Journal of Economics and Public Finance
ISSN 2377-1038 (Print) ISSN 2377-1046 (Online)
Vol. 8, No. 4, 2022
www.scholink.org/ojs/index.php/jepf

Original Paper

The Impact of Diversified Income and Agricultural Tax Reform on the Consumption of Chinese Rural Residents

Fangyuan Zhou[1], Xiao Luo[2] & Kandorera Angela Nujoma[2*]

[1] Business School, University of Shanghai for Science & Technology, China

[2] SILC Business School, Shanghai University, China

[*] Corresponding author, Kandorera Angela Nujoma, SILC Business School, Shanghai University, China

Received: October 20, 2022 Accepted: November 12, 2022 Online Published: November 24, 2022

doi:10.22158/jepf.v8n4p75 URL: http://dx.doi.org/10.22158/jepf.v8n4p75

Abstract

Income from different sources has become an important guarantee to sustain family life and normal expenses in China. How different sources of income affect farmers' expenditure levels and how they have influenced farmers' consumption since the agricultural tax reform in China since the 20th century has become a question worth exploring. Panel data from 2016 to 2020 are utilized to examine rural residents' consumption expenditures and their sources of disposable income by region to analyze the impact of different income sources on farmers' consumption and the correlation between income before and after agricultural tax reform, and finally conducts an analysis of future scenarios based on a time series model. The research results show that the elasticity of income from different sources on rural households' per capita consumption expenditure is different, among which wage income is the most elastic, while household business income has a relatively small effect on consumption expenditure, but through data analysis we can find that agricultural tax reform has a significant and continuous promotion effect on rural households' per capita consumption expenditure. The continuous cycle of agricultural tax reform is long, and the transmission chain through less tax payment, expanded reproduction, harvest, realization, and then consumption is long, thus there is a certain lag in tax reduction effect. Income from such sources in the first three years has a large impact on the current period data, while the first four and five years have a relatively small impact on current business income.

Keywords

Agricultural tax, Household income composition, Rural China, Consumption expenditure, Tax reform

1. Introduction

2020 is a decisive year in the fight against poverty. The structure of farmers' disposable income sources has changed as the goal of reaching a moderately prosperous society across the board continues to advance. As part of China's industrialization and rapid economic growth, the well-being of China's rural residents has improved significantly during this period (Chen, Xia, & Wang, 2021). Subject to climate change, the value output of traditional agriculture is decreasing, while farmers are more willing to increase their off-farm work hours to earn a relatively stable income (Khanal, ashoka, & Nedumaran, n.d.). In addition, the government's specific poverty alleviation policies, rural health insurance, survey subsidies, and incentive income have become an essential component of Chinese farmers' disposable income as transfer income, which affects their consumption intentions.

Rural business income among farmers' income sources is more vulnerable to external factors, especially taxation. In the past two decades, China's agricultural taxation policy, which has continued for centuries, has undergone several changes from 2000 to 2003. The central government has implemented agricultural tax reform. Local governments no longer levy fees on farmers, who are only required to pay a single amount of money in agricultural tax. There was a gradual reduction in the agricultural tax rate between 2004 and 2005 (Wang & Shen, 2014). The issue of farmers' burden reduction and gradual pilot work on tax and fee reform began in 1990. As a result, the Agricultural Tax Regulations of the People's Republic of China were abolished in 2006. The national farmers reduced the burden of about 125 billion yuan per year, and the per capita burden reduction of 140 yuan left stone, increasing the disposable income of farmers in business income and consumer expectations. However, there will be some lags due to the dual impact of the tax reduction chain and the agricultural cycle. Following is the remainder of this paper. Literature reviews are presented in Section 2, while data sources, data processing, and research methodologies are presented in Section 3. Section IV presents and analyzes the weights of the impact of diversified sources of rural household income on expenditure, the event correlation of business income before and after the agricultural tax, and forecasts for the period 2016 to 2020. Section 6 concludes and outlooks the whole paper.

2. Literature Review

According to existing studies (Thaler, 2008), researchers have found that income structure affects consumption structure significantly and that rural residents behave in line with the "mental accounting" theory. Therefore, the government optimizes the way and proportion of income sources to promote farmers' expenditure and consumption levels. The theory of income and consumption is an excellent starting point to understand how the diversity of incomes in Chinese rural households affects their per capita disposable consumption. Consumption theories have continuously been updated and iterated as the commodity economy developed, adding more influencing factors. Scholars have conducted countless studies and theoretical analyses on the binary relation between consumption and income. According to Keynes's (1936) "absolute income theory", income and consumption are related in the short run, so consumption depends on residents' current, absolute income, and there is a stable, functional relationship between consumption and income. Generally, the marginal propensity for consumption is referred to as MPC, and as income increases, the MPC propensity to consume will continuously decrease. Adding to this theory, Dusenbery (1949) proposes the "relative income consumption theory", which considers the intrinsic correlation between consumers. According to this theory, consumers are influenced by their own consumption habits and the consumption level of their surroundings, and there are "ratchet effects" and "demonstration effects", which shift upward with society's increasing average income (Xu, 2017). These effects naturally affect rural residents, who are a unique segment of the entire population. Based on Friedman's theory of permanent income consumption, consumers' consumption is determined by their permanent incomes, not their current incomes. Because the increased income from tax cuts will not be used for consumption immediately, government policies to influence aggregate demand by increasing or decreasing taxes will not work. Thaler (2008), a Nobel laureate in economics, proposed the hypothesis of "mental accounting", which enhances consumption theory from a behavioral economic perspective. As a starting point and background hypothesis for this study, the theory states that people have different attitudes to different sources of income, which will be reflected in their behavior.

