



Study on the Structural Stability of Macau Tourism Consumption Based on Chow-Test Dummy Model

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Abstract. Macao, with its unique advantages, presents a diversified and heterogeneous tourism development model. It has become a new fashion and hot spot for Chinese mainland tourists to enter Macao. In this paper, we use the relevant data of the annual hotel and catering business and the total retail sales of consumer goods in the website of Macao Statistics and Census Bureau, and use the Chow-Test Dummy model to study whether the tourism consumption structure of Macao is stable after the introduction of the "eight Provisions" policy. The results show that the impact of the policy on Macao tourism consumption has a weak temporal heterogeneity, as follows: After the policy was introduced, the hotel revenue increased by an average of 417 million patacas per year, an increase of 4.4%, without significant structural changes; The average annual growth rate of catering industry turnover from 417 million Patacas before the policy to 571 million Patacas after the policy has not shown a significant structural change; The total retail sales of social consumer goods declined after the policy was introduced, with an average annual decline of 16.2%, but it did not pass the test, indicating that there was no significant change in the consumption structure.

Keywords: Chow-Test; Macau tourism; Consumption structure; stability

1 Introduction

In 2005, the Historic Center of Macau was inscribed on the UNESCO world heritage list. This international recognition has strengthened Macau's historical appeal as well as giving the city a facelift as a diversified tourism destination^[1]. In recent years, Macau tourism, together with the processing industry, finance and insurance industry and construction industry, has become its main economic pillar, and to a large extent depends on tourism, which has become an important industry in Macao's economic development. After the reunification of Macao, the number of mainland Chinese tourists to Macao has soared, from 21.1% of the total number of inbound tourists to Macao in 1999, to 24.8% in 2000, to 29.2% in 2001 and 36.8% in 2002, especially after the implementation of the policy of free travel between Hong Kong and Macao in some inland provinces and cities in 2003. The number of mainland tourists to Australia

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increased significantly, reaching 5.74 million, accounting for 48.3% of the total number of inbound tourists to Macao in that year, and mainland tourists to Macao accounted for half of the tourist sources; In 2019, the number of visitors to Macao reached 27.92 million, accounting for 70.9% of the total number of inbound tourists from Macao in the year, 1.5 times that of 2003. Tourism consumption in Macao only in 2019, China's mainland reached 1,587 Patacas per capita, of which the first quarter is the peak season of consumption (per capita consumption of 1849 Patacas), China's mainland tourism consumption in Macao accounted for 14.8% higher than the per capita tourism consumption in Macao. Compared to tourists from mainland China or Hong Kong, long-haul foreign tourists to Macau spent more on lodging and shopping(Kim, W. G. et al)^[2].

On December 4, 2012, the General Secretary proposed eight strict prohibitions at the meeting of the Political Bureau of the Central Committee (referred to as the "eight provisions"), aimed at strictly controlling the "three public consumption", that is, "going abroad (border) fees, vehicle purchase and operation fees, official reception fees". Data show that in the central level "three public" funding budget released by the Ministry of Finance in 2011, the cost of official reception was as high as 1.519 billion yuan^[3].The government's policies under the anti-corruption environment have an adjustment impact on the innovation investment of enterprises(Liang, Y. and Wang, Q.)^[4].

Since the introduction of the "Eight Provisions", some scholars have done research on its impact on China's economy. Wang Xia and Wang Jingda (2015)^[5] took 31 domestic listed wine companies as samples to test the performance changes of wine enterprises before and after the introduction of the "Eight Regulations". It is found that the "eight provisions" policy has a negative impact on the operating income and comprehensive performance of white wine enterprises, while the overall sales performance of other alcohol and comprehensive financial performance show an upward trend.In terms of specific alcohol, high-end alcohol sales declined, with the lowest price growth, while middle and low-end alcohol sales increased(Xianglong Xu et al.)^[6]. Zhou Kaiwen (2014)^[7] evaluated the negative impact of this policy on Moutai Company from an empirical perspective. Gao Yui&Xiao Liuyi (2016)^[8] studied the impact on consumption structure in Hubei province before and after the introduction of the "Eight Regulations" from a provincial perspective, and the research results showed that the policy impact was significant. The research of these scholars is similar in that they are all conducted on the mainland, and the research area is relatively narrow. So far, few scholars have paid attention to the impact of the "Eight Provisions" on the tourism consumption structure of Macao and have not made specific empirical analysis.

