

Research Article

A Study on Consumer Intentional Behavior of the Promotion of Green Food Mark and Green Food Hotel in Taiwan Using Quantiles Regression Analysis

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Abstract: This study applied Principle Component Analysis to explore the principal components of the questionnaire items and designates the principle components according to the meanings of the question items. Next, this study combined the principle components and basic data to conduct Quantiles Regression Analysis, in order to understand how the basic question items affect the principle components in the case of different quantiles. Finally, this study applied Grey Relational Analysis in discussing the most satisfactory principle components of consumer intentions of green food consumption, such as green food mark and green food hotels. The results showed that, people with environmental protection knowledge are more acceptable to green food mark; while the green food hotel is less profitable; therefore, relevant governmental agencies may improve the intentions of relevant industries through subsidies or incentives.

Keywords: Green food hotel, green food mark, grey relational, principle component, quantiles regression

INTRODUCTION

Taiwan's Executive Yuan passed the "Sustainable Energy Policy Agenda" on World Environment Day in 2009 and unveiled Taiwan's carbon reduction goals. Additionally, the "National Energy-saving and Carbon Reduction Project" was laid out in 2010, which set the green food gas emission reduction goal of 2020 of returning to the level of 2005 emissions and promoting the "Carbon Reduction Year". In the following five years, Taiwan is to promote 6 low-carbon cities and by 2020, establish four low-carbon living areas in northern, southern, central and eastern Taiwan. The regional projects will be reviewed to promote "local production and local consumption" and a low-carbon production-sales system in order to develop recycling-based urban and rural areas.

The hotel industry's green food mark system has not been established in Taiwan. In 2004, the Penghu County Government and Penghu National Scenic Area Administration Office developed and proposed the green food hotel evaluation criteria to evaluate all the local hotels and bed-and-breakfasts. This is the first evaluation of green food hotels in Taiwan and it is expected to provide information for industries implementing green food environmental protection and businesses intending to run green food hotels in Taiwan. However, there are many articles regarding green food hotels (Ma *et al.*, 2008; Li and Wang, 2006; Kung and Tseng, 2004). This study intends to learn about Taiwanese consumer intentions regarding green

food mark and green food hotels in order to point out directions for the efforts of relevant governmental agencies and provide a reference for the green food hotel industry.

RESEARCH METHODOLOGY

Quantiles regression: Quantiles Regression was first proposed by Koenker and Bassett (1978). Its greatest difference from the minimum square method is that the coefficient of quantiles regression is to measure the "marginal effects" of the explanatory variables, meaning the different coefficient results of different quantiles. However, the minimum square method's regression coefficient is different in explanatory implications. OLS estimators refer to the "average" marginal effects of the explanatory variables against the explained variables, while quantiles regression refers to the marginal effect of the explanatory variables against the explained variables at certain "specific quantile". Its diagram is as shown in Fig. 1. Many empirical studies consider the average performance of a variable, as well as the situation at both ends of the distribution chain. The minimum square method can only provide an average figure, while Quantiles Regression is able to offer a wider range of quantile estimation results; therefore, the distribution of the explained variable can be more clearly explained. Moreover, it can handle the problem of heterogeneity of information. Currently, Quantiles Regression Analysis has been widely used in various fields (Li *et al.*, 2012; Saha and Su, 2012; Okada and Samreth, 2012).

