An Empirical Study on the Influencing Factors of Fruit Consumption in China

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Keywords: Fruit consumption; SPSS analysis; linear regression model.

Abstract: This article selects the data of the database in the EPS global statistics/analysis platform and the official website of the General Administration of Customs of China. Based on the relationship between fruit consumption = fruit output + fruit import volume-fruit export volume, SPSS software is used to analyze whether the relationship between fruit import volume and fruit output is significant, and examine the impact of subdivided variables such as orchard area at the end of the year, consumption level of residents, fruit production price index and exchange rate on fruit consumption by empirical test. Study shows that: due to multicollinearity and regression coefficient t test is not significant, among the subdivision variables, only the consumption level of residents meets the conditions, and the consumption level of residents is positively correlated with the fruit consumption.

1. Introduction

As the "three rural issues" have attracted much attention and the rural revitalization strategy has been proposed, the rural economy has developed rapidly and efficiently, and the level of agricultural mechanization has continued to improve. Fruit, the second largest industry in the planting industry in China, has also attracted much attention. As a kind of fresh agricultural products that are indispensable in people's daily life, fruit has a broad consumer market, with consumers all over the country and even the world.

In recent years, with the upgrading of consumption in my country and the improvement of residents' consumption levels, consumer preferences have gradually shown a diversified trend. According to our survey results, 80.99% of the participants believed that the freshness affects their buying behavior, 52.89% of the participants believed that the taste affects their buying behavior, and 42.15% of the participants believed that the nutritional content affects their buying behavior. Therefore, imported fruits are gradually influenced by consumers. The Chinese market has become a life-saving straw for the fruit industry in many developed countries [1]. The competitiveness of Chinese fruit industry is relatively weak, the development is disorderly, and the phenomenon of low-priced exports and high-priced imports has reflected the difficult plight of my country's fruit industry. In the first half of 2019, the low amount of fruit storage and the reduction in production due to disasters led to insufficient supply of storage and seasonal fruits, but imports decreased, exports increased, and fruit consumption decreased [2].

At present, scholars have little research on the influencing factors of fruit consumption in the country. Most of them are analyzing the current situation of fruits in the region and making suggestions, analyzing single or multiple fruits, or researching on regional fruit import and export trade. Among them, Zhang Yu, Huang Fen fen, Yan Min, and Zhang Ge used principal component analysis to select the main fruits for different varieties of fruits, and established linear regression and time series models for analysis [3]. In response to the hot topic- fruit trade in the China-ASEAN Free Trade Area, Zheng Xu Yun and Zhuang Lijuan analyzed the fluctuation characteristics of tropical fruit trade in the free trade area based on the constant market share model, and concluded that the structural advantage of China’s exports is gradually weakening, while the export of ASEAN Structural advantages have gradually increased [4]; based on the perspective of trade intensity, the effects of tropical fruit trade in the free trade zone under the CAFTA framework are analyzed, and the tropical fruit trade potential and export influencing factors of the free trade zone are tested through the ARIMA

model and gravity model, and the conclusion is drawn: factors such as economic scale, population size and bilateral straight-line distance significantly affect the export trade flow of tropical fruits in the free trade zone [5].

Through the separate analysis of the direct and subdivision variables of fruit consumption, this article explores the specific conclusions of the factors affecting fruit consumption, hoping to provide feasible suggestions for the adjustment and improvement of fruit consumption in China.

2. Theoretical analysis and research hypothesis

This article will build the research framework shown in Figure 1 to analyze the relationship between the directly influencing variables and the impact of six subdivision variables on fruit consumption.

