Impact of Grain Output on Agricultural Output Value

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Abstract: As a data directly reflecting the total scale and results of agricultural production in a region, agricultural output value is often used to measure the agricultural level of this region.Especially under the influence of COVID-19, food resources are in short supply from time to time, which makes us realize the importance of grain production.So in this article,we will mainly explore the impact of grain output on agricultural output value.We select data from the United States as the research object.According to the data we have got,we use scatter diagram, heatmap and the Simple Linear Regression which can help us know the relationship between two characteristics.Through the research, we found that grain output and agricultural output value are closely related which means grain output accounts for a large proportion of agricultural output value.At the end of the article, we describe the significance of studying agricultural development such as the importance of agriculture, agricultural development problems, agricultural development status and development direction.Key words: agricultural output value, agricultural importance, agricultural development and development direction.

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1. Introduction

1.1. Analysis of Agricultural Development

In this article, we will explore the influence of grain output on the gross agricultural value and analyze the current situation of Chinese agriculture. Agriculture is essential to survival, and with food, people can survive. Erik Lichtenberg from University of Maryland wrote a paper discuss the problems, which are an industry based on the development of Change free natural resources under stochastic conditions, and they have important implications for policy design. First, they studied the root causes of environmental problems and the intensity of resource management incentives, which may occasionally induce farmers to protect environmental quality. Then, they study environmental policy design under two common characteristics: (1) heterogeneity caused by resource variation (2) uncertainty. They studied the impact of the interaction in many ways. [1] Agriculture is also a part of international trade, when a region has redundant agricultural products, can choose export sales to areas that lack of food, and the income is also an important part of national economic development, at the same time, the agricultural production is also a lot of people live in a living, so agriculture is very important for countries to people. Uwe people. Uwe wrote a paper discuss the influence of population growth, economic development, and technical change on global food production and

consumption. In the future, people will get more food from less land and water resources. This paper quantifies the impact of four alternative development scenarios in the special report on the Millennium Ecosystem Assessment and emission scenarios on food production [2].

Agricultural output value as a direct reflection of the total scale of regional agricultural production and total results of the data is often used to measure the agricultural level of this region. It consists of agriculture, forestry, animal husbandry, fishing and other industries. Today, we are going to explore the impact of food production on agricultural output in agriculture. Especially under the impact of COVID-19, food resources are sometimes in short supply, which makes us realize the importance of food production. Moreover, with the deterioration of environment and climate, agricultural production will become more and more difficult. Pete Smith and Peter J.Gregory from University of Cambridge wrote a paper discuss the climate change and sustainable food production. It outline some possible impacts of climate change on agriculture, mitigation measures in agriculture that can be used to reduce greenhouse gas emissions, and outline the very significant challenges of sustainably feeding 9-10 billion people and reducing greenhouse gas emissions in the future climate. Each challenge is huge in itself, and we need to work together to achieve solutions in all aspects. Their conclusion is that maintaining the present situation is not a solution, and repairing the existing production system is improbable to provide the food and ecosystem services in the future; Fundamental changes in consumption and production may be required in the future [3].

Agricultural modernization is the foundation and difficulty of realizing modernization in an all-round way. Only by developing modernized agriculture can we improve the output and the resource utilization. Hussain Ali Bekhet and Abdullah Azlina from Universiti Tenaga Nasional(UNITEN) wrote a paper discuss the analyses of input-output in energy use in agriculture sector. They found that among the three energy related sectors, namely; Crude oil, natural gas and coal, gasoline and coal industry, and power and natural gas, it is found that the agricultural sector is more dependent on the input of gasoline and coal industry than the other two sectors. On the basis of these results, a number of policy implications have been proposed to assist policymakers in economic planning, particularly in the implementation of policies related to the energy and agricultural sectors [4]. The development of agriculture can promote the continuous increase of farmers' income, thereby improving their living standards and quality of life. Only with the stable development of agriculture can the life and life of all the people be better and happier.