Existing research suggests that diversified income sources can effectively enhance household well-being in developing countries (Sultana, Hossain, & Islam, 2015), a large part of which is reflected in per capita consumption capacity. The benefits of income diversification can be considered as follows: Diversification of income removes own labor as the sole object of value creation (Xu, 2017), and leasing land and government subsidies and compulsory insurance can stabilize expectations to stimulate consumption. Diversified income hedges the impact of climatic factors on agricultural products (Alderman & Paxson, 1994) and can mitigate income risk and increase the absolute value of income. Among them, rural household business income is held back by taxation, and the driving role of Chinese agriculture on the economy determines the application of the agricultural taxation system (Wang, 2008). Scholars have offered different views on the topic of agricultural tax reform. Luo et al. (2007) point out that tax reform has to some extent, weakened rural financing, reduced the level of rural development, and lowered the well-being of rural residents. Scholars such as Gale, Lohmar, and Tuan (2005) argue that eliminating agricultural taxes was a landmark development, but the results seem to have led to only modest income growth. Heerink, in a 2006 study, found that the net income of rural households improved by a relatively significant 5% to 11% after the agricultural tax change was eliminated.

The findings of the above scholars can be briefly summarized as follows: Diversified income contributes to the well-being of peasant households, mainly in terms of consumption. Different sources of income have different impact factors on consumption, which are influenced by the "psychological accounting" theory. The increase in business income from agricultural tax reform is limited and weak. The impact of different sources of income on consumption may vary depending on the time and policy development of the study, and the reform of agricultural taxes and fees should be time-dependent in terms of the rural household business income. There is a lag in the effect of tax reduction due to its long duration cycle and long transmission chain through less tax payment, expanded reproduction, harvesting, realization, and then consumption. Therefore, this study selects panel data of per capita consumption expenditure of rural residents by region, per capita disposable income sources of urban residents by region from 2016 to 2020, and time series data of net household business income of Heilongjiang, a large agricultural province, from 1990 to 2020, and investigates the effect of tax reduction by using R language to establish multiple linear regression models, ARIMA models, and GARCH models from 2000 to The impact of agricultural tax reform implemented in stages from 2006 on household net business income and thus acting on rural household per capita consumption expenditure.

3. Research Methodology and Data Selection

In multiple linear regression, an independent variable is analyzed in relation to multiple independent variables in order to find a quantitative relationship between them. Multiple linear regression can be described mathematically as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + +\beta_p x_p + \varepsilon$$

Where y is the dependent variable, $x_1 \cdots x_p$ is p independent variable; β_0 is the constant term, $\beta_0 \cdots \beta_p$ is partial regression coefficient; β_j indicates the average amount of change in the dependent variable y caused by the independent variable x_j alone for each unit change in the other independent variables fixed. ε is the random error, which obeys the $N(0, \sigma^2)$ distribution.

The ARIMA model requires that time series be stationary. Because the data are smooth, there will be no trend or seasonality factors over time, resulting in constant autocorrelation, mean, and variance. We can obtain the required result by taking the successive differences of a time series if it is not stationary sometimes to convert it into a stationary series. Time series (y) are commonly measured as serially dependent using AR models, whose AR terms describe how much a series (y) depends on previous error terms. MA terms describe how much the series (y) depends on prior error terms (Montgomery, Jennings, & Kulahci, 2015). Modeling a univariate time series with an Autoregressive Moving Average (ARIMA) (m, r) contains the following structure:

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \cdots + \gamma_m y_{t-m} + \epsilon_t + \beta_1 \epsilon_{t-1} + \cdots + \beta_r \epsilon_{t-r}$$

ACF and PACF can be used to select the appropriate order of polynomials, and theoretical bounds of the AIC, BIC, or AICc information criterion can also be used to select rival ARIMA models (Box, Jenkins, Reinsel, & Ljung, 2015).

GARCH hybrid models consist of two stages. The first stage fits the ARIMA best model for a smooth and linear time series, and the second stage fits the residuals, representing the data's nonlinear part. Following the first stage, a GARCH model is fitted to cover the nonlinear residuals. Therefore, this hybrid model of ARIMA GARCH is used to evaluate the time series. Model (1) is used in the first phase, and a GARCH model (2) is used in the second phase. In other words, the GARCH (m, r) model, with m being GARCH terms and r being ARCH terms, is equal to the ARCH model when m=0. The ε_t are as follows $\varepsilon_t = \sigma_t y_t$, y_t is white noise.

$$\sigma_t^2 = \omega + \sum_{i=1}^{m} \vartheta_i \varepsilon_{t-1}^2 + \sum_{i=1}^{r} \mu_i \sigma_{t-1}^2$$

The sources of household income and per capita household consumption in rural areas of all provinces, autonomous regions, and municipalities from 2016 to 2020 were taken as the study sample. Heilongjiang Province was selected for the time series analysis to obtain relevant agricultural development data from 1990 to 2020. The data were obtained based on the China Statistical Yearbook (1990-2021).

Rural household business income includes farming, planting, animal husbandry, and other aspects. Rural household business income is the total output value of the agricultural operator's business in this year or a quarter minus the total output value of the investment. The profit gained is called Rural household business income.

Wage income refers to all labor remuneration employed persons receive through various means, including wages from the main occupation they are engaged in and other labor income from second jobs, other part-time jobs, and sporadic labor. Income from rural transfers is worth goods, services, funds or ownership of assets, etc., received by rural households and household members without any counterpart payment, and does not include funds provided without compensation for fixed capital formation.

As seen in Table 1, the standard deviation of per capita consumption expenditure of agricultural households nationwide is 3480.70, indicating significant regional differences in rural consumption levels across provinces and municipalities. The differences between the maximum and minimum values of household business income, wage income, and transfer income are prominent in each province and city. Some can reach the comprehensive view that the descriptive statistics results of all variables are reasonable and in line with expectations. All the data are normalized, and the data are substituted into the model for operation to eliminate the influence of the magnitude on the model and make the fit more accurate.

