Study on the Measurement and Calculation of Environmental Pollution Bearing Index of China's Pig Scale

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Abstract. According to the environmental pollution caused by large-scale pig breeding, the SPSS statistical software and factor analysis method were used to calculate the environmental pollution bearing index of China's breeding scale from 2006 to 2015. The results showed that with the increase of scale the density of live pig farming and the amount of fertilizer application in agricultural production increased. However, due to the improvement of national environmental awareness, industrial waste water discharge is greatly reduced. China's hog farming environmental pollution load index is rising.

1. Introduction
The rapid development of pig industry and intensive, large-scale farming results in the serious pollution. The report on the work of the Chinese government in 2017 clearly pointed out that we should make vigorous efforts to control the ecological and environmental protection. We should make further efforts to tackle water pollution in the watershed areas and strengthen agricultural non-point source pollution prevention and control. In order to evaluate the carrying capacity of environmental pollution in China, the pig land scale farming capacity, the amount of fertilizer per unit area and the amount of industrial waste water discharge were used to calculate the environmental carrying index of Chinese pig scale.

2. Standardization of indicators
According to the China Statistical Yearbook and the China Animal Husbandry Statistical Yearbook, we calculated the standardized values of the density of pig farming, the amount of fertilizer applied per unit area and the amount of industrial waste water discharge from 2006 to 2015. The results are as shown in Table 1 below:

| Year | Pigs - Scale Breeding with Dimensionless Process C1 | Amount of Fertilizer Per Unit with Dimensionless Process C2 | Industrial Discharge Dimensionless C3 | Waste Water with Process |
|------|---------------------------------------------------|----------------------------------------------------------|--------------------------------------|-------------------------|
| 2006 | 0.92                                              | 1.00                                                     | 0.83                                  |                         |
| 2007 | 1.00                                              | 0.90                                                     | 0.81                                  |                         |
| 2008 | 0.93                                              | 0.2                                                      | 0.83                                  |                         |
| 2009 | 0.2                                               | 0.95                                                     | 0.85                                  |                         |
| 2010 | 0.85                                              | 0.92                                                     | 0.84                                  |                         |
| 2011 | 0.85                                              | 0.90                                                     | 0.86                                  |                         |
| 2012 | 0.81                                              | 0.2                                                      | 0.90                                  |                         |
| 2013 | 0.79                                              | 0.87                                                     | 0.95                                  |                         |
We have conducted a descriptive analysis of the evaluation indicators. The results are as Table 2.

### Table 2. The Description of the Result

|   | N | Minimum | Maximum | Mean Value | Standard Deviation |
|---|---|---------|---------|------------|--------------------|
| C1 | 10 | .1      | 1.00    | .8570      | .07617             |
| C2 | 10 | .85     | 1.00    | .9000      | .04667             |
| C3 | 10 | .81      | 1.00    | .240       | .06703             |

From the above table we can see, the size of the pig breeding scale showed an increasing trend, indicating that the number of pig breeding in China increased year by year. The search data show that by the end of 2015 China's pig number reached 708.25 million, compared with the end of 2004 increased by 13546.5. In addition, the amount of fertilizer per unit area increased year by year, the standard deviation is small, the sample fluctuation is small; Third, the industrial waste water discharge from 2006 to 2007 has increased, resulting from the rapid development of industry. Waste water pollution has increased, and after 2008, it has decreased, which does not represent the degradation of industry, but an indicate that the state took the strong efforts to prevent and control, and enterprises take more advanced technology to reduce industrial development emissions from waste.

### 3. Measurement and Calculation of Bearing Capacity of Environmental Pollution in China

First, analyze the relativity between the indicators of environmental pollution bearing capacity and the applicability test to determine whether the applicable factor analysis method is appropriate. The results are shown in Table 3 below:

### Table 3. Relativity

|   | C1   | C2   | C3   |
|---|------|------|------|
| C1 | 1.00 | .547 | -.892|
| C2 | .547 | 1.00 | -.686|
| C3 | -.892| -.686| 1.00 |

From Table 3 we can see that there is a correlation between the three original variables, and the maximum correlation reaches -0.892, which further shows that the original scalar is suitable for factor analysis.

Second, the extraction and naming of the factor. Then the common factor variance is shown in Table 4 below.

### Table 4. Commonality

|   | Original Value | Extraction Value |
|---|----------------|------------------|
| C1 | 1.00           | .966             |
| C2 | 1.00           | .37              |
| C3 | 1.00           | .949             |

Table 4 shows the information extracted from each of the original variables. It can be seen from the above table that the main component contains more than 90% of the original variables of the information, and then the factor variance contribution rate as shown in Table 5.
The factor variance after the extraction is very high, indicating that the extracted factors can best describe these three indicators. The variance contribution rate of factor 1 is 80.869%, the characteristic value is 2.426, the variance contribution rate of factor 2 is 16.178% and the characteristic value is 0.485. These two indexes explain the 97.047% (more than 80%) of the variance, so we extracted the first two components as the first and second principal components. Therefore, we get Table 6 below.

Table 6. Component Score Coefficient Matrix

| Component | 1   | 2   |
|-----------|-----|-----|
| C1        | .741| -.31|
| C2        | -.430| 1.161|
| C3        | -.43| .012|

Component 1 is expressed as F1, component 2 as F2, and the expression for each factor is:

\[
F_1 = 0.741 \times C1 - 0.430 \times C2 - 0.43 \times C3 \\
F_2 = -0.31 \times C1 + 1.061 \times C2 + 0.012 \times C3
\]

First two variance contribution rates (80.869%, 16.178%) were normalized (83.33%, 16.67%). Take the variance contribution rate of each factor was the weight, and the environmental pollution bearing index was obtained as follows:

\[
A = 83.33\% \times F1 + 16.67\% \times F2
\]

Factor scores and pig scale environmental pollution bearing load index are as follows:

Table 7. Carrying Index of Environmental Pollution of Pig Breeding

| Year | FB31   | FB32 | B3     |
|------|--------|------|--------|
| 2004 | -0.16245 | 0.72412 | -0.03820 |
| 2005 | -0.05019 | 0.58762 | 0.03853  |
| 2006 | -0.10344 | 0.59303 | 0.18289  |
| 2007 | -0.18057 | 0.68639 | 0.21080  |
| 2008 | -0.18491 | 0.66575 | 0.29404  |
| 2009 | -0.18629 | 0.6441  | 0.51279  |
| 2010 | -0.22729 | 0.63911 | 0.59673  |
| 2011 | -0.26276 | 0.63664 | 0.62232  |
| 2012 | -0.27896 | 0.62320 | 0.66744  |
| 2013 | -0.29393 | 0.62356 | 0.72091  |

As can be seen from the above table, with the scale of farms and pig breeding continue to increase, the density of pig farming scale growing, with the progress of society, especially the rapid economic development and industrial development in China over the past decade, and agricultural production in the field of fertilizer applications continue to increase, the whole environment is under tremendous pressure. But due to the national environmental awareness, industrial waste water discharge...
significantly reduced, China's hog farming environmental pollution load index is increasingly rising.

4. Conclusion
With the rapid advance of pig breeding, the environmental pollution caused by scale farming has been paid more and more attention by the society. Based on the statistics of China Statistical Yearbook and China Animal Husbandry Statistical Yearbook, this paper estimates the environmental pollution bearing index of China's hog production scale from 2006 to 2015. The results show that with the increase of scale and scale breeding pigs, Density and agricultural production in the field of fertilizer applications continue to increase. However, due to the improvement of national environmental awareness, industrial waste water discharge is greatly reduced. Therefore, China's hog farming environmental pollution load index is rising.

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