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Can Rural Industry Integration Improve Rural Household Income? Empirical Analysis Based on CFPS Data

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Abstract: *The Chinese No. 1 document of the Central Government in 2024 emphasized that promoting the integration of rural industries has significant strategic importance for building a modern agricultural power, improving farmers' income, and achieving common prosperity. Based on the panel data of the third phase of the China Household Tracking Survey (CFPS) from 2014 to 2018, this study constructs an evaluation index system for the integration of rural industries. It utilizes the entropy method to measure the integration index of rural industries and employs a bi-directional fixed-effect panel model to empirically analyze the impact of the level of rural industry integration on rural household income and the urban-rural income gap. It has been found that the development of rural industry integration can significantly increase farmers' income, narrow the income gap between urban and rural areas, overcome endogenous problems through a hysteresis effect, and maintain stable results. The mechanism analysis indicates that the increase in income from rural industry integration and the reduction of the urban-rural income gap can be achieved through the development of the agricultural products deep processing industry. In addition, the level of rural industry integration exhibits regional heterogeneity in its impact on the improvement of farmers' income in pilot and non-pilot areas. Therefore, this paper can provide empirical evidence to support the development and enhancement of relevant policies.*

Keywords: *Rural industry integration; Increase of household income; Deep processing of agricultural products*

1. Introduction

Since the idea of industrial integration first emerged in 1963 through the research work of Rosenberg (1963), the concept has become attractive to many nations in their industrial development, and numerous research works have been conducted to explain the concept and the factors that promote it. China first put forward the concept of integrating rural primary, secondary, and tertiary industries in its 2015 policy document. 1 Central Document" (Tian et al., 2020). To revitalize rural areas, industry needs to take the lead, and the key to achieving rural revitalization—the fundamental path of industrial revitalization—is the integration of rural industries (Guo et al., 2020). In recent years, the integration of rural industries has been considered a key focus for increasing farmers' income, adjusting income distribution among farmers, and achieving common prosperity. In China, the 14th Five-Year Plan for 2021 and the outline of the vision goals for 2035 clearly state the intention to continue promoting the integrated development of the primary, secondary, and tertiary industries in rural areas. The plan aims to extend the agricultural industrial chain, diversify rural economic formats, and broaden opportunities for rural households to increase their income. In short, promoting the process of rural industry integration is not only the strength and breakthrough of rural industry revitalization, but also an important measure to broaden the channels for farmers to increase their income and achieve common prosperity. It is the only way to explore the road of agricultural modernization with Chinese characteristics (Zhang and Luo, 2018; Huang, 2021; Zhao et al., 2023).

2. Literature Review

Traditionally, rural economic activities have been primarily focused on agricultural production, with rural industry and service industry development lagging behind. It is helpful to address the issue of farmers' employment, promote the coordinated economic development of rural and urban areas, achieve

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the modernization of rural areas, and ensure a stable increase in farmers' income. Therefore, the primary goal of rural industrial integration is to enhance rural households' income and reduce the income disparity between urban and rural residents (Ge et al., 2022). The existing research on rural three-industry integration mainly focuses on the following three aspects.

First, the concept definition and connotation mining of rural industry integration. In the second half of the 20th century, the study of industrial integration abroad began with the electronics, computer, and broadcasting industries and later expanded to include the agricultural sector. Rural industrial integration is based on industrial integration and represents a further refinement and extension of industrial integration in the agricultural sector (Rosenberg, 1963; Boehlje et al., 1996; Cunguara and Darnhofer, 2011). Chinese scholars have also started to focus on rural industry integration and are gradually refining the definition of relevant concepts. Rural industrial integration is based on agriculture, with farmers and their related production and operation organizations as the main body. It forms an integrated industrial chain through high-tech penetration, three-industry linkage, institutional innovation, and other methods (Zhao et al., 2017; Xiao et al., 2019).