Based on this, this paper uses the annual data of hotel and catering turnover and total retail sales of consumer goods of Macao Bureau of Statistics and Census from 2000 to 2019, takes January 2013 as the observation window, and uses Chow-Test Dummy model for empirical analysis. The significance of changes in the growth rate of hotel and restaurant turnover and total retail sales of consumer goods before and after the observation window is tested, and the average annual growth rate and its ratio of the corresponding turnover before and after the observation window are given. Based on

this, the impact of the introduction of the "Eight Provisions" policy on the stability of Macau's tourism consumption structure is studied.

2 Introduction to Chow-Test and construction of Chow-Test Dummy model

Chow-Test, or Zou parameter stability test, is a method used to examine whether there are differences in the structure of regression models between different groups (periods or Spaces)^[9]. If there is no significant difference in the structural parameters of the constructed model, the model is considered to be structurally stable; otherwise, it is considered to be structurally unstable. The characteristic of this method is that the object data to be studied is divided into two parts, the former part and the latter part of the data, and the dividing point is the test point to test whether the structural change has occurred. The selection of this demarcation point can vary according to different research purposes. For example, in the study of social and economic issues, this demarcation point can be the change of policies, regional differences or industry differences, etc. This paper adopts the former one and takes the "eight-point regulations" (January 2013) issued by the central government for the purpose of anti-corruption as the test demarcation point.

Suppose that the general form of the model to be built is as shown in formula 1.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \mu \quad (1)$$

By dividing the boundary point, it can be divided into two different corresponding samples (1,2,... n1) and (1,2,... n2), and $n_1+n_2=N$, accordingly, the model can be expressed in matrix form as formula 2.

$$\begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix} = \begin{pmatrix} X_1 & 0 \\ 0 & X_2 \end{pmatrix} \begin{pmatrix} \beta \\ \alpha \end{pmatrix} + \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix} \quad (2)$$

Where, β and α are the parameter column vectors in the model corresponding to the two samples after segmentation respectively. $Y_i(i=1,2)$ is the column vector in which the sample of the explained variable of the corresponding model is taken as the element.

In the above formula 2, if $\beta=\alpha$, it means that the two samples have no significant difference in the structure of the regression model and are stable; if they are not equal, they have a significant difference. For the convenience of the study, Dummy variables are used to construct and estimate the following formula 3.

$$Y_i = \alpha_{01} + \beta_{11} X_i + (\alpha_{02} - \alpha_{01}) D_i + (\beta_{22} - \beta_{11}) D_i X_i + \mu_i \quad (3)$$

Among them, i belongs to sample s_1 plus s_2 . D_i is equal to 0 when i belongs to sample s_1 , and 1 when i belongs to sample s_2 .

In the above formula, the coefficients D_i , $D_i \times X_i$ represent different meanings, the former represents the intercept term of the model, and the latter represents the slope of the model. Whether the model structure has structural stability can be judged by D_i ,

$D_i \times X_i$ judging the significance of the coefficient (t test), that is, if the two coefficients are equal to 0, $\alpha_{01}=\alpha_{02}$, $\beta_{11}=\beta_{22}$, which can show that there is no significant difference between the two regression models, then the structure of the model is stable; Otherwise, the structure is considered unstable.

3 Empirical Analysis

3.1 Hotel Accommodation and Tourism Food Consumption

3.1.1 Analysis of Current Situation of Macau Tourism.

Before 2012, Macau hotel revenue and tourism and catering turnover increased year by year. After the introduction of the "eight Provisions" policy, its consumption decreased to different degrees in 2014 and 2015 compared with previous years. The turnover of tourism catering increased by 14.81% in 2012, increased by 5.4% in 2013, and decreased by 0.26 percentage points and 10.52 percentage points in 2014 and 2015, respectively. Hotel revenue increased by 16.79% in 2012 and decreased by 1.44 percentage points in 2013; After that, the decline in 2014 and 2015 was more obvious, falling by 6.62 and 23.34 percentage points respectively, and then stabilizing and recovering, as shown in Figure 1.

