared to the pre-epidemic period, and since the second half of 2021, the number of visitors has remained in the range of 400,000 to 600,000, also without showing a rebounding upward trend. It is noteworthy that the number of inbound visitors to the Greater Bay Area also dropped sharply at the beginning of the epidemic, but the number of visitors soon began to rebound and rise, and remained in the range of 1.2 million in the 2021-2022 quarter. Compared to the pre-epidemic period, the number of arrivals to Macau from the Greater Bay Area dropped by only 34% and contributed 76% of the arrivals.

Table 2: Change in the number of visitors to Macau from 2020 to 2022

Period	Number of visitors and non-residents of Macau (person-times)					
	Entry Channels		Individual Tour Mainland China Arrivals		Greater Bay Area Arrivals	
	Number of people	Previous period rate of change	Number of people	Previous period rate of change	Number of people	Previous period rate of change
1st quarter of 2020	3,219,170	-65.02	1,126,096	-61.95	1,839,849	-62.50
2st quarter of 2020	49,730	-98.46	234	-99.98	25,435	-98.62
3st quarter of 2020	750,204	1,408.55	106,212	45,289.74	488,465	1,820.44
4st quarter of 2020	1,877,744	150.30	632,610	495.61	1,065,067	118.04
1st quarter of 2021	1,738,428	-7.42	606,013	-4.20	1,082,980	1.68
2st quarter of 2021	2,189,401	25.94	757,385	24.98	1,233,329	13.88
3st quarter of 2020	1,827,699	-16.52	546,301	-27.87	1,129,578	-8.41
4st quarter of 2021	1,950,415	6.71	539,429	-1.26	1,260,963	11.63
1st quarter of 2022	1,876,847	-3.77	455,393	-15.58	1,249,645	-0.90
2st quarter of 2022	1,588,260	-15.38	429,741	-5.63	1,207,275	-3.39

Figure 2 shows the occupancy of Macau hotels for the 10 quarters from 2020 to 2022, with upscale

5-star hotels still being the top choice for travelers, with the number of travelers decreasing as the star rating decreases. The number of occupants then began to rebound in the 3rd quarter, with upscale hotels in particular rebounding the fastest, surpassing their pre-outbreak numbers in the 2nd quarter of 2021. Overall, in the post-epidemic era from 2021 to 2022, the number of hotel occupants can basically return to the pre-epidemic state. Despite the decrease in the number of inbound tourists, the occupancy rate of hotels can basically be guaranteed, and even the occupancy rate of 3-, 4-, and 5-star hotels appears to be higher than the pre-epidemic rate from 2Q 2021 to 4Q 2021. In addition, the number of visitor arrivals in Q1 2020 before the new crown epidemic exceeded 3 million, but the number of hotel occupants was only around 1.5 million, i.e., occupancy rate did not exceed 50% (as shown in Figure 3 for Q1 2020), while in the 1-year period from Q3 2020 to Q3 2021, the occupancy rate increased, and despite the decrease in the number of visitor arrivals, the total occupancy The fact that the number of total occupants can be maintained at a level comparable to that before the epidemic indicates that the New Crown epidemic has not caused a significant impact on the occupancy rate of the Macau hotel industry.