Second, the evaluation method for constructing the development level of rural industry integration policy. The evaluation system for the development level of rural industry integration mainly consists of various business forms, including rural industry integration policies. Some scholars focus on three indicators: extension of the agricultural industry chain, development of agricultural versatility, and integration of factors (Kong et al., 2019; Cao et al., 2019). In addition, scholars have different method preferences, including the Analytic Hierarchy Process (AHP), Comprehensive Index Method, Industrial Coupling Degree Analysis Method, and Grey Correlation Method (Hao et al., 2023; Li et al., 2017; Tan et al., 2021; Wang et al., 2022).

Third, the monetary benefits of rural industry integration. Pertinent studies on this topic mainly focus on promoting rural industry integration policies to increase farmers' incomes. Li et al. (2018) demonstrated that rural industry integration has an income-increasing effect on farmers, while CAI (2020) argued that participation in rural industry integration can effectively increase farmers' incomes. Additionally, the enhancement of non-agricultural employment skills plays a moderating role in this process. China's rural industry integration policy has significantly boosted the entrepreneurial enthusiasm of farmers. Additionally, it has analyzed the heterogeneity of the effect of the rural industry integration policy on increasing farmers' income at the provincial level (Li, 2019). When studying the impact of rural industry integration on the increase in farmers' income, some scholars focus on the mechanism of rural industry integration policy in the process of boosting farmers' income. They believe that there is a certain intermediary effect in this process (Cao et al., 2021).

3. The Measurement of the Level of Rural Industry Integration

3.1 Construction of the index system of rural industry integration level

Table 1: Construction of index system of rural industry integration development level

Primary index	Secondary index	Evaluation content	Stats
The vertical industrial chain of agricultural products has been extended	Agricultural products processing industrial machinery level	Total power of power machinery for processing agricultural products	+
	GDP per capita of primary industry	Gross primary industry product/total rural population	+
Horizontal multi-functional expansion of agriculture	Level of agricultural service industry	Output value of agriculture, forestry, animal husbandry and fishery service industry/Output value of primary industry	+
	Pesticide application intensity	Converted fertilizer use/crop area	–

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	Social welfare level	Number of pension institutions and cultural institutions	+
Cultivation of new forms of agriculture	Development level of facility agriculture	Facility agricultural area/crop sown area	+
	Degree of branding	Number of trademarks and agricultural products certified	+
	Technology research and development level	Total funds invested in technology research and development	+
Integrated development of factors	Transfer net income level	Transfer of net income/wage income	+
	Engel coefficient	Food expenditure as a percentage of total expenditure	–
	Investment in fixed assets	Total investment in fixed assets of rural households	+
	Level of infrastructure construction	Rural power generation	+
Fusion depth	Price level	General index of household consumer prices	+
	Employment level	Rural employed population/rural population	+
	Disaster resistance	Area affected by crops/total income	+

Note: “+” represents a positive indicator, that is, the bigger the better; “-” indicates a negative indicator, that is, a smaller value is better

At present, the academic community has not established a universally recognized evaluation index system for assessing the development level of rural industry integration policies (Huang, 2022). Measurement studies on rural industry integration can be categorized into two groups: one focuses on measuring the development level index of rural industry integration in a specific region (Cheng and Kong, 2020), while the other aims to assess its economic or social impact during empirical analysis (Zhang and Wen, 2019; Zhang and Zhou, 2021). Therefore, as shown in Table 1, based on China's Rural Statistical Yearbook and existing studies, this paper selects five primary indicators.

3.2 Data processing and comprehensive evaluation

The data in this section are derived from the China Rural Statistical Yearbook, China Statistical Yearbook, China Agricultural Statistical Data, and provincial statistical yearbooks from 2014 to 2020. Some missing data were supplemented using an interpolation method. Referring to the methods of Liu et al. (2021) and Zhang et al. (2022), this paper utilizes the entropy method to assign weights and evaluate the aforementioned indicator system.