1.2. Overall Situation of World Agricultural Development

The technological route chosen by developed countries in the initial stage of transforming traditional agriculture is mainly determined by the national conditions and resource endowment of the country. Keith Fuglie from Economic Research Service, U.S. Department of Agriculture Washington, DC wrote a paper discuss the accounting for growth in global agriculture. The paper generates aggregate growth rates of agricultural output, inputs and total factor productivity at the national, regional and global levels. It said that most countries now depend on productivity-based growth instead of resource-based growth to improve agricultural output [5]. There are three models in summary: First, the agricultural mechanization model represented by the United States, Canada, Australia and other countries is primarily aimed at improving labor productivity; Keith Fuglie, Matthew Clancy, Paul Heisey and James Macdonald from University of Cambridge wrote a paper discuss the research, productivity and output growth of American agriculture. It describes the major changes that are happening in the US. The conclusion provides some advice for future research on those problems [6]. The second is the biotechnology model represented by Japan, the Netherlands, Israel and other countries, the primary purpose is to improve the land yield rate; Third, the agricultural mechanization and biotechnology model represented by France, Germany and other countries. No matter which mode to start from, countries eventually turned to mechanization, improved seed,

chemical, electrification, information and other main content of comprehensive agricultural modernization, entered the basic convergence stage of development. Hans Binswanger from University of Oxford wrote a paper illustrate that total output can only grow if more resources are given to agriculture or the technology is changed. Also output is influenced by many other investments. Research and extension have increased the need for fertilizers. As for adjustment policies: local food supplies may not grow quickly as a result of adjustment programmes, therefore structural adjustment programmes should not only ease the balance of payments; The analysis should focus on the way to make agriculture as a whole grow [7],

1.3. Overall Situation of China Agricultural Development

In recent years, our grain output increases year by year, agriculture, forest, animal husbandry, fishery gross production value all presents continuously rapid growth trend. Julian M.Alston and Philip G.Pardey wrote a paper discuss that in the past 50-100 years, great changes have taken place in agricultural production and productivity. This is largely driven by public and private investment in agriculture, which has a meaningful impact on the world's poor. First, they discussed the decline of the share of high-income countries such as the United States in global agricultural output, and the share of middle-income countries rose. Then, they studied the different modes of agricultural input in various countries and the different productivity paths adopted by their agricultural departments. Next, they looked more closely at productivity and the reason that global agricultural productivity increase rates are decreasing, which may be serious for the food prices and supply prospects of the world's poorest people. Finally, they considered the mode of agricultural research and development. [8] Under this background, it is of great significance not only to speed up the the development of Chinese agriculture, but also to make full use of the role of agriculture in developing the national economy and improving the life of people.

The development of agriculture has always been the pursuit of high yield and high quality, crop yield is higher crop yield, which is the goal that mankind has been pursuing since ancient times, will be the eternal pursuit of human goal. T.Evans and I.F,Ward Law from Division of Plant Industry, CSIRO, Canberra, A.C.T.Australia wrote a paper discuss the comparative aspects of the development of major grain production. The origin and adaptability of main cereals are also discussed. Major grains have been proved to be highly adaptive in the evolution process. Now, each grain contains a wide range of behaviors in its varieties, especially in the time related to seasonal changes in its life cycle. [9] Different crop yield level is very different, the same crop yield level will also change at any time and space, different years, different regions, different conditions have different yields. The specific indexes of crop yield also vary with different crop species and spatial and temporal conditions. Therefore, in order to better agricultural development, scientific development of agricultural development plan, according to local conditions.

Over the past four decades of reform and opening up, China's per capita grain ownership has reached 475 kilograms, compared with 351 kilograms for the world's 7.7 billion people. From this point speaking, in fact our country agriculture already achieved great achievement overall. Especially in staple foods such as rice, wheat and maize, production and demand are basically matched. But China imports more than 10 percent of its grain to meet demand, according to 2014 Chinese data, and recent imports have exceeded record levels. China has become the world's largest net importer of grain, relying entirely on the United States, South America, Australia and other countries with small populations for its imports, although China has stuck to the red line of 1.8 billion mu of arable land. But our country's agriculture still has many problems in the field of production.

1.4. China Agriculture Development Faces Roughly Three Problems

First: Problems facing agricultural development in China: agricultural management "small, scattered, chaotic" problems need to be broken through; The technical level of agricultural production is backward; Agricultural industrialization degree is not good, the organization of production body, scale degree is low.

Second: High - quality agricultural workers is lacking, it is difficult to meet the needs of modern agriculture. The phenomenon of "low grain prices hurting farmers" frequently broke out.

Third: Agricultural production quality is not high, ensure modern agriculture to develop hard. At the same time, due to the lack of strict maintenance and management measures, water quality pollution leads to further decline in water resources quality. Charles J.Godfray wrote a paper discuss the food security. It said that continued population and consumption growth means that global demand for food will increase for at least the next 40 years. Except for overexploitation of fisheries, increasing competition for land, water and energy will influence us producing foodstuff, as will the urgent need to decrease the environmental influence of foodstuff systems. The influence of climate change is a further crisis. However, people can make more food and make sure that it is used in a more efficiently and equitably way. We need a numerous-ways and interrelated strategy to assure sustainable and fair food security [10],

1.5. China Has Superior Conditions to Develop

Agricultural areas are mainly distributed in the middle and low latitudes, with favorable heat conditions. Summer is generally high in the country, and the rain and heat are the same period. The quality of cultivated land is good, and the biological resources are rich. And the southern region is humid, rich in water and heat resources, the terrain is mostly plain, basin plateau.

