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The Evaluation on The Poverty Alleviation Effect of Industrial Poverty Alleviation

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Abstract

Industrial poverty alleviation is a fundamental strategy to achieve stable poverty alleviation for poor households. Based on the research on poverty and industrial poverty alleviation, this study selects data from the China Labor Force Dynamics Survey (CLDS). The research method adopts the difference-in-diffeerence method and propensity score matching method. The purpose of the study is to measure the poverty alleviation effect of industrial poverty alleviation. This study constructs two poverty proxies based on the multidimensional poverty idea, namely, the livelihood index reflecting the livelihood level of poor households, the asset index reflecting the living and productive assets of poor households, to measure the poverty alleviation effect of industrial poverty alleviation. The research results show that: (1) Overall, industrial poverty alleviation increases the poverty alleviation rate of poor households by about 10%, which has a significant positive effect on precise poverty alleviation; (2)In terms of regional location, the poverty alleviation effect of industrial poverty alleviation in eastern China is slightly higher than that in central and western China. Based on this, this study proposes policy recommendations aimed at improving the effect of industrial poverty alleviation on poverty alleviation. The main contribution of this study is to measure the effectiveness of industrial poverty alleviation and to promote the establishment of a long-term mechanism for poverty alleviation. Due to research needs and the availability of data, this study has some limitations. This study expects to provide references for the future adjustment and optimization of industrial poverty alleviation policies and effective implementation of rural revitalization in China.

Keywords: *Poverty; Industrial Poverty Alleviation; Rural Revitalization*

Introduction

China has made great achievements in poverty reduction and eradication and has contributed to the advancement of worldwide poverty eradication programs. In the process of poverty eradication, there is a need to further play the key role of industry to benefit poverty, increase income and improve industry. Industrial poverty alleviation emphasizes participatory and blood-building capacity building, which is an important cornerstone for poor regions and poor groups to jump out of the poverty trap, reduce their poverty vulnerability and eliminate the causes of poverty. With the basic goal of increasing rural residents' income and the development of related industries as leverage, industrial poverty alleviation and industrial prosperity have gradually formed an industrial development model with stable promotion of industries and extensive participation of farmers, allowing poor households to maximize their participation in poverty alleviation projects and achieve higher income levels, cultivating their ability to

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resist various risks, and helping to fight poverty and increase income. Therefore, in order to achieve stable and timely poverty alleviation for the rural poor in China, it is necessary to play the key role of industrial poverty alleviation and industrial prosperity, to form a situation in which industries drive poverty alleviation and enrichment and industries consolidate the effect of poverty alleviation, and to fully establish a long-term mechanism for poverty return interdiction, so as to ensure the effective implementation of rural revitalization strategy (Bai, 2022; Quinn et al., 2022)

The established literature has already conducted in-depth analyses of the current situation, problems, sustainability and its mechanism of action of industrial poverty alleviation in China from different perspectives respectively, which have good reference values (Shi et al, 2020), but there is still room for further expansion, especially in terms of quantitative measurement of the effect of industrial poverty alleviation. Therefore, this study assesses the effect of industrial poverty alleviation on poverty alleviation in the context of the current industrial development in China.

Theoretical Foundation and Literature Review

The Mode of Industrial Poverty Alleviation

Industrial poverty alleviation is the key to transforming from "blood transfusion" to "blood creation", and is also an important fulcrum to realize rural revitalization. Industrial poverty alleviation promotes the continuous improvement of local economic development capacity and raises the income level and affluence of poor households through the deep and characteristic development of industries so that they can get out of poverty stably. The industrial poverty alleviation mode is to promote the economic development of the poor area by driving the industrial development of the poor area so that the poor households can get out of poverty and not return to poverty, which can realize the "trickle-down effect" but also surpass the "trickle-down effect" to a certain extent. Industrial poverty alleviation gradually breaks through the traditional practice of developmental poverty alleviation in the past, through leading enterprises and cooperatives (Ward, 2016; Suleman et al., 2023) strengthening large-scale operations, forming benefit linkage mechanisms, and jointly resisting risks.

Based on the effective implementation and precise policy of industrial poverty alleviation, the industrial poverty alleviation mode has gradually moved towards diversification, mainly in the modes of "finance+", "tourism+" and "Internet+". Lin et al. (2018) addressed the poverty reduction mechanism of poverty alleviation and development for poor households and outlined their models as industrial development, targeting and relief. Industrial poverty alleviation increases the income increase channels of poor households, especially in special hardship areas such as contiguous special hardship areas and three regions and three states, by cultivating and developing regional special industries, such as vegetable and fruit cultivation, e-commerce industry, and tourism, and continuously exploring new modes of industrial development to improve the self-development capacity of poor regions, and prevent the phenomenon of returning to poverty. In addition, Liu et al. (2019) showed that capital is invested for poor regions in the form of funds, and the industrial poverty alleviation fund model is formed through the articulation of capital and regional resource endowments. Ning et al. (2019) argued that by increasing new business subjects and developing local special industries, poor households join the process of industrial development to strengthen the channels of income generation and promote rural revitalization. In the development process of industrial poverty alleviation, "passive poverty alleviation" is replaced by "active poverty alleviation", and the industrial poverty alleviation model is constantly updated and iterated, requiring the selection and cultivation of various new business subjects to actively participate in the development of industrial projects and broaden their income generation channels, so as to achieve stable poverty alleviation (Yang, Y.& Liu, 2021; Ran et al., 2022; He et al.,2023). Therefore, in the process

of industrial poverty alleviation, it is crucial to clarify the synergistic development relationship among participants, and actively guide enterprises and cooperatives to drive the development of poor households and rural economy, improve the livelihood level of poor households, and truly play an active role in promoting income generation, helping to get rid of poverty, and seeking to get rich. (Şanli, 2022)