Table 1. Descriptive Statistics of Main Variables

Variables	Average	Standard deviation	Minimum value	Maximum value
Con	12329.61	3480.70	6070.32	22448.89
Agrincome	5233.81	1573.59	1372.79	9141.07
Salary	6654.68	4688.82	2124.96	21376.01
Trans	2998.13	1227.80	1270.06	10693.201

4. Empirical Analysis

First, the natural logarithm of the explanatory and explained variables is taken to reduce the magnitude effect on the data and make the relationship more evident in the scatterplot so that the points are more evenly distributed around the fitted line. We Use R to find that rural business income and rural household per capita consumption expenditure are inversely related, which deviates from the previous prediction of the relationship between them. The data samples show that the data from megacities such as Beijing and Shanghai are too extreme, which may affect the model building, but their data are also fundamental values. Their effects on the model will be discussed in the regression diagnosis section.

The per capita rural household consumption expenditure was selected as the explanatory variable. The net income from engaging in agricultural business, wage, and transfer income were used as explanatory variables to construct the following model.

$$\ln(Con_i) = \beta_0 + \beta_1 \ln(Agrincome_i) + \beta_2 ln(Salary_i) + \beta_3 ln(Trans_i) + \varepsilon_i$$

where i denotes a city or a province, $\varepsilon_i$is the residual term, and β_0 denotes the constant term.

The above model is fitted using the OLS least squares method, the covariance test is performed according to the VIF variance inflation factor, and the correlation coefficient matrix is obtained with the graph for the auxiliary judgment, and the results are as follows.

Table 2. VIF Variance Inflation Factor Test

Agri_log	Salary_log	Trans_log
1.13	1.38	1.25

Table 3. Correlation Coefficient Matrix

	Con	Agrincome	Salary	Trans
Con	1.0000	-0.0558	0.883	0.639
Agrincome	-0.0558	1.0000	-0.326	-0.194
Salary	0.883	-0.326	1.0000	0.504
Trans	0.639	-0.194	0.504	1.0000

Table 2 shows that the VIFs of Agri_log, Salary_log, and Trans_log are small. However, referring to the correlation coefficient matrix, we can learn that there is a significant correlation coefficient between the explanatory variable salary and the explanatory variable Con. It can be concluded that the model may have covariance and may need to eliminate the correlation problem between the explanatory variables to get the optimal model.

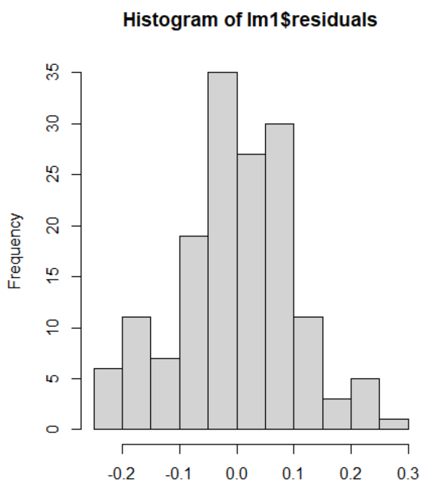
Stepwise regression analysis was performed on the models, and the AIC criterion was used as the basis for judgment to select the model with the smallest AIC value, and the related results are shown in Figure 1.

```
Start:  AIC=-702
Con_log ~ Agri_log + Salary_log + Trans_log

             Df Sum of Sq  RSS  AIC
<none>                     1.59 -702
- Agri_log    1      0.49 2.08 -662
- Trans_log   1      1.19 2.77 -618
- Salary_log  1      4.57 6.16 -494

Call:
lm(formula = Con_log ~ Agri_log + Salary_log + Trans_log)

Coefficients:
(Intercept)     Agri_log   Salary_log    Trans_log
      2.606        0.166        0.353        0.292
```

Figure 1. Automatic Selection of Model Function Calculation Results

From Figure 1, the optimal model under the AIC criterion can be obtained without excluding the explanatory variables.

Plotting residual histograms and normal Q-Q plots to observe whether the sample residual distribution conforms to a normal distribution.



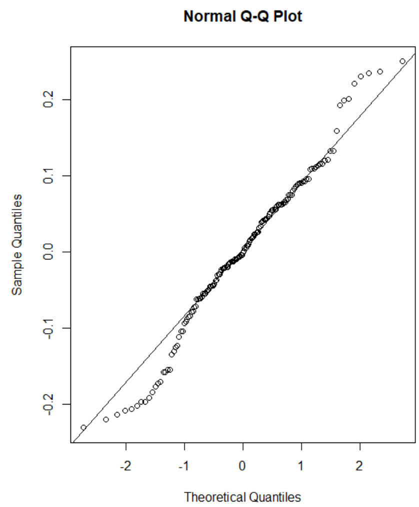


Figure 2 Residual Histogram **Figure 3 Normal Q-Q Plot**

From figures 2 and 3, we can observe that the sample residuals obey a normal distribution, which is consistent with our basic assumption of OLS least squares. The following quantitative determination of whether the residuals obey a normal distribution is made from skewness, kurtosis, and the D.W. test.

Table 4. Skewness, Kurtosis, and D.W Test Correlation Results

Skewness	kurtosis	D.W.	p-value
-0.0887	3.02	2.08	0.666

From Table 4, we know that the skewness of the sample residuals is slight, and the kurtosis is close to 3, which is in line with the requirements of normal distribution. At the same time, the D.W. test value is near 2, and the p-value is 0.666, which is more significant than 0.05, the residuals are not serially correlated, and the original hypothesis is accepted that the residuals obey normal distribution and the sample data pass the residual test.

During the data preprocessing, we mentioned that there would be more extreme data in the sample values. Beijing and Shanghai, for example, are diagnosed as they deviate significantly from the fitted regression line in the image of the explanatory variable net income from farming operations versus the explanatory variable rural household consumption expenditure per capita. Diagnostics are performed using the hatvalues function and the Cook distance method.