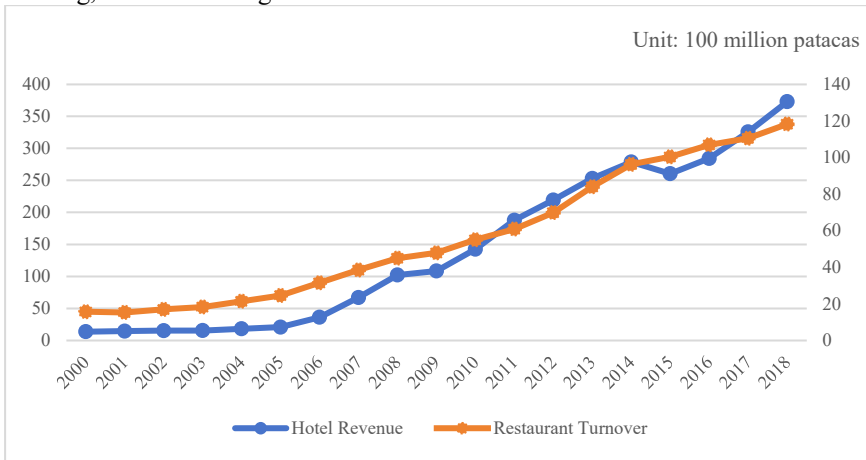


Fig. 1. Hotel revenue and restaurant turnover

As shown in the Figure 1, the two major consumption of Macau's hotel revenue and catering turnover are affected by the "eight provisions" policy, and the short-term effect is more obvious than the long-term effect, but the degree of short-term impact is not very significant. In order to provide more convincing evidence, Chow-Test and Dummy model are used for empirical analysis.

3.1.2 Data Source and Index Selection.

This paper selects the relevant data of Macao Statistics and Census Bureau website annual Statistical report. The hotel revenue and the restaurant business turnover were taken as the dependent variables in the regression model, and the time variable was introduced as the explanatory variable.

3.1.3 Construction of Chow-Test Dummy Model.

In this paper, the time point when the "Eight provisions" policy was introduced (January 2013) was adopted to truncate the hotel revenue and catering turnover into two different samples, the former sample is S_1 and the latter sample is S_2 . By observing the structural changes of the two samples, that is, to test whether the time of policy introduction is a significant turning point, Dummy variable is introduced to construct the Chow-Test model as formula 4.

$$Y_i = \beta_{01} + (\beta_{02} - \beta_{01})D_i + \beta_{11}t + (\beta_{22} - \beta_{11})D_it + e_i \quad (4)$$

Where, Y is the total revenue of the hotel, the turnover of the catering industry, and t is the time. D represents the dummy variable, equal to 0 in 2000-2012 and 1 in 2013-2018.

Combined with the relevant data of hotel revenue and catering turnover, regression was carried out using Eviews10.0 software, and the results were shown in Table 1 as follows.

Table 1. Chow-Test Dummy model regression results of hotel revenue and catering turnover

Variable	Hotel Revenue				Catering Turnover			
	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
C	-4532438.	1617583.	-2.801982	0.0134	257976.8	234563.3	1.099817	0.2888
T	1704375.	203796.3	8.363127	0.0000	469784.7	29552.20	15.89677	0.0000
Di	-1915772.	11021469	-0.173822	0.8643	-386588.7	1598207.	-0.241889	0.8121
Di×T	479311.0	688095.6	0.696576	0.4967	160634.7	99779.73	1.609894	0.1283
F value	116.09				488.40			
R ²	0.96				0.99			

As can be seen from the above results, the estimated coefficient D_i of hotel revenue and the T value of $D_i \times T$ are not significant, indicating that the change of consumption structure of hotel revenue before and after the introduction of the "eight Provisions" is not significant. In addition, the coefficient of determination R^2 is 0.96 and the F value is 116.09, so the overall fitting effect of the whole model is significant. During 2000-2012 and 2013-2018, hotel revenue increased by an average of \$177 million per month, and there was no significant impact on the consumption structure of hotel revenue in the two periods before and after the policy was introduced.

The estimated coefficient D_i of catering industry turnover and the T value of $D_i \times T$ of catering industry turnover are also not significant, indicating that the change of consumption structure of catering industry turnover is not significant after the intro-

duction of the "eight Provisions". In addition, the coefficient of determination R^2 is 0.99 and the F value is 488.40, so the overall fitting effect of the whole model is significant. This means that in the period 2000-2012 and 2013-2018, the average annual growth of the catering industry turnover before the introduction of the "Eight provisions" has not changed significantly, with an average monthly growth of 52 million patacas.