Industrial Poverty Alleviation Mechanism

Since the implementation of the policy of precise poverty alleviation, industrial poverty alleviation has gradually changed from the type of "large water irrigation" to the type of "precise drip irrigation". Liu et al. (2017) examined the mechanism of the role of industrial precision poverty alleviation from a micro perspective, and the effectiveness of the mechanism lies in the precision of industrial development projects to villages and households, reasonable allocation of land, capital, and labor, and emphasis on the role of poor households. Wu (2018) focus on the market-based mechanism in the industrial poverty alleviation model in deep-poverty areas under the guidance of the government to collaborate with multiple parties and focus on enhancing the development and creativity of poor areas to improve the efficiency of poverty alleviation. Wang et al. (2017) proposed an innovative model of poverty alleviation mechanism by studying the asset income poverty alleviation mechanism. The focus is on the different characteristics of the poor people and deep poverty areas at that time, and short-term and long-term help is interchanged, i.e., in the short term, we must focus on the living and livelihood level of poor households, and in the long term, we must focus on the level of skills and human capital possessed by poor households. On this basis, some researchers (Shi, 2019; He et al., 2022; Baker et al., 2023) examined the benefit distribution mechanism, which focuses on maximizing the long-term benefits of poverty alleviation funds and achieving poverty removal without returning to poverty. (Ir. Jaap et al., 2023)

Poverty Reduction Effect of Industrial Poverty Alleviation

There are many methods of measuring poverty in existing studies, such as Engel's coefficient method, factor analysis, international poverty standard method, etc. Garbero (2014) measured the effectiveness of poverty reduction based on the double-bonded estimation method, measured the effectiveness of the IFAD program in poverty reduction. Gao et al. (2015) used PSM to compare and analyze the poverty reduction effect of low-income and non-low-income households. Shuai Chuanmin et al. (2016) analyzed the poverty reduction effect of the IFAD program based on panel data of 1356 households and noted that the implementation of IFAD has lifted more than 380,000 poor households out of poverty. Chen (2017), and others used a similar approach to analyze the effects of the hierarchy of help subjects and the type of help measures on the effectiveness of help.Based on a sample of 863 households, Hu et al. (2018) measured the net effect of industrial poverty alleviation and found that the participation of poor households in industrial poverty alleviation significantly increased their proportion of choosing livelihood strategies and income levels. By building a propensity score probability model to measure the effect of industrial poverty alleviation in three dimensions: economic status, the standard of living, and spiritual dependence, Wang et al. (2018) showed that poverty coefficient, worker ability, skill training, degree of industrial adaptation, and rural infrastructure were the six significant factors affecting whether poor people participated in industrial poverty alleviation. Zhang et al. (2019) measured the poverty alleviation effect in the experimental area based on DID, and the results showed that the effect of poverty removal was significant, and the effect of poverty removal in the experimental group was 16% higher than that in the control group. Chen & Gu (2019) analyzed the industrial poverty alleviation mechanism in six pilot poverty alleviation reform zones based on quasi-natural experimental research methods to assess the poverty alleviation effect of industrial poverty alleviation. Some researchers (Shen et al., 2020; Fahad et al., 2023) measured the degree of contribution of industrial poverty alleviation to the livelihood level of farm households based on the generalized exact matching method based on farm household research data and found that industrial poverty alleviation reduced the income gap.

Research Methodology

Data Sources

This chapter uses data from the China Labor Force Dynamics Survey (CLDS) database, which is organized by the Social Science Research Center of Sun Yat-sen University. The CLDS is a national tracking survey on the labor force in China, which adopts a multi-stage and multi-level probability sampling method proportional to the size of the labor force and targets the working-age population aged 15-64 in households. The survey covers basic household information, household production, and consumption, household property and income, social participation, economic activities, grassroots organizations, etc. The survey sample covers 29 provinces and municipalities nationwide (except for Hong Kong, Macao, Taiwan, Tibet, and Hainan), and is represented at the regional level, economic circle, or city group level. Currently, the CLDS has completed the 2012 national baseline survey, the 2014 follow-up survey, the 2016 follow-up survey, and the 2018 follow-up survey (not yet announced). The CLDS survey completed interviews with 303 village residences, 10,612 households, and 16,253 individual laborers nationwide in 2012. 2014, 2016, and 2018 related 2014, 2016, and 2018 surveys all use a rotating sample tracking approach to follow up on the villages, households, and individuals interviewed in the previous round.

Since the 2018 CLDS data are not available for the time being, according to the research needs and data availability, two micro-survey data from the 2014 CLDS and 2016 CLDS are selected for empirical study in this chapter. We define the study population as poor farm households, so households with rural household registration in this database are selected. However, the CLDS database does not directly give information on whether farm households are poor households, and to address this situation, this chapter follows the criteria for defining poor households in China and considers farm households with annual net per capita income below the national poverty line standard in that year as poor households. The sample selection and variable processing process are as follows: (1) the sample data of urban households are excluded, and only the sample data of rural households are retained; (2) this chapter limits the research object to the household level, and only the data of the head of the household are retained for each household; (3) the farm households with annual net per capita income higher than the national poverty line standard in the current year are excluded, i.e., the non-poor households in rural households are excluded, and the poor households; (4) merging the relevant data in the individual, household, and village questionnaires according to the key information required for the study; (5) combining the data from both the 2014 CLDS and the 2016 CLDS; (6) eliminating some sample households with serious missing data; (7) eliminating sample households containing outliers; (8) eliminating sample households whose propensity scores were not successfully matched. Through the above data collation, 6124 valid samples were finally obtained.

Variable Definition

Explained Variables

The explanatory variables selected in this chapter are livelihood index, asset index, and poverty vulnerability to assess the degree of impact of the implementation of industrial poverty alleviation policies on the poverty alleviation effect of poor households, as shown in Figure 3. To ensure the reliability and accuracy of poverty alleviation effect assessment, this chapter uses asset index and livelihood index as the explanatory variables to assess the degree of impact of the implementation of industrial poverty alleviation policies on the actual poverty alleviation situation of poor households based on their actual living conditions and asset holdings.