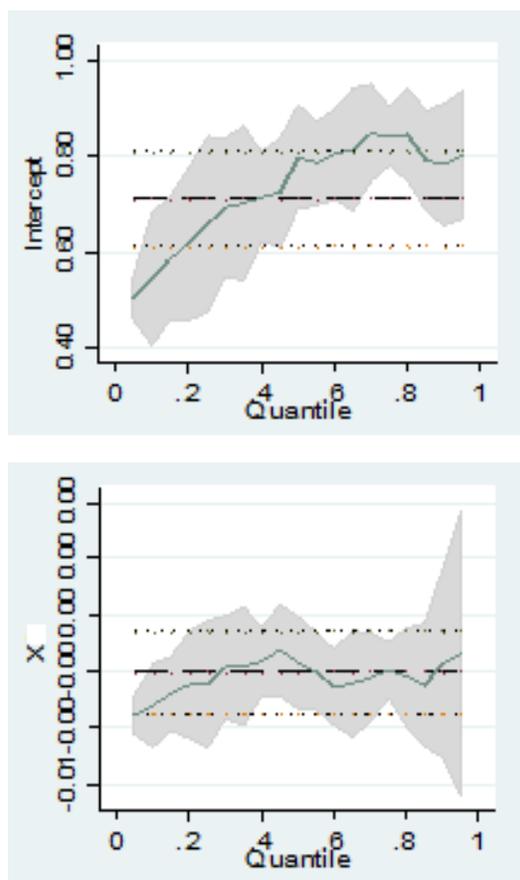


Fig. 1: Quantiles regression schematic diagram

Grey relational analysis: Deng (1989), a Mainland scholar from Huazhong University of Science and Technology, proposed the grey theory, which is successfully applied in many fields and is particularly suitable for predictive analysis. Its characteristics allow it to fully analyze the information of limited data to obtain predictive values. The grey theory is mainly for system correlational analysis and modeling in the case of system model uncertainties and information incompleteness, as it is able to explore and understand a system through forecasting and decision-making methods. At present, Grey Relational Analysis has been widely used in various fields (Pan, 2014; Hsia and Wu, 1998; Lin *et al.*, 2005).

RESULT ANALYSIS

Sample data and variables: This study distributed 120 questionnaires. The questionnaire content is based on

Wei (2012), but with some additional items. The question items are divided into 3 dimensions, including tourism green food mark-related items, green food consumption-related items and green food hotel intention-related items. In addition to the basic data, there are 50 items. In this section, Principle Component Analysis is applied to reduce the number of variables with high correlation. The reduction condition is that the Eigen Value is greater than 1. Figure 2 illustrates the diagram of implementing Principle Component Analysis. It can be learnt from the figure that there are 7 principle components with Eigen Values greater than 1. The 7 principle components are summarized and their descriptive statistical values are as shown in Table 1.

According to the meaning of the question item of Principle Component 1 (PC1), it can be named as “green food hotel profitability”. According to the meaning of the question item of Principle Component 2 (PC2), it can be named as “consumer recognition of green food hotels”. According to the meaning of the question item of Principle Component 3 (PC3), it can be named as the “green food mark recognition degree”. According to the meaning of the question item of Principle Component 4 (PC4), it can be named as the “green food mark cost”. According to the meaning of the question item of Principle Component 5 (PC5), it can be named as “environmental awareness recognition degree”. According to the meaning of the question item of Principle Component 6 (PC6), it can be named as “green food hotel service quality”. According to the meaning of the question item of Principle Component 7 (PC7), it can be named as “green food hotel competitiveness”.

Quantiles regression analysis: The 7 principle components of the above section are regarded as the dependent variables and basic question items, including average monthly income and an understanding of environmental protection knowledge, are the independent variables to conduct Quantiles Regression Analysis in order to explore how average monthly income and an understanding of environmental protection knowledge affect the 7 principle components in the case of different quantiles. The analysis results are as shown in Fig. 3 and Table 2.

In Fig. 3, this study only analyzes diagrams of significant differences. It can be learnt from Table 2 that, an understanding of environmental protection knowledge (D09) has significant differences in high and low quantiles against Principle Component 1 (PC1), meaning green food hotel profitability. In Fig. 3, the long dotted lines in the center of the diagram

Table 1: Descriptive statistics of 7 principle components

Variable	X1	X2	X3	X4	X5	X6	X7
Maximum	0.725	0.801	0.840	0.916	0.700	0.832	1.000
Minimum	0.288	0.151	0.054	0.233	0.150	0.000	0.126
Average	0.500	0.500	0.500	0.500	0.500	0.500	0.500
S.D.	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Number	120	120	120	120	120	120	120

Table 2: Use of regression models to investigate how independent variables affect the statistical values of the final term assessment results

Model PC No.	Var	Q0.25			Q0.5			Q0.75		
		Coeff	t	Sign	Coeff	t	Sign	Coeff	t	Sign
PC1	D07	6.45e-10	0.00		-8.04e-11	-0.00		0.00122	0.10	
	D09	-0.04464	-2.51	**	-0.02751	-2.24	**	-0.04323	-2.17	**
PC2	D07	0.00900	0.33		0.00291	0.22		0.00023	0.14	
	D09	-0.00855	-0.36		-0.00624	-0.45		0.00091	0.25	
PC3	D07	0.00365	0.78		2.41e-19	0.00		-0.00337	-0.28	
	D09	0.00545	0.66		0.00710	0.51		0.02195	1.88	*
PC4	D07	0.00693	0.47		-0.00154	-0.31		-0.01036	-1.02	
	D09	-0.01159	-0.65		-0.00404	-0.68		-0.01102	-1.05	
PC5	D07	0.00692	0.52		-7.98e-10	-0.00		0.00870	0.90	
	D09	-0.01266	-0.96		-0.01743	-0.08		-0.01360	-1.20	
PC6	D07	-0.00603	-0.47		-7.25e-10	-0.00		-0.04317	-2.35	**
	D09	-0.01755	-1.46		0.00101	0.16		-0.04356	-2.52	**
PC7	D07	0.01503	1.26		0.00011	0.02		-0.00280	-0.41	
	D09	0.01931	0.95		-0.00053	-0.08		0.00364	0.47	