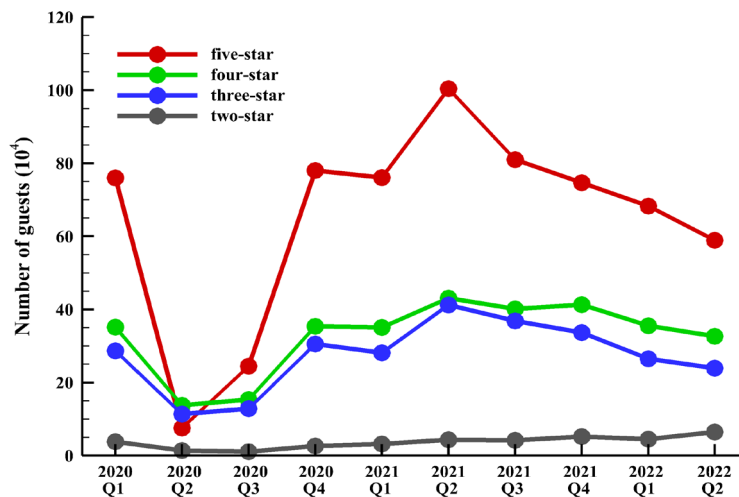


Figure 2: Statistics on the number of hotel guests in Macau

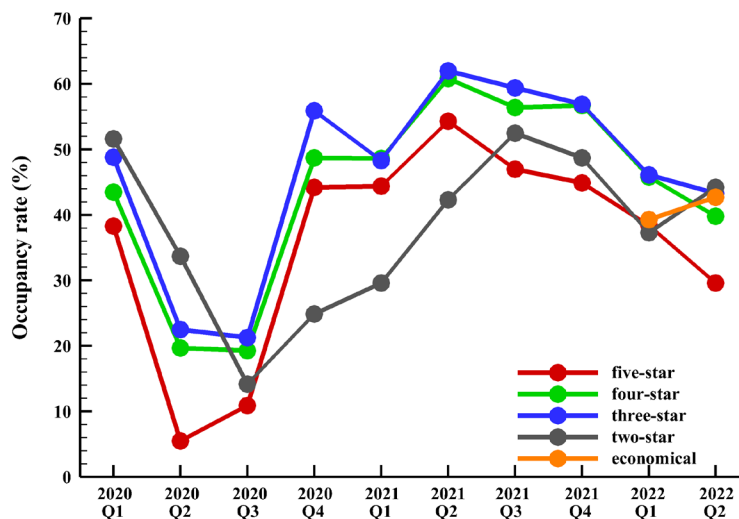


Figure 3: Macau Hotel Occupancy Rate

Figure 4 gives the statistical distribution of the average length of stay of hotel occupants in the Macau hotel industry. It can be seen that the average length of stay of occupants in all star-rated hotels was extended by the initial epidemic travel, with low-grade 2-star hotels extending their length of stay by more than a factor of 1 in Q2 2020 compared to the pre-epidemic period, which is the opposite of the change in hotel occupancy in Macau. Starting from the 3rd quarter of 2020, the average length of stay of hotel guests in Macau began to gradually return to its pre-epidemic status. In addition, the average length of stay for upscale hotel guests was 2 nights, which was generally higher than the average length of stay for other hotel classes.