Livelihood Index（LI）

This chapter refers to the China Rural Poverty Scorecard (Scorecard) developed by Shuai Chuanmin et al. (2016) to construct criteria for farm household poverty indicators, due to the research needs and limited data, some options were adjusted accordingly, and the livelihood index was constructed from multiple dimensions to measure the poverty level of poor households. In this chapter, the livelihood index was constructed from 17 dimensions reflecting the livelihood of farm households, such as household size, education level, labor force, farming equipment, durable goods, household insurance, social security, and infrastructure, to measure the livelihood level of poor households. The higher the score of the livelihood index, the higher the economic level of the poor households. The highest score of the livelihood index was 81 and the lowest score was 11, and 50% of the livelihood index was considered as their poverty line (as shown in Table 1) to measure the poverty status of the sample households.

Asset Index（AI）

Since asset ownership and use are more stable and have relatively small change trends, they can better measure the economic level and livelihood status of farm households. Therefore, researchers have gradually replaced income with asset stock and selected asset stock as a proxy to measure the livelihood level and economic status of farm households (Khan et al., 2022; Amponsah et al., 2023). Booysen et al. (2008) proposed multiple correspondence analysis (MCA), and the asset index constructed using MCA is more accurate. Therefore, this study constructs indicators based on Garbero's (2014) criteria, based on multiple correspondence analysis (MCA), and uses a comprehensive weighting criterion to construct an asset index from the perspective of livelihood assets and productive assets of poor households to measure changes in the economic level and poverty status of poor households in the medium and long term by their changes. At the same time, the 40th and 60th quartiles of the asset index were used as criteria (see Table 1), considered as two relative poverty lines, to assess the livelihood status of poor households.

Table 1 Poverty lines corresponding to two poverty proxy indicators

Poverty Agent	Livelihood Index	Asset Index 40th	Asset Index 60th
Poverty Line	46	21	23

Core explanatory variables and control variables

The core explanatory variable selected in this chapter is whether poor households participate in industrial poverty alleviation. Among them, participation in industrial poverty alleviation projects $T=1$, otherwise $T=0$. This chapter selects control variables from four aspects: household head characteristics, household characteristics, external environment, and industrial adaptability. First, to avoid the influence of human capital on the analysis results, variables reflecting the ability characteristics of the household head, such as the age of the household head, health level, and whether or not he or she participates in the workforce, are included in this chapter. Second, this chapter includes the characteristic variable of the household. Among them, household size reflects the household's demographic status, and the larger the number of people, the more likely the household is to participate in industrial poverty alleviation; the number of agricultural machinery and durable goods indicates the household's asset status; the area of cultivated land per capita indicates the household's labor force characteristics, and whether the household participates in the low-income subsidy reflects the household's economic status. Then, this chapter also includes external environment variables, such as whether natural disasters occurred in the last three years to reflect the impact of regional natural resource endowment on the poverty status of farm households, and whether there are street lights in the community, the proportion of hardened roads, and the distance to commercial centers to reflect the locational conditions of poor

households. Better transportation conditions in the community not only provide convenience for poor households to obtain employment information but also reduce the transportation costs in community industrial development and increase the proportion of poor households participating in industrial development. Finally, this chapter adds industrial adaptation variables, including education level, whether or not to participate in skill training, the number of people working in non-farm jobs with stable income, and the number of enterprises in the community. Among them, the higher the educational level of the agricultural labor force and the higher the skill level, indicating their relatively higher receptiveness to new things and employment skills, relatively higher competitiveness in industrial development, and stronger industrial adaptability. (See Table 2 for descriptive statistics of the variables).

Table 2: Descriptive statistics of variables

Variable Category	Variable Name	Abbreviations	Variable Description (Unit)	Average	Standard deviation
Explained Variables	Livelihood Index	LI	Poverty Indicator	45.4177	11.5895
	Asset Index	AI	Asset Indicator	21.9373	2.5027
Core explanatory variables	Whether to participate in industrial poverty alleviation	T	Yes=1, No=0	0.7405	0.4384
Control Variable	Household head characteristics variables				
	Age of household head	age	Age of the head of household	51.8806	10.1715
	Health status of head of household	health	Very unhealthy=1, relatively unhealthy=2, average=3, healthy=4, very healthy=5	3.6311	1.0227
	Whether to participate in work	job	Yes=1, No=0	0.8656	0.3411
	Household characteristics variables				
	Family size	famsize	Total number of families	4.6736	1.8175
	Number of agricultural machinery	machine	Total number of agricultural machines in the household	0.4289	1.1157
	Number of durable products	durable	Total number of durable goods in the household	5.5318	2.4345
	Arable land per capita	perarea	Total household arable land area divided by total household size (Unit: mu/person)	2.2659	4.6409
	Whether to participate in the low-income subsidy	subsidy	Yes=1, No=0	0.5413	0.4983
	External environment variables				
	Distance to commercial center	distance	Distance to nearest commercial center (km)	19.0788	18.3314
	Percentage of road hardening	hroad	The proportion of traffic road hardened surface (%)	63.7989	24.7591
	Availability of	lamp	Yes=1, No=0	0.3532	0.4780

Variable Category	Variable Name	Abbreviations	Variable Description (Unit)	Average	Standard deviation
	street lights				
	Whether natural disasters occurred in the past three years	disaster	Yes=1, No=0	0.3969	0.4893
	Whether Eastern Region	region	East = 1, Midwest = 0	0.3054	0.4606
	Industry Adaptive Variables				
	Education level	edu	Illiterate or semi-literate=0, elementary school=3, junior high school=6, high school or junior college=9, college=12, bachelor's degree =13, graduate and above=16	4.6589	2.5805
	Whether to participate in skills training	ability	Yes=1, No=0	0.6896	0.4627
	Number of people working in non-farm jobs with stable income	twork	Households with non-farm jobs Total number of people with stable income	1.2552	1.0227
	Number of businesses in the community	firm	Total number of enterprises in the administrative area	3.4211	9.0885

