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The Yangtze River Delta market integration and farmers ' income increase

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ABSTRACT

Market integration is of great significance to increase farmers' income. Taking 27 core cities in the Yangtze River Delta from 2011 to 2021 as an example, an evaluation index system of market integration including 8 indicators is constructed from three perspectives: regional connection, scientific and technological innovation and environmental regulation, and the entropy method is used to comprehensively evaluate the level of market integration. The measurement results show that the level of market integration in the Yangtze River Delta is still severe, and the internal differences are large. Using two-way fixed effects, it is found that the level of market integration can significantly and positively affect the per capita disposable income of rural residents, and pass the robustness test; heterogeneity analysis found that the level of market integration can significantly positively affect high-level income rural residents, but not significantly affect low-and middle-income rural residents. Suggestions are put forward from the perspectives of optimizing market integration policy, paying attention to middle and low income farmers, and coordinating regional development, so as to provide reference for policy implementation path.

KEYWORDS

Yangtze River Delta; Increase farmers' income; Market integration; Entropy method; Two-way fixed effect model

1. INTRODUCTION

The report of the 20th National Congress of the Communist Party of China clearly stated that ' build a unified national market, deepen the reform of factor marketization, and build a high-standard market system'. The unified national market is the pluralistic unity of the national market operation standards, an important support and guarantee for China's new development pattern, and of great significance to the high-quality development of China's economy. As a demonstration area of regional integration, the Yangtze River Delta has rich natural resources, scientific and technological innovation strength and market integration construction foundation. Taking the core cities of the Yangtze River Delta as an example, it is of great significance to study the impact of market integration on farmers' income increase. From the existing research, market integration is usually used as the core explanatory variable, focusing on the impact of research on variables such as high-quality economic development [1], environmental governance [2], and farmers' income [3]. Sheng et al.selected the panel data of 69 prefecture-level cities in the Yellow River Basin from 2011 to 2020 as samples to study the impact of market integration on the high-quality economic development of the Yellow River Basin [1]. Based on the environmental governance effect and internal mechanism of regional market integration, Qi Xiaofeng et al.deeply studied its heterogeneous impact on the environmental effect of regional market integration from the perspective of environmental governance importance [2]. Zou Baoling et al. used

a two-way fixed effect model to study the impact of market integration on farmers' income [3]. Farmers ' income is usually used as an explanatory variable, focusing on the impact of variables such as digital inclusive finance [4] and digital technology [5] on it ; zhang et al.found that digital inclusive finance significantly promoted farmers' income growth, but this promotion effect had a greater impact on low-income groups [4]; su Qun et al.found that digital technology significantly promotes farmers' income and has a long-term growth effect, and promoting urban-rural integration, promoting farmers' non-agricultural employment and helping the development of rural inclusive finance are important paths for digital technology to promote farmers' income [5]. This paper takes 27 core cities in the Yangtze River Delta from 2012 to 2021 as an example to study the impact of market integration on farmers' income.

2. RESEARCH DESIGN

2.1. Variables And Data Sources

2.1.1. Explained Variables

To study the impact of market integration on farmers' income, the per capita disposable income of farmers is used as a measure of farmers' income. The per capita disposable income of farmers indicates the actual income of rural residents' productive labor, which can fully represent the actual income of farmers.