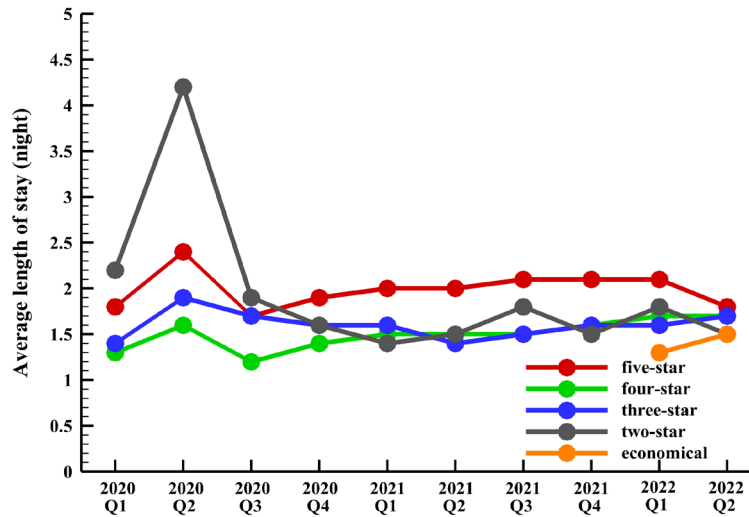


Figure 4: Average length of stay for residents

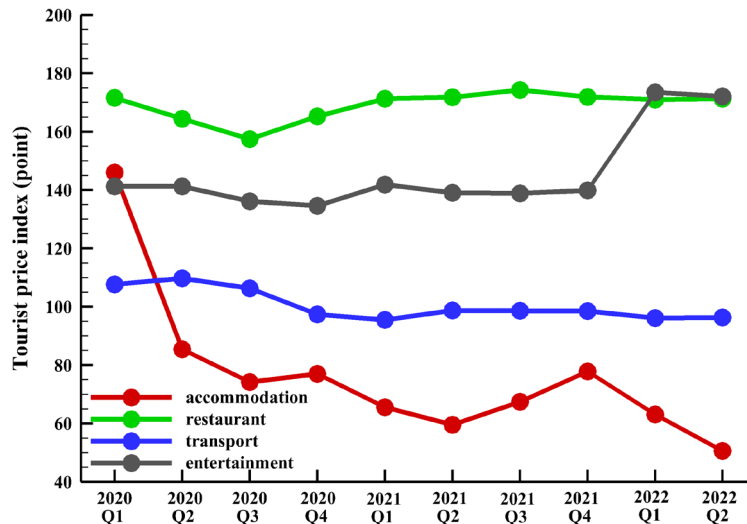


Figure 5: Tourism Price Index

The tourism price index can reflect the changes of tourism commodity prices. Figure 5 gives the changes of the price indices of the Macau tourism market before and after the epidemic. It can be seen that the tourism price indices of food and beverage, transportation and entertainment and culture were less affected by the epidemic and were basically able to remain stable. However, the price index of hotel accommodation category is on a downward trend, with the price index of hotel falling the most rapidly in the 2nd quarter of 2020, when the epidemic was at its peak, and the price index of hotel is still on a downward trend until the 2nd quarter of this year. This indicates that the prices of tourism goods in the hotel accommodation category fell faster due to the impact of the epidemic.

### 3. Supply and demand balance structure of the Macau hotel market

Through the above statistical data analysis of the supply and demand markets of the hotel industry in Macau, it can be seen that, due to the impact of the new epidemic, the tourism market in Macau has developed sluggishly, with the overall decline of inbound tourists by more than half, but the hotel industry has maintained a relatively stable state, with the number of hotels and rooms of all grades maintaining a small increase, and 5-star high-end hotels still occupying the dominant position in the hotel market in Macau, while at the same time, the occupancy rate of hotels of all grades At the same time, the occupancy rate of all hotel categories dropped significantly during the peak quarter of the epidemic, but then rebounded rapidly to return to the same state as before the epidemic. The reasons for the rapid rebound and stable occupancy of the Macau hotel market are closely related to a number of factors.

### **3.1. Analysis of the factors of the changing hotel market in Macau**

According to statistics from the Macau Statistics and Census Bureau, the average price of high-end five-star hotels in Macau in 2021-2022 is about 40% cheaper than the prices of five-star hotels in Beijing, Shanghai and Shenzhen. This has directly led to a two-fold increase in Macau tourist air ticket orders and a one-fold increase in Macau hotel bookings in the 1st quarter of 2022 compared to the same period of the previous year. Despite the fact that the global tourism and hotel markets remain sluggish due to the impact of the new crown epidemic and the restrictions on people's travel, there are several reasons why the Macau hotel industry has been able to rebound quickly and has been able to rise against the trend in the post-epidemic era.

(1) Epidemic prevention and control is reasonable and efficient. According to the development of the epidemic at home and abroad, the epidemic control in Macau is more stable, and the epidemic prevention and control travel policy is more flexible. 1 quarter of 2022 from the Mainland low-risk areas into Macao does not require isolation, and only need to show the 7-day nuclear acid, compared with travel to other cities in the Mainland does not need to pay more time costs. According to the statistics, the number of hotel guests in Macau increased by 71% in 2021, of which more than 50% were from the Mainland. 110,000 visitors arrived in Macau during the Chinese New Year period in 2022, up 25% compared to the same period of the previous year, and the per capita occupancy rate of hotels reached 63%, with the average occupancy rate of five-star hotels reaching 70%. In addition, during the "May Day" Golden Week in 2022, Macau received about 20,000 arrivals per day, with a total of about 100,000 visitors during the five-day period.

(2) Price concessions and government subsidies. In order to revive the tourism and hotel industry, the Macau government has launched a policy of "expanding visitor sources, boosting the economy, and preserving employment" since September 2020, for example, tourists can enjoy buy-one-get-one-free discounts on air tickets and 50% discount coupons on hotels. The Macau Government Tourist Office (MGTO) also cooperates with online travel platforms to offer a 50% discount on airline tickets and hotels by regularly placing a quantitative stack of red packets on online platforms. This is precisely the strategy adopted by the hotel industry to attract tourists to Macau by reducing prices in order to maintain a stable occupancy rate, as the number of visitors to Macau has dropped due to the downturn in the tourism market.