Model Construction

When evaluating the effects of public policy implementation, the net effect of this policy should be given high priority. However, the effects of fixed effects make this effect impossible to measure accurately. One is the individual effect, the difference between the individuals who participate or do not participate in the policy itself, and the results will be biased if individuals who participate and do not participate in the policy are compared directly. The second is the time effect, which would measure the results with bias due to indirect interventions from other policies, and therefore the impact of the policy being evaluated needs to be separated. To address these issues, the researcher mainly simulates a "quasi-natural experiment" state, i.e., by setting up treatment and control groups to achieve consistent estimates. Therefore, this study adopts a "quasi-experimental" approach to measure the difference in the effect of participation in industrial poverty alleviation between the two groups by setting up a treatment group and a control group, to accurately characterize the effect of industrial poverty alleviation implementation.

Difference-In-Difference Method（DID）

The difference-in-difference method (DID), which is the difference between the mean change in the treatment group and the mean change in the control group, more accurately reflects the intervention effect of policy implementation on the study population by controlling for ex-ante differences among the study subjects and filtering fixed effects such as time (Ravallion, 2007). By setting up a control group (not participating in industrial poverty alleviation, $T=0$) and a treatment group (participating in industrial poverty alleviation, $T=1$), this study assesses the difference in the effect of whether the sample households participate in industrial poverty alleviation based on DID, and measures the degree

of impact of industrial poverty alleviation on the survival status of poor households, and then assesses the effect of industrial poverty alleviation.

This study analyzes the average treatment effect of industrial poverty alleviation from the following two models. This study used difference-in-difference analysis to analyze the changes in poverty removal rate in the treatment and control groups before and after industrial poverty alleviation. In addition, based on the difference-in-difference analysis, the changes in poverty status and poverty vulnerability of the treatment and control groups before and after the project were analyzed. To measure the implementation effect of industrial poverty alleviation, this study measured the average treatment effect of industrial poverty alleviation based on a double-difference, double-difference model with the inclusion of covariates.

The difference-in-difference model was set up as follows (9).

$$Y_{it} = \beta_0 + \alpha_0 P_{it} + \beta_1 T_{it} + \alpha_1 \cdot P_{it} T_{it} + \varepsilon_{it} \quad (9)$$

The difference-in-difference model with the addition of covariates is shown in equation (10).

$$Y_{it} = \beta_0 + \alpha_0 P_{it} + \beta_1 T_{it} + \alpha_1 \cdot P_{it} T_{it} + \theta X_{it} + \varepsilon_{it} \quad (10)$$

Since 2015, China began to promote and implement industrial poverty alleviation policies on a large scale in each poor contiguous area, therefore, this study uses 2015 as the cut-off point for the implementation of industrial poverty alleviation policies to analyze the policy effects before and after the implementation of industrial poverty alleviation. Equation (1), Y_{it} is the explained variable to measure the effect of industrial poverty alleviation policy, and the following table *i* and *t* denote different poor households and different periods, respectively. T_{it} is the treatment variable of whether poor household *i* participates in industrial poverty alleviation in period *t*, and is 1 if it participates in industrial poverty alleviation, and is 0 otherwise. P_{it} is a time dummy variable. In this study, 2015 is used as the cut-off point. 2016 represents the year after the implementation of the industrial poverty alleviation policy and takes the value of 1; 2014 represents the year before the implementation of the industrial poverty alleviation policy and takes the value of 0. The cross term $P_{it}T_{it}$ reflects the net effect of the implementation of the industrial poverty alleviation policy. X_{it} represents the covariate of household *i* in period *t*, indicating the set of variables with a high degree of association with industrial poverty alleviation policy. ε_{it} is a random interference term.

Propensity Score Matching Method（PSM）

Propensity score matching (PSM) makes policy evaluation more reasonable by controlling for between-group differences and matching based on propensity values to exclude sample selection bias and endogeneity to a certain extent (Rosenbaum and Rubin, 1983). The essence of the propensity score matching method is "dimensionality reduction", using a probability model to condense the multidimensional covariates that are unbalanced between groups into one-dimensional propensity scores, achieving the effect of "dimensionality reduction". In this study, we select individual, household, and community factors that affect the poverty status of poor households and analyze the effect of industrial poverty alleviation on the explanatory variables based on the propensity score matching method to measure the policy effect of industrial poverty alleviation. As in equation (11), the propensity score value is $P(X_i) = \Pr(T = 1 | X_i)$, $T = 1$ indicates that poor households participated in industrial poverty alleviation, and X_i indicates the covariate. The average treatment effect of industrial poverty alleviation ATT is the difference between the effect of the experimental group and the control group.

$$ATT = E_{P(X)|T=1}\left\{E\left[Y^T \middle| T = 1, P(X)\right] - E\left[Y^C \middle| T = 0, P(X)\right]\right\} \quad (11)$$

First, the propensity score values were derived based on the Probit model. Secondly, based on the results of the Probit model analysis, appropriate covariates are selected to make the matching effect more

reasonable. Then, based on the k-nearest neighbor matching method (1:1), k-nearest neighbor matching method (1:4), radius matching method, and kernel matching method, the average treatment effect (ATT) of the implementation of industrial poverty alleviation policies on the effect of poverty alleviation is calculated, and the average treatment effect of the implementation of industrial poverty alleviation policies on the effect of poverty alleviation in different regions is compared and analyzed. Finally, robustness tests are conducted.

