Analysis of the Factors Influencing the Sales of "Double Eleven" Shopping Festival in China Based on Experimental and Mathematical Statistics Analysis

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Abstract—This study focuses on the Factors Influencing the Sales of "Double Eleven" shopping festival in China based on Alibaba's Case. In this paper, the relationship between "Double Eleven" sales and the capita disposable income, the internet penetration, the number of employees in the highway transport industry is analyzed by the constructing multiple regression models. In order to eliminate the influence of multicollinearity, the ridge regression method is used to simulate and fit. According to the ridge traces of the variables, when K = 0.150, the variable coefficient tends to be stable. The regression result shows that these three variables have a significant impact on the sales of "Double Eleven" shopping festival. Ridge regression analysis shows that the per capita disposable income, the increase of internet penetration rate and the employment of road transport industry promoted the sales of "Double Eleven" shopping festival. The result shows that the per capita disposable income has the greatest influence on the sales of "Double Eleven" shopping festival, and is the main driving factor for the sales growth of the "Double Eleven" shopping festival. Therefore, comprehensive analysis shows that the growth of per capita disposable income promotes the overall consumption, and naturally plays a positive role in the sales of "Double Eleven" shopping festival. The promotion of the internet penetration rate has increased the sales volume of "Double Eleven" shopping festival by increasing consumers. The increase of employment in road transport industry indicates the prosperity of express delivery business, which is also a favorable embodiment of the sales volume of "Double Eleven" shopping festival.

Keywords: E-commerce; "Double Eleven" shopping festival; Alibaba; Per capita disposable income

1. Introduction

Many people like to go shopping and buy goods they like. However, with the tempo of e-commerce technologies approached such as the Internet and the improvement of the intelligent degree of mobile devices such as smartphones, the online retail industry is booming, which quickly eats into the huge market of traditional retail industry. Alibaba, for example, was one of the first to create an e-commerce platform and is a leader in this field as well. Its online shopping software such as T-mall and Taobao has completely won the favor of Chinese

consumers. Not only are there many kinds of goods, but convenience and cheapness also make online sales more advantageous than traditional offline retailing. In order to further expand the online market, Alibaba launched the concept of "Double Eleven" shopping festival in 2009. So far, sales volume of the "Double Eleven" Shopping Festival alone increased from less than 50 million yuan in 2009 to 268.4 billion yuan in 2019. It has become an amazing global shopping carnival, with over 250,000 brands from more than 220 countries. Every year, all major platforms publish various data about the "Double Eleven" shopping festival. It is not easy to find that the sales volume of the "Double Eleven" Shopping Festival is closely related to many indicators of our life. It is of great significance to research it.

2. Literature Review

"Can College Students' Control Their Spending Spree? Evidence from Chinese College Students During 'Double Eleven' article" investigated the characteristics of Taobao merchants and found that these characteristics make Chinese students more impulsive shopping behavior during the "Double Eleven" shopping festival. It uses structured questionnaires with closed-ended questions to collect the data from the college students, and it turns out that it is proved that professional advertising strategy can encourage students' consumption to a large extent.[1]

"Analysis of Taobao Single's Day Shopping Festival from the Perspective of Managerial Economics" analyzes the phenomenon of Taobao Singles' Day from the angle of management economics. It proves that externalities have a great positive impact on the Singles' Day shopping carnival. This paper also further expounds the importance of Management Economics to modern enterprise managers.[2]

"The Plight of Humanity: Online Impulse Shopping in China" collects data from online shoppers in Beijing, Tianjin, Nanjing and Shanghai and interviews 60 college students. Combined with structural equation model analysis, it is found that both motivational factors and emotional factors have a forceful positive influence on online impulse purchase. Finally, it is concluded that the online impulse buying behavior of the "Double Eleven" shopping carnival has a motivation and emotional predictors.[3]