2. Implementation

Step 1: Finding, sorting and understanding the data
After locked our target, we were started to find the data. Although there were some issues happened at the beginning, we found a number of data.

To let the program know and display the sorted values in front of us. Lastly, with the following data, we can easily recognize witch data was the one we need.

Step 2: Visualising the Data
Use what we got in the first step to create a table about how the data were related to each other. According to the table, the depth and the magnitude of the color and the number represent how much did the data connect to each other. When the color and the number is deeper and bigger, it means two groups of data has a stronger relationship.
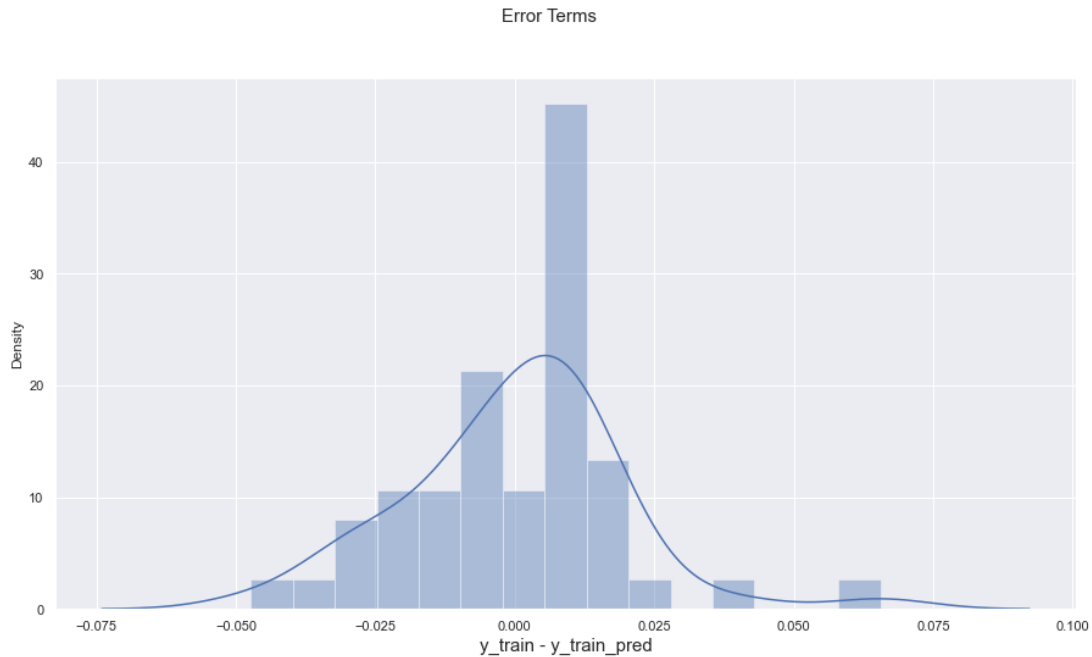
Step 3: The Simple Linear Regression
According to the data we've got, we can use the following code to create a regression table.

So a regression table with all the information on it appears. There were a bunch of information that we need to decide is the data good or bad. Firstly, the R-squared & Adj. R-squared value. We should make those two values as big as possible but lower than 1. The closer to 1 the easier to prove how good our data was. The next one was the P value, if the P value was lower than 5%(0.05) that means the data were all right or it means there must be something went wrong. After that is the normal distribution, if the two groups of data in the ND didn't include 0 between them, it means our data won't accept 0 hypothesis.

Step 4: Analysis of the Left Over Data
The purpose of this step is to make sure the error data is also normally distributed. From the following code we can get a normal distribution chart.

Error Terms

Form the chart we can see the mean value is nearly to zero, so there was nothing went wrong in our data.

3. Standard Linear Regression Model

3.1. Total Linear Regression

The simplest model in regression analysis, is a linear regression model that has only one independent variable and one dependent variable, that is, a univariate linear regression model, also known as a simple linear regression model

The formula can be written as:$Y_t = \beta_1 + \beta_2 X_t + u_t$. The formula above is named the overall regression function. Where β_1 and β_2 is an unknown parameter (regression coefficient). y_t and x_t are the T-th value of Y and X, respectively. u_t is a random error term. It is a special random variable, reflecting the influence of other factors not included in the equation on y.