3.3 Measurement results of the rural industry integration level index in each province

This paper calculates the level of rural industry integration in 31 provinces of China during the third periods of 2014, 2016, and 2018 using the methods described above. The average level of agricultural industry integration development in 31 provinces in China was 0.3144 in 2014 and increased to 0.3444 in 2018. From 2014 to 2018, the average increase was 9.55%, with an average annual increase of about 2.31%. Although the level of agricultural industry integration in some provinces declined from 2014 to 2018, the overall trend of rural industry integration in China has been on the rise, with a noticeable increase. This is due to the implementation of the government's policy promoting the triple integration of rural development in recent years, the high-quality development of the agricultural market, and the financial support of social capital from various channels. All in all, the overall level of rural industry integration has risen, indicating that China's rural areas are gradually moving towards a path of high-

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quality development. It is promising to consider agricultural industry integration as a strategic policy for rural revitalization.

4. Data Source, Variable Selection and Model Setting

4.1 Data source

1) Data from the China Household Tracking Survey (CFPS). The CFPS sample covers 162 districts and counties in 25 provinces, representing 95% of China's population. It is a comprehensive social tracking survey project that offers robust data support for academic research in related economics. In this paper, individual microdata of farmers is matched with rural macrodata from CFPS 2014, 2016, and 2018. Invalid and missing samples are eliminated based on the economic significance of variables, and the three-year samples are merged to create a balanced panel dataset. After data cleaning, a total of 44,013 individuals were included in the panel data for the years 2014, 2016, and 2018, comprising 30,865 agricultural accounts and 5,672 non-agricultural accounts.

China Rural Statistical Yearbook, China Statistical Yearbook, China Agricultural Statistical Data, and provincial statistical yearbooks are used to create evaluation indicators for assessing the level of rural industrial integration.

4.2 Variable selection

4.2.1 Explained variables

Farm household income level (*Inc*). The main sources of rural household income include agricultural income and non-agricultural income. In recent years, the number of poor laborers going out for work has increased, and the growth of non-agricultural income plays an important role in the increase of rural household income, and agricultural income is relatively stable for rural households. Therefore, referring to the existing practice of Moyalin et al. (2020), this paper selects “total income in the past 12 months” in the CFPS personal questionnaire to measure the income level of farmers.

4.2.2 Core explanatory variables

Rural industry integration level (*RID*). At present, the academic community has not formed a set of universally recognized evaluation index system on the development level of rural industry integration policies (Huang, 2022; Li et al. 2017) selected three indicators of agricultural industry chain extension, agricultural versatility and agricultural service industry integration to measure the advance level of industrial integration policies. Built on the above three dimensions, Zhang et al. (2021) added the dimension of urban-rural integration into the evaluation index system (Huang, 2022). Based on China’s rural Statistical Yearbook and existing studies, this paper selects five first-level indicators and selects 15 second-level indicators to form a comprehensive evaluation index system for the development level of rural industry integration development policy.

4.2.3 Control variables

As shown in Table 2, in this paper, 10 control variables are selected from three aspects: distinctive characteristics of farmers, family characteristics and regional characteristics.

Table 2: Variable definitions and descriptive statistics

Variable name	Define and assign values	Mean value	Standard deviation
Explained variable		47092.8200	97053.1200
Household income level	Gross income for the last 12 months	0.4503	0.1130
Urban-rural income gap	The Thiel index is calculated	0.3310	0.0715

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Explanatory variable			
The level of rural industry integration	Calculated by entropy value method	49.3790	13.1220
Control variable		0.6982	0.4432
Age	Age at time of survey	0.6433	0.4790
Sex	Male =1, female =0	5.6795	4.2875
Health level	Physical health =1, other =0	0.8687	0.3278
Educational level	Years of schooling	4.4209	2.0106
Marital status	Married =1, other =0	12.1146	2.7836
Family size	Number of family members	0.6089	0.3487
Family property situation	Total household property value (logarithm of 0 plus 1)	10.8217	0.3932
Household material capital	Owning a home (Yes =1, others =0)	0.2793	0.1728