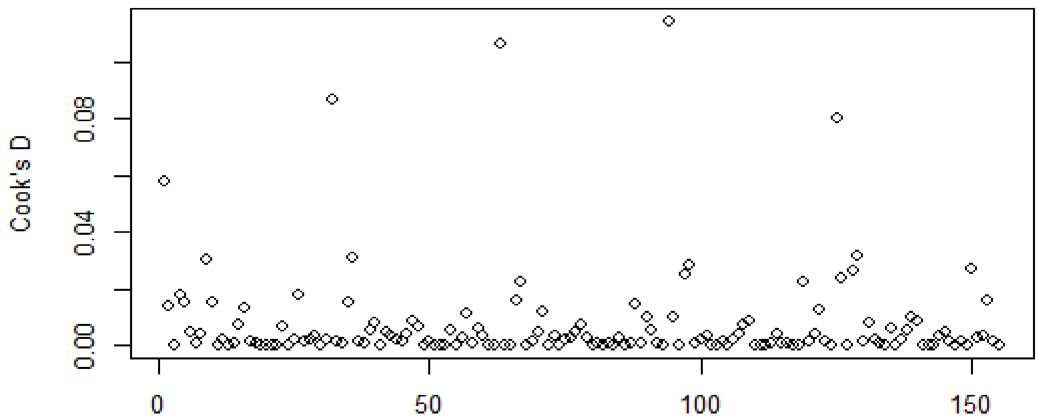


Figure 3. Cook’s Distance Function Representation Diagram

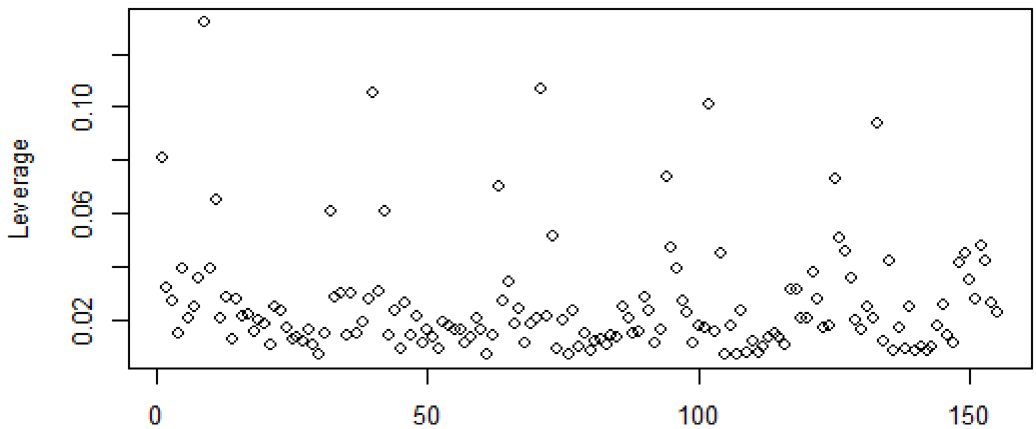


Figure 4. Hatvalues Function Representation Diagram

We can find that the hatvalues function and the Cook distance can detect data anomalies in the samples. The detections appear regularly in the figure, concentrated around the values 0.1 and 0.08, respectively; after sample verification, they are the exact Beijing and Shanghai we discussed previously. The verified data do not appear to be input errors but are instead consistent with specific economic laws; thus, the outliers need not be excluded from the model.

The results of fitting the final model above show that the rural household business income, wage income, and transfer income are very significant for the per capita consumption expenditure. The explanatory variables of the model are significant and have sound explanatory effects. Moreover, the adjustments are relatively large, and the model fits well. The F-statistic and p-value are good indicators of the model's overall explanatory power, and the model is successful overall.

Table 5. Model Fitting Results

	Estimate	Std. Error	t value	P(>|t|)	
(Intercept)	2.6060	0.3251	8.02	2.8e-13	***
Agri_log	0.1661	0.0243	6.83	1.9e-10	***
Salary_log	0.3529	0.0169	20.85	< 2e-16	***
Trans_log	0.2923	0.0275	10.63	< 2e-16	***
R^2	0.857				
Adjusted R^2	0.854				
F statistics	301 on 3 and 151 D				
p value	<2e-16				

Significance of t-statistic：0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

We can obtain the following model：

$$ln(Con_i) = 2.6060 + 0.1661\, ln(Agrincome_i) + 0.3529 ln(Salary_i) + 0.2923 ln(Trans_i) + \varepsilon_i$$

Rural household business income, wage income, and transfer income are all positively proportional to the per capita consumption expenditure of rural households, which meets the economic significance. The three coefficients are different, consistent with people's expectations of the impact of different income compositions on consumption levels. Comparatively, wage income substantially affects rural households' per capita consumption than transfer income.

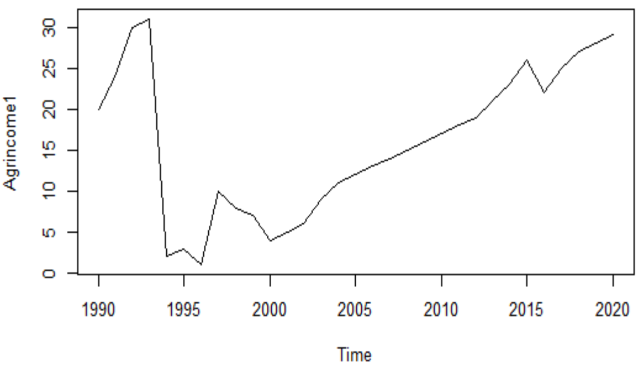


Figure 5. Time Series Variation of Raw Data on Rural Business Income

The figure shown is the time variation of rural household business income. We can initially observe a particular trend and pattern of rural household business income over time, and it is not a random variation. At the same time, combined with the real meaning of economics, the data selection is correct and can be analyzed in the next step. However, it is also found that the time series image of rural household business income is volatile, and the time series is not smooth. Then after the analysis by autocorrelation coefficient and partial autocorrelation coefficient test, the time series should be processed for smoothness.

The original data's ACF and PACF plots have large fluctuations, and the correlation and partial autocorrelation coefficients of the higher-order lagged terms are significant. They do not converge to zero significantly, and there is no evident truncation and trailing phenomenon, while there is a trend of upward. The ACF plot has more data beyond the upper confidence interval and the lower confidence interval, i.e., twice the σ interval, so it can be considered that the time series of both are not smooth. Therefore, the time series data are differenced and the ACF autocorrelation coefficient and PACF partial autocorrelation coefficient tests are performed again in the hope of obtaining a smooth series.