At the same time, the Macau government has adopted a strong subsidy policy for the hotel industry, which has caused the occupancy rates of Macau's hotels of all grades to fall directly to record lows, but because of the government's subsidy, the hotels themselves have not suffered too much, while also ensuring the quality of service. Inspired by the government's subsidy policy, the prices of Macau's high-end hotels can be described as "cabbage prices". In 2021-2022, the average price of Macau's high-end five-star hotels will be about 40% cheaper than the prices of five-star hotels in Beijing, Shanghai and Shenzhen, and the number of hotel reservations will increase by one times compared to 2020. In addition, tourism as a comprehensive consumption, subsidies on hotels will boost the consumption of other goods. As shown in Figure 6, the per capita spending structure of travelers in 2020-2022, the average per capita spending in 2021-2022 is MOP 2,260, which is more than 90% higher compared to the same period in 2020. In terms of travelers' consumption structure, shopping, accommodation and catering are the three main expenses, with shopping accounting for 70% of personal consumption and accommodation and catering together accounting for no more than 30%, and travelers' local spending on catering and shopping in Macau is more than five times that of hotel accommodation.

Diversification of tourism products. Tourism+" has become an important strategy for the development of cultural tourism in Macau, combining tourism with other forms of themes and introducing a series of new tourism activities such as "Tourism+Conventions", "Tourism+Technology", "Tourism+Health", "Tourism+Sports" and "Tourism+Culture and Creativity". A series of new tourism activities have been introduced, such as "Tourism + Exhibition", "Tourism + Technology", "Tourism + Health", "Tourism + Sports" and "Tourism + Culture and Creativity". The local government of Macau is very supportive of the joint efforts of Guangdong and Macau to build an international high-quality consumer exposition and shape a large-scale exhibition platform with international influence. Tourists can experience the exotic atmosphere of Macau by visiting famous monuments or folklore alleys while attending conventions and exhibitions. For example, the "Ctrip Global Partner Summit" was successfully held in Macau on December 9, 2021, with the active participation of Macau Government Tourist Office (MGTO), which arranged tours of Macau's scenic spots for delegates from all over the world. According to the "Overall Plan for the Construction of Hengqin Guangdong-Hong Kong-Macao Deep Cooperation Zone" issued by the State Council, the high-level construction of Hengqin International Leisure Tourism

Island will support the construction of Macau as a world tourism and leisure center, and the development of tourism industries such as leisure and vacation, conference and exhibition, sports event tourism, and health industries such as leisure and health care, rehabilitation and medical care in the cooperation zone, so as to promote the development of Macau to actively integrate into the Guangdong-Hong Kong-Macao Greater Bay Area. For example, the Macau Government Tourist Office (MGTO) presented 800 drone shows during the "May Day" Golden Week in 2022, presenting visitors with a rich and gorgeous sense of technological beauty, which was enthusiastically received by a large number of tourists and local citizens of Macau.