2.1.2. Core explanatory variables

The core explanatory variable of the article is the level of market integration; from the existing research, the level of market integration is mainly composed of production method, relative price method, professional index method and other methods. Referring to the research of Wang Jiawei et al. [6] and Wang Peng et al. [7], the entropy method is used to construct the evaluation index system of market integration in the Yangtze River Delta with 8 indicators from the perspectives of regional connection, scientific and technological innovation and environmental regulation. From the perspective of regional relations, the relative flow of population can strengthen the exchange of talents between regional markets, the relative flow of goods can open the off-site market space of products, and the relative flow of information can reduce the occurrence of opportunistic phenomena such as information asymmetry. From the perspective of scientific and technological innovation, the government's support for science and technology reflects the degree of policy inclination to scientific and technological innovation. Scientific and technological innovation promotes the flow speed and mode of talents, funds, products and other elements between markets, and accelerates the flow of elements between regions. In addition, the number of patent authorizations is used to represent the regional scientific and technological innovation achievements, which shows the level of scientific and technological innovation from the side. In addition, the Yangtze River Delta region is an important part of the Yangtze River Economic Belt. The development of the Yangtze River Economic Belt should follow the concept of ecological priority and green development. Under the premise of ensuring the harmonious coexistence of man and nature, the realization of economic development in the Yangtze River Economic Belt is in line with the new development concept, which is of great significance to the sustainable development of China's economy. In order to consider the level of environmental regulation in the process of market integration development, industrial wastewater discharge, industrial sulfur dioxide discharge and industrial smoke and dust discharge are used as proxy variables of environmental regulation, reflecting the green development level of the unified market of the Yangtze River Delta urban agglomeration.

Table 1. Yangtze River Delta market integration evaluation index system

		index	index interpretation	attribute
market integratio	A1	Total passenger volume / regional average annual population	region union	positive direction
	A2	Total freight volume / regional GDP		positive direction
	A3	Total Telecom and Postal Business / Regional Average Annual Population		positive direction
	B1	The proportion of fiscal expenditure on science and technology	scientific and technological innovation	positive direction
	B2	patent number		positive direction
	C1	industrial wastewater emissions	environmental regulation	negative direction
	C2	Industrial sulfur dioxide emissions		negative direction
	C3	Industrial smoke dust emissions		negative direction

2.1.3. Control variables

(1) Urbanization (Urb): The process of urbanization attracts rural talents and resources to move to cities, broadens the sales channels of agricultural products, and provides more jobs for rural residents; measured by the proportion of urban population in the total population. (2) Economic development level (Gdp): The level of economic development directly affects the per capita disposable income of rural residents. The per capita disposable income of rural residents in areas with high economic development is higher than that in areas with low economic development. (3) Transportation infrastructure level (Trans): The level of transportation infrastructure reflects the convenience of regional residents' transportation, which is convenient to broaden the income channels of rural residents, and is measured by the ratio of grade highway mileage to land area in the region. (4) Rural industrial structure (Ind): The high-quality development of the primary industry promotes the increase of per capita disposable income of rural residents, which is measured by the proportion of the added value of the primary industry in the GDP.

2.1.4. Data from the description

This paper studies the impact of market integration on farmers' income in the Yangtze River Delta, and selects sample data from 27 core cities in the Yangtze River Delta urban agglomeration from 2012 to 2021 (see table 2). In view of the availability and reliability of the data, the data mainly come from the EPS data platform in the city statistical yearbook; under the condition that the search data is fruitless, the mean method and linear interpolation method are used to fill in some missing data.

Table 2. The 27 core cities of the Yangtze River Delta urban agglomeration

province	city
Shanghai	Shanghai
Jiangsu	Nanjing, Wuxi, Changzhou, Suzhou, Nantong, Yangzhou, Zhenjiang, Yancheng, Taizhou
Zhejiang	Hangzhou, Ningbo, Wenzhou, Huzhou, Jiaxing, Shaoxing, Jinhua, Zhoushan, Taizhou.
Anhui	Hefei, Wuhu, Ma 'anshan, Tongling, Anqing, Chuzhou, Chizhou, Xuancheng

2.2. research method

2.2.1. Entropy method

Step 1: the original value of the first index of the evaluation object and the evaluation index is to construct the original index data matrix.

step 2: data standardization. The original data of each index were processed by range standardization method.

Very Large Indicators:

$$x_{ij}^{'} = \frac{(x_{ij} - \min\limits_{1\le i\le n} x_{ij})}{(\max\limits_{1\le i\le n} x_{ij} - \min\limits_{1\le i\le n} x_{ij})} + 0.00001 \tag{1}$$

Very small indicators:

$$x_{ij}^{'} = \frac{(\max\limits_{1\le i\le n} x_{ij} - x_{ij})}{(\max\limits_{1\le i\le n} x_{ij} - \min\limits_{1\le i\le n} x_{ij})} + 0.00001 \tag{2}$$

In the formula, $x_{ij}^{'}$ is the index value after standardization.