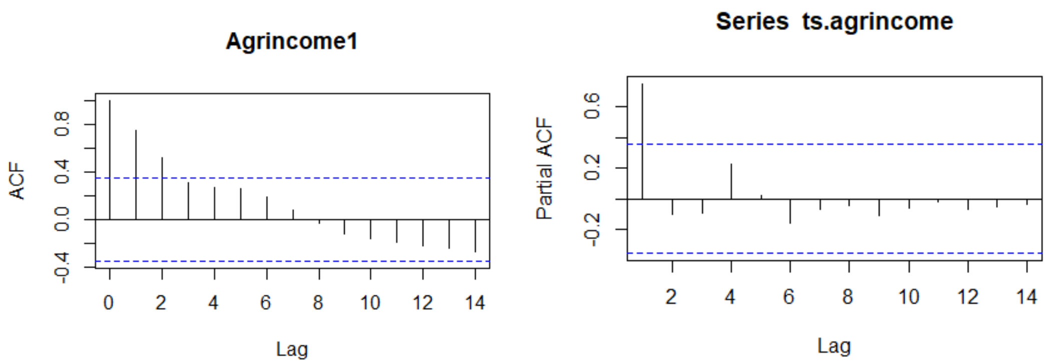


Figure 6. Raw Data on Rural Household Business Income ACF, PACF Plots

As shown in Figure 7, there are still specific trends and patterns in the changes of rural household business income data over time after first-order differencing, and the original data characteristics are retained. As shown in Figure 8, after first-order differencing, the fluctuations of ACF and PACF plots of rural household business income are small, there is no obvious trend of change, and there are certain truncated tails and trailing tails, so the time series can be considered stable and pass the ACF and PACF tests.

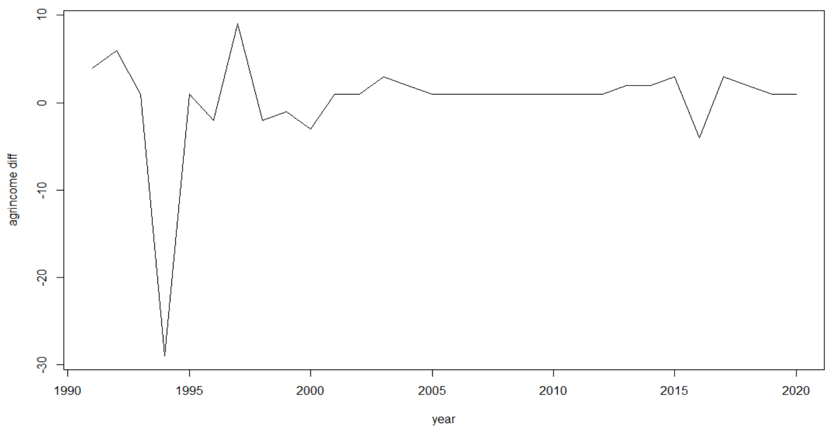


Figure 7. Time Series Variation of First-order Differential Rural Household Business Income Data

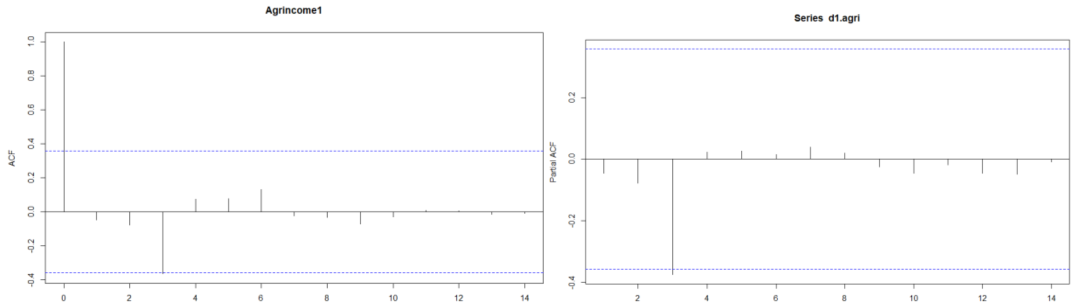


Figure 8. ACF and PACF Plots of Time Series of First-order Differential Rural Household Business Income Data

The white noise test is applied to the first-order differenced rural household business income time series data using the Ljung-Box method. It can be found that the p-values of the LB test for the 12th-order lag term are all greater than 0.05, and the original hypothesis is not rejected, which means that the tested time series is not considered a white noise series and does not pass the white noise test, and further optimization of the data is required.

Table 6. LB Test Results for First-order Differential Rural Household Business Income Time Series Data

Lagging order	p-value	Lagging order	p-value
1	0.8	7	0.5
2	0.9	8	0.6
3	0.2	9	0.7
4	0.3	10	0.8
5	0.4	11	0.8
6	0.4	12	0.9

Table 7. LB Test Results for Second-order Differential Rural Household Business Income Time Series Data

Lagging order	p-value	Lagging order	p-value
1	0.005	7	0.1
2	0.02	8	0.2
3	0.009	9	0.2
4	0.01	10	0.3
5	0.03	11	0.3
6	0.05	12	0.4

Table 8. LB Test Results for Third-order Differential Rural Household Business Income Time Series Data

Lagging order	p-value	Lagging order	p-value
1	8e-05	7	5e-04
2	5e-05	8	0.001
3	4e-05	9	0.002
4	5e-05	10	0.004
5	1e-04	11	0.007
6	3e-04	12	0.01

After the third-order difference of rural household business income, we can get its p-value within the 12th order is less than 0.05, and the original hypothesis is rejected, which means that the tested time series is not a white noise series and has research value through the white noise test, and can be further analyzed.

Three unit root tests were performed on the above time series data after third-order differencing. The calculated p-values of the third-order difference time series data are shown in Table 9. The p-value is smaller than 0.05, and the original hypothesis is rejected, i.e., The time series data is considered smooth, and no more multi-order differences are needed.