Empirical Analysis

Based on the previous theoretical analysis and research design, this chapter focuses on the empirical analysis of the poverty alleviation effect of industrial poverty alleviation. The degree of contribution and the average treatment effect of industrial poverty alleviation on poverty alleviation of poor households are measured from different poverty alleviation criteria of livelihood index and asset index.

The Degree of Contribution of Industrial Poverty Alleviation to Poor Households to Get Rid of Poverty

According to the poverty elimination criteria of the livelihood index, the poverty elimination rate of the treatment group achieved a substantial increase. As can be seen from Table 3, the poverty eradication rate of the treatment group before the implementation of industrial poverty alleviation was 13.65%, and the poverty eradication rate after the implementation was 26.32%, and the poverty eradication rate before and after the implementation of industrial poverty alleviation increased by 12.67%. The rate of poverty eradication in the control group before the implementation of industrial poverty alleviation in the same period was 5.13%, and the rate of poverty eradication after the implementation was 7.59%, and the rate of poverty eradication before and after the implementation of industrial poverty alleviation increased by 2.46%. The analysis results showed that the rate of poverty eradication in the treatment group was 10.21% higher than that in the control group due to the implementation of industrial poverty alleviation, which also showed the net contribution of industrial poverty alleviation to the policy effect in the treatment group.

According to the criteria of poverty removal by asset index, the poverty removal rate of the treatment group was improved to some extent. As can be seen from Table 3, when the 40th percentile of the asset index is chosen as the poverty line, the poverty eradication rate increases by 11.29% before and after the implementation of industrial poverty alleviation. And the poverty eradication rate of the control group increased by 2.40% from 8.33% before the implementation of industrial poverty alleviation to 10.73% after the implementation during the same period. The analysis results show that the rate of poverty eradication in the treatment group is higher than that in the control group by 8.89% due to the implementation of industrial poverty alleviation, which is also the net effect of the policy effect of industrial poverty alleviation on the treatment group. Similarly, as shown in Table 3, when the 60th percentile of the asset index is chosen as the poverty line, the rate of poverty eradication increases by 13.63% before and after the implementation of industrial poverty alleviation. The rate of poverty eradication before the implementation of industrial poverty alleviation in the same control group was 5.27%, and the rate of poverty eradication after the implementation was 8.52%, and the rate of poverty eradication before and after the implementation of industrial poverty alleviation increased by 3.25%. The analysis showed that the rate of poverty removal in the treatment group was 10.38% higher than that in the control group due to the implementation of industrial poverty alleviation, indicating the net contribution of industrial poverty alleviation to the policy effect in the treatment group.

Table 3 Poverty exit rate of poor households based on livelihood index and asset index measures (%)

Indicators		Sample group	Before industrial poverty alleviation	After industrial poverty alleviation	Amount of variation	Dual Differential
Livelihood Index		Control groups	5.13	7.59	2.46	10.21
		Processing groups	13.65	26.32	12.67	
Asset Index	40th	Control groups	8.33	10.73	2.40	8.89
		Processing groups	20.26	31.55	11.29	
	60th	Control groups	5.27	8.52	3.25	10.38
		Processing groups	10.83	24.46	13.63	

The Analysis of Poverty Alleviation Effect of Industrial Poverty Alleviation

Analysis of the Effect of Industrial Poverty Alleviation on Poverty Alleviation Based on the Difference-in-Difference Method

This chapter assesses the poverty alleviation effect of industrial poverty alleviation based on the difference-in-difference method (DID), as shown in Table 4. Models (1) and (2) denote the livelihood index as the explanatory variable, and models (3) and (4) denote the asset index as the explanatory variable. Models (1) and (3) denote the double-difference model before adding covariates, and models (2) and (4) denote the double-difference model after adding covariates. The double-difference results show that the average treatment effects of livelihood index and asset index before adding covariates are 0.2376 and 0.2714, respectively; after adding covariates, the average treatment effects of livelihood index and asset index are 1.7065 and 0.7095, respectively, both of which are greater than 0 and both of which are significant at the 1% level, indicating that the implementation of industrial poverty alleviation ensures the effective implementation of precise poverty alleviation policies.

Table 4 Regression results of double difference method

Variable Name	Livelihood Index LI		Asset Index AI	
	Model (1)	Model (2)	Model (3)	Model (4)
P×T	0.2376 (0.6664)	1.7065*** (0.4582)	0.2714* (0.1388)	0.7095*** (0.0872)
age		-0.0213** (0.0108)		-0.0077* (0.0021)
health		0.6285*** (0.1065)		0.1556*** (0.0211)
job		1.0554*** (0.3093)		-0.0628 (0.0611)
famsize		-0.3085*** (0.0622)		-0.0367*** (0.0126)
machine		1.0753*** (0.1187)		0.1338*** (0.0197)
durable		2.8306*** (0.0547)		0.6927*** (0.0113)
perarea		0.0037 (0.0202)		-0.0049 (0.0045)
subsidy		1.0167*** (0.2532)		0.0781 (0.0486)
distance		-0.0099 (0.0076)		-0.0048*** (0.0014)
hroad		0.0174*** (0.0043)		0.0078*** (0.0008)
lamp		0.6096*** (0.2301)		0.1349*** (0.0419)
disaster		-0.7944*** (0.2125)		-0.2047*** (0.0413)
region		-2.1552*** (0.2574)		-0.0023 (0.0488)
edu		0.5811*** (0.0416)		0.0509*** (0.0079)

Variable Name	Livelihood Index LI		Asset Index AI	
	Model（1）	Model（2）	Model（3）	Model（4）
ability		0.1581（0.2176）		0.1114**（0.0422）
twork		2.0656***（0.1207）		0.0148（0.0224）
firm		0.0589***（0.0132）		0.0148***（0.0023）
Constant terms	42.3101***（0.4258）	19.9712***（0.9181）	21.3861***（0.0919）	17.1625***（0.1854）
Fixed time	yes	yes	yes	yes
Individual fixed	yes	yes	yes	yes
R2	0.0761	0.5394	0.1246	0.6338
N	6124	6124	6124	6124

Note: *, ** and *** indicate significant at the 10%, 5% and 1% levels, respectively, and the numbers in parentheses are standard errors. Same below.