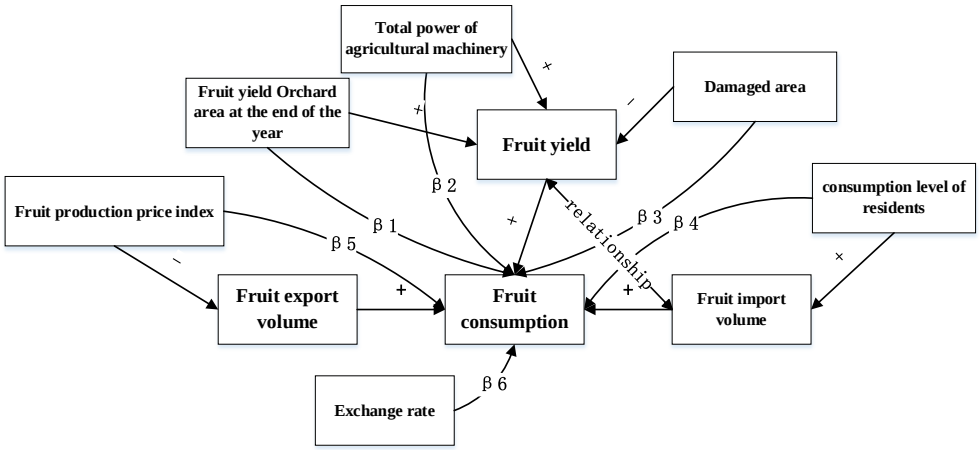

Figure 1. Theoretical model.

2.1 Directly affect variables

It is generally believed that: fruit consumption = fruit production + fruit import-fruit export. But in fact, fruit production, fruit import, and fruit export cannot explain all the differences in fruit consumption. Figure 2 reflects the balance of supply and demand in my country's fruit industry from 2009 to 2017 [6]. In the figure, the fruit production curve and fruit consumption curve almost overlap, and the fruit import volume and fruit production show a similar upward trend. Therefore, this article proposes hypotheses:

Hypothesis 1: There is a significant relationship between fruit imports and fruit production.

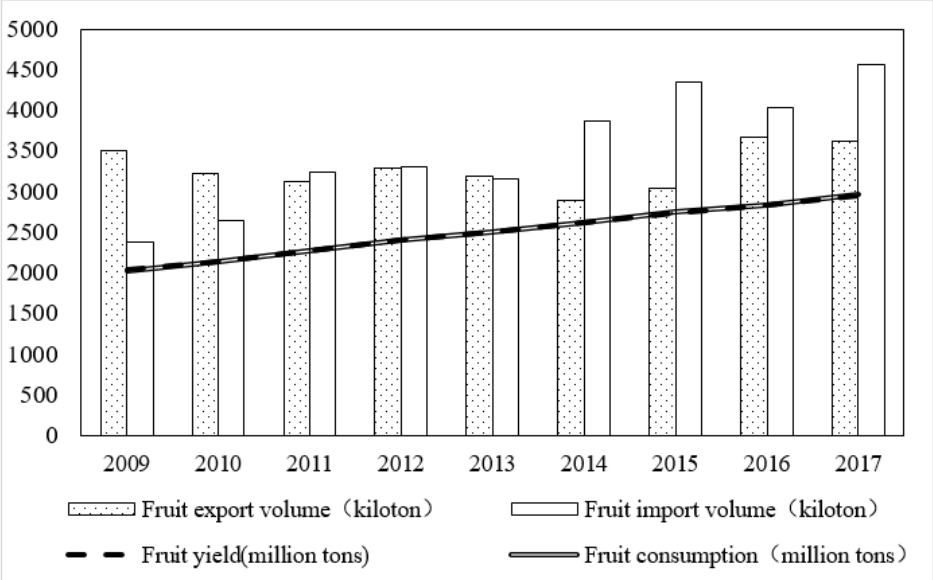

Figure 2. 2009-2017 China's fruit industry supply and demand balance (data source: National Bureau of Statistics, China General Administration of Customs official website).

2.2 Segmentation variables

2.2.1 Linear relationship. The linear relationship test is to test whether the relationship between Y and the subdivision variable is significant. This article proposes hypotheses:

Assumption 2:
H_0: The β coefficients of the variables are all 0.
H_1: At least one of the β coefficients is not equal to 0.

2.2.2 Regression coefficient. The regression β_i coefficient is tested by t test to determine whether the impact of subdivision variables on fruit consumption is significant. Propose a hypothesis:

Assumption 3:
H0: $\beta_i = 0$
H1: $\beta_i \neq 0$

2.2.3 Concluding assumptions. According to the relationship between fruit consumption and fruit production, fruit import volume, fruit export volume, and the impact of subdivision variables on the directly influencing variables, this article proposes hypotheses:

Hypothesis 4: At the end of the year, the area of orchard, total power of agricultural machinery, household consumption level, fruit production price index and fruit consumption are positively correlated, and the affected area, exchange rate and fruit consumption are negatively correlated.