Table 9. Unit Root Test Results for Third-order Difference Time Series Data

	Series	Delay order	P value
		1	0.001
RIT Diff 3	series 1	2	0.001
		3	0.001
		1	0.001
	series 2	2	0.001

	3	0.001
	1	0.001
series 3	2	0.001
	3	0.001

The third-order differenced post-operating income time series type of constant-mean, trendless p-order autoregressive process with a lag order of 3 is considered smooth, and the optional values of the parameters are given, allowing for the next step of the analysis.

4.1 Model Identification

As shown in Figure 9, after the third-order differencing, the rural household business income data still have specific trends and patterns over time, and the original data characteristics are retained. As shown in Figure 10, after first-order differencing, the ACF and PACF plots of rural household business income show less fluctuation and no apparent trend, so the time series can be considered stable and pass the ACF and PACF tests. The ACF value falls into the confidence interval quickly, showing the trailing nature; the PACF value falls into the confidence interval, showing the trailing nature. Therefore, the ARMA model is considered to fit the two-time series, and the ARIMA model is used for the original series considering that it is the time series after the third-order difference.

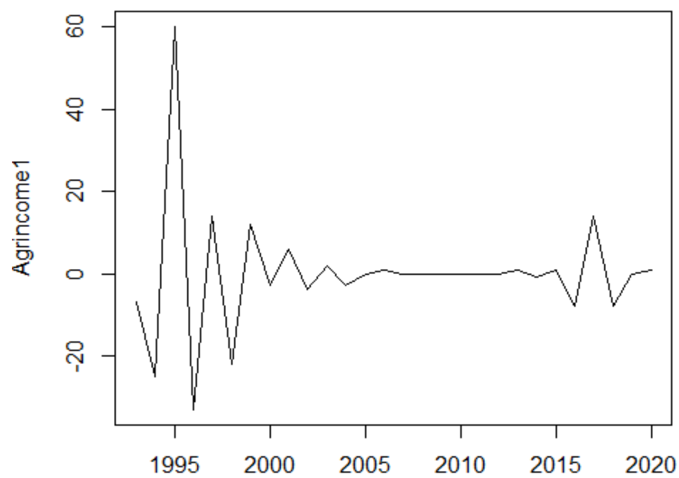


Figure 9. Time Series Variation of Third-order Differential Rural Household Business Income Data

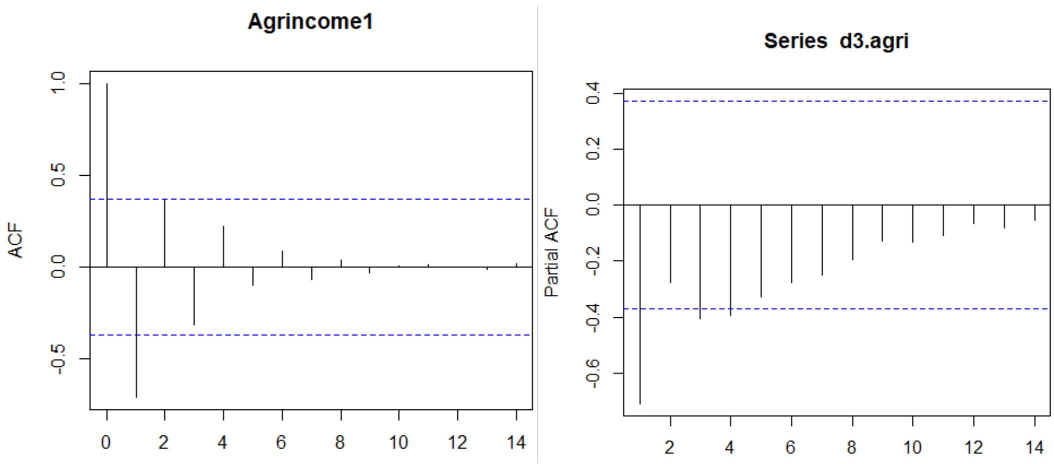


Figure 10. ACF and PACF Plots of Time Series of Third-order Difference Rural Household Business Income Data

Under the assumption that the differential order is 3, the ARIMA model parameter function is automatically calculated using the R language, and the ARIMA model for rural household business income time series data is finally established to obtain the ARIMA (5,3,1) model.

The significance of the variables and the residuals were tested for the model. Using the BP test and the Ljung-Box method, the correlation test values were calculated by plotting the residuals' normal QQ graph to verify if the residuals conformed to the normal distribution and if the residuals were white noise series. The significance was determined by t-testing the variables calculate the p-value.

Table 10 gives some test values of the ARIMA model for the raw time series data of rural household business income, each error is within the acceptable range, and the model fit performance is good.

Table 10. Test Value of Each Item

	ME	RMSE	MAE	MPE	MAPE	MASE	ACF1
Agrincome1	1.98	13.6	8.99	NaN	Inf	0.565	0.18

The residuals' normal QQ plots are plotted as shown in Figure 11. The sample residuals basically obey the normal distribution, which meets the basic requirement of the model for the residuals to obey the normal distribution with zero mean.

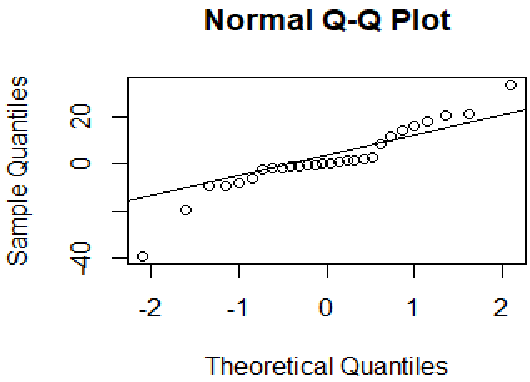


Figure 11. Normal QQ Plot of Rural Household Business Income Residuals

The residual series of the time series model are tested for white noise, and Table 11 shows the result. Since the p-values of LB statistics under each order of lags of the residual series are significantly greater than 0.05, the residual series of the fitted model can be considered white noise series, i.e., the fitted model is significantly valid.