As can be seen from Table 4, natural disasters have a greater impact on the effect of industrial poverty alleviation policies, and the lower the effect of industrial poverty alleviation on poverty alleviation in places where natural disasters occur frequently; the closer the distance to commercial centers, the greater the proportion of roads being hardened, and the greater the number of streetlights in the community indicate better natural endowment conditions and transportation. These factors can create more convenient infrastructure conditions for rural industrial development, thus improving the effect of industrial poverty alleviation, and also help guide and encourage farmers to actively participate in rural self-governance practices. Educational attainment and skill level have a significant positive impact on both the livelihood index and the asset index. The improvement of education level not only helps to improve the poverty alleviation effect of poor households but also can effectively reduce the gap between the rich and the poor. The improvement of the skill level of poor households is conducive to improving their knowledge skills and vocational skills, stimulating their endogenous development motivation, and thus improving the policy effect of industrial poverty alleviation. Therefore, strengthening skills training and employment training is an important poverty alleviation measure to improve the level of the existing labor force. The more abundant the number of people engaged in non-agricultural work with stable income, the greater the probability of participating in industrial poverty alleviation. Meanwhile, with the increasing number of industries in the administrative region, various new business subjects are emerging. Therefore, through the cultivation of new business subjects, an industrial development mechanism that benefits the poor and helps farmers can be established, thus improving the effect of poverty alleviation, realizing stable poverty alleviation, and promoting the effective implementation of rural revitalization.

Analysis of the Effect of Industrial Poverty Alleviation and Poverty Alleviation Based on Propensity Score Matching Method

Balance Test

To further verify the impact of industrial poverty alleviation on the effect of poverty alleviation on poor households, a balance test is required, which requires that there is no significant difference between households participating in industrial poverty alleviation and households not participating in industrial poverty alleviation on each characteristic variable, excluding the bias of sample selection, as shown in Table 5. On the one hand, the vast majority of variables were significantly different before matching, and after matching, no significant differences existed. On the other hand, the standardized bias rate of the covariates after matching was less than 20%, indicating a good test result (Rosenbaum et al., 1985). Therefore, the sample matching passed the equilibrium test.

Table 5 Balance test

Covariates	Sample Category	Average		Deviation rate (%)	Rate of deviation change (%)	T-test	
		Processing groups	Control groups			t-value	P>|t|
age	UM	52.46552.466	50.21252.41	21.70.5	97.5	7.630.25	0.0000.806
health	UM	3.57113.5706	3.80243.4895	-23.18.1	64.9	-7.801.70	0.0000.125
job	UM	0.90100.9012	0.76460.8406	37.216.5	55.6	13.938.63	0.0000.000
famsize	UM	4.69774.6988	4.60484.7905	5.1-1.4	71.3	2.70-0.60	0.0070.550
machine	UM	0.52880.5241	0.14410.6377	38.6-6.1	70.5	11.96-2.48	0.0000.135
durable	UM	5.39715.3967	5.91634.7808	-20.74.6	-48.6	-7.350.55	0.0000.584
perarea	UM	2.63992.6376	1.19873.6104	32.1-2.7	72.5	10.75-2.36	0.0000.109
subsidy	UM	0.70560.7057	0.07240.6578	70.82.9	92.4	13.884.89	0.0000.168
distance	UM	19.80319.814	17.01119.332	15.52.7	82.8	5.241.26	0.0000.206
hroad	UM	62.42862.44	67.71358.758	-21.85.2	60.3	-7.352.88	0.0000.143
lamp	UM	0.32790.3275	0.42540.2686	-20.212.2	39.7	-7.036.14	0.0000.000
disaster	UM	0.40070.4009	0.38640.4700	-12.25.8	-88.9	-6.652.05	0.0000.041
region	UM	0.25380.2537	0.45250.2021	-42.511.0	74.0	-15.075.87	0.0000.158
edu	UM	4.58024.5799	4.88364.9856	-11.522.5	-95.9	-4.0410.88	0.0000.000
ability	UM	0.70520.7057	0.64510.7106	12.91.1	91.8	4.46-0.51	0.0000.607
twork	UM	1.22671.2273	1.33671.1213	-10.59.6	-2.3	-3.370.75	0.0010.564
firm	UM	2.37952.3685	6.3942.5847	-39.0-2.1	94.6	-15.44-1.46	0.0000.143
Joint InspectionUM		Ps R20.3620.038		LR chi22541.16474.45		p>chi20.0000.000	

Note: U means unmatched, M means matched.

Analysis of average treatment effects

This study tested the effect of industrial poverty alleviation on poverty alleviation using k-nearest neighbor matching (1:1), k-nearest neighbor matching (1:4), radius matching, and kernel matching methods, using livelihood index and asset index as explanatory variables to measure the treatment effects of industrial poverty

alleviation implementation on the livelihood level and asset ownership of poor households, as shown in Table 6. the results of PSM analysis showed that under the four different matching methods, livelihood index and asset indices passed the significance test, indicating that industrial poverty alleviation had a significant effect on both the livelihood index and asset index. Specifically, in the full sample case, using k-nearest neighbor matching (1:1), k-nearest neighbor matching (1:4), radius matching, and kernel matching methods, the results of the impact of industrial poverty alleviation policies on the livelihood index are 3.2456, 4.3249, 4.6193 and 4.3352, respectively, and all of them are significant at the 1% level. the mean value of the average treatment effect (ATT) under the four methods is The results of the effect of industrial poverty alleviation policies on asset index were 0.7451, 0.9971, 1.0040, and 0.9603, and all were significant at the 1% level. the mean value of ATT under the four methods was 0.9266, indicating that the implementation of industrial poverty alleviation can increase the poor households' In summary, using different estimation methods, the implementation of industrial poverty alleviation policy has a significant positive effect on the livelihood index (ATT>0, p<0.01) and asset index (ATT>0, p<0.01) of poor households, i.e., the industrial poverty alleviation policy has a significant contribution to the improvement of poor households' livelihoods.