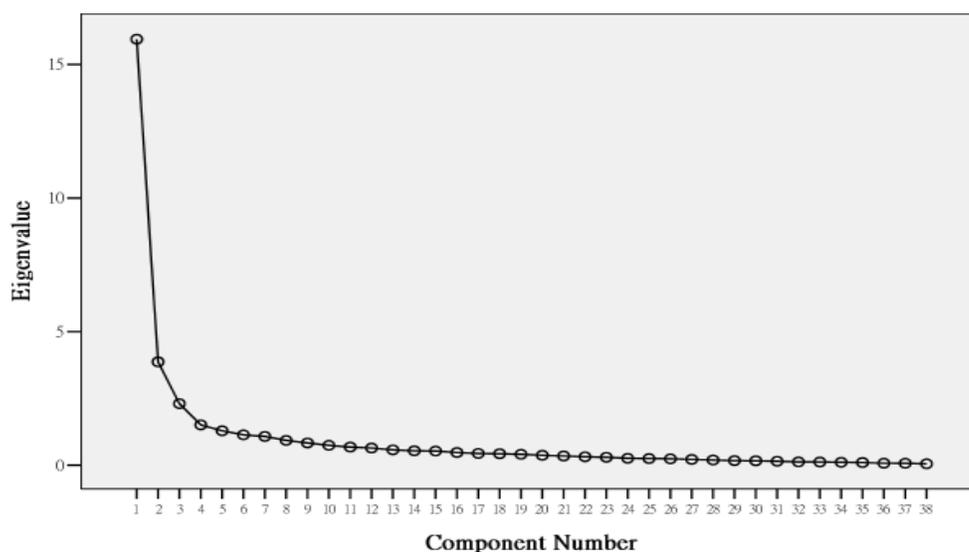
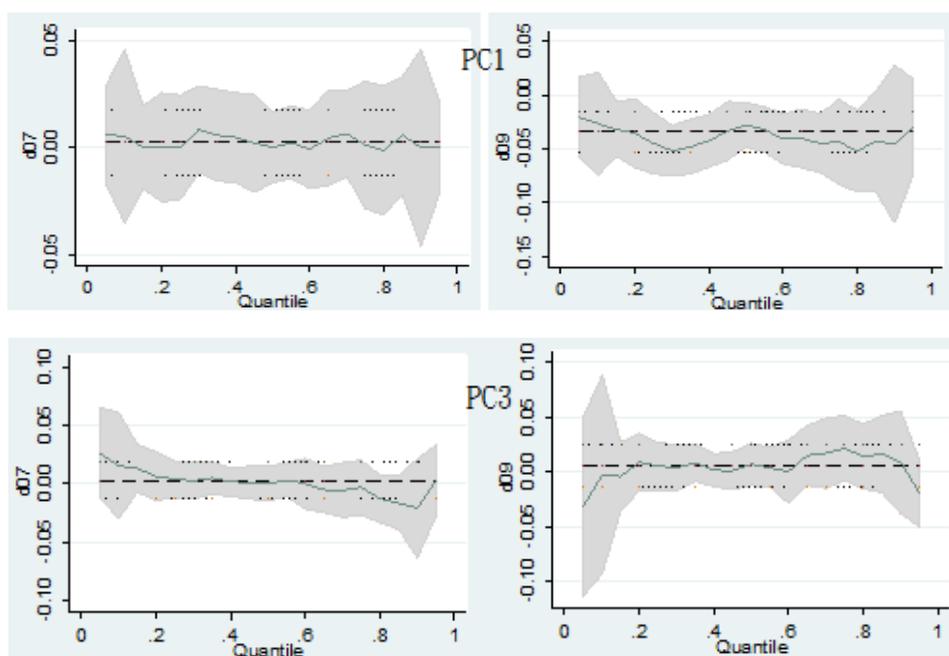