Table 11. Results of LB Test on Residual Series of Third-order Difference Rural Household Business Income Time Series Data

Lagging order	p-value	Lagging order	p-value
1	0.3	7	0.6
2	0.6	8	0.7
3	0.7	9	0.7
4	0.8	10	0.8
5	0.6	11	0.8
6	0.5	12	0.9

The Ljung-Box method was used to test whether the autocorrelation coefficients of the residuals were all zero. According to the results, the p-value of rural household business income was 0.3154, indicating that the residuals did not pass the LB test for this model. It can be assumed that the autocorrelation coefficients of the residuals are zero, and the ARIMA model may fit the present data better. However, the model fit needs to be improved. Thus, an attempt is made to build a GARCH model for the time series data of VAT tax reduction for an auxiliary analysis.

Table 12. Results of ARIMA Model Variable t-test for Rural Household Business Income

ar1	1.000000
ar2	1.000000
ar3	1.000000

ar4	0.994
ar5	0.990619
ma1	1.000

Through the above analysis, the ARIMA model established for the original time series data of rural household business income passed all tests and could fit the data better. The following model was established according to the relevant results in Table 13.

$$\nabla^5 Agrincome_t = -2.162\nabla^5 Agrincome_{t-1} - 2.634\nabla^5 gArincome_{t-2} - 2.474\nabla^5 Agrincome_{t-3} - 1.70\nabla^5 Agrincome_{t-4} - 0.611\nabla^5 Agrincome_{t-5} + \varepsilon_t - 1.000\varepsilon_{t-1}$$

Table 13. Agrincome ARIMA Model Results

	ar1	ar2	ar3	ar4	ar5	ma1
	-2.162	-2.634	-2.474	-1.70	-0.611	-1.000
s.e.	0.224	0.511	0.505	0.39	0.227	0.125

sigma^2 estimated as 208: log likelihood = -109, aic = 233

The model confirms that business income is indeed time-dependent, with past data influencing current period data. The volatility between them is also correlated, with business income in the previous period affecting the effect of business income in the current period, and thus the consumption level of rural households. This confirms the previous conjecture of the continuity of the effect of agricultural tax reform on the consumption level of rural households.

A GARCH model is established for the original time series data of VAT tax reduction, and the autocorrelation coefficient of the residuals is tested using the Ljung-Box method. This data is better fit by the GARCH model because the p-value for the residuals is 0.8, indicating that the residuals do not pass the significance test.

Through the above analysis, the original time series data to establish a GARCH model through various tests can better fit the data, according to the fitting results in Table 14 to establish the following model.

$$\sigma_t^2 = 1.70 * 10^1 + 4.64 * 10^{-1}\varepsilon_{t-1}^2 + 9.00 * 10^{-13}\sigma_{t-1}^2$$

Table 14. GARCH Model Results

	Estimate	Std. Error	t value
a0	1.70e+02	2.55e+02	0.67
a1	4.64e-01	1.23e+00	0.38
b1	9.00e-13	1.46e+00	0
Jarque Bera Test			
X-squared	23	p-value	1e-05

Box-Ljung test			
X-squared	0.07	p-value	0.8

The above model reconfirms the conclusion of the model results in the ARIMA model:

- Rural household business income is indeed time-dependent.
- Past data affect current period data.
- The volatility between them is also correlated.
- The business income in the previous period affects the effect of business income in the current period, thus affecting the rural households' consumption level, confirming the continuity of the previous effect of agricultural tax reform on the rural households' consumption level.

4.2 Model Predictions

The prediction of the model's prediction graph at a 95% confidence level is shown in Figure 15. In the next five years, household business income will further increase, which comes from the implementation and promotion of the tax reform and the economic improvement in the previous years. As a result, the tax burden of rural households will be further reduced, and the development space can be expanded, stimulating a further increase in the consumption level of rural households.

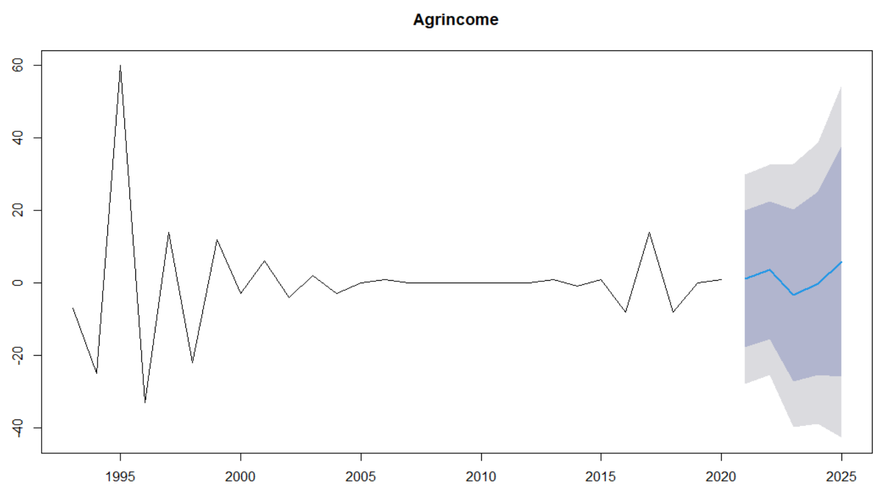


Figure 15. Time Series Forecasting of Rural Household Business Income

5. Conclusion

From the fitted model of multiple linear regression, we can learn that wage income accounts for the largest share of consumption desire, which aligns with our general expectation. This means that the secondary distribution of agricultural subsidies, insurance, and health care coverage given by the government can essentially give farmers confidence in their consumption. Rural household business income is time-dependent, and past data can affect current data. At the same time, the agricultural tax reform system has a specific time lag in producing real effects, and often the degree of influence of the previous period's data is greater than that of the previous period's data. In addition, the rural household business income data of the previous period positively affect the current period's rural household business income data. The agricultural tax reform directly acts on the rural household business income, which indirectly affects the rural household's personal consumption level and increases the total personal consumption level of rural households.