Table 6 Average treatment effects of PSM based on poverty proxy indicators (ATT)

Indicators	Matching methods	Full sample	East of China	Midwestern China
Livelihood Index	K-Nearest Neighbor Matching（1:1）	3.2456***（1.1595）	3.0883（1.9983）	5.0604***（1.3696）
	K-Nearest Neighbor Matching（1:4）	4.3249***（1.0003）	2.7645（1.7485）	4.2418***（1.2358）
	Radius Matching（Radius=0.01）	4.6193***（0.9411）	3.0009*（1.7629）	4.7793***（1.1745）
	Nuclear matching（Window width=0.06 kernel function=normal）	4.3352***（0.8998）	2.7295*（1.4890）	4.7529***（1.1010）
	Average value	4.1313	2.8958	4.7086
Asset Index	K-Nearest Neighbor Matching（1:1）	0.7451***（0.2440）	0.6409*（0.3714）	1.0518***（0.2895）
	K-Nearest Neighbor Matching（1:4）	0.9971***（0.2112）	0.6535**（0.3273）	0.8791***（0.2684）
	Radius Matching（Radius=0.01）	1.0040***（0.1983）	0.6857**（0.3283）	0.9401***（0.2535）
	Nuclear matching（Window width=0.06 kernel function=normal）	0.9603***（0.1896）	0.7334***（0.2775）	0.9435***（0.2377）
	Average value	0.9266	0.6784	0.9536

To examine the effect of industrial poverty alleviation on poverty alleviation in different regions of China, this study examined and tested the effect of industrial poverty alleviation on poverty alleviation through sub-regions, and the results are shown in Table 6. The results show that industrial poverty alleviation projects and related policies have a certain degree of positive effect on poverty alleviation in both the eastern and central and western regions of China. Among them, the effect of industrial poverty alleviation on poverty alleviation is slightly lower in China's eastern regions than in China's central and western regions, which indicates that industrial poverty alleviation policies are more favorable to less economically developed regions. On the one hand, in 2013, precision poverty alleviation was launched in various poor regions in China, and industrial

poverty alleviation has always been in a key position and received high attention from all sectors of society. In particular, whether it is to support local poverty alleviation projects or to introduce foreign investment projects, the only criterion is no longer to increase local GDP. Therefore, for economically developed regions, industrial poverty alleviation is not the only way to alleviate poverty, although it is the key to precise poverty eradication. For higher requirements for the improvement of living standards and to achieve the expected goals in the short term, industrial poverty alleviation may not be the optimal choice, and it may be more preferable to achieve poverty alleviation for the majority of the poor through other poverty alleviation methods. Industrial poverty alleviation, as an important means of support in regional poverty alleviation work, is the key to realizing the transformation from "one-time poverty alleviation" to "sustainable poverty alleviation", which should not only bring into play the advantages of resources but also clarify the industrial operation mechanism and highlight the poverty benefit of poverty alleviation industries.

Robustness Tests

In this chapter, we calculate the average treatment effect (ATT) of the implementation of industrial poverty alleviation policies on the effect of poverty alleviation and compare the average treatment effect of the effect of industrial poverty alleviation on poverty alleviation in different regions of China. As can be seen from Table 6, the test results of the four different matching methods are similar and all show a significant positive effect (ATT>0, $p<0.01$), indicating that the average treatment effect of industrial poverty alleviation on the effect of poverty alleviation on poor households' poverty alleviation is robust.

In addition, to further test the robustness of the above findings, this chapter also employs the propensity score matching-double difference method (PSM-DID) as an auxiliary test, and the results are listed in Table 7. According to the test results in Table 7, it can be obtained that the direction and trend of the average treatment effect of livelihood index and asset index under poverty proxies are consistent with the test results in Table 6, both of which show significant positive effects (ATT>0, $P<0.01$), indicating that the assessment of the effect of industrial poverty alleviation policies is relatively stable.

Table 7 Robustness tests based on poverty proxy indicators.

Indicators	Before Diff（T-C）	After Diff（T-C）	DID
Livelihood Index	2.332*** （0.375）	6.701*** （0.557）	4.369** （0.672）
Asset Index	0.788** 0.081）	1.719*** 0.121）	0.931*** （0.146）

Conclusions and Recommendations

Research Conclusions

Based on relevant literature studies, this chapter constructs a livelihood index reflecting the livelihood level of poor households, an asset index reflecting the living assets and productive assets of poor households, based on the China Labor Force Dynamics Survey (CLDS) data, and employs the difference-in-difference method and propensity score matching method. The degree of contribution of industrial poverty alleviation to the effect of poverty alleviation of poor households was quantitatively analyzed. The results of the study indicated that.

On the whole, the effect of industrial poverty alleviation on poverty eradication is very obvious, which improves the poverty eradication rate in poor areas and has a significant positive contribution to precise poverty eradication. On the one hand, according to the criteria of poverty eradication in the livelihood

index and asset index (40th and 60th quartiles), the net contribution of industrial poverty alleviation implementation to the poverty eradication rate of poor households in the treatment group is 10.21%, 8.89% and 10.38%, respectively; on the other hand, the average treatment effects of industrial poverty alleviation policies on the livelihood index and asset index are 4.1313 and 0.9266, respectively, indicating that industrial poverty alleviation The effective implementation of the policy has a positive effect on the livelihood index and asset index, i.e., the intervention effect of industrial poverty alleviation is significant and improves the livelihood level of poor households.