Fig. 2: Diagram of the results of principle component analysis



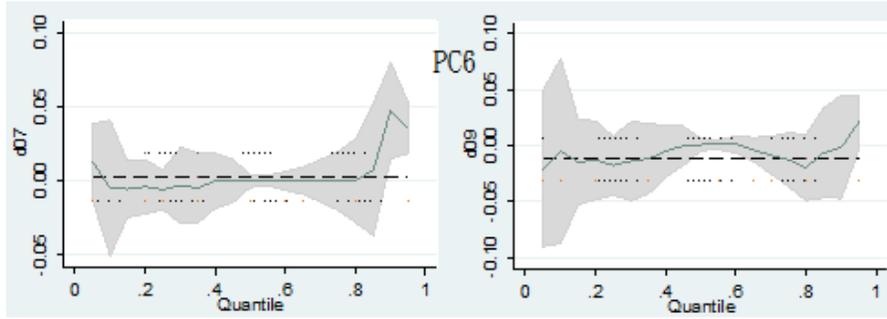


Fig. 3: Diagram results of quantiles regression analysis

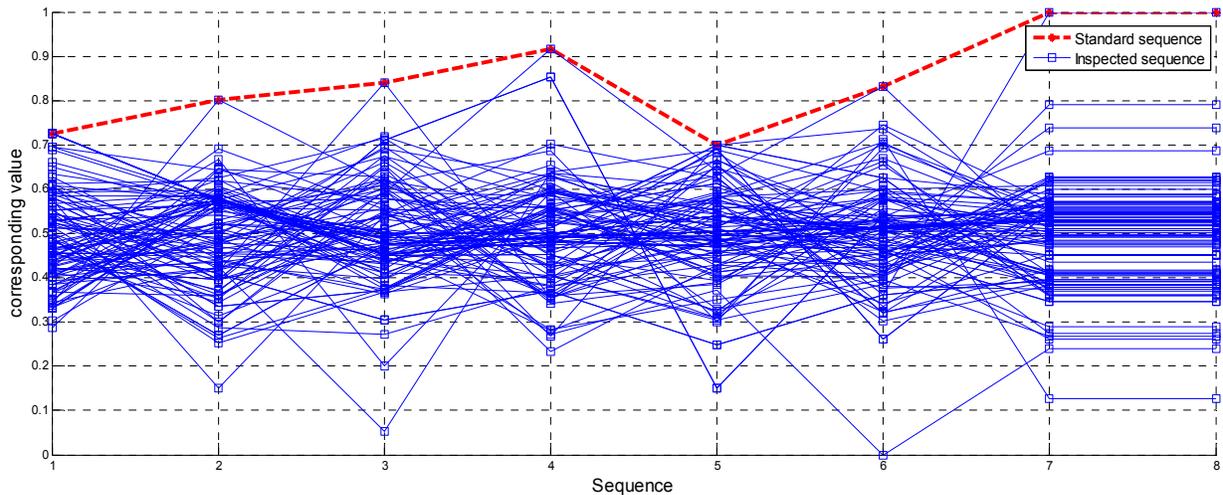


Fig. 4: Recognition degree performance analysis results of respondents

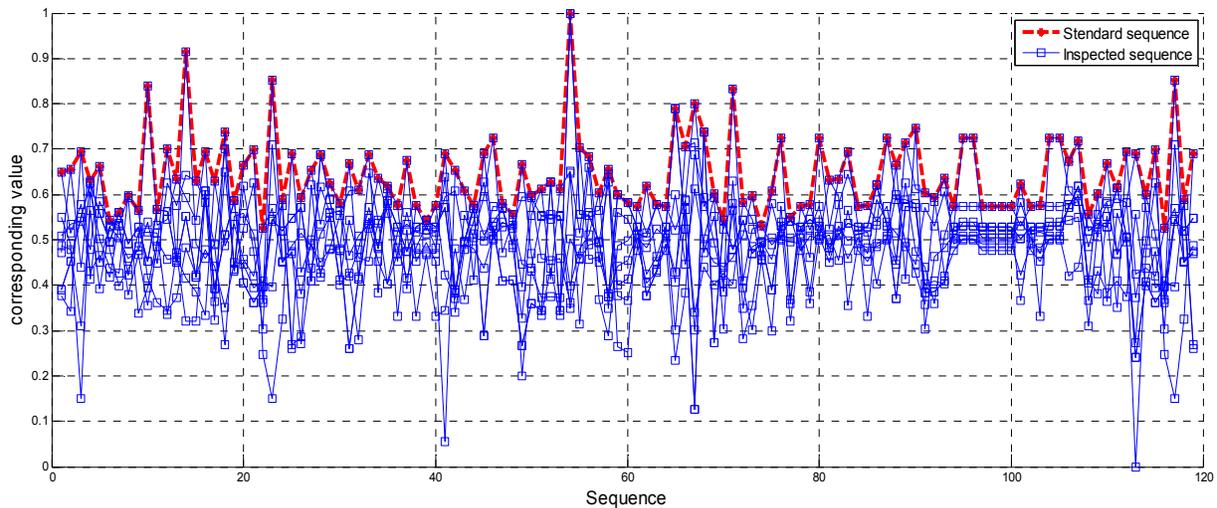


Fig. 5: Recognition degree performance analysis results of various question items

represents the minimum square regression model; the area circled by the upper and lower short dotted lines is the confidence area; the irregular curves are the quantile regression lines; the grey area is the confidence area of quantile regression. As shown in the right diagram of

PC1 that, the minimum square regression model has overestimation, as compared to the Quantiles Regression Model, regardless of low or high quantiles. As people generally have a certain understanding of environmental protection knowledge, the green food

hotel cost is bound to be higher and less profitable than general hotels. Hence, it is suggested that the government provide incentives or subsidy measures to improve the intentions of relevant businesses. According to Table 2, an understanding of environmental protection knowledge (D09) has significant differences against Principle Component 3 (PC3), meaning the green food mark recognition degree, in the case of high quantiles. As shown in the right figure of PC3 in Fig. 3, the minimum square regression model has underestimation in the case of high quantiles, as compared to the Quantiles Regression Model. If the public have a certain degree of environmental protection knowledge, they can better recognize green food mark. Therefore, when promoting green food mark, it should strengthen the importance of promoting environmental protection, thus, the effect will be better if the public generally recognizes environmental protection. According to Table 2, average monthly income (D07) and understanding of environmental protection knowledge (D09) have significant differences against Principle Component 6 (PC6), meaning green food hotel service quality, in the case of high quantiles. In Fig. 3, the left and right figures of PC6 show that the minimum square regression model has underestimation, as compared to the Quantiles Regression Model with high quintiles. This illustrates that people with higher average monthly incomes are confident in green food hotel service quality and they are more concerned about environmental protection-related issues, meaning they are willing to spend more money in green food hotels. As they are more confident in green food hotel service quality, they will not be disappointed with lower service quality due to environmental friendly equipment and utensils.