In conclusion, the continuity of the impact of agricultural tax reform on rural households' consumption level is not only the current period's rural household business income but also the previous period's rural household business income has an indirect impact. The previous period's agricultural tax reform encouraged farmers to invest more money in renovating arable land and high-quality fertilizers, which directly promotes the expansion and reproduction of agricultural operations in the current period, affecting the current period's related tax amount and income and indirectly affecting the current period's per capita consumption amount. In the future, rural household business income will further increase, which stems from the implementation of agricultural tax reform and the accumulation of land advantages over the previous years. The burden of farm households will be further reduced, allowing room for development to expand and stimulating further improvement in living standards.

Continue to stimulate wage income growth and provide farmers with various employment possibilities. The impact of agricultural tax reduction and related agricultural tax items on farmers' consumption level and the living standard has continuity, multiple measures to reduce the cost of land for farmers, significant efforts to provide farmers with advanced agricultural appliances, increase the output of acres and related agricultural products, enhance farmers' enthusiasm for planting and breeding, and promote sound transformation and upgrading within the industry, gradually transforming from labor-intensive agriculture to high-tech agriculture driven by new technologies. The ultimate beneficiaries are the entire national grain reserves, end consumers, and agricultural operators. The government has been pushing forward the "agricultural life" system for many years, and its practical effects are slowly unfolding, with the introduction of a series of policies and measures to benefit the people, and the gradual release of the effect of reducing the burden. Taxation departments at all levels should continue to increase their efforts to implement the measures to support the healthy development of agriculture and tax reduction without compromise or delay.

6. Limitation and Future Research Plan

This paper is relatively complete to complete a multiple linear regression and time series modeling and analysis, but through reflection still found some shortcomings. Many areas need to continue to improve.

1. The overall sample size is small. Limited by the data collection, I only found thirty years of annual data. Doing the time series regression will lead to a small sample size, and thus the fit is insufficient. If monthly and quarterly data can be found, it is possible to make a time series with more seasonal fluctuations.

2. time series establishment is relatively not satisfactory enough. Due to the knowledge limitations, time series analysis did not use more advanced explanatory models, such as the multivariate vector machine model. For real-world problems, relatively complex model interpretation and fitting effect may be better, so in-depth research can try to learn the relevant models.

3. The problem of representing and being represented between data. The time series data used in this time series analysis is relatively representative of the agricultural data of Heilongjiang province as a sample with 30 periods. Although it can yield relatively typical time series relationships, it cannot play a good generalization and representation role for provinces in different regions of China, with different degrees of development and responsibilities for agriculture.

References

Alderman, H., & Paxson, C. H. (1994). Do the poor insure? A synthesis of the literature on risk and consumption in developing countries. *Economics in a changing world*, 48-78. https://doi.org/10.1007/978-1-349-23458-5_3

Box, G. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). *Time series analysis: forecasting and control*. John Wiley & Sons.

Chen, Y., Xia, Q., & Wang, X. (2021). Consumption and income poverty in rural China: 1995-2018. *China & World Economy*, *29*(4), 26. https://doi.org/10.1111/cwe.12383

Duesenberry, J. S. (1949). *Income, saving, and the Theory of Consumer Behavior* (pp. 213-233). Harvard University Press: Cambridge, MA, USA.

Friedman, M. A. (1957). *Theory of the Consumption Function* (pp. 112-150). Princeton University Press: Princeton, NJ, USA. https://doi.org/10.1515/9780691188485

Gale, H. F., Lohmar, B., & Tuan, F. C. (2005). *China's new farm subsidies*. USDA-ERS WRS-05-01. https://doi.org/10.2139/ssrn.759444

Heerink, N., Kuiper, M., & Shi, X. (2006). China's new rural income support policy: Impacts on grain production and rural income inequality. *China & World Economy*, *14*(6), 58-69. https://doi.org/10.1111/j.1749-124X.2006.00045.x

Keynes, J. M. (1936). The General Theory of Employment, Interest and Money. *J. R. Stat. Soc.*, *99*, 383-388. https://doi.org/10.2307/2980590

Khanal, A., ashoka, & Nedumaran, S. (n.d.). *Consumption, habit formation, and savings: evidence from a rural household panel survey*. Social Science Electronic Publishing.

Lu, Y., Zhou, Y., Liu, P., & Zhang, S. (2022). A Study on the Influence of the Income Structure on the Consumption Structure of Rural Residents in China. *Sustainability*, *14*(16), 10380. https://doi.org/10.3390/su141610380

Luo, R., Zhang, L., Huang, J., & Rozelle, S. (2007). Elections, fiscal reform and public goods provision in rural China. *Journal of Comparative Economics*, *35*(3), 583-611. https://doi.org/10.1016/j.jce.2007.03.008

Montgomery, D. C., Jennings, C. L., & Kulahci, M. (2015). *Introduction to time series analysis and forecasting*. John Wiley & Sons.

Sultana, N., Hossain, M. E., & Islam, M. K. (2015). Income diversification and household well-being: a case study in rural areas of Bangladesh. *International Journal of Business and Economics Research*, *4*(3), 172-179. https://doi.org/10.11648/j.ijber.20150403.20

Thaler, R. H. (2008). *Commentary—mental accounting and consumer choice: anatomy of a failure*. Marketing Science. https://doi.org/10.1287/mksc.1070.0348

Wang, L. (2008). *Tax reform, local resources and village leader elections in rural China*. University of Toronto Working Paper. Toronto, Canada.

Wang, X., & Shen, Y. (2014). The effect of China's agricultural tax abolition on rural families' incomes and production. *China Economic Review*, *29*, 185-199. https://doi.org/10.1016/j.chieco.2014.04.010

Xu, T. (2017). Income Diversification and rural consumption—Evidence from Chinese provincial panel data. *Sustainability*, *9*(6), 1014. https://doi.org/10.3390/su9061014