3. Research design

3.1 Sample selection and data sources

This article selects the national fruit industry for 9 consecutive years from 2009 to 2017 as the research object, and analyzes the relationship between fruit production, fruit import volume, fruit export volume and other directly affecting variables. Fruit output, fruit import volume, and fruit export volume can be reflected by subdivision variables such as orchard area at the end of the year, household consumption level, fruit production price index, etc., so we specifically explore the impact of subdivision variables on fruit consumption.

The data comes from the China Macroeconomic Database, the China Three Rural Database, the National Bureau of Statistics and the official website of the General Administration of Customs in the EPS global statistical data/analysis platform. Data collation mainly uses Microsoft Excel 97-2003, and data analysis mainly uses SPSS 17.0.

3.2 Variable definition

3.2.1 The explained variable. The explained variable in this article is fruit consumption. Fruit consumption refers to the quantity of fruits purchased and consumed by Chinese residents in a certain period of time.

3.2.2 Explain variables. Fruit yield. It shows the quantity of fruits produced in a certain period of time in China. The area of the orchard at the end of the year, the total power of agricultural machinery, and the area affected by the disaster are the subdivision variables that affect fruit production. Regardless of other factors, the larger the orchard area at the end of the year, the greater the fruit yield. The total power of agricultural machinery can reflect the use of machinery when producing fruits. Without considering other factors, the higher the value of the total power of agricultural machinery, the higher the efficiency of fruit production and the greater the fruit output. Regardless of other factors, the larger the affected area, the lower the fruit yield.

Fruit imports. Indicates the quantity of fruits purchased by our country from abroad. The level of household consumption is a subdivision variable that affects the volume of fruit imports. It is generally believed that, regardless of other factors, the higher the consumption level of residents, the more the

residents pay attention to the quality of the fruit and the experience of trying new tastes, and the greater the amount of fruit imported.

Fruit export volume. Indicates the quantity of Chinese fruits sold abroad. The fruit production price index is a subdivision variable that affects the export volume of fruit. It is generally believed that without considering other factors, the higher the fruit production price index, the smaller the fruit export volume.

3.2.3 Control variables. The control variable in this article is the exchange rate. Represents the ratio of currency exchange between two countries. This article selects the ratio of the amount of RMB corresponding to 1 U.S. dollar to 1 U.S. dollar to reflect changes in exchange rates. In general, the higher the exchange rate, the smaller the fruit consumption.

The variables in this article are shown in Table 1.

Table 1. Definition of main variables.

Variable type	Variable name		Variable symbol
Explained variable	Fruit consumption		Y
Explain variables	Fruit yield	Fruit yield Orchard area at the end of the year	OA
		Total power of agricultural machinery	TPAM
		Damaged area	DA
	Fruit import volume	consumption level of residents	CLR
	Fruit export volume	Fruit production price index	FPPI
Control variable	Exchange rate		ER

3.3 Model construction

In order to test the hypothesis, this article builds the model as follows:

$$Y=\beta_0 + \beta_1 OA + \beta_2 TPAM + \beta_3 DA + \beta_4 CLR + \beta_5 FPPI + \beta_6 ER + \epsilon \quad (1)$$

The model is to construct the relationship between six subdivision variables and fruit consumption. It is mainly used to study the impact of subdivision variables on fruit consumption.