3.2. Sample Linear Regression

In reality, because there are too many units, we can't control all the values, so we need to estimate them.

The formula can be written as:$\widehat{Y_t} = \widehat{\beta_1} + \widehat{\beta_2} X_t$, where $\hat{y}_t$ is the y value corresponding to x_t on the sample regression line, which can be regarded as the estimation of $E(y_t)$; The sample regression function of the intercept coefficient is $\widehat{\beta_1}$, and $\widehat{\beta_2}$ is the slope coefficient of the sample regression function. They are evaluate values of the overall regression coefficients $\widehat{\beta_1}$ and $\widehat{\beta_2}$.

The actually observed y_t value of the dependent variable is not exactly equal to $\hat{y}_t$. If e is used to represent the difference between the two, $e_t = y_t Y - \hat{y}_t$, then there is:$\widehat{Y_t} = \widehat{\beta_1} + \widehat{\beta_2} X_t + e_t (t = 1,2,\ldots,n)$. The name of the formula is sample regression function. In the formula, e_t is the residual.

The purpose of this formula is to make the sample regression function as near as possible to the true population regression function.

4. The Estimation of Standard Linear Regression Model

4.1. The Estimation of Population Variance

The formula is: $S^2 = \frac{\sum e_t^2}{n-2}$. The numerator is the sum of the squares of the residuals, and the denominator is the degree of freedom, where n is the number of sample observations, and 2 is the number of regression coefficients in the linear regression equation. The positive square root of S^2 is also called the standard error of regression estimation.

4.2. Properties of Least Squares Estimator

Under the condition that the standard assumption can be satisfied, the expected value of the least squares estimator of the regression coefficient is equal to its true value.

The formulas are: $E(\widehat{\beta_1}) = \beta_1 E(\widehat{\beta_2}) = \beta_2$. And the variance: $Var(\widehat{\beta_1}) = \sigma^2_{\widehat{\beta_1}} = \sigma^2 \left(\frac{1}{n} + \frac{\overline{X}}{\sum(X_t - \overline{X})^2} \right) Var(\widehat{\beta_2}) = \sigma^2_{\widehat{\beta_2}} = \frac{\sigma^2}{\sum(X_t - \overline{X})^2}$. The least squares estimator is a linear function of y_t , and its expected value is equal to the true value of the overall regression coefficient. Thus, the sample size and the variance are in inverse proportional (when sample size increases, variance decreases).

Gauss Markov theorem shows that the least square estimator is the best estimation method under the standard assumption. However, this only shows that if we estimate repeatedly or expand the sample size, the estimated value calculated by the best estimation method is most likely to approach the true value.