Step 3: calculate the information entropy of the jth index.

$$e_j = -\frac{1}{\ln n}\sum_{i=1}^{n} p_{ij} \ln p_{ij} \tag{3}$$

In the formula, $p_{ij} = \dfrac{x_{ij}^{'}}{\sum\limits_{i=1}^{n} x_{ij}^{'}}$, is the characteristic proportion of the j th evaluation object under the i th index.

Step 4: Determine the weight coefficient of the jth index.

$$w_j = \frac{1 - e_j}{\sum\limits_{j=1}^{m}\left(1 - e_j\right)} \tag{4}$$

Step 5: use the obtained weight to multiply the corresponding standardized variables, and then sum the product to obtain the market integration level.

2.2.2. Double fixed effect model

To study the impact of market integration on farmers' income, through the single factor regression model, it is found that the impact of market integration on farmers' income in the sample data has

time effect and individual effect, so the two-factor regression model is selected. Through the Hausman test, it is found that both the time effect and the individual effect are related to the explanatory variables. Therefore, taking the sample data of the Yangtze River Delta as an example, the impact of market integration on farmers ' income is studied, and a two-way fixed effect model is selected.

$$Y_{it} = \beta_0 + \beta_1 \text{Integration}_{it} + \beta_2 Urb_{it} + \beta_3 Gdp_{it} + \beta_4 Trans_{it} + \beta_5 Ind_{it} + u_i + v_t + \mu_{it} \quad (5)$$

In the formula, Y is the per capita disposable income of farmers, and Integration is the level of market integration, which is measured by the entropy method. U is the individual fixed effect, V is the time fixed effect, u is the random error term. Other explanatory variables are controllable variables.

3. EMPIRICAL ANALYSIS

3.1. Descriptive Statistics

Table 3 shows that the level of market integration in the core cities of the Yangtze River Delta is only 0.19, indicating that the level of market integration in the Yangtze River Delta still needs to be improved. At the same time, the average per capita disposable income of rural residents in the core cities of the Yangtze River Delta is 21247 yuan, and the standard deviation is 7210; it shows that the problem of farmers ' income in the core cities of the Yangtze River Delta is still serious and there are great differences.

Table 3. Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Pci	270	21247.14	7210.393	6820	41486.89
Integration	270	0.1934622	0.073926	0.0958047	0.543139
Urb	270	0.325065	0.3165701	0.0743113	1.689781
Gdp	270	92237.99	37347.65	22801	187415
Trans	270	1.469506	0.341231	0.7376692	2.24022
Ind	270	0.0556913	0.0395722	0.0032655	0.1986008

3.2. Baseline Regression

It can be seen from Table 4 that in regression models (1) and (2), the level of market integration, the core explanatory variable, has a significant positive impact on the per capita disposable income of rural residents, indicating that improving the level of market integration can increase the income of rural residents. Scientifically and effectively improving the level of market integration is an effective way to increase farmers ' income. In addition, the control variables significantly affect the disposable income of rural residents, through the 1 % significance test. It is worth noting that the level of transportation infrastructure has a significant negative impact on the per capita disposable income of rural residents, indicating that the improvement of the level of transportation infrastructure promotes the flow of rural talents to other regions. The benefits generated are greater than the production and living benefits generated by the level of transportation infrastructure for farmers.

Table 4. Benchmark regression

	(1)	(2)
Integration	9644.6***(5.76)	3695.9***(2.73)
Urb		12811.5***(7.15)
Gdp		0.0421***(6.11)
Trans		-1887.1***(-2.86)
Ind		51258.2***(8.96)
cons	19381.3***(58.47)	12402.9***(8.22)
individual fixed effect	YES	YES
time-fixed effect	YES	YES
R-sq	0.977	0.988

Note: * * *, * *, * represent the statistical significance test of 1 %, 5 % and 10 % respectively.