(2) In terms of regional location, the effect of industrial poverty alleviation on poverty alleviation is slightly higher in eastern China than in central and western China. The resources and economic conditions in the eastern region of China are relatively better, which has a propulsive effect on industrial development and thus leads to a slightly higher effect of industrial poverty alleviation in the eastern region of China than in the central and western regions of China.

Policy Recommendations

To effectively promote the mechanism of industrial development for the benefit of the poor and help rural revitalization, this study puts forward the following policy recommendations.

First, scientifically plan industrial revitalization projects and promote industrial integration and development. Industrial development needs to make full use of local resource endowments and develop special industries based on the implementation and development of resource advantages in poor areas, etc., to adapt them to the development of the area. On the one hand, actively guide poor areas to gradually transform from industrial coverage to long-term industrial development, deeply promote production and marketing docking, lengthen industrial product chains, strengthen the brand value of industries, promote the formation of sustainable livelihoods for poor households, and enable poor households to obtain more stable income and achieve stable poverty alleviation. On the other hand, promote the integrated development of one, two and three industries, and actively promote poverty alleviation and poverty-led models such as market-oriented allocation of land elements, special industries and industrial diversification, so that industrial development can play an important role in the effective connection between poverty alleviation and rural revitalization.

Secondly, poverty alleviation should be combined with helping the will, wisdom and skills to promote material and spiritual "double poverty alleviation". Poverty alleviation should be effective and future-oriented, i.e. to enhance the endogenous development capacity of farmers and alleviate the poverty vulnerability of poor households. In the process of industrial poverty alleviation, we should strengthen professional education and special skills training required for rural revitalization, improve the level of human capital, stimulate the endogenous power to increase income and get rich, and continuously strengthen the sustainable risk resistance. According to the development plan of poverty alleviation industries and the trend of industrial structure adjustment, targeted training and education should be provided to farmers who are on the verge of returning to poverty, to enhance their endogenous development capacity, promote higher quality and fuller employment, and strengthen their ability to increase and stabilize their income. Implement special skills training, encourage the development of new labor-intensive industries, and broaden employment and entrepreneurship channels. Absorb low- and middle-skilled laborers into employment, and innovate employment fields and methods. The development of industrial poverty alleviation provides conditions and opportunities for local organization, effectively improving poverty in the current and future stages by enhancing endogenous development capacity, strengthening the main role of farmers in rural development, and achieving common prosperity.

Thirdly, innovate the industrial development mode and build the interest linkage mechanism. In the process of industrial development, by strengthening the main force of farmers, enterprises and cooperatives, strengthening the joint drive of new business entities and farmers, innovating the development of industrial models, constantly strengthening the mechanism of benefit and poverty, and truly playing an active role in promoting income and seeking prosperity. Actively develop high value-added agricultural products, and constantly improve the value of agricultural products; focus on primary processing, fine processing and deep processing of agricultural products, and improve the logistics and transportation management mechanism in the process of industrial development. In addition, actively develop order agriculture, promote enterprises and farmers to sign long-term production and sales contracts, forming long-term cooperative relationships. Explore the implementation of such forms of cooperation as underwriting acquisition and guaranteed income, and adopt rent, salary and share capital to guarantee farmers' reasonable income, to embed farmers in the chain of industrial development and ensure that they can share the value-added income of rural industrial development to the greatest extent.

Fourth, strengthen the infrastructure construction in deep poverty areas and promote coordinated regional development. Infrastructure such as roads, water conservancy and networks are the foundation for deep poverty areas to completely escape from poverty. We should continuously increase investment in infrastructure such as roads, communication networks and big data in deep-poverty areas, strengthen the implementation of labor mobility policies, and promote models such as "finance+" and "ecology+" to reduce the vulnerability to poverty in deep-poverty areas and promote industry to deepen development. In addition, targeted support measures should continue to be implemented for deep poverty areas to strengthen the risk resistance of farmers, promote sustainable local economic development, and achieve poverty eradication without returning to poverty.

Limitations and Future Research

Limitations

Due to the availability of research study capacity, information and data, this study has some shortcomings to be further improved. Meanwhile, as academic and policy research related to poverty prevention and poverty governance issues continues to intensify, many important issues worthy of study will gradually emerge.

With the continuous promotion of rural revitalization and rural agricultural modernization, future studies will have higher requirements for the comprehensiveness and synthesis of micro data, and the updating of causal assessment methods will require more detailed data to obtain purer identification effects. Therefore, based on the comprehensive research data, micro-survey project data and macro-monitoring data, this research group intends to further obtain relevant data at the county, township and village levels in the representative areas of rural revitalization, and supplement the existing data of rural monitoring sites to form a characteristic database to support the future research objectives of this project, which can also provide valuable and rich data resources for future research

Future Research

By 2020, China will have fully achieved the goal of removing absolute poverty from the population under the current standard, all poor counties have been removed from the list, and the regional poverty problem under the perspective of absolute poverty has been solved, making a great contribution to alleviating world poverty. After this, poverty alleviation will enter a new stage, where absolute poverty has disappeared, but relative poverty will continue to exist. Therefore, it is necessary to establish a good institutional system, continue to

consolidate and expand the achievements in poverty alleviation, promote rural revitalization in depth, and solidly promote common prosperity. Because of this, this study measures and evaluates the implementation effect of industrial poverty alleviation since the implementation of China's precise poverty alleviation policy, brings into play the key role of industrial poverty alleviation and industrial prosperity, forms a situation in which industry drives poverty eradication and consolidates the effect of poverty alleviation, and fully establishes a long-term mechanism for poverty return interdiction, in the expectation of improving the poverty-beneficial effect of industry and reducing poverty vulnerability, so as to ensure the effective implementation of the rural revitalization strategy. We provide corresponding policy suggestions for the adjustment and optimization of China's next rural industrial development policies and the effective implementation of rural revitalization.

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