4. Empirical analysis

4.1 Descriptive statistics

After normality test, all variables obey normal distribution. It can be seen from Table 2 that the maximum value of fruit consumption is 295.9728 million tons, the minimum value is 202.8348 million tons, the average value is 25,317,233 tons, and the median is 25,089.86, indicating that my country's fruit consumption is large, and more than half of the years of fruit consumption are greater than Mean. The maximum orchard area at the end of the year was 13127.2 thousand hectares, the minimum was 10902.8 thousand hectares, the average was 11889.789 thousand hectares, and the median was 11830.6 thousand hectares, indicating that the orchard area at the end of more than half of the years was less than the average. The maximum value of the total power of agricultural machinery is 289.671 million kilowatts, the minimum is 197.371 million kilowatts, the standard deviation is 3055.7912, the average value is 249.5189 million kilowatts, and the median is 260.436 million kilowatts, indicating that the total power of agricultural machinery has a large change, more than half of the total power of

agricultural machinery in the year is greater than the average value. The maximum value of the damaged area is 15,532 thousand hectares, the minimum value is 7300.1 thousand hectares, the standard deviation is 3079.9867, the average value is 11066.233 thousand hectares, and the median is 10394.9 thousand hectares, indicating that the damaged area has changed greatly due to weather, and more than half of the years, the damaged area is less than the average. The maximum resident consumption level is 22,902 RMB, the minimum is 9514 RMB, the standard deviation is 4571.13823, the average is 16195.5922 RMB, and the median is 16190.2 RMB, indicating that the resident consumption level has changed greatly, and the resident consumption level is less than the average in more than half of the years. The minimum value of the fruit production price index is 100, the maximum value is 148.19, the average value is 132.3656, and the median is 136.66, indicating that the fruit production price index has changed a lot, and the fruit production price index in more than half of the years is greater than the average value. The maximum value of the exchange rate is 6.83, the minimum is 6.14, the average is 6.4811, and the median is 6.4588, indicating that more than half of the exchange rate is less than the average.

Table 2. Descriptive statistics of main variables.

Variable	Sample Size	Mean	Median	Standard Deviation	Minimum	Maximum
Y	9	25031.7233	25089.86	3198.6849	20283.48	29597.28
OA	9	11889.789	11830.6	783.6843	10902.8	13127.2
TPAM	9	24950.189	26043.6	3055.7912	19737.1	28967.1
DA	9	11066.233	10394.9	3079.9867	7300.1	15532
CLR	9	16195.5922	16190.2	4571.13823	9514	22902
FPPI	9	132.3656	136.66	15.57317	100	148.19
ER	9	6.4811	6.4588	0.27271	6.14	6.83

4.2 Correlation analysis

The significance test of the correlation coefficient between the directly influencing variables. It can be seen from Table 3 that among the three variables, the relationship between fruit import volume and fruit output is significant, while the other variables are not significant. That is, hypothesis 1 is verified.

Table 3. Pearson correlation analysis of directly affecting variables.

Variable	Fruit production	Fruit import volume	Fruit export volume
Fruit yield	1		
Fruit imports	0.960^{***}	1	
Fruit export volume	0.206	0.063	1

Note: *****.*. Means significant correlation at the levels of 0.01, 0.05, and 0.1 respectively.

Significance test is performed on the correlation coefficient between the subdivision variables in the model. It can be seen from Table 4 that among the six variables, the relationship between the total power of agricultural machinery and the orchard area at the end of the year, the disaster-affected area and the orchard area at the end of the year, the level of residents' consumption and the orchard area at the end of the year, the fruit production price index and the orchard area at the end of the year, the exchange rate and the area affected by the disaster ,the exchange rate and the consumption level of residents is not significant, and the other variables are both significant in pairs. Therefore, there may be multiple collinearity in the established multiple regression model. Therefore, the partial correlation analysis of the subdivision variables is done.

Table 4. Pearson correlation analysis of segmentation variables.

Variable	0A	TPAM	DA	CLR	FPPI	ER
OA	1					
TPAM	0.509	1				
DA	-0.205	-0.889***	1			
CLR	0.054	0.881***	-0.911***	1		
FPPI	0.551	0.971***	-0.825***	0.837***	1	
ER	-0.911***	-0.627*	0.406	-0.226	-0.661*	1

Note: ***. **.*. Respectively indicate significant correlation at the levels of 0.01, 0.05, and 0.1.

The partial correlation analysis is shown in Table 5. There is a significant correlation between the total power of agricultural machinery and the area of orchard at the end of the year, the consumption level of residents and the area of orchard at the end of the year, the consumption level of residents and the total power of agricultural machinery, the fruit production price index and the area of orchard at the end of the year, the fruit production price index and the total power of agricultural machinery, fruit production price index and household consumption level, exchange rate and year-end orchard area, exchange rate and total power of agricultural machinery, exchange rate and household consumption level, exchange rate and fruit production price index.