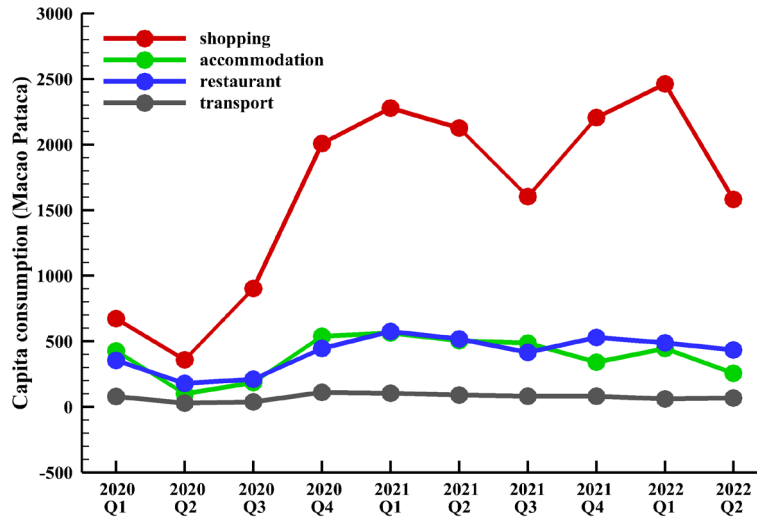


Figure 6: Amount of per capita spending of Macau visitors

### 3.2. Price Equilibrium Embodiment in Macau Hotel Market

When supply and demand are in equilibrium, the selling price of the good produced per unit of time is called the equilibrium price, which can be regarded as the intersection of the supply price and the demand price. The supply price determines the production cost of the good, while the demand price determines the marginal utility of the good to the buyer [9]. The equilibrium of the market is reached only when the supply price and the demand price are equal, and this equilibrium is a stable equilibrium. When supply and demand change, for example, the scale of production leaves the equilibrium position, other factors will act to bring it back to the equilibrium position, so as to ensure the equilibrium of supply and demand in the market.

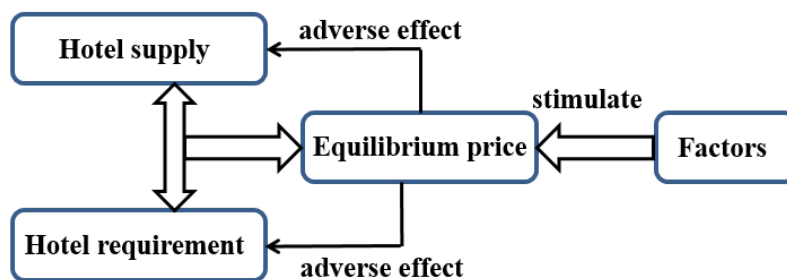


Figure 7: Hospitality industry supply and demand balance structure

As shown in Figure 7, there is an interaction between the supply and demand of hotel commodities and the price of stay in Macau. Hotel prices are influenced by their own supply-demand relationship, as well as by other tourism goods (e.g., airfare, food and beverage, etc.). When the market demand for hotels in Macau decreases due to the epidemic, hotel prices will also be affected by the positive effect of the supply side, causing them to fall below the equilibrium market value; conversely, when the market demand for hotels increases, for example, when hotels start to fill up again during the Golden Week on May 1, hotel prices will be higher than their original market value and their prices will increase [10]. Macau is mainly a secondary and tertiary industry, and its tourism and gaming industries play a pivotal role in its economy. During the peak of the epidemic in the 2nd quarter of 2020, both inbound tourism

and hotel occupancy in Macau reached extreme points, which led to the decay of the entire tourism economy and directly led to a decline in the hotel economy. It is in this context that the Macau government has taken reasonable and efficient measures to activate the tourism and hotel markets, to increase the willingness to travel through multiple price discounts and bundled spending, and to introduce a series of "tourism+" activities to attract more tourists to Macau, greatly enriching All of these measures are to stimulate the equilibrium price of hotels, which has the opposite effect on the supply and demand of hotels. The equilibrium price is a market value response to changes in supply and demand. In a market economy, price fluctuations also represent that market regulation mechanisms are operating.

#### 4. Conclusions

The hotel industry is one of the sectors most severely affected by the new crown epidemic, an external shock, and price fluctuations visually reflect changes in its business conditions. Based on the data published by the Macau Statistics and Census Bureau, this paper studied the development of the hotel and tourism market in Macau from 2020 to 2022, comparing and analyzing the supply, demand and price fluctuations of the hotel industry before and after the epidemic, and found the following conclusions.

(1) Due to the impact of the epidemic, the number of inbound tourism in Macau has severely decreased since the 2nd quarter of 2020, and the total number of inbound tourists in Macau is still less than half of the pre-epidemic level as of today.

(2) Upscale hotels dominate the Macau hotel market, with the number of hotels and room operations of all grades declining significantly at the beginning of the outbreak, but quickly rebounding and rising, with hotel occupancy rates basically maintaining at levels comparable to those before the epidemic.

(3) Macau's hotel price index experienced a significant decline, which was closely related to the equilibrium relationship between supply and demand in the hotel market and the policy's regulation and control policies. According to the equilibrium price theory, the implementation of efficient epidemic prevention and control strategies, price concessions and subsidies policies, and diversified tourism activities can create favorable incentives for the equilibrium price of hotels, which in turn counteracts the supply and demand market of hotels, thus forming the equilibrium structure of supply and demand in the hotel market.

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