3.3. Robustness Test

In order to confirm the impact of market integration on farmers' income and improve the robustness of the benchmark regression, this paper conducts a robustness test on the benchmark regression. The specific implementation method is to use the principal component analysis method to recalculate the market integration level of 27 core cities in the Yangtze River Delta, and substitute all samples for regression, so as to complete the robustness test of this paper.

Table 5. Robustness test

	(3)
Integration	491.0**(2.25)
Urb	13665.8***(7.76)
Gdp	0.0388***(5.41)
Trans	-2106.2***(-3.25)
Ind	51031.2***(8.87)
cons	13479.1***(9.22)
individual fixed effect	YES
time-fixed effect	YES
R-sq	0.988

Note: * * *, * *, * represent the statistical significance test of 1 %, 5 % and 10 % respectively.

It can be seen from Table 5 that the coefficient of market integration level measured by principal component analysis is significantly positive at the confidence level of 5 %, indicating that market integration significantly promotes farmers' income increase. Therefore, the benchmark regression of this paper passes the robustness test.

3.4. Heterogeneity Analysis

The effect of market integration on rural residents with different income levels may be heterogeneous. This paper divides the per capita disposable income of rural residents into three parts: low level, medium level and high level, and analyzes the heterogeneous impact of market integration on the per capita disposable income of rural residents.

Table 6. Heterogeneity analysis

	(4)	(5)	(6)
Integration	-3014.7(-1.39)	1437.9 (1.10)	15224.1***(4.72)
Urb	-1982.3(-0.45)	5244.3(1.54)	-4410.6(-1.40)
Gdp	0.00872(0.78)	0.0423***(6.09)	0.0366***(2.79)
Trans	559.5(0.56)	-1758.3*(-1.74)	-5059.4***(-3.66)
Ind	59102.9***(2.75)	48722.8***(7.81)	27783.2(0.82)
cons	11377.3***(4.61)	15192.1***(7.43)	27739.4***(8.52)
individual fixed effect	YES	YES	YES
time-fixed effect	YES	YES	YES
N	80	107	80
R-sq	0.993	0.999	0.998

Note: * * *, * *, * represent the statistical significance test of 1 %, 5 % and 10 % respectively.

It can be seen from Table 6 that market integration is promoting the heterogeneity of per capita disposable income of rural residents. From the regression (4) and (5), it can be seen that the level of market integration cannot significantly affect the change of per capita disposable income of rural residents; from regression (6), it can be seen that market integration can significantly increase the per capita disposable income of rural residents, and the impact coefficient is greater than the benchmark regression impact coefficient. Due to the poor economic conditions of rural residents with low and middle income levels, compared with rural residents with high income levels, rural residents with low and middle income levels are less likely to interact with society, less likely to obtain more favorable market sales channels, and less likely to obtain high-income market jobs. Therefore, market integration cannot really benefit rural residents with low and middle income. Rural residents with high income levels can take advantage of the policy opportunity of market integration to expand the scale and channels of income and generate more income, so that the market integration policy can benefit rural residents with high income levels first.

4. CONCLUSION AND SUGGESTION

4.1. Conclusion

Taking 27 core cities in the Yangtze River Delta from 2011 to 2021 as an example, an evaluation index system of market integration including 8 indicators is constructed from three perspectives : regional connection, scientific and technological innovation and environmental regulation, and the entropy method is used to comprehensively evaluate the level of market integration. The measurement results show that the level of market integration in the Yangtze River Delta is still severe, and the internal differences are large. Using two-way fixed effects, it is found that the level of market integration can significantly and positively affect the per capita disposable income of rural residents, and pass the robustness test; heterogeneity analysis found that the level of market integration can significantly positively affect high-level income rural residents, but not significantly affect low-and middle-income rural residents.