Table 5. Partial correlation analysis of segmentation variables.

Variable	OA	TPAM	DA	CLR	FPPI	ER
0A	1.000					
TPAM	0.979***	1.000				
DA	-0.314	-0.363	1.000			
CLR	-0.873***	-0.910***	0.468	1.000		
FPPI	0.914***	0.892***	-0.197	-0.725**	1.000	
ER	-0.922***	-0.935***	0.449	0.749**	-0.880***	1.000

Note: ***. * *.*. Respectively indicate significant correlation at the levels of 0.01, 0.05, and 0.1.

According to the comparison of F values (see Table 6), the consumption level of residents is retained in the final model, and the orchard area at the end of the year, and total power of agricultural machinery, fruit production price index, and exchange rate are removed.

Table 6. Selection of variables.

Variable		OA TPAM	CLR OA	CLR TPAM	FPPI OA	FPPI TPAM	FPPI CLR	ER OA	ER TPAM	ER CLR	ER FPPI
F value	First group	3027.988	21455.1	3027.988	21455.1	3027.988	86.365	21455.1	3027.988	86.365	21471.75
	Second group	21455.1	86.365	86.365	21471.75	21471.75	21471.75	3436.992	3436.992	3436.992	3436.992

Adjust the model to Y=$\beta_0 + \beta_1 DA + \beta_2 CLR + \epsilon$

4.3 Regression analysis

According to the regression results in Table 7, it can be concluded that the adjusted R^2 is 0.998, , indicating that the affected area and the consumption level of residents together explain 99.8% of the difference in fruit consumption. The F value is 2556.327 and Sig. is close to 0, which indicates that there is a significant linear relationship between fruit consumption and the subdivision variable damaged area and the consumption level of residents. It is reasonable to use the multiple linear regression model to analyze it, which verifies Hypothesis 2. It indicates that the variables are the average value of fruit consumption at 0. The damaged area and fruit consumption showed a negative correlation, with a regression coefficient of -0.055, indicating that for every 1,000 hectares of damaged area increased, fruit consumption decreased by 0.05,500 tons. Sig. is 0.170, the damaged area has no significant impact on fruit consumption, and it fails the test of hypothesis 3. There is a positive correlation between the consumption level of residents and the consumption of fruits, and the regression coefficient is 0.665, indicating that for every 1 RMB increase in the consumption level of residents, the consumption of fruits will increase by 0.665 million tons. Sig. is close to 0, the household consumption level has a significant impact on fruit consumption, and it passes the test of hypothesis 3. At the same time, Hypothesis 4 is partially verified. In the end: $Y=14864.391+0.665CLR$. The revised theoretical model is shown in Figure 3 [7].

Table 7. Regression results.

Model	Variable	Non-standardized coefficient		Standard coefficient	t	Sig.	Collinearity statistics	
		B	Standard error	Beta			tolerance	VIF
1	(constant)	14864.391	759.430		19.573	0.000		
	DA	-0.055	0.035	-0.053	-1.559	0.170	0.169	5.910
	CLR	0.665	0.024	0.951	27.984	0.000	0.169	5.910
	Observed value		9	Adj R-squared			0.998	
	F value		2556.327	Sig.			0.000[a]	

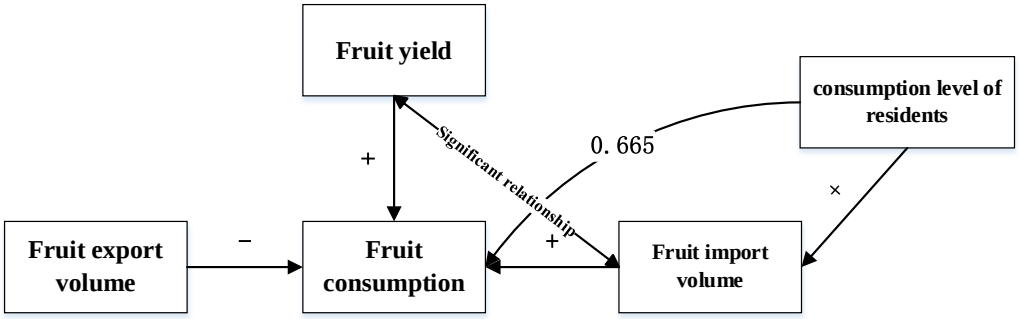

Figure 3. Revised theoretical model.

