State Analysis of Apple Industry in China

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Abstract: China is the first apple production country in the world, and apple planting industry occupies an important position in China, so through the analysis of the state of apple industry in China. It is of great significance to stabilize the apple commodity market and promote the healthy development of the industry. According to the preliminary analysis of the data, it can be found that with the increase of the year, the apple yield has a significant linear growth trend. Therefore, through comprehensive analysis, this paper establishes a regression model and uses MATLAB to solve. Based on the test and analysis of the model, five criteria are given to judge the merits and demerits of the data, and the requirements of data integrity, that is, whether there is abnormal data culling in the process of model fitting. By analyzing the export volume of fresh apple and apple juice in China and the world, the export scatter model of fresh apple and apple juice in China and the world is established. The scattered point model of apple planting area between China and the world is established. It shows that China's apple market plays a very important role in and influences international trade. China is the largest apple producer in the world and plays an important role in the international apple production. The influencing factors of fresh apple export include distance, economic development of importing country, international politics, product quality, cost, market environment and brand. In terms of the future change law and forecast, the development level of the apple industry is constantly improving, the supply will continue to exceed the demand in the next few years. And the polarization phenomenon of domestic apple price will be more and more obvious.

1. INTRODUCTION

Apples are the largest fruit planted in our country. The cultivated area and yield account for about 20% and 30% of the total fruit in China, which plays an important role in the national economy. China is the world's largest apple production country, cultivation area and yield account for more than 30% of the world's total apple. In recent years, there have been new changes in the consumption structure of apples in the domestic market, people's consumption demand for processed products such as apple juice is rising day by day, while satisfying the domestic market supply, China's apple export is also growing, and the importance of apple industry in the world is increasing. In this form, the production of fresh agricultural products, including apples, needs to further change the mode of development, from the quantitative expansion type to the quality benefit type, gradually stabilize the apple planting area, adjust the variety structure, expand the processing proportion, prolong the industrial chain, build the superior brand, and upgrade from the aspects of industrialization, commercialization and branding.

In recent years, a large number of scholars have carried out a lot of research on the state of apple industry. For example, Wang Hongye and Lu Xingkai took 70 representative apple orchards in Shaotong City as the research object, and gave the measures to improve the quality and efficiency of
apples in the cold highland of southwest China, which laid the foundation for industrial upgrading[1]. Based on the analysis of the present situation of apple industry in China, Song Zhe and Wang Hong discussed the main problems of apple industry in China and the development trend of apple industry in China in the future, and put forward some solutions to the problems of apple industry in China[2]. Liu Xiaoguang, Zhou Ying and others gave some suggestions to improve the competitive advantage by comparing the international competitiveness of Apple industry between China and Japan[3]. By analyzing the development trend of Chinese apple industry, Zhai Heng and Shu Huairui put forward solutions to the problems facing the apple industry[4].

By analyzing the influence factors of apple planting area, cost change and apple export, this paper establishes the relationship between output and year according to the data of total output of apple plantation in China from 1985 to 2016, and forecasts the total output from 2019 to 2030. Through the above analysis, combined with the total area of apple orchard and the relevant data of selling price, this paper expounds the future development of apple industry and the current industrial situation, and gives reasonable suggestions on how to invest reasonably in fruit farmers to obtain greater income. In order to alleviate the “labor pain” in the process of industrial structure reform, to safeguard the vital interests of farmers, to stabilize the market operation and to promote the healthy development of industry, it is of great significance to the development of apple planting industry in the future of our country.

2. TESTS AND METHODS

2.1 Establishment of a linear model between year and yield

According to the data of the National Bureau of Agricultural Statistics as shown in Table 1, the scattered plot of the total output of apples on apple plantations in China increases with the year is shown in figure 1.

| Year | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Production | 361.41 | 431.93 | 1400.77 | 2043.12 | 2401.11 | 3326.33 | 3598.48 | 3849.07 | 3968.26 | 4092.32 | 4261.34 | 4388.2 |

Figure 1 Changes in apple yield
According to the scattered plot of apple yield change in figure 1, the linear relationship between yield and year is obtained [5]. Therefore, the linear regression equation between yield and year is established, such as (1), which $\varepsilon$ is error.

$$\begin{align*}
y = a + bx + \varepsilon \\
\varepsilon \sim N(0, \sigma^2)
\end{align*}$$