4.3 Model setting

$$Inc_{ipt} = \alpha_0 + \alpha_1 RID_{pt} + \alpha_2 X_{ipt} + \mu_i + \lambda_t + \lambda_p + \varepsilon_{ipt} \quad (1)$$

In the model(1), *i* represents the individual, *p* represents the province, and *t* represents the year, where represents the income of the *i* individual farmer in the province *p* in the year *t*; represents the level of income gap between urban and rural residents, measured by Theil index; reflects the level of rural industry integration of p province in year *t*; is the control variable at the level of family characteristics. is the individual fixed effect, is the time fixed effect, is the provincial fixed effect, and is the random disturbance term

5. Empirical Results and Analysis

This paper investigates the impact of rural industry integration policy on farmers' income from two perspectives. First of all, according to Equation (1), this paper utilizes a two-way fixed effect model to examine the influence of rural industry integration level on farmers' income, and the findings are presented in Table 3. Column (1) of Table 3 controls for individual fixed effects, year fixed effects, and province fixed effects. The estimated coefficient of rural industry integration level reflects the overall impact on rural household income, which is significant at a 99% confidence level. This suggests that the enhancement of rural industry integration has effectively boosted the growth of rural household income. In order to avoid estimation bias, control variables for individual characteristics and family characteristics of farmers are included in column (2), and control variables for regional characteristics of the farmers' location are added to column (3) accordingly. It can be found that the estimated coefficient of core explanatory variables is still significantly positive.

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Table 3: Estimates the impact of rural industry integration on rural household income

variable	(1)	(2)	(3)
The level of rural industry integration	Rural household income	Rural household income	Rural household income
	0.0060***	0.0058***	0.0043***
age	(9.4860)	(9.1710)	(6.6810)
		4.57e-05	5.15e-05
sex		(0.8520)	(0.9630)
		0.0035***	0.0036***
Health level		(2.7540)	(2.8430)
		4.22e-05	4.80e-05
Educational level		(0.5600)	(0.6380)
		9.87e-05**	0.000100**
Marital status		(2.3780)	(2.4160)
		0.0008***	0.0008***
Household material capital		(4.9520)	(4.8800)
		-0.0004***	-0.0004***
Family property situation		(-3.3850)	(-3.3340)
		0.0002***	0.0002***
Per capita GDP		(12.5100)	(12.3900)
			0.0033***
Industrial structure			(5.2350)
			-0.0018***
Constant term			(-6.3470)
	0.0037***	-0.0028	-0.0370***
Observed number	(18.2600)	(-1.1160)	(-5.2010)
Individual fixation effect	45,242	45,242	45,242
Year fixed effect	year	year	year
Provincial fixed effect	YES	YES	YES
Adjusted goodness of fit	YES	YES	YES
variable	0.4800	0.4850	0.4870

The empirical results show that rural industry integration can indeed promote the growth of farmers' income, and further demonstrate hypothesis 1. The reason is that the integration of rural industries effectively extends and develops the industrial chain of agricultural products, and effectively leaves the added value in the industrial chain in the hands of rural areas and farmers, from which farmers can obtain more profits (Wang and Bo, 2023). At the same time, rural industrial integration encourages farmers to participate in economic activities together, integrates rural factor resources, reduces rural production costs through economies of scale, and then increases farmers' income.