"Exploring Determinants of Consumers' Platform Usage in 'Double Eleven' Shopping Carnival in China" takes China's "Double Eleven" Global Online Shopping Carnival as the research object to investigate the determinants of consumers' behavior in using the shopping platform. The authors define the GOSC as a unique scenario in which a consumer's emotional state regarding such events plays a greater role in determining behavior than in a normal online shopping environment. And based on the cognitive emotion theory (CET) research results, cognitive and emotional state will have a positive impact on consumers during consumption.[4]

"E - urbanism: E-commerce, Migration, and the Transformation of Taobao Villages in Urban China" conducts an in-depth study on the effect of e-commerce and population migration on urbanism. Using the conceptual framework of e-urbanism, this paper analyzes the impact of e-commerce and migration on the social spatial transformation of Taobao village in Guangzhou province. The ICT infrastructure and production network is the basis of e-commerce development theory.[5]

"Legitimacy building and e-commerce platform development in China: The Experience of Alibaba" discusses the acceptance of technology and from the perspective of legality construction. This paper uses the case of Alibaba to analyze and conclude that e-commerce enterprises should attach more importance to the theory of establishing legitimacy among stakeholders.[6]

"Do farmers gain internet dividends from E-commerce adoption? Evidence from China" uses spot check data from 1,030 households in China, the effect of e-commerce adoption on household income was examined. It is concluded that the revenue of e-commerce adopters is clearly better than that of non-adopters.[7]

"Informality and rural industry: Rethinking the impacts of E-Commerce on rural development in China" does not believe that the rise of e-commerce will revitalize the countryside and reduce the disparity between urban and rural areas. This article studies the case of Zeguo town in Zhejiang province. Through the data analysis and the semi-structured interviews with local government officials and businessmen, the author found that Taobao's reduction of restrictions on capital entry made the local shoe industry in Zeguo town make rapid progress. The non-standard operation of a large number of self-employed people has greatly increased the cost of production factors like industrial land and labor, which has a huge negative impact on local enterprises.[8]

"The adoption and impact of E-commerce in rural China: Application of an endogenous switching regression model" analyzes 2019 data on farmers in Shandong, Henan and Shaanxi provinces, and addresses the self-selection bias using the endogenous switching regression (ESR) model to explore several major factors affecting farmers' profitability through e-commerce. The PSM method is also used to test the robustness, and the results are consistent with the ESR model.[9]

"Foreign Direct Investment, Exports and Long-term Economic Growth in Alabama: A co-integration Analysis" links exports and the foreign direct investment (FDI) to economic growth in Alabama and provides a state-specific co-integration study. It proves that exports are a huge contributor to Alabama's economic growth. This article uses the case of Mercedes-Benz's investment in Alabama to prove that if Alabama is to continue to succeed economically, it needs to attract foreign investment to improve its supplier network, improve investment in infrastructure and improve the business environment.[10]

3. Methods

3.1 Model Specification

The main content of this paper is the relationship between the sales volume of "Double Eleven" shopping festival and per capita disposable income, the internet penetration rate, and the number of employees in road transportation industry.

First of all, we established a multiple regression model (1):

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \mu \qquad (1)$$

As shown in Figure 1, Y stands for the sales volume of "Double Eleven" shopping festival, X1 stands for the per capita disposable income, X2 stands for the internet penetration rate, and X3 stands for the number of employees in the road transport industry.

Table 1. Definitions of variables.

Varname	Variable	Meaning
Y	Sales (One hundred million yuan)	The sum of the prices of all goods sold during the Tmall "Double Eleven" shopping festival
X_1	The capita disposable income	The amount of money the average person has at his or her disposal
X_2	The internet penetration	The percentage of the population using the Internet
X_3	The number of employees in the highway transport industry	The total number of people employed in road transportation jobs

3.2 The Explanation of Variables

Sales: the total sales volume of a company is the money earned after selling its products to consumers over a certain period of time. Generally, it is not only the unit prices of the products, but also the cost of the follow-up services and supporting facilities it obtains.

The capita disposable income: the per capita disposable income of residents is an important index reflecting the living standard of residents. It includes total per capita disposable income after deducting the paid personal income tax, the social security fee paid by the individual and the bookkeeping subsidy of the investigating households.

