Analysis on economic carrying capacity index of pig breeding in China

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Abstract: In this paper, factor analysis method was employed to analyze and calculate the Gross Domestic Product (GDP) per capita in the last decade, the proportion of research and experiment development (R&D) expenditure equivalent to GDP, urban and rural residents’ pork consumption and explored the scale of Chinese pig breeding on economic carrying capacity index. The result showed that the growth of GDP had led to better techniques and higher field investment, and stronger support like science and technology from the government provided good conditions for large scale of pig breeding. Besides, the substantial increase of pork consumption between rural and urban residents has contributed to the pig breeding in large scale. As a result, the economic carrying capacity index in Chinese pig farming is on the rise.

1. Introduction
During the Twelfth Five-year Plan period, Chen Yao, the chief scientist of national pig breeding industry technology system and professor from the Life Science School of Sun Yat-sun University, concluded, “The scale of pig breeding grows rapidly, the price fluctuates, and hog cycle still exists. Life efficiency increases steadily and requirements for market access continues to be higher and higher.” In recent years pork price has fluctuated greatly and people have made profits by pig breeding in a large scale. There appeared a hog cycle with profit in one year, a balance in two years but deficit in three years. Under this circumstance, massive cultivation came into its appearance.

2. Confirmation and Calculation of Indicators
With the broad application of carrying capacity and its extension in environmental, economic and social fields, many kinds of capacity appeared, which means the maximum bearing power of a thing and a phenomenon. In this paper, the economic carrying capacity of pig scale breeding refers to the society’s demand for pig breeding and the supporting role of economy and science and technology in pig breeding. GDP, R&D expenditure and urban and rural residents’ pork consumption were used to promote this analysis. Through the data study, dimensionless process was conducted to avoid different dimensions. This study was presented with a relatively treatment method.

According to per capita GDP(C1), R&D expenditure equivalent to GDP(C2) and urban and rural residents’ pork consumption from 2006 to 2015, the following table was presented.
Table 1. Standardization of Evaluation Index of Economic Carrying Capacity of Pig Scale Breeding

| Time  | Per capita GDP with dimensionless process (C11) | R&D expenditure/GDP with dimensionless process (C22) | Urban and residents’ pork consumption dimensionless process (C33) |
|-------|-----------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------|
| 2006  | 0.3348                                        | 0.6860                                              | 0.8821                                                       |
| 2007  | 0.4102                                        | 0.7198                                              | 0.7856                                                       |
| 2008  | 0.4825                                        | 0.7440                                              | 0.7938                                                       |
| 2009  | 0.5245                                        | 0.8213                                              | 0.8572                                                       |
| 2010  | 0.6176                                        | 0.8502                                              | 0.8739                                                       |
| 2011  | 0.7282                                        | 0.8599                                              | 0.8719                                                       |
| 2012  | 0.8003                                        | 0.8889                                              | 0.9112                                                       |
| 2013  | 0.8772                                        | 0.9565                                              | 0.9826                                                       |
| 2014  | 0.9442                                        | 0.9758                                              | 0.9950                                                       |
| 2015  | 1.0000                                        | 1.0000                                              | 1.0000                                                       |

Data Source: *China Statistical Yearbook*

From the above table we can see that China’s per capita GDP shows a trend of increase year by year; the economy develops much faster; the proportion R&D expenditure accounting for GDP is growing in a row. With the development of economy, more funds are invested in science and technology. Moreover, residents’ growing income has contributed to the larger pork consumption between rural and urban people.

3. Calculation of Index of Economic Carrying of Scale Pig Breeding
We use SPSS software to evaluate the economic carrying capacity of Chinese pig scale farming. On the basis of the correlation test, we obtained the common factor variance of the original variable. The data showed that the principal component contained more than 80% of the original variables, and then the contribution rate of common factor variance is as followed.

Table 2  Contribution Rate of Common Factor Variance

| Component | Initial Eigenvalues | Square extraction & loading | Square rotation & loading |
|-----------|---------------------|------------------------------|---------------------------|
|           | Summation Variance % | Summation Variance % | Summation Variance % |
|           | Accumulation %       | Accumulation %            | Accumulation %           |
| 1         | 2.813                | 93.769                      | 93.769                    |
|           | .171                 | 5.691                       | 99.460                    |
| 3         | .016                 | .540                        | 100.000                   |
|           | 1.732                | 57.742                      | 57.742                    |
|           | 1.252                | 41.719                      | 99.460                    |
The high factor variance showed the factor extracted can best explain the three indexes. The variance contribution rates of factor one and factor two were 93.769% and 5.691% respectively, and the characteristic values were 2.813 and 0.171 respectively. These two indexes explained 99.460% (more than 80%) of variance, therefore we extracted the first two components as the first and second component. Furthermore, factor score coefficient matrix is as follows.

Table 3 Factor Score Coefficient Matrix

|        | Component 1 | Component 2 |
|--------|-------------|-------------|
| C11    | .926        | -.568       |
| C22    | .837        | -.459       |
| C33    | -1.024      | 1.753       |

Factor expression:

\[ F1 = 0.926C11 + 0.837C22 - 1.024C33 \]
\[ F2 = -0.568C11 - 0.459C22 + 1.753C33 \]

The first two contribution rates were normalized and we obtained two statistics, 94.28% and 5.72%. Considering the variance contribution rate as the weight, we got the expression of economic carrying capacity index \( A \):

\[ A = 94.28\% \times F1 + 5.72\% \times F2 \]

The index of economic carrying capacity of China's pig farming scale from 2006 to 2015 is as follows:

Chart 1 Economic Carrying Capacity Index

The data showed that with the economic and social development, the improvement of living standards, the increase of consumption capacity and demand, the country’s science and technology investment is also increasing, which provides economic support for pig breeding. The economic carrying capacity of pig farming is on the rise.

4. Conclusion and Outlook

In this paper, we use the SPSS analysis software to evaluate the economic carrying capacity index of China’s pig scale breeding from the data of the past decade. The results show that the progress of society, the increase of people’s income and consumption demand contribute to the development of overall economy. The state invests more in science and technology, which promotes the large-scale
breeding of live pigs and the economic carrying capacity is still increasing. Therefore, there exists a large market in Chinese pork consumption and large scale breeding is likely to further expand. However, expanding the scale of farming may do harm to environment, which is worth our vigilance.

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