Substitute the sample value to (2).

$$\begin{align*}
y_i = a + bx_i \\
\varepsilon_i \sim N(0, \sigma^2)
\end{align*}$$

$\hat{y} = \hat{a} + \hat{b}x$ to $y$ the linear regression equation of $x$. And the $\hat{a}$ and $\hat{b}$ solution equation such as (3).

$$\begin{align*}
\hat{b} &= \frac{\sum_{i=1}^{n} x_i y_i - n \bar{x} \bar{y}}{\sum_{i=1}^{n} x_i^2 - n \bar{x}^2} \\
\hat{a} &= \bar{y} - \hat{b} \bar{x}
\end{align*}$$

Bring the data in table 1 into equation (3) and solve the regression coefficient [6]. As shown in table 2. $R^2$ of which The correlation coefficient, $P$ the probability corresponding to the $F$, $s^2$. For the estimation error variance.

| TABLE 2 REGRESSION COEFFICIENTS |
|----------------------------------|
| Regression coefficient | Estimated regression coefficient | Confidence interval of regression coefficients |
| $\hat{a}$ | -275327.2911924356 | [-300898.28, -249756.29] |
| $\hat{b}$ | 138.7039738348 | [125.9 538, 151.4542] |

$R^2 = 0.9833$, $F = 587.52$, $p \leq 0.001$, $s^2 = 4.0048 \times 10^4$

Make a residual distribution [7]. Figure 2:

![Figure 2 Distribution of residuals](image)

From the residual distribution map, we can see that the confidence intervals of the remaining residuals except the first and fifth data contain zero points, the first and fifth points can be eliminated, and then recalculated. The new regression coefficient is obtained as shown in Table 3.
TABLE 3 REGRESSION COEFFICIENTS

| Regression coefficient | Estimated regression coefficient | Confidence interval of regression coefficients |
|------------------------|---------------------------------|-----------------------------------------------|
| $\hat{a}$              | -294374.2380221431              | [-309229.29, -279519.17]                     |
| $\hat{b}$              | 148.1919804852                  | [140.7926, 155.5913]                         |

$R^2 = 0.9962$, $F = 2132.96$, $p < 0.001$, $s^2 = 7808.44$

The data of apple yield in Table 1 are substituted into formula (4), and the predicted yield of the model is obtained as shown in Table 4.

TABLE 4 ESTIMATED APPLE PRODUCTION

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------|------|------|------|------|------|------|------|
| Actual production | 3326.33 | 3598.48 | 3849.07 | 3968.26 | 4092.32 | 4261.34 | 4388.2 |
| Projected output | 3491.6427531 | 3639.8347335941 | 3788.0267140793 | 3936.2186945645 | 4084.4106750947 | 4232.6026555349 | 4380.7946360201 |
| Error | 4.969% | 1.149% | -1.586% | -0.807% | -0.193% | -0.674% | -0.169% |

Table 4 shows that after excluding the first and fifth data, the other data fit well, and the predicted yield and actual yield are more compatible, so the linear relationship can be used to express the relationship between yield and year.

2.2 Comparison of Fresh Apples and Apple Juice Exports between China and the World

The apple export trade in our country is characterized by the agglomeration of adjacent areas, and most of the areas belong to the high and low agglomeration types, that is, the apple export trade has obvious "Matthew effect"[8]And the degree of agglomeration is strengthening. From the point of view of various influencing factors, unit area output, specialization level, infrastructure, product-ion-consumption ratio and export trade stock have significant positive effects on apple exports, while trade barriers have significant negative effects on exports. Therefore, when studying the influence of various factors on export volume, unit yield should be analyzed. Export prices and related costs are more appropriate.

The export volume of apple is $y$, the output per unit area is $x_1$, the export price is $x_2$, the material and service cost per mu is $x_3$, the direct cost is $x_4$. Table 5:

TABLE 5 COMPARISON OF FRESH APPLE AND APPLE JUICE EXPORTS IN CHINA AND THE WORLD

| Year | Exports from China | Exports from Global | Percentag share | Exports from China | Exports from Global | Percentage share |
|------|--------------------|--------------------|----------------|--------------------|--------------------|-----------------|
| 2017 | 107.86             | 744.71             | 14.48%         | 64.04              | 219.82             | 29.13%          |
| 2016 | 104.99             | 841.84             | 12.47%         | 45.54              | 197.2              | 23.09%          |
| 2015 | 63.02              | 907.27             | 6.94%          | 39.82              | 227.21             | 17.53%          |
| 2014 | 64.91              | 837.93             | 7.75%          | 40.13              | 218.28             | 18.38%          |
| 2013 | 72.73              | 863.93             | 8.42%          | 54.67              | 231.99             | 23.57%          |
| 2012 | 68.72              | 833.99             | 8.24%          | 50.02              | 221.8              | 22.55%          |
| 2011 | 73.71              | 861.34             | 8.56%          | 53.86              | 209.81             | 25.67%          |
| 2010 | 74.95              | 852.73             | 8.79%          | 61.5               | 230.74             | 26.65%          |

The export scatter plots of fresh apple and apple juice in China and the world are shown in figures 3 and 4 respectively:
The statistical table of apple export volume and unit yield price is shown in Table 6:
TABLE 6 APPLE EXPORTS AND PRICES

| Year | Unit production | Export prices | Material and service costs per mu | Direct costs | Export volume |
|------|-----------------|---------------|-----------------------------------|--------------|--------------|
| 2016 | 1258.94         | 8.51          | 1681.85                           | 1369.15      | 104.99       |
| 2015 | 1231.32         | 9.12          | 1767.76                           | 1474.39      | 63.02        |
| 2014 | 1200.69         | 8.3           | 1885.81                           | 1557.28      | 64.91        |
| 2013 | 1164.29         | 7.22          | 1809.81                           | 1499.59      | 72.73        |
| 2012 | 1150            | 7.09          | 1904.42                           | 1553.95      | 68.72        |
| 2011 | 1101.81         | 6.79          | 1917.34                           | 1580.14      | 73.71        |
| 2010 | 1036.28         | 5.83          | 1882.48                           | 1549.01      | 74.95        |
| 2005 | 846.82          | 3.88          | 559.15                            | 532.72       | 46.35        |

Establishment of unit area production and export volume, export price and export volume, per mu
of material and service costs and export volume, direct costs and export volume scatter diagrams are
shown in figures 5, 6, 7 and 8:

![Figure 5 Output per unit area and exports](image)

![Figure 6 Export prices and exports](image)

![Figure 7 Goods and services per mu and exports](image)

![Figure 8 Direct costs and exports](image)

It can be found from figure 5 that the value $y$ decreases with the increase $x_1$ of the linear model

$$y = x_1 \beta_1 + \beta_0 + \epsilon$$  (5)

As can be seen from Figure 6, with $x_2$As the y value decreases, the linear model is

$$y = x_2 \beta_1 + \beta_0 + \epsilon$$  (6)

To establish regression model synthetically

$$y = x_1 \beta_1 + x_2 \beta_2 + \beta_0 + \epsilon$$  (7)

Apple is the most foreign exchange-generating horticultural product in China, mainly exporting
fresh apples and concentrated apple juice. The international market share of fresh apples and
concentrated apple juice in China is about 20% and 40% respectively. The main export markets of fresh apples are concentrated in Asian countries and Russia. The main export markets of apple juice are mainly developed countries such as the United States, Japan and Russia.

3. CONCLUSION
Based on the relationship between apple yield and year, and the comparison between China and global fresh apple and apple juice exports, the following conclusions are drawn:

In recent years, China has actively promoted the development of characteristic agricultural industry, and the level of development of apple industry has been continuously improved. At present, China becomes the largest apple producer in the world, with planting area and total output accounting for about 50% of the world. Apple exports are among the highest in the world, and China is moving from a big apple producer to a powerful apple industry. For the future trend of the apple industry, some boutique apple, functional apple prices will remain high, even higher than in previous years. China's apple export volume will grow steadily every year, occupying a very important position in the global market, the future apple industry will also develop towards export, enhance the competitiveness of China's apple brand.

In terms of output, combined with the analysis of yield model, the total output of Chinese apples in 2016 is 43.88 million tons, and the domestic apple market is oversupply. It can be predicted that the form of apple oversupply will continue in the coming years.

In terms of prices, the price of ordinary apples has risen in recent years, but as consumers pursue nutrition and health care, the market price of high-end boutique apples and functional apples will be higher and higher, and the price of low-end apples will be lower and the polarization of domestic apple prices will become more and more obvious.

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