3.2 Total Retail Sales of Consumer Goods

3.2.1 Total Retail Sales of Consumer Goods.

Before 2013, the total retail sales of consumer goods in Macao showed an overall growth year by year except in 2009, which was affected by the world economic crisis, as show in the Figure 2. During 2000-2009, it showed a steady growth, with an average annual growth of 1.861 billion Patacas, with an average annual growth rate of 39.75%. Then, it showed rapid growth from 2010 to 2013, with an average annual growth rate of 1.072 billion Patacas, an average annual growth rate of 46.59%, 1.17 times that of the previous period; In the period from 2013 to 2016, the average annual decline was 184 million Patacas, an average annual decline of 2.67%; Since then, growth has stabilized. From the perspective of policy implementation, the impact of the "eight provisions" on the total retail sales of consumer goods in Macao is not obvious in the short term, compared with 2012 (an increase of 79.19%), resulting in an increase of 23.62% and 4.31% in 2013 and 2014, respectively. In the subsequent period, there was a slight impact, and the total sales fell by 4% in 2015 and 2016 for two consecutive years.



Fig. 2. Total retail sales of consumer goods

3.2.2 Data Source and Index Selection.

Select the data of total retail sales of consumer goods from 2000 to 2018 in the statistical report of Macao Statistics and Census Bureau website. The total retail sales of consumer goods is taken as the explained variable of the regression model, and time t

is taken as the explanatory variable. Again, the structural turning point is set for January 2013.

3.2.3 Construction of Chow-Test Dummy Model.

The time point when the "Eight Provisions" policy was introduced is still adopted to truncate the total retail sales of social consumer goods into two different samples, the former sample is S1, and the latter sample is S2. By observing the structural changes of the two samples, that is, to test whether the time of policy introduction is a significant turning point, Dummy variable is introduced to construct the Chow-Test model as the same formula 4.

But where, Y_i is the total retail sales of consumer goods under different sample conditions (s_1, s_2) and t is time.

Combined with the relevant data of the total retail sales of consumer goods, regression was carried out using Eviews10.0 software, and the results were shown in the Table 2.

Table 2. Regression results of Chow-Test Dummy model for total retail sales of consumer goods

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6065537.	4015364.	-1.510582	0.1517
T	3096039.	505888.3	6.120005	0.0000
Di	43667228	27358847	1.596092	0.1313
Di×T	-1205192.	1708076.	-0.705585	0.4913
R-squared	0.950526	F-statistic	96.06362	

As can be seen from the above results, the estimated coefficient Di and the T value of Di×T of the total retail sales of consumer goods are not significant, indicating that the change in the consumption structure of the total retail sales of consumer goods before and after the introduction of the "Eight Provisions" is not significant. In addition, the coefficient of determination R^2 is 0.95 and the F value is 96.06, so the overall fitting effect of the whole model is significant. From 2000 to 2012, compared with the period from 2013 to 2018, the annual growth rate in the early period was 3.741 billion Patacas, and the annual growth rate in the later period was 2.148 billion Patacas, and the annual growth rate in the early period was 25 times that of the annual growth rate in the later period. Even so, it did not significantly affect the structure of the total retail sales of social consumer goods.

4 Summary

According to the results of empirical analysis, before the introduction of the "eight-point Regulations", tourism accommodation consumption increased by 16.79% in 2012, and then increased by 15.35% in 2013, with a decrease of 8.61%. After the introduction of the "eight Provisions", the annual average growth of tourism and ca-

tering turnover from 2013 to 2018 was 9.33%, and from 2000 to 2012 was 12.93%, with a slight decrease of 3.61%. The total retail sales of consumer goods in the "eight provisions" before the introduction of the average annual growth of 3.741 billion Patacas, after an average annual growth of 2.148 billion Patacas, because in 2015, 2016 for two consecutive years the change rate of 4%, but even so, it did not significantly affect the structure of the total retail sales of consumer goods.

As a new measure to fight corruption and promote integrity under the new situation, the proposal of the "Eight Provisions" has no certain impact on the tourism consumption structure of Macao, which means that the tourism consumption of Macao is not driven by public funds, nor will it lead to the increase of demand and the rise of prices, thus squeezing people's normal consumption. Although some scholars have analyzed that the "Eight Regulations" has a short-term negative impact on some industries or enterprises in the mainland, and these industries or enterprises are often related to high-end consumption, but the long-term effect is not significant, which can be regarded as the "eight regulations" policy has only a long-term effect on the tourism consumption structure of Macao, but no short-term effect. Therefore, as a market for tourism development, Macao should further maintain the rationality of people's consumption structure, improve the quality of economic structure growth to a greater extent, and promote the healthy, stable and sustainable development of the economy.

Project

"Quantitative Research on the development of Green Finance and the Dynamic effect of Industrial Structure in China"; University-level project "Mechanism, Path and Performance Evaluation of Fujian Manufacturing Industry to achieve Dual Carbon Goal" (No.: KYZX2023026)

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