The internet penetration: the internet penetration rate refers to the proportion of people who use the Internet. It can directly show the development degree of a country's Internet. It includes various Internet tools such as mobile phones, computers and tablet computers. According to China's current situation, the number of Internet users using mobile phones is far greater than that using other devices. The improvement of Internet penetration has played an important role in paving the way for the development of e-commerce platforms.

The number of employees in the highway transport industry: the number of employed people in the road transport industry includes various groups, such as drivers of operating vehicles, road safety personnel and toll station staff. Because of China's large population, the road transportation volume is second to none. Its domestic market is much larger than that of other modes of transportation.

4. Data

4.1 Data Sources

First, I downloaded the relevant data from 2009 to 2019 from the National Bureau of Statistics, and sorted it out with the Excel. First of all, in order not to affect the accuracy of subsequent experiments, I classified and refined the data. Then, by interpreting the meaning of the data, I chose linear regression based on per capita disposable income, Internet penetration rate and the number of employees in road transport industry. In Table 1, I explained the meaning of each variable and what they represent in detail.

4.2 Data Description

Figure 1 shows the change of sales changes during the Tmall "Double Eleven" shopping festival from 2009 to 2019. In the first year, the sales volume of the film festival was only 50 million yuan, but in 2019, only ten years later, it reached an astonishing 268.4 billion yuan, while the sales volume of Black Friday in the United States in 2019 was only 52 billion yuan. In addition to the rapid development trend of e-commerce, it is more a reflection of China's current economic transformation, that is, the transformation from investment and export-driven economic growth to consumption-driven economic growth.
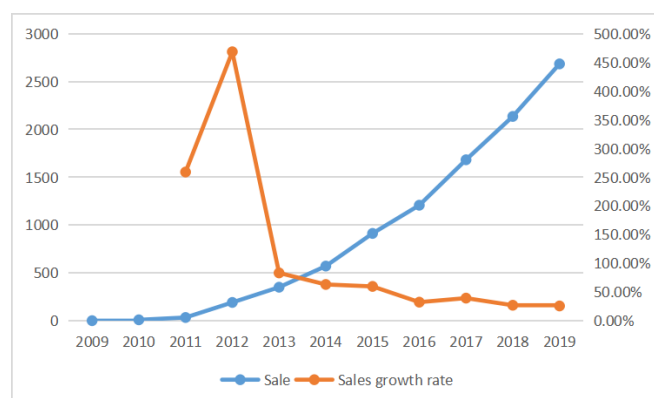

Figure1 The Sales of the Tmall "Double Eleven" Shopping Festival

Figure 2 shows that from 2009 to 2019, the disposable income of Chinese families has increased from more than 10,000 yuan to more than 30,000 yuan, showing a relatively stable growth trend. After a careful study of China's economic development, it is not difficult to find that in the 21st century, China's economic development has reached an unprecedented height, and the working people at the grass-roots level have gradually accumulated some savings through their hard work, which laid the foundation for the success of the shopping carnival on "Double Eleven" shopping festival.
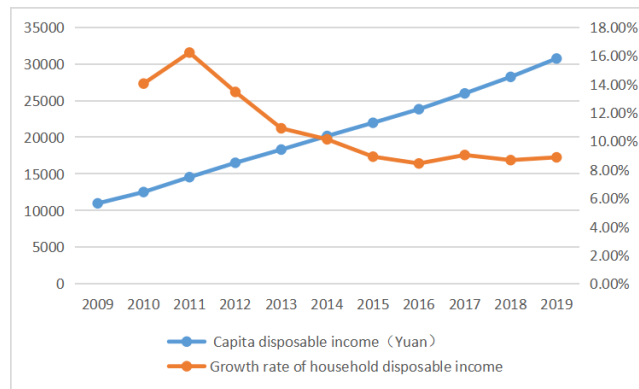
Figure 2 The Capita disposable income