Grey relational analysis: Grey Relational Analysis is employed to conduct principle component recognition degree performance analysis of the principle components and respondents. First, principle component recognition degree performance analysis is conducted on the respondents. The results are as shown in Fig. 4.

The bold red dotted lines in the figure refer to the standard sequence, while the thin solid lines refer to the comparison sequence. When the comparison sequences of thin solid lines are closer to the standard sequences of solid lines, the performance values will be higher. According to the analysis results, the top three respondents, in terms of questionnaire principle component recognition, are No. 14, 54 and 107 respondents, respectively. The last three respondents, in terms of questionnaire principle component recognition, are No. 22, 113 and 116 respondents, respectively.

Afterwards, this study conducted recognition degree performance analysis of the various principle components. The analysis results are as shown in Fig. 5.

According to the analysis results, the principle component of the highest recognition degree is Principle Component 2 (PC2), meaning the green food hotel recognition degree. This suggests that the general public is increasingly concerned about environmental protection issues due to the gradual rise of environmental protection awareness, which is reflected in the degree of green food hotel recognition. The final Principle Component 3 (PC3) is the green food mark recognition degree, which suggests that the government should spend more efforts in the promotion of green food mark. The analysis results have reference value for relevant government agencies.

CONCLUSION

The main contribution of this study is using Quantiles Regression Analysis and grey correlational analysis to explore the impact of average monthly income and understanding of environmental protection knowledge on principle components in a method different from other literature regarding the conventional studies of relevant green food hotel issues. The Grey Relational Analysis found that the public has considerable preference for green food hotels; however, there is great space for governmental efforts in promoting green food mark. The analysis results are expected to provide a reference to relevant governmental agencies and better business environments for the promotion of green food hotels in Taiwan.

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