5. Conclusions and recommendations

5.1 Conclusion

The article found that: The relationship between fruit imports and fruit production is significant. Through regression analysis, it is concluded that there is a significant linear relationship between fruit consumption and the subdivision variable affected area and residents' consumption level. The affected area has no significant impact on fruit consumption, and the level of residents' consumption has a significant impact on fruit consumption. There is a positive correlation between the consumption level of residents and the consumption of fruits, and the remaining subdivision variables are not significant due to multicollinearity or regression coefficient t test, and do not meet the conditions, and ultimately do not enter the model.

5.2 Suggestions

In response to the difficult plight of my country's fruit industry, the author puts forward the following two suggestions: The improvement of residents' consumption level means that quality becomes more and more important. The fruit market should solve the phenomenon of quality and sales homogeneity and achieve standardized production. Pay attention to brand promotion, create my country's high-quality and well-known fruit brands to meet people's demand for high-quality fruits, thereby reducing the number of imported fruits and effectively alleviating my country's plight. With the advent of the digital age, cross-border e-commerce exports have gradually become an important channel for Chinese companies to explore overseas markets, enhance brand internationalization, and enhance international core competitiveness. My country is already in a leading position in the world [8]. According to the data in Figure 4, it can be concluded that the export structure of cross-border e-commerce accounts for a large proportion, and the proportion is gradually decreasing. In order to ensure the quality of exports and allow foreign customers to have a deeper understanding of the fruits they purchased, a QR code can be attached to the exported fruits. Customers can scan the QR code to obtain information about the entire process from standardized production, picking, transportation, and extraction. Information, with good quality to ensure a higher price [9] [10].

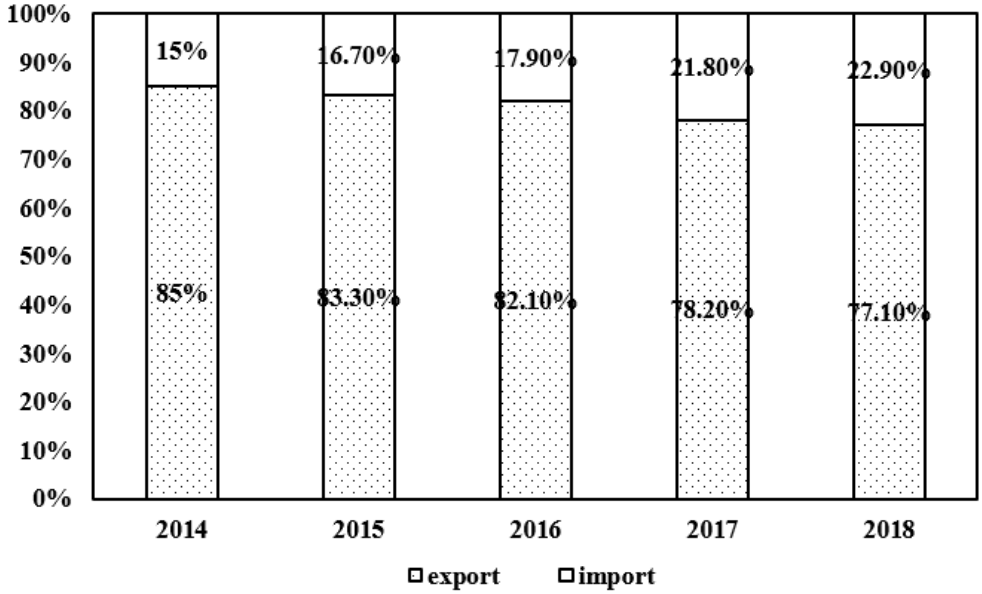

Figure 4. 2014-2018 cross-border e-commerce import and export structure (data source: the official website of the General Administration of Customs).

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