4.2. Suggestion

Optimize market integration policies and build a fair competitive market environment. The original intention of the market integration policy is to break regional barriers and build a fair competition market environment. In order to increase farmers' income, the Yangtze River Delta region should further optimize the market integration policy, solve the difficulties and blockages in the process of

policy implementation in a timely manner, and effectively ensure the implementation of the market integration policy. At the same time, the government should promote the unified opening of the agricultural product market, formulate consistent agricultural product quality standards and testing systems, and ensure the free circulation of agricultural products in the Yangtze River Delta region. This can not only broaden the sales channels of agricultural products, but also improve the quality of agricultural products through market competition, thereby increasing farmers' income. In addition, the government should increase support for agriculture, through financial subsidies, tax relief and other policy measures to reduce farmers ' production costs and improve their profitability. In addition, the government should also strengthen market supervision, severely crack down on price hikes, hoarding and other behaviors that disrupt market order, and protect the legitimate rights and interests of farmers. Finally, the government should actively promote the construction of agricultural insurance system, provide risk protection for farmers, and reduce losses caused by unpredictable factors such as natural disasters and epidemics, so as to stabilize farmers' income.

Pay attention to rural residents with low and medium income levels and implement targeted poverty alleviation policies. In the process of market integration in the core cities of the Yangtze River Delta, special attention should be paid to the rural residents with low and medium income. The previous empirical test results show that the level of market integration in the core cities of the Yangtze River Delta cannot significantly affect rural residents with low and medium income levels. Therefore, the government can increase the income of rural residents at low and middle income levels by implementing targeted poverty alleviation policies. Specifically, the government should appropriately tilt the policy to rural residents with low and medium income levels, set up special funds, support rural residents with low and medium income to develop characteristic industries, such as planting characteristic agricultural products and carrying out rural tourism, and increase the income of rural residents by increasing the added value of the industry. At the same time of policy inclination and financial assistance, we should pay attention to the income-generating ability of rural residents, increase investment in education and training for rural residents with low and medium income, and improve their labor skills and employability. By providing vocational skills training, entrepreneurship guidance and other services to help rural residents find better employment opportunities or start their own businesses, so as to improve their income level.

Layout regional coordinated development and promote the integration of urban and rural development. The Yangtze River Delta region should make full use of its advantages of superior geographical location and strong economic strength to layout regional coordinated development and promote the integration of urban and rural development. Through the formulation of scientific urban and rural planning, we will guide farmers to gather in cities and towns and promote the transfer of rural population to cities and towns. This can not only create employment opportunities for farmers and improve the living environment, but also promote the development of rural economy through the process of urbanization. At the same time, it is necessary to increase investment in rural infrastructure construction and improve rural production and living conditions. By building roads, water conservancy, electricity and other infrastructure, farmers ' production costs are reduced and their production efficiency is improved. In addition, the government should also actively promote the equalization of public services in urban and rural areas to ensure that farmers can enjoy the same education, medical and other public service resources as urban residents, so as to improve their quality of life and social status.

Promote the development of agricultural industrialization and enhance the added value of agricultural products. Under the background of market integration in the core cities of the Yangtze River Delta, promoting the development of agricultural industrialization is an important way to increase farmers' income. As one of the core income sources of rural residents, the high-quality development of agricultural industrialization is of great significance to increase farmers' income. At the same time, we should encourage and support farmers to set up cooperatives or agricultural enterprises to achieve large-scale and intensive management. By integrating agricultural resources, improving production

efficiency and reducing production costs, farmers can obtain higher economic benefits. At the same time, the government should also guide farmers to develop deep processing industries and increase the added value of agricultural products. Through the introduction of advanced processing technology and equipment, the development of diversified agricultural products processing products to meet market demand. This can not only increase the income source of farmers, but also improve the market competitiveness of agricultural products.

Strengthen agricultural science and technology innovation and promotion, improve agricultural production efficiency. The Yangtze River Delta region should strengthen the innovation and promotion of agricultural science and technology, and improve the efficiency and quality of agricultural production. The government should increase investment in agricultural science and technology research and development, introduce and cultivate agricultural science and technology talents, and promote the transformation and application of agricultural science and technology innovation achievements. Through the promotion of advanced agricultural technology and equipment, improve farmers' production capacity and technical level. At the same time, the government should also establish a sound agricultural science and technology service system to provide farmers with technical advice, training and guidance services. Through the establishment of science and technology service system, farmers can more easily obtain scientific and technological information and technical support, so as to improve the efficiency and quality of agricultural production. This will help to improve the income level and quality of life of farmers.

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