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6. Robustness Test

In this paper, multiple control variables such as individual characteristics, family characteristics, industry characteristics, and regional characteristics are introduced in the benchmark regression process. It has been found that the integration of rural industries does have an impact on the increase in rural household income, which mitigates the endogenous issue to some extent. However, the bidirectional causal relationship between the level of rural industry integration and the increase in rural household income may introduce bias in the research findings. In this paper, the hysteresis effect is utilized to address the endogenous issue stemming from reverse causality in the model. Depending on the estimation results presented in Table 4, the coefficient of household income after a two-period lag is significantly positive, and the coefficient of the urban-rural income gap is significantly negative. This indicates that the estimation conclusion of this paper is relatively robust.

Table 4: Lag effect

	(1)	(2)
Variable	Rural household income	Urban-rural income gap
Lag two periods of rural Industrial integration level	0.0047*	-0.1190***
	(1.6980)	(-3.3850)
Age	3.08e-05	-0.0011
	(0.3560)	(-0.6170)
Sex	0.0025	-0.0091
	(1.0390)	(-0.2060)
Health level	0.0001	0.0116***
	(1.0320)	(4.5680)
Educational level	0.0001	0.0027
	(1.4140)	(1.5710)
Marital status	0.0005	-0.0015
	(1.2490)	(-0.2160)
Household material capital	2.37e-05	0.0183***
	(0.1090)	(4.9750)
Family property situation	0.0001***	-0.0001
	(4.6960)	(-0.3300)
Per capita GDP	0.0062***	-0.4300***
	(3.0850)	(-14.8400)
Industrial structure	-0.0029***	0.0447***
	(-5.0910)	(4.6330)
Constant term	-0.0665***	5.2140***
	(-2.9580)	(15.7600)
Observed number	12,945	20,646
Individual fixation effect	year	year
Year fixed effect	YES	YES
Provincial fixed effect	YES	YES
	0.5850	0.4180

7. Mechanism Discussion and Heterogeneity Analysis

7.1 Mechanism analysis

The benchmark estimation results of this paper show that the improvement of the level of rural industry integration substantially increases the income of rural households and significantly Narrows the

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income gap between urban and rural areas. Further, according to the theoretical analysis framework, rural industry integration may promote the increase of farmers' income by promoting the deep processing of agricultural products. In order to verify this mechanism, due to the limited public data of existing agricultural product processing parks, this paper selects 43 agricultural product processing enterprises from the A-share listed companies in database as samples with reference to Li (2022) method, and the selected mechanism variable is the total factor productivity (*TFP*) of agricultural product deep processing enterprises. For the identification of agricultural product processing enterprises, this paper refers to the industry classification of agricultural product deep processing industry in the National Economy Industry Classification and Code. In addition, with reference to the estimation method of Lu et al. (2012), LP method is used to measure *TFP* for benchmark regression, and the consequences of OP method are used for robustness test.

$$TFP_{pit} = \alpha_0 + \alpha_1 RID_{pit} + \alpha_2 X_{pit} + \lambda_p + \lambda_i + \lambda_t + \lambda_h + \varepsilon_{ipt} \quad (2)$$

$$Inc_{pit} = \alpha_0 + \alpha_1 TFP_{pit} + \alpha_2 RID_{pit} + \alpha_3 X_{pit} + \lambda_p + \lambda_i + \lambda_t + \lambda_h + \varepsilon_{ipt} \quad (3)$$

In Table 5, paragraphs (1), (2) and (3) are listed as the total factor productivity of agricultural products deep processing enterprises measured by LP method, and columns (2) and (3) are the estimation results of *TFP* on farmers' income and urban-rural income gap respectively. It can be observed in the results that the regression coefficient of *TFP* measured by LP method is significantly positive for farmers' income and significantly negative for urban-rural income gap. Also, these empirical results are consistent with the results of Zhang and Wu (2023). It can be seen that hypothesis 3 in this paper is valid.

Table 5 (4), (5) and (6) lists the robustness test of regression results using OP method to measure *TFP*. It can be seen from the results that the regression coefficient for rural household income is significantly positive, and the regression coefficient for urban-rural income gap is significantly adverse. It shows that the regression results of the mechanism test pass the robustness test.