Figure 3 shows that from 2009 to 2019, China's Internet penetration rate has grown steadily and rapidly. Since 2009, China's communication technology, especially mobile communication technology, has entered a rapid development stage. The rise of many mobile phone manufacturers has made it cheaper and easier to use the internet.
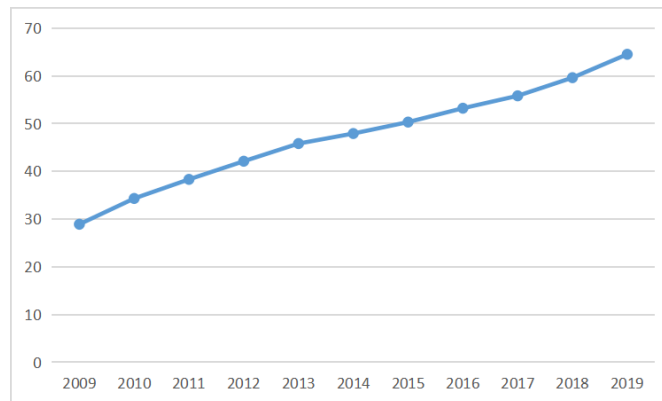

Figure 3 The Internet penetration in China

Figure 4 shows the curve of the number of road transport employment in China from 2009 to 2019. From 2011 to 2013, there was a significant change. In the three years, the number of highway transportation employment increased sharply, which is because the development of various infrastructure equipment and technology played an extremely important role in promoting the construction of China's highways. That is, in 2013, China's expressway mileage jumped to the top in the world. This leaves the country's road transport sector in need of enough people to support the vast network of roads. Since then, although the mileage of roads has increased, a series of optimization measures have kept the employment of road transport relatively stable.
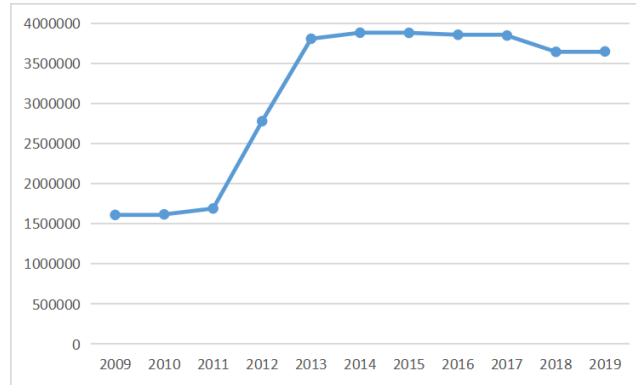
Figure4 The Number of employees in the highway transport industry in China

5. Empirical Results

In regression analysis, the collinearity of independent variables is easy to occur. Generally, the VIF values greater than 10 indicate severe collinearity. When collinearity appears, the sign of regression coefficient may be completely opposite to the actual situation. Independent variable that should be significant are not significant, but the independent variable that should not be significant are significant. As shown in Table 2, the values of $\ln X_1$ and $\ln X_2$ are both greater than 10, resulting in collinearity problem. Therefore, the ridge regression is used to solve the collinearity of independent variables in regression analysis.

Table 2 Multicollinearity test result.

Variables	VIF
$\ln X_1$	89.404
$\ln X_2$	93.058
$\ln X_3$	4.087

In order to eliminate the influence of multicollinearity, the ridge regression method is used for simulation fitting. Ridge regression analysis is a biased estimation method, but there is not necessary to exclude explanatory variables. It can guarantee that the variance of estimators is very small and the sum of squares of residuals does not deviate too much from its minimum value, thus obtaining a more authentic and credible regression process than the least square estimation. Figure 5 shows the ridge regression estimation and ridge trace diagram on the model. Figure 6 is a scatter diagram of decomposition coefficient R^2 changing with ridge regression coefficient K.
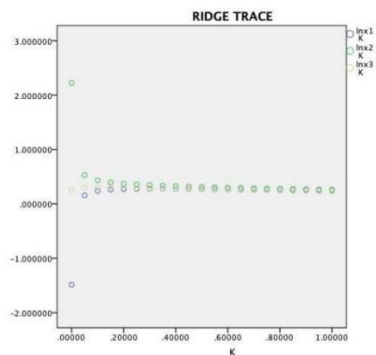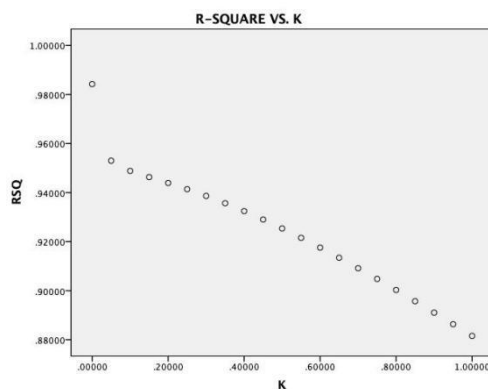
Figure 5. The ridge traces of the variables