5. Model (Linear Regression)

Linear regression is the method we used in this experiment. Its definition is: A statistical analysis method that uses regression analysis in mathematical statistics to determine the interdependent quantitative relationship between two or more variables. Also, there are some formulas related to it.
Overall correlation coefficient:$\gamma = \frac{Cov(X,Y)}{\sqrt{Var(X)Var(Y)}}$. Sample correlation coefficient:$r = \frac{\sum(X_t - \overline{X})(Y_t - \overline{Y})}{\sqrt{\sum(X_t - \overline{X})^2 \sum(Y_t - \overline{Y})^2}}$. The calculation formula:$r = \frac{n\sum X_t Y_t - \sum X_t \sum Y_t}{\sqrt{(n\sum X_t^2 - (\sum X_t)^2)(n\sum Y_t^2 - (\sum Y_t)^2)}}$. The purpose of using this formula is to find the size of r. The value of r is between 0 and 1, and when r is equal to 0, x and y are related. When r is greater than 0, x will increases when y increases. When r is less than 0, x will decreases when y decreases.

```
                          OLS Regression Results
==============================================================================
Dep. Variable:     Total agricultural output   R-squared:              0.992
Model:                              OLS   Adj. R-squared:              0.992
Method:                   Least Squares   F-statistic:                 6088.
Date:                Sat, 27 Aug 2022   Prob (F-statistic):        3.17e-52
Time:                        00:03:44   Log-Likelihood:             126.50
No. Observations:                  50   AIC:                        -249.0
Df Residuals:                      48   BIC:                        -245.2
Df Model:                           1
Covariance Type:              nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const           0.0660     0.008      8.070      0.000      0.050      0.082
Crops output Total  0.9280     0.012     78.024      0.000      0.904      0.952
==============================================================================
Omnibus:                       5.617   Durbin-Watson:               1.646
Prob(Omnibus):                 0.060   Jarque-Bera (JB):            6.506
Skew:                          0.290   Prob(JB):                   0.0387
Kurtosis:                      4.669   Cond. No.                    6.13
==============================================================================
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According to the table, we can see that the values of r-squared and adjusted r-squared are very close to 1, and the value of p is also very close to 0, indicating that there is a strong relationship between the data.

Let's move to the next section of data. According to this section of data, we can get a function of y=kx+b, where the total crop output corresponds to k value and constant -- constant corresponds to b value. Next, on the value of p, a perfect zero. As for the confidence interval, the data in the table shows that 0 is not within the confidence interval, so we will reject the null hypothesis and accept the replacement hypothesis, that is, there is a close relationship between the two groups of data.

According to the formula, the estimate value we got is 0.9927428398541723, which is near to 1. It means Crops output Total is very important to Total agricultural output. So we can increase total agricultural output by increasing Crops output Total.

6. Conclusion

The development history of the world agricultural modernization road shows that the importance of agriculture is self-evident, and each region and country has different national conditions and geographical environment, so each region and country has a development path that suits its own characteristics. Therefore, there is no immutable fixed mode to realize agricultural modernization, and only starting from reality is the correct choice to achieve success.

Based on the experience of domestic and foreign agricultural modernization, and the current situation and basic conditions of our agricultural status quo, the basic connotation of agricultural modernization with Chinese characteristics can be summarized as follows: to give enough food, improve the degree of benefit of farmers, sustainable development of resources as the goal, improving agricultural labor productivity, resource output rate and commodity rate as the approach, supported by modern science and technology and equipment, on the basis of household contract operation, and under the comprehensive action of market mechanism and government regulation, We will build a diversified industrial form and multifunctional industrial system that closely connects agriculture, industry and trade, integrates production, processing and marketing.

6.1. The Development Path of China's Characteristic Agricultural Modernization Is Mainly Because of Those Factors

First, at present, the agricultural productivity level of China is not high, compared with the average level of the developed country science and technology contribution rate is lower 20 ~ 30 percentage points. Therefore, the realization of agricultural modernization must improve the level of agricultural science and technology, through increasing capital input, applying modern science and technology and equipment, moderate concentration of land and strengthening organization and management to improve agricultural efficiency.

Second, modern agriculture is oriented by market demand. The main purpose of farmers engaged in agricultural production is to provide commodities for the market and maximize profits. The operation scale of farmers in China is generally small, and the degree of marketization of agricultural commodity rates and agricultural resources allocation is low. Therefore, it is urgent to strengthen the comprehensive effect of market mechanism and government regulation.

Third, managing agriculture with industrialized means has become an important feature of modern agriculture. In our country, there are about 250 million farmers, not only a large number and small scale, but also similar structure and behavior, it is very difficult to effectively connect with the changing market. Therefore, to promote agricultural modernization, we must build the agricultural industry and trade cohesive, production and marketing merges into one, diversified industrial form and multifunctional industrial system. In this process, we must vigorously develop farmers' professional cooperative organizations, through various types of farmers' cooperatives to set up various forms of leading enterprises, so that farmers can really enjoy the results of the sale of income.

Fourth, The issue of food is always a top priority. So we have to pay attention to farmers' livelihoods. These hard workers should be rewarded accordingly. Only by solving the problem of food and clothing can the country be basically stable and begin to develop at a high level.

6.2. In Brief, China's Agricultural Modernization Development Is Roughly Divided into Four Directions

First, develop modern agriculture, improve the yield land's rate and the utilization rate of resources, produce safe agricultural products in large quantities, develop agricultural science and technology, improve the service system, and enhance the quality of agricultural production

Second, develop the organization of production, integrate production and management, connect the market, better develop brand construction and industrial integration, so that farmers can enjoy the profits and increase their income

Third, the state should increase the training of high-quality agricultural labor force, enhance the status of agricultural labor force, make full use of the ability of talents in the new era, and reduce the phenomenon of "cheap grain hurting farmers"

Fourth, improve the quality of agricultural production, improve the relevant maintenance and management measures. While developing agriculture, we should protect the ecological environment, develop new energy sources, reduce resource consumption and reduce pollution. Water resources are closely related to agriculture. Only by protecting the quality of water resources can we better irrigate farmland, develop agriculture and guarantee People's Daily life

Finally, according to our research, food production has a huge impact on agricultural output value. Therefore, if we want to develop agriculture well, we must increase food production. Only by developing agriculture well can people's lives be guaranteed, the people become more and more happy, and the country become more and more prosperous

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