Table 5: Results of mechanism test

	(1)	(2)	(3)	(4)	(5)	(6)
	Mediating effect (LP method)			Robustness test for intermediate Effects (OP method)		
VARIABLES	TFP_LP	finc	Theil	TFP_OP	finc	Theil
TFP_LP		9,627.9663***	-0.0125***			
		(1,239.6064)	(0.0021)			
Control variable	YES	YES	YES	YES	YES	YES
TFP_OP					11,078.8747***	-0.0124***
					(1,405.1726)	(0.0024)
Constant	37.0068***	831437.4482***	-2.0807***	33.5864***	847236.7577***	-2.0354***
	(0.6297)	(156,707.2383)	(0.2008)	(0.5701)	(157,308.7655)	(0.2013)
Observations	42,624	42,624	42,624	42,624	42,624	42,624
R-squared	0.9597	0.2921	0.6456	0.9430	0.2922	0.6456

7.2 Heterogeneity analysis

In this paper, 31 provinces are classified and compared according to the following two methods, in order to investigate the overall relative difference in the level of rural industry integration development and the comparative difference between regions and their contribution rates. First of all, according to the

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list of pilot provinces of rural industry integration development published by the Ministry of Agriculture and Rural Affairs in 2016, 31 provinces are divided into pilot areas and non-pilot areas. Among them, the pilot provinces include Liaoning, Heilongjiang, Jiangsu, Zhejiang, Shandong, Henan, Hubei, Hunan, Jiangxi, Anhui, Chongqing and Guizhou 12 provinces, the rest are non-pilot provinces.

Table 6: Heterogeneity analysis between pilot and non-pilot areas

	(1)	(2)	(3)	(4)
	a1	a2	b1	b2
VARIABLES	Inc	Inc	Theil	Theil
Rid	0.00335***	-0.0012	-0.0074***	-0.0037
	(4.4060)	(-1.2720)	(-1.2360)	(-0.0554)
Control variable	YES	YES	YES	YES
Observations	23,689	33,231	8,155	6,351
R-squared	0.7050	0.7040	0.6860	0.6900
Individual fixation	YES	YES	YES	YES
Year fixation	YES	YES	YES	YES
Provincial fixation	YES	YES	YES	YES

As shown in Table 6, columns (1) and (2) respectively show the impact of rural industry integration level on the income of farmers in pilot areas and non-pilot areas. The results show that the impact of rural industry integration level on the income level of farmers in pilot areas is significantly positive, while the impact on the income level of farmers in non-pilot areas is not significantly negative. This is consistent with the conclusions of previous studies (Chen and Ma, 2022).

8. Conclusions

The research findings are as follows: First, the integrated development level of rustic three industries in China shows an overall upward trend. In 2014, the average level of integrated development of agricultural industries in 31 provinces in China was 0.3144, and in 2018, the average was 0.3444. From 2014 to 2018, the average increased by 9.55%, with an average annual increase of about 2.31%. Although the development level of agronomic industry integration in some provinces has declined from 2014 to 2018, from the overall point of view, the level of rural industry integration in China has shown an upward trend, and the increase is obvious. However, there are some differences among provinces and regions, which are related to the local historical development level, the degree of pastoral tertiary industry integration and geographical location. Second, the integration of rural industries can significantly promote the growth of pastoral households, which can be mainly achieved by increasing the operational income, wage income and transfer income of the households in which the rural households belong. And the integration of rural industries can significantly narrow the urban-rural income gap. Thirdly, the intermediation effect of agricultural product processing in the process of promoting farmers' income increase and narrowing the income gap is verified. Hypothesis 3 in the theoretical hypothesis part of this paper is verified. Rural industrial integration accelerates the agglomeration of upstream and downstream of the industrial chain, improves technological innovation ability and industrial added value, promotes the technological innovation and development of agricultural product processing enterprises, and thus improves the income of farmers.

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