Figure 6. R-SQUARE VS. K

When K=0.150,R^2=0.946, The coefficient of variables tends to stable.

Table 3 Regression result.

Variable	Coefficient	Standard Error	Standard Coefficient	t-Statistic	P
$\ln X_1$	2.101	0.496	0.262	4.238	0.004**
$\ln X_2$	4.354	0.661	0.395	6.591	0.000**
$\ln X_3$	2.052	0.679	0.295	3.023	0.019*
Constant	-62.574	7.753	0.000	-8.071	0.000**

Note: R^2=0.946, Adjusted R^2=0.923，F=41.106 Sig.(F)=0.000.

As can be seen from the above table 3, the per capita disposable income, the internet penetration rate and the number of employed persons in road transport industry are taken as independent variables, and the sales volume is taken as dependent variable for ridge regression analysis, and the K value is taken as 0.150. As can be seen from the above table, the model value is 0.946, which means that per capita disposable income, the internet penetration rate and the number of employed persons in road transport industry can explain 94.63% of the change in sales volume.

When the model was tested by F, it was found that the model passed the F test (F=41.106, p=0.000<0.05). The model formula is as follows (2):

$$\ln Y = -62.574 + 2.101 * \ln X_1 + 4.354 * \ln X_2 + 2.052 \ln X_4 \qquad (2)$$

The regression coefficient of per capita disposable income is 2.101(t=4.238, p=0.004<0.01), which means that per capita disposable income will have a significant positive impact on sales. The regression coefficient of the internet penetration rate is 4.354(t=6.591, p=0.000<0.01), which means that the internet penetration rate will have obvious beneficial effects on sales. The regression coefficient of the number of employed persons in road transport industry is 2.052(t=3.023, p=0.019<0.05), which means that the number of employed persons in road transport industry will have obvious beneficial effects on sales.

6. Conclusions

Taking Alibaba as an example, this paper studies the factors that influence the sales of China's "Double Eleven" shopping festival and drew the following conclusions.

First, per capita disposable income had a significant positive impact on sales of the "Double Eleven" shopping festival, with a regression coefficient of 2.101(t=4.238, p=0.004<0.01). With the development of China's economy, China's per capita disposable income has increased dramatically. From more than 10,000 yuan in 2009 to more than 30,000 yuan in 2019. As people get richer, they will spend more money, so sales will increase gradually.

Second, the internet penetration has a significant positive impact on sales volume of the "Double Eleven" shopping festival, with a regression coefficient of 4.354(t=6.591，p=0.000<0.01). The penetration of the Internet also greatly promoted the growth of sales. More and more families can surf the Internet, which means that more and more people can meet their own needs by shopping online. This is also a positive factor in the sales growth of "Double Eleven" shopping festival.

Third, the number of employees in the road transport industry has a significant positive impact on sales, and the regression coefficient is 2.052(t=3.023，p=0.019<0.05). We use road transport employment to represent the development of China's infrastructure, especially transportation. In 2009, the number of employed people in the road transportation industry was 1.6 million. By 2019, this number had risen to 3.6 million. The large-scale expansion of public transportation leads to a surge in employment in road transportation, which makes online shopping easy enough, thus promoting sales of the "Double Eleven" shopping festival.

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